CBI CLAIM WAIVED

Ellen Thompson
Paralegal
DuPont Legal
1007 Market Street
D-7098-1
Wilmington, DE 19898
Tel: 302-774-3294
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October 17, 2012

***CERTIFIED MAIL -***
***RETURN RECEIPT REQUESTED***

Mr. Lance Nixon
Superfund Enforcement Assessment
Section (6SF-TE)
U.S. EPA, Region 6
1445 Ross Avenue
Dallas, TX 75202-2733

**RE: Response to EPA's 104(e) Request for Information for**
**Cedar Chemical Site in West Helena, Arkansas**

Dear Mr. Nixon:

The attached information constitutes the response of E. I. du Pont de Nemours and Company (DuPont) to EPA's request for information for the Cedar Chemical Site.

DuPont will supplement this response if additional information is found, or if information submitted is determined to be incorrect.

If you have any questions pertaining to this response, please call me at 302-774-3294 or the attorney responsible for this matter, James Allen at 302-774-8553

Very truly yours,

Ellen Thompson
Senior Paralegal

ET:ldw

9392034

## ENCLOSURE 3

## CEDAR CHEMICAL CORPORATION SUPERFUND SITE
## INFORMATION REQUEST

## QUESTIONS

1. Please provide the full legal name, mailing address, and phone number of the Respondent.

   **E. I. du Pont de Nemours and Company**
   **1007 Market Street**
   **Wilmington, Delaware 19898**
   **302-774-1000**

2. For each person answering these questions on behalf of the Respondent provide full name, title, business address, and business telephone and fax number.

   **James Allen**
   **Corporate Counsel**
   **E. I. du Pont de Nemours and Company**
   **D7084**
   **1007 Market Street**
   **Wilmington, Delaware 19898**
   **Phone: 302-774-8553**
   **Fax: 302-774-1189**

   **Ellen Thompson**
   **Senior Paralegal**
   **E. I. du Pont de Nemours and Company**
   **D7098-1**
   **1007 Market Street**
   **Wilmington, Delaware 19898**
   **Phone: 302-774-3294**
   **Fax: 302-774-1189**

3. If the respondent wishes to designate an individual for all future correspondence concerning this Site, including legal notices, please provide the individual's name, address, telephone number, and fax number.

   **Ellen Thompson**
   **E. I. du Pont de Nemours and Company**
   **D7098-1**
   **1007 Market Street**
   **Wilmington, Delaware 19898**
   **Phone: 302-774-3294**
   **Fax: 302-774-1189**

4. Please explain the business relationship between your company and Cedar Chemical Corporation.

**Contacts in all DuPont sites in the US and Canada were requested to conduct a good faith, diligent search of their files in response to this 104(e) request: After performing a good faith, diligent search, DuPont found one document related to the Cedar Chemical Company. See attachment A. Copies of Nexus documents provided to us by Joseph W. Ghormley, Quattlebaum, Grooms, Tull & Burrow are also enclosed. See attachment B.**

5. Identify all transactions with the Site owners and/or operators of the Site that resulted in materials being sent to the Site by you for any purpose. Identify and provide all documents related to each transaction including, but not limited to, invoices, manifests, shipping papers, bills of lading, receipts, log book entries, trip tickets, work orders, contracts, documents showing the nature of the materials involved and any EPA and/or State environmental filings or correspondence. For each transaction, identify and state:

   a. The type and purpose for the transaction;

   b. A description of the materials involved, including their quantity and chemical content and characteristics;

   c. Any amounts paid by you in connection with each transaction;

   d. The date of each transaction; and

   e. The date the materials were sent to the Site.

**DuPont does not have any additional information. Please see response #4**

6. Provide a copy of the tolling agreement between your company and Cedar Chemical, including any restatements, amendments, or other documents. If there are any other tolling agreements, or joint operating agreements, with other companies, provide copies of such agreements.

**Please see response #4**

7. Identify all persons, including you, who may have arranged to have the raw materials mixed at Cedar Chemical Inc. In addition, identify the owner of the hazardous materials involved in each such arrangement

**Please see response #4**

8. If any of the documents solicited in this information request are no longer available, please indicate the reason why they are no longer available.

**DuPont employs a records retention policy that provides for the orderly maintenance of the records important to the business of DuPont, and in the interest of economy and efficiency provides a specific time frame for the disposal of records that are no longer pertinent to business or required by law to be maintained. DuPont will supplement this response if additional information is found.**

# ATTACHMENT A

| Vendor Name | 003.2003 | 004.2003 | Grand Total |
|---|---|---|---|
| CEDAR CHEMICAL CORPORATION | $ 967,869.21 | $ 417.55 | $ 968,286.76 |
| Grand Total | $ 967,869.21 | $ 417.55 | $ 968,286.76 |

# ATTACHMENT B

Superfund-Arkansas Cedar Chemical

ENVIRONMENTAL
APR 24 2008
LEGAL

Quattlebaum, Grooms, Tull & Burrow
A PROFESSIONAL LIMITED LIABILITY COMPANY
111 Center Street, Suite 1900
Little Rock, Arkansas 72201-4382

Joseph W. Ghormley
jghormley@qgtb.com

Licensed in Arkansas and Oklahoma

(501) 379-1700
Telecopier
(501) 379-1701
Writer's Direct Dial
(501) 379-1764

ENVIRONMENTAL
APR 24 2008
LEGAL

April 10, 2008

David C. Shelton, Esq.
Senior Counsel
E.I. du Pont de Nemours and Company
DuPont Building, 1007 Market Street
Wilmington, Delaware 19898

Re: Former Cedar Chemical Corporation Facility
West Helena, Arkansas

Dear Mr. Shelton:

Please find enclosed a disc with copies of nexus documents linking E.I. du Pont de Nemours and Company ("DuPont") to the Cedar Chemical site in West Helena, Arkansas

To make a long story short, the Cedar Chemical site was used for toll manufacturing of various chemicals from the early 1970s to 2002. When the site's owner declared bankruptcy a few years ago, the State of Arkansas became very interested in the site. In 2006, the State sued ExxonMobil, Helena Chemical and Wormald, a division of Tyco, to recover an estimated one billion dollars in future clean-up expenses plus other damages. Harry Stephens Farms, Inc., which is a neighboring family-owned farm operation, then sued the same three companies based on a plume from the Cedar site that is allegedly under its property.

We were granted summary judgment based on the statutes of limitation in the Stephens litigation. Stephens has appealed and we are awaiting a decision on the appeal. The State withdrew its litigation in exchange for an agreement with the parties to conduct an investigation at the site and preserve documents. We expect to remediate the site at a cost which is two to three orders of magnitude less than the State's original estimate. ExxonMobil and Helena Chemical are now splitting costs for compliance with the investigation agreement with the State. While reviewing documents we are required to preserve, we noticed that DuPont engaged in toll manufacture for production of various substances at the Cedar site for a number of years.

Please call me, or have your Superfund lawyer call me, when you have had an opportunity to review the disc. We are in the process of contacting several other companies who have used the site, and we believe ExxonMobil is still inclined to work on a per capita basis, which you may find appealing given the duration of Dupont's involvement with the Cedar site.

We would appreciate receiving your response by April 21, 2008. Thank you for your attention to this matter.

Sincerely,

QUATTLEBAUM, GROOMS,
TULL & BURROW PLLC

Joseph W. Ghormley

JWG:tsr
Enclosures

ADEQ

ARKANSAS
Department of Environmental Quality

ENVIRONMENTAL
JUN 16 2008
LEGAL

June 11, 2008

James B. Allen
E.I. du Pont de Nemours and Company
Environmental Counsel
DuPont Building, 1007 Market Street
Wilmington, Delaware 19898

Dear: James B. Allen,

The Arkansas Department of Environmental Quality ("ADEQ") assumed control of the former Cedar Chemical Corporation facility in West Helena, Arkansas (the "Site"), following Cedar Chemical Corporation's bankruptcy. ADEQ is currently working with Helena Chemical Company, Wormald U.S. Inc. and Exxon Mobil Corporation in the conduct of investigation activities at the Site, and documents located to date indicate your company may have engaged in toll manufacture activities at the Site during its operational history.

ADEQ has the authority to seek information pursuant to, *inter alia*, the Arkansas Remedial Action Trust Fund Act, Ark. Code Ann. §§ 8-7-501 *et seq.* Accordingly, ADEQ requests that one or more representatives of your company attend a meeting regarding the Site to be held at ADEQ Headquarters in North Little Rock, Arkansas, on June 24, 2008. ADEQ further invites one or more representatives of your company to participate in a visit to the Site to be conducted on June 25, 2008.

A list of the companies receiving similar versions of this letter is enclosed.

Thank you for your attention to this matter.

Sincerely,

Dara A. Hall
Attorney
Arkansas Dept. of Environmental Quality

Encl.

COMPANIES RECEIVING REQUESTS TO ATTEND MEETING AND SITE VISIT REGARDING FORMER CEDAR CHEMICAL CORPORATION SITE

BASF Corporation

Bayer CropScience

BP

Chevron Corporation

DuPont

FMC Corporation

Goodrich Corporation

Rhodia

Rohm & Haas

Syngenta

Unknown

10,500 DCA
8660 TOC
3479 $H_2O$
22,639 TOTAL

} theory composition of T-12

SUGGEST:

15000 LB LOAD
= 6957 LB DCA
5562 LB. P. ACID

CREATIVITY FOR OUR CUSTOMERS

# Triplex, Inc.

P.O.Box 3815 • Little Rock, Ark. 72203 • (501) 376-3623

INDUSTRIAL HOSE - METAL HOSE - HYDRAULIC HOSE - HOSE FITTINGS OF ALL TYPES - GASKETS—CUT AND FABRICATED - GASKET MATERIALS PACKINGS - O RINGS - CHEVRON PACKING - CUPS CEMENTS - MATTING - CONVEYOR BELTING

PCB 10164 lbs

Toluene 7464 lbs

Carb. 19 lbs

OR-4976-Y REV. 12-63

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

ORGANIC CHEMICALS DEPARTMENT
DYES AND CHEMICALS DIVISION

September 27, 1972

Eagle River Chemical Corporation
West Helena, Arkansas

Attention: Bruce Davey

Gentlemen:

CERTIFICATE OF ANALYSIS

We are listing below the analysis on the 98,326 pounds of 3,4-Dichloroaniline 93 Technical which was scheduled for shipment on Sept. 26 from Deepwater, New Jersey in Car No. GATX-32886 via RDG-B&O-MP. This is against our Order No. D31-15084.

| ANALYSIS | SPECIFICATIONS | RESULTS |
|---|---|---|
| LOT | | 98C |
| Purity | 93.0% Min. | 94.11 |
| Isomeric Dichloroanilines | 7.0% Max. | 3.35 |
| Monochloroanilines | 0.55% Max. | .55 |
| Moisture | 0.1% Max. | .06 |
| Aniline | 0.2% Max. | .08 |

Very truly yours,

E. F. Schultz
Technical Supervisor - Intermediates

EFS/jad

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

THIS PAPER IS COLORED WITH DU PONT DYES

Bill Chochelford -
How much does this increase over Projected production cost,

DUPONT
E. I. DU PONT DE NEMOURS & COMPANY
WILMINGTON, DELAWARE 19898

CHEMICALS DEPARTMENT
CHEMICALS DIVISION

February 21, 1975

Mr. John Holcomb, Plant Manager
Eagle River Chemical Company
Route 242
West Helena, Arkansas 72590

Dear Mr. Holcomb:

Effective March 1, 1975, we are increasing our price on the following product:

| Product | From (Price Per Lb.) | To |
|---|---|---|
| 3,4-Dichloroaniline 93 Tech. | $.82 T/C or T/T | $.90 |

The shipping terms for this product will be on an F.O.B. Deepwater, New Jersey basis.

Very truly yours,

Intermediates Sales

RMK/dlb



AB0000114724/4

# 25—NONCONDENSED AROMATIC COMPOUNDS

SAMUEL R. WILEN AND P. M. APFELBAUM

34916a Current studies in the chemistry of unusual aromatic hydrocarbons. Thyagarajan, Bndalur S. (Univ. of Idaho, Moscow, Idaho). *Intra-Sci. Chem. Rep.* 1970, 4(1), 76 pp. (Eng). A review, of valence tautomers of $C_8H_8$, annulenes, 10π-electron systems, cyclodecapentaenes, barrelenes, bullvalenes, radialenes, helicenes, colicenes, homoarom. hydrocarbons, antiarom. mols., benzocyclopropenes, cyclobutadienes, and coranaphenes, with ~135 refs. SNTT

34917b Preparation of halo anilines (literature review). Ovchinnikov, P. N.; Bat, I. I.; Bezdel, L. S. (USSR). *Tr., Gos. Inst. Prikl. Khim.* 1969, No. 62, 5–29 (Russ). A review on the redn. of $O_2NC_6H_4X$ (I) with metals, sulfides, $H_2S$, $N_2H_4$-$H_2O$, and H over catalysts, and substitution of halogens by $NH_3$. Hydrogenation of I on stationary catalysts under pressure in column reactors is recommended as most promising technol. process. 134 refs. J. Panchartek

34918c Disproportionation and transalkylation of toluene. Otani, Seiya; Iwamura, Takao; Sato, Masaki (Toray Ind., Ltd., Japan). *Sekiyu Gakkai Shi* 1970, 13(4), 282–5 (Japan). A review of the title (Tatoray) process developed by Toray Co., Japan, with 15 refs. DSJY

34919d Influence of transalkylation reactions on the alkylation of benzene by ethylene. Mamedov, A. A.; Pinsker, A. E. (Gos. Nauch.-Issled. Proekt. Inst. Azotn. Prom., Dneprodzerzhinsk, USSR). *Neftekhimiya* 1970, 10(2), 189–94 (Russ). The alkylation of $C_6H_6$ with $C_2H_4$ took place with simultaneous transalkylation of the polyethyl-substituted benzenes, which occurred with intermediate formation of 1,1-diarylethanes. The alkylate contained 30% EtPh as optimum content. Penta- and hexaethylbenzenes, as well as 4-ethylidene-1,1,2,3,5,6-hexaethyl-2,5-cyclohexadiene were active poisons for the catalyst of the $C_6H_6$-$C_2H_4$ alkylation. The activity of the catalytic complex was maintained at a high level by providing the conditions to obtain low-alkylated compds. only. The equil. compn. of $Et_2C_6H_4$ isomers obtained during alkylation was obtained by transalkylation on account of the intermol. redistribution of the Et groups from polyethylbenzenes to $C_6H_6$ with the participation of 1,1-diphenylethane. GGJR

34920x Reduction of an aromatic carboxyl to a methyl group. Benkeser, Robert A.; Foley, Kevin M.; Gaul, James M.; Li, George S. H. (Dep. of Chem., Purdue Univ., West Lafayette, Indiana). *J. Amer. Chem. Soc.* 1970, 92(10), 3232–3 (Eng). A mixt. of aromatic acid [BzOH, *m*- or *p*-$MeC_6H_4CO_2H$, *p*-Cl-, or $BrC_6H_4CO_2H$, *o*-$C_6H_4(CO_2H)_2$, 3,5-$Me_2C_6H_3CO_2H$] and $Cl_3SiH$ in MeCN was refluxed, treated with $Pr_3N$, refluxed, treated with KOH in MeOH, and refluxed to give the corresponding Me derivs. (e.g., BzOH → PhMe). DSJN

34921y Reactions of halometal alcoholates. XXXI. Synthesis of monohydroxyaryl(dimethyl)arylmethanes. Lapkin, I. I.; Belonovich, M. I.; D'yakova, G. F. (Perm. Gos. Univ., Perm, USSR). *Zh. Org. Khim.* 1970, 6(5), 983–5 (Russ). The simultaneous reaction of $XCMe_2OMgBr$, YOMg, and $HCO_2Et$ or $(CO_2Et)_2$ gave 33–76% $XCMe_2Y$ (X, Y given): Ph, $C_6H_3Me(Pr\text{-}iso)OH\text{-}2,5,4$; Ph, 4-hydroxynaphthyl; 4-$MeC_6H_4$, 4-hydroxynaphthyl; 4-$MeC_6H_4$, $C_6H_2Me(Pr\text{-}iso)OH\text{-}2,5,4$; 4-$MeC_6H_4$, 4-$HOC_6H_4$; 3-$MeC_6H_4$, 4-hydroxynaphthyl; 3-$MeC_6H_4$, 4-$HOC_6H_4$; 4-$MeC_6H_4$, $C_6H_2(OH)Me\text{-}4,2$; 3-$MeC_6H_4$, $C_6H_2Me(Pr\text{-}iso)OH\text{-}2,5,4$; Ph, 4-$HOC_6H_4$; Ph, $C_6H_2(OH)Me\text{-}4,3$; Ph, $C_6H_3(OH)Me\text{-}4,2$; and Ph, $C_6H_3(OH)Me\text{-}3,5$. CPJR

34922z Complexes of aromatic hydrocarbons with metal halides and hydrogen halides. VIII. Absorption bands of anions in ir spectra of complexes of aromatic hydrocarbons with aluminum halides and hydrogen halides. Korobeinicheva, I. K.; Bochkarev, V. S.; Koptyug, V. A. (Novosibirsk. Inst. Org. Khim., Novosibirsk, USSR). *Zh. Obshch. Khim.* 1970, 40(4), 854–8 (Russ). Ir spectra were shown for complexes of $AlCl_3$ and HCl or $AlBr_3$ and HBr with mesitylene and $C_6Me_6$, as well as for melts of KBr-$AlBr_3$ and NaCl-$AlCl_3$ in vaseline oil. The spectra indicated the existence of complexes of type $A.HX.AlX_3$ and $A.HX.2AlX_3$ where A = an aromatic compd. and X = Cl or Br. The spectra showed the existence of ions $AlX_4^-$ and $Al_2X_7^-$, resp., in the complexes of above types. This confirms the ionic nature of these complexes of types $AH^+.AlX_4^-$ and $AH^+.Al_2X_7^-$. G. M. Kosolapoff

34923a Preparation of a benzene alkylation catalyst by the boron trifluoride-promotion of inorganic oxides. Kozorezov, Yu. I.; Novozhilova, T. S.; Ryabtseva, Yu. V. (Krasnodar. Filial, VNIINeftekhim, Krasnodar, USSR). *Neftepererab. Neftekhim. (Moscow)* 1970, (4), 44–6 (Russ). A catalyst for alkylating $C_6H_6$ with $C_3H_6$ was obtained from com. $Al_2O_3$ calcined at 600° and promoted at 50° with ≧2 wt. % $BF_3$. The conversion of $C_3H_6$ was 98% at 1 atm, 75°, space velocity of $C_6H_6$ 3 $hr^{-1}$, and 5–6 (moles) $C_6H_6$-$C_3H_6$, yielding 150% iso-PrPh, based on $C_3H_6$. GGJR

34924b Combined production of isopropylbenzene and ethylbenzene. Safronov, V. S.; Kiselev, V. B.; Zatulovskii, G. M.; Fesenko, V. D.; Sorokin, A. D. (Kuibyshev. Zavod Sin. Spirta, Kuibyshev, USSR). *Neftepererab. Neftekhim. (Moscow)* 1970, (4), 36–8 (Russ). $C_6H_6$ was alkylated with a gas mixt. cont. $C_3H_6$ and $C_2H_4$ on $AlCl_3$ catalyst at 25–30 atm, 120–5°, and 1:3–3.5 molar olefins-$C_6H_6$. The olefin conversion was 99–99.9 in 1 pass and $AlCl_3$ consumption 6–6.3 kg/ton alkylbenzenes, yielding alkylate with 6–7% EtPh, and 28–30 wt.% iso-PrPh, which were sepd. by fractionation. GGJR

34925c Simplified method for determining the sensitivity of the fractionating column zone to regulation. Mikhno, S. F.; Koptev, G. P.; Zykov, D. D. (Bagleiskii Koksokhim. Zavod, USSR). *Koks Khim.* 1970, (5), 42–5 (Russ). For mixts. in which 2 components predominated, temp. ranges corresponding to zones of max. sensitivity to automatic control in fractionating columns were detd. from max. in plots of concn. differences $\Delta = y - x$ of the low boiling component in the vapor and liq. phases against temp. *t*. These zones (for mixts. contg. mainly $CS_2$-$C_6H_6$, $C_6H_6$-PhMe, and PhMe-$Me_2C_6H_6$) were broader than those calcd. ($t$ = 54.5–71.5°, 88–103°, and 118–32°, $x$ = 0.05–0.17, 0.66–0.18, and 0.67–0.19). The calcd. ranges for the most sensitive plate were $t$ = 60–4°, 93–7°, and 123–7°, and $x$ = 0.48–0.36, 0.47–0.34, and 0.48–0.34. Lucile S. Davison

34926d Reduction of 3,4-dichloronitrobenzene on platinum catalysts. Bat, I. I.; Ovchinnikov, P. N.; Chistyakova, G. A.; Rebrova, V. V.; Guseva, L. G.; Ostrovskii, V. I.; Grachev, A. M.; Ershova, T. M.; Shcherbakova, S. S. (USSR). *Tr., Gos. Inst. Prikl. Khim.* 1969, No. 62, 57–63 (Russ). Pilot plant and com. scale expts. were carried out on catalytic hydrogenation of 3,4-dichloronitrobenzene (I) to 3,4-dichloroaniline (II). The catalysts were prepd. by satn. of the AP-3 activated C with $H_2PtCl_6$ followed by redn. with $HCO_2Na$ or H. Pilot plant expts. were run using 40 ml of a catalyst contg. 0.5% Pt, 0.20–0.22 g I per ml of catalyst/hr, 30% I soln. in $PhNH_2$, under H pressure of 200 atm, and at 80–140°. A catalyst contg. 1% Pt gave satisfactory results. Com. scale expts. with recycling H were run using 1500–1800 ml of the catalyst, 0.25–0.28 g I per ml of catalyst/hr, 30% I soln. in $PhNH_2$, H pressure of 200 atm, and H vol. rate of 30,000 $hr^{-1}$ intermediate products were sepd. at 40–50° but not at 60–80° and the degree of dechlorination of I was <0.1 mole %. The conversion degree of I was >99.7% over the temp. range 70–95°, and the I content of the product was <0.06%. The catalyst retained its activity for >2100 hr. Ryszard Piekos

34927e Stable carbonium ions. 12. Methyleneiminonium salts. 1. Volz, Heinrich; Kiltz, Hans H. (Inst. Org. Chem., Univ. Karlsruhe, Karlsruhe, Ger.). *Tetrahedron Lett.* 1970, (22), 1917–20 (Ger). Treatment of $RR^1NMe$ with $(p\text{-}MeOC_6H_4CH_3)_2CH^+$ or $Ph_3C^+$ (as $ClO_4^-$ salts), followed by $CCl_4$ gave >80% methyleneiminonium salts $2,4,6\text{-}Me_3C_6H_2N^+{:}CH_2Me$, $2,4,6\text{-}Me_3C_6H_2N^+(CD_3){:}CD_2$, *tert*-$BuMeN^+{:}CH_2$, or *tert*-$Bu_2N^+{:}CH_2$ (as perchlorates). When $(p\text{-}MeOC_6H_4CH_3)_2CH^+ClO_4^-$ was used, deprotonation of the carbonium ion to the carbene was not detected, although the immonium salts were formed. $Me_2N$ yielded a mixt. of $Me_2N^+{:}CH_2ClO_4^-$ and its $Me_2N$ addn. compd. The methyleneimmonium salts were demethylated with $H_2O$ and formed Mannich bases with C-H acids and the methylene group was reduced to methyl with $HCO_2H$. They underwent electrophilic substitution with aromatic amines. CWJG

34928f Sulfide catalysts in chloro- and dichloronitrobenzene reduction reactions. Bat, I. I.; Chistyakova, G. A.; Ovchinnikov, P. N.; Guseva, L. G.; Rebrova, V. V. (USSR). *Tr., Gos. Inst. Prikl. Khim.* 1969, No. 62, 69–74 (Russ). Pilot plant and autoclave expts. were run on hydrogenation of *m*-$ClC_6H_4NO_2$ (I) and 3,4-dichloronitrobenzene on 2% PdS, 0.5% PtS, 2 and 20% Re as $Re_2S_7$ pptd. on the AP-3 activated C. Pilot plant expts. were run using 40 ml of a catalyst, ~0.20 g of a nitro compd. per ml of catalyst/hr, and H pressure of 200 atm. Redn. of a 25% soln. in *m*-$ClC_6H_4NH_2$ at 80 and 100° on the PdS and PtS catalysts was highly selective but the catalysts were considerably less active than the pure metals. Autoclave runs with the $Re_2S_7$ catalysts carried out under H pressure of 100 atm showed them to have no tendency to dechlorinate I or the solvent even under forcing conditions. However, the catalysts were less active than Pt. The 5 and 10% $Re_2S_7$ catalysts were also highly selective in pilot plant expts. Their activity and selectivity increased with increasing $Re_2S_7$ content; selectivity dropped in time due to the loss of S. With a 5% catalyst, the dechlorination degree increased from 0.04–0.08% at the start to 0.2% after 360 hr, and to 1.7% after 1400 hr. This makes the catalysts unsuitable for industrial use. Ryszard Piekos

34929g Rearrangements of tertiary amine N-oxides. XXVI. Reactions of arylnitrones with lead tetraacetate. Tamagaki, Seizo; Oae, Shigeru (Fac. Eng., Osaka City Univ., Osaka, Japan). *Bull. Chem. Soc. Jap.* 1970, 43(5), 1573–4 (Eng). The oxidn. of arylnitrones with $Pb(OAc)_4$ to give tertiary amine *N*-oxides was studied. A soln. of α,*N*-diphenylnitrone in $C_6H_6$

AB0000114724/5

DCA

400 parts $3,4-Cl_2C_6H_3NO_2$

4 " morpholine

.012 part Pt

3 or 4 hours $H_2$ @ 2C.8 atm. 80°C ± 10

10164

7464

17628 parts

based on total wt

$\frac{17628}{400} \times .012 = .5288 \div .05 = 10.5$ # Catalyst

$\frac{10164 \times .012}{400 \times .05} = 6.1$ lbs - catalyst based on DCNB

Bill Shackelford

Bill attached
Crude notes on Dupont's
Hyday. Comments
of you & your
staff appreciate.
Please see that J E Fowler
sees cost est.

Thanks

1-7-80

① BASIS – WEST HELENA LANNATE UNIT
– 5000000 LBS Liquid Hydan (MHA) 1981 &
10,000,000 LBS MHA 1982 with startup quantities
in 1980 est. at .500 to 1.0 MM LBS.
– Startup 2 MTS after approval earliest possible date
estimated as September 1, 1980

VERTAC STRENGTHS are:
ⓐ Excellent project manag. reputation throughout Dupont
ⓑ Hydan provides a vehicle that would allow co manufacture
of Lannate insecticide
ⓒ VERTAC process unit is a good basic fit will excellent
long term capacity. Ultimate capacity in excess of 15 MM#/yr.
– However, on the negative side:
ⓐ Hydan is not a commodity thru LANNATE with a slim
margin.
ⓑ To avoid corrosion & interference with LANNATE, project
modifications will be about $300M.

② Modifications – ESTIMATED COST $300,000 with an additional
$25 to 40M in Dedicated Laboratory equipment.
ⓐ VERTAC will require some type of capital financing
By Dupont.
ⓑ VERTAC would retain title to all equipment except
possibly the Hast. C centrifuge (~$180,000) supplied by Dupont.
ⓒ Estimated timing for the project is 60 days after approval.
all major equipment items are in hand or available.
ⓓ Equipment added is generally corrosion resistant
equipment (glass, Hastelloy, FRP) quite similar to
the MCA project.

③ Environmental & Safety
ENVIRONMENTALLY MHA is quite similar to Lannate.
Liquid wastes ~~were~~ are malodorous requiring deep
well or equiv. disposal. However, on site liquid wastes
may be minimal. There are no solid wastes. Air
emissions are analogous to Lannate with malodorous
mercaptan & sulfide emissions. In general safety
considerations are less severe than Lannate (no
low level toxicants) But corrosives & cyanide
containing chemicals are involved. Because of deficiencies
during Lannate operations as to odor, the West Helena
plant has as well for special attention in this area

④ Manufacturing — Costs should be less than the Lannate operation (fewer process steps, no packaging, etc.). Cost estimate reflects both past Lannate & MOBIL NBE operations. Some thoughts:

ⓐ BUILD a fee schedule to accomodate Lannate & Hydan.

ⓑ Secure an acceptable IDLE month/charge

ⓒ " " " fixed monthly fee

ⓓ " " production incentive fee

ⓔ Plant costs:

$.10 → $.15/# for 5mm to 10mm #/yr range fully amortized basis

.12 → .20/# " " " "

⑤ Additional Points

MHA is an old line commodity chicken feed additive. Liquid Hydan is a more convienent form with definite market potential. Dupont has extensive research background on liquid Hydan altho on a 300 gal scale & 25 yrs plus experience on solid Hydan. Jess Stuart is the product manager for both Lannate & Hydan.

⑥ Lannate / Hydan comparison:

| | Lannate: | Hydan: |
|---|---|---|
| transport. Intermediate | - dedicated S/S T/T for slurry | Plan to use same |
| environmental | - Malodorous sulfur compounds | - same |
| | - low level toxicity & MIC | - less hazardous |
| process | - vac. evaporation | - acid hydrolysis |
| | - solvent exchange | - evaporation |
| | - MIC RXN | - neutralization |
| | - formulation | - centrifugation |
| | - filtration | |
| Waste | - packaging | |
| | - deep well malodorous | ditto |
| | - onsite innocuous | |

Lannate Proj. Profitability

BASIS Liquid Hydan (MHA) in Lannate Unit

| | 1981 | 1982 |
|---|---|---|
| - VOLUME | 416M#/MT<br>5MM#/yr. | 813M#/MT<br>10MM#/yr. |
| - COSTS | | |
| - Raw Matls | — assume None By Depart — | |
| - Dir. Plt Costs | $.08 /# | $.05 /# |
| - Indir Plt Costs | .05 | .04 /# |
| - Plt Adm | .02 | .01 |
| ~~[illegible]~~ Plt Cost | $.15 /# | $.10 /# |
| WITH Dep. tax Ins | .20 | .12 |
| - Modification Costs | — assume By Depart (~$300M) | |
| - Startup Costs | $50 to 100M | |
| - Project Revenue ~~[illegible]~~ | - 1750 MM (35¢/#)<br>- 1500 (30¢/#)<br>1250 MM (25¢/#) | 3.0 MM (30¢/#)<br>2.5 MM (25¢/#)<br>2.0 MM (20¢/#) |
| - Pretax Op Margin | .15 — .20 ¢/#<br>$.750 — 1,000 Million | .13 — 17<br>1.3 — 1.7 million |
| - Return on assets | .5 — .6 | .8 — 1.5 |

~~[illegible]~~ MT

- Idle Mt: — $75M
- Manf. Monty: (Hydan) 100M
  (Lannate) 125M ~~[illegible]~~ M
- Prod incentive
  Hydan: 15¢/#
  Lannate: 50¢/gal

25 mm

Sales $1.35 — 1.50

Sales 1.25 price est (99¢/# solid) 300000.00

10000000

900

140

HCl — 1¢
waste — 4¢
$H_2$ — 1¢
cyan — ?
} rovers

99¢/#
est. MHA @ 40¢/#

mod 6 cent

25
40

60¢

mfc 40 cents

transportat 100 40¢

Still can make Lannate !

| | | | | |
|---|---|---|---|---|
| invest | $1.500 M | 1.5 | 1.5 | 1.5 |
| Gross Ret | 40% | 50% | 60% | 70% |
| annual profit | $600 M | $750 M | $900 M | $1050 M |
| | 12 | 12 | 12 | 12 |
| per MT | $50 M/MT | $62.5 M/MT | 75 M/MT | $87.5 M/MT |
| per # @ 5 mm | 12¢/# | 15¢/# | 18¢/# | 21¢/# |
| @ 10 mm | 6¢/# | 7.5/# | 9¢/# | 10.5/# |
| total cost range | 24–32 | 27–35 | 30–38 | 33–41 |

25 → 40¢/#

125 — 145

$200/hr

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ESTIMATED MANUFACTURING COSTS PRODUCT 7-HHA Dupont (Liquid/Hydrous)

| (A) PLANT PRODUCTION | Liquid/Hydrous | | |
|---|---|---|---|
| Basis (schedule & capacity) | 500 M#/yr Campaign 1 Reaction 41 KM/H | | 100 M#/yr Campaign 1 Reaction 833 K/H |
| | Laminate unit after modification BASIS avg. prod | | |
| (B) EXPENSE DESCRIPTION | $/lb. ($M/MT) | $/lb. ($M/MT) | $/lb. ($M/MT) |
| 1. Raw Materials (100 M# BASIS) | | MOBILE + INSTALLATION NO LAUNDRY | |
| Type / Units / Unit Cost | | | |
| HCl 31% .29 | | | |
| Cyanuric .87 | — NO COST — | | |
| NH3 .03 | Common Manufacture | | |
| Nitrogen | | | |
| Raw Materials | | | |
| 2. Direct Manufacturing Cost | | | |
| A. Salaries & fringes | (2 M) | (2M) (4M) | (3) |
| B. Wages & fringes | (12 M) | (12M) (11.7M) | (18) |
| C. Ordinary supply | (1M) | — — | (2) |
| D. Nitrogen | — | (2M) (1.5M) | — |
| E. Gas | (2M) | — — | (3) |
| F. Power | (10 M) | (5M) (4M) | (12) |
| G. Water & air | (1M) | (1M) (M) | (1) |
| H. Other | (4 M) | (6M) (7M) | (5) |
| Dir. Mfg. Cost | .076 (37 M) | (26M) (33M) | .053 (49M) |
| 3. Indirect Manufacturing Cost | | | |
| A. Effluent control | (2M) | (3M) — | (2) |
| B. Laboratory | (4M) | (9M) (6M) | (6) |
| C. Stores & receiving | (4 M) | (8M) (7.2M) | (6) |
| D. Safety & security | | | |
| E. Shipping & packaging | | (12M) | |
| F. Maintenance | (11 M) | (6M) (15M) | (14) |
| G. Yards & grounds | (1) | — (1.3) | (1) |
| Indir. Mfg. Cost | .055 (23 M) | (23M) (41.5) | .035 (29M) |
| 4. Plant Administration | .017 (7M) | (5M) (5M) | .011 (9) |
| Total Plant Cost | .149 (62 M) | (54M) (90M) | .098 (82M) |
| 5. Insurances, Taxes, & Depreciation | .043 (18 M) | (8M) (19M) | .022 (18) |
| Total Amortized Plant Cost | .192 (80 M) | (62M) (109M) | .12 (100M) |

Manf cost compared with
MOBIL NBE Unit & Tannate
Unit cost pages + inflation

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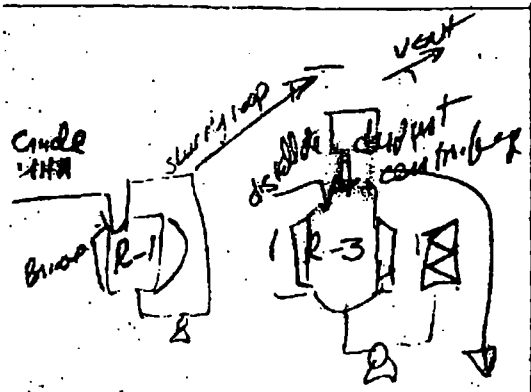
PROCESS: HYDAN (Dupont) STEP: DATE: 6/19/80




Rx R-1 1 Mgal

Material:

Volume:

Raw Materials:

Other:

Dup. Hot C Cont.

Chemistry

Name

MW

MP

BP

SPGR

CHARGE

PROCESS VESSEL CONDITIONS

| ITEM | MOLES | #'s | VOLUME | JKT | Δ H | TEMP | PRES | OPN | TIME |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

RKS (5548 / 534.8# Basket / gears) = 10 Baskets in 12 HRS
1.2 hr / BASKET
(liquid per Basket 125 gals)

Seems R...

AB0000118211/8

# HYDAN Modification Costs
(out of pocket)

(1) 31% HCl, RELOCATE FRP TANK, PUMP, PIPING, 12M gal — $20M
(2) Cyanhydrin service convert SS slurry tank, 17M gal, overhaul mixer, pump, piping, instruments - Add piping jumper to R-2 — 2.5M
(3) Provide BRINE SERVICE in conjunction with existing steam to R-2 JACKET (90 psig steam) — 10M
(4) Refurbish R-2 inspect repair glass, rupture disk, load cells — 2M
(5) RELOCATE glass condensers, 2x60 ft² glass piping 4" vapor & 2" reflux — 20M
(6) Relocate Karbate jet & after condenser with vacuum pressure control & glass vapor piping — 12M
(7) Relocate 600 gal glascote receiver install piping & level glass or load cell with pump to waste water (on or off site) — 15M
(8) Refurbish existing MTAO slurry, Lannate odor control vent network, blower, overall flare or provide suitable alternate — 30M
(9) Provide NH3 service, 500 gal anhydrous noise tank with piping to R-2 & concrete pad & sparger — 3M
(10) Setup R-1 for slurry feed glass transfer piping (blow from R-2), add cooling water to jacket (?), corrosion resistant pump & slurry loop — 20M
(11) Install Dupont Centrifuge OVD R-3 complete with steel structure, elec. controls, ventilation, access platform — 30M
(12) Reline R-3 with Derakane plus add centrifuge entry chute, reline centrifuge chute, provide level system for R-3, & add distillate recycle line — 15M
(13) Provide pump around mixer for R-3 relocate kenics & slurry pump & transfer to waste water tank — 15M
(14) Provide 2x20M gal MHA liq. storage tanks (FRP) with tank diking, level inst, vent systems, piping, etc. — 50M
(15) Provide MHA final product cart. filter — 3M
(16) MISC. provisions to allow for Lannate / Hydan turnaroads — 15M
(17) Misc contingencies & engr. — 272.5

$300M

Sub Inst — 25 to 40M

cc: Tom Greg
Ken
Joe

AG-303 REV. 2-86

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WALKER'S MILL, BARLEY MILL PLAZA
WILMINGTON, DELAWARE 19898

AGRICULTURAL PRODUCTS DEPARTMENT

July 18, 1988

Mr. Geoffrey Pratt
Cedar Chemical Corporation
5100 Poplar Avenue, 24th Floor
Memphis, Tennessee 38137

Dear Geoff:

Thanks for returning the fully executed confidentiality agreement for "Fortress". Enclosed is process information provided under the terms of the confidentiality agreement so that you may determine your interest in making the "Fortress" technical.

We are currently doing toxicity testa and venture economics. We do not anticipate having in-house facilities available for this task and therefore will give prime consideration to contracting. We would by mid-August appreciate a budget type quote of the toll fee for this product. If we know which wastes you can handle we can estimate the cost of handling the others. The volume is estimated at 1MM pounds per year in 1991 and 1992 increasing to 2MM or 3MM pounds in 1996 depending on the final use rate.

Sincerely,

T. N. Kirchner
Contract Manager

TNK/df525
Attachment:
Guidelines & Instructions
"Fortress" Manual



AB0000118068/1

E. I. DU PONT DE NEMOURS & COMPANY, INC.
AGRICULTURAL PRODUCTS DEPARTMENT
WILMINGTON, DELAWARE 19898

# CONTRACTORS MANUAL

## "FORTRESS"

## PRELIMINARY PROCESS FLOW SHEET INFORMATION

DU PONT CONFIDENTIAL INFORMATION

MANUAL NUMBER 2

WHEN NO LONGER NEEDED, PLEASE RETURN TO

E. I. DU PONT DE NEMOURS & CO., INC.
AGRICULTURAL PRODUCTS DEPARTMENT
CONTRACT MANAGER, MANUFACTURING DIVISIO
WALKER'S MILL, BARLEY MILL PLAZA
WILMINGTON, DELAWARE 19898

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| | |
|---|---|
| Exhibit 1 | Reactions |
| Exhibit 2 | Process Information |
| Exhibit 3 | Possible Process Arrangement |
| Table 1 | Process stream compositions based on 100 pounds of "Fortress" technical |

MSDS for "Fortress" tech, Chlorine, Dichloridate, HCl, Chloral, and Phosphorus Trichloride

EXHIBIT 1

(1) $PCl_3 + Cl_2 \xrightarrow{CH_2Cl_2} PCl_5$ (not isolated)

| Phosphorus Trichloride | Chlorine | Phosphorus Pentachloride |
|---|---|---|
| 137.4 | 70.9 | 208.3 |

(2) $PCl_5 + CCl_3\text{-}CHO \xrightarrow{CH_2Cl_2} Cl_3C\text{-}\underset{Cl}{CH}\text{-}O\text{-}PCl_4$ (not isolated)

| Pentachloride | Chloral | Phosphorane |
|---|---|---|
| 208.3 | 147.4 | 335.6 |

(3) $Cl_3C\text{-}\underset{Cl}{CH}\text{-}O\text{-}PCl_4 + H_2S \xrightarrow{CH_2Cl_2} Cl_3C\text{-}\underset{Cl}{CH}\text{-}O\text{-}\overset{S}{\overset{\|}{P}}Cl_2 + 2HCl$

| Phosphorane | Hydrogen Sulfide | "Dichloridate" | Hydrogen Chloride |
|---|---|---|---|
| 355.6 | 34.1 | 316.8 | 36.5 |

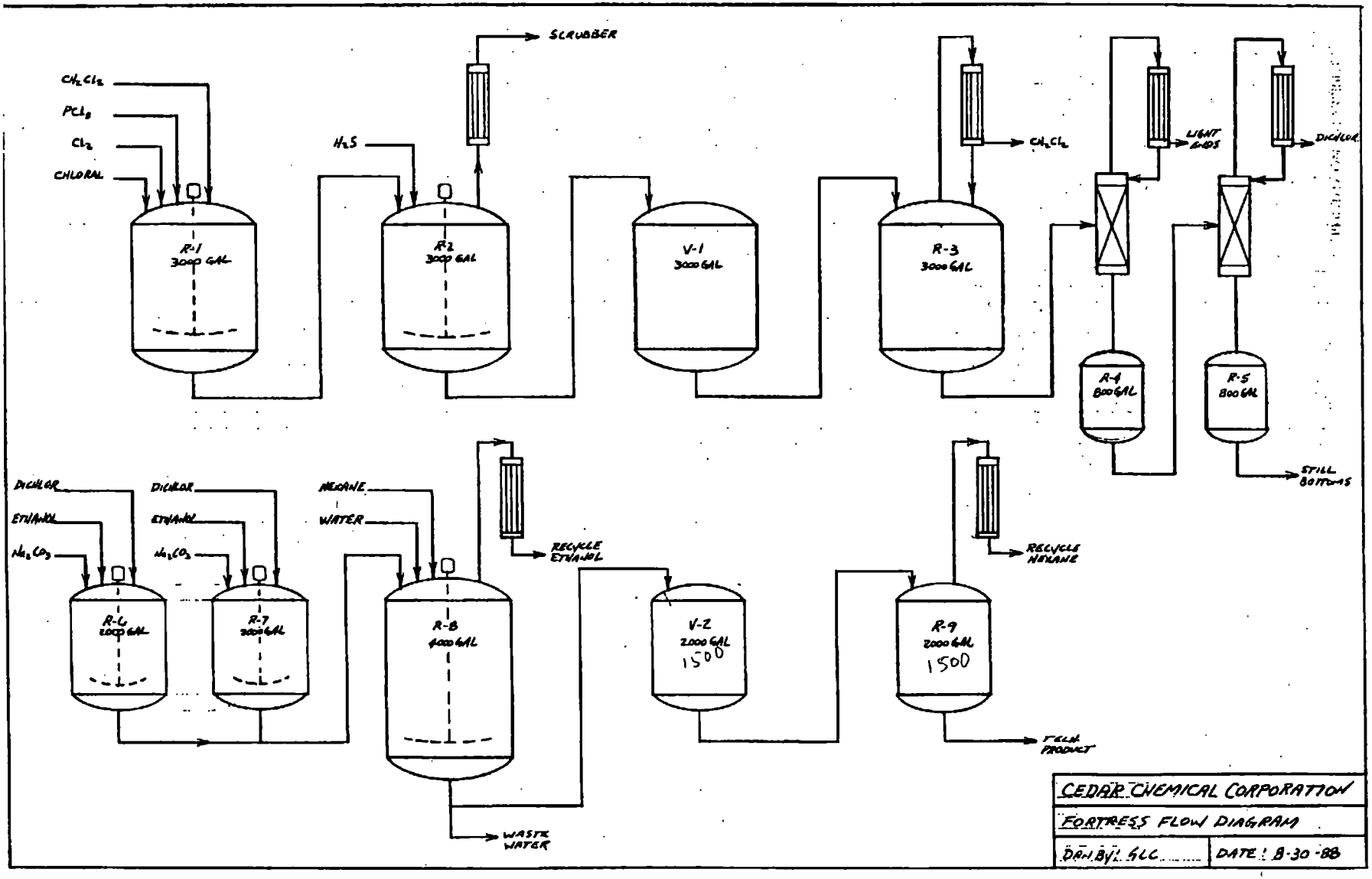
(4) $Cl_3C\text{-}\underset{Cl}{CH}\text{-}O\text{-}\overset{S}{\overset{\|}{P}}Cl_2 + 2EtOH \xrightarrow[EtOH]{Na_2CO_3} Cl_3C\text{-}\underset{Cl}{CH}\text{-}O\text{-}\overset{S}{\overset{\|}{P}}(OEt)_2 + 2HCl$

| "Dichloridate" | Ethanol | DPX-43898 | Hydrogen Chloride |
|---|---|---|---|
| 316.8 | 46.1 | 336.0 | 36.5 |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temp., °C | 25 | 25 | 25 | 25 | 5 | 25 | -10 | 25 | 25 | - | 80-90 | - | 100-160 | - | 140-175 | 25 | 25 | 25 | - | 30 | - | 25 | 25 | 25 | (1) | 25 | - | 70-80 |
| Press., mm Hg | Atm | Atm | Atm | Atm | Atm | Atm | Atm | Atm | Atm | Atm | Atm | 10-75 | 10-75 | 5-20 | 5-20 | Atm | Atm | Atm | - | Atm | 50-100 | Atm | Atm | Atm | Atm | Atm | 100-200 | 100-200 |
| State, S/L/G | L | L | G | L | L | G | G | L | L | L | L | L | L | L | L | L | L | S | - | L | L | L | L | L | L | L | L | L |
| Composition, lbs | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $CH_2Cl_2$ | 1340.0 | - | - | - | 1340.0 | - | 20.0 | 1320.0 | 1320.0 | 1308.0 | 14.0 | 14.0 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| $PCl_3$ | - | 131.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| $CF_2$ | - | - | 67.6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| $PCl_5$ | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Chloral | - | - | - | 112.5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Phosphorane | - | - | - | - | 131.1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| $H_2S$ | - | - | - | - | - | 39.0 | 6.2 | 2.8 | 2.8 | 2.8 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| HCl | - | - | - | - | - | - | 30.0 | 2.0 | 2.0 | 2.0 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Dichloridate | - | - | - | - | - | - | - | 152.4 | 152.4 | tr | 152.4 | 1.0 | 151.4 | 149.1 | 6.3 | 149.1 | - | - | - | - | - | - | - | - | - | - | - | - |
| $C_2HCl_5$ | - | - | - | - | - | - | - | 3.9 | 3.9 | - | 3.9 | 3.2 | 0.7 | 0.7 | - | 0.7 | - | - | - | - | - | - | - | - | - | - | - | - |
| $POCl_3$ | - | - | - | - | - | - | - | 32.2 | 32.2 | 3.9 | 28.3 | 27.6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| $PSCl_3$ | - | - | - | - | - | - | - | 34.8 | 34.8 | 3.3 | 31.5 | 30.5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| S-Bis | - | - | - | - | - | - | - | 38.6 | 38.6 | - | 38.6 | - | 38.6 | 2.3 | 36.3 | 2.3 | - | - | - | - | - | - | - | - | - | - | - | - |
| Tris | - | - | - | - | - | - | - | 4.5 | 4.5 | - | 4.5 | - | 4.5 | - | 4.5 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| S-Tris | - | - | - | - | - | - | - | 3.2 | 3.2 | - | 3.2 | - | 3.2 | - | 3.2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| O-Anal. | - | - | - | - | - | - | - | 1.3 | 1.3 | - | 1.3 | - | 1.3 | 1.0 | 0.3 | 1.0 | - | - | - | - | - | - | - | - | - | - | - | - |
| Impurities | - | - | - | - | 140.1 | - | - | 10.3 | 10.3 | - | 10.3 | - | 11.8 | 2.0 | 9.8 | 2.0 | - | - | - | 99.3 | 6.4 | - | - | 36.3 | 16.4 | 16.4 | 2.8 | 13.6 |
| Ethanol | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 729.3 | - | - | 683.3 | 668.3 | - | - | 13.9 | - | - | 2.8 | - |
| $Na_2CO_3$ | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 108.8 | - | 9.7 | - | - | - | 9.7 | - | - | - | - |
| $NaHCO_3$ | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 78.9 | - | - | - | 78.9 | - | - | - | - |
| NaCl | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 53.6 | - | - | - | 53.6 | - | - | - | - |
| DPX-43898 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 100.0 | 0.6 | - | - | tr | 100.2 | 100.2 | - | 100.0 |
| Hexane | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 320.0 | - | - | 320.0 | 320.0 | 320.0 | - |
| Water (2) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2000.0 | 2000.0 | - | - | - | - |
| Total | 1340.0 | 131.1 | 67.6 | 112.5 | 1631.2 | 39.0 | 64.2 | 1606.0 | 1606.0 | 1316.0 | 288.0 | 76.5 | 211.9 | 151.5 | 60.4 | 151.1 | 729.3 | 108.8 | | 983.6 | 675.1 | 320.0 | 2000.0 | 2269.7 | 436.6 | 436.6 | 325.0 | 113.6 |

Notes: (1) 70-80°C at end of distillation, 25°C during washes.

(2) Water wash done in two equal charges totaling the amount shown.


SCRUBBER
$CH_2Cl_2$
$PCl_3$
$Cl_2$
CHLORAL
$H_2S$
R-1 3000 GAL
R-2 3000 GAL
V-1 3000 GAL
R-3 3000 GAL
$CH_2Cl_2$
LIGHT ENDS
DICHLOR
R-4 800 GAL
R-5 800 GAL
STILL BOTTOMS
DICHLOR
ETHANOL
$Na_2CO_3$
DICHLOR
ETHANOL
$Na_2CO_3$
HEXANE
WATER
R-6 1000 GAL
R-7 2000 GAL
R-8 4000 GAL
RECYCLE ETHANOL
V-2 2000 GAL 1500
R-9 2000 GAL 1500
RECYCLE HEXANE
FILM PRODUCT
WASTE WATER
CEDAR CHEMICAL CORPORATION
FORTRESS FLOW DIAGRAM
DRAWN BY: GLC
DATE: 8-30-88

Sodium perborate

INTERNAL CORRESPONDENCE

DATE: August 28, 1980

TO: Robert Kirk

FROM: George Mather

Copy for
John M
Larry C
Joe P
Tom L

CC: [redacted]
Circulatory Copy
M-304-107

SUBJECT: HYDAN Project

As indicated, Vertac has been given final consideration for the HYDAN project to start up in October 1980. As indicated on several occasions, DuPont has reacted quite negatively to extensive initial modification expenditures. For this reason the proposal for HYDAN in the Lannate Unit was rejected while DuPont requests refinement of our August 6th proposal for HYDAN in the BSC Unit.

The attached revised process package is more thorough and appears to answer several of Vertac's earlier concerns and questions. Hopefully a fine tuned estimate can now be made.

NOTE: HYDAN appears to be a good solid relatively simple process with immediacy for Vertac. Although the upside market potential is not known, it is a new form of a stable large volume feed additive in which DuPont enjoys a good position. I believe this a project worth sharpening our pencils for and is one of the better opportunities reviewed by myself over the last five years.

GMayl

:tes

Attachment

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

ENERGY AND MATERIALS DEPARTMENT

August 25, 1980

George F. Mather
Business Manager
Specialty Chemicals & Custom Manufacturing
Vertac Chemical Corporation
5100 Poplar Avenue
Memphis, TN 38137

TECHNICAL DATA PACKAGE

Attached is updated Technical Data Package*for Hydan® for your review. This information includes the composition, processing requirements, handling requirements and other details necessary to process this material successfully for Du Pont. This information is transmitted in accordance with our Confidential Technical Information Agreement dated December 19, 1974.

After your review, please confirm to me your original quotation dated August 6, 1980.

To indicate your receipt and understanding of this technical information, please sign the copy of this letter marked "Wilm. E&M Dept. Copy" and return it to me. Inquiries concerning this information should be directed to:

E. I. Du Pont De Nemours and Company
Biochemicals Department
Wilmington, DE 19898
Attention: C. H. Wilson, Manufacturing Div.

Very truly yours,

R. J. De Stefano/gmc

R. J. DE STEFANO
SENIOR PURCHASING AGENT
CONTRACTING SECTION

* Dated 8/1/80

ACCEPTED:

VERTAC CHEMICAL CORPORATION

BY: George F Mather

TITLE: Business Mgr

DATE: August 29 1980

There's a world of things we're doing something about

PERSONAL AND
CONFIDENTIAL

Update 8/1/80

# TECHNICAL DATA PACKAGE

# LIQUID HYDAN® MANUFACTURE

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II. PROCESS DESCRIPTION

III. RAW MATERIAL AND FINISHED PRODUCT PHYSICAL PROPERTIES

IV. ANALYTICAL REQUIREMENTS AND SAMPLE PLAN

V. FINISHED PRODUCT SPECIFICATIONS

VI. INVENTORY RECORDS AND CONTROLS

August 1, 1980

## I. INTRODUCTION

Liquid Hydan® is a nutrient feed supplement for poultry feeds, and is analogous to solid Hydan®, which has been produced by Du Pont since 1954. The liquid product in this document will be referred to as "Liquid Hydan®". The product is categorized as GRAS (Generally Recognized As Safe).

The process is "fairly well-defined". Development work to date has been in glass laboratory equipment and in 50 and 300-gal, glass-lined Pfaudler reactors. Process conditions based on updated process development information are summarized in an attached flowsheet. Additional data will be transmitted as it becomes available. Analytical methods and raw material and finished product specifications are being developed, and will be transmitted as they become available.

Du Pont's schedule requires start-up of facilities in October, 1980, with product available for sale in November. Estimated production quantities are shown:

| YEAR | MM POUNDS OF 88% LIQUID HYDAN® |
|---|---|
| 1980 | .5 |
| 1981 | 5.0 |
| 1982 | 10.0 |
| 1983 | 15.0 |

August 1, 1980

## II. PROCESS DESCRIPTION

### A. GENERAL

The batch process consists of a reaction step, vacuum evaporation, neutralization, cooling, and then centrifugation to remove the byproduct ammonium chloride. The cake is washed with a near-saturated ammonium chloride solution for yield recovery and the wash recycled to the evaporation step. The byproduct wet cake will be either land-filled or redissolved for deep well disposal. The finished product will be shipped in bulk and possibly 55-gal drums. A minor amount of one-quart samples will be requested.

All materials in the process are malodorous, and a vapor incineration system is advisable. Should no incinerator be available, exhaustive scrubbing with NaOCl may suffice to control odors. The spent scrubber solution then becomes an additional waste.



AB0000118111/5

August 1, 1980

## II. PROCESS DESCRIPTION

### B. HYDROLYSIS REACTION

#### Chemistry

$$CH_3SCH_2CH_2CH(OH)CN + 1.18\ HCl + 2H_2O \xrightarrow{95°C}$$

M.W. 131.2 "Cyanhydrin M" M.W. 36.5 M.W. 18

$$CH_3SCH_2CH_2CH(OH)COOH + NH_4Cl + .18\ HCl$$

M.W. 150.2 MHA (Methionine Hydroxy Analog-free Acid) M.W. 53.5 M.W. 36.5

#### Description

A specified quantity of 31% hydrochloric acid (20° Be) is charged at ambient temperature to the reactor. The amount will be 1.18 moles per mole of Cyanhydrin M (calculated as commodity). The specified amount of Cyanhydrin M is then added over 60-90 minutes while cooling is applied to the reactor. Chilled cooling water (5-10°C) is recommended to minimize Cyanhydrin M addition time and achieve but not exceed 95-100°C. (See Figure 1 for a typical temperature profile.) During the first 60-80% of the Cyanhydrin M addition, the reactor temperature will rise due to the exothermic reaction. Full cooling may then be required in order to not overshoot the 95°C maximum. If the reaction temperature exceeds 95°C at full cooling, the addition rate should be decreased. Cooling will likely be required to maintain a temperature of 95-100°C during addition of the remaining 20-40% of the Cyanhydrin M charge. After all the Cyanhydrin M has been added, 95-100°C is maintained for about 2 hours to complete the hydrolysis reaction. It will be necessary to use steam heating on the vessel jacket to maintain 95-100°C during the holding period. A condenser to provide reflux to the reactor will be necessary. Roughly 10-30% of the 0.18 molar excess of HCl will be lost to the overhead vapor stream. The rest will remain in the reaction mass (hydrolyzate).

The byproduct of the reaction is ammonium chloride. A portion of the ammonium chloride will precipitate during the reaction to form a slurry containing ~9-12 wt % solids at 95°C. The solids are easily resuspended, and show no tendency to foul glass laboratory equipment. It is important that these solids not undergo severe attrition in the process, since the smaller particles would make the final separation step difficult.



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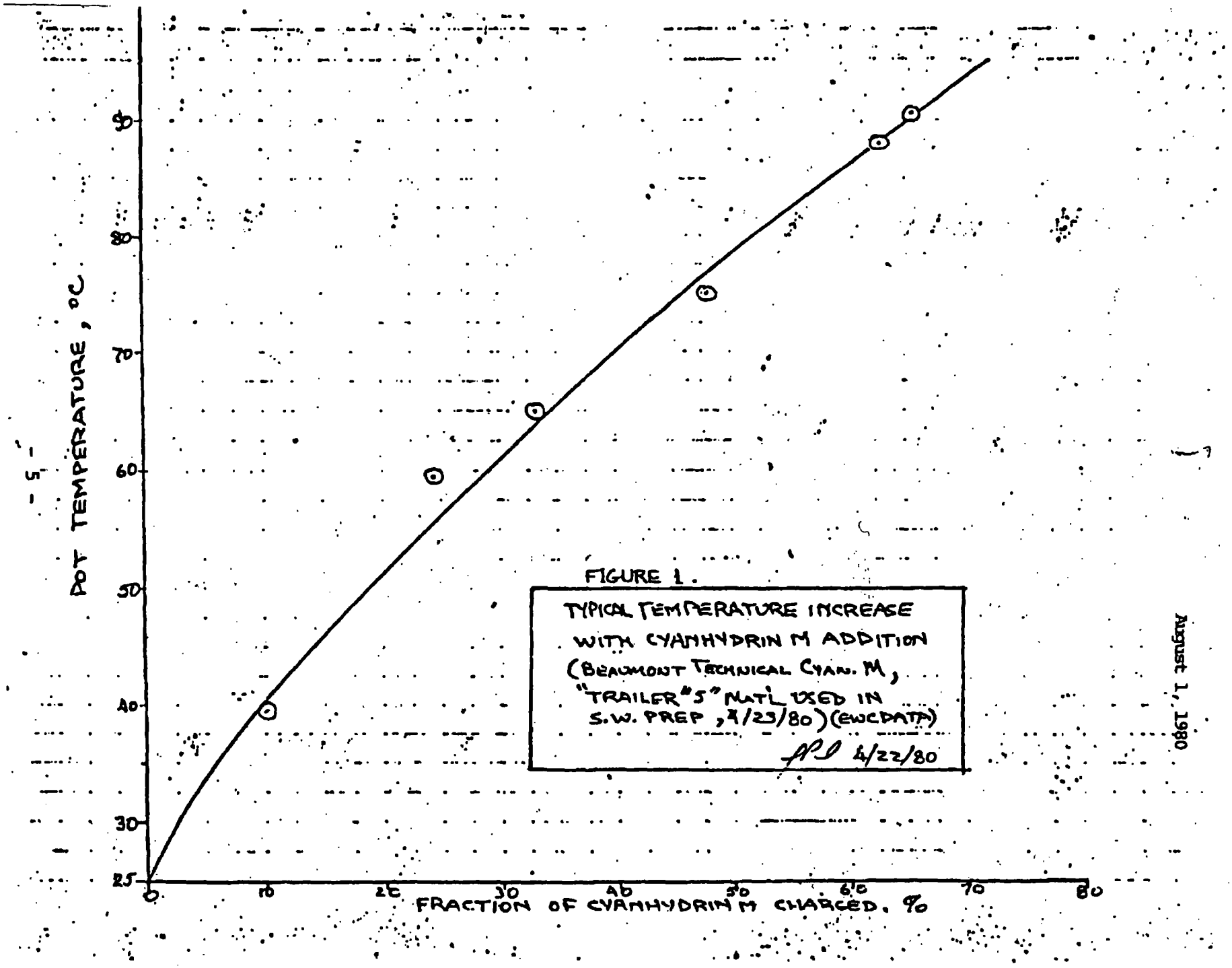



FIGURE 1.

TYPICAL TEMPERATURE INCREASE WITH CYANHYDRIN M ADDITION (BEAUMONT TECHNICAL CYAN. M, "TRAILER" 5" MAT'L USED IN S.W. PREP, 3/23/80) (EWCDATA)

APS 4/22/80

August 1, 1980



AB0000118111/7

## II. PROCESS DESCRIPTION

An acceptable cycle time for addition and hold is ~3.5 hours.

### C. VACUUM CONCENTRATION

The slurry from the prior reaction step is transferred to a second glass-lined, agitated vessel. Vacuum is applied slowly (to avoid "bumping") to an operating pressure of 140-150 torr, where it is maintained. Steam is applied to the jacket and approximately 20% of the slurry weight is evaporated and collected* (See Section II, J. Process Flowsheet). During the distillation, the reactor temperature will rise from ~70°C to 85°C at the indicated pressure. The distillation rate should be maximized to reduce cycle time which is expected to be ~3.5-4 hours. At the end of this step, the liquid portion of the slurry should be slightly more concentrated than the final product.

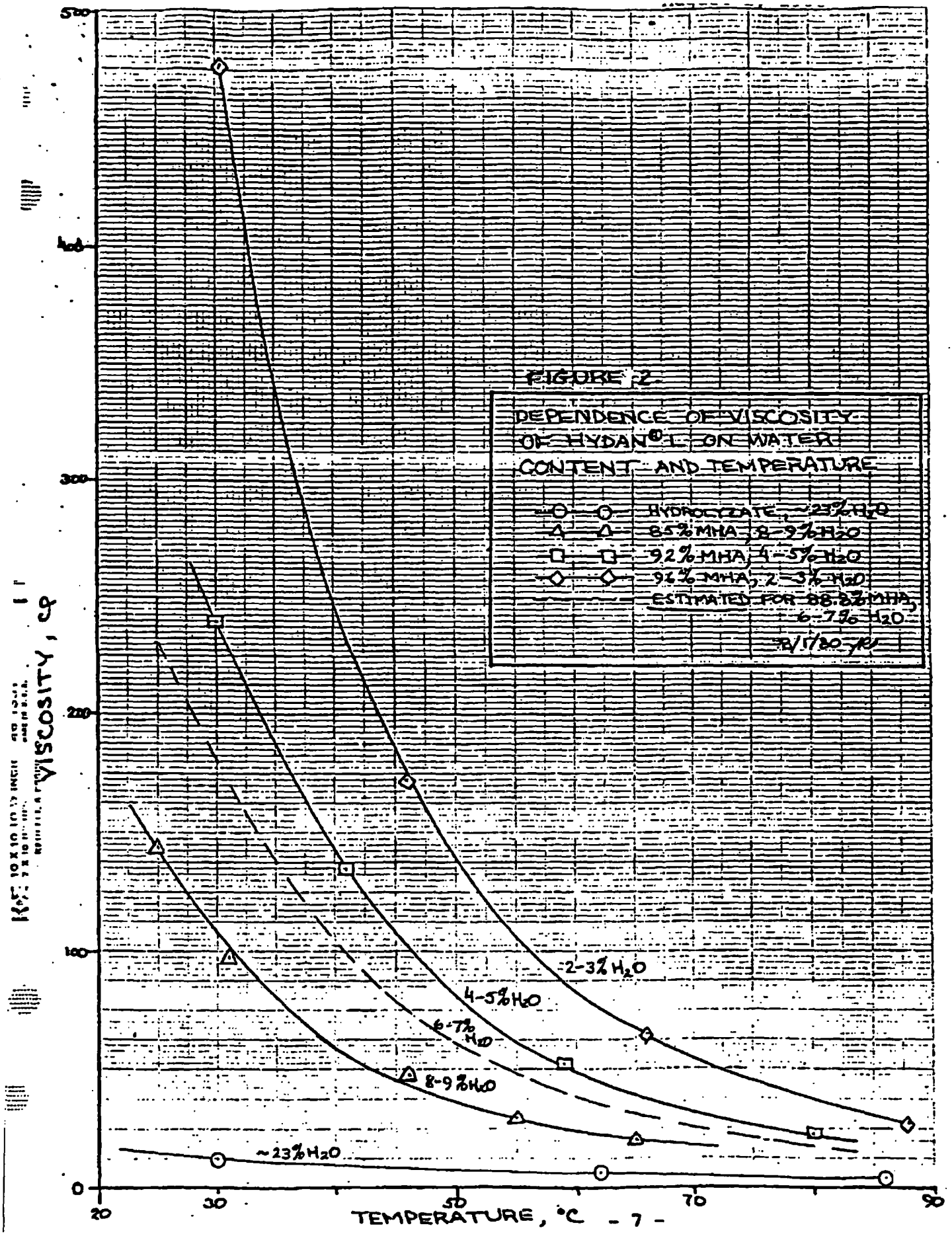
There must be a means of measuring the quantity of distillate removed, since this step controls the strength of the finished product. Use of dual receivers on load cells may be desirable; this would allow collection of 20% of the slurry weight in a larger "main" receiver and subsequent collection of an additional 1-1.5% of slurry weight in a small, accurately calibrated receiver. Distilling out too much water results in a more viscous slurry which is more difficult to transfer and filter (see Figure 2). Termination of the concentration step prior to the endpoint will depress the finished product assay, resulting in rework by reblending or return to the concentrator for further distillation.

The overheads from the step are malodorous and acidic due to methyl mercaptan, dimethyl disulfide, hydrochloric acid and traces of other organic compounds. The composition of the distillate is roughly:

| | | |
|---|---|---|
| $H_2O$ | - | 90 wt % |
| HCl | - | 9.0% |
| $CH_3SH$ | - | 0.2% |
| $CH_3SSCH_3$ | - | 0.7% |
| Other Organics | - | 0.1% |

The noncondensable part of the vapor stream is best disposed of by incineration and the condensed liquid neutralized, deodorized and sent to a biotreatment facility or deep welled (deodorization may not be needed for deep welling). An alternative method of treating the noncondensed vapor stream is scrubbing with an

*Removal of 19.6% of the slurry weight results in a product strength of 88.8% MHA (goal strength). It may be preferable to overconcentrate by removing ~21-21.5% of the slurry weight in order to remove additional $NH_4Cl$ and allow subsequent product strength adjustment by water addition. Tests are in progress to determine the optimum concentration endpoint.






AB0000118111/9

alkaline solution of sodium hypochlorite (see Section II,G. Overhead Vapor Scrubbing).

## D. NEUTRALIZATION

After concentration, roughly 10% of the excess of HCl (∿0.4 lb HCl/100 lb Hydan® L) remains in the slurry and must be neutralized with anhydrous ammonia prior to product isolation. The neutralization and subsequent cooling are carried out preferably in a third jacketed, agitated, glass-lined vessel (to reduce the cycle time in the second vessel) although these operations may be performed in the concentrator.

After release of vacuum, cooling water should be applied to the vessel jacket since the neutralization is exothermic ($\Delta H_{rxn} \simeq$ 23 kcal/gmole). Approximately 0.2 lb $NH_3$/100 lb slurry (∿26 lb $NH_3$/batch) is charged below the surface of the agitated slurry. The ammonia must be anhydrous to avoid adding back unwanted water and the addition weight must be monitored accurately to avoid overcharging. The addition itself requires about 15-40 minutes due to a limitation imposed by the ammonia uptake rate. The endpoint of the neutralization is defined as a slurry pH of 0.8-1.0 at 25°C. Initial endpoint determinations will be accomplished by withdrawing samples and measuring pH with a lab pH meter and probe calibrated against a pH 1.00 standard solution. A system will be developed for accurate pH sampling and measurement in the reaction vessel. Overcharging of ammonia can be corrected by addition of HCl (preferably anhydrous HCl to eliminate water addition to the slurry, although 31% HCl is acceptable). Data for pH adjustment using $NH_3$ and HCl will be forwarded when available.

The neutralized slurry is cooled while agitating to a temperature of ∿30°C and held for ∿30 minutes before filtration. Additional $NH_4Cl$ precipitates on cooling. Cooling will require about 2 hours from ∿85° to 30°C, including a 30-minute hold period at 30°C.

## E. BYPRODUCT REMOVAL

Laboratory work has been conducted using a basket centrifuge (at ∿900 G's) for byproduct separation. The cake must be washed with a volume of saturated $NH_4Cl$ solution equal to 3 displacement washes (each wash being ∿7% of the wet cake weight, or ∿1.8% of the slurry weight). Three separate washes may be needed. The wash solution is prepared by dissolving a washed wet cake from a previous batch in cold water ($NH_4Cl$ solubility is ∿27 wt % at 20°C, ∿43% at 100°C). The wash water will be recycled to the concentration step to reduce Hydan® L yield loss. The wet cake composition with and without 3 displacement washes is:

## II. PROCESS DESCRIPTION

Without wash: MHA - ~7-9 wt %
$H_2O$ - ~0.8%

With 3 washes: MHA - ~1.3-1.8%
$H_2O$ - ~6-8%

with the balance being $NH_4Cl$ and a small amount of other impurities. The washed wet cake will be malodorous and appropriate odor control measures (venting the centrifuge and the area to a scrubber, shipping in sealed containers) should be employed to prevent odor releases. Disposal is discussed in the following section.

During the early stages of start-up of the process, washing of the wet cake and recycle of wash to the concentrator may be eliminated to minimize start-up problems and allow faster development of the operation. After the process is debugged, cake washing and wash recycle will be employed.

The filtrate from the separation is the final product. Sufficient storage must be available for analysis prior to shipment via tank trailer directly to our customer. This intermediate storage tank should preferably be agitated to allow adjustment of product strength by water addition. Tankage should be available also for holdup due to shipping delays, etc. Filters must be used prior to loading to remove any suspended solids due to storage conditions. The finished product is malodorous, so storage tanks should be vented to a vapor incineration facility or to vessels with a common vent. The vapor pressure of liquid Hydan® is very low; therefore, no yield loss is expected due to storage.

Rework of finished product due to lower than specification assay could be accomplished by two means 1) reconcentrating in the vacuum evaporator or 2) reblending into specification product. The ammonium chloride concentration in the finished product is fixed by a solubility-temperature relationship.

A Hastelloy C, 48" diameter basket centrifuge, complete with batch sequencing controls has been purchased by Du Pont for potential use.

## F. BYPRODUCT AND WASTE DISPOSAL

The washed ammonium chloride cake will contain 6-8% water, ~1-2% MHA, and a small amount of other impurities, and is malodorous. It should be disposed of in accordance with appropriate environmental regulations pertaining to the chosen disposal site.

## G. OVERHEAD VAPOR SCRUBBING/ODOR CONTROL

All overhead vapor streams and equipment vents should be passed through a chemical scrubber to eliminate odorous discharges to

## II. PROCESS DESCRIPTION

the environment and neutralize acidic components. Odorous releases will be common unless scrupulous attention is given to this aspect of design. This control may be accomplished using a packed scrubber (preferably using glass or Teflon® linings and packings) and an alkaline solution of sodium hypochlorite. Overhead vapor scrubbing was successfully employed in a recent Semiworks campaign where a packed caustic (20% sodium hydroxide) scrubber was followed by a simple "pot" scrubber containing ∿11% sodium hypochlorite and 5% sodium hydroxide. The charges employed (which were more than adequate for the equivalent of a 500-gal reactor batch) were:

| | Caustic Scrubber | | Hypochlorite Scrubber | |
|---|---|---|---|---|
| | lbs | gal | lbs | gal |
| NaOH (50%) | 318 | 25 | 64 | 5 |
| $H_2O$ | 459 | 55 | --- | --- |
| NaOCl (12.5%) | --- | --- | 584 | 70 |

These charges were not exhausted during the runs and are probably adequate for a batch larger than 500 gal, but no scrubber capacity tests were conducted. The effluent vapor stream from the hypochlorite scrubber was mercaptan-free and smelled only of sodium hypochlorite. A single packed scrubber using a caustic/sodium hypochlorite solution (∿10%-15% NaOH, ∿9-10% NaOCl) would probably be adequate for the interim production unit. Tests to determine scrubber capacity required will be performed and the results forwarded when available. Sodium hypochlorite is an exothermic oxidizer. Heat of reaction may be such that external cooling is required.

Spent scrubber solutions must be disposed of according to pertinent environmental regulations.

### H. EXPECTED PROCESS YIELDS

Lab studies to date indicate essentially quantitative yields in the hydrolysis step based on 100% pure Cyanhydrin M. A yield loss is incurred only in liquid product holdup in the byproduct wet cake. This loss is reduced by washing the wet cake with a saturated ammonium chloride solution.

### I. MISCELLANEOUS DATA

- Hydrolysis heat of reaction = ∿28.7 kcal/g mole Cyanhydrin
  ∿52M BTU/lb mole
- Heat capacity of hydrolyzate = ∿1.05 BTU/lb°F
- Neutralization heat of reaction = ∿23 kcal/g mole HCl

## II. PROCESS DESCRIPTION

### J. PROCESS FLOWSHEET

The attached flowsheet presents the process with the most current information available except for the byproduct cake washing and wash recycle. This information, as well as an update on the product and stream compositions, will be forwarded when available.

### K. MATERIALS OF CONSTRUCTION

The process involves handling hot acidic, chloride bearing slurries initially, and when cool the slurry contains solid ammonium chloride and about 3% in solution. The finished product is also acidic, with a pH of ∿.9. Therefore, the following is recommended:

- Cyanhydrin M storage and handling - S/S
- HCl storage - FRP
- Anhydrous $NH_3$ - C/S
- Hydrolysis Reactor - G/L
- Hydrolysis Condenser - G/L, Teflon®-lined (or "Kynar")
- Vacuum Evaporator - G/L
- Distillate Receiver - G/L, Teflon®-lined, Karbate, Plastic-lined (Placite 3066, Derakane 411)
- Evaporator Condenser - G/L, Teflon® or "Kynar"-lined, Karbate
- Any Process Pumps - Hastelloy C or Zr, or Teflon®-lined or glass-lined
- Slurry Storage Tank - G/L
- Centrifuge - Hastelloy C
- Product Storage, Tanks - FRP, Polyethylene, Polypropylene
- Ammonium Chloride Disposal - Polyethylene, FRP
- Centrifuge Wash Water and Receiver Tanks - FRP, PE, PP, C/S (1/4" thick for corrosion allowance)
- Overhead Piping - G/L, Teflon® or "Kynar"-lined
- All Transfer Piping up to Centrifuge - G/L, Teflon® or "Kynar"-lined

ENGINEERING DEPARTMENT SKETCH SHEET SHEET NO. _____

PROJ. NO. _____ PLANT _____ TITLE HYDAN® L PROCESS — INTERIMS MANUFACTURING

BLDG. OR AREA _____ FUNCTION _____ SUBJECT _____

NAME _____ DATE 7/3/80

BASIS: 100 lbs HYDAN® L @ 88.0% ACTIVE

OVERALL YIELD: 95.6% FROM CYANHYDRIN M (97% PURE)

| STEP | DESCRIPTION | INPUT MATERIAL | INPUT lbs. | INPUT lbmoles | INPUT GAL. | PROCESS STEP | OUTPUT MATERIAL | OUTPUT lbs. | CONDITIONS TEMP °C | CONDITIONS PRESS. PSIG | CONDITIONS TIME HRS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A. | CHARGE 20°Bc HCl TO VESSEL @ AMBIENT TEMP. CHARGE ~1/2 OF CYANHYDRIN M OVER 30-45 MIN WHILE COOLING TO ATTAIN MAX. TEMP. OF 95°C. CHARGE REMAINING CYANHYDRIN M @ 95°C. MAINTAIN 95±3°C FOR ADDITIONAL 1-2 HRS BY HEATING. AMMONIUM CHLORIDE PRECIPITATES DURING REACTION. | • CYANHYDRIN M<br>HYDROCHLORIC ACID (31.1%) | 83.4<br>87.6 | 0.62<br>0.75 | 9.0<br>9.1 | A HYDROLYSIS (168.9, 18.0) | • VENT LOSS | 2.1 | 20-95 | ATM | 2-3 | • EXOTHERMIC ($\Delta H_{rxn}$ = 28.7 kcal/mole)<br>• BATCH MAN. YIELD = 100%<br>• PRODUCT IS METHIONINE HYDROXY ANALOG (MHA) IN AN ACIDIC, AQUEOUS SLURRY OF $NH_4Cl$<br>• SLURRY MAY BE RUMBED, DOES NOT SET-UP, AND DOES NOT ADHERE TO GLASS OR NON-WETTING SURFACES<br>• VOL % SOLIDS ~10-12% @ 95°C |
| B. | APPLY VACUUM; SLOWLY DECREASE PRESSURE TO 140 TORR. MAINTAIN HEATING @ 140 TORR UNTIL POT TEMP. REACHES 85°C TO REMOVE APPROX. 20% OF THE SLURRY WEIGHT AS DISTILLATE. | | | | | B CONCENTRATION (135.8, 14.1) | • DISTILLATE | 33.1 | 70-85 | 140 TORR | 3-4 | • BATCH DISTILLATION TO REMOVE $H_2O$ AND EXCESS HCl<br>• 2 PHASE DISTILLATE; ORGANIC PHASE ~1 wt %, MOSTLY DMDS<br>• SOLIDS CONTENT OF SLURRY ~80-90% (VOL)<br>• DISTILLATION MAY BE RUN @ PRESSURES UP TO ATMOSPHERIC (OPTIMUM TO BE DEFINED) |
| C. | CHARGE AMMONIA BELOW SURFACE OF SLURRY TO ADJUST pH OF LIQUID TO 0.9±0.1 (@ 30°C). | • AMMONIA (ANHYDROUS) | 0.3 | 0.02 | - | C NEUTRALIZATION (136.1, 14.1) | • AMMONIA | 0.01 | ~80-85 | ATM. | 0.3 | • AMMONIA ADDITION IS REQ'D TO CONVERT THE REMAINING 10% OF THE EXCESS HCl TO AMMONIUM CHLORIDE<br>• MAY BE NECESSARY TO COOL BEFORE NEUTRALIZATION.<br>• $\Delta H_{rxn}$ ≈ 23 kcal/mole |
| D. | COOL SLURRY IN JACKETED, AGITATED VESSEL PRIOR TO FILTRATION. | | | | | D COOLING (136.1, 14.0) | — | — | ~25-50 | ATM. | 2-4 | • ADDITIONAL AMMONIUM CHLORIDE MAY PRECIPITATE IN COOLING<br>• OPTIMUM TEMP. TO BE DEFINED BASED ON MAXIMUM $NH_4Cl$ PRECIPITATED AND VISCOSITY INCREASE OF LIQUID @ LOWER TEMPERATURE |
| E. | REMOVE AMMONIUM CHLORIDE SOLIDS BY SOLID/LIQUID SEPARATION IN A BASKET CENTRIFUGE. | | | | | E FILTRATION (100.0, 9.8) | • $NH_4Cl$ WETCAKE | 36.1 | ~25-50 | ATM. | 0.5 | • CENTRIFUGE SHOULD OPERATE @ ~900 G<br>• BY-PRODUCT WETCAKE CONTAINS ~10-12% FILTRATE<br>• POLISHING FILTER MAY BE REQ'D AFTER PRODUCT STORAGE TANK TO REMOVE FINES WHEN PACKING-OUT |



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ENGINEERING DEPARTMENT SKETCH SHEET Sheet No.

Proj. No. Plant Title

Bldg. or Area Function Subject

Name Date

| STREAM NUMBER | COMPONENTS (in pounds) MeSH | HCN | Pyridine Salt | $H_2O$ | Cyanohydrin | HCl | $NH_4Cl$ | Org. By-Prod.② | $NH_3$ | MHA③ | Σ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.6 | 0.2 | 0.3 | 1.1 | 80.9① | | | 0.3 | | | 83.4 |
| 2 | 0.5 | 0.2 | | | | 1.4 | | | | | 2.1 |
| 3 | 0.1 | | 0.3 | 39.3 | | 3.7 | 32.6 | 0.3 | | 92.6 | 168.9 |
| 4 Aqueous / Organic | 0.1 / - | | | 29.7 / - | | 3.0 / - | | - / 0.3 | | | 32.8 / 0.3 = 33.1 |
| 5 | | | 0.3 | 9.6 | | 0.7 | 32.6 | | | 92.6 | 135.8 |
| 6 | | | | | | | | | 0.01 | | 0.01 |
| 7 | | | 0.3 | 9.6 | | | 33.6 | | | 92.6 | 136.1 |
| 8 | | | 0.3 | 9.6 | | | 33.6 | | | 92.6 | 136.1 |
| 9 | | | 0.3 | 0.4 | | | 31.6 | | | 3.8 | 36.1 |
| 10 | | | | 9.2 | | | 2.0 | | | 88.8④ | 100.0 |

ABBREVIATIONS

MeSH – Methyl Mercaptan
HCN – Hydrogen Cyanide
HCl – Hydrogen Chloride
$NH_4Cl$ – Ammonium Chloride
$NH_3$ – Ammonia
MHA – Methionine Hydroxy Analog

NOTES

① Cyanohydrin Content by Bromide/Bromate Assay. Actually includes ~2% as Organic By-Products (see note ② below). Pure Cyanohydrin Content Actually ~78.9 lb.

② Contains:
- Methanol
- Dimethyl Sulfide (trace)
- Dimethyl Disulfide (major)
- Acrolein Dimer ()
- Pyridine (trace)
- "Aldol M" (major)
- $CH_3SCH_2CH_2CH\begin{matrix}SCH_3\\SCH_3\end{matrix}$ (major)
- Other Organics

③ Apparent MHA Content by Bromide/Bromate Assay. Actually Includes: 3% as MHA Polymer; 5% as MHA Monomer Amide; 4% as Org. Br. Comp. (C-Br-C)



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## III. RAW MATERIAL AND FINISHED PRODUCT PHYSICAL PROPERTIES

Safety, toxicity, and physical property information for chemicals used in this process are given on the following pages.

Key to abbreviations:

From National Institute for Occupational Safety and Health "Registry of Toxic Effects of Chemical Sbustances, 1977"

$LC_{LO}$ = Lowest published lethal concentration [=] $\frac{conc}{time}$

$LD_{LO}$ = Lowest published lethal dose [=] weight/body weight

$LD_{50}$ = Lethal dose which will kill 50 percent of the population [=] weight/body

$TC_{LO}$ = Lowest published toxic concentration (lowest concentration which will produce a toxic, but not necessarily lethal effect [=] conc/time

ALD = Approximate lethal dosage (Haskell Laboratory)

ACGIH = American Conference of Governmental Industrial Hygienists



AB0000118111/16

AMMONIA

C. A. S. REGISTRY NO 7664417

AMMONIA

| | | |
|---|---|---|
| 3 | HIGH HEALTH HAZARD | DATE ISSUED 3/79 |
| | | LATEST REVISION |
| 2 | MODERATELY COMBUSTIBLE | |

"key"

# MATERIAL SAFETY DATA SHEET

## I PRODUCT IDENTIFICATION

| | | | |
|---|---|---|---|
| MANUFACTURER'S NAME | E. I. DU PONT DE NEMOURS & CO. | Regular Telephone No<br>Emergency Telephone No. | 800-424-9300 |
| ADDRESS | 1007 MARKET STREET, WILMINGTON, DE 19898 | | |
| TRADE NAME | AMMONIA (ANHYDROUS) | | |
| SYNONYMS | AMMONIA | | |

## II HAZARDOUS INGREDIENTS

| MATERIAL OR COMPONENT | | HAZARD DATA |
|---|---|---|
| AMMONIA | 100% | TLV = 25 ppm |

## III PHYSICAL DATA

| | | | |
|---|---|---|---|
| Boiling Point, 760 MM HG | (-27.4°F) (-33°C) | Melting Point | (-106.6°F) (-77°C) |
| Specific Gravity ($H_2O$-1) | 1.3 @ 61.7°F (16.5°C) | Vapor Pressure | 10ATM @ 78.3°F (25.7°C) |
| Vapor Density (Air-1) | 0.6 | Solubility in $H_2O$, % by Wt. | 89.9g/100ml (32°F) |
| % Volatiles by Vol. | 100 | Evaporation Rate (Butylacetate-1) | Gas |
| Appearance and Odor | Colorless liquid with pungent odor. Odor Threshold: 21.4 ppm | | |
| M. W. 17.03 | | | |
| STRUCTURAL FORMULA– (As ) (Applicable ) | $NH_3$ | | |



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## IV FIRE AND EXPLOSION DATA

| | | | |
|---|---|---|---|
| FLASH POINT (Test Method) | Gas flammable | AUTOIGNITION TEMPERATURE | 1204°F (651°C) |
| FLAMMABLE LIMITS IN AIR, % BY VOL. | LOWER 16 | UPPER | 25 |
| EXTINGUISHING MEDIA | Stop flow of gas. | | |
| SPECIAL FIRE FIGHTING PROCEDURES | Use water to keep surroundings cool, until leak is shut off. | | |
| UNUSUAL FIRE AND EXPLOSION HAZARD | Flammable toxic gas. | | |

## V HEALTH HAZARD INFORMATION

HEALTH HAZARD DATA TWA = 25 ppm Stel = 35 ppm

ROUTES OF EXPOSURE

INHALATION: Causes violent coughing, burning of eyes and throat, swelling of eyelids - pulmonary edema - death.

SKIN CONTACT: Severe burns - irritation.

SKIN ABSORPTION: Not significant.

EYE CONTACT: Severe burns, irritation and superficial corneal lacerations.

INGESTION: Gastric burns - death.

EFFECTS OF OVEREXPOSURE: Immediate coughing, vomiting and breathing difficulty.

ACUTE OVEREXPOSURE: Inflammation of respiratory tract. Possible death.

CHRONIC OVEREXPOSURE: Eye, nose and respiratory inflammation.

EMERGENCY AND FIRST AID PROCEDURES Call a physician.

EYES: Flush with water for 15 mins.

SKIN: Flush with water for 15 mins.

INHALATION: Fresh air - oxygen.

INGESTION: Drink large amounts of water to dilute chemical. Do not induce vomiting if in shock, extreme pain or unconscious.

NOTES TO PHYSICIAN

No salve or ointment should be applied to skin during 24-hr. period following injury.



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DATE ISSUED 3/79 LAST REVISION

## VI REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY

None.

INCOMPATIBILITY Reacts exothermically with acids, contact with mercury, chlorine, iodine, bromide, calcium, silver oxide and hypochlorite can form explosive compounds.

HAZARDOUS DECOMPOSITION PRODUCTS

None.

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION

Will not occur.

## VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

Flood with water.

NEUTRALIZING CHEMICALS

Flood with water or use 5% acetic acid if readily available.

WASTE DISPOSAL METHOD

Wash to waste pond. Dilute for discharge.

## VIII SPECIAL PROTECTION INFORMATION

VENTILATION REQUIREMENTS

Keep concentration below 50 ppm.

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY (SPECIFY IN DETAIL)

Airline respirator of self-contained breathing apparatus.

EYE

Goggles and face shield.

GLOVES

Impervious-Neoprene butyl rubber.

OTHER CLOTHING AND EQUIPMENT

Impervious apron, boots, or air supplied acid type suit.



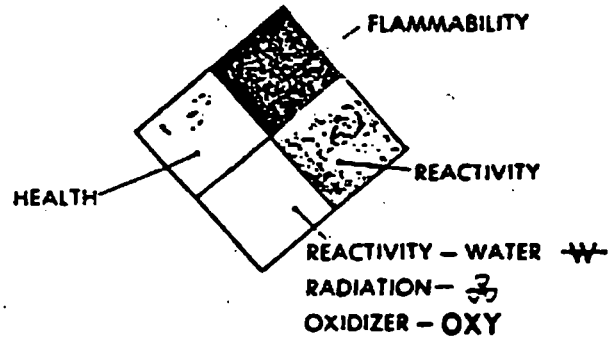
AB0000118111/19

## IX SPECIAL PRECAUTIONS

PRECAUTIONARY STATEMENTS

Danger. Hazardous liquid and gas. Do not get in eyes, on skin or clothing.

NFPA SYMBOL:



Material Name: Ammonium Chloride
Molecular Formula: $NH_4Cl$
Molecular Weight: 53.50

I. IDENTIFICATION:

A. Other Names: Sal Ammonia

B. Structural Formula: $NH_4Cl$

II. PHYSICAL PROPERTIES

Liquid ( ) Gas ( ) Solid (X) Polymorphic ( )

Melting Point: 338°C
Boiling Point: 520°C
Specific Gravity:
Solubility: In 100g $H_2O$ =37.2 @ 20°C, 77.3 @ 100°C
Appearance: White crystals
Vapor Pressure: 1mm @ 160.4°C

III. HAZARD CLASSIFICATION:

IV. TOXICITY DATA:

Oral $LD_{50}$ = 1650 mg/kg
species rat

V. HEALTH EFFECTS:

Do not eat material.
Large doses can cause nausea, vomiting, and acidosis.

VI. FIRST AID:

VII. NECESSARY PRECAUTIONS:

Wear rubber gloves and safety glasses. Ammonium chloride should be stored in cool, dry environment. In event of a spill, the spill should be washed to a chemical sewer with a copious quantity of water.



AB0000118111/21

MATERIAL NAME: Hydrochloric Acid, 32%
Molecular Formula: HCl
Molecular Weight: 36.47

August 1, 1980

## IDENTIFICATION

Other Name: Muriatic Acid
Hydrochloric Acid, aqueous

Code Numbers: CAS No. 007647010

Structural Formula: HCl

## PHYSICAL PROPERTIES

liquid [x] gas [ ] solid [ ] polymorphic [ ]

Melting Point: -74°C
Boiling Point: 110°C
Specific Gravity: 1.16
Solubility in Water: ∞
Soluble in MeOH
Appearance: Like Water, colorless to slightly yellow
Odor: Pungent
Flash Point: None
Autoignition Temperature: None
Threshold Limit Value: 5 ppm (ACGIH year 1978)

## HAZARD CLASSIFICATION

Corrosive Liquid; Irritating Material
Nonflammable liquid, but reacts with most metals with evolution of hydrogen which when mixed with air may result in fire or explosion if ignited.

Acute Oral $LD_{50}$: [illegible] mg/kg
Species - Rabbit

Inhalation $LC_{50}$: 3124 ppm/1 hr
Species - Rat

August 1, 1980

## HEALTH EFFECTS

### Acute Symptoms

Irritation, burning sensation, coughing

## FIRST AID

### In Case of Contact

Eyes: In case of contact with the eyes, immediately flush eyes with copious amounts of water for at least 15 minutes. Consult physician at once.

Skin: In case of contact with the body, immediately remove contaminated clothing and wash skin with soap and water. Seek medical attention.

## NECESSARY PRECAUTIONS

Wear rubber gloves, rubber or plastic apron, face shield and splash-proof goggles. Use spot ventilation. Avoid breathing fumes. In event of a spill, flush the area with a copious quantity of water to a chemical sewer and neutralize the sewer outfall as necessary.



AB0000118111/23

CYANHYDRIN M

C. A. S. REGISTRY NO. 17773-41-0

| | |
|---|---|
| 1 | SLIGHT HEALTH HAZARD |
| 1 | SLIGHTLY COMBUSTIBLE |
| 1 | SLIGHTLY REACTIVE |

DATE ISSUED: 3/79

LATEST REVISION:

# MATERIAL SAFETY DATA SHEET

## I PRODUCT IDENTIFICATION

MANUFACTURER'S NAME: E. I. DU PONT DE NEMOURS & CO.

Regular Telephone No
Emergency Telephone No. 713-727-9268

ADDRESS: P. O. BOX 3269, BEAUMONT, TEXAS 77704

TRADE NAME: CYANHYDRIN M

SYNONYMS: 2-HYDROXY-Y-METHYLTHIOBUTYRONITRILE

## II HAZARDOUS INGREDIENTS

MATERIAL OR COMPONENT

2-HYDROXY-Y-METHYLTHIOBUTYRONITRILE

HYDROGEN CYANIDE

METHYL MERCAPTAN

PYRIDINE

ACETIC ACID

SULFURIC ACID

## III PHYSICAL DATA

| | | | |
|---|---|---|---|
| Boiling Point, 760 MM HG | 60°C @ 1mm Hg | | -62.2°C (-80°F) |
| Specific Gravity ($H_2O$-1) | 1.112 | Vapor Pressure | 0.40mm Hg @ 46.1°C |
| Vapor Density (Air-1) | | Solubility in $H_2O$, % by Wt. | 11.3 |
| % Volatiles by Vol. | | Evaporation Rate (Butylacetate-1) | <1 |
| Appearance and Odor | Colorless to slight yellow color; garlic-like or burnt almond odor. | | |
| M. W. 131 | OH | | |
| STRUCTURAL FORMULA – (As / Applicable) | $CH_3SCH_2CH_2CHCN$ | | |



AB0000118111/24

## IV FIRE AND EXPLOSION DATA

| | | | |
|---|---|---|---|
| FLASH POINT (Test Method) | 135°C (275°F) Tag open cup ASTM D1310 | AUTOIGNITION TEMPERATURE | |
| FLAMMABLE LIMITS IN AIR, % BY VOL.(HCN) | LOWER 5.6 | UPPER | 40 |
| EXTINGUISHING MEDIA | Water. Do not use dry chemical. | | |
| SPECIAL FIRE FIGHTING PROCEDURES | | | |
| UNUSUAL FIRE AND EXPLOSION HAZARD | Cyanhydrin M decomposes with heat liberating HCN. | | |

## V HEALTH HAZARD INFORMATION

HEALTH HAZARD DATA: Class B poison.

ROUTES OF EXPOSURE

| | |
|---|---|
| INHALATION | Lethal due to HCN present. |
| SKIN CONTACT | Skin irritant and mild skin sensitizer. |
| SKIN ABSORPTION | Maybe lethal due to HCN present. |
| EYE CONTACT | Irritant. |
| INGESTION | May cause death due to HCN poisoning. |

EFFECTS OF OVEREXPOSURE

ACUTE OVEREXPOSURE

CHRONIC OVEREXPOSURE

EMERGENCY AND FIRST AID PROCEDURES

| | |
|---|---|
| EYES | Remove to fresh air, wash with soap and water. |
| SKIN | Remove contaminated clothing. Bathe thoroughly with soap and water. |
| INHALATION | Remove to fresh air. Give antidote for cyanide poisoning. |
| INGESTION | Induce vomiting and treat for cyanide poisoning. |

NOTES TO PHYSICIAN



AB0000118111/25

DATE ISSUED: 3/79 LAST REVISION

## VI REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY

Temperatures above 100°C.

INCOMPATIBILITY

HAZARDOUS DECOMPOSITION PRODUCTS

Cyanhydrin decomposes above 100°C (212°F) liberating HCN.

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION

None.

## VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

Isolate area. Wash away with water.

NEUTRALIZING CHEMICALS

Ferrous sulfate solution made alkaline with caustic soda solution.

WASTE DISPOSAL METHOD

Drain and flush with water.

## VIII SPECIAL PROTECTION INFORMATION

VENTILATION REQUIREMENTS

Provide adequate ventilation. Personnel should avoid breathing vapors or contact with skin.

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY (SPECIFY IN DETAIL)

Wear full face air mask.

EYE

Wear goggles or face mask.

GLOVES

Wear heavy duty surgical or neoprene gloves. Discard after use.

OTHER CLOTHING AND EQUIPMENT

Full faced air mask or self-contained air mask with full acid suit.



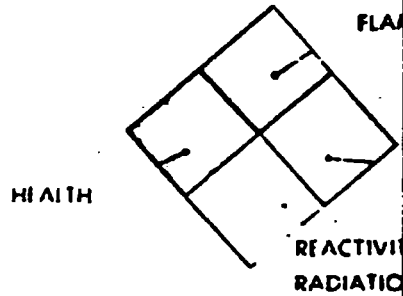
AB0000118111/26

## IX SPECIAL PRECAUTIONS

PRECAUTIONARY STATEMENTS

Cyanhydrin M is a penetrating, highly obnoxiously odorous chemical. It permeates leather and rubber shoe soles and the vapors are absorbed by clothing especially synthetics of acetate nature. Avoid contact, wear coveralls or full acid suit.

NFPA SYMBOL:




REACTIVITY WATER -W-
RADIATION -
OXIDIZER - OXY

August 1, 1980

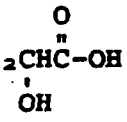
# SAFETY DATA SHEET

MATERIAL NAME: Hydan® L
Molecular Formula: $C_5H_{10}O_3S$
Molecular Weight: 150.24

## I. IDENTIFICATION:

A. Other Names: None

B. Structural Formula*:



*In concentrated aqueous solutions, this material exists as an equilibrium mixture of linear and cyclic dimers along with smaller amounts of higher polymers.

## II. PHYSICAL PROPERTIES:

| | |
|---|---|
| Liquid | |
| Freezing Point: | Below -22°C |
| Boiling Point: | Above 120°C |
| Specific Gravity: | 1.22 at 25°C (approx. 10.2 lbs per gal) |
| Solubility: | Completely miscible with water |
| Appearance: | Amber to Dark Brown Liquid |
| Viscosity (CS, Approx.): | 100°F: 35<br>80°F: 70<br>32°F: 500<br>0°F: 3500 |
| pH | Less than 2.0 |

## III. HAZARD CLASSIFICATION:

Does not meet criteria of any of the DOT hazardous material classifications. No restrictions apply to its shipping.

## IV. TOXICITY DATA:

GRAS. Status by FDA. Toxic dose level currently unknown, testing in progress for complete definition. Non-corrosive



AB0000118111/28

to skin (DOT Skin Corrosion Test) and not irritating to skin (FHSA Skin Irritation Test). But, a severe eye irritant (FHSA Eye Irritation Test). (GRAS - Generally Regarded As Safe)

V. HEALTH EFFECTS:

Specific effects of large doses not known. Probably typical for strong acid. Causes eye burns due to acidity.

VI. FIRST AID:

In case of contact, immediately flush eyes with water for at least 15 minutes. Call a physician. In case of skin contact, remove any contacted clothing and flush skin area with large quantities of water.

VII. NECESSARY PRECAUTIONS:

Keep away from heat and flame. In case of fire, use water, dry chemical or carbon dioxide. For a spill or leak, flush spill area with large amounts of water.

Avoid breathing vapor or mist. Use with adequate ventilation. Wash thoroughly after handling. Wear rubber gloves and safety glasses when handling.

In the event of a spill, wash the area thoroughly with water to a chemical sewer. The area may be deodorized by flushing with a 5-10% solution of sodium hypochlorite in water, followed by additional water washing.

## IV. ANALYTICAL REQUIREMENTS AND SAMPLE PLAN

The following analytical equipment will be required along with the usual assorted glassware normally present in a control laboratory:

- Two Liquid Chromatographs with Variable Wavelength Detectors (dedicated) capable of operating at 220 nm. (The flow system must be compatible with acidic (i.e. pH 1.5) eluents).
- Gas Chromatograph with thermal conductivity.
- Oxidation-Reduction titration apparatus.
- pH Meter.

The assay method and impurity profile for the Cyanhydrin M are liquid chromatograph procedures. The impurity profile indicates the amount of sulfur-bearing impurities that will be present in the final product. This method will probably be quantitative by start-up.

The assay method for product is an oxidation-reduction (bromide-bromate) titration. However, it will also be necessary to know the actual content of active ingredient which is determined on the liquid chromatograph after a preliminary acid hydrolysis in standard laboratory equipment.

Water content is determined on a gas chromatograph and pH on a standard pH meter. Chloride ion is determined by a modification of the Volhard method. It has not yet been established whether this or an ion chromatographic procedure gives the more accurate results.

As usual, start-up will require numerous determinations that will not be required during normal plant operation.

An estimate of the analysis required during start-up are shown in Table I and those which will probably be required during normal operation in Table II.

TABLE I

TENTATIVE STARTUP SAMPLE SCHEDULE

(Assume 2 Months)

| Sample | Analyses | Method | Frequency |
|---|---|---|---|
| Cyanhydrin M | Strength<br>Impurities | LC | Each T/C |
| After Hydrolysis | Strength | Titration & LC | Batchwise |
| After Concentration | Strength | Titration & LC | Batchwise |
| After Neutralization | pH | Meter | Batchwise |
| After Correction | pH | Meter | |
| Product batch tank (2 samples) | Strength | Titration & LC | Batchwise |
| | $H_2O$ | GC | |
| | $NH_4Cl$ | Titration | |
| Product storage tank (2 samples) | Strength | Titration & LC | Before filling a T/T |
| | $NH_4Cl$ | Titration | |
| | $H_2O$ | GC | |
| | Cross Contam. | To be Supplied | |



AB0000118111/31

TABLE II

TENTATIVE ROUTINE SAMPLE PLAN

| | | Method | Frequency |
|---|---|---|---|
| Cyanhydrin M | Strength<br>Impurities | LC | Each tank car |
| After concentration | Strength<br>pH | Titration<br>Meter | Batchwise |
| After neutralization | Strength<br><br>pH | Titration & LC<br>Meter | Batchwise |
| Product batch tank | Strength | Titration | Daily |
| Product storage tank | Strength<br><br>$NH_4Cl$<br>$H_2O$ | Titration & LC<br>Titration<br>GC | Before filling a T/T |

August 1, 1980

## V. FINISHED PRODUCT SPECIFICATIONS

Specifications likely to be placed on the product are shown in the following table:

| | | Method |
|---|---|---|
| Strength by Titration | 89.5 ± 1.5% | Bromide/Bromate Titration [H 555.65(E)] |
| Strength by LC | No more than 4% below titration strength | Ion Exchange HPLC [H 900.306(E)] |
| $H_2O$ | 7.0 ± 1.0% | Karl Fischer Titration, or Gas Chromatography (Method to be written) |
| $Cl^-$ | <1.5% | Volhard Titration or Ion Chromatography (Method to be written) |
| pH | .8-1.0 | pH Electrode |



AB0000118111/33

## VI. INVENTORY RECORDS AND CONTROLS

A physical inventory must be taken monthly. Du Pont will establish the monthly production periods for accounting purposes, and will assist in setting up necessary records.

During the normal business days, there will be daily communication concerning production, shipments, etc.

ENVIRONMENTAL
APR 24 2008
LEGAL

Quattlebaum, Grooms, Tull & Burrow
A PROFESSIONAL LIMITED LIABILITY COMPANY
111 Center Street, Suite 1900
Little Rock, Arkansas 72201-4382

Joseph W. Ghormley
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ENVIRONMENTAL
APR 24 2008
LEGAL

April 10, 2008

David C. Shelton, Esq.
Senior Counsel
E.I. du Pont de Nemours and Company
DuPont Building, 1007 Market Street
Wilmington, Delaware 19898

Re: Former Cedar Chemical Corporation Facility
West Helena, Arkansas

Dear Mr. Shelton:

Please find enclosed a disc with copies of nexus documents linking E.I. du Pont de Nemours and Company ("DuPont") to the Cedar Chemical site in West Helena, Arkansas.

To make a long story short, the Cedar Chemical site was used for toll manufacturing of various chemicals from the early 1970s to 2002. When the site's owner declared bankruptcy a few years ago, the State of Arkansas became very interested in the site. In 2006, the State sued ExxonMobil, Helena Chemical and Wormald, a division of Tyco, to recover an estimated one billion dollars in future clean-up expenses plus other damages. Harry Stephens Farms, Inc., which is a neighboring family-owned farm operation, then sued the same three companies based on a plume from the Cedar site that is allegedly under its property.

We were granted summary judgment based on the statutes of limitation in the Stephens litigation. Stephens has appealed and we are awaiting a decision on the appeal. The State withdrew its litigation in exchange for an agreement with the parties to conduct an investigation at the site and preserve documents. We expect to remediate the site at a cost which is two to three orders of magnitude less than the State's original estimate. ExxonMobil and Helena Chemical are now splitting costs for compliance with the investigation agreement with the State. While reviewing documents we are required to preserve, we noticed that DuPont engaged in toll manufacture for production of various substances at the Cedar site for a number of years.

Please call me, or have your Superfund lawyer call me, when you have had an opportunity to review the disc. We are in the process of contacting several other companies who have used the site, and we believe ExxonMobil is still inclined to work on a per capita basis, which you may find appealing given the duration of Dupont's involvement with the Cedar site.

We would appreciate receiving your response by April 21, 2008. Thank you for your attention to this matter.

Sincerely,

QUATTLEBAUM, GROOMS,
TULL & BURROW PLLC

Joseph W. Ghormley

JWG:tsr
Enclosures

# SODIUM PERBORATE SYSTEM

1. The production rate calls for dissolving 12 MM pounds of fines over a one year period with mother liquor. The ratio of fines to ML is 1/1.16. At this ratio and an 85% stream factor, it requires a production rate of about 80 to 85 M pounds per day.

2. According to the DuPont batch cycle time, a batch requires about 48 hours. On this basis it would take a 160-170 M pound batch every other day to meet the production requirements.

3. The attached sketch shows a system to accomplish this task. It would require a 12 to 15,000 gallon mother liquor storage tank, a solids dissolving box, ("rock box"), and a 15 M gal product storage tank.

4. The ML could be shipped in one tank truck per day, and finished product returned in two tank trucks per day. One of the product trucks could be a back haul on a mother liquor truck. In addition, solids will require an average about one box truck per day.

5. The "rock box" would need to be big enough for the required batch. The existing tank farm dike is about 16 feet square. It would require a height of 12 feet to hold about 20,000 gallons. A finished batch would be about 15,000 gallons plus free board for foaming.

6. Mother liquor will come in at about 50-60 deg.C (122 deg.F) and the temperature must be maintained to keep from dropping solids. Preheating the ML would help reduce batch times in the "rock box". Maintaining tank temperature is a minimum requirement. An insulated, circulated tank will be required, agitation would be a plus.

7. The ML and fines would be charged to the "rock box", circulated and heated. It will require about a 30 foot inclined conveyor to charge the solids. The pump piping, and heat exchanger will need to be designed for a slurry. A batch meter will be required. Addition of live steam to raise the temperature to design conditions would require 18,000 pounds of steam per batch without heat loses.

8. Steam sparging and clean out provisions should be included to compensate for plugging. Clean out and foam control require deionized water per DuPont. A deionizer would be required for the system.

9. With a pH probe in the circulating line, it could be determined when the batch was complete.

10. Some sort of platform to observe the operation of the "rock box" would be required. Provisions should also be made to keep the pump from plugging, which would require observation.

11. The existing T-N205 can be used for product storage. It has an existing pump with a closed impeller. The pump may be better suited for use on the ML tank and purchase an open impeller pump for product circulation and storage. Preferably all pumps should have open impellars.

12. Dupont calls for trimming product with de-gassed ML. A line from the ML tank passing through the batch meter could be used to trim.

13. The operation calls for loading/unloading three tank trucks and one box truck per day on average. Super sacks need to be moved around and handled. In addition, the solids and ML must be charged and pumped.

14. The unit should be thoroughly cleaned prior to start-up to remove any organics.

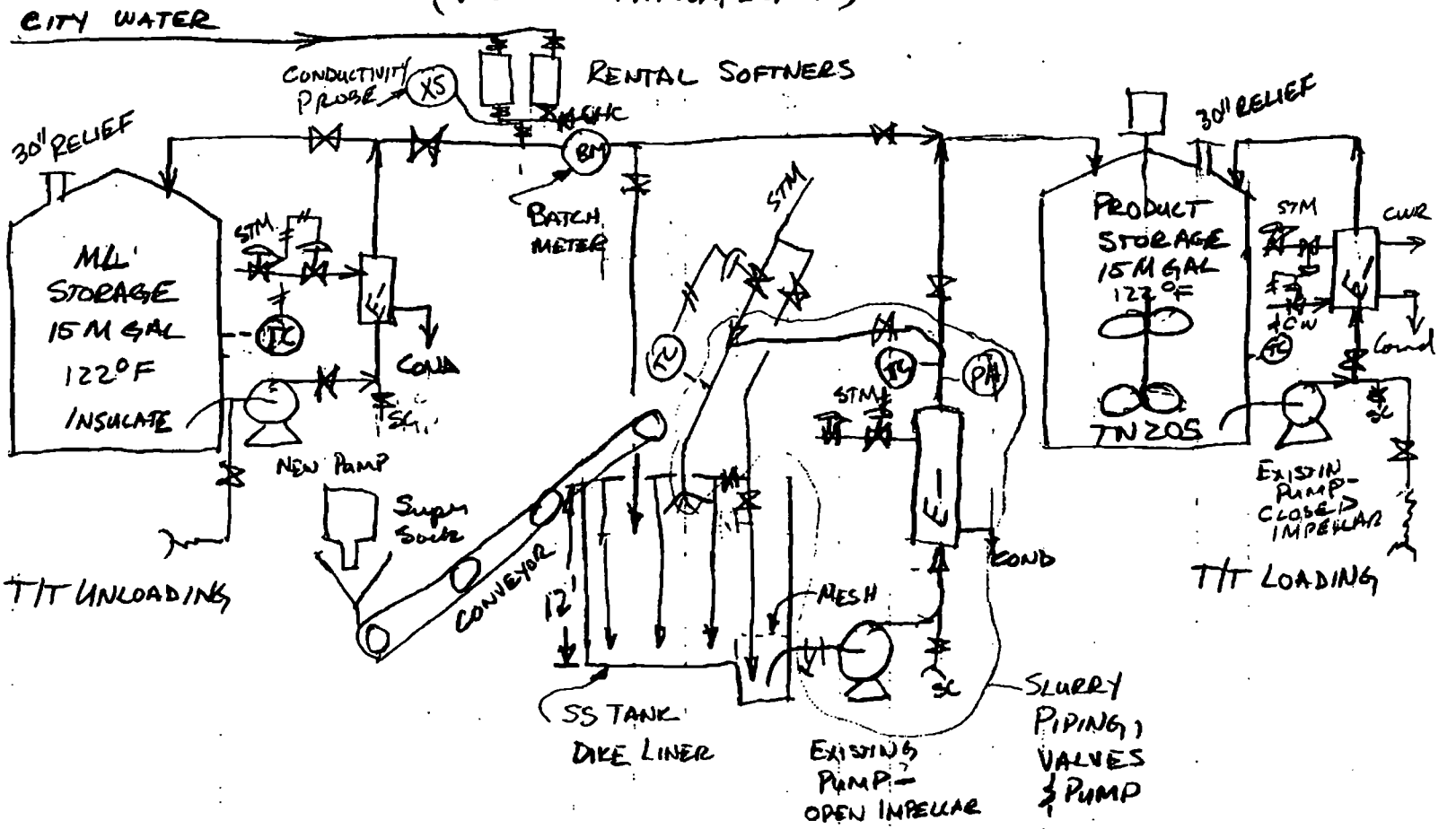
15. The lab observed an acrid odor during their run. An air permit would probably be required.

16. The process risks involved are:
    A. De-gassing in the storage tanks. Adequate relief should be provided.
    B. Will the pumps keep from plugging on the rock box?
    C. Can adequate heat be supplied to the "rock box" during cold weather?
    D. Can the fines be broken into small enough chunks to keep from plugging the conveyor hopper without taking an inordinate amount of time and effort?
    E. Will solids dissolve in the "rock box"? A lab run should be made simulating the process.
    F. Exchanger frequency of plugging, cleanout time and use of de-ionized water is a question.
    G. Odors and plumes could cause problems.

Gene N. Eggers
10/2/91

# SODIUM PERBORATE

(ALL SS PIPING & EQUIP)




EXCHANGERS TO BE PIPE IN PIPE

GNE
10/1/91

This process consists of combining sodium metaborate mother liquor and sodium perborate tetrahydrate fines in a reaction tank. The resulting metaborate solution is sent to DuPont for use in their perborate process.

The mother liquor arrives in tanker trucks and is pumped directly into the reaction tank. The fines arrive in bulk bags and are added to the mother liquor in the reaction tank. The sodium metaborate comes out of DuPont's perborate process as a mother liquor. In our process oxygen is given off and additional water is produced.

Steam is the heating mechanism.

The product we ship is used in the manufacture of color-fast bleach as is added to Tide.

It is pumped from the reaction tank directly into tanker trucks.

09-Jan-92

# WEST HELENA SCHEDULE

| | PROPANIL | UNIT 1 | UNIT 3 | UNIT 4 | GRACE |
|---|---|---|---|---|---|
| 06-Jan | STAM M-4 | CTBL | | DEHPA | AMP |
| 13-Jan | STAM M-4 | CTBL | | DEHPA | AMP |
| 20-Jan | STAM M-4 | CTBL | | DEHPA | AMP |
| 27-Jan | STAM M-4 | | | DEHPA | AMP |
| 03-Feb | STAM M-4 | D-8 | | DEHPA | AMP |
| 10-Feb | STAM M-4 | CO-300 | | DEHPA | AMP |
| 17-Feb | STAM M-4 | CO-300/800 | | DEHPA | AMP |
| 24-Feb | STAM M-4 | | | DEHPA | AMP |
| 02-Mar | STAM M-4 | BFG | | DEHPA | AMP |
| 09-Mar | STAM M-4 | BFG | | DEHPA | AMP |
| 16-Mar | STAM M-4 | BFG | PERBORATE | DEHPA | AMP |
| 23-Mar | PROPANIL | | PERBORATE | DEHPA | AMP |
| 30-Mar | PROPANIL | | PERBORATE | DEHPA | AMP |
| 06-Apr | PROPANIL | MTPO(?) | PERBORATE | DEHPA | AMP |
| 13-Apr | STAMPEDE | MTPO(?) | PERBORATE | DEHPA | AMP |
| 20-Apr | STAM M-4 | MTPO(?) | PERBORATE | | AMP |
| 27-Apr | STAM M-4 | MTPO(?) | PERBORATE | | AMP |
| 04-May | STAM M-4 | | PERBORATE | | AMP |
| 11-May | STAM M-4 | | PERBORATE | | AMP |
| 18-May | STAM M-4 | | PERBORATE | | AMP |
| 25-May | PROPANIL | | PERBORATE | | TA |
| 01-Jun | ICI/PROP | BFG | PERBORATE | | TA |
| 08-Jun | ICI/PROP | BFG | PERBORATE | | TA |
| 15-Jun | ICI/PROP | BFG | PERBORATE | | TA |
| 22-Jun | ICI/PROP | | PERBORATE | | TA |
| 29-Jun | ICI/PROP | | PERBORATE | | TA |
| 06-Jul | ICI/PROP | | PERBORATE | | TA |
| 13-Jul | ICI/PROP | | PERBORATE | | TA |
| 20-Jul | ICI/PROP | | | | TA |
| 27-Jul | ICI/PROP | | SECTAGON | | TA |
| 03-Aug | ICI/PROP | | SECTAGON | | TA |
| 10-Aug | ICI/PROP | | SECTAGON | | TA |
| 17-Aug | ICI/PROP | | SECTAGON | | TA |
| 24-Aug | ICI/PROP | | | | TA |
| 31-Aug | ICI/PROP | | PERBORATE | | TA |
| 07-Sep | ICI/PROP | BFG | PERBORATE | | TA |
| 14-Sep | ICI/PROP | BFG | PERBORATE | | TA |
| 21-Sep | ICI/PROP | BFG | PERBORATE | | TA |
| 28-Sep | ICI/PROP | | PERBORATE | | TA |
| 05-Oct | STAM M-4 | CTBL | PERBORATE | | TA |

May add a mother liquor tank (new) vented to the atmosphere, a product storage tank (DEHPA waste water tank) and a dissolving tank (cattle trough) vented to atmosphere in front of reaction tank.

Sodium meta perborate similar to Borax.

Fines cast as a solid chunk

Is the decomposition of peroxide, which is a function of heat and time.

Entrainment of liquid is solved by the addition of a mist eliminator. Micron particles of metaborate attached to water vapor.

Perborates are strong oxidizing materials so what is the explosion potential?
and -----
At what point when dissolved in water does it become a concern?

Sodium metaborate a soil sterilizer.

T. Lodice

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

July 8, 1992

Mr. Robert A. Blackhall
Senior Purchasing Agent
Contracting Section, Materials & Logistics
E. I. du Pont de Nemours & Company
Chestnut Run Plaza
Hickory Run 1110
Wilmington, DE 19880-0723

Dear Bob:

The development of one piece of data for the perborate project is taking longer than we had anticipated and this has delayed our latest proposal. To confirm our discussion of a few days ago, Cedar is willing to accept the processing fees proposed by du Pont at our meeting on June 11, 1992, with a slight modification in the method of payment. We would propose that for 12 million pounds of fines processing our fee would be $0.08 per pound of fines processed. For the first 6 million pounds of fines, Cedar would be paid $0.10 per pound and for the second 6 million pounds $0.06 per pound. This would average to $0.08 per pound and would take care of the $0.02 per pound penalty suggested by Jim Pawloski, if the project were terminated at the 6 million pound level.

Cedar is developing the capital estimate for the minimum investment case necessary to begin the trial portion of the project. Frankly, we are finding it difficult to stay within the guidelines suggested at our meeting, but are continuing to work with local Memphis du Pont personnel to find the lowest cost approach. This capital cost number is important because Cedar would expect to be compensated for this capital investment in the event that the project could not proceed due to events which should have been predicted by du Pont. These would include problems encountered at your Memphis plant due to metaborate prepared by Cedar to du Pont's specifications. For events which could have been foreseen by Cedar which prevent the project from proceeding, we would not expect compensation for the capital investment.

I believe these comments reflect the agreement reached at our June meeting and we will complete our proposal as soon as the capital investment number has been developed.

Sincerely,

Geoffrey L. Pratt
Director of Custom Manufacturing

mc

cc: D. Hoppel
T. Lodice
J. Pawloski
R. Tomblin

CEDAR CHEMICAL CORPORATION

To: Gene Pearce

Date: June 7,1991

From: Greg Satterfield

Subject: Dupont Borate Lab Run

On June 6, I ran a process check on the Dupont Sodium Meta Borate project using their guidelines. The run consisted of 400 grams of mother liquor heated to 97 degrees C. which had added to it 345 grams of fines. The addition of the fines was done over a period of 3 hours with the temperature held between 97-100 degrees C. The process was monitored by observing the O2 evolution through a water bubbler off the condenser. The purpose of the run was to observe for process difficulties with raw materials, and physical problems associated with the fines addition.

## Raw Materials

The mother liquor was received in polyethylene jugs. It was noticed upon receiving that the drums were bulging at the bottom. Upon venting, it was noted that there was considerable pressure in the jugs. The mother liquor itself was turbid but with no solids visible.

The fines were very free flowing and dusted quite easily. This dust was slightly acrid. There was no obvious foreign matter noted in the sample.

## Process

During the heat up to 97 deg.C, it was noted that about 55 deg.C. gas evolution started just from the mother liquor. This rate increased somewhat as the temperature increased. The initial fines addition was done at 97 deg.C with an approximate doubling of the rate of O2 evolution. This wasn't a surge but just a steady increase in rate. There was some foaming initiated by this addition. It appeared that the foaming lessened after 1/2 of the fines were added so that by the end of the addition, there was no foam layer present. It was noted that upon each addition of fines, some foaming was present. In addition, it was observed that the solids went into solution within 1 minute. Also,the temperature dropped an average of 5 degrees during the addition. There was a total of 6 additions over a period of 3 hours with no physical problems noted. It was observed that if the agitation was lost that when commenced, there was vigorous evolution of gas. Outside of this occurence, the evolution of gas remained steady for 8 hours, then decreased until no bubbles were observed by 0800 the following morning. In this lab run, it took 20 hours until no O2 was observed.

DUPONT PERBORATE 7/21/92 - TJL

| ITEM | TRIAL COST | COST |
|---|---|---|
| I. Reactor (T-N205) | | |
| A. Process Piping (DI water) | 2,000 | 2,000 |
| B. Instrumentation (TIC, PI, LI) | 6,000 | 6,000 |
| C. Tank Modifications (new top manway) | 4,000 | 4,000 |
| | 12,000 | 12,000 |
| II. EXCHANGER (New) | | |
| A. Exchanger | 25,000 | 25,000 |
| B. Process Piping | 2,000 | 2,000 |
| C. Installation (frame modifications) | 6,000 | 6,000 |
| D. Insulation (exchanger, steam, process) | 8,000 | 8,000 |
| E. Utility Piping - Steam, C.W. | 5,000 | 5,000 |
| | 46,000 | 46,000 |
| III. PRODUCT TANK | | |
| A. Tank Installation | 0 | 10,000 |
| B. Pump | 0 | 6,000 |
| C. Piping | 0 | 5,000 |
| D. Instrumentation | 0 | 3,000 |
| E. Heating | 0 | 8,000 |
| F. Insulation | 0 | 10,000 |
| | 0 | 42,000 |
| IV. SOLIDS HANDLING | | |
| A. Hopper | 4,000 | 4,000 |
| B. Installation (operator access) | 6,000 | 9,000 |
| C. Instrumentation & Electrical | 2,000 | 5,000 |
| D. Rotary Airlock | 0 | 5,000 |
| E. Delumper | 0 | 14,000 |
| F. Eductor/conveyor | 0 | 10,000 |
| G. Hoist | 0 | 12,000 |
| | 12,000 | 59,000 |
| V. DI WATER | | |
| A. Tank | 15,000 | 15,000 |
| B. Pump | 6,000 | 6,000 |
| C. Piping | 5,000 | 5,000 |
| D. Instrumentation (LI, TI, PI) | 2,000 | 2,000 |
| | 28,000 | 28,000 |
| SUB-TOTAL | 98,000 | 187,000 |
| CONTINGENCY (20%) | 19,600 | 37,400 |
| TOTAL | 117,600 | 224,400 |

KEMUTEC Inc. 130 Wharton Road, Bristol, PA 19007 (215) 788-8013 FAX (215) 788-8113

| | | | |
|---|---|---|---|
| To : | Cedar Chemical Co | Fax Message No : | 4343 |
| Fax No : | 501-672-3795 | Transmitted by : | MDC |
| Country : | USA | Time Transmitted : | 4:47pm |
| Attn : | Tom Lodice | Date : | March 8, 1993 |
| From : | Mark Chalmers | Pages : | 1 of 2 |
| Subject : | Test results | | |

Tom:

Attached herewith, please find Kemutec test report # A-739 for tests conducted at our facility on March 3, 1993. We appreciated your taking the time to visit our facility to witness these tests.

We trust that we have met all of your requirements and look forward to working with you in the future. Should you have any questions or require any further assistance in this matter, please do not hesitate to contact us.

Very truly yours,

KEMUTEC, Inc.

Mark D. Chalmers
Applications Engineer

cc: Shamrock Systems



AB0000119468/2

# KEMUTEC, INC. TEST REPORT

| Test Report # | Equipment: AERO-MECHANICAL CONVEYOR | Date of Test |
|---|---|---|
| A-739 | Model # FLOVEYOR F4 | March 3, 1993 |

Customer: Cedar Chemical Company
Address: P.O. Box 2749 - West Helena, AR 72390
Customer Representative: Tom Lodice

Material tested: Sodium Perborate Monohydrate (A, B & C)
Sodium Perborate from Jacobson mill (D)
Test Requirements: Convey at a capacity of 16,000 lbs per hour

## TEST CONDITIONS

| TEST REFERENCE | A | B | C | D |
|---|---|---|---|---|
| Feed Method | hopper fed | poured | poured | hopper fed |
| Configuration: Length / Angle | 20' - 40 | 20' - 40 | 20' - 40 | 20' - 40 |
| Disc/Boss type | Stain. steel wire & poly-urethane riveted discs | | | |
| Inlet hopper vibration | none | none | none | none |
| Slide Setting (rough %) | 1.5" | full | full | 2" |
| Test material wet or dry | dry | dry | dry | dry |
| Total weight processed (lbs) | 83 | 55 | 83 | 69 |
| Duration of test (min) | 50 | 17 | 18 | 6 |
| Feed rate (lbs / hr) | 5,976.00 | 11,647.08 | 16,599.96 | 41,400.00 |

## TEST ANALYSIS

EQUIPMENT - For this particular product, a Floveyor model F4 Aero-Mechanical Conveyor was used. The conveyor measures 20' centers and is mounted on a mobile base fitted with a winch for angle adjustment. In this test, conveyor angle was 40 deg. from horizontal.

PROCEDURES - In tests A & D, product was fed into the Floveyor via a 3 cubic foot surge hopper fitted with a Mucon Iris Diaphragm valve. The product was conveyed to an upper mezzanine where it was bag collected and weighed. In tests B & C, the product was poured into the feed hopper via drums.

OBSERVATIONS - In all four tests, the product was easily conveyed regardless of feed rate. In test D, the feed hopper began to surge however, due to the minimal amount of product, it was not possible to determine what impact this surging would have on a continuously fed system.

CONCLUSIONS - Based on our analysis, Kemutec Inc recommends using a 4" Floveyor Aero-Mechanical Conveyor to handle a capacity of 16,000 lbs / hour.

TESTS CONDUCTED BY: M. Chalmers & D. Johnson (Kemutec Inc) & S. Brown (Shamrock Systems)

Cedar Chemical Corporation
PO Box 2749
Highway 242 South
West Helena, AR 72390
Attn: Mr. Geoffrey L. Pratt

Wilmington, DE

R.A. Blackhall

This document, when properly executed, shall constitute an Agreement between E.I. DU PONT DE NEMOURS & COMPANY (DU PONT) and CEDAR CHEMICAL CORPORATION (CEDAR).

SERVICES: To cover the cost to chemically convert DU PONT-furnished sodium perborate tetrahydrate (SPDT) fines into sodium metaborate solution for DU PONT'S Memphis, TN plant.

PERIOD OF AGREEMENT: ~~September~~ Oct 1, 1992 through March 1, 1994. April

QUANTITIES: Approximately 12,000,000 lbs. (+/- 2%) of SPDT fines. (This is conditional on CEDAR'S ability to chemically convert the SPDT fines to specification; ~~and, on CEDAR'S ability to achieve a production rate of approximately 50,000 lbs. per day.)~~

SPECIFICATIONS: Per DU PONT'S Technology Package, "Rework SPDT Fines Into Sodium Metaborate Solution", by John D. Super, dated August 9, 1991, (copy in your possession).

COMPENSATION: $0.08/lb. of SPDT processed

If SPDT processed in the trial meets specification and is unacceptable to DU PONT (due to internal DU PONT problems with using the processed SPDT), this Agreement is terminated and DU PONT will reimburse CEDAR seventy thousand dollars ($70,000.00) to cover CEDAR'S startup costs.

Per CEDAR'S letter dated July 27, 1992 from G.L. Pratt to DU PONT'S R.A. Blackhall, which is included herein by reference.

If DU PONT elects, after 6.0MM lbs. of SPDT has been processed and accepted by DU PONT, additional quantities may be processed to a total of 12.0MM lbs. (+/- 2%) at the $0.08/lb. fee. If DU PONT elects to cease processing of any quantity exceeding 6.0MM lbs., but less than 12.0MM lbs. (+/- 2%), DU PONT agrees to pay CEDAR an amount of $0.02/lb. times the number of pounds not processed to the total of 12.0MM lbs.

Cedar Chemical Corporation
PO Box 2749
Highway 242 South
West Helena, AR 72390
Attn: Mr. Geoffrey L. Pratt

Wilmington, DE

R.A. Blackhall

TERMS & CONDITIONS: DU PONT'S General Conditions, EM-6685, Rev. 12/88, are attached hereto and made a part hereof.
V (as hand-annotated)

YIELD: Per projection in "Specifications".

WASTE: The conversion process will not generate any aqueous waste. ~~Plant washouts will be returned to DU PONT with product shipments.~~ Fugitive emissions, with contaminants potentially harmful to DU PONT'S process, will be the responsibility of CEDAR to dispose.

Confirming CEDAR'S letter of September 9, 1991 from G.L. Pratt to DU PONT'S R.A. Blackhall, which is included herein by reference.

INVOICES: Invoices will be sent to the following address:

Original invoices to:

E.I. du Pont de Nemours & Company
Du Pont Chemicals
1007 Market Street
B-8209
Wilmington, DE 19898
Attn: Mr. Jim Pawloski

Copies of invoices to:

E.I. du Pont de Nemours & Company
2571 Fite Road
Memphis, TN 38127
Attn: Ms. Bess Hwang/Mr. Pete Garrison

Cedar Chemical Corporation
PO Box 2749
Highway 242 South
West Helena, AR 72390
Attn: Mr. Geoffrey L. Pratt

Wilmington, DE

R.A. Blackhall

CONTRACT ADMINISTRATOR: Business Contract Administrator - Jim Pawloski, Wilmington, DE (302) 773-4061. Technical Contract Administrator - Bess Hwang/Pete Garrison, Memphis, TN (901) 353-7100.

ENTIRETY: This document, and the documents specifically referred to herein, embody the entire Agreement, and there are no agreements, understandings, conditions, warranties or representations, oral or written, express or implied, with reference to the subject matter hereof which are not merged herein. No modifications hereof shall be of any force or effect unless in writing and signed by both parties.

Please signify your acceptance of the above by signing in the space provided below and returning the PINK COPY to Robert A. Blackhall, E.I. du Pont de Nemours & Company, PO Box 80723, CRP-HR-1102, Materials and Logistics, Wilmington, Delaware 19880.

| CEDAR CHEMICAL CORPORATION | E.I. DU PONT DE NEMOURS & COMPANY |
|---|---|
| BY: _____ | BY: _____ |
| TITLE: DRAFT | TITLE: DRAFT |
| DATE: _____ | DATE: _____ |

CEDAR INTERNAL CORRESPONDENCE

cc: T. Lodice
M.J. Pocrass
G. Pratt
J. Walker

To: D. Hoppel

From: J. Krusling

Date: December 7, 1992

Subject: Perborate Trial

The following are my comments and observations from the 11/18/92 perborate trial:

1. The perborate sent for the trial was a mixture of off-spec material and good product. Also, most of the material was from recent production. For the most part, the material was free flowing.

2. One super sack did have some solid chunks. This made it difficult to charge to T-4205. In addition, pieces of paper bags were mixed in with the perborate. I am told that the paper is from the repackaging of 50 and 100 pound bags and is not unexpected.

3. Since most of the material was free flowing, charging was not a proplem. The perborate was charged into the reactor over a two two period. Had all of the perborate been charge on one day, the charge would have been approximately 10 hours. Because there was very little foaming during the addition, a faster addition rate could have been possible.

4. Although there was very little foaming during this batch, this could be due to the blend of off-spec and good material. Had the material been all off-spec or older material, more foaming could occur.

5. There was excellent temperature control during the addition of the perborate fines. This could also have helped reduce the foaming. Also, this allowed a slightly faster addition rate than expected. Less time time was needed to allow the temperature in T-4205 to come back up after each super sack was added.

6. A production rate can not be determined based on this trial due to the presence of iron filings in the system. The iron catalyzed the peroxide decomposition to the point where it was all decomposed as soon as the perborate was added to the tank. Another trial would be necessary to determine a production rate.

7. The source of the iron filings is most ikely the packaging operation at DuPonts warehouse. A carbon steel conveyor was used to charge the supersacks. Perborate is abrasive and will pick up iron. DuPont has seen this before.

8. Allthough the temperature range for loading the product trucks is 122 - 158 F, the trucks did not lose as much heat as DuPont had expected. Because the trucks were not unloaded immediately, this was not a proble for DuPont. In the future, the maximum loading temperature may have to be lowered to 140 F. Narrowing the temperature range should not pose a problem.

9. DuPont has started to re-work the material into their process. They did have some difficulty filtering the Meta solution, but this was not unexpected. Their initial results of the final product have beed good. There was not a problem after filtering out the iron filings.

CEDAR
CHEMICAL CORPORATION

**Facsimile Cover Sheet**

Neil

Info DM

**To:** Gene McCutchen, Purchasing Agent
**Company:** Dupont
**Phone:**
**Fax:** 302-892-1531

**From:** Geoffrey L. Pratt
**Company:** Cedar Chemical Corporation
**Phone:** 901-685-5348
**Fax:** 901-684-5398

Dear Gene:

Based on a conversation with Tonya Pellegrin today, Cedar is proposing that we extend the contract order #LPMD1333 dated September 17, 1992 covering the cost of converting Dupont's sodium perborate into sodium metaborate by an additional one month period until July 31, 1994. This extension is based upon recent success in improving the reaction rate by the use of caustic soda.

Further, Cedar proposes to handle the cost of the caustic soda used by billing Dupont on a monthly basis for caustic consumed at Cedar's cost of purchase.

We hope that during the month of July we can use this new found reaction capability to work out a reasonable logistics program so that both Cedar and Dupont can achieve their goals on this project. Please contact me at 901-684-5373 if you have any comments on this proposal.

Sincerely,

Geoffrey L. Pratt, Vice President
Custom Manufacturing & Specialty Chemicals

GLP:lc

cc: Tonya Pellegrin, Dupont, Memphis, fax 901-353-7782
Dave Hoppel
Jim Krusling
Ed White

DuPont Specialty Chemicals
2571 Fite Rd.
Memphis, Tennessee 38127

DuPont Specialty Chemicals

DVH
MSP
J.K.
J.W.
T.L.

October 20, 1993

Mr. Bob Christian
Cedar Chemical

RE: Perborate Fines/Rework

Dear Mr. Christian

Per our discussion on Friday, October 15, you should have received two truckloads of dry Perborate product. One truckload consisted of mixed grades of Monohydrate product. The second truckload consisted of a 50/50 split between hard Tetrahydrate and Monohydrate product. In the future we will try to honor your requests as best we can, but you do understand that we cannot limit ourselves to certain grades of product.

For the next batch we will be sending hard Tetra rework material. It will be relatively chunky and should flow through your process easily after it has been crushed.

Concerning batch processing time we are eager to meet the projected 2 day batch production as outlined in the Metaborate Technology package. The last batches that have been produced have been taking 5-7 days to be processed instead of 2-3. We'd like to rework as much product as we can. This necessitates producing batches in a 2 day turnaround or sooner. Batch production times longer than 3 days are simply not acceptable. We are available to assist you in troubleshooting this problem and others. Please do not hesitate to contact me.

It has been brought to my attention that the bottoms of all Perborate supersacks are being cut to release the product. We understand that this is necessary for bags of hard product. However, for supersacks containing fines or free flowing material this is not necessary. There is a program in place to recycle used supersacks. Cutting of bags should be limited to supersacks of hard, caked material. Please unload bags of free flowing or fines material through the spout.

Sincerely Yours,

Camille D. English

Camille D. English

CDE:ed

E.I. du Pont de Nemours and Company
Printed on Recycled Paper



AB0000119323/1

DuPont Specialty Chemicals
2671 Fite Rd.
Memphis, Tennessee 38127

DuPont Specialty Chemicals

October 27, 1993

To: Mr. Jim Krusling/Cedar Chemical
From: Ms. Camille English/Dupont
Re: Perborate Fines/Rework

Dear Mr. Krusling

I've been informed by Bob Christian that the Perborate Tetrahydrate product you received was very moist. I had believed the product to be hard and caked as I informed Bob in my fax. Even though my information was incorrect, the consistency of the product you received is indicative of much of the Tetra/Mono that will be reworked through Cedar.

Per Gary Roberts of Pine Bluff Warehouse, these are some suggestions for things you can to do to process damp product.

1) You can unload two bags at the same time, one bag of fines and one bag of damp product.

2) You can also unload one bag of fines and then a second bag of damp and then send them both up your bucket elevator--this may require temporarily turning off the power to some equipment. I believe both options will work, the first will require some equipment modification to your hoist assembly.

If you have any more problems with handling the Perborate product please contact me. Gary is an excellent resource for handling this product and I contact him for you as necessary.

Previously I faxed you some information on sampling the batches as they cook. I'd like to follow the next few batches closely in hopes of determining what is causing the prolonged cook times. Could you please fax me the following info:

1)Product Charge Time(Hrs to chg)
2)Beginning Cook Time
3)Daily sampling of meta and H2O2 concentrations
4)Batch Ending Cook Time

Thanks for all your efforts.

Sincerely Yours,

Camille D. English

DuPont Specialty Chemicals
2571 Fite Rd.
Memphis, Tennessee 38127

DuPont Specialty Chemicals

October 18, 1993

To: Mr. Tom Lodice/Cedar Chemical
From: Ms. Camille English/Dupont
Re: Perborate Fines/Rework

Dear Mr. Lodice

This memo is in regards to Perborate reprocessing facility at Cedar Chemical. The last few batches of metaborate that have been prepared at Cedar have taken quite a well to be processed. According to the Technology package written by Ms. Bess Hwang, the estimated preparation time should be 2-3 days. We've been receiving batches that have taken as long as 7 days before processing is complete. To approximate the 1MM lb. per month goal, batches will have to be completed at 2-3 day intervals.

Dupont Technical resources are prepared to assist with this problem. We've asked for some non-routine sampling of the batches until the designated specification is reached. I've shared this info with your Process Engineer, Jim Krusling.

At our first meeting, we inquired about processing of drums as well as supersacks at your rework facility. Bennie Britton/Dupont also sent a sample drum for use in sizing your equipment. We have a supply of drummed material, in addition to the supersack material, that we would like to rework through Cedar as soon as possible.

Sincerely Yours,

Camille D. English

Camille D. English
901-353-7542



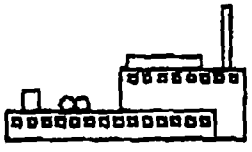
AB0000119323/3

# DuPont Specialty Chemicals - Memphis

## Telecopier Transmittal Sheet

Date: 10/22/93

TO: Mr. Tom Lodice
Cedar Chemical



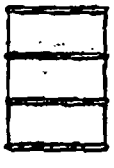
Fax Number to be sent to 501-572-3795

FROM: Ms. Camille English
2 sheets including Coversheet

My Fax Number is (901) 353-7792

Message:

If you encounter any problems with receipt of this document
Please Call: Elaine Dickson
Phone No. (901) 353-7429



**CEDAR CHEMICAL CORPORATION**
P.O. Box 2749, Hwy. 242 S.
West Helena, AR 72390
(501) 572-3701
Fax. No. (501) 572-3795

TO: DuPont Specialty Chemicals

ATTENTION: Camille English

FAX NO: (901) 353-7792

FROM: Tom Lodice

DATE: October 25, 1993

NO. OF PAGES: 1

---

MESSAGE

Dear Camille

I apologize for not getting back to you sooner regarding the handling of the drummed material but we have been busy trying to resolve the production and material handling problems. We agree that the current processing time is much too long but we have been unable to determine why your process does not operate as described in your Technology package.

Also, we have unexpectedly received some material which appears to be damp. This material tends to be very sticky and has caused us problems with the conveying system. In summary, we will not address the handling of the drummed material until we can resolve the current difficulties we are experiencing with this process. Once the unit operates on a routine basis, we will look at the possibility of handling the drummed material.

Sincerely,

Thomas J. Lodice

Thomas J. Lodice

cc: B. Christian
D. Hoppel
J. Krusling
M.J. Procrass

DuPont Specialty Chemicals
2571 Fite Rd.
Memphis, Tennessee 38127

DUH
MSP
J.K.
J.W.
T.L.

DuPont Specialty Chemicals

October 20, 1993

Mr. Bob Christian
Cedar Chemical

RE: Perborate Fines/Rework

Dear Mr. Christian

Per our discussion on Friday, October 15, you should have received two truckloads of dry Perborate product. One truckload consisted of mixed grades of Monohydrate product. The second truckload consisted of a 50/50 split between hard Tetrahydrate and Monohydrate product. In the future we will try to honor your requests as best we can, but you do understand that we cannot limit ourselves to certain grades of product.

For the next batch we will be sending hard Tetra rework material. It will be relatively chunky and should flow through your process easily after it has been crushed.

Concerning batch processing time we are eager to meet the projected 2 day batch production as outlined in the Metaborate Technology package. The last batches that have been produced have been taking 5-7 days to be processed instead of 2-3. We'd like to rework as much product as we can. This necessitates producing batches in a 2 day turnaround or sooner. Batch production times longer than 3 days are simply not acceptable. We are available to assist you in troubleshooting this problem and others. Please do not hesitate to contact me.

It has been brought to my attention that the bottoms of all Perborate supersacks are being cut to release the product. We understand that this is necessary for bags of hard product. However, for supersacks containing fines or free flowing material this is not necessary. There is a program in place to recycle used supersacks. Cutting of bags should be limited to supersacks of hard, caked material. Please unload bags of free flowing or fines material through the spout.

Sincerely Yours,

Camille D. English

Camille D. English

CDE:ed



AB0000119310/1

DUPONT

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

CONTRACT ORDER

D. Hoppel

| DATE | CONTRACT ORDER NO. | ALT NO | PAGE NO |
|---|---|---|---|
| September 17, 1992 | LPMD-1333 | | 1/3 |

E. I. DU PONT DE NEMOURS & COMPANY

Cedar Chemical Corporation
5100 Poplar Avenue
24th Floor
Memphis, TN 38137
Attn: Mr. Geoffrey L. Pratt

Wilmington, DE
ISSUING POINT — LOCATION CODE
DIRECT ALL INQUIRIES ▶ R.A. Blackhall
ISSUED BY — BUYER CODE

This document, when properly executed, shall constitute an Agreement between E.I. DU PONT DE NEMOURS & COMPANY (DU PONT) and CEDAR CHEMICAL CORPORATION (CEDAR).

SERVICES: To cover the cost to chemically convert DU PONT-furnished sodium perborate tetrahydrate (SPBT) Fines ("Distressed" Rework Sodium Perborate) into sodium metaborate solution for DU PONT'S Memphis, TN plant.

PERIOD OF AGREEMENT: October 1, 1992 through April 1, 1994.

QUANTITIES: Approximately 12,000,000 lbs. (+/- 2%) of SPBT Fines. (This is conditional on CEDAR'S ability to chemically convert the SPBT Fines to specification.)

SPECIFICATIONS: Per DU PONT'S Technology Package, "Rework SPBT Fines Into Sodium Metaborate Solution", by Bess Hwang, dated October 1, 1992, which is attached hereto and made a part hereof.

COMPENSATION: $0.08/lb. of SPBT processed

If SPBT processed in the trial meets specification and is unacceptable to DU PONT (due to internal DU PONT problems with using the processed SPBT), this Agreement is terminated and DU PONT will reimburse CEDAR seventy thousand dollars ($70,000.00) to cover CEDAR'S startup costs.

Per CEDAR'S letter dated July 27, 1992 from G.L. Pratt to DU PONT'S R.A. Blackhall, which is included herein by reference.

If DU PONT elects, after 6.0MM lbs. of SPBT has been processed and accepted by DU PONT, additional quantities may be processed to a total of 12.0MM lbs. (+/- 2%) at the $0.08/lb. fee. If DU PONT elects to cease processing of any quantity exceeding 6.0MM lbs., but less than 12.0MM lbs. (+/- 2%), DU PONT agrees to pay CEDAR an amount of $0.02/lb. times the number of pounds not processed to the total of 12.0MM lbs.

G-506-LC

DUPONT **E. I. DU PONT DE NEMOURS & COMPANY** INCORPORATED **CONTRACT ORDER**

WILMINGTON, DELAWARE 19898

| DATE | CONTRACT ORDER NO | ALT. NO | PAGE NO |
|---|---|---|---|
| September 17, 1992 | LPMD-1333 | | 2/3 |

E. I. DU PONT DE NEMOURS & COMPANY

Cedar Chemical Corporation
5100 Poplar Avenue
24th Floor
Memphis, TN 38137
Attn: Mr. Geoffrey L. Pratt

DIRECT ALL INQUIRIES

Wilmington, DE — ISSUING POINT — LOCATION CODE

R.A. Blackhall — ISSUED BY — BUYER CODE

TERMS & CONDITIONS: DU PONT'S General Conditions, EM-6685, Rev. 12/88, (as hand annotated) is attached hereto and made a part hereof.

YIELD: Per projection in "Specifications".

WASTE: The conversion process will not generate any aqueous waste. Fugitive emissions, with contaminants potentially harmful to DU PONT'S process, will be the responsibility of CEDAR to dispose.

Confirming CEDAR'S letter of September 9, 1991 from G.L. Pratt to DU PONT'S R.A. Blackhall, which is included herein by reference.

INVOICES: Invoices will be sent to the following address:

Original invoices to:

E.I. du Pont de Nemours & Company
Du Pont Chemicals
1007 Market Street
B-8209
Wilmington, DE 19898
Attn: Mr. Jim Pawloski

Copies of invoices to:

E.I. du Pont de Nemours & Company
2571 Fite Road
Memphis, TN 38127
Attn: Ms. Bess Hwang/Mr. Pete Garrison

G-506-LC

DUPONT

**E. I. DU PONT DE NEMOURS & COMPANY** INCORPORATED

WILMINGTON, DELAWARE 19898

**CONTRACT ORDER**

| DATE | CONTRACT ORDER NO | ALT NO | PAGE NO |
|---|---|---|---|
| September 17, 1992 | LPMD-1333 | | 3/3 |

E. I. DU PONT DE NEMOURS & COMPANY

Cedar Chemical Corporation
5100 Poplar Avenue
24th Floor
Memphis, TN 38137
Attn: Mr. Geoffrey L. Pratt

DIRECT ALL INQUIRIES

Wilmington, DE — ISSUING POINT — LOCATION CODE

R.A. Blackhall — ISSUED BY — BUYER CODE

CONTRACT ADMINISTRATOR: Business Contract Administrator - Jim Pawloski, Wilmington, DE (302) 773-4061. Technical Contract Administrator - Bess Hwang/Pete Garrison, Memphis, TN (901) 353-7100.

ENTIRETY: This document, and the documents specifically referred to herein, embody the entire Agreement, and there are no agreements, understandings, conditions, warranties or representations, oral or written, express or implied, with reference to the subject matter hereof which are not merged herein. No modifications hereof shall be of any force or effect unless in writing and signed by both parties.

Please signify your acceptance of the above by signing in the space provided below and returning the PINK COPY to Robert A. Blackhall, E.I. du Pont de Nemours & Company, PO Box 80723, CRP-HR-1102, Materials and Logistics, Wilmington, Delaware 19880.

CEDAR CHEMICAL CORPORATION

BY: [signature]

TITLE: Director Custom Mfg

DATE: October 1, 1992

E.I. DU PONT DE NEMOURS & COMPANY

BY: [signature]

TITLE: Sr Purchasing Agent

DATE: September 24, 1992

CEDAR CHEMICAL

EM-668S Rev. 12/88

# GENERAL CONDITIONS
# OFF-PLANT SERVICE
# E. I. DU PONT DE NEMOURS AND COMPANY
## (INCORPORATED)

### 1. DEFINITIONS

When used in this Agreement:

MATERIAL means any unfinished matter, including packaging supplies, furnished by or on behalf of DU PONT to CONTRACTOR for processing, handling, storage, or for use in the production of finished goods.

PRODUCT means finished goods meeting DU PONT specifications that have been produced by CONTRACTOR from MATERIAL. PRODUCT also means finished goods that have been furnished by or on behalf of DU PONT for handling, storage or use by CONTRACTOR for DU PONT'S benefit.

REPLACEMENT COST shall be defined as follows:

1. When the MATERIAL or PRODUCT was bought by DU PONT, REPLACEMENT COST means the price paid by DU PONT, including all freight and handling charges.
2. When the MATERIAL or PRODUCT was manufactured by DU PONT for sale in its then existing form, REPLACEMENT COST means DU PONT'S list price for the MATERIAL or PRODUCT, less ten percent (10%).
3. When the MATERIAL or PRODUCT was manufactured by DU PONT, but not for sale by DU PONT in its then existing form, the REPLACEMENT COST means DU PONT'S manufacturing cost, including fixed and variable costs, plus all freight and handling charges.
4. In all cases REPLACEMENT COSTS shall include any fees paid by DU PONT for services for any processing of MATERIAL or PRODUCT.

The "price" as used in these definitions of REPLACEMENT COST will be the price of the MATERIAL or PRODUCT in effect at the time the loss, damage or destruction of the MATERIAL or PRODUCT occurred.

### 2. ASSIGNMENT AND SUBCONTRACTING

Neither party shall assign or transfer this Agreement, in whole or in part, or any interest arising under this Agreement or subcontract any work hereunder without the prior written consent of the other party. Subject to the provisions of this clause, this Agreement shall insure the benefit of and be binding upon the successors and assigns of the parties.

### 3. NONDISCRIMINATION

CONTRACTOR warrants that it has complied with all applicable laws, rules, orders and regulations of governmental authority covering the production, sale and delivery of the MATERIAL, PRODUCT or services specified herein, including, but not limited to, Executive Order 11246, and the rules and regulations promulgated thereunder, the Rehabilitation Act of 1973 and the Vietnam Era Veterans Readjustment Act of 1974. Further, CONTRACTOR warrants that in the performance of the services hereunder, it will comply with all applicable provisions of the Fair Labor Standards Act of 1938, as amended.

### 4. FORCE MAJEURE

No liability shall result to either party from delay in performance or from nonperformance caused by circumstances beyond the control of the party who has delayed performance or not performed. The nonperforming party shall be diligent in attempting to remove any such cause and shall promptly notify the other party of its extent and probable duration.

If a party, due to circumstances beyond its control, is unable to supply the total demands for the goods or services required by the Agreement, then that nonperforming party shall allocate its available supply among all purchasers in proportion to the amounts previously provided to those purchasers.

If the party who has delayed performance or not performed on account of circumstances beyond its control is unable to remove the causes within fifteen (15) days, the other party shall have the right to terminate, without penalty, this entire Agreement or any portion of it.

### 5. TERMINATION

If CONTRACTOR should refuse or fail to supply sufficient number of properly skilled personnel, or should it fail to make prompt payment to subcontractors for labor and MATERIAL used hereunder, or should it disregard or be in violation of any laws, ordinances or governmental regulations, or should it otherwise violate any of the clauses of this Agreement, or if DU PONT, hereunder in good faith, determines that personnel, MATERIAL, PRODUCT or equipment as required hereunder are being used in an unsafe manner or in any way such that DU PONT'S title thereto is in jeopardy, or that CONTRACTOR'S credit or financial position is impaired, then DU PONT may, without prejudice to any other right or remedy, terminate or suspend this Agreement without liability on written notice. Termination under this clause or under any other clause of this Agreement shall not relieve or release either party hereto from any rights, liabilities or obligations which it has accrued prior to the date of such termination.

**6. DEFAULT**

In the event that either party hereto shall default in the substantial performance of any material obligation specified herein, the nondefaulting party shall notify the other party hereof in writing and, if such default is not remedied within fifteen (15) days from date of such notice, then the nondefaulting party shall have the right to terminate this Agreement immediately. If, in the nondefaulting party's sole opinion, such default may result in substantial property damage, injury, accident or death, that party may, at any time, immediately suspend this Agreement without penalty or damages.

**7. SAFEKEEPING/TITLE**

CONTRACTOR assumes full responsibility and liability for the safekeeping and safe handling of all DU PONT MATERIAL or PRODUCT when such MATERIAL or PRODUCT is in CONTRACTOR'S care, custody and control. Unless otherwise specified in this Agreement, title to such MATERIAL or PRODUCT shall remain with DU PONT. CONTRACTOR shall reimburse DU PONT for the REPLACEMENT COST of any such MATERIAL or PRODUCT lost, damaged or destroyed while in CONTRACTOR'S care, custody or control. Reimbursement shall not affect DU PONT'S title to such MATERIAL or PRODUCT. CONTRACTOR shall segregate and placard such MATERIAL or PRODUCT indicating DU PONT'S ownership. CONTRACTOR shall obtain prior written approval of DU PONT before moving any such MATERIAL or PRODUCT to a new location.

**8. CONTAMINATION**

CONTRACTOR will take all steps necessary to prevent the contamination of DU PONT MATERIAL or PRODUCT when in CONTRACTOR'S care, custody and control. In the event of contamination, CONTRACTOR shall, at DU PONT'S option and at CONTRACTOR'S cost, rework, replace and/or dispose of all such contaminated MATERIAL or PRODUCT.

**9. INDEMNIFICATION**

CONTRACTOR will indemnify DU PONT for all liability, loss and expense incurred by DU PONT resulting from any act or omission, negligent or otherwise, ~~by DU PONT or~~ CONTRACTOR or CONTRACTOR'S agents, subcontractors or assigns in performance under this Agreement. This indemnity shall not apply ~~where the sole cause of~~ the liability, loss or expense is the willful misconduct or negligence of DU PONT.

The liability, loss or expense covered by this indemnity includes settlements, judgments, court costs, attorneys' fees and other litigation expenses incurred by DU PONT arising out of (1) injury to or death of any person, including employees of CONTRACTOR or DU PONT, or (2) loss of or damage to property, including property of CONTRACTOR or DU PONT, or (3) damage to the environment.

**10. INSURANCE**

CONTRACTOR, at its expense, shall carry and maintain in force at all times relevant hereto insurance of the type and minimum coverage limits as follows:

(a) Workers' Compensation—Statutory; and Employer's Liability—$100,000 per accident.

(b) Commercial General Liability (Occurrence Form), including Contractual Liability, in a combined single limit for Bodily Injury and Property Damage—$500,000 per occurrence.

(c) Comprehensive Automobile Liability, in a combined single limit for Bodily Injury and Property Damage—$500,000 per occurrence.

(d) Other insurance appropriate for CONTRACTOR'S business or required by law.

Upon DU PONT'S request, certificates of insurance evidencing the coverages required above of CONTRACTOR shall be filed with DU PONT'S designee. Such certificates shall provide that the insurer will give DU PONT thirty (30) days' advance notice of any changes in or cancellation of coverage. If in connection with the work being performed hereunder CONTRACTOR will not use motor vehicles on DU PONT property, other than parking areas, a letter so stating is acceptable in lieu of the automobile insurance certificate.

In the event any subcontractor is employed, with or without DU PONT'S consent, for the services covered in this Agreement, then CONTRACTOR assumes full responsibility to ensure that the subcontractor's services are covered by the same insurance limits as set forth herein.

Neither failure of CONTRACTOR to comply with any or all of the insurance provisions of this Agreement, nor the failure to secure endorsements on the policies as may be necessary to carry out the terms and provisions of this Agreement shall be construed to limit or relieve CONTRACTOR from any of its obligations under this Agreement, including the *INSURANCE* article.

**11. INDEPENDENT CONTRACTOR**

It is understood that the employees, methods, facilities and equipment of CONTRACTOR shall at all times be under its exclusive direction and control. CONTRACTOR'S relationship to DU PONT shall be that of an independent contractor and nothing in this Agreement shall be construed to constitute CONTRACTOR or any of its employees or officers, as an employee, agent, joint venturer or partner of DU PONT.

**12. WASTE DISPOSAL**

The parties agree to employ best efforts and work toward minimizing the waste generated. CONTRACTOR agrees to return any hazardous waste to DU PONT or its designate for disposal.

**WASTE DISPOSAL (Cont'd.)**

CONTRACTOR further agrees to furnish all required equipment and labor at no additional cost to DU PONT to remove and dispose of such quantities of nonhazardous waste as are produced hereunder and which DU PONT elects not to have returned to it. Prior to the start of actural processing hereunder, CONTRACTOR and DU PONT will agree in writing of the identity of any waste disposal subcontractor, methods used and the location of sites to be used for waste disposal hereunder. CONTRACTOR will notify DU PONT and get the written approval of DU PONT'S Contract Administrator prior to changing any waste disposal subcontractors, methods, or location of waste disposal under this Agreement. CONTRACTOR agrees that such waste will be transported and disposed of in a safe and environmentally sound manner so as to prevent any waste from entering the environment as a pollutant. CONTRACTOR will exercise controls necessary to prevent scattering of the waste or access to containers containing such wastes unless said access is authorized by DU PONT.

CONTRACTOR shall not use, reuse, sell or otherwise dispose of any DU PONT MATERIAL, processed MATERIAL not meeeting specification, or PRODUCT for its account, unless otherwise agreed to in writing by DU PONT'S Contract Administrator. CONTRACTOR agrees not to use, reuse, sell or otherwise dispose of any DU PONT packaging material without the prior written permission of DU PONT'S Contract Administrator, and then only if all DU PONT identification is completely removed.

**13. RECORDS AND INSPECTION**

CONTRACTOR agrees to maintain, in accordance with "Generally Accepted Accounting Principles and Practices", such records as may be necessary to adequately reflect the accuracy of CONTRACTOR'S charges and invoices for reimbursement under this Agreement and maintain such other additional records as DU PONT may from time to time reasonably require in connection with this Agreement. DU PONT shall have the right from time to time to inspect and verify the records kept by CONTRACTOR in connection with this Agreement. DU PONT'S duly authorized representatives shall have the right to visit, observe, audit, and inspect CONTRACTOR'S production and related facilities utilized to accomplish the objectives of this Agreement at any time during CONTRACTOR'S normal business hours. DU PONT'S duly authorized representatives shall also have the right to select and inspect samples of MATERIAL, MATERIAL-in-process and PRODUCT in CONTRACTOR'S facility received, obtained or produced under this Agreement and to reject PRODUCT or CONTRACTOR-supplied MATERIAL on the basis of the selected samples if DU PONT'S specifications are not met. DU PONT'S inspection or failure to exercise its right to test samples for compliance with DU PONT'S specifications shall not be deemed to establish that such MATERIAL or PRODUCT met DU PONT'S specifications.

**14. TAXES**

DU PONT agrees either to pay directly all property taxes, licenses, charges and assessments properly levied by any properly constituted governmental authority upon the DU PONT-owned MATERIAL, equipment (if any) and PRODUCT hereunder, or to reimburse CONTRACTOR therefore if paid by CONTRACTOR at DU PONT'S written direction. CONTRACTOR assumes full responsibility for the payment of all federal and state taxes of whatever sort, social security and unemployment compensation taxes, withholding taxes, and all other taxes or charges applicable to CONTRACTOR'S actions, employees, facilities and materials for performing services hereunder or applicable to CONTRACTOR'S income hereunder.

**15. AUTHORITY**

The parties hereby represent that they have full power and authority to enter into and perform this Agreement and the parties know of no contract, agreements, promises or undertakings which would prevent the full execution and performance of this Agreement.

**16. RESERVATION OF RIGHTS**

DU PONT'S waiver of any of its remedies afforded hereunder or by law is without prejudice and shall not operate to waive any other remedies which DU PONT shall have available to it, nor shall such waiver operate to waive DU PONT'S rights to any remedies due to a future breach, whether of a like or different character.

**17. HEADINGS**

All headings of the clauses of this Agreement are inserted for convenience only and shall not affect any construction or interpretations of this Agreement.

**18. NONDISCLOSURE**

CONTRACTOR agrees not to disclose to others (a) the fact that DU PONT has purchased or plans to purchase services, articles, MATERIALS or PRODUCT from CONTRACTOR or (b) any information or knowledge that may be gained or learned by CONTRACTOR about the business, PRODUCTS, employees or methods employed by DU PONT unless such disclosure is necessary to perform service required under this Agreement or as required by law.

**19. APPLICABLE LAW**

The laws of the State of Delaware shall govern the construction of this Agreement.

**20. SEVERABILITY**

In the event that any clause of this Agreement shall be found to be void or unenforceable, such findings shall not be construed to render any other clause of this Agreement either void or unenforceable, and all other clauses shall remain in full force and effect unless the clause(s) which is/are invalid or unenforceable shall substantially affect the rights or obligations granted to or undertaken by either party.

## 21. CORPORATE STATUS

In the event that CONTRACTOR'S invoice does not indicate that CONTRACTOR is an incorporated entity. by use of the words (or abbreviations) "Incorporated", "Corporation" or "P.C." as a part of CONTRACTOR'S company name, then CONTRACTOR shall display its tax identification number (TIN) on the invoice in lieu of such designations. Failure to furnish such information may result in withholding twenty percent (20%) of Agreement payments in accordance with IRS regulations.

## 22. SAFETY AND HEALTH

CONTRACTOR acknowledges that hazards may be involved in providing the services described hereunder. Accordingly, CONTRACTOR agrees to perform its services in a careful and workmanlike manner and to take all necessary precautions in the processing, handling, transportation and disposal of MATERIAL and PRODUCT involved in this Agreement to avoid an unhealthy or unsafe work environment, injuries to persons, damage to property or pollution. DU PONT may provide CONTRACTOR with certain information regarding the MATERIAL involved hereunder, including procedures for processing, handling, transporting and disposal, as well as toxicological data. Any information supplied by DU PONT shall be the latest information known to DU PONT and relevant to the work to be performed hereunder. Such information is provided without warranty or representation as to its completeness or suitability in providing the services herein. The methods employed and the precautions taken to handle DU PONT-owned equipment, if any, MATERIAL and PRODUCT shall be determined by and rest solely with CONTRACTOR. CONTRACTOR agrees to provide its employees with a safe and healthy workplace using, but not limited to, such information as is or may be provided by DU PONT.

DU PONT shall have the right to immediately suspend this Agreement, without liability to CONTRACTOR, if at anytime DU PONT in its sole judgment determines that CONTRACTOR has violated any of the provisions of this clause. Further, if CONTRACTOR fails to correct any such violation within seven (7) days immediately following DUPONT'S written notice to CONTRACTOR of the violation, DU PONT has the right to terminate this Agreement.

## 23. WARRANTY

CONTRACTOR warrants that the PRODUCT or services delivered hereunder will be free of defects in MATERIAL and workmanship and meet the specifications supplied by DU PONT. In the event that PRODUCT or services supplied by CONTRACTOR fails to meet any of the aforementioned warranties or are otherwise defective, CONTRACTOR shall, at DU PONT'S option, replace the defective PRODUCT or refund the purchase price including freight charges. CONTRACTOR further agrees to reimburse DU PONT for all costs incurred in the recall of defective PRODUCT and for all expenditures made in the settlement of any claim against DU PONT relating to defective PRODUCT or services supplied by CONTRACTOR. DU PONT shall notify CONTRACTOR promptly of any claim against DU PONT with respect to the PRODUCT or services supplied hereunder and shall provide CONTRACTOR and/or its insurance carrier with information needed for settlement or defense of such claims.

## 24. SHIPMENTS

Freight charges, excluding detention and demurrage charges, for all MATERIAL or other items supplied directly by DU PONT under this Agreement and for all PRODUCT produced hereunder by CONTRACTOR and shipped per DU PONT'S instructions shall be for DU PONT'S account. Detention and demurrage charges on incoming shipments shall be borne by CONTRACTOR unless caused by DU PONT'S early or excessive delivery of MATERIAL. Shipments of MATERIAL or PRODUCT hereunder to third parties are to be made by CONTRACTOR upon written direction from DU PONT.

## 25. CONFLICT OF INTEREST

CONTRACTOR shall not hire any employee or officer of DU PONT while that employee or officer is an employee or officer of DU PONT. CONTRACTOR shall not pay any salaries, commissions, fees, or make any payments or rebates, to any employee or officer of DU PONT, or to any designee of any such employee or officer, or favor any employee or officer of DU PONT, or any designee of any such employee or officer, with gifts or entertainment of significant cost or value or with service or goods sold at less than full market value. CONTRACTOR agrees that its obligation to DU PONT under this clause shall also be binding upon any subcontractors and sub-subcontractors of work hereunder. CONTRACTOR further agrees to insert the provisions of this clause in each such subcontract.

## ~~26. CLAIMS~~

In the event complaints are made against DU PONT relating to PRODUCT ~~produced by CONTRACTOR~~, a representative of DU PONT shall investigate the complaint and ~~assign responsibility therefor~~. Claims that result from a complaint attributable to MATERIAL ~~provided by DU PONT~~ or attributable to PRODUCT that meets all production specifications herein shall be ~~assumed by DU PONT. Claims attributable to services performed by CONTRACTOR shall be assumed by CONTRACTOR.~~

N. Robbins

RECEIVED
MAY 20 1993
Ans'd.....

DuPont Corporate Contracting
Chestnut Run Plaza
Wilmington, DE 19880-0721

DuPont Corporate Contracting

CONTRACT ORDER
E. I. DUPONT DE NEMOURS AND COMPANY

May 12, 1993

LPMD-1333 2 Page 1 of 2
Contract Order No. Alt. No.

Cedar Chemical Corporation
5100 Poplar Avenue - 24th Floor
Memphis, TN 38137
Attn: Mr. Geoffrey L. Pratt

Wilmington, Delaware
Issuing Point

R. A. Blackhall
Issued By

## ALTERATION #2

Reference is made to the Agreement entered into on September 17, 1992 between E. I. du Pont de Nemours & Company (DuPont) and Cedar Chemical Corporation (Cedar Chemical) to cover the cost to chemically convert DuPont-furnished sodium perborate tetrahydrate (SPBT) fines and sodium perborate monohydrate fines (SPBM) into sodium metaborate solution for DuPont's Memphis, Tennessee facility. It is hereby mutually agreed to amend the aforesaid Agreement in the following manner effective May 1, 1993.

SPECIFICATIONS: Add the following:

Per Exhibit A, "Technology Package - SPBM Addendum Rework SPBT Fines Into Sodium Metaborate Solution," dated December 3, 1992, which is attached hereto and made a part hereof.

All other terms and conditions of the current Agreement, except as modified in the above manner, shall continue in full force and effect.

Please have your authorized representative execute in the space provided below, indicating acceptance of this alteration. Cedar Chemical will keep one original and return one executed copy of this order to Robert A. Blackhall, E. I. du Pont de Nemours & Company, P. O. Box 80723, Materials and Logistics, Chestnut Run Plaza, Hickory Run Building, Room #1102, Wilmington, Delaware 19880. These copies must be returned, so payment can be made against this alteration.

Cedar Chemical Corporation

BY: _____
Geoffrey L. Pratt

Director of Custom Manufacturing
Title

E. I. du Pont de Nemours & Company

BY: _____

Senior Purchasing Agent
Title

Page 2 of 2 for Du Pont internal use only.

E. I. du Pont de Nemours and Company

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AB0000065456/1

# TECHNOLOGY PACKAGE - SPBM ADDENDUM
## REWORK SPBT FINES INTO SODIUM METABORATE SOLUTION

### GENERAL

It is proposed to include Sodium Perborate Monohydrate (SPBM) Fines in the original 12,000,000 lbs. of material to be reworked over a twelve month period. SPBM Fines are defined as material which does not meet salable product specifications. This includes fines and rework. They undergo the same chemical decomposition as SPBT Fines discussed previously except for the presence of fewer waters of hydration. Differences from the Technology Package dated September 2, 1992 are highlighted below.

### CHEMISTRY

$NaBO_2.H_2O_2 \rightarrow NaBO_2 + 1\ H_2O + 0.5\ O_2$

### MATERIAL BALANCE

Basis: 1,000 lbs. SPBM Fines and 320 g/l final Meta solution

| | | |
|---|---|---|
| IN | 1,000 | lbs. SPBM Fines |
| | 1,635 | lbs. DI $H_2O$ |
| | 1.9 | lbs. Mg dry solids as $Mg(OH)_2$ |
| OUT | 161 | lbs. Oxygen |
| | 659 | lbs. Meta |
| | 1,815 | lbs. $H_2O$ |
| | 1.9 | lbs. Mg Solids |

Approximate meta solution volume = 228 gal.

### DETAILS

- MSDS is available for dry, granular SPBM.
- Higher active oxygen content may accelerate initial decomposition rates and increase foaming potential. However, SPBM's faster dissolution should reduce foaming potential. SPBM Fines addition rate may need to be adjusted.
- SPBM fines have a greater tendency to dust than SPBT fines. Du Pont may conduct additional air monitoring to determine appropriate personal protective equipment.

U. Hoppel

RECEIVED
MAY 20 1993
Ans'd.....

DuPont Corporate Contracting
Chestnut Run Plaza
Wilmington, DE 19880-0721

WNR

DUPONT

DuPont Corporate Contracting

CONTRACT ORDER
E. I. DUPONT DE NEMOURS AND COMPANY

May 12, 1993

LPMD-1333 (Contract Order No.) 2 (Alt. No.) Page 1 of 2

Cedar Chemical Corporation
5100 Poplar Avenue - 24th Floor
Memphis, TN 38137
Attn: Mr. Geoffrey L. Pratt

Wilmington, Delaware
Issuing Point

R. A. Blackhall
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Cedar Chemical Corporation

BY: _____
Geoffrey L. Pratt

Director of Custom Manufacturing
Title

E. I. du Pont de Nemours & Company

BY: _____

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Title

Page 2 of 2 for Du Pont internal use only.

E. I. du Pont de Nemours and Company

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# TECHNOLOGY PACKAGE - SPBM ADDENDUM
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Basis: 1,000 lbs. SPBM Fines and 320 g/l final Meta solution

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|---|---|---|
| IN | 1,000 | lbs. SPBM Fines |
| | 1,635 | lbs. DI $H_2O$ |
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Approximate meta solution volume = 228 gal.

### DETAILS

- MSDS is available for dry, granular SPBM.
- Higher active oxygen content may accelerate initial decomposition rates and increase foaming potential. However, SPBM's faster dissolution should reduce foaming potential. SPBM Fines addition rate may need to be adjusted.
- SPBM fines have a greater tendency to dust than SPBT fines. Du Pont may conduct additional air monitoring to determine appropriate personal protective equipment.

**CEDAR INTERNAL CORRESPONDENCE**

cc:- T. Lodice* M.J. Pocrass*
J. Walker* D. Shaffhauser*
E. White* Unit 4
PHI File Shift Supervisors

To: D. Hoppel

From: J. Krusling*

Date: May 11, 1994

Subject: **SHE Review 94404**

In preparation for a trial, a SHE review was held on May 11, 1994 (* denotes those attending, also attending B. Davis Unit 4 Operator) to review using the caustic catalized reaction perborate process. Action points and ares of concern are as follows:

1. Safety Items

   1.1 Contact DuPont to find out if there is a MSDS for the sodium metaborate solution that includes caustic (J. Krusling)

2. Health Items

   2.1 There were health related items.

3. Environmental Items

   3.1 There were no environmental related items.

4. Operations Items

   4.1 Revise operating procedures to include caustic process and arrange for operator training. (J. Krusling/J. Walker)

   4.2 Consider starting at a lower temperature or lower caustic concentration until it can be determined if there will be any venting or foaming problems. (J. Krusling)

   4.3 Make the first batch half size to establish system performance. (J. Krusling)

   4.4 Check to see if there is a pressure transmitter available for T-4205 as an indication of excessive O2 evolution. (T. Lodice)

J. Wagner

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

September 9, 1991

Mr. Robert A. Blackhall
Senior Purchasing Agent
Contracting Section, Materials & Logistics
E. I. du Pont de Nemours & Company
BMP-15-1284
Wilmington, DE 19898

Dear Bob:

Having witnessed the trials at du Pont's Memphis plant and received the latest process information from John Super, Cedar is now ready to offer its proposal for the processing of twelve million pounds of sodium perborate tetrahydrate (SPBT) fines over approximately a twelve month period. The project is based upon du Pont shipping process mother liquor and fines to Cedar's West Helena, Arkansas plant on a schedule to be agreed. The solid perborate will be shipped in bulk bags containing approximately 2,000 pounds each. It is assumed that the material will flow from the bulk bags even though it may contain some moderate size chunks. The mother liquor and solid fines will be mixed, heated, and the hydrogen peroxide content decomposed according to the procedures provided by du Pont. Du Pont will backhaul the resultant sodium metaborate solution to its Memphis plant.

For the above services, Cedar proposes to charge du Pont $0.08 per pound of SPBT fines processed with a target to complete the processing of twelve million pounds in a twelve month period beginning in the fourth quarter of 1991. Our strategy will be to use minimal capital investment to begin the project and add incremental equipment to improve productivity as we gain experience. We reserve the right to cease processing upon 30 day written notice to du Pont, if we find that the productivity goals cannot be met.

Based upon information provided by du Pont, it is assumed that the process does not generate any aqueous waste and that plant washouts can be returned to du Pont as part of the product shipments. Fugitive emissions due to leaks, etc. which might contain contaminants harmful to du Pont's process will be Cedar's responsibility to properly dispose of, but du Pont will work with Cedar to minimize costs associated with such disposal. Cedar anticipates that a specific air permit for this process

will not be required and has contacted the Arkansas Department of Pollution Control and Ecology suggesting this fact. The commencement of this project is contingent upon a favorable response from the regulatory agency, which is anticipated.

Please advise, if clarification of this proposal is required or if additional information is needed. We look forward to being of service to du Pont.

Sincerely,

Geoffrey L. Pratt
Director of Custom Manufacturing

mc

cc: John D.Super, du Pont
R. Tomblin
G. Pearce
D. Hoppel
M. Pocrass
J. Wagner

MBC

## SECTION III

## OCCUPATIONAL HAZARDS*

### A. Fire and Explosion Hazards

#### 1. MBC

MBC presents a serious explosion hazard while dispersed in air. Its explosion properties in air were determined at Du Pont's Develoment Laboratory, and the test results are summarized below:

| | |
|---|---|
| MIE, joules (± 0.005) | 0.111 |
| LEL (no go), g/l | 0.02 |
| Max. explosion pressure, psi | 79 |
| (dp/dt) maximum, psi/sec. | 2690 |
| average, psi/sec. | 1150 |

As a normal precaution, MBC should be protected from open flames, electrical sparks, static discharges, and similar sources of ignition. Carbon dioxide or dry chemical fire extinguishers are recommended for fire fighting. Water is also acceptable.

Design of the drying system must keep the MBC dust concentration below the LEL.

#### 2. MCC

MCC is not explosive or flammable. Methylchloroformate vapors ( a raw material used in MCC manufacture) may be present and are flammable. Use chemical foam, dry chemical, or carbon dioxide fire extinguishers.

#### 3. OPD

OPD has a flash point of 136°C and a lower explosion limit of approximately 0.025%.

Foam, dry chemical, $CO_2$ or water spray are the suggested extinguishing media to be used in case of fire. When heated to composition, OPD emits highly toxic nitrogen oxide fumes.

*Additional information is contained in the MSDS sheets in the appendix.

## OCCUPATIONAL HAZARDS*

A. Fire and Explosion Hazards (Cont'd)

4. HCl

Hydrochloric acid is not flammable, however, because of its corrosive nature, it will attack metals and liberate hydrogen, which does burn. To extinguish a fire, use water, foam, dry chemical or $CO^2$ extinguishers and neutralize with chemically alkaline substances to avoid formation of hydrogen gas.

5. MBC Waste Brine

MBC waste brine is not flammable but at high pH and/or high temperatures, ammonia, methanol, and low boiling organics may evolve. Other information is based on individual components.

6. Methanol (0.4% of Brine)

Methanol is a flammable liquid with explosive vapors. It has a lower explosive limit of 6% and an upper explosive limit of 36.5%. Extinguishing media to be used in case of a fire include dry chemical, $CO_2$, water spray and "alcohol" foam. Water spray should be used to cool tanks or containers.

7. Ammonium Chloride (3% of Brine)

Ammonium chloride will not burn. If overheated (260-315°C), ammonia and hydrogen chloride gases may be released. Use water for fires in the area. Water spray will reduce irritant fumes.

8. Ammonia Column Heads

The heads from the ammonia column are composed of relatively high percentages of ammonia (15%) and methanol (3-5%). It boils at 155°F and has a flash point greater than 155°F.

Ammonia has a "TLV" of 18 $mg/m^3$ (25 ppm) and methanol a "TLV" of 260 $mg/m^3$ (200 ppm), for an 8-hour work day. Short-term exposure level (15 minutes for ammonia is 27 $mg/m^3$ (35 ppm) and for methanol 310 $mg/m^3$ (250 ppm).

The vapor above the liquid has concentrations of ammonia up to 90%. Ammonia column heads must not be exposed to sparks, heat or flame. The transfer wagon is inerted with nitrogen prior to loading.

*Additional information is contained in the MSDS sheets in the appendix.

## OCCUPATIONAL HAZARDS*

### B. Health Hazards

#### 1. MBC

MBC is a cream colored powder with no detectable odor. It is also a very low toxicity product. MBC does not cause skin or eye irritation; persons should keep MBC from their eyes, skin, and clothes. After exposure to MBC, wash well with soap and water, and avoid breathing dust.

It has been shown that MBC can cause tumors of the liver in mice when they are fed a diet containing MBC for their normal lifetime. There are no reported long term adverse health effects from plant exposures to MBC.

MBC is an intermediate in the production of benomyl. Du Pont's AEL (acceptable exposure limit) is 5 $mg/m_3$.

#### 2. MCC

Methyl Cyanocarbamate is classified as having very low toxicity. An approximate lethal dose (ALD) of 11,000 mg/kg was found for acute ingestion tests in rats. Eye contact with MCC will cause mild to minimal effects. If contact occurs, flush with water for at least 15 minutes to insure adequate dilution of MCC.

#### 3. OPD

Orthophenylenediamine is moderately toxic when swallowed, absorbed through the skin or inhaled. Oral ingestion tests with rats show an $LD_{50}$ of 1070 mg/kg. Inhalation toxicity tests resulted in an LC (4 hr. rate) of 3.6 mg/l OPD is an irritant to both the skin and the eyes. Skin tests on rats showed an $LDL_{50}$ of 5000 mg/kg. OPD may cause skin irritations and direct skin contact will cause severe burns. Eye contact calls for at least 15 minutes of thorough water flushing to adequately dilute the OPD. Skin contact requires washing with soap and water.

In hot water solutions, OPD is more easily absorbed through the skin. OPD attacks the hemoglobin in the blood and is mildly cyanotic.

Handling of molten OPD can cause thermal burns. Protect against thermal burns and chemical exposure by wearing butyl chemical suit with gloves attached, chemical hood, neoprene rubber boots, Nomex coveralls, Nomex hood liner, and supplied breathing air.

* Additional information is contained in the MSDS sheets in the appendix.

B. Health Hazards (Cont'd)

4. HCl

Hydrochloric acid is classified as a moderately toxic substance. Hcl is very corrosive and skin contact may cause severe burns. When eye contact occurs, at least 15 minutes of thorough water washing is important to prevent permanent visual impairment or loss of sight. Erosion of teeth may result from prolonged exposure to low concentrations. Concentrations of 1000-2000 ppm are hazardous to life. A one minute exposure LCLD has been found to be 1000 ppm (inhallation, human) and for ingestion tests, a 2 hour LCLO of 1000 mg/m$^3$ (inhalation, mammal) resulted.

Wear rubber gloves, goggles and face shield when sampling. Wear rubber gloves, goggles, chemical suit, overshoes and hood when connecting or disconnecting lines. The Du Pont 8 and 12 hour AEL is 5 ppm, which is also the ceiling limit.

5. MBC Waste Brine

The untreated MBC waste brine consists primarily of water and inorganic salts with a small amount of organic by-products and some MBC. Skin tests on guinea pigs with undiluted waste brine showed negligible irritation and no sensitization. The brine exhibits a low acute toxicity with a 96 hour $LC_{50}$ of 2900 ppm for fat head minnows in aquatic toxicity tests. Other toxicity information is based on the individual components which are detailed below.

6. Sodium Chloride

Sodium chloride is a slightly toxic substance that makes up approximately 13% of the waste brine. The oral $LD_{50}$ for rats has been found to be 3000 mb/kg and the LDLO for rabbits intravenously tested was 1100 mg/kg. Skin absorpiton/contact tests with rats yielded an LDLO of 3500 mg/kg. Aquatic toxicity tests show a 96 hour TLM 1000 ppm.

7. Ammonium Chloride

Ammonium chloride which makes up 3% of the brine, is a slightly toxic chemical. Irritation of the respiratory tract may result when ammonium chloride fumes are inhaled. An $LD_{50}$ (oral, rats) was found to be 1650 mg/kg for ingestion while mice exhibited an LDL0 of 500 mg/kg in skin adsorption/contact tests.

* Additional information is contained in the MSDS sheets in the appendix.

B. Health Hazards (Cont'd)

8. MCC

See III.B.2

9. Methanol

Methanol makes up 0.4% of the waste brine and is a very toxic substance which may be fatal or cause blindness if swallowed. Inhalation toxicity tests resulted in a TCLO equal to 86,000 mg/m$^3$ for hamsters and an oral dose LDLO of 340 mg/kg for hamsters. In 30 day tests, no tumors were found and no significant pathological changes occurred in rates fed methanol orally in food.

10. Ammonia Column Heads

Avoid all contact with ammonia column heads. Avoid ingestion or breathing of the fumes as the mucous membranes of the eyes and respiratory tract may be damaged.

Rubber gloves, goggles, and face shield must be worn at all times when sampling ammonia column heads. Full coverage (chemical suit, rubber gloves, rubber boots, and chemical hood) is required for breaking into lines containing ammonia column heads. If contacted with the skin, flush well with water. If it contacts the eyes, flush well with water (15 minutes) and report to a doctor immediately.

| | | | |
|---|---|---|---|
| -810-4 | 50 | 525 | 475 ✓ |
| -810-5 | 48 | 518 | 470 ✓ |
| -810-4 | 50 | 520 | 470 ✓ |
| -810-4 | 46 | 525 | 479 ✓ |
| | 44 | 520 — | UN104 2350 476 ✓ |
| -810-4 | 44 | 522 | 476 ✓ |
| -810-4 | 48 | 525 | 477 ✓ |
| -810-4 | 44 | 525 | 481 ✓ |
| -810-4 | 46 | 523 | 477 ✓ |
| -810-439 | 43 | 524 | 483 ✓ |
| -39 | 50 | 526 | 476 ✓ |
| -31 | 45 | 525 | 480 ✓ |
| -31 | 46 | 570 | 524 ✓ |
| 53 | 42 | 527 | 485 ✓ |
| 52 | 43 | 525 | 482 ✓ |
| -4 | 46 | 522 | 476 ✓ |
| -4 | 95 | 525 | 435 ✓ |
| -52 | 44 | 524 | 480 ✓ |
| -5 | 54 | 524 | 470 ✓ |
| -53 | 48 | 516 | 468 ✓ |
| -31 | 42 | 522 | 480 ✓ |
| -31 | 46 | 524 | 478 ✓ |
| -4 | 70 | 518 | 448 ✓ |
| -4 | 43 | 527 | 484/10660 |
| -39 | 46 | 530 | 484 ✓ |
| -39 | 44 | 535 | 491 ✓ |
| -39 | 44 | 536 | 486 ✓ |
| -39 | 44 | 533 | 489 ✓ |
| 39 | 46 | 536 | 490 ✓ |
| 39 | 44 | 530 | 486 ✓ |
| | | | 100 |
| | | | 13565 |

12-15-88

BX 1

4-12
5-2
39-8
31-4
52-1
V-10104 53-1

Pscheck

14456

E. I. Du Pont De Nemours & Company, Inc.
Agricultural Products Department
Wilmington, Delaware

# CONTRACTOR'S MANUAL

## MBC SYNTHESIS

DU PONT CONFIDENTIAL INFORMATION
SPECIAL CONTROL

MANUAL NUMBER 10

WHEN NO LONGER NEEDED, PLEASE RETURN TO:

E. I. Du Pont De Nemours & Co., Inc.
Agricultural Products Department
Contract Manager, Manufacturing Division
Walker's Mill, Barley Mill Plaza
Wilmington, Delaware 19898

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CONTRACTORS MANUAL

MBC SYNTHESIS

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## SECTION I

### INTRODUCTION

This contractors manual is intended for the contractor's exclusive use and must not be released to anyone not involved in the campaign without written authorization from Du Pont's Contract Administrator.

The Contract Administrator is available to answer any questions which may arise regarding this data package.

## SECTION II

## DESCRIPTION OF PROCESS OPERATION

### A. PRODUCT DESCRIPTION

The product manufactured is methyl-2-benzimidazole carbamate (MBC). In dry form, MBC is an intermediate in the production of benomyl which is the active ingredient in "Benlate" compounds.

MBC is a white, crystalline solid with negligible odor and vapor pressure, which decomposes at 310°C. The finished product specifications are listed below.

| Item | Specification | Method* |
|---|---|---|
| Assay (%) | 98.0 Min. | B176.028 (B) |
| Water (%) | .25 Max. | B176.849 (R) |
| Inorganic Salts (Ash), % | .50 Max. | B176.027 (R) |
| Chlorides (as NaCl), % | .50 Max. | B176.089 (R) |

*Analytical methods for these tests are given in the Appendix.

The following are physical properties of MBC.

| | |
|---|---|
| Physical Form | White to tan, crystalline solid |
| Molecular Weight | 191.19 |
| Melting Point, decomposes at | 310°C |
| Solubility in Water (essentially insoluble in all commercial solvents) | 8 ppm |
| Bulk Density, lbs/ft$^3$ - unpacked | 22 |
| Bulk Density, lbs/ft$^3$ - packed | 28 |
| Flammable lower limit | 0.02 gram/liter |



AB0000119153/6

B. Raw Materials Description

1.0 MCC Salt Solution

MCC salt solution (24-26%) is synthesized at the Du Pont Belle Plant for internal use and for contract formulation for MBC.

MCC (Methyl Cyanocarbamate, Sodium Salt Solution) is a white crystalline aqueous suspension with the following properties:

| | |
|---|---|
| Specify Gravity | 1.02 |
| Boiling Point (760 mm) | 100°C |
| pH | 8.0 |
| Vapor Pressure | Negligible |
| Odor | Negligible |
| MCC Solubility in Water | 22-25% |
| Appearance | Clear Solution above 55°C |
| Decomposition Temp. | 75°C |
| Melting Point | 55°C |

2.0 Ortho - phenylenediamine (OPD)

OPD is relatively stable at atmospheric temperatures, but decomposes rapidly when exposed to air at high temperatures.

OPD can be supplied by Du Pont Chambers Works plant in two forms:

- As 99.5% purity flake in 225 lb. fiber packs
- As 99.5% purity anhydrous molten solution in 5,000 gal. tank wagons. Anhydrous OPD shipments in tank wagons are not regulated by the DOT.

A flake OPD solution (mixed with water) can be stored at 90°C with little decomposition if air is thoroughly excluded with inert gas. The anhydrous OPD can be stored for up to two months at 130°C with little decomposition provided the system is rigorously inerted with nitrogen.

The specifications for flake OPD and anhydrous OPD are attached:



AB0000119153/7

E. I. DU PONT DE NEMOURS & COMPANY
AGRICULTURAL PRODUCTS DEPARTMENT

June 6, 1985
ISSUE NO. 1

GROUP: PHENYLENEDIAMINE

A 8-7-3

## RAW MATERIAL SPECIFICATION

## O-PHENYLENEDIAMINE, FLAKE
$(C_6H_4(NH_2)_2)$

REQUIREMENTS

| ITEM | SPECIFICATIONS | STD METHOD OF ANALYSIS |
|---|---|---|
| Purity, % | 99.5 Min. | CW 25-36-30-1A |
| Isomers (PPD + MPD), % | 0.25 Max. | CW 25-36-30-1A |
| Water, % | 0.10 Max. | CW 25-19-14-1A |
| DAP, ppm | 5 Max. | CW 6-94-1B |
| AHP, ppm | 10 Max. | CW 6-94-1B |
| Fe, ppm | 25 Max. | CW 6-94-1B |
| Color, absorbance | 0.5 Max. | CW 25-19-11-4 |

APPLICATION OF MATERIAL

MBC Technical

AUTHORIZATION

SAR 68-85-01

AUTHORIZED SUPPLIER

Du Pont - Chambers Works

RMS-1/023

E. I. DU PONT DE NEMOURS & COMPANY
AGRICULTURAL PRODUCTS DEPARTMENT

June 2, 1986
ISSUE NO. 2
SUPERCEDES: 7/14/83

GROUP: AMINES
o-PHENYLENEDIAMINE (OPD)

A 8-7-2

## RAW MATERIAL SPECIFICATION

## O-PHENYLENEDIAMINE, ANHYDROUS
$C_6H_4 (NH_2)_2$

REQUIREMENTS

| ITEM | SPECIFICATIONS | STD METHOD* OF ANALYSIS |
|---|---|---|
| o-Phenylenediamine, % | 99.0 Min. | P277.101(B) |
| Isomers (PPD+MPD) plus Tar, % | 0.6 Max. | P277.101(B) & P277.7334(B) |
| Aniline, % | 0.25 Max. | P277.101(B) |
| Water, % | 0.20 Max. | BWB-1797 RM (Tentative) |
| 2,3-Diaminophenazine, ppm | 5 Max.* | ESB-60-82 (Tentative) |
| 2-Amino-3-hydroxyphenazine, ppm | 10 Max.* | ESB-60-82 (Tentative) |
| 4-Aminodiphenyl, ppb | None detected* | 178.1 RRB (Tentative) (2) (3) |
| n-cyclohexylaniline, ppm | 700 Max.** | |
| 2-Aminodiphenyl, ppm | 750* | 178 RRA (Tentative) (2) |
| All other impurities by GC, %(1) | 0.80 | P277.101(B) |
| Freezing Point, °C | 100 Min. | P277.219(B) |

(1) Defined as the total GC area percent in a 30 minute run representing compounds other than OPD, aniline and isomers.
(2) Analytical methods from Pontchartrain Plant.
(3) Method sensitive to 10 ppb.

---

* Not approved by the Chambers Works and Pontchartrain Plants. Color spec dropped as per conversation with WAB.
** For material purchased from Pontchartrain.

APPLICATION OF MATERIAL
Carbendazim Technical

AUTHORIZATION
SAR 8-83-2
QAR 86-B-3 (Auth. OPD with ~700 ppm of n-cyclohexylaniline)

AUTHORIZED SUPPLIER
Du Pont - Chambers Works, Pontchartrain

BELLE PLANT

RMS-1/023



AB0000119153/9

The following are physical properties of flake OPD:

| | |
|---|---|
| - Molecular Weight | 108.1 |
| - Melting Point, °C | 100-102 |
| - Boiling Point, °C | 256-258 |
| - Density, lb/gal at 100°C | 8.965 (liq) |
| - Density, lb/gal at 78°C | 10.583 (sol) |
| - Vapor Pressure at T°C | mmHg |
| 100 | 2.4 |
| 150 | 25.0 |
| 200 | 158.0 |
| 250 | 630.0 |

Following are physical properties of anhydrous OPD:

| | |
|---|---|
| Molecular Weight $(C_6H_4(NH_2)_2$ | 108.1 |
| Melting Point, °C | 103.8°C |
| Boiling Point, °C | 256-258 |
| Density, lb/gal at 100°C | 8.89 |
| Density, lb/gal at 110°C | 8.84 |
| Density, lb/gal at 120°C | 8.78 |
| Density, lb/gal at 130°C | 8.73 |
| Flash Point, °C | 136°C |
| Vapor Pressure at T, °C | mm Hg |
| 100 | 2.6 |
| 150 | 26 |
| 200 | 158 |
| 250 | 680 |
| Heat Capacity at T, °C | Cp Btu/lb °F |
| 100 (s) | 0.494 |
| 110 (l) | 0.568 |
| 120 (l) | 0.574 |
| 130 (l) | 0.581 |
| 140 (l) | 0.588 |



AB0000119153/10

## 3.0 Hydrochloric Acid (HCl)

Hydrochloric acid is a clear, colorless to slightly yellow liquid with a strong pungent odor.

The specifications for HCl are:

| ITEM | SPECIFICATIONS | METHOD | ANALYTICAL METHOD |
|---|---|---|---|
| Specific Gravity ($^{0}$ Be' at 60$^{0}$F) | 20$^{0}$ Min. | H918.717(B) | H918.717(B) |
| Assay (as HCl) | 31.45 Min. | H918.028(B) | H918.028(B) |
| Total sulfur compounds as (as $SO_3$) ppm | 100 Max. | H918.755(B) | * |
| Iron (as Fe) | 3 Max. | H918.335(B) | H918.335(B) |
| Heavy metals (as Pb) ppm | 1.5 Max. | H24.12(B) | * |
| Arsenic (as As) ppm | 0.2 Max. | H918.026(B) | * |
| Fluorine (as $F_2$) ppm | 50 Max. | H24.16(B) | * |
| Copper (as Cu) ppm | 1.0 Max. | H918.102(B) | H918.102(B) |
| Residue on ignition (Alkalies & Earths) ppm | 50 Max. | H24.15 | * |
| Volatile organic compounds (as C) ppm | 7 Max. | H918.813(B) | * |

*Vendor's analysis certificate accepted

Physical properties for HCl are:

| | |
|---|---|
| Molecular Weight (HCl) | 36.47 |
| Boiling Point, °C | Approaches 110 |
| Freezing Point, °C | -53 |
| Density, lb/gal at 15.5°C | 9.67 |
| Viscosity at 25°C, cp | 1.53 |

HCl is shipped in tank cars or tank wagons.

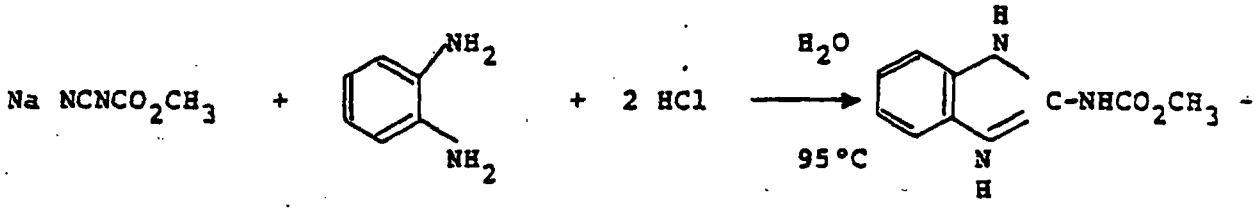
The DOT hazard class is: Corrosive Liquid.

C. Manufacturing Process

1. Process Description

a. Process Chemistry and Side Reactions

Main Reaction

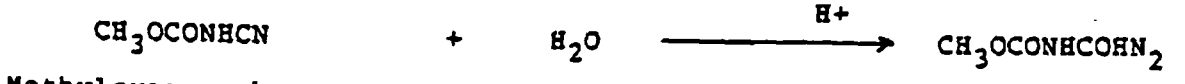



| | | | | |
|---|---|---|---|---|
| MCC | + | o-Phenylene-diamine (OPD) | + Hydrochloric Acid | Methyl 2-Benzimidazole carbamate (MBC) |

NaCl + $NH_4Cl$

Sodium Chloride — Ammonium Chloride

Side Reation




Methylcyanocarbamate — Methyl allophanate

C. Manufacturing Process (Cont'd)

1. Process Description

b. Process Steps

1) Reaction

MCC is reacted with OPD to produce MBC. The reactor should be a glass or Monel lined vessel. The vessel must be steam jacketed, nitrogen inerted, and have effective agitation to prevent caking and to continuously move the reaction slurry. The agitator power input should be about 5 HP/1000 gallon. A water scrubber is also necessary to scrub reactor off gasses.

During the reaction step, a 10%-15% molar excess of MCC to OPD is used for optimum yield to MBC. The reaction occurs at pH 4 and at a temperature of 95°C.

MCC is charged to the reactor first at a temperture of 60°C. Flake or anhydrous OPD is then charged to the reactor, and the mixture is circulated and heated to 70°C. At 70°C, the pH measuring system is activated and hydrochloric acid is slowly added. At this point an exothermic reaction begins. The acid feed rate is adjusted to slowly bring the temperature to 95°C and pH 4.0 $\pm$ 0.2. These conditions will be maintained for 72 minutes. During the temperature rise, cooling will be required. Heat may be required to maintain 95°C during the period. The MBC is insoluble in the aqueous reaction medium, and it precipitates to form a 15 to 20% slurry. At the end of the hold period, the slurry will be cooled to 50°C. Also at the end of the hold period, the pH system should be isolated and washed with water.

Continuous nitrogen inerting of the reactor head space is critical throughout the charging, reaction and pump out steps to minimize impurities in the finished product.



AB0000119153/13

C. Manufacturing Process (Cont'd)

1. Process Description (Cont'd)

b. Process Steps

2) Material Handling

MCC is shipped in 55 gal. drums (475 lbs. net) as a 24-26% solution that forms two-phases during shipment. Facilities will be required to melt the solid MCC into a single phase solution at a temperature of 60°C prior to transfer into the nitrogen inerted reactor.

OPD is shipped from the Du Pont Chambers Works, NJ, plant in flake form or as a molten anhydrous liquid. If the OPD is handled in flake form, an agitated, $N_2$ inerted, solution charge tank maintained at 70°C is recommended. A specified number of drums of flake OPD is added to the solution tank containing hot water to form a 70% solution.

If the OPD is handled in molten anhydrous form, facilities to maintain the material at 115-120°C are recommended. In general, the material could be unloaded directly from an OPD T/W to a charge tank. From there, the material is metered directly into the reactor. Maintaining the molten OPD charging facilities at 115-120°C is critical to prevent pluggages.

3) Filtration

Solid MBC is separated from the reaction slurry which contains 15-20% solids using a vacuum or Nutsche filter. The cake is rinsed twice with 50-60°C process water to remove soluble impurities. The filtered mother liquor (pH 4-5) is collected in a storage tank and is treated using one of the following methods:

- o High temperature, high pH hydrolysis treatment or
- o Activated carbon adsorption treatment.

In addition to one of these two methods of treatment, an ammonia stripping column may be required to remove ammonia nitrogen from the waste stream.

A filter cloth of 120 cfm polypropylene screen is recommended for a vacuum filter. Cloths of higher or lower porosity ( ) will cause out-of-spec. chlorides water in the product and/or yield loss.



AB0000119153/14

C. Manufacturing Process (Cont'd)

1. Process Description (Cont'd)

b. Process Steps (Cont'd)

4) MBC Drying

The filtered MBC wet cake contains 40 to 50% moisture. The MBC must be dried to an average moisture content of less than 0.1%. In existing operations, a direct heat rotary dryer operating at 110°C is used. Heated air provides the heat transfer medium for the dryer system. Protection against an MBC dust explosion must be incorporated into the design of the drying system. The explosion properties for MBC dust are listed on page 16.

MBC from the dryer is discharged into a storage bin and then bulk packaged in 50 Kilo lever packs.

c. Materials of Construction

Glass lined steel or Monel is satisfactory for MBC slurry. Carbon steel is used for dry MBC service and flake OPD equipment. Use glass lined steel, Monel or titanium for MCC service. Rubber-lined carbon steel, fiberglass reinforced polyester, and polypropylene-lined pipe is satisfactory for HCl. For MBC filtration mother liquor at pH 4-5, teflon lined pipe is acceptable.

d. Waste Treatment

Any aqueous waste streams, such as scrubber water, may require biotreatment prior to discharge from the plant, depending on local regulations. As mentioned above, the mother liquor from the filtration step requires high temperature, high pH hydrolysis treatment or activated carbon treatment to reduce the TOC load. An ammonia steam stripping column is also required to remove ammonia heads from the treated mother liquor stream. The column overheads should be burned in an approved liquid incenerator.



AB0000119153/15

C. Manufacturing Process (Cont'd)

1. Process Description (Cont'd)

d. Waste Treatment (Cont'd)

Waste Characterization

MBC Process Off-Gas Scrubber Effluent

The off-gas is mainly carbon dioxide, but contains small amounts of dimethyl-carbonate, water vapor, ammonia and HCl.

| | Analysis - ppm | Lbs/Day |
|---|---|---|
| Total $N_2$ | 1.6 | 0.35 |
| COD | 130 | 27 |
| BOD | 35 | 7 |

lb. $CO_2$ gas/lb. MBC = .26

Filter Mother Liquor Stream

The mother liquor stream from the filtration step has the approximate composition:

| | Percent |
|---|---|
| Water | 79-84% |
| Sodium Chloride | 9-13% |
| Ammonia Chloride | 3-4% |
| Cyanacarbonate Sodium Salt | 2-3% |
| Other Organic Compounds | 0-1% |

The mother liquor is a translucent orange-red free-flowing liquid. It has a density of 9.1 lb/gal. and a pH of 4-5. The normal amount of mother liquor produced per lb. of MBC is 7:1.

Aqueous Ammonia Heads Stream

The aqueous ammonia overhead stream from the steam stripping column has the approximate composition:

| | Percent |
|---|---|
| Water | 82% |
| Ammonia | 15% |
| Methanol | 3% |



AB0000119153/16

The following are pertinent operating control limits for the MBC process at the Belle, West Virginia Plant.

| Reaction | Normal | Control Limits Min. | Control Limits Max. | Critical Limits Min. | Critical Limits Max. |
|---|---|---|---|---|---|
| MCC Charge, lbs.* | 3320 | - | - | - | - |
| OPD Charge, lbs.* | 3230 | 3000 | 3300 | 2900 | 3400 |
| pH | 4 | 3.8 | 4.2 | 3.5 | 4.5 |
| Temperature, °C | 95 | 90 | 97 | 88 | 98 |
| Reaction Time, hrs. | 2 | - | - | - | - |
| HCl Consumption, lbs. | 4000 to 5000 | 3500 | 5200 | 2800 | 5400 |
| Hold Period, Minutes | 72 | 60 | 90 | 30 | 120 |
| Dryer | | | | | |
| Dryer Exit Air Temperature, °C | 110 | 100 | 115 | 90 | 120 |
| Filtration | | | | | |
| Filter Wash Water Temp., °F | 122 | 120 | 130 | 100 | 140 |

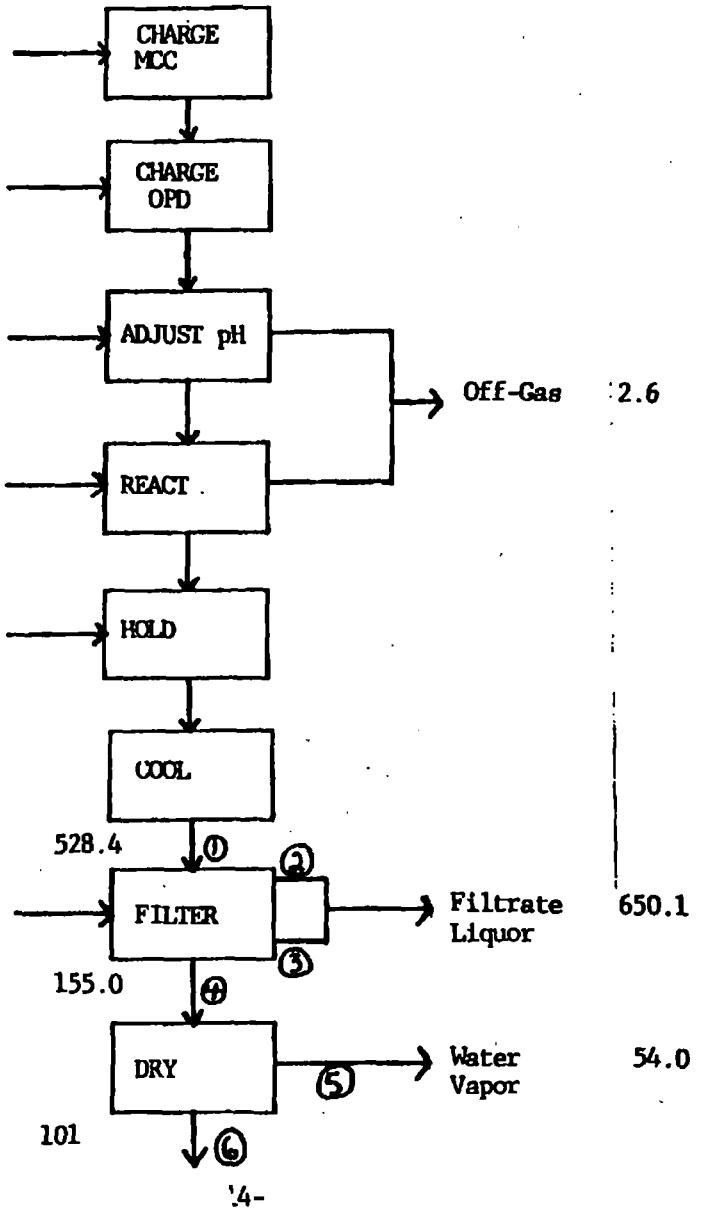
* Charges based on 4,000 gal. reactor. Charges can be scaled down proportionally for smaller vessel.



AB0000119153/17

70% OPD SOLUTION

| Process Description | Inputs | Lbs. |
|---|---|---|
| Charge MCC | MCC | 305.5 |
| Charge OPD | OPD (70% Solution | 88.2 |
| Charge HCl | Hydrochloric Acid (31.5%) | 32.2 |
| Charge HCl & React To MBC | HCl (31.5%) | 17.1 |
| Hold Period To Complete Reaction | HCl (31.5%) | 76.7 |
| Cool Slurry | Water (Reactor Flush) | 11.3 |
| Filter & Wash Cake | Water | 280.0 |
| Dry MBC | | |




Lbs. | Outputs | Lbs.

-4-

## KEY TO MATERIAL BALANCE - FLOW SHEET

| Stream No. | Description | T, °C | Lbs/Gal. | Total | | MBC | $H_2O$ | NaCL | $NH_4Cl$ | Unknown |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lbs. | Gals. | | | | | |
| 1 | Slurry | 35 | 9.6 | 525.1 | 54.7 | 100.0 | 313.2 | 65.7 | 24.2 | 22.0 |
| 2 | Clear Liquid | 35 | 9.4 | 342.3 | 36.7 | - | 259.2 | 49.3 | 17.8 | 17.0 |
| 3 | Clear Liquid | 50 | 8.8 | 307.8 | 26.1 | - | 280.0 | 16.4 | 6.4 | 5.0 |
| 4 | Wet Cake | 50 | 6.0 | 155.0 | 25.8 | 100.0 | 54.0 | Trace | Trace | 0.9 |
| 5 | Vapor | 110 | - | 54.0 | - | nil | 54.0 | - | - | - |
| 6 | Dry Powder | 25 | 2.67 | 101.0 | 37.7 | 100.0 | < 0.1 | Trace | Trace | 0.9 |



AB0000119153/19

## SECTION III

## OCCUPATIONAL HAZARDS*

### A. Fire and Explosion Hazards

#### 1. MBC

MBC presents a serious explosion hazard while dispersed in air. Its explosion properties in air were determined at Du Pont's Develoment Laboratory, and the test results are summarized below:

| | |
|---|---|
| MIE, joules (± 0.005) | 0.111 |
| LEL (no go), g/l | 0.02 |
| Max. explosion pressure, psi | 79 |
| (dp/dt) maximum, psi/sec. | 2690 |
| average, psi/sec. | 1150 |

As a normal precaution, MBC should be protected from open flames, electrical sparks, static discharges, and similar sources of ignition. Carbon dioxide or dry chemical fire extinguishers are recommended for fire fighting. Water is also acceptable.

Design of the drying system must keep the MBC dust concentration below the LEL.

#### 2. MCC

MCC is not explosive or flammable. Methylchloroformate vapors ( a raw material used in MCC manufacture) may be present and are flammable. Use chemical foam, dry chemical, or carbon dioxide fire extinguishers.

#### 3. OPD

OPD has a flash point of 136°C and a lower explosion limit of approximately 0.025%.

Foam, dry chemical, $CO_2$ or water spray are the suggested extinguishing media to be used in case of fire. When heated to composition, OPD emits highly toxic nitrogen oxide fumes.

*Additional information is contained in the MSDS sheets in the appendix.



AB0000119153/20

## SECTION III (Cont'd)

## OCCUPATIONAL HAZARDS*

A. Fire and Explosion Hazards (Cont'd)

4. HCl

Hydrochloric acid is not flammable, however, because of its corrosive nature, it will attack metals and liberate hydrogen, which does burn. To extinguish a fire, use water, foam, dry chemical or $CO^2$ extinguishers and neutralize with chemically alkaline substances to avoid formation of hydrogen gas.

5. MBC Waste Brine

MBC waste brine is not flammable but at high pH and/or high temperatures, ammonia, methanol, and low boiling organics may evolve. Other information is based on individual components.

6. Methanol (0.4% of Brine)

Methanol is a flammable liquid with explosive vapors. It has a lower explosive limit of 6% and an upper explosive limit of 36.5%. Extinguishing media to be used in case of a fire include dry chemical, $CO_2$, water spray and "alcohol" foam. Water spray should be used to cool tanks or containers.

7. Ammonium Chloride (3% of Brine)

Ammonium chloride will not burn. If overheated (260-315°C), ammonia and hydrogen chloride gases may be released. Use water for fires in the area. Water spray will reduce irritant fumes.

8. Ammonia Column Heads

The heads from the ammonia column are composed of relatively high percentages of ammonia (15%) and methanol (3-5%). It boils at 155°F and has a flash point greater than 155°F.

Ammonia has a "TLV" of 18 $mg/m^3$ (25 ppm) and methanol a "TLV" of 260 $mg/m^3$ (200 ppm), for an 8-hour work day. Short-term exposure level (15 minutes for ammonia is 27 $mg/m^3$ (35 ppm) and for methanol 310 $mg/m^3$ (250 ppm).

The vapor above the liquid has concentrations of ammonia up to 90%. Ammonia column heads must not be exposed to sparks, heat or flame. The transfer wagon is inerted with nitrogen prior to loading.

*Additional information is contained in the MSDS sheets in the appendix.



AB0000119153/21

## OCCUPATIONAL HAZARDS*

### B. Health Hazards

#### 1. MBC

MBC is a cream colored powder with no detectable odor. It is also a very low toxicity product. MBC does not cause skin or eye irritation; persons should keep MBC from their eyes, skin, and clothes. After exposure to MBC, wash well with soap and water, and avoid breathing dust.

It has been shown that MBC can cause tumors of the liver in mice when they are fed a diet containing MBC for their normal lifetime. There are no reported long term adverse health effects from plant exposures to MBC.

MBC is an intermediate in the production of benomyl. Du Pont's AEL (acceptable exposure limit) is 5 $mg/m_3$.

#### 2. MCC

Methyl Cyanocarbamate is classified as having very low toxicity. An approximate lethal dose (ALD) of 11,000 mg/kg was found for acute ingestion tests in rats. Eye contact with MCC will cause mild to minimal effects. If contact occurs, flush with water for at least 15 minutes to insure adequate dilution of MCC.

#### 3. OPD

Orthophenylenediamine is moderately toxic when swallowed, absorbed through the skin or inhaled. Oral ingestion tests with rats show an $LD_{50}$ of 1070 mg/kg. Inhalation toxicity tests resulted in an LC (4 hr. rate) of 3.6 mg/l OPD is an irritant to both the skin and the eyes. Skin tests on rats showed an $LDL_{50}$ of 5000 mg/kg. OPD may cause skin irritations and direct skin contact will cause severe burns. Eye contact calls for at least 15 minutes of thorough water flushing to adequately dilute the OPD. Skin contact requires washing with soap and water.

In hot water solutions, OPD is more easily absorbed through the skin. OPD attacks the hemoglobin in the blood and is mildly cyanotic.

Handling of molten OPD can cause thermal burns. Protect against thermal burns and chemical exposure by wearing butyl chemical suit with gloves attached, chemical hood, neoprene rubber boots, Nomex coveralls, Nomex hood liner, and supplied breathing air.

* Additional information is contained in the MSDS sheets in the appendix.



AB0000119153/22

B. Health Hazards (Cont'd)

4. HCl

Hydrochloric acid is classified as a moderately toxic substance. Hcl is very corrosive and skin contact may cause severe burns. When eye contact occurs, at least 15 minutes of thorough water washing is important to prevent permanent visual impairment or loss of sight. Erosion of teeth may result from prolonged exposure to low concentrations. Concentrations of 1000-2000 ppm are hazardous to life. A one minute exposure LCLD has been found to be 1000 ppm (inhallation, human) and for ingestion tests, a 2 hour LCLO of 1000 $mg/m^3$ (inhalation, mammal) resulted.

Wear rubber gloves, goggles and face shield when sampling. Wear rubber gloves, goggles, chemical suit, overshoes and hood when connecting or disconnecting lines. The Du Pont 8 and 12 hour AEL is 5 ppm, which is also the ceiling limit.

5. MBC Waste Brine

The untreated MBC waste brine consists primarily of water and inorganic salts with a small amount of organic by-products and some MBC. Skin tests on guinea pigs with undiluted waste brine showed negligible irritation and no sensitization. The brine exhibits a low acute toxicity with a 96 hour $LC_{50}$ of 2900 ppm for fat head minnows in aquatic toxicity tests. Other toxicity information is based on the individual components which are detailed below.

6. Sodium Chloride

Sodium chloride is a slightly toxic substance that makes up approximately 13% of the waste brine. The oral $LD_{50}$ for rats has been found to be 3000 mb/kg and the LDLO for rabbits intravenously tested was 1100 mg/kg. Skin absorpiton/contact tests with rats yielded an LDLO of 3500 mg/kg. Aquatic toxicity tests show a 96 hour TLM 1000 ppm.

7. Ammonium Chloride

Ammonium chloride which makes up 3% of the brine, is a slightly toxic chemical. Irritation of the respiratory tract may result when ammonium chloride fumes are inhaled. An $LD_{50}$ (oral, rats) was found to be 1650 mg/kg for ingestion while mice exhibited an LDL0 of 500 mg/kg in skin adsorption/contact tests.

* Additional information is contained in the MSDS sheets in the appendix.



AB0000119153/23

B. Health Hazards (Cont'd)

8. MCC

See III.B.2

9. Methanol

Methanol makes up 0.4% of the waste brine and is a very toxic substance which may be fatal or cause blindness if swallowed. Inhalation toxicity tests resulted in a TCLO equal to 86,000 mg/m$^3$ for hamsters and an oral dose LDLO of 340 mg/kg for hamsters. In 30 day tests, no tumors were found and no significant pathological changes occurred in rates fed methanol orally in food.

10. Ammonia Column Heads

Avoid all contact with ammonia column heads. Avoid ingestion or breathing of the fumes as the mucous membranes of the eyes and respiratory tract may be damaged.

Rubber gloves, goggles, and face shield must be worn at all times when sampling ammonia column heads. Full coverage (chemical suit, rubber gloves, rubber boots, and chemical hood) is required for breaking into lines containing ammonia column heads. If contacted with the skin, flush well with water. If it contacts the eyes, flush well with water (15 minutes) and report to a doctor immediately.



AB0000119153/24

## SECTION IV

## GENERAL PRODUCT INFORMATION

### A. FACILITY PREPARATION

Equipment used for the manufacture of this product should be thoroughly cleaned to avoid crosscontamination with other pesticides or chemicals. The system should be kept dry. The Contract Administrator must be informed with the identification, name, toxicological and other available basic data concerning the material(s) produced in the equipment just prior to production of MCC.

All weight scales are to be verified for accuracy by an outside agency (governmental or scale service company). Scales must meet the requirements of the National Bureau of Standard's Handbook 44.

Excellent housekeeping in the area of the filling operation must be maintained. Any residual product must be cleaned from scales, fillers, and scaling equipment.



AB0000119153/25

B. PACKAGING

MBC will be packaged in 50 kilo leverpaks (41 gal). Du Pont will furnish packaging supplies. Leverpaks will be filled, checkweighed, sealed, labeled and batch numbers applied.

C. PRODUCT RELEASE

Finished product will be released only by the Contract Administrator. Lot numbers of finished product shipped must appear on the packing list.

Material which is not released will be held and considered for release or designated as rework.

D. SHIPPING

Leverpaks are to be shipped unpalletized by truck.



AB0000119153/28

E. TRACE LEVEL CONTAMINATION

Disposition of trace level contaminated product will be determined by the Contract Administrator.

F. QUALITY CONTROL

Sampling and analysis of each MBC dryer batch is required to assure product integrity.

A representative sample from of each dryer batch will be taken, mixed and split into two portions. One sample will be analyzed at the contractors to determine if all specifications are met. Samples having analyses outside of specification limits may be reanalyzed as long as the Contract Administrator is kept informed of all results. Material which fails to meet specification a second time will be designated as rework. The Contract Administrator will decide the disposition of this material. Additional analysis may be required if analytical variability is high.

The second portion of the lot sample will be sent to the Contract Administrator for random crosschecks of analytical results.

G. RECORDS AND DATA

The following records will be kept by the Contractor and submitted to the Contract Administrator at the end of the campaign. For additional information regarding lot numbering system, weight control, etc., refer to the Guidelines for Contractors, Formulating-Packaging-Process, Du Pont Products.

Record

1. Synthesis Batch Sheets
2. Analytical Results
3. Inventory Summary
4. Receipt & shipping notices (invoices) & bills of lading

## H. LABORATORY METHODS

Laboratory methods are included in the Appendix. Tests for product quality and compliance with critical product specifications will be made per these specifications. If the Contractor must modify the method the Contract Administrator shall be informed.



AB0000119153/32

## SECTION V

## APPENDIX

A. MATERIAL SAFETY DATA SHEETS

B. ANALYTICAL METHODS

C. RAW MATERIAL SPECIFICATION SHEETS



AB0000119153/33

## SECTION V

## APPENDIX A

## MATERIAL SAFETY DATA SHEETS

## SECTION III

## OCCUPATIONAL HAZARDS*

### A. Fire and Explosion Hazards

#### 1. MBC

MBC presents a serious explosion hazard while dispersed in air. Its explosion properties in air were determined at Du Pont's Develoment Laboratory, and the test results are summarized below:

| | |
|---|---|
| MIE, joules (± 0.005) | 0.111 |
| LEL (no go), g/l | 0.02 |
| Max. explosion pressure, psi | 79 |
| (dp/dt) maximum, psi/sec. | 2690 |
| average, psi/sec. | 1150 |

As a normal precaution, MBC should be protected from open flames, electrical sparks, static discharges, and similar sources of ignition. Carbon dioxide or dry chemical fire extinguishers are recommended for fire fighting. Water is also acceptable.

Design of the drying system must keep the MBC dust concentration below the LEL.

#### 2. MCC

MCC is not explosive or flammable. Methylchloroformate vapors ( a raw material used in MCC manufacture) may be present and are flammable. Use chemical foam, dry chemical, or carbon dioxide fire extinguishers.

#### 3. OPD

OPD has a flash point of 136°C and a lower explosion limit of approximately 0.025%.

Foam, dry chemical, $CO_2$ or water spray are the suggested extinguishing media to be used in case of fire. When heated to composition, OPD emits highly toxic nitrogen oxide fumes.

*Additional information is contained in the MSDS sheets in the appendix.



AB0000121326/1

## OCCUPATIONAL HAZARDS*

A. Fire and Explosion Hazards (Cont'd)

4. HCl

Hydrochloric acid is not flammable, however, because of its corrosive nature, it will attack metals and liberate hydrogen, which does burn. To extinguish a fire, use water, foam, dry chemical or $CO^2$ extinguishers and neutralize with chemically alkaline substances to avoid formation of hydrogen gas.

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AB0000121326/3

## OCCUPATIONAL HAZARDS*

B. Health Hazards (Cont'd)

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B. Health Hazards (Cont'd)

8. MCC

See III.B.2

9. Methanol

Methanol makes up 0.4% of the waste brine and is a very toxic substance which may be fatal or cause blindness if swallowed. Inhalation toxicity tests resulted in a TCLO equal to 86,000 mg/m$^3$ for hamsters and an oral dose LDLO of 340 mg/kg for hamsters. In 30 day tests, no tumors were found and no significant pathological changes occurred in rates fed methanol orally in food.

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Neil Robbins

**CEDAR INTERNAL CORRESPONDENCE**

DATE: November 1, 1988

TO: Craig Keese

FROM: Stanley Bernard

CC: Attendees

SUBJECT: Development Meeting Minutes

A development/business meeting was held at the West Helena facility October 31, 1988 attended by John Miles, Charlie Parker, Tom Lodice, Neil Robbins, Craig Keese, John Whitsett, Geoff Pratt, Bill Gastrock, and Stanley Bernard.

1. West Helena Income/Expense and Budget

   Neil presented forecast budget for 1988 and 1989.
   Without any corrective action a loss of approximately $53,000 would be realized for 1988.
   Corrective actions that could be taken are:

| | |
|---|---|
| Returning excess task force fund & set aside - | $150,000 |
| Forthcoming rebate from 2,4-DB task force - | $150,000 |
| Sell Propanil 4 inventory - | $ 90,000 |
| Sell 2,4-DB inventory - | $ 60,000 |
| Reduce expenses - | $ 50,000 |
| Run 75 M Gal Cedar 4 lb. | $ 50,000 |

   Concern was raised about effect of showing profit in 1988 on profit picture for 1989.
   John presented a preliminary capital budget for 1989. He is to propose a brief explanation/rationale for each for presentation at the upcoming November 15 meeting.

2. Custom/Toll Manufacturing

   Geoff presented potential Toll projects currently active:

| | | |
|---|---|---|
| Dupont MCB: | Timing - | 1st Quarter 1989 |
| | Plant - | Diphone |
| | Duration - | 2 months |
| | Income - | approx. $500,000 |
| Pennwalt E-2265: | Timing - | 1st - 2nd Quarter 1989 |
| | Plant - | Diphone |
| | Duration - | 2 months |
| | Income - | approx. - $500,000 |

Monsanto Resin: Timing: Multi-year
Income: $600,000/year

Petrlyn dye: Status: undecided

Richmond benzene derivative: Status: to be determined soon
Richmond has potential to develop custom business and show be persued.

Geoff also presented potential custom projects:

Ortho Cobra: Similar in manufacture to Tackle.

$CS_2$ Fusmigants: There is a need to increase the number of thiocarbamate products.

Also discussed were ways to increase activity in the custom manufacturing business:

1. *Involve custom consultants*
2. Increase trade slow participation
3. Increase trade society participation
4. Increase trade jounal advertisement
5. Develop new custom brochure
6. Meeting participants actively make custom business contacts
7. Better our existing custom business contacts (pursue custom manufacturing managers at large instead of those limited to the agricultural products.)

3. Cedar Product Development

Bill Gastrock presented his progress with developing new Cedar products:

1. DCA: Raw materials have been received for an evaluation of DCNB synthesis. Information available in 2 weeks.

2. Ziram: Potential 6 million pound market. Keese to discuss in November with UCB and OrCal.
Results of West Helena lab work show quite easy to synthesize. Uncertainty as to what finished *product is best.*

3. Glyoxylic Acid: Computer search shows numerous methods of synthesis. Further information exchange with Chemi-Linz is warranted.

4. Pyrethroids: Raw materials probably not available.

5. 1,2,3,4-Butanetetracarboxylic Acid - Gastrock to contact Clark Welch in regard to this project.

4. WHAM

Stanley presented approximate cost of Wham and comparison to E.C. formulation. A premium sales price will be charged for Wham and sold on allocation.

A comparison of product availability based on outputs of the rental flaker and production flaker.
10,000 gal ready Feb. 1
85,000 gal ready March 1 (rental)
120,00 gal ready March 1 (production)
55,000 gal ready April 1 (rental)
20,000 gal ready March 15 (production)

Wham marketing tasks to be completed.
Advertising
Slide show
Export packaging
Label design
Allocation
MSDS
Promotions
Price Sheet

Geoff stated contract complete with exception of analytical methods which Stanley will submit.

Job assignments

Raw materials - Charlie Parker
Product distribution - Memphis/Parker
Label design - Bernard
Package - Bernard
Technical contact - Satterfield/Bernard
Contract - Pratt
Palletized product - Bernard
Registration - Bellet/Bernard/Keese

Bellet "brand-carrying" registration application to Washington Nov. 1, 1988. Conditional registration expected Dec. 1, 1988.

DCA from R&H should be 98%. Keese to bring up in forthcoming meeting with R&H.

5. Propanil

Celanese pleased with letter from EPA regarding use of M.O. in propanil. Alvarez expects no problems in suppling Cedar starting Jan. 1, 1989. Production timing of Propanil 4 will be limited to M.O. availability. M.O. on hand for 70,000-75,000 gal.

Projected consumption of propanil technical.

| | Dec. | Jan. | Feb. | Mar. | Apr. | May |
|---|---|---|---|---|---|---|
| Stam | | 350 | 170 | 170 | 440 | 140 |
| Propnail 4 | | 300 | 480 | 640 | 360 | 400 |
| Wham | 150 | 150 | 150 | 150 | | |

Stanley to prepare technical bulletin for flaked propanil technical.

Propanil 4 inventory: 30,000 gal.

Butoxone

Keese has contacted Marks for 2,4-DB quote. Neil to contact Gilmore for quote on producing 20,000 gal. of ester immediately.

Keese revealed plans to move formulation of Butoxone from Gilmore to Helena Chemical, Cordele, Ga.
Neil to coordinate manufacture and containers.
Stanley to supply Helena with technical information.

Butoxone inventory:

| | |
|---|---|
| Butoxone 200 | 20,000 gal. |
| Butoxone 175 | 50,000 gal. |

Other subjects:

Keese to talk with Whitsett and Bumpers about replacement for Sherry Thaxton.

CC: Keese
Brown
Miles

CC: Tom Kim
Neil Joe
Charlie Greg

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

November 11, 1988

Mr. Ted Kirchner
Contract Manager
E.I. DuPont De Nemours & Co.
Walkers Mill, Barley Mill Plaza
Wilmington, Delaware 19898

Dear Ted,

This is to confirm our conversation of November 10, regarding the production by Cedar of 600,000 to 800,000 lbs of MBC commencing in December, 1988. Cedar proposes the following terms for the production:

1) That a plant modification fee not to exceed $50,000 be paid by DuPont amortized over the quantity of MBC to be produced. The modifications are expected to include the installation of a recirculation loop with temperature and pH control, facilities to melt solid MCC in drums, a jacketed OPD charge line, conversion of a reactor vent line from stainless steel to fiberglass, and a hydrochloric acid feed system. These items have been recommended by DuPont's production staff based on their prior commercial experience.

2) DuPont will provide all raw materials which will be delivered to Cedar's West Helena plant.

3) The basis for waste disposal will be to return the material to DuPont's Belle, West Virginia plant with DuPont bearing the cost associated with the freight and disposal. Cedar will make every effort to dispose of aqueous waste through it's biological system as soon as possible after start-up. This may occur when sufficient material can be collected for characterization and verification that the waste is suitable for treatment in Cedar's nonhazardous biological treatment system. The fee for this service, to include materials required for the treatment, will be developed after completion of the waste evaluation work.

4) The fee for processing the MBC will be $9,000 per day for a trial period intended to establish that the plant as modified can produce specification product, with raw

material consumption, waste generation, and productivity levels acceptable to both parties. The daily fee would be assessed only after Cedar's plant is ready for the injection of chemicals and only when the plant is in working condition. There will be a $100,000 minimum fee should the project be declared nonfeasible during this trial period or subsequent standard production period.

5) Following mutual agreement that the trial period is over, Cedar would proceed on a fixed cost per unit of production. This cost is to be determined by dividing the number of days in a given month times $8,000 per day by the number of pounds produced in that month. The average daily production rate is estimated to be 10,000 lbs. per day by Cedar and 17,000 lbs. per day by DuPont and thus the unit cost is expected to be in the range of $.47 to $.80 per pound.

6) Nitrogen is considered to be a raw material and will be metered to the reaction equipment. It will be charged to DuPont at Cedar's costs plus 5%.

Subject to rapid agreement on this proposal, Cedar would target to begin production of MBC on or around December 1, 1988. This rapid schedule would require appropiate support from DuPont's technical staff to confirm the plant modifications required and identify the appropiate operating, safety, and environmental procedures required. It is assumed that DuPont's technical staff will be present during the trial period.

I believe that this covers the major items that we discussed yesterday, but if additional issues need to be addressed, please call. We have located the major items necessary to modify the plant and are ready to begin the modifications immediately.

We hope that these terms are acceptable to you. Thank you for giving us the opportunity to bid on this project.

Sincerely,

Geoffrey L. Pratt
Director of Operations/
Custom Manufacturing

/kt

DATE 11/15 55

CC: Tom L Joe P
Ken H Greg S.

To: John Miles
Tom Lodice

From: D. H. Claudio - DuPont - Belle, W. Va.

## Belle Operating Procedures

Attached are the operating procedures for OPD handling, MBC reaction and MBC filtration. Also included is an MBC reactor Logsheet and a method for determination of $H_2O$ in MBC (which was not included in the contractors manual).

USE STANDARDS FOR MINIMUM ESSENTIAL INSTALLATIONS

AB0000118912/1

# MBC REACTOR LOGSHEET

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BATCH NUMBER | | | | | | | | | | | | |
| OPERATOR | | | | | | | | | | | | |
| DATE | | | | | | | | | | | | |
| TIME STARTED | | | | | | | | | | | | |
| WATER CHARGE (LBS) | | | | | | | | | | | | |
| CYANAMIDE CHARGE (LBS) | | | | | | | | | | | | |
| *REACTOR TEMP (<25°C) | | | | | | | | | | | | |
| REACTOR pH (4.5-5.5) | | | | | | | | | | | | |
| REACTOR LEVEL (16-18%) | | | | | | | | | | | | |
| MCF CHARGE (LBS) | | | | | | | | | | | | |
| CAUSTIC CHARGE (4300-4600 LBS) | | | | | | | | | | | | |
| *REACTOR TEMP (50-60°C) | | | | | | | | | | | | |
| REACTOR pH (6.8-7.2) | | | | | | | | | | | | |
| REACTOR LEVEL (30-35%) | | | | | | | | | | | | |
| OPD CHARGE (LBS) | | | | | | | | | | | | |
| *REACTOR TEMP (55-60°C) | | | | | | | | | | | | |
| HCL (STEP 19) (1800-2200 LBS)* | | | | | | | | | | | | |
| REACTOR pH (4.0-4.3) | | | | | | | | | | | | |
| HCL TOTAL (5000-6000 LBS) | | | | | | | | | | | | |
| *REACTOR TEMP (95-97°C) | | | | | | | | | | | | |
| REACTOR pH (3.8-4.2) | | | | | | | | | | | | |
| REACTOR LEVEL (60-65%) | | | | | | | | | | | | |
| AFTER COOLING | | | | | | | | | | | | |
| *REACTOR TEMP (75-85°C) | | | | | | | | | | | | |
| WATER FLUSH (LBS) | | | | | | | | | | | | |
| TIME FINISHED | | | | | | | | | | | | |
| TANK LEVELS | | | | | | | | | | | | |
| CYANAMIDE Start | | | | | | | | | | | | |
| Finish | | | | | | | | | | | | |
| MCF Start | | | | | | | | | | | | |
| Finish | | | | | | | | | | | | |
| CAUSTIC Start | | | | | | | | | | | | |
| Finish | | | | | | | | | | | | |
| OPD Start | | | | | | | | | | | | |
| Finish | | | | | | | | | | | | |
| HCL Start | | | | | | | | | | | | |
| Finish | | | | | | | | | | | | |

If HCl consumption during Step 19 <1,800 lbs, have E&I buff pH cells before starting next batch.

HC:lal
/5/88

E. I. du Pont de Nemours and Co. (Inc.)
Biochemicals Department

Method No. B 176.849 (R)
Second Issue: 3-28-72
Supersedes: B 176.849 ( ),
4-3-70

# 2-BENZIMIDAZOLE CARBAMIC ACID, METHYL ESTER (E-965)

## Determination of Water

## Karl Fischer Reagent Method

### I. Applicability

This rapid titration technique may be used for the quantitative determination of water in E-965. By proper choice of sample size and reagent concentration, the method is suitable for the measurement of water over a wide concentration range.

### II. Principle

The sample is dissolved in a methanol-pyridine mixture which has been pre-neutralized with Karl Fischer Reagent (KFR). This reagent is a mixture of iodine, sulfur dioxide, pyridine and methanol. The sample is then titrated with KFR. During the titration, iodine is reduced to hydrogen iodide; and consequently, as long as water is present, the iodine color will be discharged. The end point is reached at the first appearance of unused iodine, determined electrometrically.

### III. Unusual Safety Considerations

Methanol is a toxic, volatile liquid (TLV = 200 ppm) and may be absorbed through the skin. Exposure to this material is to be minimized by the use of "Buta-Sol" rubber gloves and handling in a well-ventilated area.

Karl Fischer reagent (KFR) contains four toxic materials; namely, iodine (TLV = 0.1 ppm), sulfur dioxide (TLV = 5 ppm), pyridine (TLV = 5 ppm), and methanol. This reagent should be dispensed in a well-ventilated area. Care must be exercised to avoid unnecessary inhalation of the reagent or direct contact of the reagent with the skin. Following accidental spillage, wash with generous amounts of water.

E-965 Intermediate is a moderately toxic powder. Avoid contact with skin or eyes and wear a respirator when handling this material in dusty operation. Wash exposed areas with soap and water. Launder contaminated clothing before reuse. The dust may explode, so keep it away from sparks, flames and other sources of ignition.

IV. Sensitivity, Precision, and Accuracy

The sensitivity of the method, assuming that the volume of KFR can be measured to the nearest 0.1 ml, is ca. 0.003%. The accuracy is extremely dependent on isolating the sample and the test solution from atmospheric moisture.

V. Apparatus and Reagents

(Equivalent apparatus may be substituted. Reagents are reagent grade.)

1. "Aquameter", Beckman, Model KF-3, equipped with a "Duo Platinum Electrode", Beckman No. 39032

   (The "Aquameter" is normally furnished with a 10-ml buret. It is desirable to replace this with a 25-ml buret to avoid refilling when titrating water standard and samples of the sizes specified by the method.)

   [The delivery tip of the buret is modified to accommodate a flask having an 18/9 female spherical joint by slipping a one-inch length of Tygon® tubing (1/4 in. id x 1/16 in. wall) upon the tip to a point just above the tapered portion of the tip, and then slipping over this an 18/9 male joint which has been cut off about 1/4-inch above the ball. This arrangement provides a gas tight seal.]

2. Needles, hypodermic, 3-in., 22-gauge

3. Stirring bar, magnetic, polyethylene coated

4. Syringe, 5-ml

5. Titrating vessel, 300-ml, 3-neck Erlenmeyer type flask

   The middle neck is equipped with an 18/9 female spherical joint to fit the spherical joint of the "Aquameter" buret tip. The electrode is fitted through a rubber stopper in one of the other necks. The remaining neck is used for admitting sample and is equipped with a rubber stopper containing a serum cap and a small needle or Bunsen valve to allow air to escape.

   (This flask is fabricated as a special item for this laboratory by Ace Glass Co., Vineland, N. J., using Sketch SK-10998.)

6. Methanol, refined, dry (<0.01% water)

7. Methanol - pyridine, dry 1 + 1

   Mix equal volumes of methanol and dry pyridine and add KFR (ca. 3.5 mg $H_2O$/ml) with agitation until a light red-brown color is obtained. Store in a gs bottle.

8. Karl Fischer reagent (stabilized, ca. 6 mg $H_2O$/ml, Fisher Scientific Co., Cat. No. SO-K-3)

9. Karl Fischer reagent, ca. 3.5 mg $H_2O$/ml

   Prepare by mixing 6 mg $H_2O$/ml reagent with an equal volume of dry methanol (<0.01% water). Dispense from a 50-ml reservoir type buret protected from atmospheric moisture by a drying tube.

10. Karl Fischer reagent, ca. 0.3 mg $H_2O$/ml

    a. Add KFR (ca. 3.5 mg $H_2O$/ml) to ca. 900 ml of dry methanol with agitation until a red-brown color is obtained. Then add 100 ml (grad cyl) of KFR (3.5 mg $H_2O$/ml), dilute to one-liter with methanol, and mix. Store in buret reservoir bottle protected from atmospheric moisture with a drying tube. Rinse the buret a few times with the KFR to be standardized before standardizing.

    b. Standardization:

       Inject 5.0 ml (syringe) of standard methanol-water solution (1.0 mg $H_2O$/ml) in place of sample into the 150 ml of preneutralized methanol-pyridine in step 5 of Section VI. Titrate the standard with the KFR to be standardized according to the procedure and record the titer.

    c. Calculation of mg of water equivalent to one ml of KFR:

$$\text{mg } H_2O/\text{ml KFR} = \frac{\text{ml standard} \times \text{mg } H_2O/\text{ml standard}}{\text{ml KFR titer, step 10}}$$

       Post the result to the nearest 0.001 mg $H_2O$/ml KFR and standardize frequently.

11. Pyridine

12. Water, standard in methanol, 1.0 mg $H_2O$/ml

    a. Obtain a supply of dry methanol and titrate a 50 ml (pipet) portion of the solution with standard KFR (ca. 3.5 mg $H_2O$/ml) by the visual method.

b. Calculate the water content (mg $H_2O$/ml) of the methanol:

$$\text{mg } H_2O/\text{ml} = \frac{\text{ml KFR x mg } H_2O/\text{ml}}{\text{ml of methanol}}$$

c. Measure about 900 ml of the methanol into a dry quart rs bottle and add sufficient water (pipet) to make the water content ca. 1.0 mg/ml and mix.

ml $H_2O$ to add =

[(1.0 x ml MeOH, step c) - (mg $H_2O$/ml, step b x ml MeOH, step c)]$10^{-3}$

d. Titrate a 50 ml (pipet) portion of the solution with standard KFR (ca. 3.5 mg $H_2O$/ml) by the visual method and again calculate the water content as in step b. Post the water content to the nearest 0.001 mg/ml. Keep bottle closed as much as possible and standardize frequently.

VI. Procedure

Note: Leave instrument power "ON" continuously to assume maximum stability of the instrument.

1. Place 100 ml (grad cyl) of dry methanol-pyridine solution in the titrating vessel and add the stirring bar.

   (It is convenient to assemble the titrating vessel with the "Aquameter" in such a manner that it is unnecessary to move the vessel or buret. Solutions that have been titrated are then removed by means of a vacuum line and trap. Keep the vessel closed when not adding or removing solution.)

2. Adjust the stirrer to give thorough mixing without excessive splashing.

3. Making the following initial settings and adjustments. (This step is necessary only at the beginning of testing.)

| | |
|---|---|
| Buret switch | - closed |
| Timer | - 25 seconds |
| Selector switch | - 1 |
| Polarizer control | - counterclockwise limit |
| Sensitivity control | - clockwise limit |

If the "Read" light is on or comes on, press the "Titrate" button. Slowly turn the "Polarizer" control clockwise until the "Standby" light comes on. Then adjust the "Sensitivity" control until the meter reads 35 + 5 microamperes.

Turn the "Selector" switch to 2 and adjust the "Polarizer" control until the meter reads 5 microamperes.

4. Turn the "Buret" switch to "Deliver", press the "Titrate" button and allow the instrument to titrate the solution to the end point at the rate of 3 drops per second. The rate is controlled by means of the stopcock.

   (If the meter tends to drift during the "Standby" cycle, press the "Titrate" button again when the "Read" light comes on.)

5. Weigh (± 0.001 g) ca. 1.0 g of sample on a piece of glassine powder paper, remove the rubber stopper and transfer the sample through the side arm of the flask into the pretitrated methanol pyridine mixture. Replace the rubber stopper.

6. Fill the buret and record the buret reading. Press the "Titrate" button and allow the instrument to titrate at the rate of 3 drops/second.

7. Read and record the buret reading when the "Read" light comes on.

8. Determine the net ml of KFR used in step 7 by difference and calculate per cent water as follows:

$$\% \text{ water} = \frac{\text{net ml KFR} \times \text{mg } H_2O/\text{ml}}{\text{g sample} \times 10}$$

   Report the result to the nearest 0.01%.

VII. Comments

1. Adherence to volume ratios and titration rates specified in the method are imperative for accurate and reproducible results.

2. Glass and polyethylene tubing are satisfactory for KFR supply and vacuum lines. Rubber tubing will admit moisture to the KFR and KFR reacts with the plasticizer in "Tygon" tubing.

3. If the KFR loses color while standing in the buret, there is probably a leak in the system. Check for small cracks in the polyethylene tubing where it is joined to glass and look for hairline cracks in glass welds.

TC. John Mills
Tom Lodice

From: D. H. Claudio

Safety Alarms/ Interlocks

attached is information on safety alarms and interlocks associated with MBC manufacturing. I have circled those which are of most interest.

## 4.0 REACTION

### 4.6 Interlocks and Alarms

These devices are broken up into two categories:

A. Safety Interlocks and Alarms - these devices have direct or indirect safety implications and must be checked on a periodic basis, not to exceed one year in frequency.

B. Operating Aid Interlocks and Alarms - these devices have no direct or indirect safety implications, but must be checked on a periodic basis.

In the Wet "Benlate" process area, E&I checks all interlocks and alarms on a periodic basis that does not exceed one year in frequency.

Refer to the Belle Mechanical Job Procedure JP-108 for details regarding interlocks and alarms.

Approvals Needed to Bypass Safety Interlocks and Alarms

The responsibility and authority for bypassing any Safety Interlock or Alarm rests with the Business Unit Manager. The safety interlocks and alarms are designed to work at a specific limit. No one is to bypass a safety interlock or alarm without approval of the Business Unit Manager.

Alarm/Interlock Lamp Color Standard

Lamp color standards apply to process related functions and instrument panel lights. Review the following color codes:

| Lamp Color | Function |
|---|---|
| Red | o Critical safety, environmental, or occupational health interlocks or alarms.<br>o Immediate action is required. (The word "interlock" must be included in the name plate or tag description where available). |



AB0000118912/9

## 4.0 REACTION

### 4.6 Interlocks and Alarms (Cont'd)

| Lamp Color | Function |
|---|---|
| White | o Process information alarms. Time for decision exists. Further developments can be awaited. |
| | o Action step by operator is required, not safety related, as in sequenced or batch operation. |
| Amber (Yellow) | o Interlock bypass only. (To date, there are no amber panel lights for the MBC process. |
| Green | o Unit or function "running", "open", "on". |
| | o Valve, pump, etc. in normal process operating position (usually "on" or "open"). |
| Blue | o Unit not running. |
| | o Valve, pump, etc., in normal process-not operating position (usually "off" or closed"). |

Note: Anytime the interlocks or alarms are not working properly, notify supervision immediately. Supervision will request assistance from E&I personnel.



AB0000118912/10

## 4.0 REACTION

### 4.6 Interlocks and Alarms (Cont'd)

#### A. Safety Interlocks

| Condition | Interlock Action | Comment |
|---|---|---|
| 1. MCF Tank Hi Level Interlock | Stops the MCF unloading pump. | Refer to Action Required for this interlock located in Chapter IV.A.2.22 in the raw material handling and description section. |
| 2. MBC Reactor Pump Not Running | Close the automatic feed valves to the reactor and opens the cyanamide circulating valve. The MCF pump is stopped. (The cyanamide will be kept circulating at low temperature while the interlock condition is resolved). | The MBC reactor pump field switch must be left in the "start" position in order for the pump to run when the sequencer is in steps 4 through 28. To restart the pump, hit the reset button and turn the MBC sequencer man. operation to the "output on" position. If pump fails to start, contact Supervision to line up Maintenance and E&I assistance. |
| 3. MBC Reactor Hi Level Interlock | Close the automatic feed valves to the reactor and opens the cyanamide circulating valve. The MCF pump is stopped. (Cyanamide will keep circulating through the cyanamide cooler until the interlock condition is resolved.) | The high level alarm sounds at 90% level and the high-high level interlock takes effect at 97%. Have the MBC field operator close the following manual valves if the level should continue to rise above 90% level in the reactor:<br>a. water to the pH loop (3rd floor)<br>b. MCF (3rd)<br>c. cyanamide (4th)<br>d. process water (4th)<br>e. caustic (4th by cooler)<br>f. OPD (4th)<br>g. HCl (4th) |



AB0000118912/11

4.0 REACTION

4.6 Interlocks and Alarms (Cont'd)

A. Safety Interlocks (Cont'd)

| Condition | Interlock Action | Comment |
|---|---|---|
| 3. Continued | | Determine the cause of the high level and correct the problem. Once the condition(s) is resolved, hit the reset button to resume normal operation. Refer to SP 15 for flushing out the level diptube. |
| (4) MBC Reactor Agitator Not Running Interlock | Closes the automatic feed valves and opens the cyanamide circulating valve (to allow cyanamide to circulate through cyanamide cooler). The MCF pump is stopped. | The MBC reactor agitator field switch must be left in the "start" position in order for the agitator to run throughout the MBC reaction (sequence steps 1 through 30). If the field switch is in the "start" position, hit the reset switch in the ECR on the MBC reactor agitator breaker and start the agitator. If agitator fails to start, contact Supervision to line up Maintenance and E&I assistance (to check fuses or motor failure). The agitator runs continously since reactor batches are made one after another. The agitator will only be shut off during a shutdown of greater than 24 hours. Agitation is needed for both steps in the MBC reaction. |
| 5. Velpar Reactor Exh. Down | The Velpar reactor exhauster blower will shutdown when the Velpar process is either down or not operating under the correct set of conditions. | Velpar's blower is located on the roof of Bldg. 174. Call the Velpar (Hexazinone Intermediate) CCR on Ext. 1670 to notify them that the "Velpar Reactor Exh. Down" interlock light has lit up. |



AB0000118912/12

## 4.0 REACTION

### 4.6 Interlocks and Alarms (Cont'd)

#### A. Safety Interlocks (Cont'd)

| Condition | Interlock Action | Comment |
|---|---|---|
| 6. MBC Reactor Step 1 Hi Temp. Interlock | a. The automatic feed valves to the MBC reactor close and the cyanamide circulating valve opens (permits the cyanamide to circulate through the cyanamide cooler and maintain a low temperture).<br>b. The MCF pump is stopped.<br>c. The automatic steam valve to the reactor's jacket (25# steam) will close and the raw water (used for the MBC plate cooler) automatic valve will open. | The step 1 high temperature interlock will be enabled when the temperature of the reactor's contents reach 60°C. During reaction step 1, MCF and caustic are added to the cyanamide/water solution, an exothermic reaction takes place. Temperatures, above 60°C must be avoided to prevent MCF from vaporizing. The normal control temperature of 55°C is specified to allow a margin of safety, especially since any escape of MCF from the system presents a yield loss and a toxicity hazard. Ensure that the remote/local switch is set in remote. If it is not in remote, switch it to remote. The remote/local switch is on the lower left hand corner of the "MBC reactor temperature primary temperature controller". The temperature programmer specifies the MBC reactor temperature at 55°C during Step 9. If the programmer is out of step with the 55°C set point, switch the "MBC reactor temperature primary temporary controller" to local and set at 55°C. Finish the batch in local and contact E&I to repair the MBC temperature programmer (moore controller). |



AB0000118912/13

4.0 REACTION

4.6 Interlocks and Alarms (Cont'd)

A. Safety Interlocks (Cont'd)

| Condition | Interlock Action | Comment |
|---|---|---|
| 6. (Cont'd) | | If raw water supply seems to be insufficient for proper cooling, notify Supervision. Determine (with assistance of OSD) if the raw water valves in front of MDA-PACM and at Station 110 are open to the 100% open position. Check plate cooler for pluggage. |
| 7. MBC Reactor Step 2 Hi Temperature Interlock | a. The automatic feed valves to the MBC reactor close and the cyanamide circulating valve opens (permits flow through the cyanamide cooler and maintains a low temperature).<br>b. The MCF pump is stopped.<br>c. The automatic steam valve to the reactor's jacket (25# steam) will close and the raw water (used for the MBC plate cooler) automatic valve will open. | The step 2 high temperature interlock will be enabled when the temperature of the reactor's contents reach 98°C. The temperature of the reaction mass must be maintained at 95°C ± 2°C during the 21 hold timer to ensure that the reaction goes to completion. The temperature programmer is increasing from 75°C to 95°C during the second reaction.<br>The temperature programmer sets the MBC reactor temperature at 95°C during step 20. If the programmer is out of step with the 95°C set point, switch the "MBC reactor temperature primary temperature controller" to local and set at 95°C. |



AB0000118912/14

4.0 REACTION

4.6 Interlocks and Alarms (Cont'd)

A. Safety Interlocks (Cont'd)

| Condition | Interlock Action | Comment |
|---|---|---|
| 7. (Cont'd) | | Finish the batch in local and contact E&I to repair the MBC reactor temperature programmer (Moore Controller) before proceeding. If raw water supply seems to be insufficient for proper cooling, notify Supervision. Determine (with OSD assistance) if the raw water valves in front of MDA-PACM and at Station 110 are open to the 100% open position. Check plate cooler for pluggage. |
| (8) MBC Reactor Hi Pressure Interlock | a. The automatic feed valves to the MBC reactor close and the cyanamide circulating valve opens (permits the cyanamide cooler to recirculate cyanamide and maintains a low temperature).<br>b. The MCF pump is stopped.<br>c. The automatic steam valve to the reactor's jacket (#25 steam) will close and the raw water (used for the MBC plate cooler) automatic valve will open. | When the reactor's pressure reaches 15 inches $H_2O$ the interlock is engaged. Normally, the reactor's pressure will reach 15" $H_2O$ when the sequencer is in step 19. Refer to "Normal Operation" discussion of high pressure in Chapter IV.A.4.3 step 17 substep e. Read all "Key Points" for step 17. |



AB0000118912/15

4.0 REACTION

4.6 Interlocks and Alarms (Cont'd)

A. Safety Interlocks (Cont'd)

| Condition | Interlock Action | Comment |
|---|---|---|
| 9. MBC Reactor Step 9 Hi Lo pH Interlock | a. If the pH goes above 9.0 during the MCF-Caustic (step 9) addition step, the caustic valve closes. | The pH control of the 1st step reaction is critical. pH must be maintained at 7.0 ± 0.2 during step 9. The MCF feed valve closes if the MCF pump stops. The caustic feed valve closes if the caustic pump stops. Refer to "Normal Operations" in Chapter IV.A.4.3 step 9 for Action Required if the MCF pump gases off. When the interlock condition is removed, (pH drops to less than 7.2) hit "reset" button and continue step 9 operation. |
| | b. If the pH drops below 4.5 during the MCF-caustic (step 9) addition step, the MCF and caustic valves close. | Depress the "caustic addition" button to open the caustic valve and increase the pH to the normal range of 7.0 ± 0.2. Bring the pH up slowly. When pH begins to rise above a pH of 6.8 and MCF is needed, depress the "reset" button and continue step 9 operation. Refer to "Normal Operations" in Chapter IV.A.4.3. step 9 for Action Required if the MCF pump gases off. The MCF feed valve closes if the MCF pump stops. The caustic valve closes if the caustic pump stops. |



AB0000118912/16

4.0 REACTION

4.6 Interlocks and Alarms (Cont'd)

A. Safety Interlocks (Cont'd)

| Condition | Interlock Action | Comment |
|---|---|---|
| 10. MBC Reactor Step 2 Lo pH Interlock | a. The automatic feed valves will close and the cyanamide circulating valve opens.<br>b. The MCF pump is stopped. | When pH drops below 3.8 during steps 19, 20 or 21, the interlock is engaged. If the pH during step 21 "hold time" deviates from the 3.8 to 4.2 pH range, the timer will disengage for "Step 21 Hold Timer" and the timer will stop and only restart when pH falls in 4.0 ± 0.2 range. Refer to "Normal Operations" in Chapter IV.A.4.3, step 19 for additional information. |



AB0000118912/17

4.0 REACTION

4.6 Interlocks and Alarms (Cont'd)

A. Safety Interlocks (Cont'd)

| Condition | Interlock Action | Comment |
|---|---|---|
| 10 MBC Reactor Step 2 Lo pH Interlock | a. The automatic feed valves will close and the cyanamide circulating valve opens.<br>b. The MCF pump is stopped. | When pH drops below 3.8 during steps 19, 20 or 21, the interlock is engaged. If the pH during step 21 "hold time" deviates from the 3.8 to 4.2 pH range, the timer will disengage for "Step 21 Hold Timer" and the timer will stop and only restart when pH falls in 4.0 0.2 range. Refer to "Normal Operations" in Chapter IV.A.4.3, step 19 for additional information. |



AB0000118912/18

4.0 REACTION

4.6 Interlocks and Alarms

D. Operating Aid Alarms

| Alarm Condition | Action Required |
|---|---|
| 1. HCl Tank Low Level | Detailed information for Action Required for this alarm is located in Chapter IV.A.2.52 in the raw material handling and description section. |
| 2. Slurry Tank Low Level | If slurry tank low level alarm should sound, the MBC operator (wearing chemical gloves and goggles) must verify the level by looking into the slurry tank. If there are no more batches of MBC downstream to charge to the slurry tank, the slurry tank must be washed out using a water hose. If the slurry tank level instrumentation needs attention, contact E&I for assistance. |
| 3. Slurry Tank Agitator Not Running | If slurry tank level is greater than 0%, the MBC field operator should start the slurry tank agitator, using the field switch, located beside the slurry tank. If agitator doesn't start, reset breaker in ECR and try to restart agitator. If agitator fails to start, have E&I check fuses, motor failure and have Maintenance check for pump failure. If slurry tank is empty, leave agitator off until more slurry is added. |
| 4. HCl Added | If 2200 lbs. of 31.5% HCl are added to the MBC reactor in step 19 the "HCl Added" alarm will sound and the sequencer will automatically advance to step 20.<br><br>Refer to "Normal Operations" in Chapter IV.A.4.3 step 17.g for additional information regarding the "HCl added" alarm. Normally the alarm will indicate an excess of HCl was added in step 19. Circle the 2200 in red on the MBC reactor logsheet to notify Supervision. |

4.0 REACTION

4.6 Interlocks and Alarms (Cont'd)

D. Process Control Alarms (Cont'd)

| Alarm Condition | Action Required |
|---|---|
| 5. MBC Reactor pH Loop Low Flow | Acknowledge the alarm. Look at the "pH sample line flow" gauge on the board. The alarm will sound when less than 10% flow is going through the loop. Normally in step 25 the alarm sounds when pumping out a reactor batch. In step 28 the circulating lines are flushed out and the pH loop is flushed-the alarm normally sounds in step 28. If the alarm sounds when sequencer is in steps 5-24, try jogging the MBC reactor pump three or four times to break up the plug in the pH loop. Request the MBC operator wash out the loop by valving water to flush the lines. Sometimes the flexible hose will plug up first and the operator can concentrate effort on the flexible hose or the elbow where the flexible hose connects to the stationary part of the pH loop.<br><br>The board operator will try the opposite pH cell to verify pH. Have the field operator ensure that pH loop is valved correctly and that it corresponds to the pH meter that is in use (check pH meter calibration in the CCR). If the MBC operator verifies that the flexible line is plugged, follow SP#11 in removing the flexible hose, washing the hose out and putting the hose back in service. Refer to SP#11 for the proper protective equipment. If the MBC reactor cooler exit temperature is deviating from normal (i.e. cooler is not cooling effectively) it may be time to acid wash the MBC reactor per SP#6. Contact Supervision if the efforts listed above do not break up the plug. |

## 4.0 REACTION

### 4.7 Emergency Shutdown

a. If electricity fails, the reactor system will lose feeds, agitation, circulation, and cooling. When power is restored, resume normal operation. Turn motors off so restart is controlled when power is restored.

b. If instrument air fails, an alarm will sound in the control room when the pressure drops to 60 psig. Do not start a new batch. Stop any charging and hold under agitation. If necessary, throttle the manual raw water (in plate cooler) valve to hold reactor temperature. Resume charging when air pressure is restored.

c. If nitrogen fails, an alarm will sound in the control room when the pressure drops to 35 psig. Do not start a new batch. Stop any charging and hold under agitation and temperature control until nitrogen pressure is restored.

d. If process air fails, continue to circulate the slurry in the slurry tank or reactor until process air is restored. Then continue normal operation.

There is no emergency shutdown button for the reaction system. If an emergency shutdown is necessary due to a local fume alert, fire in Building 174, or building evacuation, the reactor operation can be safely shutdown by referring to "Shutdown Points" on the next page during the operation. Refer to the Troubleshooting guide in section 4.8 for additional information.

Refer to the guidelines for "Fail-Safe Position of Valves" in Chapter IV.A.4.4.8 for fail-safe position of the valves in the reactor's service.

Note: If utilities fail, keep posted by listening to the plant "hot line" phone located in the Wet "Benlate" CCR for up-to-date information when the utilities will return to normal operation.

During an emergency, it may not be practical to follow a normal shutdown as outlined in section 4.5. If possible, the MBC reaction is best shutdown at one of the following shutdown points (to minimize the potential of losing a reactor batch):

## 4.0 REACTION

### 4.7 Emergency Shutdown (Cont'd)

**SHUTDOWN POINTS**

1. After adding cyanamide and water (step 3 on sequencer) the reactor can be shutdown. Little decomposition will occur, and the reactor can be down for two to three days. To minimize decomposition, pH should be adjusted to 4-5 if possible and batch cooled below 25°C.

2. Once MCF and caustic addition has started (step 9 on sequencer), the Step I reaction must be carried through to completion (step 10 on sequencer) before reactor is shutdown, in order to prevent losing the batch. pH must also be adjusted to 7.0. Refer to Chapter IV.A.4.3, Step 9.

3. After the OPD is added (step 15 on sequencer) and HCl is being charged (step 19 on sequencer) the Step II reaction must be carried through to completion (step 21 on sequencer). Stopping HCl addition for up to ten minutes, however, will not affect yield or product purity. Refer to Chapter IV.A.4.3, Steps 17-19.

4. MBC slurry can be held in the reactor or slurry tank for an indefinite period without significant decomposition, provided nitrogen blanking is maintained.

Note: Supervision should be notified immediately if you have to shutdown the reactor under any emergency situation.

11/75 BF

To: John Miles
Tom Lodice

From: Dave Claudio - DuPont - Belle

MBC Reactor Operating Instructions:

Attached you will find the MBC reactor operating procedures. The procedures that I have sent you pick up at the point where the MBC has been made and the OPZ is ready to be charged. You will note the procedure references step 16 . . . , step 15 . . , step 21 . . . , etc. These "steps" refer to our Texas drum sequencer that I've mentioned to you during your recent trip. Please call myself or Ron if we can be of assistance.

USE STANDARDS FOR MINIMUM ELECTRICAL INSTALLATIONS

AB0000118912/23

4.0 REACTION (Continued)

4.3 NORMAL OPERATION (Continued)

| ACTION | KEY POINTS |
|---|---|
| 12. Fill OPD weigh bin:<br>a. Record the level in the OPD storage tank before proceeding. | Supervision will specify OPD charge per standard operating condition ranges (per pink sheets-Chapter IV., Section C). The recirculating line is a jacketed pipe that allows steam to maintain OPD in a liquid state. The weigh bin is steam traced and insulated to prevent OPD from setting up in the weigh tank. |
| b. The OPD weigh tank fills up to the amount specified by Supervision. | |
| c. The three-way valve (in the OPD recirculating line on the roof directly south of the OPD weigh bin) opens and OPD is diverted away from the recirculating line into the weigh bin. The recirculating pump continues to transfer OPD from the OPD storage tank to the weigh bin on the roof. Refer to the troubleshooting guide in Section 4.8 if the need arises. Refer to the Interlock & Alarms in Section 2.42(b) when the molten OPD storage tank pressure lo alarm sounds. | |



AB0000118912/24

4.0 REACTION (Continued)

4.3 NORMAL OPERATION (Continued)

| ACTION | KEY POINTS |
|---|---|
| 12. (Continued) | |
| d. When the OPD liquid fills the OPD weigh tank to the specified amount in step 12.b., the upper OPD scale cutoff point is reached closing the three-way valve to the OPD weigh bin and access to the recirculating line through the three-way valve is opened. | Refer to the Troubleshooting Section 4.8 if the OPD liquid exceeds the upper OPD scale cutoff. |
| e. Record the level in the OPD storage tank after the upper OPD scale cutoff point has been reached. | The storage tank level will normally decrease between 1-2% for each batch of OPD used. |
| 13. Set the "MBC Sequencer Mode Selection" switch in "Manual" and manually advance the sequencer to step 13, using the "forward" button on the "MBC Sequencer Manual Adv". | The temperature in the MBC reactor before adding OPD is 55-56°C. |
| 14. Set the "MBC Sequencer Mode Selection" switch back to "Auto" and advance the sequencer to steps 14 and 15 automatically. | The "MBC reactor sequencer ready" light will sound an alarm. Depress the advance button and the light will go out. Step 14 is an (spare) immediate step. |



AB0000118912/25

4.0 REACTION (Continued)

4.3 NORMAL OPERATION (Continued)

| ACTION | KEY POINTS |
|---|---|
| 15. OPD is discharged from the OPD weigh tank and charged to the MBC reactor: | The OPD charge valve is located on the bottom of the OPD weigh tank. In step 15 this automatic valve opens and charges the contents of the OPD weigh tank into the reactor. |
| a. the charge valve opens | |
| b. The "OPD charge" timer is started. Follow Troubleshooting Section 4.8 if the "MBC Reactor Sequencer Time in Step" alarm sounds. | The "OPD charge" timer begins in step 15 and will sound only if 25 minutes have elapsed from the start of step 15 when OPD begins its charge to the reactor to the point where the charge has taken longer than 25 minutes. |
| c. The temperature set point is rapidly increased to 75°C. | The temperature programmer is designed to increase the set point to 75°C at the onset of step 15. During step 15, the sequencer checks to ensure the programmer has reached the desired set point. This doesn't mean that the actual reactor temperature has reached this set point. OPD is charged to the reactor as a molten solution. The temperature of OPD in storage is maintained at 120°C - 130°C. |
| d. When the lower OPD scale cutoff is reached, the OPD charge is complete. | Normally, the low cutoff on the OPD scale is set at zero. When the OPD charge is complete the reactor temperature will be approximately 65-70°C. |
| 16. The sequencer will automatically advance to step 19: | The sequencer will automatically advance through steps 16, 17, and 18 en route to step 19. |
| a. During step 16, OPD charge valve on bottom of the OPD weigh tank is closed. | |
| b. During step 17, the temperature set point is checked. | The temperature programmer adjusted the set point to 75°C in step 15. |

4.0 REACTION (Continued)

4.3 NORMAL OPERATION (Continued)

| ACTION | KEY POINTS |
|---|---|
| 16. (Continued) | |
| c. Step 18 is spare and the sequencer will automatically advance into step 19. | Step 18 is an immediate step. |
| d. Record the HCl storage tank level at start of step 19. | |
| 17. HCl addition is started: | 31.5% HCl is added to the reaction mass to maintain pH at 4.0 $\pm$ 0.2 by continuous HCl addition. Heat input is mostly by heat of reaction with some heating from the reactor's jacket steam. The reaction temperature must be maintained below 100°C at all times during the second step reaction. Tempertures greater than 100°C do not affect yield; however, a significant foaming problem is encountered at high temperatures. The heat evolved is low due to slow acid addition rate but the temperature is held down to assist in controlling the $CO_2$ gas evolved with HCl addition. When the interlock condition subsides and the condition that caused the interlock is brought under control, the HCl addition can continue only after the "Reset" button has been depressed. |
| a. The acid pump is on constant circulation. | |
| b. The acid charge valve is opened and controlled by pH. | |
| c. The set point for "HCl to MBC reactor for pH adjustment" pH controller must be set at 4.0. | |
| d. Set the set point for "MBC reactor pressure override control" pressure controller at 13-15" $H_2O$. | |
| e. If the pressure in the reactor exceeds 15" $H_2O$ pressure, the "MBC reactor high pressure interlock" will kick in. HCl will stop adding to the reactor due to the interlock. When the pressure drops down to less than 15" $H_2O$ pressure, depress the "Reset" button on the "MBC Sequencer Interlock In" switch. | Once the first 200 to 300 lbs. of HCl have been added to the reactor, the HCl addition will take place more rapidly, i.e., HCl will be charged to reactor quicker after approximately 300 lbs. of HCl are added to the reactor. |



AB0000118912/27

4.0 REACTION (Continued)

4.3 NORMAL OPERATION (Continued)

| ACTION | KEY POINTS |
|---|---|
| 17. (Continued) | |
| f. The pH controller will attain a pH of 4.2 in step 19. When the pH reaches 4.2 in step 19, the sequencer will automatically advance to step 20. | |
| g. If more than 2200 lbs. of HCl are charged to the reactor in Step 19 the "HCl Added" light will sound an alarm. (If weak strength acid, lower than 28% acid, is used it will require more acid than normal to lower the pH to 4.2 in step 19). Acknowledge the alarm. The sequencer will automatically advance to step 20. | If the HCl charge is less than 1800 lbs., complete the batch and have E&I buff the pH cells before starting the next batch. |
| h. Record the amount of HCl added in step 19 and the reactor pH on the MBC reactor logsheet. Also, note on the reactor logsheet if 2200 lbs. of acid were added during step 19. Circle 2200 lbs. in red ink. | If over 2200 lbs. of HCl are added in Step 19, the red circled 2200 lbs. that is recorded on the MBC reactor logsheet will notify Supervision that an unusual amount of acid was charged to the reactor. |



AB0000118912/28

## 4.0 REACTION (Continued)

### 4.3 NORMAL OPERATION (Continued)

| ACTION | KEY POINTS |
|---|---|
| 18. The sequencer is in step 20. The temperature set point is increased slowly (it reaches 80°C in step 20). HCl flow to the reactor is continued to maintain pH at 4.0 ± 0.2. When the temperature of the reaction mass reaches 93°C and the pH is between 3.8 and 4.2, the timer is running. The sequencer will automatically advance to step 21. | The temperature programmer is increasing temperature slowly from 75°C (where it was set in step 15) to 95°C. When the set point hits 95°C, the actual temperature of the reaction mass will increase. The sequencer controls the temperature set points of the reactions by a temperature programmer. Throughout step 20 the temperature of the reaction mass will be increased to 93°C by the heat of reaction and with steam to the jacket. |
| 19. The second step reaction is completed and the reactor mass undergoes a hold period to increase yields. When the actual reactor mass temperature reaches 93°C, the 21 hold timer will begin to time. The pH must be 4.0 ± 0.2 or the 21 hold timer will stop. | The 21 hold timer is set by Supervision at a time per the standard operating condition range. (pink sheets - Chapter IV.C.). These two conditions must be met for the 21 hold timer to time: (1) reactor temperature is at 95°C ± 2°C and (2) pH at 4.0 ± 0.2. |
| a. The 21 hold timer will stop and re-start (without reset) if reactor temperature or pH interlock conditions are encountered. The 21 hold timer light will be lit during the step 21 hold period. | FOR EXAMPLE: If the 21 hold timer is running and the pH increases to 4.3, the timer will stop and only re-start when the pH decreases to 4.2. |
| b. Once the timer times out, the 21 hold period is completed, the step 21 hold timer light will shut off and the sequencer will automatically advance to step 23. | If reactor interlock for pH and temperature is encountered, the timer will stop and re-start (without reset) if these conditions are lost and gained. The timer will not be zeroed. It will continue timing from where it left off if any interlock condition is met. During the advance from step 21 to 23, the sequencer will pass through step 22 where the acid addition is stopped: |



AB0000118912/29

4.0 REACTION (Continued)

4.3 NORMAL OPERATION (Continued)

| ACTION | KEY POINTS |
|---|---|
| 19. b. (Continued) | a. the HCl charge valve is closed<br>b. the jacket steam valve is closed<br><br>NOTE: Step 22 is an immediate step.<br><br>NOTE: If "step 2 high temperature interlock" is encountered, HCl will stop charging to the reactor).<br><br>To maintain a temperature of 95°C ± 2°C, the raw water flow to the cooler will increase/ decrease depending upon whether reactor temperature needs to be raised or lowered. |
| c. Record the following on MBC reactor logsheet:<br><br>1. reactor temperature (°C)<br>2. reactor pH<br>3. reactor level (%)<br>4. HCl storage tank level after finish of HCl addition (M lbs.). | |
| 20. The 2nd reaction is completed once step 21 is completed. During step 23: | The reacted mass is better known as MBC. During the cool period, the slurry mass will cool from 95°C + 2°C to a range between 70-85°C before it is pumped to the slurry tank. |
| a. The temperature set point is decreased to 50°C. | |
| b. The "cool" timer is started. | |



AB0000118912/30

4.0 REACTION (Continued)

4.3 NORMAL OPERATION (Continued)

| ACTION | KEY POINTS |
|---|---|
| 20. (Continued) | |
| c. Check that the slurry tank level is less than 45% level. | A full reactor batch of MBC will raise the slurry tank level 35%. The maximum level in the slurry tank allowable before pumping into it is ~~50%~~ 45% |
| d. The raw water automatic valve to the inlet of the cooler opens to the 100% open position to cool the batch down. | |
| e. When the cooler exit temperature reaches 50°C and the slurry tank level is below 45% the sequencer will automatically advance to step 24. The sequencer can also be advanced manually to step 25, and the batch pumped out. | |
| f. If the cooling period in step 23 exceeds 40 minutes the "MBC reactor sequencer time in step" alarm will sound. | If the "time in step" alarm sounds, the MBC plate cooler may not be cooling effectively, indicating pluggage. |
| 21. The sequencer is in step 24 and the "MBC reactor sequencer ready" alarm will sound. | |
| a. Only depress the "Advance" button if the reactor temperature is between 50°-75°C. | |
| b. When the reactor temperature falls to within 50°-75°C, "Advance" the sequencer to step 25. | |



AB0000118912/31

## 4.0 REACTION (Continued)

### 4.3 NORMAL OPERATION (Continued)

| ACTION | KEY POINTS |
|---|---|
| 21. (Continued) | |
| c. Before the batch is pumped out to the slurry tank, record the:<br>1) reactor temperature after cooling and<br>2) cooler exit temperature after cooling<br>on the MBC reactor logsheet. | The reactor temperature after cooling is normally 50°-70°C and the cooler exit temperature is normally 50°C. |
| 22. The sequencer is in step 25. | The reactor batch is discharged to the slurry tank. Both the recirculating valve and the discharge valve are located slightly west of the top of the MBC reactor. |
| a. The reactor recirculating valve is closed. | |
| b. The reactor discharge valve is opened. | |
| c. The pH loop valve is closed. | |
| d. When the level in the reactor decreases to 0%, the sequencer will automatically advance to step 28. | If the reactor level reaches 0% and the sequencer does not advance, put the mode selector in manual and advance to step 26, 27, and 28. Steps 26 is an immediate (spare) step. In step 27, the water flush counter zeroes. |
| e. The "MBC reactor pH loop low flow" panel alarm will sound because the slurry doesn't travel through the pH loop on way to the slurry tank. Acknowledge the alarm and proceed. | |



AB0000118912/32

4.0 REACTION (Continued)

4.3 NORMAL OPERATION (Continued)

| ACTION | KEY POINTS |
|---|---|
| 23. The sequencer is in step 28. | The "flush water charge to MBC reactor" counter is normally set at 1700 for a 1700 lb. water flush for step 28. |
| a. Ensure the "flush water charge to MBC reactor" counter has been set at the amount specified by Supervision. | |
| b. The process water valve is opened and the recirculating loop is flushed. The water is discharged to the slurry tank. | Since the water is charged to the reactor and discharged from the reactor concurrently, the MBC reactor recirculating loop and the pH loop are thoroughly flushed. |
| c. The pH loop valve is opened for flush out. | |
| d. When the specified amount of water has been charged to the reactor (the cutoff point is reached), the water flush counter counts out. | |
| e. Have the MBC operator flush out the pH loop on the third floor. | |
| 1. shut off the MBC reactor pump using field switch. | |
| 2. put mode selection in manual and turn outputs on. | |
| 3. the "MBC reactor pump not running interlock" will come on. | |



AB0000118912/33

4.0 REACTION (Continued)

4.3 NORMAL OPERATION (Continued)

| ACTION | KEY POINTS |
|---|---|
| 23. e. (Continued)<br>4. flush out the pH loop per SP 15.0.<br>5. after flush out, turn the MBC reactor pump on using field switch. | |
| 24. Advance the sequencer to step 29:<br>a. The water valve closes.<br>b. The pH loop valve closes.<br>c. The sequencer will automatically advance to step 30. | Step 29 is an immediate step en route to step 30. |
| 25. The sequencer is in step 30:<br>a. The recirculating valve is opened.<br>b. The reactor discharge valve is closed.<br>c. The temperature set point remains at 50°C.<br>d. The "MBC reactor sequencer ready" alarm sounds (to indicate that reactor is ready to start another batch of MBC). | The reactor is prepared for the next batch of MBC. During step 30, the sequencer checks to ensure that the temperature programmer has reached the desired set point. This does not mean that the actual reactor temperature has reached this set point. No interlock conditions exists. |



AB0000118912/34

4.0 REACTION (Continued)

4.3 NORMAL OPERATION (Continued)

| ACTION | KEY POINTS |
|---|---|
| 25. (Continued)<br><br>e. Leave the agitator running and $N_2$ purge to the reactor on and press the "Advance" push button to make another batch as directed by Supervision. Check downstream progress to coordinate reactor batch cycles. | |
| 26. Continue to fill out the following paperwork:<br><br>a. 12 hour shift - Wet "Benlate" operating log<br>b. MBC patrol checklist<br>c. MBC reactor logsheet<br>d. benomyl reactor batch logsheet<br>e. benomyl dryer logsheet<br>f. benomyl patrol checklist<br>g. CCR logbook<br>h. fork truck safety inspection tag<br>i. safety equipment inspection checklist | The MBC operator is responsible for the:<br><br>a. MBC partrol checklist<br>b. fork truck safety inspection tag<br>c. safety equipment inspection checklist<br><br>The benomyl operator is responsible for the:<br>a. benomyl dryer logsheet<br>b. benomyl patrol checklist<br><br>The board operator is responsibile for the rest of the paperwork. |



AB0000118912/35

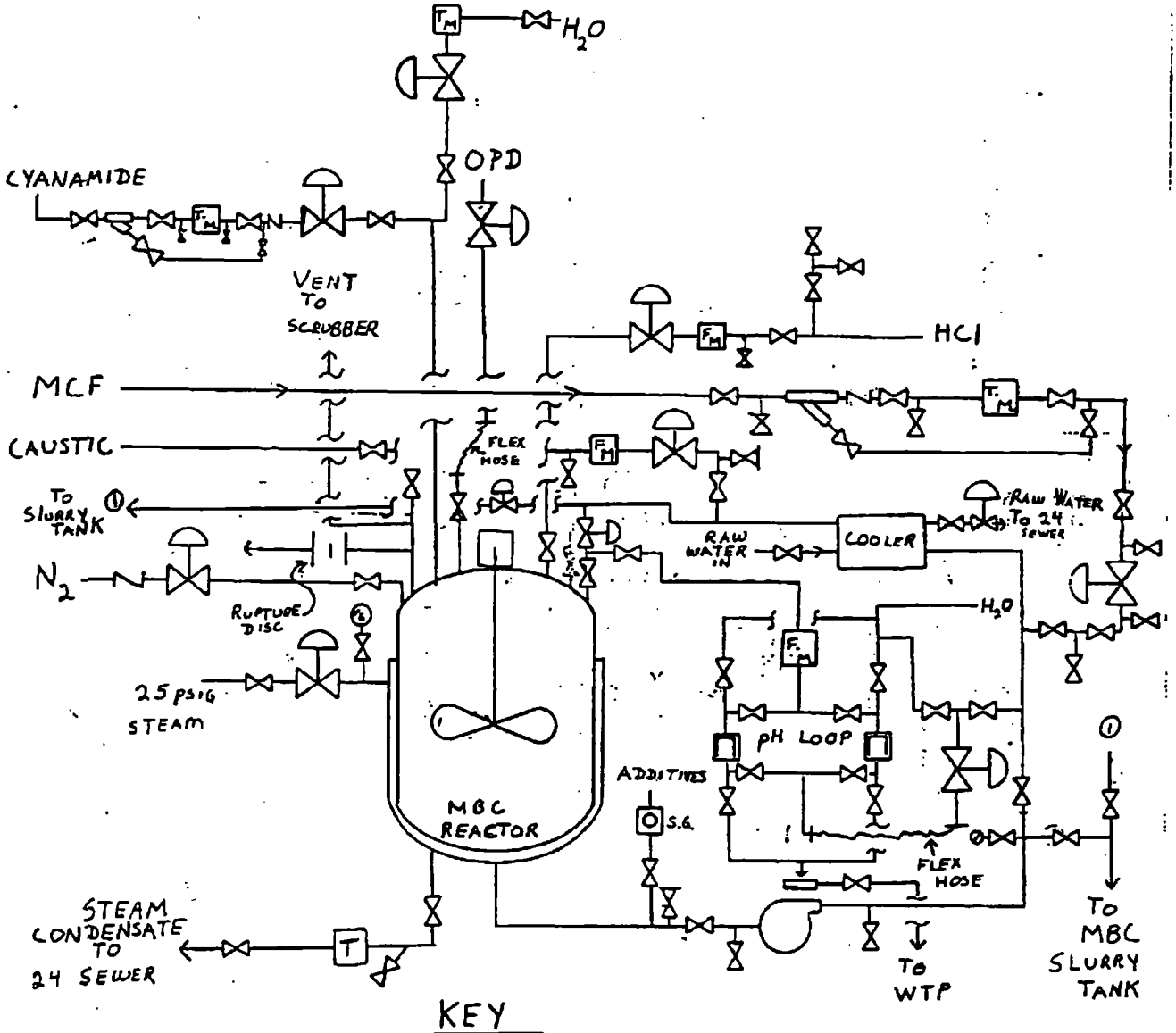
## 4.0 REACTION (Continued)

### 4.3 NORMAL OPERATION (Continued)

| ACTION | KEY POINTS |
|---|---|
| 27. Refer to the diagrams on the following pages:<br>a. MBC reaction system<br>b. Slurry tank system | |

## 4.0 REACTION

### DIAGRAM: MBC REACTION SYSTEM

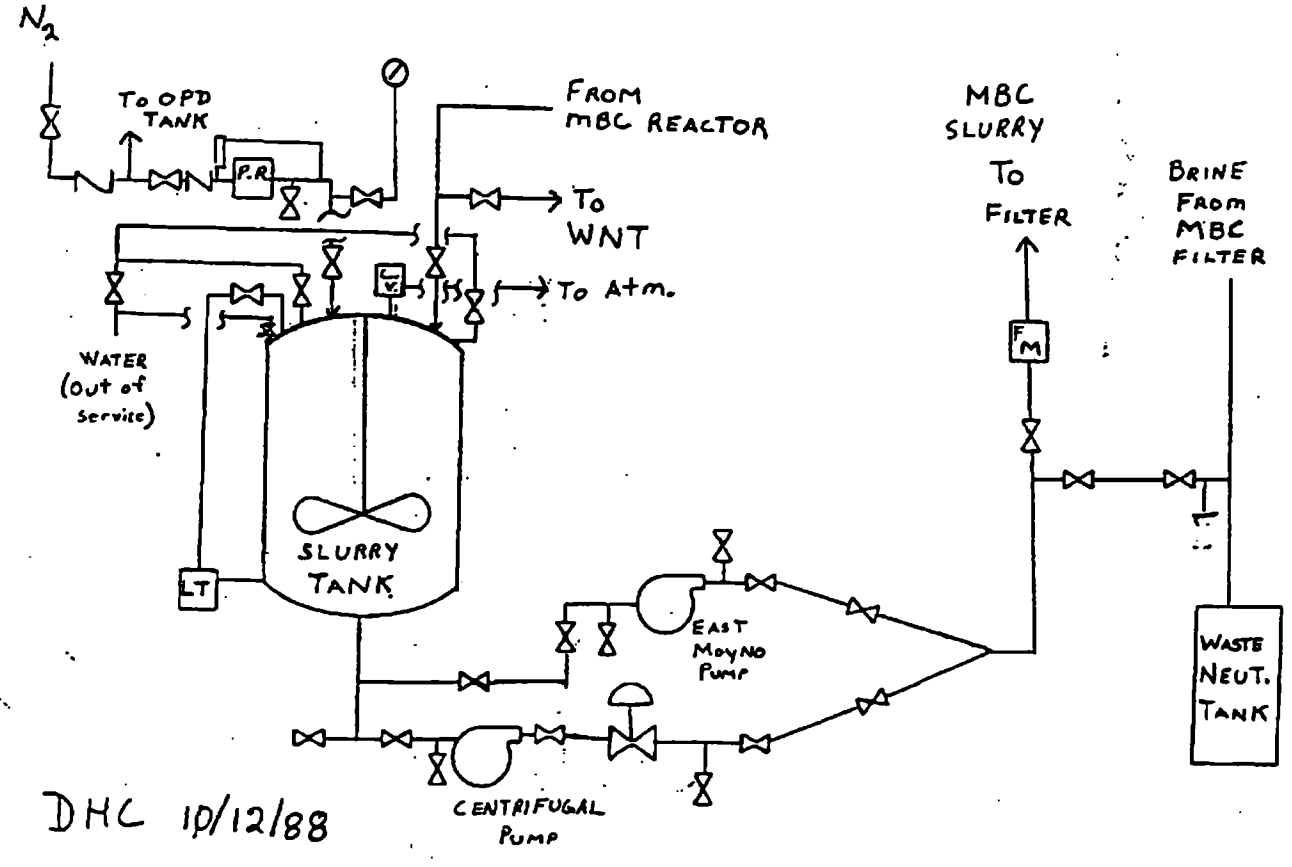



DHC 10/12/88

MBC REACTOR SKETCH

DIAGRAM:

# MBC SLURRY TANK




DHC 10/12/88

KEY

P.R – PRESSURE REGULATOR

F.M – FLOW METER

L.T. – LEVEL TRANSMITTER

C.V. – CONSERVATION VENT

4436

## 6.1. OPD TRUCK UNLOADING

### 6.1.1. FUNCTION

OPD is unloaded from tank trucks spotted at the OPD unloading spot near 4-1/2 track.

Each truck load is about 38,000 lbs. of molten OPD (commodity basis) and will last a little over 2 days at capacity operation.

OPD tank trucks are ordered from Du Pont's Chambers Works' Plant in Deepwater, N.J. and from Du Pont's Pontchartrain Plant in Louisiana. From the time a T/T departs from Chambers Works' the truck will arrive at Belle approximately 12-14 hours later. Scheduling must be done a minimum of 12 hours in advance of the T/T's departure from Chambers Works. The delivery time from Pontchartrain is about 24 hours.

In case of an unscheduled OPD T/T, AgChem First Line Supervisor can receive the Supervisor's approval to order OPD T/T by ordering through the diamines CCR (540-3173).

6.1.1.(a) Protective Equipment for Sampling OPD

5-E: Chemical gloves attached to chemical suit, boots, chemical hood plus supplied air respirator (mask). NOTE: Use latex gloves in addition to chemical gloves for unloading and wear the special Nomex coveralls and Nomex hood under the chemical suit. Long (knee-high) rubber boots must also be worn.

6.1.1.(b) Breaking into OPD lines:

5-E: Chemical gloves attached to chemical suit, boots, chemical hood plus supplied air respirator (mask). NOTE: Use latex gloves in addition to chemical gloves for unloading and wear the special Nomex coveralls and Nomex hood under the chemical suit. Long (knee-high) rubber boots must also be worn.



AB0000118912/39

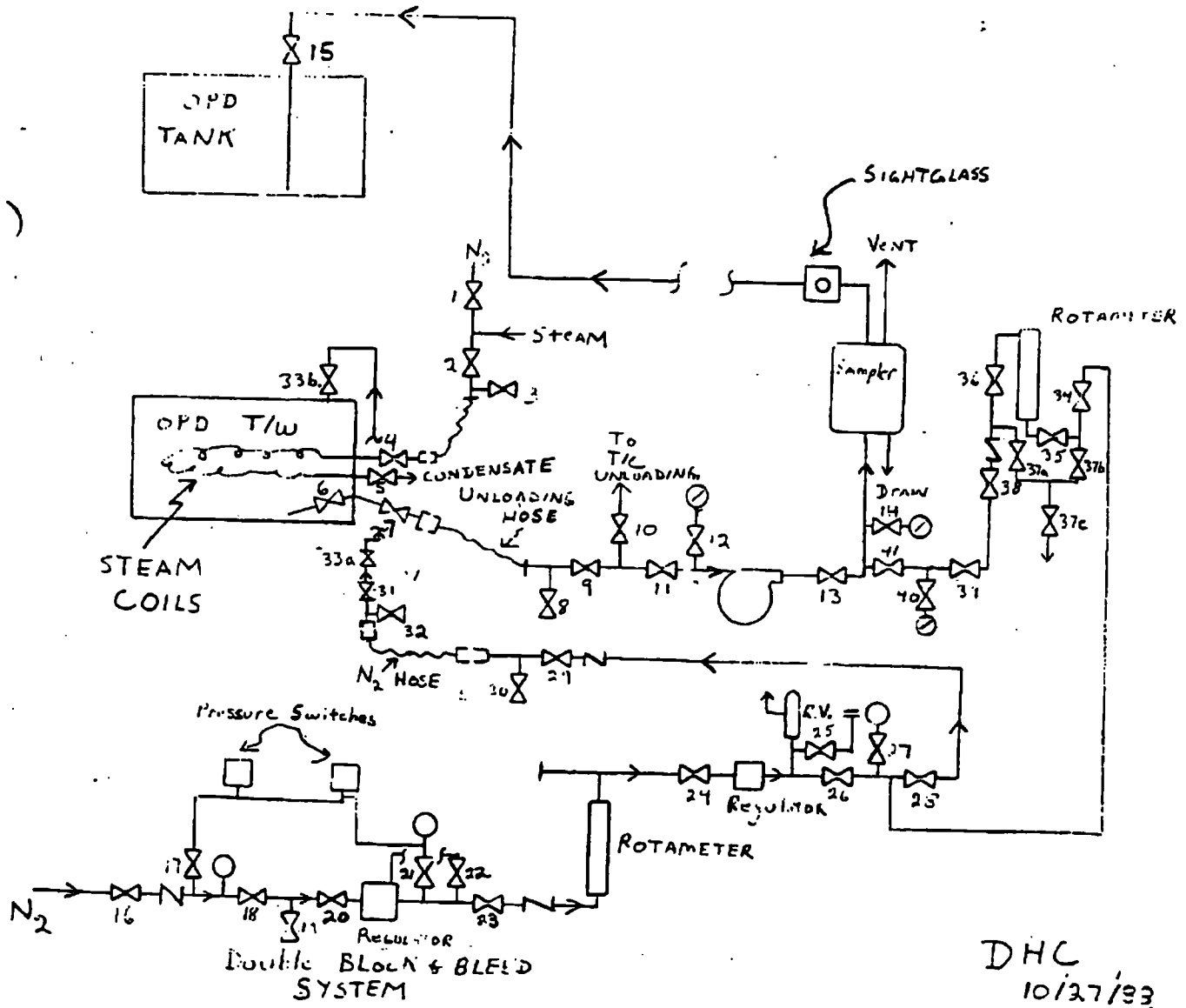
## 6.1. OPD TRUCK UNLOADING

### 6.1.2. SKETCH



AB0000118912/40

# OPD TANK WAGON UNLOADING



## 6.1. OPD TRUCK UNLOADING

### 6.1.3. ENVIRONMENTAL CONTROLS

Follow the unloading procedures to clear and isolate the unloading line to prevent spillage from the hose while disconnecting.

The OPD unloading area drains to the Waste Treatment Plant. They must be notified in case of a spill or leak. See section 6.2.1.(b) for PPE requirement when working around an OPD spill. OPD should be shoveled into drums and the residual washed with hot water. Air sampling must also be conducted in the event of a spill.

If a spill or leak is detected:

| | ACTION | KEY POINTS |
|---|---|---|
| 1. | Close tank truck discharge valves 6 and 7. | Wear full coverage per Chapter III. B.6.2.1.(b). |
| 2. | Close pump suction valves 9 and 11. | Isolate and minimize the leak. |
| 3. | Shut down the OPD unloading pump. | Don't run it with suction valves closed. |
| 4. | Notify the Waste Treatment Plant. | |
| 5. | Notify your supervisor. He will help you: | |
| | o Barricade the leak or spill to prevent exposure to others. | |
| | o Further clean up or wash down the spill. The spill should be shoveled into drums, and the residual washed to the Waste Treatment Plant with hot water. | Wear full coverage per Chapter III.B.6.2.1.(b) and arrange for air monitoring samples to be taken. |

## 6.1. OPD TRUCK UNLOADING

### 6.1.4. DETAILED UNLOADING STEPS

DATE/TIME_____ OPD TANK LEVEL (FINAL))_____

OPERATOR_____ OPD TANK LEVEL (INITIAL)_____

TANK WAGON NO._____ DIFFERENCE_____

T/W WEIGHT (GROSS)_____ USED DURING UNLOADING_____

T/W WEIGHT (TARE)_____ WEIGHT UNLOADED BY LEVEL _____

BILLED WEIGHT_____

| | ACTION | KEY POINTS |
|---|---|---|
| ____ 1. | Record initial information above. Test the safety shower at the OPD spot. | Record information on unloading checklist. (See Section 6.2.7 of this procedure for a copy of the checklist. |
| ____ 2. | Check the Bill of Lading to be sure it says the load is OPD. Stop and notify Supervision if it doesn't. | |
| ____ 3. | Verify that the tank wagon number agrees with the number of the trailer to be unloaded. Also check to see if it agrees with that on the Bill of Lading. If it doesn't, stop and notify supervision. | |
| ____ 4. | Be sure that the OPD tank level is below 110,000 lbs. (64%). | Tank high level is 90%. A truck load is about 38,000 lbs. Be sure you have enough room to unload. A truck load will raise the tank level by about 20%. |
| ____ 5. | Check the product tag on the trailer. If it is not OPD, do not unload. Notify your supervisor. | |



AB0000118912/43

## 6.1. OPD TRUCK UNLOADING

### 6.1.4. DETAILED UNLOADING STEPS

| | ACTION | KEY POINTS |
|---|---|---|
| ____ 6. | Chock the front and rear wheels on both sides and post unloading signs. Have the driver set his brake. | |
| ____ 7. | If the trailer is not disconnected from the cab, lock the driver's keys in the lock box. | |
| -OR- | | |
| ____ 8. | If the trailer is disconnected from the cab:<br>o Place dolly wheel pads under the dolly wheels.<br>o Place jackstand under the front of the trailer.<br>o Install a king pin lock and tag. | |
| ____ 9. | Attach the ground wire to the trailer. | Be sure the grounding points penetrate the paint for a good ground. |
| ____10. | Fill out the unloading checklist. See section III.B.6.2.7. | |



AB0000118912/44

## 6.1. OPD TRUCK UNLOADING

### 6.1.4. DETAILED UNLOADING STEPS

| | ACTION | KEY POINTS |
|---|---|---|
| ____11. | Check that the $N_2$ hose is clear by opening valve 29 and 31 on the nitrogen line. Close valves 29 and 31 if line is clear. | Close valves 30 and 32. |
| ____12. | Put on full coverage per Chapter III.B.6.2.1.(b). | Wear the Nomex coveralls and hood under the chemical suit. (The Nomex is necessary to provide adequate burn protection in the event of a spill or spray). |
| ____13. | Remove the cap on the trailer vent valve. | |
| ____14. | Hook up the flexible nitrogen line to the trailer Kamloc fitting at valve 33. | |
| ____15. | Remove the cap on the tank wagon unloading line at valve 7. | Stand away from the cap as you remove it. |
| ____16. | Hook up the unloading hose at valve 7. Wire down the ears on the Kamloc. | Use a new gasket and remember - the unloading hose is steam jacketed and is hot! |
| ____17. | Check the trailer temperature gauge on the front of the trailer. If the trailer is 105°C (220°F) or above, the OPD in the trailer will be molten. If the trailer is less than 105°C, the OPD will not be entirely melted. | Molten OPD melts at 103°C. Do not unload unless the temperature is 110°C or above. |
| ____18. | Hook up steam to the trailer steam coils by connecting the steam hose to valve 4. | |
| ____19. | Open valves 2, 4 and 5 to start steam flow to the coils. Wait til the T/W temperature on the front gauge is 110°C, then close steam valve 2. | The trailer is now hot enough to unload. |



AB0000118912/45

## 6.1. OPD TRUCK UNLOADING

### 6.1.4. DETAILED UNLOADING STEPS

| | ACTION | KEY POINTS |
|---|---|---|
| ____20. | Close pump discharge valve 13. | |
| ____21. | Tell the control room operator that you will be blowing $N_2$ to the OPD tank. Ask him to tell you if the storage tank high pressure alarm goes off. | |
| ____22a. | Open $N_2$ valves 34,35, 36, 38, 39 and 41. Leave open until the tank high pressure alarm goes off, Then close valve 41. | |
| ____22b. | Check the nitrogen pressure gauge on the T/W. The gauge will show 10 to 20 psi. | |
| ____23. | Be sure pump drain valve 8 and valve 10 from OPD tank car unloading are both closed. | |
| ____24. | Open trailer discharge valves 6 and 7, unloading line valve 9, and pump suction valve 11. Open valve 13 in the transfer line. | Check for leaks as each valve is opened. |



AB0000118912/46

## 6.1. OPD TRUCK UNLOADING

### 6.1.4. DETAILED UNLOADING STEPS

| | ACTION | KEY POINTS |
|---|---|---|
| ____25. | Start the pump. Verify that OPD flow has been established by checking | Check unloading line for leaks. Record the OPD color on the check sheet. |
| ____26. | Once flow has been establish, watch the pressure gauge on the T/W. The pressure will begin to decrease. When the pressure decreases, open nitrogen valves 29 and 31, then trailer vent valves. 33a and 33b. | Nitrogen will flow into the trailer. Check the $N_2$ rotameter on the $N_2$ line. It should read when flow is going into the trailer. If the rotameter does not register flow, the vent valve may be plugged. Shut off the unloading pump and determine what part of the $N_2$ system is plugged. |
| ____27. | Check the OPD storage tank level to be sure it is rising. | The board operator will notify the unloader when the level begins to rise. |
| ____28. | Patrol the line to check for leaks. | Check the pressure on the T/T. It must not fall below 5 psig. (A vacuum will collapse the trailer) |
| ____29. | When the storage tank level stops rising and the pump gasses, shut off the pump. | The OPD tank high pressure alarm will go off when the trailer is empty. |



AB0000118912/47

## 6.1. OPD TRUCK UNLOADING

### 6.1.4. DETAILED UNLOADING STEPS

| | ACTION | KEY POINTS |
|---|---|---|
| ____30. | Let nitrogen blow from the trailer through the line for 5 minutes, then close pump discharge valve 13. | |
| ____31. | Close truck discharge valves 6 and 7. | |
| ____32. | Close pump suction valves 9 and 11 and carefully open pump drain valve 8 to drain residue from the hose and pump suction line. | Wear full coverage per Chapter III.B.6.2.1.(b). |
| ____33. | Disconnect the Kamloc fitting on the unloading line. Install the "elbow" on the end of the unloading hose. | Flush residue to the Waste Treatment Plant sump with hot water. |
| ____34a. | Open steam bleed valve 3 and disconnect steam hose from T/W. | |
| ____34b. | In cold weather, blow out the steam coils on the tank wagon by opening valve 1. | Do this before disconnecting the steam hose in cold weather. This prevents the steam coils from freezing and bursting. |
| ____35. | Leave the nitrogen pad on the trailer until the trailer pressue builds up to 10-15 psi. | |
| ____36. | When the T/W pressure reaches 10-15 psig, close trailer $N_2$ valve 33a and 33b. | |



AB0000118912/48

## 6.1. OPD TRUCK UNLOADING

### 6.1.4. DETAILED UNLOADING STEPS

| | ACTION | KEY POINTS |
|---|---|---|
| ____37. | Close $N_2$ inlet valve 29. | |
| ____38. | Open bleed valve 32 to bleed pressure from the hose. | |
| ____39. | Disconnect the Kamloc at valve 33a. Leave $N_2$ pressure on the trailer. | |
| ____40. | Replace the cap on the trailer unloading line. | |
| ____41. | Remove the ground wire. | |
| ____42. | Fill out the unloading checklists (Section II.B.2.7.) | Do this before the truck leaves. |
| ____43. | After the truck is disconnected, either give the driver his keys or remove the king pin lock from the trailer. | |
| ____44. | After the cab is connected, remove chocks and tell the driver he can leave. | |
| ____45. | Fill out final information at the start of the checklist. | |
| ____46. | Place the completed copies of the unloading checklist in the mailbox in the Wet "Benlate" CCR. | |



AB0000118912/49

## 6.1. OPD TRUCK UNLOADING

### 6.1.5. TROUBLESHOOTING

| | PROBLEM | PROBABLE CAUSE | DO THIS |
|---|---|---|---|
| 1. | Can't get $N_2$ flow to trailer. | o Trailer vent line plugged. | Hook steaam up to trailer. |
| | | o New block and bleed is activated.<br>o Valving not right on $N_2$ line. | Have E&I check $N_2$ double block and bleed system. |
| 2. | Pump discharge pressure won't come up to 20 psi. | Unloading line is not full. | Shut the pump off and wait 30 seconds, then cut it back on. |
| 3. | Hose leaks at fittings. | Bad gaskets. Check gaskets prior to unloading. | Stop transfer, disconnect the hose, and replace gaskets. |
| 4. | Can't get OPD flow started. Tank level doesn't increase. | o Discharge of pump to tank plugged. | |
| | | o Pump not running. | |
| | | o Plugged lines. | Be sure all tracers are hot. Ensure all unloading valves between truck and pump are open. |
| | | o Tank truck not heated. | Be sure temperature is 110°C. Refer to III. B.6.2.4. |
| | | o Valve 15 at OPD tank is closed. | |



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## 6.1. OPD TRUCK UNLOADING

### 6.1.6. EMERGENCY SHUTDOWN

Shut down the T/T unloading pump in case of emergency, i.e., fire alarm, fume alert, plant disaster, power failure, loss of nitrogen, broken unloading hose or to lend assistance to an injured employee in the area:

| ACTION | KEY POINTS |
|---|---|
| 1. Close truck discharge valves 6 and 7. | |
| 2. Shut down the pump. | |
| 3. Close pump suction valves 9 and 11. | |
| 4. Barricade the area to prevent others from exposure. | Wear PPE specified in 6.2.1.(b). |
| 5. Notify Waste Treatment Plant. | |
| 6. Nofity your supervisor. | |
| 7. See Section III.B.6.2.3. | |



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## 6.1. OPD TRUCK UNLOADING

### 6.1.7. OPD T/T UNLOADING CHECKLIST

The T/T unloading checklists on the following pages must be filled out each time an OPD T/T is unloaded. After the T/T is unloaded and the checklists have been completed, return the completed checklist to the mail box in the CCR.



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Raw Material: _____ Date: _____ Time: _____
Unloader: _____ Container Number: _____
Container Type: _____ Tank Wagon _____ Tank Car _____ Iso-tank

Tank Level (Final): _____ lbs.
Tank Level (Initial): _____ lbs.
Subtotal: _____ lbs.
Used During Unloading: _____ lbs.
Total Unloaded: _____ lbs.

____ 1. Verify container contents:
_____ Bill of Lading
_____ Container Number (See daily instructions or contact your supervision for the number.)
_____ Sample Container
_____ Record pH (cyanamide, HCl, caustic containers only) using pH paper

____ 2a. For T/W or iso-tank:
____ Chock wheels
____ Jackstand
____ Kingpin lock/tag
____ Ground wire attached
____ Lock up driver's keys

2b. For tank cars (T/C):
____ Close/lock/tag derail
____ Red & blue flag on derail
____ Chock wheels/set brake
____ Ground wire attached
____ Rack red light on
____ Safety bar

____ 3. Tank farm scrubber water on for MCF, BI, HCl T/C's and MCF/BI iso-tanks.

____ 4. Safety shower working.

____ 5. Vent/inert container.

____ 6. Hook up unloading hose and pressure test - check for leaks.

____ 7. Turn on pump and verify product is unloading.

____ 8. Shut pump off when container is empty.

____ 9. Clear unloading and inerting hoses.

____ 10. Close valves on container and disconnect hoses.

____ 11. Install blind flange or plug or cap on unloading and vent valves on container.

____ 12a. For T/W or iso-tank:
____ Remove chocks, jackstand, kingpin lock and ground wire
____ Return keys to driver

____ 12b. For tank cars (T/C):
____ Remove safety bar
____ Retract ramp/amber light on
____ Turn placards to residue
____ Remove red flag
____ Remove ground wire
____ Remove red and blue derail flags
____ Unlock/open derail

____ 13. Comments (condition of container, items needing repair, etc.).



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CC: ~~D. H. Claudio~~
L. Schottle

TO: D. A. LANE - C&P - CHAMBERS WORKS
OR
~~T. P. COOL~~ - PD - PONTCHARTRAIN
M. RIVERS
FROM: C. L. BALDWIN - AG - BELLE

## BELLE OPD TANK WAGON CHECKLIST

TANK WAGON # _____

BEFORE UNLOADING: DATE ___/___/___; TIME _____ AM/PM; UNLOADER _____

1. All caps/plugs in place & ears closed? OK NO (Circle one)
   Comments:

2. OPD found between last unloading valve and caps? YES NO (Circle one)
   Comments:

3. OPD found between $N_2$/vent valve and caps? YES NO (Circle one)
   Comments:

4. Front temp. gauge work? YES NO Comments:
   Back temp. gauge work? YES NO

5. Shell $N_2$ pressure gauge works? YES NO Comments:
   Vent $N_2$ pressure gauge works? YES NO

6. Are there any steam coil leaks? YES NO
   Comments:

. . . . . .

DURING UNLOADING: DATE ___/___/___; TIME _____ AM/PM; UNLOADER _____

1. What is the OPD color in the sight glass? (Circle one number)

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Clear | | Pink | | Red | | Purple | | Black |

. . . . . .

AFTER UNLOADING: DATE ___/___/___; TIME _____ AM/PM; UNLOADER _____

1. Are all valves closed tightly? YES NO
   Comments:

2. Are all caps/plugs closed tightly? YES NO
   Comments:

3. Did the trailer pressurize to 20 psig? YES NO
   Comments:

4. Is the back of the trailer clean after unloading? YES NO
   Comments:

5. Were the panel steam coils blown with air to prevent freezing?
   YES NO
   Comments:

6. Other comments:

CLB/PWT/bjs

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# 5.0 FILTRATION

## 5.01 FUNCTION OF OPERATION

The MBC slurry from the MBC reactor is cooled by circulating through an external plate cooler. The cooled MBC slurry is pumped to the slurry tank via the external plate cooler. From this point on, the MBC process is continuous. The slurry is pumped (Moyno filter feed pumps are used to pump the slurry from the ground floor to the 4th floor) at controlled rates to a variable speed, vacuum, belt filter. The slurry is filtered and the cake washed twice with approximately 40-45°C process water to remove impurities. Treatment of the filtrate mother liquor, or MBC waste brine, is discussed in the operating procedure entitled, "Treatment of MBC Waste".

## 5.02 FILTERING ZONES

The straight line filter has two filtering zones:

1. Mother liquor from the first zone is neutralized with caustic in an agitated waste neutralization (WNT) tank and pumped to either the Calgon unit (Bldg. 305 - East Calgon) or to the BBT tank (Benlate® Brine Treatment tank). The BBT tank gives the treatment of the MBC Waste brine a great deal of flexibility in handling the waste brine. Refer to the "Treatment of MBC Waste" operating procedure for additional information. The letters WNT will be used in lieu of Waste Neutralization Tank.

2. Mother liquor from the second zone is returned as the first cake wash.

3. Heated process water used to wash the filter cloth is returned as the final cake wash. The process water is heated by a pic water system located on the east end of the straight line filter on the 4th floor. The filter cloth wash is necessary in preventing the filter cloth from blinding with MBC solids.

A vacuum pump pulls vacuum on the MBC slurry that is being filtered. The best filter operation is obtained with a vacuum of 5-10" Hg on the MBC slurry (east) end and 10-15" Hg on the cake wash (west) end and with a cake thickness of 3/8" to 3/4". The cloth must be washed completely clean of all residual cake or the cloth will blind.

Wet filtered cake drops into a screw conveyor (on the west end of the filter) and is discharged to the MBC dryer feed screw (on the west end of the MBC dryer on the third floor).



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## 5.0 FILTRATION

### 5.03 SUPPLEMENTAL EQUIPMENT DESCRIPTION

Equipment description is located in Chapter II., however, additional information is given:

### D.A.3-4-1 STRAIGHT LINE FILTER

Horizontal belt type filter, approximately 4 ft. wide x 9 ft. long having a minimum of 28 sq. ft. of active filter area to filter and wash 7500 pph of 15% suspended solids slurry (approximately 13 gpm) to produce 2220 pph of wet filter cake (approximately 50% solids). Water wash will be sprayed on the cloth to remove residual cake following solids discharge. Recycled cloth wash together with additional fresh water will be used as the final cake wash to remove mother liquor and wash filtrate. This final wash is reapplied to the cake as the initial wash. Cake discharge will be by scraper.

Filter medium will be a monofilament polypropylene type with an air permeability of approximately 25 cfm/sq. ft. with Velcro material used to fasten the ends of the filter cloth together.

Filter will be furnished with feed box, two wash headers or wash distributors, compartmented suction box to provide removal of mother liquor filtrate, initial wash filtrate, and final wash filtrate, scraper, and filter medium spray showers. Vertical splash shields will be provided to catch cover shower splash.

Filter drive will provide for 1 ft./min. to 10 ft./min. belt speeds. At full capacity, these speeds will provide cake thickness variation of 1/8 in. to 1-1/4 in.

Hycar rubber with Dacron® reinforcing shall be used for the filter belt. All metal parts in contact with process materials will be Monel. All structrual steel and other external carbon steel must be painted per Du Pont System #109X. The light mint green paint will provide the filter with anti-corrosion protection against chlorides present in the brine.

Vendor to furnish 5 HP U.S. Motor or equavilent varidrive, 10-1 ratio, to give belt speed of 1.1-11.4 FPM complete with sprockets, chain and chainguard with 3 HP, 440V, 3 phase, 60 cycle motor. Motors purchased by Vendor must be totally enclosed and in accordance with Du Pont Specification 4514R5.



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## 5.0 FILTRATION

### 5.03 SUPPLEMENTAL EQUIPMENT DESCRIPTION (Continued)

Modifications to the straight line filter include: the installation of a cylindrical helical roller on either end of the straight line filter to guide the filter cloth to follow the hycar rubber belt; filter cloth with Velcro material is used to fasten the ends of the filter cloth together; and the discharge chute on the west end of the filter extends to a level even with the upper side of the filter cloth to prevent MBC from falling onto the floor.



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# 5.0 FILTRATION

## 5.1 START-UP

| ACTION | KEY POINTS |
|---|---|
| 1. Refer to straight line filter start-up check in Chapter IV. 3.3a and check out the straight line filter. | Detailed information for D.A.3-4-1 "Straight line filter" start-up is located in section 3.3.a. |
| 2. Refer to cake wash pump start-up check in Chapter IV.3.3.b and check out the cake wash pump. | Detailed information for D.A.3-6-5 "Cake wash pump" start-up is located in section 3.3.b. |
| 3. Refer to cloth wash pump start-up check in Chapter IV.3.3.c and check out the cloth wash pump. | Detailed information for D.A.3-6-8 "Cloth wash pump" start-up is located in section 3.3.c. |
| 4. Start the WNT (Waste Neutralization Tank) pump and start the WNT agitator using the field switches located by the WNT on 1st floor. | The WNT pump pressure range of normal operation is 65 to 85 psig. |
| a. Turn the pH meter for the WNT pH conrol on (located in the CCR). | The pH meter control operates the automatic caustic valve to the WNT. |
| b. Ensure seal flush is on to the pump. | The seal flush normally runs at 1.5 gph. |
| 5. Open the following manual valves:<br>a. filter separator<br>b. cake wash tank discharge<br>c. cloth wash tank discharge<br>d. WNT discharge<br>e. caustic inlet valve to the WNT<br>f. process water to the filter<br>g. WNT inlet, circulation line and pH loop on the WNT<br>h. raw water to the condenser | These manual valves must be opened during the filtration operation or flow will be blocked to a key part of the filtration step. |



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## 5.0 FILTRATION

### 5.1 START-UP (Continued)

| ACTION | KEY POINTS |
|---|---|
| 6. Ensure that the following tanks maintain 50% level after filtration system is started up:<br>a. cake wash<br>b. cloth wash<br>c. WNT | The MBC patrol checklist must be performed a minimum of twice per 12 hour shift. Approximately every 2 hours, the MBC equipment must be patrolled in case leaks, spills or equipment failure develop. |
| 7. Ensure that the slurry tank agitator is running. | |
| 8. Vacuum pump operation check out:<br>a. open valve on vapor line to pump<br>b. open valves to the level gauges<br>c. open process water valves to vacuum pump and separator<br>d. pump seal on<br>e. water flow to separator must be set at 1 gpm (use rotameter to adjust flow).<br>f. open water valves (inlet and exit) on the heat exchanger.<br>g. Open valves in the vacuum pump system's circulation loop. | The vacuum pump for the MBC straight line filter is located on the fourth floor, NE of the straight line filter.<br><br>The water provides cooling medium in the exchanger. |
| 9. Discharge screw operation check out:<br>a. hold the discharge screw test field switch in the run position.<br>b. the screw must be rotating so MBC wet cake moves toward the center of the screw.<br>c. if screw direction is opposite than normal (i.e. product movement is toward the ends of the screw) shutdown the discharge screw and contact Supervision. | The discharge screw is on the straight line filter's west end.<br><br>MBC product will plug the screw if the wrong rotation is used. E&I will check out if motor's leads were reversed when motor was installed and E&I will correct problem. |



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## 5.0 FILTRATION

### 5.1 START-UP (Continued)

| ACTION | KEY POINTS |
|---|---|
| 9. (Continued) | |
| d. refer to SP 12 for cleaning the MBC discharge screw if MBC wet cake build-up is evident. | |
| 10. Straight line filter rotation check out: | |
| a. hold the straight line filter drive motor field switch in the run position to start up the filter. | If the motor makes a humming noise when the field switch is depressed in the run position, but does not start, have E&I inspect for loose connection or blown fuse in the wiring or control apparatus. |
| b. request Maintenance inspect the drive motor to determine if equipment is properly lubricated. | |
| c. request Maintenance inspect the drive belt to ensure that belt is not too tight. The direct-connected couplings must be properly aligned and balanced to prevent vibration and reduce wear on motor bearings. | Note: The filter drive motor is interlocked to the MBC conveying system, i.e. the filter will not run if the conveying system and cake and cloth wash pumps are down. Ask benomyl operator for assistance in holding test button during check out. |
| d. if the equipment passes Maint. or E&I inspection, the filter will be moving towards the discharge (west) end of the filter. If filter and hycar belt are moving in the opposite direction (i.e. toward the slurry or east end) shutdown the filter and contact Supervision immediately. | If filter is running in opposite direction, MBC slurry will spill onto the floor and create a slipping hazard. E&I will check out if motor's leads were reversed when motor was installed and E&I will correct the problem. |



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## 5.0 FILTRATION

### 5.1 START-UP (Continued)

| ACTION | KEY POINTS |
|---|---|
| 11. While the straight line filter is running: | The straight line filter is a key point in removing water and impurities from the MBC slurry. If unit is not operating properly, the potential of wet MBC (out-of-spec. MBC due to high water) and/or MBC high in chlorides (out-of-spec MBC due to high chlorides) exists. Holes or rips in the filter cloth allows fine MBC solids to transfer through the filter's cake and cloth wash tanks and possibly to the Calgon unit or to BBT tank. |
| a. ensure that filter cloth is tight and lays across the belt smoothly. | |
| b. inspect the filter cloth for rips, tears or Velcro ends not fastened. Contact Maintenance if the inspection turns up any rips, tears or unloosened ends. | |
| c. inspect that filter cloth is lined up with the E. and W. end helical pulleys which guide the filter cloth for proper alignment. Contact Maintenance if the helical pulleys or filter cloth are not lined up properly. | |
| d. using the water hose directly above the slurry feed trough, open the quick opening manual valve and thoroughly spray water over the entire upper portion of the filter cloth. Also wash out the slurry feed trough; and cake and cloth wash troughs. Watch the cloth and cake wash tank level gauges and maintain a 50% level by using water hose. | The filter cloth must be totally saturated with water. The water will begin to fill the cake and cloth wash tanks and WNT. |



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## 5.0 FILTRATION

### 5.1 START-UP (Continued)

| ACTION | KEY POINTS |
|---|---|
| 11. (Continued) | |
| e. Following the start-up sections referenced in Chapter IV, start-up the MBC equipment in the following order below: | The straight-line filter is interlocked on the MBC grinding, conveying and storage equipment. |

| Order of Start-up | Equipment | Chapter IV. Section | |
|---|---|---|---|
| 1. | Storage bin rotary valve | 7.1 | |
| 2. | Pneumatic conveying blower | 7.1 | |
| 3. | Dryer outlet blower | 6.1 | |
| 4. | Pulverizer | 7.1 | |
| 5. | Dryer dust collector rotary valve | 6.1 | |
| 6. | Dryer dust collector screw | 6.1 | |
| 7. | Inlet blower | 6.1 | |
| 8. | Dryer drive motor | 6.1 | |
| 9. | Pic water heater | 5.1 | The pic water heater is on the 4th floor, E. of the filter. Adjust pic water temperature to 130°F by opening steam valve wider or throttling down steam on pic water set-up. Ensure water is flowing through system. Thermometer is on N. side of pic water set-up. Refer to SP21 for additional information. |
| 10. | Vacuum pump | 5.1 | Refer to Section 5.1, step 8. |
| 11. | Cake wash pump | 3.3.b | Perform start-up check |
| 12. | Cloth wash pump | 3.3.c | Perform start-up check |
| 13. | Filter drive motor | 5.1 | Refer to Section 5.1 Steps 10 and 11.a-d. |
| 14. | Dryer feed screw | 6.1 | |



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## 5.0 FILTRATION

### 5.1 START-UP (Continued)

11. (Continued)

| Order of Start-up | Equipment | Chapter IV. Section | |
|---|---|---|---|
| 15. | Filter discharge screw | 5.1 | Refer to Section 5.1 Step 9. |
| 16. | Filter feed pump | 5.1 | The filter feed pump is on the 1st floor NE of the process water tank. There are two Moyno filter feed pumps. To start the pump, depress the field switch which is located E. of the E. Monyo pump. Ensure valving is lined up for proper flow through E. or W. pump, whichever is in use. |
| 17. | WNT pump and agitator | 5.1 | Refer to section 5.1 step 4. |

| ACTION | KEY POINTS |
|---|---|
| 12. With the MBC equipment running, the straight line filter drive motor will stay on without holding the field switch in the run position. Inspect the water flowing to the cake and cloth wash troughs. If the water is flowing freely into the troughs and onto the filter, proceed to step 13. If the water flow is restricted, there is a plug in the cake or cloth wash line. Refer to SP17 if any pluggage exists. | Up until step 11.e, the filter drive motor was interlocked because the MBC conveying, grinding, drying and storage equipment was down. Since the equipment was started up in Step 11.e the drive motor will run continuously as long as the field switch is in the run position and the first 13 pieces of equipment in step 11.e remain on. |
| 13. The vacuum pulled on the straight line filter can be checked out to determine if adequate vacuum exists: | |



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## 5.0 FILTRATION

### 5.1 START-UP (Continued)

| ACTION | KEY POINTS |
|---|---|
| 13. (Continued) | |
| a. 1st wash header vacuum will be in the 10-16" Hg range. The vacuum gauges are on the 4th floor by handrail near E. end of filter. | The 1st wash header is the area underneath the cloth wash trough. |
| b. 2nd wash header vacuum will be in the 5-10" Hg range. | The 2nd wash header area is underneath the cake wash (center) trough. |
| c. if inadequate vacuum is being pulled, check to see if the water is pulled off the cloth. Check the vacuum hoses and inspect for leaks or loose hose clamps. If hoses need attention, contact Maintenance, inspect the belts on the vacuum header for leaks and have Maintenance correct the problem. Do not proceed until the inadequate vacuum problem is resolved. Contact Supervision of vacuum problems. | Inadequate vacuum on the filter may cause MBC to go out-of-spec. Wet MBC or MBC high in chlorides may be due to inadequate vacuum. Refer to step 11's key point. |
| d. if vacuum meets ranges specified in step 13.a and b, proceed to normal operation in section 5.2. | |



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## 5.0 FILTRATION

### 5.2 NORMAL OPERATION

| ACTION | KEY POINTS |
|---|---|
| 1. Follow the Filtration Start-up Section 5.1. | The filtration start-up Section details the steps necessary to start-up the straight line filter. |
| 2. Lining up the filter feed pump: If all the steps outlined in Section 5.1 Step 11.e have been performed and the MBC equipment is started up: | This will remove the interlock conditions on the straight line filter. |
| a. ensure there is material in the slurry tank (either MBC slurry or water) i.e. the MBC slurry level is greater than 5%. | During normal operation, MBC slurry is pumped to the filter. However, if an acid wash was performed in the MBC reactor, the neutralized acid wash must be sent to the WNT per SP 6 "Acid Washing the MBC reactor". |
| b. open the manual valves on the bottom of the MBC slurry tank and on the suction and discharge side of the filter feed pump. | |
| c. ensure the drain valves on the discharge side of the filter feed pump are closed and bull plug is inserted in each drain opening. | The plugs are inserted to prevent a spill if the manual drain valve was left inadvertently open. The drain plugs are normally only removed to insert a water hose to unplug MBC slurry at the plug. |
| d. the filter feed pump, already running, will pump the MBC slurry up to the fourth floor. | |
| e. Adjust the filter feed pump speed by using the "filter feed pump speed" controller in the CCR to obtain a cake thickness of 3/8" to 3/4" on the filter. If "filter feed pump speed" controller malfunctions, obtain E&I assistance to check the flowmeter (on 2nd floor E. of the benomyl blender scale on the I beam) and the controller in the CCR. | The producton rate specified by Supervision will determine the speed of the filter feed pump. The filter feed rate will normally vary from 40% to 70% depending on production rates. Supervision will provide this information. |



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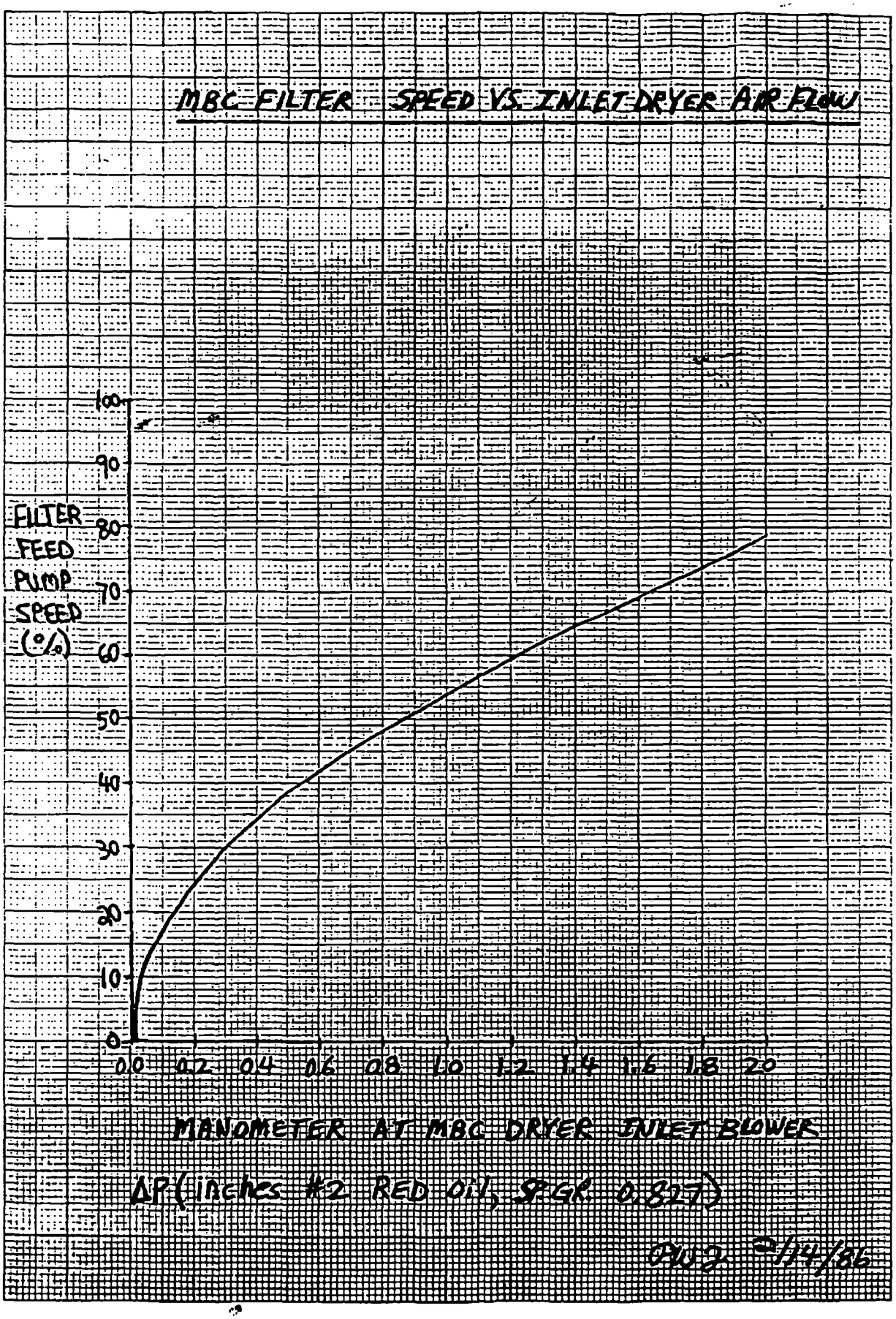
## 5.0 FILTRATION

### 5.2 NORMAL OPERATION (Continued)

| ACTION | KEY POINTS |
|---|---|
| 2. (Continued) | |
| f. Depending on the filter feed pump speed adjustment: (a.) the variable drive motor speed will have to be increased or decreased to maintain a 3/8" to 3/4" cake thickness on the filter and (b.) the inlet damper will have to be adjusted per the "MBC Filter Speed vs. Inlet Dryer Flow" graph on the following page. | The variable drive motor speed can be adjusted using the variable drive speed controller on the NW end of the filter above the handrail. The filter can be adjusted from 1 ft./min. to 10 ft./min. to obtain the desired 3/8" to 3/4" cake thickness. |
| (1) board operator obtains filter feed rate (either verbally or written instructions from Supervision). | |
| (2) board operator adjusts "filter feed pump speed" controller to desired setting. | |
| (3) board operator reads the graph "MBC Filter Speed vs. Inlet Dryer Air Flow" and with the filter feed pump speed (%) on X-axis, reads directly to the right till the curved line is reached. Then go down to the Y-axis to determine the manometer setting at the inlet blower. | This step is critical to maintain the proper amount of air flow through the damper and into the MBC dryer to prevent an explosive atmosphere from forming in the dryer. The graph is on the next page. |
| (4) board operator notifies the (by P.A.) MBC operator at what setting the manometer must read at the desired filter feed rate to maintain a safe non-explosive atmosphere in the MBC dryer. | |
| (5) the MBC operator will adjust the damper on the 4th floor by the inlet blower until the desired manometer reading is obtained. | The manometer reading can be obtained by determining at what height the brownish-red oil is at. |




46 1320
K·E 10 X 10 TO ½ INCH 2 X 10 INCHES KEUFFEL & ESSER CO. MADE IN U.S.A.

## 5.0 FILTRATION

### 5.2 NORMAL OPERATION (Continued)

| ACTION | KEY POINTS |
|---|---|
| 3. Adjust the feed distributor to ensure that cake is uniform across the width of the filter cloth. | Uneven distribution of the slurry/wet cake may be detrimental in achieving low (5-16" Hg) vacuum. |
| 4. Adjust the wash rate to maintain a flow of 5 gpm. Also ensure that water is overflowing evenly over the entire width of the cake and cloth wash troughs. Check clarity of cake wash (excessive solids indicate a tear in the cloth). | Wash water removes impurities (excess OPD and chlorides) from the MBC cake. If the Control Lab ever reports high chlorides in MBC, log info. in CCR logbook and adjust wash rate to 5 gpm. Contact Supervision. |
| 5. Check temperature of wash:<br>a. 1st wash temperature is 40-50°C.<br>b. 2nd wash temperature is 30-40°C. | Although MBC is essentially insoluble in hot or cold water, the wash water must be warm (30-50°C) to rapidly dissolve any impurities in the MBC. |
| 6. Maintain cake wash tank and cloth wash tank levels at 50% by adjusting water flow to the wash. Check cloth wash spray underneath west end of filter for proper operation. If spray is not hitting the cloth with enough volume, (i.e. water is trickling out the nozzle) increase pic water supply. Occasionally, the cloth wash spray nozzle becomes plugged - contact Maintenance to remove nozzle and clean nozzle. | For best operation of the filter, 50% level in the tanks is desired.<br><br>Pic water system is at the E. end of the filter. Maintain the pic water system between 122-130°F by adjusting steam and water flow rates. Refer to SP21 for pic water heater operation. |
| 7. Ensure a constant level is maintained in the separator and the WNT. If the level continually decreases, increase the water flow and check for leaks. | The unit runs best with a constant flow. If the WNT level remains constant, there will have to be less adjustments made at the Calgon unit. |



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## 5.0 FILTRATION

### 5.2 NORMAL OPERATION (Continued)

| ACTION | KEY POINTS |
|---|---|
| 8. Check vacuum operation:<br>a. 1st wash header vacuum @ 10-16" Hg<br>b. 2nd wash header vacuum @ 5-10" Hg<br>c. refer to start-up section 5.1 step 8 for proper vacuum operation. | Refer to start-up Section 5.1 step 13 for trouble-shooting techniques on poor vacuum. Poor vacuum (less than 5" Hg) indicates a thin cake, air leakage through filter hoses. |
| 9. Monitor the cake discharging off the cloth (on the W. end of the filter) into the dryer discharge screw. If discharge screw is coated with MBC (greater than 1/2" layer of MBC in the screw) clean the screw per SP 12. | The cake will fall across the width of the filter cloth into the screw. If the cake is falling off the edges of the cloth, locate the problem (raised edge guides, mis-aligned scraper, or too thick a cake) and correct. If Maintenance assistance is required, contact Maintenance. |
| 10. Monitor the slurry feed onto the E. end of the filter cloth. Use water hose to spray water into slurry feed trough and unblock any plugged feed openings. If forming box needs adjustment, follow SP 18.<br><br>If slurry is falling off the E. end, ask the board operator to reduce the filter feed rate and adjust the variable speed drive and dryer damper accordingly. Refer to step 5.2.f in this section for filter feed pump speed adjust-ment and dryer damper adjust-ment. | The slurry must feed the filter cloth in a uniform manner for best operation. Feed must be through each opening in the feed box and the slurry must drop onto the cloth so the width of the cloth is covered with slurry, except for 2" from each edge. As the slurry settles out, the entire width will be covered. |



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## 5.0 FILTRATION

### 5.2 NORMAL OPERATION (Continued)

| ACTION | KEY POINTS |
|---|---|
| 11. Patrol the filtration equipment routinely. The filter discharge screw must be cleaned out six times (minimum) per 12 hour shift to avoid pluggage in the screw. | Fill out the MBC patrol checklist twice per 12 hour shift. Refer to SP 12 for cleaning the screw. |



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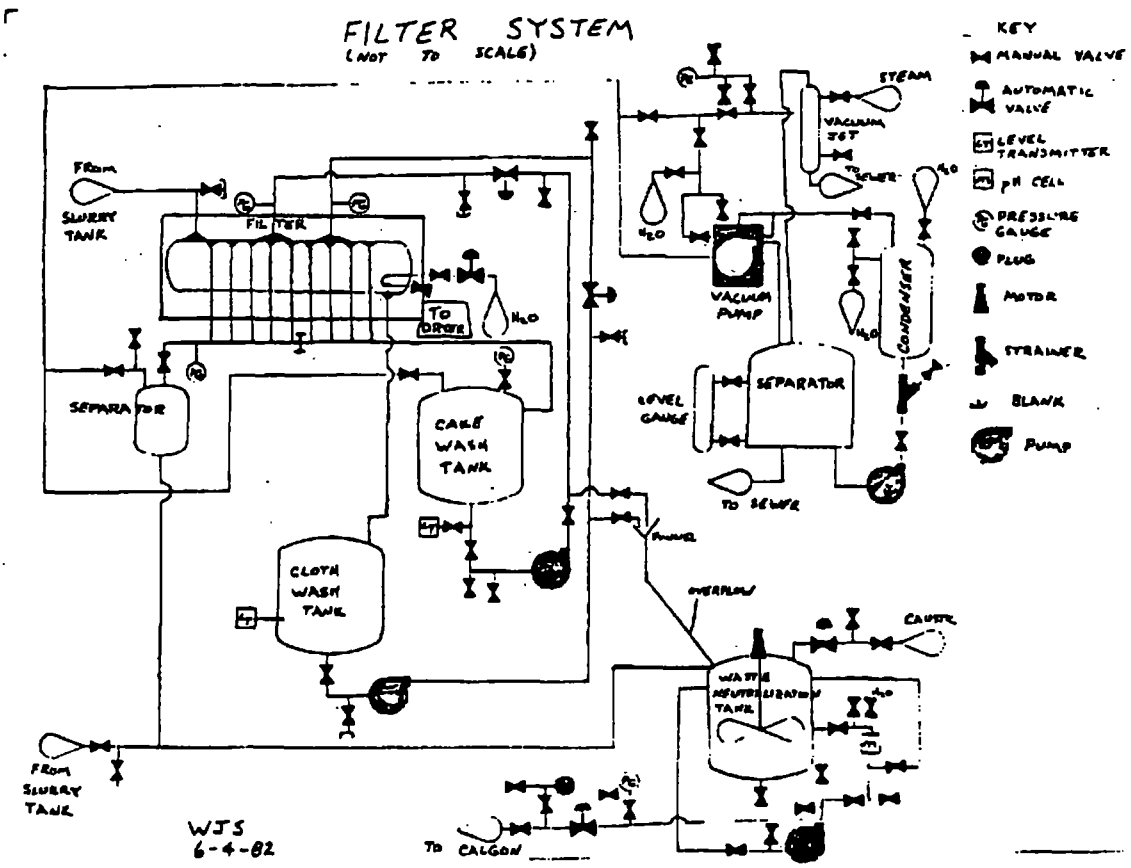
## 5.0 FILTRATION

### DIAGRAM: FILTER SYSTEM



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## 5.0 FILTRATION

DIAGRAM: Straight-Line Filter



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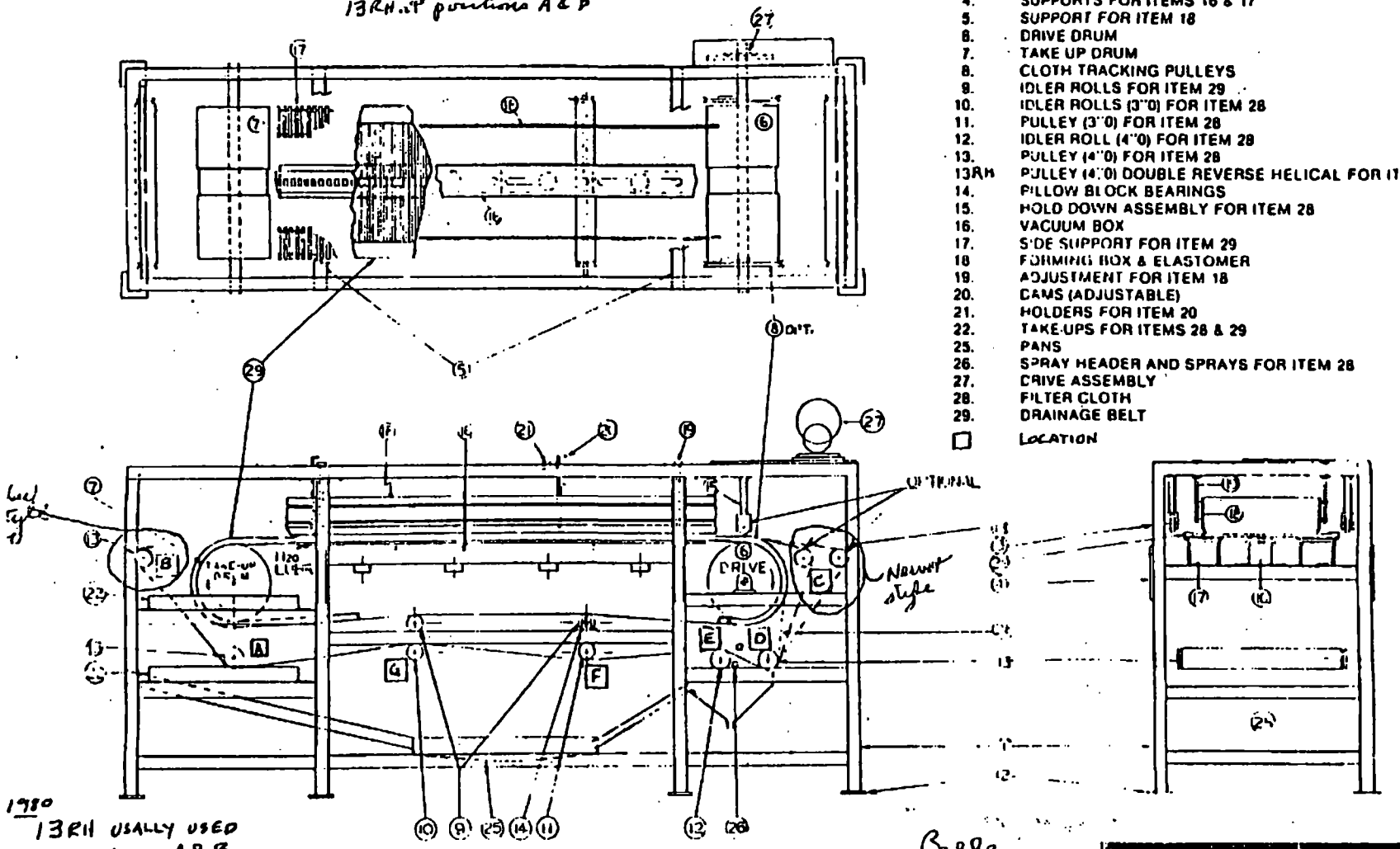
have not changed since 1969.

Not regularly used currently except for very heavy cakes.

1980 style uses Item 13 at position C, and Item 13RH at positions A & B

1/80

| ITEM NO. | NAME |
|---|---|
| 1. | FRAME |
| 2. | FLOOR PLATES |
| 3. | VERTICAL SUPPORTS (REMOVABLE) |
| 4. | SUPPORTS FOR ITEMS 16 & 17 |
| 5. | SUPPORT FOR ITEM 18 |
| 6. | DRIVE DRUM |
| 7. | TAKE UP DRUM |
| 8. | CLOTH TRACKING PULLEYS |
| 9. | IDLER ROLLS FOR ITEM 29 |
| 10. | IDLER ROLLS (3"0) FOR ITEM 28 |
| 11. | PULLEY (3"0) FOR ITEM 28 |
| 12. | IDLER ROLL (4"0) FOR ITEM 28 |
| 13. | PULLEY (4"0) FOR ITEM 28 |
| 13RH | PULLEY (4"0) DOUBLE REVERSE HELICAL FOR ITEM |
| 14. | PILLOW BLOCK BEARINGS |
| 15. | HOLD DOWN ASSEMBLY FOR ITEM 28 |
| 16. | VACUUM BOX |
| 17. | SIDE SUPPORT FOR ITEM 29 |
| 18 | FORMING BOX & ELASTOMER |
| 19. | ADJUSTMENT FOR ITEM 18 |
| 20. | DAMS (ADJUSTABLE) |
| 21. | HOLDERS FOR ITEM 20 |
| 22. | TAKE-UPS FOR ITEMS 28 & 29 |
| 25. | PANS |
| 26. | SPRAY HEADER AND SPRAYS FOR ITEM 28 |
| 27. | DRIVE ASSEMBLY |
| 28. | FILTER CLOTH |
| 29. | DRAINAGE BELT |
| ☐ | LOCATION |




1980
13RH USALLY USED AT LOC. A&B

Belle
SL11969
Mar 14 '69

# STRAIGHT LINE FILTERS, INC.

P.O. BOX 1911 WILMINGTON DELAWARE 19899 Phone 302 - 654-8805

SLF

| PARTS IDENTIFICATION DIAGRAM | |
|---|---|
| STRAIGHT LINE FILTERS, INC. WILMINGTON, DELAWARE | |
| NOT ALL PARTS SHOWN IN ALL VIEWS | NO SCALE |
| R 5-79 | PL 100A |

AB0000118912/73

## 5.0 FILTRATION

### 5.3 NORMAL SHUTDOWN

| ACTION | KEY POINTS |
|---|---|
| 1. Wash out the slurry tank when the MBC shutdown begins: | Whenever a shutdown is performed the filtration equipment must be thoroughly washed to prevent the cloth from blinding and lines from plugging. |
| a. Acknowledge the "Slurry tank low level" alarm | The alarm will sound in the CCR. |
| b. Wearing cotton gloves and goggles, climb the MBC slurry tank platform ladder. Chain-off the platform and loosen all of the wing nuts (except for one) on the metal plate manhole cover on top of the slurry tank. Slide the plate to the right side and using a flashlight look into the slurry tank. | When looking into the slurry tank, do not stick your head into the slurry tank. The plane of the flange that the manhole cover rests on must not be broken with the operator's head or feet. Use the flashlight to see inside the slurry tank. The level will be below the agitator blade. |
| c. Using the water hose (located behind the blender scale's I-beam), spray water down the sides of the inside walls of the slurry tank. Remove MBC slurry from the agitator shaft and blades. As the water-slurry mixture is pumped to the filter, continue to rinse out the bottom of the slurry tank. | Hang the water hose above the overhead piping to prevent a tripping hazard. (Use ladder safety techniques covered in Belle Safety Manual Procedure No. G-1.) The water-slurry mixture will turn clear after about 30 minutes of washing. |
| 2. After all the slurry and water has been pumped out of the slurry tank, stop the slurry tank agitator. Acknowledge the "Slurry tank agitator not running" alarm in the CCR. | The field switch for the agitator is by the stairs on the south side of the slurry tank on second floor. |
| 3. Leave the water hose running inside the slurry tank until the water-slurry mixture has turned clear. It will normally take 30 minutes for the mixture to turn clear. | The water hose will provide additional water needed to wash out the filtering equipment downstream. |



AB0000118912/74

## 5.0 FILTRATION

### 5.3 NORMAL SHUTDOWN (Continued)

| ACTION | KEY POINTS |
|---|---|
| 4. Using the field switch, shut off the filter feed pump. | There are 2 field switches for the filter feed pump: 1st floor - by E. Moyno filter feed pump. 4th floor - on N. wall, north of the filter platform. |
| 5. Insert water hose into water spud connection on suction side of the cake and cloth wash tank pumps. Turn water on to flush lines upstairs to the filter. | Inspect cake and cloth wash troughs on the filter. Clear water indicates that solids have been purged from the system to the WNT. |
| 6. Inspect cake and cloth wash troughs on filter. Once the wash has turned clear (about 15 minutes) close the discharge valve on the cloth wash pump discharge side in order to rinse out the cloth wash tank. | The tanks must be cleaned thoroughly to prevent any MBC fine solids to plug up the lines upon start-up. The cake wash tank and WNT are also washed out. |
| 7. Using the water hose above the slurry feed trough, hose down:<br>a. the slurry feed trough,<br>b. the cake and cloth wash troughs,<br>c. the straight-line filter frame<br>d. the entire upper surface of the filter cloth being careful not to get any water into the dryer discharge screw. | This will prevent any pluggage upon start-up.<br><br>Do not allow water to go into the dryer discharge screw because water in the dryer will plug the dryer screw and dryer plus out-of-spec. MBC (high moisture) would be made. |
| 8. Using the field switches located beside the specific equipment listed, shutdown the following equipment in the order listed below:<br>a. filter drive motor<br>b. filter discharge screw<br>c. cloth wash pump<br>d. cake wash pump. | Shutdown each piece of equipment in the order listed to avoid interlock from engaging. |



AB000118912/75

## 5.0 FILTRATION

### 5.3 NORMAL SHUTDOWN (Continued)

| ACTION | KEY POINTS |
|---|---|
| 9. Hose down the upper surface of the filter cloth, east of the cloth wash trough, while holding the field switch for the drive motor in the start position. This ensures a clean filter cloth. Hose down the filter for five minutes. | The drive motor will only run if the test button is held down because the discharge screw, cloth and cake wash pump interlocks are engaged. |
| 10. Shut off the cloth wash spray which uses the pic water system on the 4th floor, east of the filter. | |
| 11. Shut off the vacuum pump. | |
| 12. Shut down the WNT agitator and the WNT pump. | |
| 13. Refer to the normal shutdown procedures for shutdown of MBC equipment on the following page. | |



AB0000118912/76

## 5.0 FILTRATION

### 5.3 NORMAL SHUTDOWN (Continued)

MBC Filtration, Drying, Grinding and Storage Shutdown

Below is a list of which equipment to shutdown (in order) when the MBC equipment is shutdown due to: instructions from Supervision; MBC storage bin is full (greater than 3.0 ft. outage); or a mechanical shutdown is required.

| Order of Shutdown | Equipment - location of field Switch | Refer to Chapter IV Section |
|---|---|---|
| 1 | MBC slurry tank agitator - 2nd floor | 5.3 step 2 |
| 2 | Filter feed pump - two field switches<br>1) by E. Moyno filter feed pump on on 1st floor<br>2) on N. wall, north of filter platform, 4th floor | 5.3 step 4 |
| 3 | Filter drive motor - NW corner of filter | 5.3 step 8 |
| 4 | Filter discharge screw - NW corner of filter | 5.3 step 8 |
| 5 | Cloth wash pump - two field switches<br>1) 4th floor, N. of filter<br>2) 2nd floor, by cloth wash pump | 5.3 step 8 |
| 6 | Cake wash pump - two field switches<br>1) 4th floor, N. of filter<br>2) 2nd floor, by cake wash pump | 5.3 step 8 |
| 7 | Cloth wash spray - manual valves by the 4th floor pic water sytem | 5.3 step 10 |
| 8 | Vacuum pump - 4th floor by vacuum pump | 5.3 step 11 |
| 9 | WNT agitator and WNT pump - 1st floor by WNT | 5.3 step 12 |
| 10 | Dryer feeder screw - two field switches<br>1) 4th floor<br>2) 3rd floor | 6.3 |
| 11 | Dryer inlet blower - 4th floor by inlet blower (Allow the dryer dust collector to run out) | 6.3 |



AB0000118912/77

## 5.0 FILTRATION

### 5.3 NORMAL SHUTDOWN (Continued)

MBC Filtration, Drying, Grinding and Storage Shutdown

| Order of Shutdown | Equipment - location of field Switch | Refer to Chapter IV Section |
|---|---|---|
| 12 | Dryer drive motor - 3rd floor by dryer | 6.3 |
| 13 | Dryer Outlet blower - use the field switch on the roof (in case of emergency shutdown there is a field switch for the outlet blower on the 4th floor) | 6.3 |
| 14 | Dryer Dust Collector discharge screw- on roof beside the east end of the D/C discharge screw | 6.3 |
| 15 | Dryer Dust Collector discharge rotary valve - two field switches:<br>1) on roof beside east end of D/C discharge screw<br>2) on 4th floor, beside the dryer D/C discharge rotary valve | 6.3 |
| 16 | Dryer discharge rotary valve (valve is on 2nd floor above the pulverizer) - switch is beside the pulverizer | 7.3 |
| 17 | Pulverizer (2nd floor by pulverizer) | 7.3 |
| 18 | $N_2$ to pulverizer ($N_2$ supply valve is beside the pulverizer) | 7.3 |
| 19 | Pneumatic conveying blower - use the field switch on the roof beside the MBC storage bin (in case of emergency shutdown there is a field switch for pneumatic conveying blower on 4th floor) | 7.3 |
| 20 | Storage bin rotary valve - beside storage bin on roof | 7.3 |



AB0000118912/78

## 5.0 FILTRATION

5.4 Interlocks and Alarms - Refer to the details in Chapter IV.A.4.6 for explanation of safety and process control interlocks and alarms; approvals needed to bypass safety interlocks and alarms; and Alarm/Interlock Lamp Color Standard.

A. Process Control and Safety Interlock

| Condition | Interlock Action | Comment |
|---|---|---|
| 1. MBC Separation and Drying Shutdown | Depending which "Run/Stop" light (indicating that a particular group of MBC equipment was shutdown) is lit on the "Stop" side, that equipment has been shutdown. The run/stop lights are coded green/blue, respectively. Refer to description of color code in Chapter IV.A.4.6. | Refer to explanation on the next page for detailed information. Determine which MBC equipment has shutdown and then, start-up according to section:<br>5.3 Filtration<br>6.3 Drying<br>7.3 Grinding and Storage<br><br>If the unit is shutdown, this alarm will remain lit. |



AB0000118912/79

## 5.0 FILTRATION

### 5.4 Interlocks

The following equipment is grouped in an interlock sequence for automatic shutdown. The number in parenthesis (preceding each item) indicates the order of shutdown, that is, a failure of any unit will shut down higher numbered units.

| GROUP A | COMMENT |
|---|---|
| 1. Low pulverizer $N_2$ flow, (21.6 scfm) pneumatic conveyor blower and/or storage bin rotary valve. | Safety interlock, to prevent explosion of dust particles. |
| 2. Pulverizer (2nd floor). | Process interlock. |
| 3. Dryer discharge rotary valve. | Process interlock. |
| 4. Dryer drive. | Process interlock. |
| 5. Filter drive. | Process interlock. |
| 6. Filter feed pump. | Process interlock. |

| GROUP B | |
|---|---|
| 1. Pulverizer $N_2$ flow, pneumatic conveying blower and/or storage bin rotary valve. | Safety interlock, to prevent explosion of dust particles. |
| 2. Pulverizer. | Process interlock. |
| 3. Dryer dust collector rotary valve. | Process interlock. |
| 4. Dryer dust collector screw. | Process interlock. |

Note: For example - from Group B,

Example 1: if the pulverizer (item 2) shuts down, then the higher numbered units, (item 3 & 4) dryer dust collector rotary valve and the dryer dust collector screw respectively, will interlock and shutdown. To start up: start item 4, 3 and 2 (in that order). Example 2: if the dryer dust collector screw (item 4) shuts down, then only the dryer dust collector screw will be affected since there are no higher numbered units existing in group B. To start up: start item 4.



AB0000118912/80

## 5.0 FILTRATION

### 5.4 Interlocks (Continued)

| | COMMENT |
|---|---|
| **GROUP C** | |
| 1. Dryer discharge rotary valve and/or dryer outlet blower. | Process interlock. |
| 2. Dryer drive. | Process interlock. |
| 3. Filter drive. | Process interlock. |
| 4. Filter feed pump. | Process interlock. |
| **GROUP D** | |
| 1. Dryer outlet blower. | Safety interlock. |
| 2. Dryer inlet blower. | Safety interlock. |
| **GROUP E** | |
| 1. Cake wash pump. | Process interlock. |
| 2. Cloth wash pump. | Process interlock. |
| 3. Filter drive. | Process interlock. |
| 4. Filter feed pump. | Process interlock. |
| **GROUP F** | |
| 1. Dryer feed screw, filter discharge screw and/or cloth wash pump. | Process interlock. |
| 2. Filter drive. | Process interlock. |
| 3. Filter feed pump. | Process interlock. |
| **GROUP G** | |
| 1. Filter discharge screw. | Process interlock. |
| 2. Filter drive. | Process interlock. |
| 3. Filter feed pump. | Process interlock. |



AB0000118912/81

## 5.0 FILTRATION

### 5.4 Interlocks (Continued)

| | |
|---|---|
| High $\Delta P$ (10 in. $H_2O$) across the dryer dust collector stops the outlet blower. | This interlocks the dryer and filter system. (Process interlocks). |
| High $\Delta P$ (10 in. $H_2O$) across the storage bin dust collector stops the pneumatic conveying blower. | This interlocks the filter and dryer systems. (Process interlock.) |

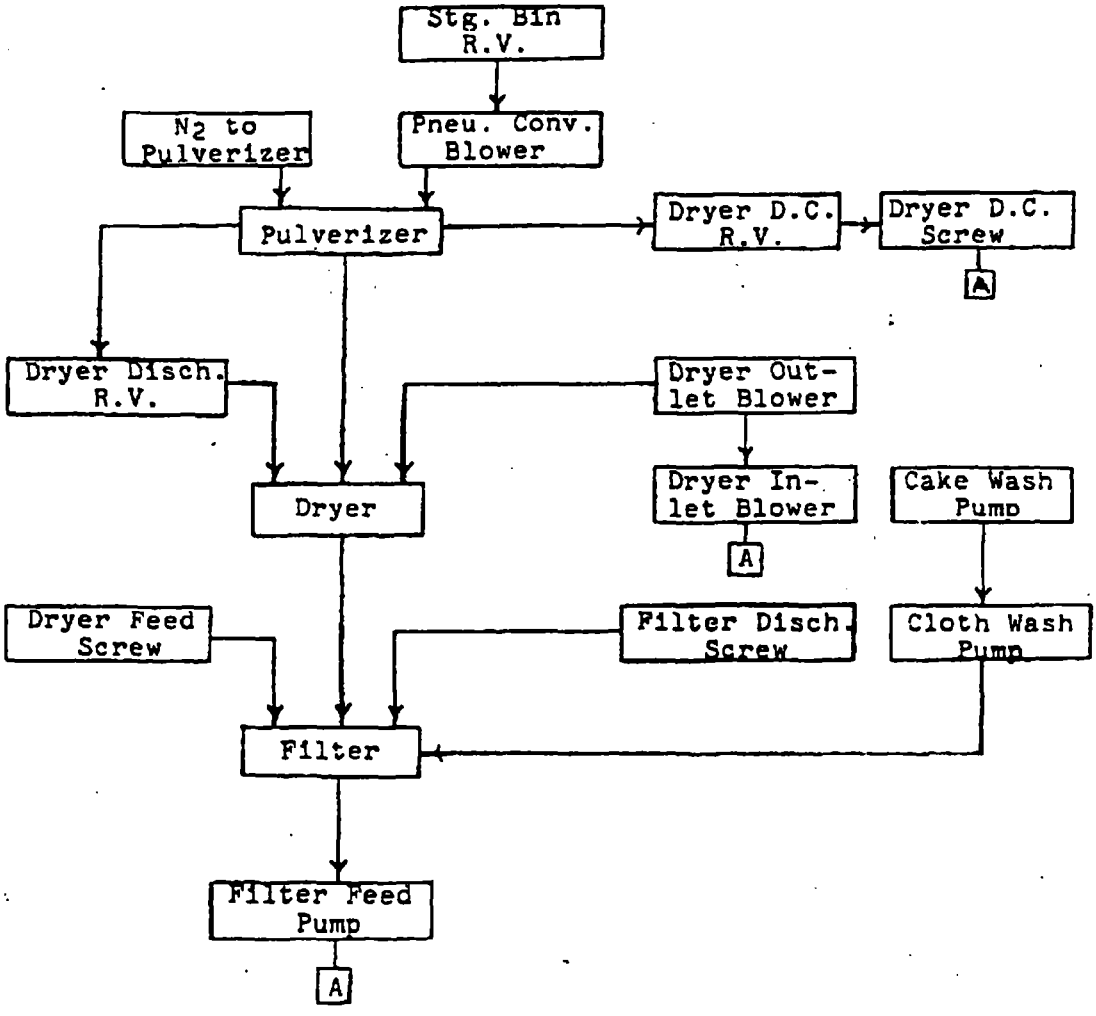
NOTE: Refer to interlock block diagram on the next page to see how the MBC interlock system operates.



AB0000118912/82

## 5.0 FILTRATION

### INTERLOCK BLOCK DIAGRAM




Symbols and Abbreviations

[A] - Alarm on shutdown
→ - Interlock flow
R.V. - Rotary Valve
D.C. - Dust Collector

5.0 FILTRATION

5.4 Interlocks and Alarms (Continued)

B. Safety Alarm

| Alarm Condition | Action Required |
|---|---|
| 1. Waste Neutralization Tank Hi Level<br><br>Note: Additional information regarding the E. Calgon Unit (Bldg. 305) and the BBT (Benlate® Brine Treatment) tank can be found in the operating procedures entitled, "Treatment of MBC Waste". | a. Call Calgon operator by P.A. and ask him if any problems exist that could be causing the WNT - Hi Level alarm to go off. If problems at Calgon exist, ask the Calgon operator to resolve the problems. Notify the Calgon operator when the "Hi Level" alarm light goes out.<br><br>b. Check the automatic valve (by the WNT) that controls brine flow to the BBT or to Calgon, is functioning properly. If automatic valve is sticking in the 100% open or 100% closed position, contact E&I for assistance with the valve.<br><br>c. Check the quick opening valve (above Station 110) to ensure it is in the open position if brine is flowing to Calgon. Wearing gloves, remove the grating in the catwalk directly above the quick opening valve. Tie yourself off with safety harness. If valve is closed and the brine is supposed to be flowing to Calgon, place your arm below the plane of the grating and open the quick opening valve. |

5.0 FILTRATION

5.4 Interlocks and Alarms (Continued)

B. Safety Alarm (Continued)

| Alarm Condition | Action Required |
|---|---|
| 1. (Continued) | |
| | d. Check the wheel valve (above Station 110) to ensure it is in the open position if brine is flowing to the BBT (Benlate® Brine Treatment) tank. If valve is closed and brine is supposed to be flowing to the BBT tank, tie yourself off with the safety harness to the handrail, and wearing gloves, remove the grating in the catwalk directly above the wheel valve. Place your arm below the plane of the grating and turn the wheel valve counter-clockwise to open the valve. |
| | e. Check that manual valves downstream of the WWT, by the suction and discharge of the WWT pump and in the transfer lines to the BBT tank or Calgon inside 174 Bldg. are open and lined up properly. |
| | f. Check to see if the brine line to Calgon is plugged. Notify the Calgon operator that the line is being blown out so that adjustments can be made at Calgon. Follow SP16 for clearing the line from the WWT to Calgon. |

5.0 FILTRATION

5.4 Interlocks and Alarms (Continued)

C. Process Control Alarms

| Alarm Condition | Action Required |
|---|---|
| 1. MBC Separation and Drying Shutdown | Determine which group of MBC equipment shut down (look at the "Run/Stop" lights in the CCR) and start the equipment back up following the start-up procedures in section :<br>5.1 Filtration<br>6.1 Drying<br>7.1 Grinding and Storage<br>Refer to the Interlock Groups in Section 5.4.A to determine which equipment must be started up. If the unit is shutdown, this alarm will remain lit. |
| 2. MBC Filter Wash Water Low Flow | Acknowledge the alarm:<br>1) Check if the MBC operator is washing out the filter troughs and filter cloth. The pic water system supplies water for the filter cloth spray nozzle, water hose above the slurry feed trough, and for the pH loop flush out.<br>2) Check if the cloth wash spray nozzle is providing 5 gpm flow underneath the discharge end of the filter. If the water flow is just trickling out of the spray nozzle, the nozzle is plugged. Shut off the filter feed (field switch on fourth floor north wall) pump and contact Maintenance to remove spray nozzle for cleaning. Remove the pluggage and put nozzle back in place. |





AB0000118912/86

5.0 FILTRATION

5.4 Interlocks and Alarms (Continued)

C. Process Control Alarms (Continued)

| Alarm Condition | Action Required |
|---|---|
| 2. (Continued) | 3) Check pic $H_2O$ temperature. If above 130°F, reduce steam supply to pic $H_2O$ system and increase water supply. Refer to SP 21 for pic water heater operation. |
| | 4) Determine if water to pH loop was inadvertently left on. Close water valve to pH loop. |

## 5.0 FILTRATION

### 5.5 Emergency Shutdown

| ACTION | KEY POINTS |
|---|---|
| 1. If electricity fails, filtration will stop. When power is restored, start up per section 5.1 and resume normal operation. Contact Supervision. | All of the electrical equipment listed in section 5.3 step 13 "MBC Filtration, Drying, Grinding and Storage Shutdown" will shutdown if electricity fails. |
| 2. If instrument air fails, an alarm will sound in the CCR when the pressure drops below 60 psig. Hold the material in the slurry tank under agitation. Contact Supervision. If there is MBC slurry on the filter, process the material and clean up the filtration system. Resume normal operation when air pressure is restored. | To clear up and clean up the filtration system, when there is slurry in the slurry tank, refer to Chapter IV. Section 5.3 steps 4-10. |
| 3. If nitrogen fails, an alarm will sound in the CCR when the pressure drops below 35 psig. This will shutdown the pulverizer and therefore lead to an interlock shutdown of the filtration system. Refer to Chapter IV., 5.4.A for steps to take when "MBC Separation and Drying Shutdown" alarm sounds. Resume normal operation when nitrogen pressure is restored. | The "Nitrogen to pulverizer low flow interlock" will engage and cause filter equipment to interlock in shutdown mode. |

Note: If utilities fail, keep posted by listening to the plant hot line phone located in the Wet Benlate® CCR for up-to-date information when the utilities will return to normal operation.

There is no emergency shutdown button for the filtration system. If an emergency shutdown is necessary due to a local fume alert, fire in Bldg. 174 or building evacuation, the filtration operation can be safely shutdown by shutting off the pulverizer located on the second floor. Per Chapter IV.A.5.4. This action will shutdown the MBC Separation and Drying Process.



AB0000118912/88

## 5.0 FILTRATION

### 5.5 Emergency Shutdown (Continued)

If evacuation is necessary, follow procedures outlined in the Biochem Division Disaster Plan.

Refer to the guidelines for "Fail-Safe Position of Valves" in Chaper IV., A.4.4.8 for fail-safe position of the valves in the filtration operation.



AB0000118912/89

## 5.0 FILTRATION

### 5.6 Troubleshooting

| ACTION | | KEY POINTS |
|---|---|---|
| Equipment | Problem | Reference in Chapter IV Section: |
| Straight-line filter | Start-up<br>Order of start-up | 3.3(a)<br>5.1 step 11(e) |
| | Discharge screw | 5.1 step 9 and 11 |
| | Rotation of filter | 5.1 step 10 |
| | Filter Cloth | 5.1 step 11 and Special Procedure 18 |
| | Filter Drive Motor Interlock | 5.1 step 12 |
| | Filter Feed Pump | 5.1 step 11(e) item 16<br>5.2 step 2 |
| | Filter Feed Pump Speed Adjustment | 5.2 step 2(e) and (f) |
| | MBC Slurry Feed | 5.2 step 3 and step 10 |
| | Shutdown | 5.3 Filtration System Shutdown |
| Cake Wash and Cloth Wash equipment | Start-up | 3.3(b) cake wash pump<br>3.3(c) cloth wash pump<br>5.1 Filtration System Start-up |
| | Order of start-up | 5.1 step 11 (e) |
| | Plugged cloth wash line | Special Procedure 17 |
| | Cloth wash spray | 5.2 step 4<br>5.4.C.2 Process Control Alarm |
| | Flow, temperature and tank level | 5.2 steps 4,5,6 |
| | Shutdown | 5.3 Filtration System Shutdown |



AB0000118912/90

## 5.0 FILTRATION

### 5.6 Troubleshooting

| ACTION | | KEY POINTS |
|---|---|---|
| Equipment | Problem | Reference in Chapter IV Section: |
| WNT, Separator, and Brine Line to Calgon or BBT | Start-up and problems with pump or agitator | 5.1 step 4; 3.7(a) WNT agitator; 3.7(b) WNT pump |
| | Level | 5.2 step 7 |
| | Hi-Level | 5.4 B. Safety Alarm |
| | Shutdown | 5.3 Filtration Shutdown |
| | Valving to Calgon | 5.4 B.1. step b, c, e and f |
| | Valving to BBT | 5.4 B.1 step b, d and e |
| Slurry tank | Low level | 4.6.D.(2) alarm |
| | Agitator-not running | 4.6.D.(3) alarm |
| | Slurry feed | 5.2 step 10 and 3 |
| | Clean up and shutdown | 5.3 step 1,2, and 3 |
| Vacuum pump | Start-up | 5.1 step 8 |
| | Order of start-up | 5.1 step 11(e) |
| | Poor vacuum | 5.1 step 13 |
| Filtration Equipment | Start-up | 5.1 |
| | Normal Operation | 5.2 |
| | Normal Shutdown | 5.3 |
| | Interlocks and alarms | 5.4 |
| | Emergency Shutdown | 5.5 |
| | Standard Operating Conditions | C. Pink pages |



AB0000118912/91

## 5.0 FILTRATION

### 5.6 Troubleshooting

| ACTION | KEY POINTS |
|---|---|
| For Specific Problems: | |
| **Special Procedure Title** | **Special Procedure** |
| Cleaning MBC screws | 12 |
| Clear Out Brine Lines from WNT to Calgon | 16 |
| Unplug Cloth Wash Line to Filter | 17 |
| Changing MBC Filter Cloth | 18 |
| Pic Water Operation | 21 |



AB0000118912/92

CC: John Miles - Cedar
David Claudio - DuPont
Ron Smith - DuPont

12/17/88

To: Tom Ladice
From: Art Sepcie
Subj: Misc. MBC Items

1. Please have daily consumption/Production report FAXed to me at LaPorte (713) 470-3195
2. Return to normal OPD charges in R-101
3. During Transfer of R-101, insure pressure in R-101 remains positive to keep from sucking in air.
4. Stress to all personnel the importance of minimizing air into the vessels
5. Pack this 1st batch of MBC into drums, and any future batches that are off-color (but good assay) should preferentially be put into drums.
6. If unable to get the 50Kg into drums, black out that item on the label and write on the quantity in the drum. For accounting purposes, fill drums with the same amount each time. (let me know what that quantity is)
7. Supersacks are also to be filled with a consistent amount as possible. If product quality is consistently good, mixing of batches can be done.
8. Batch (Lot) Numbers are to be put on each container having product - preferably on the container, not the label. DuPont's Lot numbering

(1)

8. (cont)
system is as follows: V 12 1788 - 001
code for Cedar Chem | month | day | year | sequential Lot number
NON-SMEARING MARKER PEN or INK should be used.
If mixing batches, write the Lbs of each batch following the Lot Number.

9. Labels are to be attached to each container. Black print Carbendazim labels have a peel-off backing and should be stuck onto the drum. Red print Carbendazim labels have holes punched in them so they can be attached to one of the lift straps by tie-wrap fasteners. Net weight is to be written on the supersack label. Do not remove peel-off back from supersack label.

10. All Full containers are to be placed on pallets. Drums should be double stacked and stretch wraped or single layer and tied together to avoid shifting during transport. One supersack per pallet. Double stacking is approved for storage and transportation if secured in truck so they do not shift.

11. Drum closure seals are to be attached to locking rings on all drums. For the super sacks, please advise me of possible methods to secure with the "DuPont" seals.

12. Product will initially be stored at Blackhawk warehouse.

(2)

13. Waste Brine must be pH 7-8 before filling into rail cars.

I think we have made significant progress in this project, and will continue to improve from here. You and your people have done well - I commend all on an outstanding effort in such a short time.
As rates increase over the next week or so, I see rail cars to be a bottle-neck. I am interested in pursueing a way to put some of the brine to Cedar Chemical waste treatment. Analysis of the waste brine for treatment facility parameters should be done as early as possible so Joe Porter can advise on disposal.

Please call me as questions arise or if I can help in some way.

Thanks.

DU PONT

A. J. (ART) SEPCIE
Section Engineer - Contract Administration

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Agricultural Products Department
La Porte Plant
P.O. Box 347
La Porte, Texas 77571
Business: (713) 470-3254
Home: (713) 479-3798



AB0000118906/3

cc: Tom Joe
Ken Greg
Neil Charlie

**CEDAR INTERNAL CORRESPONDENCE**

DATE: 05/05/89

TO: Bill Eissler

FROM: Geoffrey Pratt

CC: John Miles
Willard Brown
Niven Morgan

SUBJECT: Custom Manufacturing Update

ICI

On March 31, an extension to the Permethrin products contract was signed continuing production until June 30, 1989. The daily production fee of $9M, and standby fee of $3,333 will continue with a minimum guarantee of $470M. On April 20, we offered an additional three months to ICI, which would extend production until September 30, 1989. We asked also if ICI has interest in a new multiyear contract. Joe Gallagher will respond by the end of May when 1990 forecasts will become more available.

| | |
|---|---|
| Budgeted 1989 revenue: | $ 0 |
| Expected 1989 revenue: | $1.2 - 1.4MM |

Phillips 66

D-8

To date, 156150 lbs. of D-8 have been made (March 25-30), against a purchase order for 520M lbs. of D-8 and 10,000 lbs. of CO 800. Revenue from this purchase order will be $106M (D-8 at $0.17/lb., CO-800 at $0.18/lb.) We need to raise the fees by $.02/lb on the next order.

| | |
|---|---|
| Budgeted 1989 revenue: | $240M |
| Expected 1989 revenue: | $240M |

MES

We have a purchase order for 255M lbs. of MES. The production will begin in mid-May, and should last 45 days. A laboratory collaborative between Phillips and Cedar is in progress to standardize assay results between the two laboratories, a problem in past production. Cedar also agreed to attempt to reduce Phillips waste disposal costs by modifying the wash procedures.

| | |
|---|---|
| Budgeted 1989 revenue: | $126M |
| Expected 1989 revenue: | $230M |

Driscal

We have made a proposal for 2-400M lbs. of an emulsion polymer to commence in May, 1989. This is a single reactor operation with minimal waste generated by final cleanup. Plant preparation will be $30M to be paid by Phillips. A daily fee of $9M and a $100M minimum will apply. Raw materials will be supplied mainly by Phillips. Raw materials supplied by Cedar (including nitrogen and deionized water) will be marked up five percent. If successful this product, which is part of a family of polymers, could extend our line of toll 'crack fillers'.

DUPONT MBC

247,770 lbs. was produced from December 16, 1988 to March 6, 1989. Total revenue was $449M in 1989 and $140M in 1988 for a total of $589M. This project was expected to produce 600 - 800 lbs. of MBC and take 60-80 days with projected revenue of $480 - $640M. Processing charges were all per diem; $9,000 during start-up, and $8,000 during stable production. Plant modification costs were estimated to be $50M which DuPont agreed to pay. Ultimately, DuPont paid $59,770 due to a documented scope change required by them. However, total plant preparation costs were $116,440 and Cedar absorbed the $56,670 difference. A major part of the underestimated cost was related to damage to the dryer vent filtration system and belt filter vacuum system from the Diphone production.

Of the total revenue, $52,361 was from onsite waste treatment (1,309,025 lbs. at $0.04) which was negotiated after the project started. DuPont's alternative cost is $0.0672/lbs. at their Belle, West Virginia site.

OR-CAL

Sectagon

The contract price for Sectagon is $1.60/gallon for the first quarter of 1989. Cedar credits OR-CAL $0.45/lb amine (x conversion factor of 0.86 #amine/#Sectagon) and $0.23/lb carbon bisulfide (x conversion factor of 2.05) for raw material provided by OR-CAL. There is a $.10/gallon drumming charge. Two production campaigns were completed between January 19 to February 13 (180045 gallons) and between March 31 and April 15 (129804 gallons) for a total of 309,849 gallons versus the 1989 budget of 1MM gallons. Additional production would begin in the Fall. Billing YTD is $355,265, which is distorted compared to budget due to the inclusion of raw materials and packaging supplies under the modified contract.

| | | |
|---|---|---|
| Budgeted 1989 revenue: | $500M | |
| Expected 1989 revenue: | $500M | |
| Actual YTD revenue: | $170M | (1989 budget basis) |

ALBRIGHT AND WILSON

This project was to produce 3-5MM lb/year of Briquest products; phosphonates, and diphosphonic acid derivatives, over a 2-3 year period. A secrecy agreement was signed and a technology exchange made. Modification of the RP-10 unit would have cost $350M. We proposed that Albright and Wilson pay this capital cost plus $9M/operating day. Albright and Wilson would provide all raw material and pay for waste disposal. Albright and Wilson responded with a requirement of no more than $5M/operating day in order to adjust their total costs to less than $.20/lb at the production rate for our 4M gallon reactors. We declined to consider this since the economics could not support the committment of resources and risk involved. Also, the chemistry involved is not in our prime areas of interest. Albright and Wilson indicated they had found a toll producer who was willing to meet their cost constraints. This project is terminated

Projected Revenue: $450M - $750M for two years

AIR PROJECTS

This project would produce 500-1000M lb of an acrylated styrene resin over an eighteen month period beginning in mid-summer, 1989. The project would use the 3M gallon Propanil reactor and flaker. Estimated plant time 30-60 days. A secrecy agreement is signed and a technical data package has been received. A technical review with the client will be scheduled. (May 9)

| | |
|---|---|
| Budgeted 1989 revenue: | $ 0 |
| Potential 1989 revenue: | $300M - 600M |

MONSANTO EP-560

This project would produce a phenol/formaldehyde resin used as a drum and pipe coating. The contract would be multiyear with volumes: 750M lbs - 1989, 1.5MM lbs - 1990, 2-3MM lb - 1991, and beyond. The toll fee must be in the $.50 - $.80/lb range. The work would be carried out in the 3M gallon Propanil reactor with a plant modification cost of $250M. The largest single cost would be for a pressure leaf filter. This project is not in our prime areas of technical interest, but would be a constant user of the second half of the year for Propanil equipment.

| | |
|---|---|
| Budgeted 1989 revenue: | $ 0 |
| Potential 1989 revenue: | $600M |

CEDAR INTERNAL MEMO
WEST HELENA PLANT

DATE: 5/23/90

FAX TO: Geoff Pratt

FROM: John Miles

CC: Tom Lodice
Charlie Parker

RE: MBC

1. Dupont being able to supply OPD at the rate of 40M lbs. every 10 days should not cause us any problems. Our average production rate once we got going last time was about 3500 lbs/day of MBC, which is about 2300 lbs/day of OPD. Thus, a 40M lb. T/L would last about 15 days.

2. I am sure that Dupont would like to work on increasing the production rate. The very best rate we could achieve with perfect OPD supply logistics at 40M lbs. every 10 days ( and improved plant process/mechanical operation) would be 6000 lbs./day.

3. We should expect a minimum of 4 months operation based on the 6000 lb/day rate to 6 months based on our demonstrated 3500 lb/day rate.

4. Tom is beginning to address the plant refurbishing program/ cost. We should schedule a technical review ASAP, to be sure we cover the pertinent items and get a clear picture from Dupont of how they view the campaign.

Dave-

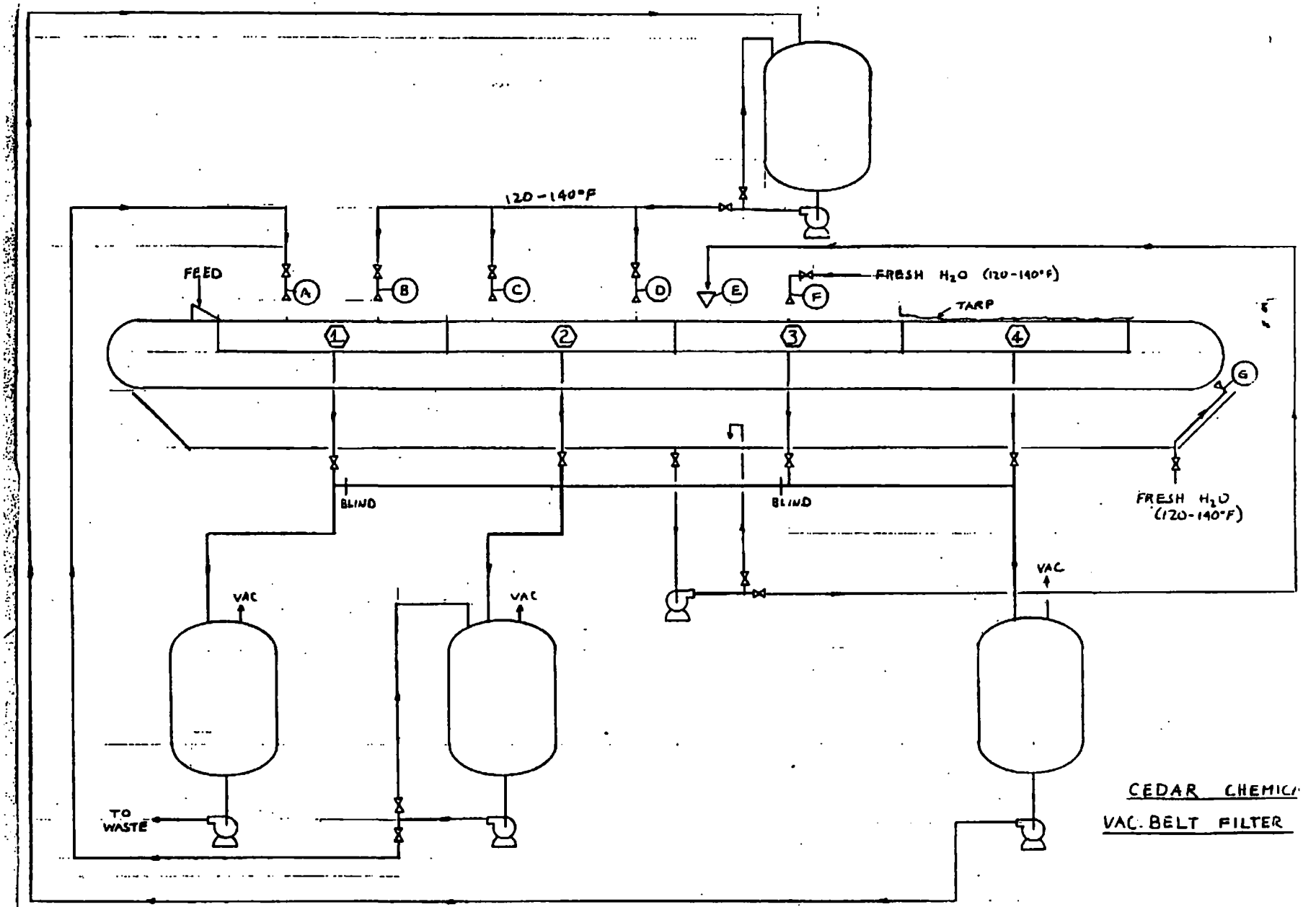
Our filter belt is 36 inches wide (32" cake width) with 28 feet of filtration area (4 vac pans x 7' each). Following is a summary of our wash arrangement:

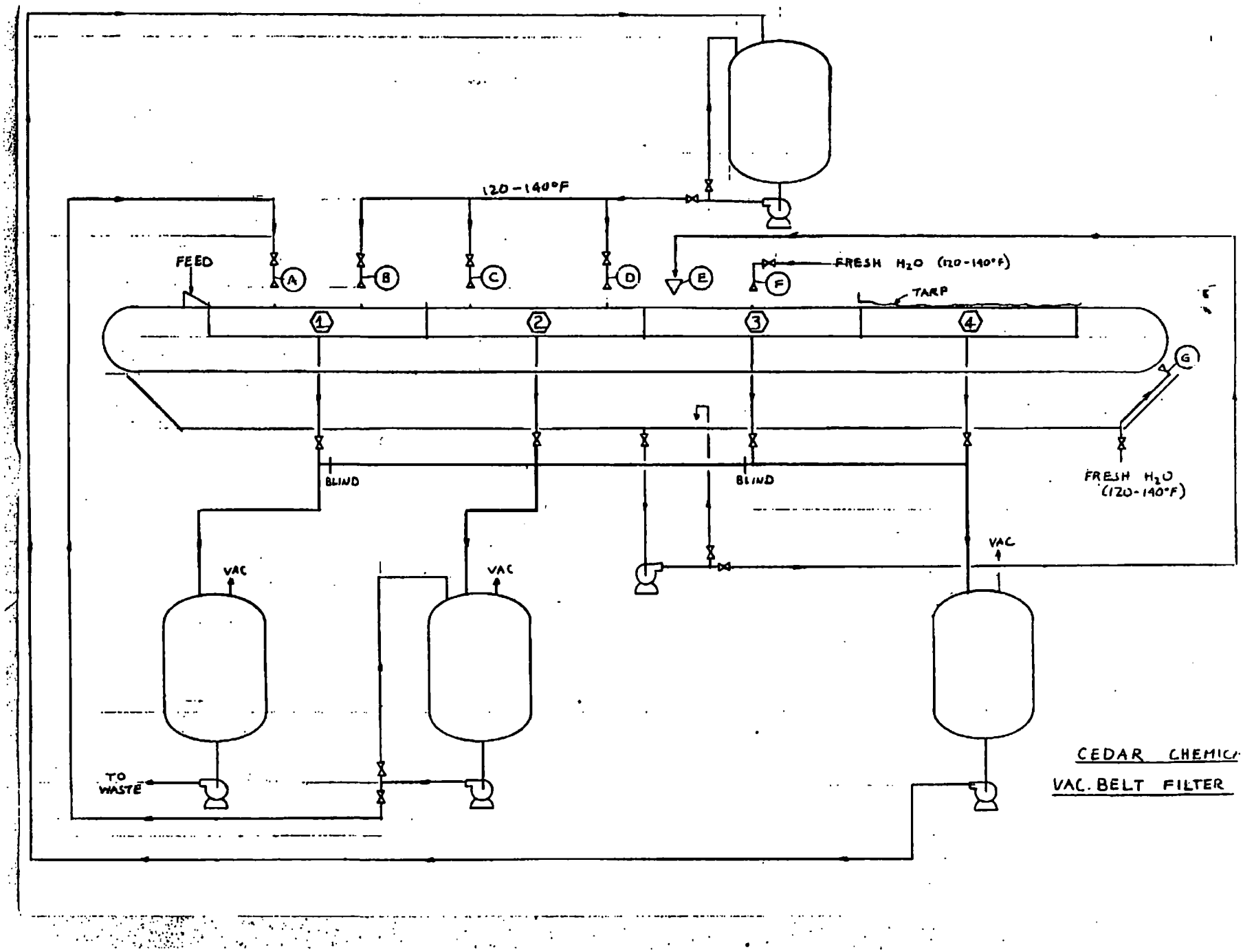
| ITEM | DISTANCE FROM FEED PAN | NUMBER OF NOZZLES |
|---|---|---|
| A | 2'-1" | 4 |
| B | 4'-11" | 4 |
| C | 8'-5" | 4 |
| D | 12'-10" | 2 |
| E | 15'-0" | Trough |
| F | 17'-6" | 4 |
| G | — | 4 |
| — | 19'-9" | Tarp (8' long) |

Let me know if you need any more detail.

Thanks,

Tom Lodico


120 - 140°F
FEED
A
B
C
D
E
F
FRESH H2O (120-140°F)
TARP
1
2
3
4
G
BLIND
BLIND
FRESH H2O (120-140°F)
VAC
VAC
VAC
TO WASTE
CEDAR CHEMICA
VAC. BELT FILTER




AB0000118898/4

MBC PRODUCTION 10-26-90

| BATCH NO. | LBS. OPD | LBS. OPD / LB. MBC | DRUMS MCC | LBS. HCL | DRUMS MBC | LBS. MBC | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 3,000 | 1.049 | 32 | 2,960 | 26 | 2,860 | | |
| 2 | 2,920 | 0.737 | 32 | 4,250 | 36 | 3,960 | | |
| 3 | 2,900 | 0.775 | 32 | 6,020 | 34 | 3,740 | | |
| 4 | 3,000 | 0.557 | 32 | 6,160 | 49 | 5,390 | | |
| 5 | 2,900 | 0.694 | 32 | 6,020 | 38 | 4,180 | | |
| 6 | 2,900 | 0.879 | 32 | 4,820 | 30 | 3,300 | | |
| 7 | 2,870 | 0.725 | 32 | 5,170 | 36 | 3,960 | | |
| 8 | 2,900 | 0.573 | 32 | 5,740 | 46 | 5,060 | | |
| 9 | 2,910 | 0.519 | 32 | 5,620 | 51 | 5,610 | | |
| 10 | 2,900 | 0.732 | 32 | 4,830 | 36 | 3,960 | | |
| 11 | 2,870 | 0.725 | 32 | 4,880 | 36 | 3,960 | | |
| 12 | 2,880 | 0.655 | 32 | 3,960 | 40 | 4,400 | | |
| 13 | 2,900 | 0.643 | 32 | 3,160 | 41 | 4,510 | | |
| 14 | 2,900 | 0.732 | 32 | 5,280 | 36 | 3,960 | | |
| 15 | 2,900 | 0.549 | 32 | 6,180 | 48 | 5,280 | | |
| 16 | 2,900 | 0.613 | 32 | 5,910 | 43 | 4,730 | | |
| 17 | 2,930 | 0.619 | 32 | 5,650 | 43 | 4,730 | | |
| 18 | 2,900 | 0.676 | 32 | 5,630 | 39 | 4,290 | 5 | 550 |
| 19 | 2,900 | 0.549 | 32 | 5,610 | 48 | 5,280 | 3 | 330 |
| 20 | 2,900 | 0.659 | 32 | 5,810 | 40 | 4,400 | 5 | 550 |
| 21 | 2,890 | 0.751 | 32 | 6,130 | 35 | 3,850 | 6 | 660 |
| 22 | 2,930 | 0.683 | 32 | 5,870 | 39 | 4,290 | 6 | 660 |
| 23 | 2,910 | | 32 | 6,020 | | | | |
| 24 | | | | | | | | |
| 25 | | | | | | | | |
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| 61 | | | | | | | | |
| | 66,910 | 0.699 | 736 | 121,680 | 870 | 95,700 | | |

AR000011898/5

TO: Mr. John Miles April 2. 1989

SUBJECT: MBC Production Summary FROM: K. J. Howard

CC: Mr. R. Fairchild
Mr. T. Lodice
Mr. C. Parker
Mr. J. Porter
Mr. N. Robbins
Mr. G. Satterfield

After reconciling all of the batch sheets, inventory sheets, and other reports, here is my summary of MBC production completed on 3/6/89.

MBC produced was 247,770 pounds corrected for tare weight of the bags.

MCC used was 833,160 pounds (as weighed by R-N101 weigh scales)

OPD used was 164,380 pounds (as weighed by R-N101 weigh scales)

HCl used was 325,620 pounds (as weighed by R-N101 weigh scales)

NaOH used was 2450 pounds (as weighed by R-N102 weigh scales)

Waste water produced was 2,106,780 pounds (as weighed by R-N102)

I cannot account for all of the wastewater produced. However, I can account for a large majority of the total as follows:

| | | | |
|---|---|---|---|
| (1) | Total MCC + OPD + HCl + NaOH - MBC | = | 1,077,840 pounds |
| (2) | Filtercake wash water @ 1/3 of (1 + MBC) | = | 441,870 |
| (3) | Water flush from R-1 to R-3 365#/batch | = | 20,400 |
| (4) | Water flush R-3 & Filter 300#/batch | = | 16,800 |
| (5) | Rinse R-1, R-3, V-N104, Filter, & Dryers | = | 110,000 |
| (6) | Scrubber (may not be empty) | = | 107,000 |
| (7) | MCC drum rinse (not part of R-2 wt) 1736 drums @ 15#/drum @ 3 rinses/drum | = | 78,000 |
| (8) | Wash dryer for repairs (should be ours?) | = | 25,000 |
| | Total accounted | | 1,876,910 pounds |

More than likely a considerable portion of the remainder is due to washing the warehouse floor because of the sloppiness of the early operation before the ratio of MCC to OPD was corrected by the customer.

As you know, the operation was difficult until it was recognized that the quality of the MCC was so unreliable and unknown. We must have a method of analyzing for the quality of MCC for this operation to be optimized. Crystallization as well as raw material usages appeared to be almost completely controlled by the MCC quality and probably its concentration. The product color was adversly affected by the smallest trace of air, and also the ratio with MCC which gets back to the MCC bugaboo again. The production rate was terrible for several reasons, chiefly percent moisture from the filter which gets back to the MCC again, mechanical problems with a dryer, and OPD delivery problems.

**CEDAR INTERNAL CORRESPONDENCE**

DATE: May 29, 1990

TO: Joe Forthman

FROM: Tom Lodice

CC: Robert Ray
John Miles
Guinn Cantrell
Norman Rowan

SUBJECT: DuPont MBC

The following items in the P-10 unit need to be done in order to make the filtration and drying system operable. Please start working on these items and aim for completion by July 1.

1. Replace Busch pump for dryers.
2. Replace iris valves and outlets on both dryers.
3. Replace diaphragm pump on V-N601.
4. Replace Viking pump on V-N602.
5. Remove, inspect, and repair dust collectors.
6. Remove all rollers on the belt filter. Clean each roller and coat with epoxy. Inspect and lubricate all bearings. Reinstall all rollers.
7. Inspect the liquid ring vacuum pump.
8. Inspect all other pumps in the building.
9. Re-install 14.9 psig relief valves on V-N601, 602, and 603.
10. Re-install the sightglass on V-N603.
11. Re-install the sightglass on V-N607.
12. Replace the steam pressure regulator to D-N601.
13. Reconnect the piping from P-N605.
14. Clean out and paint the drum tub with Extend.
15. Locate and repair the Vanton Flexiliner pumps. Order new motors or parts to insure that they can be operated safely.

16. Check out the control panel in the dryer building to verify that all instruments and electrical components are operable.

17. Clean the filter (particularly the rubber belt) and operate it to verify that it is operating properly and the rubber belt is tracking correctly.

**CEDAR INTERNAL CORRESPONDENCE**

DATE: May 29, 1990

TO: Joe Forthman

FROM: Tom Lodice

CC: Robert Ray
John Miles
Guinn Cantrell
Norman Rowan

SUBJECT: DuPont MBC

The following items in the P-10 unit need to be done in order to make the filtration and drying system operable. Please start working on these items and aim for completion by July 1.

1. Replace Busch pump for dryers.
2. Replace iris valves and outlets on both dryers.
3. Replace diaphragm pump on V-N601.
4. Replace Viking pump on V-N602.
5. Remove, inspect, and repair dust collectors.
6. Remove all rollers on the belt filter. Clean each roller and coat with epoxy. Inspect and lubricate all bearings. Reinstall all rollers.
7. Inspect the liquid ring vacuum pump.
8. Inspect all other pumps in the building.
9. Re-install 14.9 psig relief valves on V-N601, 602, and 603.
10. Re-install the sightglass on V-N603.
11. Re-install the sightglass on V-N607.
12. Replace the steam pressure regulator to D-N601.
13. Reconnect the piping from P-N605.
14. Clean out and paint the drum tub with Extend.
15. Locate and repair the Vanton Flexiliner pumps. Order new motors or parts to insure that they can be operated safely.

16. Check out the control panel in the dryer building to verify that all instruments and electrical components are operable.

17. Clean the filter (particularly the rubber belt) and operate it to verify that it is operating properly and the rubber belt is tracking correctly.

**CEDAR INTERNAL CORRESPONDENCE**

DATE: June 10, 1990

TO: Joe Forthman

FROM: Tom Lodice

CC: Robert Ray
John Miles
Guinn Cantrell
Norman Rowan

SUBJECT: DuPont MBC

The following items in the P-10 unit need to be done in order make MBC. We had a good start last month, but work has slowed down in the past couple of weeks. The filter itself should be the top priority so that we can assure ourselves that it is still operable after being idle for 1 1/2 years. Please continue working on these items and aim for completion by August 1. There are some items in the process unit that can't be done until we shut down, but we must be ready to do the work and have all materials on hand.

R-N101

1. Reconnect OPD truck unloading piping to R-N101. Reconnect and test the tracing and insulation.

2. Repipe 4" TFE circulation line through exchanger. Verify that cooling water is connected to exchanger with control valve. Verify that control valve is connected to controller.

3. Install pH loop and pH probes, 2 controllers, and flow meter.

4. Connect 1 1/2" TFE HCl piping to top of R-N101 through control valve. Blind HCl piping going to R-N102.

5. Reconnect piping from R-N101 to R-N103.

R-N104

6. Install 2" SS piping from R-N104 to R-N101. Trace and insulate.

7. Install 1 1/2" SS drum charge line from slab area to R-N104. Trace and insulate.

8. Replace R-N104 agitator.

9. Connect vacuum piping to R-N104.

R-N103

10. Reconnect R-N103 slurry piping.

11. Replace the two 1 1/2" SS air actuated valves on the R-N103 slurry piping. Connect both vavles to an air switch so they work opposite to each other.

WAREHOUSE

12. Replace iris valves and outlets on both dryers.

13. Remove, inspect, and repair dust collectors.

14. Remove all rollers on the belt filter. Clean each roller and coat with epoxy. Inspect and lubricate all bearings. Reinstall all rollers.

15. Operate the liquid ring vacuum pump.

16. Re-install 14.9 psig relief valves on V-N601, 602, and 603.

17. Re-install the sightglass on V-N603.

18. Re-install the sightglass on V-N607.

19. Replace the steam pressure regulator to D-N601.

20. Reconnect the piping from P-N605.

21. Check out the control panel in the dryer building to verify that all instruments and electrical components are operable.

22. Clean the filter (particularly the rubber belt) and operate it to verify that it is operating properly and the rubber belt is tracking correctly.

23. Clean and repair all 3 belt conveyors.

24. Build 2 overflow weirs for belt filter.

# COMMUNICATION CONFIRMATION REPORT

CEDAR CHEMICAL CORP 07-13-90 11:47 AM

INPUT TIME : 11:45 AM
TYPE : FILE
START TIME IMMEDIATE
FILE NO. : F01 (01 PAGE)

| NO. | TEL NO. | PASSWORD | RESULT | NO. | TEL NO. | PASSWORD | RESULT |
|---|---|---|---|---|---|---|---|
| 001 | 19017614854 | | GOOD | | | | |

CEDAR CHEMICAL CORPORATION
P.O. Box 2749, Hwy. 242 S.
West Helena, AR 72390
(501) 572-3701
Fax. No. (501) 572-3795

TO: Craig Keese

FROM: Neil Robbins

ATTENTION:

DATE: 7-18-90

FAX NO:

NO. OF PAGES: 2 + Covers

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MESSAGE

WEST HELENA PLANT
YEAR END PROJECTED STATEMENT OF INCOME
AS OF 6/30/90

| PRODUCT | | (With Strel) Y - T - D 1991 Est QTY | Unit Price | Total | % | (Without Strel) Y - T - D 1991 Est QTY | Unit Price | Total | % |
|---|---|---|---|---|---|---|---|---|---|
| PROPANIL - NET SALES | | | | | | | | | |
| 3lb | gls | 350.0 | 8.60 | 3.010 | | 350.0 | 8.60 | 3.010 | |
| 4lb | gls | 450.0 | 13.00 | 5.850 | | 450.0 | 13.00 | 5.850 | |
| Tech | lbs | | | | | | | | |
| Flaked T | lbs | 1.000.0 | 2.00 | 2.000 | | 1.000.0 | 2.00 | 2.000 | |
| Wham | gls | 150 0 | 13.00 | 1.950 | | 150.0 | 13.00 | 1.950 | |
| DCA | lbs | 2.000.0 | 1.60 | 3.200 | | 2.000.0 | 1.60 | 3.200 | |
| 60 df | lbs | | | | | | | | |
| 50 wdg | lbs | 750.0 | 1.95 | 1.463 | | 750.0 | 1.95 | 1.463 | |
| Strel | gls | 325.0 | 11.05 | 3.591 | | | | | |
| TOTAL NET SALES - PROPANIL | | | | 21.064 | 100.0% | | | 17.473 | 100.0% |
| COST OF SALES | | | | 17.524 | 83.2% | | | 14.208 | 81.3% |
| GROSS MARGIN | | | | 3.540 | 16.8% | | | 3.265 | 18.7% |
| BUTOXONE - NET SALES | | | | | | | | | |
| Butox - este | gls | 20.0 | 22.00 | 440 | | 20.0 | 22.00 | 440 | |
| Butox 175 | gls | 100.0 | 16.10 | 1.610 | | 100.0 | 16.10 | 1.610 | |
| Butox 200 | gls | 20.0 | 17.50 | 350 | | 20.0 | 17.50 | 350 | |
| TOTAL NET SALES - BUTOXONE | | | | 2.400 | 100.0% | | | 2.400 | 100.0% |
| COST OF SALES | | | | 1.938 | 80.8% | | | 1.938 | 80.8% |
| GROSS MARGIN - BUTOXONE | | | | 462 | 19.3% | | | 462 | 19.3% |
| CONTRACT MFG - NET SALES | | | | | | | | | |
| ICI | | | | | | | | | |
| B F Goodrich | | | | 400 | | | | 400 | |
| Dupont cnt | | | | 500 | | | | 500 | |
| Orfom | | | | 240 | | | | 240 | |
| MTPO | | | | 1.000 | | | | 1.000 | |
| Grace | | | | 2.950 | | | | 2.950 | |
| Sectagon II | | | | 500 | | | | 500 | |
| MES | | | | 375 | | | | 375 | |
| Dupont MBC | | | | 810 | | | | 810 | |
| XYZ | | | | 1.400 | | | | 1.400 | |
| Other | | | | | | | | | |
| TOTAL NET SALES - CONTR | | | | 8.175 | 100.0% | | | 8.175 | 100.0% |
| COST OF SALES-CONTRACTS | | | | 5.712 | 69.9% | | | 5.712 | 69.9% |
| IDLE PLANT COST | | | | | 0.0% | | | | 0.0% |
| TOTAL | | | | 5.712 | 69.9% | | | 5.712 | 69.9% |
| GROSS MARGIN | | | | 2.463 | 30.1% | | | 2.463 | 30.1% |
| Environmental Cost | | | | 300 | | | | 300 | |

c 10.51 STD EFFECT
c 10.20 Syn

| | Y - T - D 1991 Est TOTAL | | Y - T - D 1991 Est TOTAL | |
|---|---|---|---|---|
| TOTAL NET SALES - W. H. | 31.639 | 100.0% | 28.048 | 100.0% |
| TOTAL W. H. COST OF SALES | 25.474 | 80.5% | 22.158 | 79.0% |
| GROSS MARGIN | 6.165 | 19.5% | 5.890 | 21.0% |
| Gen & Admin Expenses | 1.450 | 4.6% | 1.450 | 5.2% |
| Depr/Amort ( In C.O.S ) | | | | |
| Interest | 1.245 | 3.9% | 1.245 | 4.4% |
| Total Epenses | 2.695 | 8.5% | 2.695 | 9.6% |
| INCOME BEFORE TAX | 3.470 | 11.0% | 3.195 | 11.4% |



AR000006505614

CC: Tom
Charlie
Neil

**CEDAR INTERNAL CORRESPONDENCE**

DATE: 8/9/90

TO: File

FROM: Geoffrey L. Pratt

CC: Randal Tomblin
Bill Eissler
John Miles
Niven Morgan, Jr.

SUBJECT: DuPont Meeting
July 25, 1990
Ted Kirchner

Bill Eissler and I met with Ted Kirchner regarding the upcoming MBC campaign. The following items were discussed:

1. We will receive 462,000 pounds of MCC from Belle's inventory and 151,000 pounds from DuPont's Brazilian location. This will give a total of 613,000 pounds of MCC which should convert to 800,000 of MBC.

2. We discussed the fact that the Brazilian material may be difficult to handle since it had been in inventory for several years. Ted indicated that if we had problems with it, we should discuss them with him at the time to determine, if adjustments to fees were required. He did not feel that the MCC degrades in storage but that it may be difficult to remove from the drums.

3. In a conference call with Art Sepcie, we discussed the projected start up date. DuPont is under the impression that August 20th is our target date. We indicated that a date in early September was more likely. Ted requested that we stay in constant touch on the scheduling of start up because supplies of OPD need to be appropriately scheduled.

4. We had heard earlier that the supply of OPD was restricted to one truckload every ten days which would have restricted Cedar's output to 6,000 pounds a day of MBC. Both Art and Ted indicated that OPD supply is no longer a problem and as long as we adequately inform DuPont of our needs they can keep pace with our production. Some discussions between Art and Tom Lodice regarding storage facilities for OPD have occurred and we should obtain an estimate for any plant modification costs required for this exercise so that it can be presented to DuPont for approval before we proceed with the changes.

5. I presented Ted with my letter of July 25, 1990, dealing with a standby fee of $8,000 per day, if delays in production are caused by DuPont's failure to provide raw materials or other necessary services. Ted has agreed to this and will incorporate it in a new contract to cover the period from August, 1990 to August, 1991.

6. It is DuPont's intention to supply all raw materials including muriatic and caustic. They will issue blanket orders against which we can release.

7. DuPont would like a copy of the daily production computer report sent to Art Sepcie on a weekly basis.

8. Ted indicated that there would be no repeat of the MBC production in future years. This run is intended to use up excess supplies of MCC as a strategic reserve for their Benomyl program. DuPont is studying the possibility of a long range toll contract on Benomyl because other products at Belle are beginning to crowd out Benomyl production. This contract would probably contain a percentage of DuPont's Benomyl production for each year. We indicated to Ted that although currently we produce only MBC and the final butyl isocyanate reaction is carried out at Great Lakes Chemical, it might be to his advantage to have Cedar conduct both operations, since the addition of the isocyanate reaction would not proportionately increase the tolling fee.

9. We asked Ted if DuPont had any new toll projects we could consider, any custom manufacturing opportunities, or any licensing opportunities. He indicated that they have an insecticide which is probably too small in volume for their long range plans which may be available for purchase and that a decision probably would be made by year end. He also indicated that the intermediate that we had looked to make for their herbicide Harmony is no longer of interest to DuPont since they are purchasing Harmony from the outside.

Geoffrey L. Pratt

mc

CC: Tom
Charlie
Neil

**CEDAR INTERNAL CORRESPONDENCE**

DATE: 8/9/90

TO: File

FROM: Geoffrey L. Pratt

CC: Randal Tomblin
Bill Eissler
John Miles✓
Niven Morgan, Jr.

SUBJECT: DuPont Meeting
July 25, 1990
Bob Blackhall

Bill Eissler and I met with Bob Blackhall, Elaine Donald and Paul Smith regarding the upcoming CNT Project. The following items were discussed:

1. DuPont was overly optimistic in forecasting CNT needs this year and will reduce the current projected run from three rail cars of PNT to two. They will also delay their projected October run into December. We indicated the reduction for the current run would pose no problems to us except the price would have to be adjusted and that we were currently committed through the end of the year to produce MBC. However, we did indicate that if their need became desperate, we may be able to negotiate a gap in the MBC production, otherwise, the next projected opening for CNT would be February, 1991.

2. We discussed product pricing and agreed that the simplest way to handle this next year's production would be to bill DuPont automatically for a $30,000 plant preparation and clean up fee, plus a fixed fee per pound of CNT based upon a $10,000 per day processing fee divided by the productivity target of 21,277 pounds per day presented in my letters of May 4, 1990 and July 9, 1990. This pricing formula would apply for all quantities down to a minimum of two cars of PNT (approximately 250,000 pounds).

3. Cedar should continue to supply chlorine to the project and bill DuPont for any caustic used in the scrubbing system.

4. DuPont would like copies of Certificates of Analyses on each lot in a product rail car, sent to them at the time the car is shipped. The COA should be faxed to Paul Smith at 609/540-3177 and the second copy should be faxed to 609/540-4498.

5. Cedar should continue to fax the records of car weights and receiving reports as they have in the past.

6. DuPont is interested in a long term contract on CNT and Bob Blackhall will develop a formula to adjust our fees due to inflation. They rejected the formula which we had proposed. The major issue is that our formula inflates our profit as our costs

rise. We indicated that we felt that this was very reasonable and would probably insist that a formula do that.

7. We asked if DuPont had additional projects for consideration and Elaine mentioned two:

A. Nitration of Ethyl Hexyl Alcohol - this nitrated product is a Cetane enhancer and the market for this product is expected to grow rapidly due to EPA pressure on the gasoline refiners. DuPont got out of this business on a make or buy decision and has since regretted this since their supplier, Ethyl, is very inflexible in pricing. They would be interested in a long term contract for us to produce the material and would provide us with their technology which they say removes much of the hazard associated with nitrating alcohols of this kind. There have been some serious accidents in the production of this material and we looked at the product several years ago under a development program with Mobil. Both Cedar and Mobil agreed to terminate the project, when Mobil's technology could not produce a process that both companies felt was safe. We will have to review DuPont's process very carefully to make sure that their claims on safety are justified. They did manufacture the product for many years with no accidents. DuPont expects this product to increase rapidly into the 10 to 12 million pounds plus demand per year.

B. Elaine also mentioned a project which again could have requirements in the millions of pounds perhaps beginning at approximatley three quarters of a million pounds for a poly isobutylene amine. DuPont does not have know how for this process and Elaine described it from literature sources as a reaction between poly isobutylene and chlorine in a solvent with subsequent amination using different amines which she described as DMAPA, or DEAT. DuPont has conducted a preliminary literature search on this process and will provide us with this information to determine our further interest. This would be a custom chemical project since the technology would belong to Cedar.

Geoffrey L. Pratt

mc

**CEDAR INTERNAL CORRESPONDENCE**

DATE: September 14, 1990

TO: Joe Forthman

FROM: Tom Lodice

CC: Robert Ray
John Miles
Guinn Cantrell
Norman Rowan

SUBJECT: DuPont MBC

I did a quick walk-through of the DuPont unit and came up with the following list of items which still need to be done by September 26. The first truck of OPD will be here on October 1 and the unit will be operating by October 3. Norman and myself will be able to help with some of the details on the filter system as needed. It appears that another massive effort is going to be required to be done in time.

I. WAREHOUSE
- A. Reinstall Busch vacuum pump.
- B. Install both vacuum controllers.
- C. Install dust collectors (cages to ship 9/18).
- D. Repair/replace butterfly valves on both dust collectors.
- E. Repair/replace iris valves & chutes under both dryers.
- F. Remove all spray nozzles & piping on top of filter.
- G. Install & pipe 2 new feed troughs on filter.
- H. Install filter belt (belt to ship on 9/14).
- I. Re-install 14.9 psig relief valves on V-N601, 602, & 603.
- J. Pipe P-N601 to R-N102 & T-N206.
- K. Pipe P-N602 to first feed trough.
- L. Pipe P-N603 to second feed trough.
- M. Electrical & Instrumentation
    1. Dust Collectors
    2. Vacuum Pumps
    3. Pumps
    4. Vent Blower

II. UNIT
- A. Inspect/repair steam tracing on 2" OPD line to R-N101.
- B. Repair/replace steam press reg to OPD truck.
- C. Pipe HCl to R-N101 through existing control valve.
- D. Replace cooling water control valve to R-N101 exchanger.
- E. Repipe 4" TFE circulation line on R-N101.
- F. Reinstall 1" Kynar pH loop on R-N101 circ. loop.
- G. Repair 2" transfer line from R-N101 to R-N103, especially

hoses.

H. Install 1 1/2" SS steam traced line to top of R-N104 to charge MCC drums.
I. Connect R-N104 to vacuum system.
J. Install 2" SS steam traced line from R-N104 to top of R-N101.
K. Pipe up Vanton slurry pump on R-N103.
L. Reinstall 2 - 1 1/2" SS air actuated valves on R-N103 slurry piping.
M. Electrical & Instrumentation
    1. HCl control valve to R-N101 (pH control)
    2. pH transmitters and controllers
    3. R-N101 absolute pressure and alarm
    4. Air-actuated valve on OPD charge to R-N101.
    5. R-N101 cooling water control valve.

**CEDAR INTERNAL CORRESPONDENCE**

DATE: 9/28/90

TO: Neil Robbins

FROM: Geoffrey Pratt

CC: J. Miles
B. Eissler

SUBJECT: du Pont MBC Campaign

Following our discussion on the billing procedure for this project, I discussed the billing with Ted Kirchner at du Pont. In view of the length of the run, which if it proceeds according to plan will be roughly four months in length, it is not appropriate to wait until the end of the project to bill du Pont. Accordingly, would you arrange to bill them for the first part of the campaign on November 21, 1990. This invoice will cover production days in October and part of November. The production cut off date can be whatever is convenient to your record keeping and the invoicing could be delayed beyond November 21, if this fits in with your billing procedures. Following the initial invoice, the rest of the campaign should be billed at approximately equal monthly periods but the exact billing date is not critical.

All invoices should be sent to Ted Kirchner, Contract Manager, E. I. du Pont de Nemours & Company, Inc., Agricultural Products Department, Walker's Mill, Building 6-212, Wilmington, DE 19898. Please let me know, if this billing procedure presents a problem or if clarification is needed.

mc

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

August 15, 1990

Mr. Robert A. Blackhall
E. I. du Pont de Nemours & Company
Materials & Logistics Department
P. O. Box 80015, BMP-15-1284
Wilmington, DE 19898

Dear Bob: NOT WITH MY COPY

Attached is a signed contract order for the production of MBC from MCC which has been signed on behalf of Cedar Chemical.

We took the liberty of making some changes in the Contract Order and in the attached General Conditions on the theory that if you had no objections to these changes, it would speed the process of reaching the contract. Some of the proposed changes are self-explanatory but the proposed change in specifications to "best efforts" and deletion of item 26 on the General Conditions needs explanation. Cedar has concern regarding warranting the specifications for the MBC in view of the variability, source, and age of the MCC salt. We reviewed the results from the last MBC campaign and found that we met or exceeded the specifications for most of the batches produced, particularly in the later stages of the campaign. In this current campaign, Cedar will with the aid of du Pont's technical staff, be adjusting the process in the early stages in an effort to improve productivity and product consistency. The use of best efforts for specifications rather than a warranty appears to be more appropriate under these circumstances.

Please let me know, if these changes need to be discussed rurther.

Sincerely,

Geoffrey L. Pratt
Director Operations
Custom Manufacturing

mc

Enclosure

cc: Ted Kirchner
bcc: W. Eissler
J. Miles
C. Parker
T. Lodice
[redacted]
A. Malone

TO: T. Lodice
J. Miles
J. Walker
B. Oberle
R. Fairchild
N. Robbins
C. Parker
G. Pearce
L. Duncan
D. Williams
G. Satterfield
J. Porter

CEDAR CHEMICAL

FROM: Art Sepcie ( typed from hand written note dated 10/6/90)

A) Raw Materials

CP Keep in touch with John Madron about OPD, (609-540-3483). C. Parker to order or release OPD, MCC, HCL, 41 gal drums, and 48 x 48 pallets, as needed.

NR Invoice DuPont for pallets purchased by Cedar, attach copy of back-up invoice.

NR Caustic is small-bill at end of campaign.

CP C. Parker has drum labels.

B) Waste Disposal

CP 5 railcars located - C. Hubach to have moved to Cedar and give C. Parker T/C numbers.

JP/GS Cedar to attempt disposal in their waste ponds. Advise A. Sepcie of cost.

A. Sepcie to advise Cedar of waste water sample that will need to be sent to Chambers Works, if they can handle the waste.

R. Smith to advise A. Sepcie if Belle might except some of the waste.

C) Finished Product

Bud FAX a daily production report to C. Hubach (713)470-319.

JW/DW Product to be filled initially into supersacks then transfer to 50 kg (110 lb.) drums. Install wire and seal on drum closure.

4 changes 10/9 CP

DW Stack ~~5~~ drums per pallet and band drums together. Stack pallets 2 high for shipping.

Lot or batch numbers must be on all drums listed as:

V10690-001A or B

location month day year lot #

DW Drum weight, if not printed on label, needs to be put on each label.

DW No product or dust can be on outside of product drum shipped.

CP C. Parker to contact C. Hubach for orders to ship truck of product. Most likely will send to "Total Distribution Warehouse", Charleston, W. Va.

BC If no production is made in a day, please note reason on production report that is Faxed to C. Hubach.

GS Send a 4 oz. sample of each batch to Ron Smith at Belle Plant. Send next day delivery, twice/week. Address:

Ron Smith
901 West DuPont Ave.
Belle, W. Va. 25015

D) MBC Process

Conditions noted in SOP must be followed.

ALC 15,200 lbs of MCC salt and 3000 lbs. OPD give an 17.3% molar excess. Tests have shown 10%-15% molar excess is sufficient and should be the goal if the first couple of batches prove good.

Cont'd

cc John Miles

cc: Charlie
Tom
Neil

606-LC REV 11/87

E. I. DU PONT DE NEMOURS & COMPANY INCORPORATED
WILMINGTON, DELAWARE 19898

CONTRACT

| November 30,1988 | LOAB-84563 | | 1 |
|---|---|---|---|
| DATE | CONTRACT ORDER NO. | ALT. NO. | PAGE NO. |

E. I. DU PONT DE NEMOURS & COMPANY

Cedar Chemical Corporation
24th Floor, 5100 Poplar Avenue
Memphis, TN 38137

DIRECT ALL ENCLOSURES

| WILMINGTON, DELAWARE | 053 |
|---|---|
| ISSUING POINT | LOCATION CODE |
| R. A. WALSH | 048 |
| ISSUED BY | BUYER CODE |

This document, when properly exectued, shall constitute an Agreement between E. I. DU PONT DE NEMOURS AND COMPANY (DU PONT) and CEDAR CHEMICAL CORPORATION (CEDAR).

SERVICES: To cover the cost of toll manufacturing MBC from DU PONT-supplied MCC salt per the instructions in the Contractor's Manual supplied to CEDAR at an earlier date and made a part hereof by reference.

PERIOD OF AGREEMENT: December 1, 1988 through March 31, 1989. The campaign is expected to be complete by early February.

QUANTITIES: Not to exceed 780,000 lbs. of MBC. Exact quantity will be agreed upon by both parties.

SPECIFICATIONS: See Contractor's Manual.

COMPENSATION: As described in the letter from CEDAR'S Geoffrey L. Pratt to DU PONT'S Ted Kirchner, dated November 11, 1988, attached hereto and made a part hereof.

TERMS AND CONDITIONS: DU PONT'S General Conditions (for) Off-Plant Services, EM-6685, as revised 1/86 and as modified, are attached hereto and made a part hereof.

CONTRACT ADMINISTRATOR: D. H. Claudio

CONTRACT COORDINATOR: P. D. Lewis

INVOICES: Invoices should be mailed to:

E. I. du Pont de Nemours and Company
901 West Du Pont Avenue
Belle, WV 25015
Attn: P. D. Lewis

G-506-1A 5/87

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

# CONTRACT ORDER

November 30, 1988 (DATE) | LOAB-84563 (CONTRACT ORDER NO.) | ALT. NO. | 2 (PAGE NO.)

E. I. DU PONT DE NEMOURS & COMPANY

Cedar Chemical Corporation
24th Floor, 5100 Poplar Avenue
Memphis, TN 38137

DIRECT ALL ENQUIRIES

WILMINGTON, DELAWARE (ISSUING POINT) 053 (LOCATION CODE)

R. A. WALSH (ISSUED BY) 048 (BUYER CODE)

ENTIRETY: This document, and the documents specifically referred to herein, embody the entire Agreement, and there are no agreements, understandings, conditions, warranties or representations, oral or written, express or implied, with reference to the subject matter hereof which are not merged herein. No modifications hereof shall be of any force or effect unless in writing and signed by both parties.

Please signify your acceptance of the above by signing in the space provided below and returning the carbon copy to R. A. Walsh, E. I. du Pont de Nemours and Company, Materials and Logistics Department, Wilmington, Delaware 19898.

CEDAR CHEMICAL CORPORATION

BY: Geoffrey L. Pate

TITLE: Director Custom Manufacturing

DATE: December 16, 1988

E. I. DU PONT DE NEMOURS AND COMPANY

BY: C. F. DesJardins

TITLE: C. F. DES JARDINS, DIRECTOR CHEMICALS, ENERGY, & TRADING

DATE: December 14, 1988

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

November 11, 1988

Mr. Ted Kirchner
Contract Manager
E.I. DuPont De Nemours & Co.
Walkers Mill, Barley Mill Plaza
Wilmington, Delaware 19898

Dear Ted,

This is to confirm our conversation of November 10, regarding the production by Cedar of 600,000 to 800,000 lbs of MBC commencing in December, 1988. Cedar proposes the following terms for the production:

1) That a plant modification fee not to exceed $50,000 be paid by DuPont amortized over the quantity of MBC to be produced. The modifications are expected to include the installation of a recirculation loop with temperature and pH control, facilities to melt solid MCC in drums, a jacketed OPD charge line, conversion of a reactor vent line from stainless steel to fiberglass, and a hydrochloric acid feed system. These items have been recommended by DuPont's production staff based on their prior commercial experience.

2) DuPont will provide all raw materials which will be delivered to Cedar's West Helena plant.

3) The basis for waste disposal will be to return the material to DuPont's Belle, West Virginia plant with DuPont bearing the cost associated with the freight and disposal. Cedar will make every effort to dispose of aqueous waste through it's biological system as soon as possible after start-up. This may occur when sufficient material can be collected for characterization and verification that the waste is suitable for treatment in Cedar's nonhazardous biological treatment system. The fee for this service, to include materials required for the treatment, will be developed after completion of the waste evaluation work.

4) The fee for processing the MBC will be $9,000 per day for a trial period intended to establish that the plant as modified can produce specification product, with raw

material consumption, waste generation, and productivity levels acceptable to both parties. The daily fee would be assessed only after Cedar's plant is ready for the injection of chemicals and only when the plant is in working condition. There will be a $100,000 minimum fee should the project be declared nonfeasible during this trial period or subsequent standard production period.

5) Following mutual agreement that the trial period is over, Cedar would proceed on a fixed cost per unit of production. This cost is to be determined by dividing the number of days in a given month times $8,000 per day by the number of pounds produced in that month. The average daily production rate is estimated to be 10,000 lbs. per day by Cedar and 17,000 lbs. per day by DuPont and thus the unit cost is expected to be in the range of $.47 to $.80 per pound.

6) Nitrogen is considered to be a raw material and will be metered to the reaction equipment. It will be charged to DuPont at Cedar's costs plus 5%.

Subject to rapid agreement on this proposal, Cedar would target to begin production of MBC on or around December 1, 1988. This rapid schedule would require appropiate support from DuPont's technical staff to confirm the plant modifications required and identify the appropiate operating, safety, and environmental procedures required. It is assumed that DuPont's technical staff will be present during the trial period.

I believe that this covers the major items that we discussed yesterday, but if additional issues need to be addressed, please call. We have located the major items necessary to modify the plant and are ready to begin the modifications immediately.

We hope that these terms are acceptable to you. Thank you for giving us the opportunity to bid on this project.

Sincerely,

Geoffrey L. Pratt
Director of Operations/
Custom Manufacturing

/kt

EM-6685 Rev. 1/96

# GENERAL CONDITIONS
# OFF-PLANT SERVICE
# E. I. DU PONT DE NEMOURS AND COMPANY
## (INCORPORATED)

### ASSIGNMENT AND SUBCONTRACTING

The rights and obligations covered herein shall not be assignable by either party in whole or in part, nor shall either party subcontract any of its obligations hereunder without the prior written consent of the other party.

### NONDISCRIMINATION

CONTRACTOR warrants that it has complied with all applicable laws, rules, orders and regulations of governmental authority covering the production, sale and delivery of the materials or services specified herein, including, but not limited to, Executive Order 11246, and the rules and regulations promulgated thereunder, the Rehabilitation Act of 1973 and the Vietnam Era Veterans Readjustment Act of 1974. Further, CONTRACTOR warrants that in the performance of the services hereunder, it will comply with all applicable provisions of the Fair Labor Standards Act of 1938, as amended.

### FORCE MAJEURE

Except to the extent otherwise provided herein, no liability shall result to either party from delay in performance or from nonperformance caused by circumstances beyond the control of the party affected, including but not limited to acts of God, fire, flood, explosion, war, action or request of governmental authority, accident, labor trouble or shortage, inability to obtain material, power, equipment or transportation, but each of the parties hereto shall be diligent in attempting to remove such cause or causes and shall promptly notify the other party of its extent and probable duration.

Services affected hereunder may be eliminated from this Agreement without liability, but the Agreement shall remain otherwise unaffected. In the event of inability for any reason to supply the total demands for the service or product specified herein, CONTRACTOR shall allocate its available supply among any or all purchasers, as well as departments and divisions of CONTRACTOR, on such a basis as is fair and practical, without liability for any failure of performance which may result therefrom.

If the party suffering the Force Majeure is unable to remove the cause or causes within seven (7) days, the other party hereto shall have the right to terminate, without penalty, this entire Agreement or any portion thereof caused by the Force Majeure event.

### TERMINATION

If CONTRACTOR should refuse or fail to supply sufficient quantity of properly skilled personnel, or if it should fail to make prompt payment to subcontractors for labor and materials used hereunder, or it should disregard or be in violation of any laws, ordinances or governmental regulations, or should it otherwise violate any of the provisions of this Agreement, or if DU PONT, hereunder in good faith, determines that personnel, materials, products or equipment as required hereunder are being used in an unsafe manner or in any way such that DU PONT'S title thereto is in jeopardy, or that CONTRACTOR'S credit or financial position is impaired, then DU PONT may, without prejudice to any other right or remedy, terminate or suspend this Agreement without liability on written notice.* Termination under this provision or under any other provision of this Agreement shall not relieve or release either party hereto from any rights, liabilities or obligations which it has accrued prior to the date of such termination.

### DEFAULT

In the event that either party hereto shall default in the substantial performance of any material obligation specified herein, the nondefaulting party shall notify the other party hereof in writing and, if such default is not remedied within fifteen (15) days from date of such notice, then the nondefaulting party shall have the right to terminate this Agreement immediately. If, in DU PONT'S sole opinion, such default may result in substantial property damage, injury, accident or death, DU PONT may, at any time, immediately suspend this Agreement without penalty or damages. Termination under this provision or under any other provision of this Agreement shall not relieve or release either party hereto from any rights, liabilities or obligations which it has accrued prior to the date of such termination.

*The foregoing notwithstanding, it is agreed that such notice shall specify with reasonable particularity the event or circumstances on which such notice is based. If such event or circumstances shall have been cured or corrected within fifteen (15) days following receipt of such notice, suspension or termination shall be deemed of no force or effect.

**CONTAMINATION AND RESPONSIBILITY**

CONTRACTOR shall take all steps necessary to prevent the contamination of DU PONT'S material or product with foreign substances. CONTRACTOR shall perform services in accordance with DU PONT specifications, and shall bear the cost of handling, reworking or replacing any material or product failing to meet specifications hereunder as the result of CONTRACTOR'S acts or omissions.

**LOSS AND DAMAGE/TITLE**

CONTRACTOR assumes full responsibility and liability for the safe handling and safekeeping of any material or product which DU PONT may deliver or cause to be delivered to CONTRACTOR while such material is in CONTRACTOR'S care, custody and control. Unless otherwise specified, title to such material shall remain with DU PONT. Except as may otherwise be set forth in this Agreement, CONTRACTOR shall reimburse DU PONT for the replacement value of any such material or product lost, damaged or destroyed while in CONTRACTOR'S possession, whether or not caused by the negligence or willful misconduct of CONTRACTOR, its employees, agents or assigns.* CONTRACTOR shall segregate and placard such material and product indicating DU PONT'S ownership thereof. CONTRACTOR shall obtain prior written approval of DU PONT before moving any such material to a new location.

*unless such loss or damage shall have been caused by the negligence or willful misconduct of DU PONT, its employees, agents or assigns.

**INDEMNIFICATION**

CONTRACTOR shall fully indemnify DU PONT against all liability, loss and expense (including reasonable attorney's fees, settlements, judgments and costs) resulting from injury to or death of any person (including, without limitation, injury to or death of employees of CONTRACTOR or DU PONT) or loss of or damage to property (including, without limitation, damage to DU PONT'S or CONTRACTOR'S property) or the environment incurred by DU PONT ~~or a third party~~ and resulting in any way from any act or omission, negligent or otherwise, on the part of ~~DU PONT~~ CONTRACTOR, its agents, employees, subcontractors or assignees, in connection with the performance of this Agreement, except when such loss and expense are caused ~~solely~~ by the ~~willful misconduct or~~ negligence of DU PONT.

**INSURANCE**

CONTRACTOR shall carry and maintain in force at all times relevant hereto, at CONTRACTOR'S expense, insurance of the type and of minimum coverage limits as follows:

1. Worker's Compensation—Statutory with Employer's Liability—$100,000 per accident;
   - ~~This policy shall provide a waiver of subrogation against DU PONT.~~
2. Comprehensive General Liability, Bodily Injury and Property Damage including contractual liability to cover CONTRACTOR'S obligations under this Agreement in a combined single limit—$500,000 per occurrence;
   - This policy shall name DU PONT as an Additional Insured.
3. Comprehensive Automotive Liability, Bodily Injury and Property Damage in a combined single limit—$500,000 per accident;
   - If CONTRACTOR will not operate motor vehicles on DU PONT property or utilize such vehicles in connection with the work being performed hereunder, a letter so stating is acceptable in lieu of the automotive insurance certificate.

Certificates of insurance in a form acceptable to DU PONT, evidencing the coverages required above shall be filed with DU PONT in accordance with the *DOCUMENTS* provision herein prior to the furnishing of services under this Agreement. Such certificates shall provide that the insurer will give DU PONT not less than ten (10) days' advance notice of any changes in or cancellation of coverage. In the event any subcontractor is employed for the services covered in this Agreement, then the CONTRACTOR assumes full responsibility to ensure that the subcontractor's services are covered by the same insurance limits as set forth herein.

**INDEPENDENT CONTRACTOR**

It is understood that the employees, methods, facilities and equipment of CONTRACTOR shall at all times be under its exclusive direction and control. CONTRACTOR'S relationship to DU PONT shall be that of an independent contractor and nothing in this Agreement shall be construed to constitute CONTRACTOR or any of its employees or officers, as an employee, agent, joint venturer or partner of DU PONT.

**WASTE DISPOSAL**

CONTRACTOR agrees to furnish all required equipment and labor at no additional cost to DU PONT to remove and dispose of such quantities of waste as may be generated hereunder and which DU PONT elects not to have returned to it. CONTRACTOR shall not use, reuse, sell or otherwise dispose of any DU PONT material, processed

material not meeting specifications, or product for its account unless previously agreed to in writing by DU PONT'S Contract Administrator. Prior to the start of actual processing hereunder CONTRACTOR and DU PONT will agree in writing on the identity of any subcontractor, methods used and the location of sites to be used for waste disposal hereunder. CONTRACTOR will notify DU PONT and get the written approval of DU PONT'S Contract Administrator prior to changing any subcontractors, methods or location of waste disposal under this Agreement.

CONTRACTOR agrees that such waste will be transported and disposed of in such a manner* ~~as to prevent any waste from entering the environment as a pollutant. CONTRACTOR will exercise control necessary to prevent scavenging of the waste or access to containers containing such waste unless said access is authorized by DU PONT.~~

*as DU PONT shall approve.

**RECORDS AND INSPECTION**

CONTRACTOR agrees to maintain, in accordance with generally accepted accounting principles and practices, such records as may be necessary to adequately reflect the accuracy of CONTRACTOR'S charges and invoices for reimbursement under this Agreement and maintain such other additional records as DU PONT may from time to time reasonably require in connection with this Agreement. DU PONT shall have the right from time to time to inspect and verify the records kept by CONTRACTOR in connection with this Agreement. DU PONT'S duly authorized representatives shall have the right to visit, observe, and inspect CONTRACTOR'S production and related facilities utilized to accomplish the objectives of this Agreement at any time during CONTRACTOR'S normal business hours. DU PONT'S duly authorized representatives shall also have the right to select and inspect samples of material, material-in-process and product in CONTRACTOR'S facility pursuant to this Agreement and to reject product or CONTRACTOR-supplied material on the basis of the selected samples if DU PONT'S specifications are not met. DU PONT'S inspection or failure to exercise its right to test samples for compliance with DU PONT'S specifications shall not be deemed to establish that such material or product met DU PONT'S specifications.

**TAXES**

DU PONT agrees either to pay directly all property taxes, licenses, charges and assessments levied by any governmental authority upon the DU PONT-owned material, equipment and product hereunder, or to reimburse CONTRACTOR therefor if paid by CONTRACTOR at DU PONT'S written direction. CONTRACTOR assumes full responsibility for the payment of all federal and state taxes of whatever sort, social security and unemployment compensation taxes, withholding taxes, and all other taxes or charges applicable to CONTRACTOR'S actions, employees, facilities and materials for performing services hereunder or applicable to CONTRACTOR'S income hereunder.

**AUTHORITY**

The parties hereby represent that they have full power and authority to enter into and perform this Agreement and the parties know of no agreements, contracts, promises or undertakings which would prevent the full execution and performance of this Agreement.

**RESERVATION OF RIGHTS**

Either party's waiver of any of its remedies due to a breach by the other party shall be without prejudice and shall not operate to waive any other remedies which it shall have available to it, nor shall such waiver operate to waive its rights to any remedies due to a future breach, whether of a like or different character.

**HEADINGS**

The headings of the provisions of this Agreement are inserted for convenience only and shall not constitute a part hereof.

**NONDISCLOSURE**

CONTRACTOR will not disclose to others (a) the fact that DU PONT has purchased or plans to purchase services, articles, materials or product from CONTRACTOR or (b) any information or knowledge that may be gained or learned by CONTRACTOR about the business, products, employees or methods employed by DU PONT unless such disclosure is necessary to perform services hereunder or as required by law.

**COMPLIANCE WITH LAWS**

CONTRACTOR agrees that in the performance of the processing operations and other services provided hereunder, including but not limited to the disposal of any waste materials resulting from said operations, it will comply with all applicable laws, rules and regulations of governmental authority in connection therewith.

**APPLICABLE LAW**

The law of the State of Delaware shall govern the construction of this Agreement.

**SEVERABILITY**

In the event that any provision of this Agreement shall be found to be void or unenforceable, such findings shall not be construed to render any other provision of this Agreement either void or unenforceable, and all other provisions shall remain in full force and effect unless the provisions which are invalid or unenforceable shall substantially affect the rights or obligations granted to or undertaken by either party.

**CORPORATE IDENTITY**

In the event that CONTRACTOR'S invoice does not indicate that CONTRACTOR is an incorporated entity, by use of the words (or abbreviations) "Incorporated", "Corporation" or "P.C." as a part of CONTRACTOR'S company name, then CONTRACTOR shall display its tax identification number (TIN) on the invoice in lieu of such designations. Failure to furnish such information may result in withholding twenty percent (20%) of Agreement payments in accordance with IRS regulations.

**HAZARDS**

CONTRACTOR recognizes that hazards may be involved in performing the services described hereunder. The information supplied by DU PONT concerning processing or handling of Material and Product is the latest information known to DU PONT and relevant to the work to be performed hereunder. Such information is provided without warranty or representation as to its completeness or suitability in providing the services herein. The methods employed and the precautions taken to handle DU PONT-owned equipment, if any, Material and Product shall be determined by and rest solely with CONTRACTOR. CONTRACTOR agrees to provide its employees with a safe and healthy workplace using, but not limited to, such information as is or may be provided by DU PONT.

DU PONT shall have the right to immediately suspend this Agreement, without liability to CONTRACTOR, if at anytime DU PONT in its sole judgment determines that CONTRACTOR has violated any of the provisions of this Article. Further, if CONTRACTOR fails to correct any such violation within seven (7) days immediately following DU PONT'S notice to CONTRACTOR of the violation, DU PONT has the right to terminate this Agreement.

**SAFETY AND HEALTH**

CONTRACTOR shall conduct the operations hereunder in conformity with generally accepted safety practices. It is understood and agreed that CONTRACTOR shall be solely responsible for the safety of its operations, its employees and the public as it might be affected by CONTRACTOR'S operations, and CONTRACTOR acknowledges that its compliance with any safety recommendations made by DU PONT shall not, by itself, discharge CONTRACTOR from this sole responsibility.

DU PONT shall have the right to immediately suspend this Agreement, without liability to CONTRACTOR, if at anytime DU PONT in its sole judgment determines that CONTRACTOR has violated any of the provisions of this Article. Further, if CONTRACTOR fails to correct any such violation within ~~seven (7) days~~ *fifteen (15) days immediately following DU PONT'S notice to CONTRACTOR of the violation, DU PONT has the right to terminate this Agreement.

**WARRANTY**

CONTRACTOR warrants that the Product delivered hereunder will ~~(1) be free of defects in materials and workmanship, (2)~~ meet the specifications referred to herein ~~, and (3) comply with all applicable warranties implied in law~~. In the event that Product supplied by CONTRACTOR fails to meet any of the aforementioned warranties or are otherwise defective, CONTRACTOR shall, at DU PONT'S option, replace the defective Product or refund the purchase price including freight charges. ~~CONTRACTOR further agrees to reimburse DU PONT for all costs incurred in the recall of defective Product and for all expenditures made in the settlement of any claim against DU PONT relating to defective Product supplied by CONTRACTOR.~~ DU PONT shall notify CONTRACTOR promptly of any claim against DU PONT with respect to the Product supplied hereunder and shall provide CONTRACTOR and/or its insurance carrier with information needed for settlement or defense of such claims.

**SHIPMENTS**

Freight charges, excluding detention and demurrage charges for all Material or other items supplied by DU PONT under this Agreement, and for all Product produced hereunder by CONTRACTOR and shipped per DU PONT'S instructions, shall be for DU PONT'S account. Detention and demurrage charges on incoming shipments shall be borne by CONTRACTOR unless caused by DU PONT'S early or excessive delivery of Material. Shipments of Material or Product hereunder to third parties are to be made by CONTRACTOR upon written direction from DU PONT.

| NB c# | P/# | Batch No | # Waste Water | Cumulative # WW | |
|---|---|---|---|---|---|
| 2082 | 9.61 | 1 | 20,000 | 20,000 | |
| 3142 | 1.20 | 2 | 22,610 | 42610 | |
| 3674 | 5.44 | 3 | 20,000 | 62610 | |
| 3590 | 5.74 | 4 | 20,600 | 83210 | |
| 3169 | 5.05 | 5 | 16,000 | 99210 | |
| 4892 | 5.18 | 6 | 25,330 | 124,540 | |
| 2858 | 10.07 | 7 | 28,780 | 153,320 | |
| | | 8 | 17,000 | 170 320 | |
| | | 9 | 22,710 | 193 030 | |
| | | 10 | 22,580 | 215610 | |
| | | 11 | 22,840 | 238,450 | Approx 113,000 to R/C |
| | | 12 | 24.220 | 262,670 | |

9. What is bulk density of dryer feed? 40 lb/ft³ — RES 11-7

10. Look at charging spare rx with HCl versus running line — Cedar

11. Confirm that OPD trailers are available. Any special requirements. — RES
OK - bottom discharge @ rear: DuPont uses jkted pipe. They have problems w/ traced in cold weather

12. What are the waste loading numbers of untreated brine in terms of COD, $NH_3-N_2$, total $N_2$, BOD, pH call Joe Porter — RES 11-7

13. How bio degradable is it? call Joe Porter — RES 11-7

14. Check scrubber waste load that Cedar can expect. TOC 3 lb/day, Tot N <1 lb/day — RES 11-7

15. What does Cedar do with drums — RES 11-7

16. Can product go in super sacs? Any limit on dimensions? — RES 11-7

Untreated brine – main constituent is MCC which is not highly biodegradable based on COD/BOD ratio

| | | |
|---|---|---|
| COD | 40000 ppm | 3000 lb/day |
| $NH_3N$ | 12000 | 940 |
| Tot N | 21000 | 1725 |
| BOD | 5000 | 375 |

AG-303 REV. 2-86

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WALKER'S MILL, BARLEY MILL PLAZA
WILMINGTON, DELAWARE 19898

AGRICULTURAL PRODUCTS DEPARTMENT

CC: Tom
Neil
Charlie

November 16, 1988

Mr. Geoff Pratt
Cedar Chemical Corporation
5100 Poplar Avenue, 24th Floor
Memphis, Tennessee 38137

Dear Geoff:

We are pleased to award the manufacture of 600-800M pounds of MBC to Cedar's West Helena plant. We do this according to the proposal in your November 11, 1988 letter.

We look forward to a successful, safe start-up and to working again with the folks at Cedar and West Helena.

Sincerely,

T. N. Kirchner
Contract Manager

TNK/df678



AB0000119009/3

11-4-88
Cedar/DuPont meeting MBC

# Follow up items

1. Confirm capacity of Brazil dryer check dimensions, re bulk density & throughput — RES 11-7

2. Confirm that Cedar filter configuration is ~~S~~ will give same results as Belle, 316 stainless is Cedar's mat of constr. — RES 11-7

3. Transmit cloth spes on filter to RES 50μ polypropylene cloth. — Cedar

4. Check if R5 is large enough for one charge of MCC soln? — Cedar

5. R1 needs pH cell, loop and controller with interlock on low pH

6. Pressure indicator on R1, Belle has interlock on pressure.

7. External heat exchanger on R1, will 263 Φ ~~RES~~
Hastalloy ht exchanger be adequate? yes
16" diam x 16' long Do we need. yes

8. Agitation in R1 is standard retreat curve 120 rpm (high) 59 ~~25~~? (low)
Is this OK? — RES

9. What is bulk density of dryer feed? RES 11-7

10. Look at charging spare rx with HCl versus running line Cedar

11. Confirm that OPD trailers are available. Any special requirements. RES

12. What are the waste loading numbers of untreated brine in terms of COD, $NH_3-N_2$, total $N_2$, BOD, pH call Joe Porter RES 11-7

13. How bio degradable is it? call Joe Porter RES 11-7

14. Check scrubber waste load that Cedar can expect. RES 11-7

15. What does Cedar do with drums RES 11-7

16. Can product go in super sacs? Any limit on dimensions? RES 11-7

MBC PRODUCTION

| BATCH NO. | LBS. OPD | LBS. OPD / LB. MBC | DRUMS MCC | LBS. HCL | DRUMS MBC | LBS. MBC | REWORK DRUMS | REWORK LBS. |
|---|---|---|---|---|---|---|---|---|
| 1 | 3,000 | 1.049 | 32 | 2,960 | 26 | 2,860 | | |
| 2 | 2,920 | 0.737 | 32 | 4,250 | 36 | 3,960 | | |
| 3 | 2,900 | 0.775 | 32 | 6,020 | 34 | 3,740 | | |
| 4 | 3,000 | 0.557 | 32 | 6,160 | 49 | 5,390 | | |
| 5 | 2,900 | 0.694 | 32 | 6,020 | 38 | 4,180 | | |
| 6 | 2,900 | 0.879 | 32 | 4,820 | 30 | 3,300 | | |
| 7 | 2,870 | 0.725 | 32 | 5,170 | 36 | 3,960 | | |
| 8 | 2,900 | 0.573 | 32 | 5,740 | 46 | 5,060 | | |
| 9 | 2,910 | 0.519 | 32 | 5,620 | 51 | 5,610 | | |
| 10 | 2,900 | 0.732 | 32 | 4,830 | 36 | 3,960 | | |
| 11 | 2,870 | 0.725 | 32 | 4,880 | 36 | 3,960 | | |
| 12 | 2,880 | 0.655 | 32 | 3,960 | 40 | 4,400 | | |
| 13 | 2,900 | 0.643 | 32 | 3,160 | 41 | 4,510 | | |
| 14 | 2,900 | 0.732 | 32 | 5,280 | 36 | 3,960 | | |
| 15 | 2,900 | 0.549 | 32 | 6,180 | 48 | 5,280 | | |
| 16 | 2,900 | 0.613 | 32 | 5,910 | 43 | 4,730 | | |
| 17 | 2,930 | 0.619 | 32 | 5,650 | 43 | 4,730 | | |
| 18 | 2,900 | 0.676 | 32 | 5,630 | 39 | 4,290 | 5 | 550 |
| 19 | 2,900 | 0.549 | 32 | 5,610 | 48 | 5,280 | 3 | 330 |
| 20 | 2,900 | 0.659 | 32 | 5,810 | 40 | 4,400 | 5 | 550 |
| 21 | 2,890 | 0.751 | 32 | 6,130 | 35 | 3,850 | 6 | 660 |
| 22 | 2,930 | 0.683 | 32 | 5,870 | 39 | 4,290 | 6 | 660 |
| 23 | 2,910 | | 32 | 6,020 | | | 6 | 660 |
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| 61 | | | | | | | | |
| | 66,910 | 0.699 | 736 | 121,680 | 870 | 95,700 | 31 | 3,410 |

November 7, 1990

# DUPONT DAILY PRODUCTION REPORT

PRODUCT MBC BULK CONTRACTOR CEDAR CHEMICAL

CAMPAIGN 50 KG DRUMS

QUANTITY 600M LBS

| DATE | ~~Batch~~ REPORT | DAILY PROD. | CAMPAIGN TOTAL | ON HOLD | APPROVED TO SHIP |
|---|---|---|---|---|---|
| 11/5/90 | 21 | 41 @ 110 each | 91,630 | | |
| 11/6/90 | 22 | 51 @ 110 each | 96,310 | | |
| 11/7/90 | 23 | 48 @ 110 each | 100,930 | | |
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AB0000118846/2

Rework Sheet

# DUPONT DAILY PRODUCTION REPORT

PRODUCT MBC BULK CONTRACTOR CEDAR CHEMICAL

CAMPAIGN 50 KG DRUMS

QUANTITY 600M LBS

| DATE | REWORK | DAILY PROD. | CAMPAIGN TOTAL | ON HOLD | APPROVED TO SHIP |
|---|---|---|---|---|---|
| 10/31/90 | 9B-18 | 5 @ 110 each | 5507 | | |
| 11/1/90 | 10B-19A | 3 @ 110 each | 8807 | | |
| 11/5/90 | 10B-20A | 3 @ 110 each | 12107 | | |
| 11/5/90 | 9B-20B | 2 @ 110 each | 14307 | | |
| 11/5/90 | 10B-21 | 6 @ 110 each | 20907 | | |
| 11/6/90 | 9B-22 | 6 @ 110 each | 27507 | | |
| 11/7/90 | 9B-23 | 6 @ 110 each | 34107 | | |

CEDAR CHEMICAL PROCESS CONTROL LAB

To: C. Hubach
1-713-470-3195
PRODUCT: MEC - Unit #3

DAILY LAB REPORT

| Date | Batch No. | Chloride | % Ash | % A.I. | Color | %H2O | other |
|---|---|---|---|---|---|---|---|
| | | 0.5 % Max | 0.5 % Max | 98.0 % Min | Report | 0.25% Max. | |
| 10/31/90 | V103190-18A | 0.27 | 0.13 | 98.8 | OFF-WHITE | 0.04 | 3 * |
| 10/31/90 | V103190-18B | 0.36 | 0.16 | 98.2 | OFF-WHITE | 0.01 | 2 |
| 11/1/90 | V110190-19A | 0.24 | 0.15 | 99.3 | " | 0.10 | 3 |
| 11/1/90 | V110190-19B | 0.54 | 0.26 | 98.1 | " | 0.02 | 0 |
| 11/2/90 | V110590-20A | 0.28 | 0.10 | 99.4 | " | 0.10 | 3 |
| 11/2/90 | V110590-20B | 0.32 | 0.14 | 98.8 | " | 0.03 | 2 |
| 11/4/90 | V110590-21A | 0.34 | 0.08 | 98.9 | " | 0.10 | 3 |
| 11/4/90 | V110590-21B | 0.22 | 0.07 | 99.1 | " | 0.07 | 3 |
| 11/5/90 | V110690-22A | 0.21 | | 98.3 | " | 0.06 | 3 |
| 11/5/90 | V110690-22B | 0.32 | | 98.9 | " | 0.01 | 3 |
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* DRUMS OF OFF-SPEC. BLENDED BACK.

Revised 10/2/90

DATE:_____ BATCH #_____

MBC
BATCH SHEET

1. Scrubber circulating___; T-N201 level___%; pH___; Initial___

2. Charge MCC to R-N101___; Agitator on low___; Nitrogen purge___
   Time Comp. _____ Final Wt._____ R-N101
   Time Start_____ Start Wt._____
   Pounds MCC Charged to R-N101_____ Initial_____

3. Charge OPD
   Time Comp._____ Final Wt._____ Final Temp_____F
   Time Start_____ Start Wt._____ Start Temp_____F
   Pounds OPD Charged to R-N101_____ Initial_____

4. Charge 1500 Pounds HCL slowly; Agitator on high_____
   Time Comp._____ Final Wt._____ Temp_____F
   Time Start_____ Start Wt._____ Temp_____F Initial_____
   Weight after starting cool loop_____Continue HCL addition to 4.2 pH.
   Time Comp._____Final Wt._____ Temp_____ pH_____
   Time Start_____Start Wt._____ Temp_____ pH_____
   Pounds HCL added to 4.2 pH _____ Initial_____

5. Continue HCL addition (100-120 lbs/min) to pH 4.0 & Temp 203 F.
   TOTAL TIME FOR COMPLETION OF STEPS 4 AND 5 SHOULD BE APPROX. 2 HOURS!

| TIME | R-N101 WT. | TOTAL #'S HCL | pH | TEMP | COMMENTS |
|---|---|---|---|---|---|
| ____ | _____ | _____ | _____ | _____ | _____ |
| ____ | _____ | _____ | _____ | _____ | _____ |
| ____ | _____ | _____ | _____ | _____ | _____ |

6. START HOLD PERIOD OF 72 MINUTES; pH 4.0 (3.8-4.2); Temp 203F (199-207).

| TIME | R-N101 WT. | TOTAL #'S HCL | pH | TEMP | COMMENTS |
|---|---|---|---|---|---|
| ____ | _____ | _____ | _____ | _____ | _____ |
| ____ | _____ | _____ | _____ | _____ | _____ |
| ____ | _____ | _____ | _____ | _____ | _____ |
| ____ | _____ | _____ | _____ | _____ | _____ |
| ____ | _____ | _____ | _____ | _____ | END OF 72 MIN HOLD |

   TOTAL #'S HCL ADDED _____ Initial_____

7. Cool to 122 F; Flush pH loop_____;
   Time complete _____R-N101 Temp_____ Initial_____

8. Transfer to R-N103
   Time Comp_____ Final Wt._____ R-N101; Start Wt._____R-N103
   Time Start_____ Start Wt._____ Final Wt._____
   Pounds from R-N101_____ Pounds to R-N103_____
   Initial_____

file:\Tom\MBCSOP

CEDAR CHEMICAL PROCESS CONTROL LAB

To: C. Hubach
1-713-470-3195
PRODUCT: MBC - Unit #3

DAILY LAB REPORT

| Date | Batch No. | Chloride | % Ash | % A.I. | Color | %H2O | other |
|---|---|---|---|---|---|---|---|
| | | 0.5 % Max | 0.5 % Max | 98.0 % Min | Report | 0.25% Max. | |
| 10/31/90 | V103190-018A | 0.27 | 0.13 | 98.8 | OFF-WHITE | 0.06 | 3 * |
| 10/31/90 | V103190-018B | 0.36 | 0.16 | 98.2 | OFF-WHITE | 0.01 | 2 |
| 11/1/90 | V110190-19A | 0.24 | 0.15 | 99.3 | " | 0.10 | 3 |
| 11/1/90 | V110190-19B | 0.54 | 0.26 | 98.1 | " | 0.02 | 0 |
| 11/2/90 | V110590-20A | 0.28 | 0.10 | 99.4 | " | 0.10 | 3 |
| 11/2/90 | V110590-20B | 0.32 | 0.14 | 98.8 | " | 0.03 | 2 |
| 11/4/90 | V110590-21A | 0.34 | 0.08 | 98.9 | " | 0.10 | 3 |
| 11/4/90 | V110590-21B | 0.22 | 0.07 | 99.1 | " | 0.07 | 3 |
| 11/5/90 | V110690-22A | 0.21 | 0.09 | 98.3 | " | 0.06 | 3 |
| 11/5/90 | V110690-22B | 0.32 | 0.15 | 98.9 | " | 0.01 | 3 |
| 11/7/90 | V110790-23A | 0.15 | 0.14 | 99.4 | " | 0.17 | 3 |
| 11/7/90 | V110790-23B | . | | 99.1 | " | 0.02 | 3 |
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* DRUMS OF OFF-SPEC. BLENDED BACK.

AG-303 REV. 2-86

CC: Tom
Neil
Charlie

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WALKER'S MILL, BARLEY MILL PLAZA
WILMINGTON, DELAWARE 19898

AGRICULTURAL PRODUCTS DEPARTMENT

November 16, 1988

Mr. Geoff Pratt
Cedar Chemical Corporation
5100 Poplar Avenue, 24th Floor
Memphis, Tennessee 38137

Dear Geoff:

We are pleased to award the manufacture of 600-800M pounds of MBC to Cedar's West Helena plant. We do this according to the proposal in your November 11, 1988 letter.

We look forward to a successful, safe start-up and to working again with the folks at Cedar and West Helena.

Sincerely,

T. N. Kirchner
Contract Manager

TNK/df678



AB0000065671/1

cc John Miles

cc: Charlie
Tom
Neil

306-LC REV 11/87

E. I. DU PONT DE NEMOURS & COMPANY INCORPORATED
WILMINGTON, DELAWARE 19898

CONTRACT

| DATE | CONTRACT ORDER NO. | ALT. NO. | PAGE NO. |
|---|---|---|---|
| November 30, 1988 | LOAB-84563 | | 1 |

E. I. DU PONT DE NEMOURS & COMPANY

Cedar Chemical Corporation
24th Floor, 5100 Poplar Avenue
Memphis, TN 38137

DIRECT ALL INQUIRIES

| | |
|---|---|
| WILMINGTON, DELAWARE (ISSUING POINT) | 053 (LOCATION CODE) |
| R. A. WALSH (ISSUED BY) | 048 (BUYER CODE) |

This document, when properly exectued, shall constitute an Agreement between E. I. DU PONT DE NEMOURS AND COMPANY (DU PONT) and CEDAR CHEMICAL CORPORATION (CEDAR).

SERVICES: To cover the cost of toll manufacturing MBC from DU PONT-supplied MCC salt per the instructions in the Contractor's Manual supplied to CEDAR at an earlier date and made a part hereof by reference.

PERIOD OF AGREEMENT: December 1, 1988 through March 31, 1989. The campaign is expected to be complete by early February.

QUANTITIES: Not to exceed 780,000 lbs. of MBC. Exact quantity will be agreed upon by both parties.

SPECIFICATIONS: See Contractor's Manual.

COMPENSATION: As described in the letter from CEDAR'S Geoffrey L. Pratt to DU PONT'S Ted Kirchner, dated November 11, 1988, attached hereto and made a part hereof.

TERMS AND CONDITIONS: DU PONT'S General Conditions (for) Off-Plant Services, EM-6685, as revised 1/86 and as modified, are attached hereto and made a part hereof.

CONTRACT ADMINISTRATOR: D. H. Claudio

CONTRACT COORDINATOR: P. D. Lewis

INVOICES: Invoices should be mailed to:

E. I. du Pont de Nemours and Company
901 West Du Pont Avenue
Belle, WV 25015
Attn: P. D. Lewis

# 309503

506-LA 5/87

DUPONT

E. I. DU PONT DE NEMOURS & COMPANY INCORPORATED
WILMINGTON, DELAWARE 19898

CONTRACT ORDER

| DATE | CONTRACT ORDER NO. | ALT. NO. | PAGE NO |
|---|---|---|---|
| November 30, 1988 | LOAB-84563 | | 2 |

E. I. DU PONT DE NEMOURS & COMPANY

Cedar Chemical Corporation
24th Floor, 5100 Poplar Avenue
Memphis, TN 38137

DIRECT ALL INQUIRIES

| | | |
|---|---|---|
| WILMINGTON, DELAWARE (ISSUING POINT) | | D53 (LOCATION CODE) |
| R. A. WALSH (ISSUED BY) | | D48 (BUYER CODE) |

ENTIRETY: This document, and the documents specifically referred to herein, embody the entire Agreement, and there are no agreements, understandings, conditions, warranties or representations, oral or written, express or implied, with reference to the subject matter hereof which are not merged herein. No modifications hereof shall be of any force or effect unless in writing and signed by both parties.

Please signify your acceptance of the above by signing in the space provided below and returning the carbon copy to R. A. Walsh, E. I. du Pont de Nemours and Company, Materials and Logistics Department, Wilmington, Delaware 19898.

CEDAR CHEMICAL CORPORATION

BY: [signature]

TITLE: Director Custom Manufacturing

DATE: December 16, 1988

E. I. DU PONT DE NEMOURS AND COMPANY

BY: C. F. Des Jardins

TITLE: C. F. DES JARDINS, DIRECTOR CHEMICALS, ENERGY, & TRADING

DATE: December 14, 1988

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

November 11, 1988

Mr. Ted Kirchner
Contract Manager
E.I. DuPont De Nemours & Co.
Walkers Mill, Barley Mill Plaza
Wilmington, Delaware 19898

Dear Ted,

This is to confirm our conversation of November 10, regarding the production by Cedar of 600,000 to 800,000 lbs of MBC commencing in December, 1988. Cedar proposes the following terms for the production:

1) That a plant modification fee not to exceed $50,000 be paid by DuPont amortized over the quantity of MBC to be produced. The modifications are expected to include the installation of a recirculation loop with temperature and pH control, facilities to melt solid MCC in drums, a jacketed OPD charge line, conversion of a reactor vent line from stainless steel to fiberglass, and a hydrochloric acid feed system. These items have been recommended by DuPont's production staff based on their prior commercial experience.

2) DuPont will provide all raw materials which will be delivered to Cedar's West Helena plant.

3) The basis for waste disposal will be to return the material to DuPont's Belle, West Virginia plant with DuPont bearing the cost associated with the freight and disposal. Cedar will make every effort to dispose of aqueous waste through it's biological system as soon as possible after start-up. This may occur when sufficient material can be collected for characterization and verification that the waste is suitable for treatment in Cedar's nonhazardous biological treatment system. The fee for this service, to include materials required for the treatment, will be developed after completion of the waste evaluation work.

4) The fee for processing the MBC will be $9,000 per day for a trial period intended to establish that the plant as modified can produce specification product, with raw

material consumption, waste generation, and productivity levels acceptable to both parties. The daily fee would be assessed only after Cedar's plant is ready for the injection of chemicals and only when the plant is in working condition. There will be a $100,000 minimum fee should the project be declared nonfeasible during this trial period or subsequent standard production period.

5) Following mutual agreement that the trial period is over, Cedar would proceed on a fixed cost per unit of production. This cost is to be determined by dividing the number of days in a given month times $8,000 per day by the number of pounds produced in that month. The average daily production rate is estimated to be 10,000 lbs. per day by Cedar and 17,000 lbs. per day by DuPont and thus the unit cost is expected to be in the range of $.47 to $.80 per pound.

6) Nitrogen is considered to be a raw material and will be metered to the reaction equipment. It will be charged to DuPont at Cedar's costs plus 5%.

Subject to rapid agreement on this proposal, Cedar would target to begin production of MBC on or around December 1, 1988. This rapid schedule would require appropiate support from DuPont's technical staff to confirm the plant modifications required and identify the appropiate operating, safety, and environmental procedures required. It is assumed that DuPont's technical staff will be present during the trial period.

I believe that this covers the major items that we discussed yesterday, but if additional issues need to be addressed, please call. We have located the major items necessary to modify the plant and are ready to begin the modifications immediately.

We hope that these terms are acceptable to you. Thank you for giving us the opportunity to bid on this project.

Sincerely,

Geoffrey L. Pratt
Director of Operations/
Custom Manufacturing

/kt

# GENERAL CONDITIONS
# OFF-PLANT SERVICE
# E. I. DU PONT DE NEMOURS AND COMPANY
## (INCORPORATED)

### ASSIGNMENT AND SUBCONTRACTING

The rights and obligations covered herein shall not be assignable by either party in whole or in part, nor shall either party subcontract any of its obligations hereunder without the prior written consent of the other party.

### NONDISCRIMINATION

CONTRACTOR warrants that it has complied with all applicable laws, rules, orders and regulations of governmental authority covering the production, sale and delivery of the materials or services specified herein, including, but not limited to, Executive Order 11246, and the rules and regulations promulgated thereunder, the Rehabilitation Act of 1973 and the Vietnam Era Veterans Readjustment Act of 1974. Further, CONTRACTOR warrants that in the performance of the services hereunder, it will comply with all applicable provisions of the Fair Labor Standards Act of 1938, as amended.

### FORCE MAJEURE

Except to the extent otherwise provided herein, no liability shall result to either party from delay in performance or from nonperformance caused by circumstances beyond the control of the party affected, including but not limited to acts of God, fire, flood, explosion, war, action or request of governmental authority, accident, labor trouble or shortage, inability to obtain material, power, equipment or transportation, but each of the parties hereto shall be diligent in attempting to remove such cause or causes and shall promptly notify the other party of its extent and probable duration.

Services affected hereunder may be eliminated from this Agreement without liability, but the Agreement shall remain otherwise unaffected. In the event of inability for any reason to supply the total demands for the service or product specified herein, CONTRACTOR shall allocate its available supply among any or all purchasers, as well as departments and divisions of CONTRACTOR, on such a basis as is fair and practical, without liability for any failure of performance which may result therefrom.

If the party suffering the Force Majeure is unable to remove the cause or causes within seven (7) days, the other party hereto shall have the right to terminate, without penalty, this entire Agreement or any portion thereof caused by the Force Majeure event.

### TERMINATION

If CONTRACTOR should refuse or fail to supply sufficient quantity of properly skilled personnel, or if it should fail to make prompt payment to subcontractors for labor and materials used hereunder, or it should disregard or be in violation of any laws, ordinances or governmental regulations, or should it otherwise violate any of the provisions of this Agreement, or if DU PONT, hereunder in good faith, determines that personnel, materials, products or equipment as required hereunder are being used in an unsafe manner or in any way such that DU PONT'S title thereto is in jeopardy, or that CONTRACTOR'S credit or financial position is impaired, then DU PONT may, without prejudice to any other right or remedy, terminate or suspend this Agreement without liability on written notice.* Termination under this provision or under any other provision of this Agreement shall not relieve or release either party hereto from any rights, liabilities or obligations which it has accrued prior to the date of such termination.

### DEFAULT

In the event that either party hereto shall default in the substantial performance of any material obligation specified herein, the nondefaulting party shall notify the other party hereof in writing and, if such default is not remedied within fifteen (15) days from date of such notice, then the nondefaulting party shall have the right to terminate this Agreement immediately. If, in DU PONT'S sole opinion, such default may result in substantial property damage, injury, accident or death, DU PONT may, at any time, immediately suspend this Agreement without penalty or damages. Termination under this provision or under any other provision of this Agreement shall not relieve or release either party hereto from any rights, liabilities or obligations which it has accrued prior to the date of such termination.

*The foregoing notwithstanding, it is agreed that such notice shall specify with reasonable particularity the event or circumstances on which such notice is based. If such event or circumstances shall have been cured or corrected within fifteen (15) days following receipt of such notice, suspension or termination shall be deemed of no force or effect.

**CONTAMINATION AND RESPONSIBILITY**

CONTRACTOR shall take all steps necessary to prevent the contamination of DU PONT'S material or product with foreign substances. CONTRACTOR shall perform services in accordance with DU PONT specifications, and shall bear the cost of handling, reworking or replacing any material or product failing to meet specifications hereunder as the result of CONTRACTOR'S acts or omissions.

**LOSS AND DAMAGE/TITLE**

CONTRACTOR assumes full responsibility and liability for the safe handling and safekeeping of any material or product which DU PONT may deliver or cause to be delivered to CONTRACTOR while such material is in CONTRACTOR'S care, custody and control. Unless otherwise specified, title to such material shall remain with DU PONT. Except as may otherwise be set forth in this Agreement, CONTRACTOR shall reimburse DU PONT for the replacement value of any such material or product lost, damaged or destroyed while in CONTRACTOR'S possession, whether or not caused by the negligence or willful misconduct of CONTRACTOR, its employees, agents or assigns.* CONTRACTOR shall segregate and placard such material and product indicating DU PONT'S ownership thereof. CONTRACTOR shall obtain prior written approval of DU PONT before moving any such material to a new location.

*unless such loss or damage shall have been caused by the negligence or willful misconduct of DU PONT, its employees, agents or assigns.

**INDEMNIFICATION**

CONTRACTOR shall fully indemnify DU PONT against all liability, loss and expense (including reasonable attorney's fees, settlements, judgments and costs) resulting from injury to or death of any person (including, without limitation, injury to or death of employees of CONTRACTOR or DU PONT) or loss of or damage to property (including, without limitation, damage to DU PONT'S or CONTRACTOR'S property) or the environment incurred by DU PONT ~~or a third party~~ and resulting in any way from any act or omission, negligent or otherwise, on the part of ~~EXCEPT EXCEPT~~ CONTRACTOR, its agents, employees, subcontractors or assignees, in connection with the performance of this Agreement, except when such loss and expense are caused ~~solely~~ by the ~~willful misconduct or~~ negligence of DU PONT.

**INSURANCE**

CONTRACTOR shall carry and maintain in force at all times relevant hereto, at CONTRACTOR'S expense, insurance of the type and of minimum coverage limits as follows:

1. Worker's Compensation—Statutory with Employer's Liability—$100,000 per accident;
   ~~• This policy shall provide a waiver of subrogation against DU PONT.~~
2. Comprehensive General Liability, Bodily Injury and Property Damage including contractual liability to cover CONTRACTOR'S obligations under this Agreement in a combined single limit—$500,000 per occurrence;
   • This policy shall name DU PONT as an Additional Insured.
3. Comprehensive Automotive Liability, Bodily Injury and Property Damage in a combined single limit—$500,000 per accident;
   • If CONTRACTOR will not operate motor vehicles on DU PONT property or utilize such vehicles in connection with the work being performed hereunder, a letter so stating is acceptable in lieu of the automotive insurance certificate.

Certificates of insurance in a form acceptable to DU PONT, evidencing the coverages required above shall be filed with DU PONT in accordance with the *DOCUMENTS* provision herein prior to the furnishing of services under this Agreement. Such certificates shall provide that the insurer will give DU PONT not less than ten (10) days' advance notice of any changes in or cancellation of coverage. In the event any subcontractor is employed for the services covered in this Agreement, then the CONTRACTOR assumes full responsibility to ensure that the subcontractor's services are covered by the same insurance limits as set forth herein.

**INDEPENDENT CONTRACTOR**

It is understood that the employees, methods, facilities and equipment of CONTRACTOR shall at all times be under its exclusive direction and control. CONTRACTOR'S relationship to DU PONT shall be that of an independent contractor and nothing in this Agreement shall be construed to constitute CONTRACTOR or any of its employees or officers, as an employee, agent, joint venturer or partner of DU PONT.

**WASTE DISPOSAL**

CONTRACTOR agrees to furnish all required equipment and labor at no additional cost to DU PONT to remove and dispose of such quantities of waste as may be generated hereunder and which DU PONT elects not to have returned to it. CONTRACTOR shall not use, reuse, sell or otherwise dispose of any DU PONT material, processed

material not meeting specifications, or product for its account unless previously agreed to in writing by DU PONT'S Contract Administrator. Prior to the start of actual processing hereunder CONTRACTOR and DU PONT will agree in writing on the identity of any subcontractor, methods used and the location of sites to be used for waste disposal hereunder. CONTRACTOR will notify DU PONT and get the written approval of DU PONT'S Contract Administrator prior to changing any subcontractors, methods or location of waste disposal under this Agreement.

CONTRACTOR agrees that such waste will be transported and disposed of in such a manner* as to prevent waste from entering the environment as a pollutant. CONTRACTOR will exercise controls necessary to prevent scavenging of the waste or access to containers containing such waste unless said access is authorized by DU PONT.

*as DU PONT shall approve.

## RECORDS AND INSPECTION

CONTRACTOR agrees to maintain, in accordance with generally accepted accounting principles and practices, such records as may be necessary to adequately reflect the accuracy of CONTRACTOR'S charges and invoices for reimbursement under this Agreement and maintain such other additional records as DU PONT may from time to time reasonably require in connection with this Agreement. DU PONT shall have the right from time to time to inspect and verify the records kept by CONTRACTOR in connection with this Agreement. DU PONT'S duly authorized representatives shall have the right to visit, observe, and inspect CONTRACTOR'S production and related facilities utilized to accomplish the objectives of this Agreement at any time during CONTRACTOR'S normal business hours. DU PONT'S duly authorized representatives shall also have the right to select and inspect samples of material, material-in-process and product in CONTRACTOR'S facility pursuant to this Agreement and to reject product or CONTRACTOR-supplied material on the basis of the selected samples if DU PONT'S specifications are not met. DU PONT'S inspection or failure to exercise its right to test samples for compliance with DU PONT'S specifications shall not be deemed to establish that such material or product met DU PONT'S specifications.

## TAXES

DU PONT agrees either to pay directly all property taxes, licenses, charges and assessments levied by any governmental authority upon the DU PONT-owned material, equipment and product hereunder, or to reimburse CONTRACTOR therefor if paid by CONTRACTOR at DU PONT'S written direction. CONTRACTOR assumes full responsibility for the payment of all federal and state taxes of whatever sort, social security and unemployment compensation taxes, withholding taxes, and all other taxes or charges applicable to CONTRACTOR'S actions, employees, facilities and materials for performing services hereunder or applicable to CONTRACTOR'S income hereunder.

## AUTHORITY

The parties hereby represent that they have full power and authority to enter into and perform this Agreement and the parties know of no agreements, contracts, promises or undertakings which would prevent the full execution and performance of this Agreement.

## RESERVATION OF RIGHTS

Either party's waiver of any of its remedies due to a breach by the other party shall be without prejudice and shall not operate to waive any other remedies which it shall have available to it, nor shall such waiver operate to waive its rights to any remedies due to a future breach, whether of a like or different character.

## HEADINGS

The headings of the provisions of this Agreement are inserted for convenience only and shall not constitute a part hereof.

## NONDISCLOSURE

CONTRACTOR will not disclose to others (a) the fact that DU PONT has purchased or plans to purchase services, articles, materials or product from CONTRACTOR or (b) any information or knowledge that may be gained or learned by CONTRACTOR about the business, products, employees or methods employed by DU PONT unless such disclosure is necessary to perform services hereunder or as required by law.

## COMPLIANCE WITH LAWS

CONTRACTOR agrees that in the performance of the processing operations and other services provided hereunder, including but not limited to the disposal of any waste materials resulting from said operations, it will comply with all applicable laws, rules and regulations of governmental authority in connection therewith.

**APPLICABLE LAW**

The law of the State of Delaware shall govern the construction of this Agreement.

**SEVERABILITY**

*In the event that any provision of this Agreement shall be found to be void or unenforceable, such findings shall not* be construed to render any other provision of this Agreement either void or unenforceable, and all other provisions shall remain in full force and effect unless the provisions which are invalid or unenforceable shall substantially affect the rights or obligations granted to or undertaken by either party.

**CORPORATE IDENTITY**

*In the event that* CONTRACTOR'S invoice does not indicate that CONTRACTOR is an incorporated entity, by use of the words (or abbreviations) "Incorporated", "Corporation" or "P.C." as a part of CONTRACTOR'S company name, then CONTRACTOR shall display its tax identification number (TIN) on the invoice in lieu of such designations. Failure to furnish such information may result in withholding twenty percent (20%) of Agreement payments in accordance with IRS regulations.

**HAZARDS**

CONTRACTOR recognizes that hazards may be involved in performing the services described hereunder. The information supplied by DU PONT concerning processing or handling of Material and Product is the latest information known to DU PONT and relevant to the work to be performed hereunder. Such information is provided without warranty or representation as to its completeness or suitability in providing the services herein. The methods employed and the precautions taken to handle DU PONT-owned equipment, if any, Material and Product shall be determined by and rest solely with CONTRACTOR. CONTRACTOR agrees to provide its employees with a safe and healthy workplace using, but not limited to, such information as is or may be provided by DU PONT.

DU PONT shall have the right to immediately suspend this Agreement, without liability to CONTRACTOR, if at anytime DU PONT in its sole judgment determines that CONTRACTOR has violated any of the provisions of this Article. Further, if CONTRACTOR fails to correct any such violation within seven (7) days immediately following DU PONT'S notice to CONTRACTOR of the violation, DU PONT has the right to terminate this Agreement.

**SAFETY AND HEALTH**

CONTRACTOR shall conduct the operations hereunder in conformity with generally accepted safety practices. It is understood and agreed that CONTRACTOR shall be solely responsible for the safety of its operations, its employees and the public as it might be affected by CONTRACTOR'S operations, and CONTRACTOR acknowledges that its compliance with any safety recommendations made by DU PONT shall not, by itself, discharge CONTRACTOR from this sole responsibility.

DU PONT shall have the right to immediately suspend this Agreement, without liability to CONTRACTOR, if at anytime DU PONT in its sole judgment determines that CONTRACTOR has violated any of the provisions of this Article. Further, if CONTRACTOR fails to correct any such violation within ~~seven (7) days~~ *fifteen (15) days immediately following DU PONT'S notice to CONTRACTOR of the violation, DU PONT has the right to terminate this Agreement.

**WARRANTY**

CONTRACTOR warrants that the Product delivered hereunder will ~~(1) be free of defects in materials and workmanship (2)~~ meet the specifications referred to herein ~~and (3) comply with all applicable warranties implied at law.~~ In the event that Product supplied by CONTRACTOR fails to meet any of the aforementioned warranties or are otherwise defective, CONTRACTOR shall, at DU PONT'S option, replace the defective Product or refund the purchase price including freight charges. ~~CONTRACTOR further agrees to reimburse DU PONT for all costs incurred in the recall of defective Product and for all expenditures made in the settlement of any claim against DU PONT relating to defective Product supplied by CONTRACTOR.~~ DU PONT shall notify CONTRACTOR promptly of any claim against DU PONT with respect to the Product supplied hereunder and shall provide CONTRACTOR and/or its insurance carrier with information needed for settlement or defense of such claims.

**SHIPMENTS**

Freight charges, excluding detention and demurrage charges for all Material or other items supplied by DU PONT under this Agreement, and for all Product produced hereunder by CONTRACTOR and shipped per DU PONT'S instructions, shall be for DU PONT'S account. Detention and demurrage charges on incoming shipments shall be borne by CONTRACTOR unless caused by DU PONT'S early or excessive delivery of Material. Shipments of Material or Product hereunder to third parties are to be made by CONTRACTOR upon written direction from DU PONT.

(3 300-4C 11/89

DUPONT E. I. DU PONT DE NEMOURS & COMPANY INCORPORATED

WILMINGTON, DELAWARE 19898

# CONTRACT ORDER

CC: Top two pages only
Charlie
Neil

| DATE | CONTRACT ORDER NO | ALT. NO. | PAGE NO |
|---|---|---|---|
| July 26, 1990 | LOGB-61738 | | |

E. I. DU PONT DE NEMOURS & COMPANY

Cedar Chemical Corporation
PO Box 2749
Highway 242 South
West Helena, AR 72390
Attn: Mr. Geoffrey L. Pratt

DIRECT ALL INQUIRIES

Wilmington, Delaware

R.A. [redacted] — LOCATION CODE

ISSUED BY — BUYER CODE

This document, when properly executed, shall constitute an Agreement between E.I. DU PONT DE NEMOURS & COMPANY (DU PONT) and CEDAR CHEMICAL CORPORATION (CEDAR).

SERVICES: To cover the cost of toll manufacturing MBC from DU PONT-supplied MCC salt per the instructions in the Contractor's Manual #13, "MBC Synthesis", dated October 1988, given to Geoff Pratt of CEDAR on July 25, 1990. This manual is made a part hereof by reference.

PERIOD OF AGREEMENT: August 1, 1990 through July 31, 1991.

QUANTITIES: Approximately 600,000 lbs. of MCC Salt to approximately 800,000 lbs. of MBC.

SPECIFICATIONS: Per Contractor's Manual dated October 1988.

COMPENSATION: As described in the letter from CEDAR'S, Geoffrey L. Pratt, to DU PONT'S, Ted Kirchner, dated November 21, 1989, attached hereto and made a part hereof.

$9,000.00/day - Initial Production Fee
$8,000.00/day - Processing Delay Fee*
$.04/lb. - Waste fee
*There will be an $8M/day fee charged to DU PONT if DU PONT fails to have raw materials at CEDAR for their consumption.

TERMS & CONDITIONS: DU PONT'S General Conditions, EM-6685, revised 12/88, are attached hereto and made a part hereof.

YIELD: Best efforts.

RATE: Best efforts. Per meeting on 6/19/90 with A.J. Sepcie, Ross Kendel of DU PONT and Geoff Pratt of CEDAR, they will develop a plan for maximum rate. Last campaign which had OPD supply interruptions, rate was 6M/day. Rate is function of MCC variable.

G-506-LC 11/89

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

CONTRACT ORDER

July 26, 1990 | LOGH-61738 | | |
DATE | CONTRACT ORDER NO. | ALT. NO. | PAGE NO.

E. I. DU PONT DE NEMOURS & COMPANY

Cedar Chemical Corporation
PO Box 2749
Highway 242 South
West Helena, AR 72390
Attn: Mr. Geoffrey L. Pratt

Wilmington, Delaware

DIRECT ALL INQUIRIES

R.A. Blackhall | LOCATION CODE
ISSUED BY | BUYER CODE

QUALITY: Last product in the filter and two (2) dryers was MBC; last product in the reactors was chloroparanitrotoluene. No herbicides have been in the equipment per Geoff Pratt of CEDAR.

WASTE: MBC aqueous waste to be disposed of by CEDAR in their on-site biological system. Caustic pretreat is included in this fee.

CONTRACT ADMINISTRATOR: A.J. Sepcie

ORIGINATOR: A.G. Rohrer

INVOICES: Invoices should be mailed to:
E.I. du Pont de Nemours & Company
PO Box 2020
LaPorte, TX 77572-2020
Attn: D. Kirkpatrick

ENTIRETY: This document, and the documents specifically referred to herein, embody the entire Agreement, and there are no agreements, understandings, conditions, warranties or representations, oral or written, express or implied, with reference to the subject matter hereof which are not merged herein. No modifications hereof shall be of any force or effect unless in writing and signed by both parties. Please signify your acceptance of the above by signing in the space provided below and returning the pink copy to R.A. Blackhall, E.I. du Pont de Nemours & Company, Materials and Logistics Department, PO Box 80015, BMP-15-1264, Wilmington, Delaware 19898.

| CEDAR CHEMICAL CORPORATION | E.I. DU PONT DE NEMOURS & COMPANY |
|---|---|
| BY: _____ | BY: R.A. Blackhall |
| TITLE: _____ | TITLE: Sr. Purchasing Agt. |
| DATE: _____ | DATE: July 31, 1990 |

Chlorination of p-Nitro toluene

DUPONT CHLORINATION DAILY LAB REPORT

| RN105 —— PNT DRYING | | | RN101 COMPLETION | | | | RN103 FINAL ASSAY | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ATE | BATCH | 0.2MAX % WATER | 92% MIN % CNT | 1-6% %PNT | 135-139°F CRYST. PT. | 1.5-7.5% %DCNT | 6.5-8.5 PH * | 1-6% %PNT | 1.5-7.5% %DCNT | 135-139°F CRYST. PT. | 92%M %CNT |
| 17/89 | CNT079001 | 0.12 | 93.3 | 3.3 | 136.1°F | 2.9 | 6.8 | 3.2 | 3.2 | 136.1°F | 93.4 |
| 19/89 | CNT079002 | 0.14 | 92.1 | 4.3 | 136°F | 3.2 | 3.7 | 3.4 | 3.2 | 136°F | 93. |
| 20/89 | CNT079003 | 0.07 | 92.8 | 3.7 | 136.6°F | 3.0 | 6.9 | 3.5 | 2.8 | 136.6°F | 93.4 |
| 21/89 | CNT079004 | 0.08 | 92.9 | 3.1 | 136°F | 3.4 | 5.9 | 3.1 | 2.9 | 136°F | 93.6 |
| 22/89 | CNT079005 | 0.07 | 92.2 | 3.9 | 136.4°F | 3.4 | 5.9 | 3.3 | 3.1 | 136.4°F | 93.4 |
| 24/89 | CNT079006 | 0.08 | 93.4 | 2.7 | 136.4°F | 3.6 | 6.4 | 2.7 | 3.4 | 136.4°F | 93.7 |
| 25/89 | CNT079007 | 0.04 | 92.7 | 3.7 | 136°F | 3.2 | 6.8 | 3.4 | 2.8 | 136.0°F | 93.4 |
| 26/89 | CNT079008 | 0.05 * | 93.4 | 3.2 | 136.8°F | 2.9 | 5.6 | 1.9 | 3.6 | 136.8°F | 94.2 |
| 27/89 | CNT079009 | 0.03 * | 93.3 | 1.3 | 136.6°F | 5.2 | 7.5 | 1.3 | 5.2 | 136.6°F | 93.3 |

* CHANGED FROM PREVIOUS REPORT

MU-2500 REV. 5-83

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
CHAMBERS WORKS
DEEPWATER, NEW JERSEY 08023

CC: R. T. King, Wilmington
S. A. Hamdan, Wilmington
D. P. Heintzelman, Wilmington
T. L. Hamberger, Wilmington
E. A. Donald, Wilmington
J. M. Anderson, Jr., Chs Wks
S. O. Rogers, Chs Wks
P. H. Smith, Chs Wks

July 5, 1989

Mr. Tom Lodice
Cedar Chemical Corporation
P. O. Box 2749
West Helena, AR 72390

Dear Tom:

Based on your attached letter and our review of the equipment set, please proceed with the required waste water handling modifications. These modifications should not exceed $5,500 without additional approval.

Sincerely,

Karl F. Kamenski

Karl F. Kamenski

KFK:bml
5030U
Attach.



AB0000118465/2

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

June 20, 1989

REPLY TO: P. O. BOX 2749
WEST HELENA, AR 72390
(501) 572-3701

Karl Kamenski
AI&V Dept.
E.I.DuPont & Co.
Chambers Works
Deepwater, NJ 08023

Dear Karl,

In accordance with our conversations regarding the handling of the wastewater from the 2-Cl-4-NT process, we propose to treat the waste streams as follows:

1) The first 2 washes will be neutralized to a pH of 7 to 10 in a 3000 gallon glass-lined reactor and then transferred to a railcar for shipment back to DuPont.
2) The third wash will remain in the reactor to be used as the first wash for the next batch.
3) The soda ash wash will be transferred to a 3000 gallon glass-lined reactor where it will be cooled, filtered, and transferred to a 20,000 gallon tank for deepwell disposal by truck.
4) The scrubber liquor will be held in a 5,000 gallon tank and then transferred to a 3,000 gallon reactor where it will be neutralized with hydrochloric (or sulfuric) acid and sodium sulfite prior to transfer to the 20,000 gallon tank used to hold the soda ash wash water.

In order to handle the waste as described, we will be required to modify the piping as follows:

1) We will install bag filters on the soda ash wash water line to the wastewater tank in order to remove solidified product from the wastewater prior to deepwell disposal. The cost for this modification is estimated to be $1800.
2) We will install new piping to transfer ferric hydroxide wastewater to railcars in order to prevent contamination of the "deepwell wastes" with ferric hydroxide slime. The cost for this modification is estimated to be $3,700.

Please advise me as to whether or not these changes are acceptable and we will get these modifications completed as soon as possible.

Thanks for your help and I'll look forward to seeing you on Thursday.

Sincerely,

Tom Lodice TJL

DuPont 2-Chloro-4-Nitroaniline
Operating Procedures

Table of Contents

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III. Spill Control

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A. Preparation of Caustic Solution for Scrubber and treatment of spent caustic solution

B. Connecting PNT Tank Car

C. Disconnecting PNT Tank Car

D. Connecting Chlorine Tank Car

E. Disconnecting Chlorine Tank Car

F. Charging PNT to R-N105

G. Drying PNT

H. Thionyl Chloride Addition

I. Transferring Dried PNT to R-N101

J. Starting Up Chlorine Vaporizer

K. Shutting Down Chlorine Vaporizer

L. Chlorinating PNT

M. Washing Product

N. Transferring Product to the Product Car

V. Alarms and Interlocks

VI. Batch Charges

VII. Batch Sheets

# DuPont 2-Chloro-4-Nitrotoluene
# Operating Procedures

## I. Process Summary

### I-A. Drying PNT

Para-nitrotoluene (PNT) is charged into R-N105, a 2000 gal. glass lined reactor, for drying. Drying is accomplished by heating, sparging with nitrogen ($N_2$) and then adding thionyl chloride ($SOCl_2$). Off gases pass to the scrubber in which caustic soda (NaOH) solution is circulated.

### I-B. Chlorinating PNT

The dried batch of PNT is transferred to R-N101, a 4000 gal. glass lined reactor, for chlorination. Ferric chloride ($FeCl_3$) and iodine ($I_2$) are added as catalysts. The batch temperature is maintained at 167 degrees F while chlorine gas ($Cl_2$) is sparged into the reaction mass. $Cl_2$ flows from a tank car through a vaporizer into the reactor. The progress of the reaction is monitored by checking freeze point and by vapor phase chromatography (VPC). The product is 2-chloro-4-nitrotoluene (CNT).

Also formed are these by-products:
- dichloronitrotoluene (DCNT)
- hydrogen chloride (HCl)

The HCl passes as a gas to the scrubber.

### I-C. Product Specifications

The product specifications and manufacturing specifications are shown below. The manufacturing specs are tighter than the product specs so process control action can be taken in time to prevent exceeding the product specs.

| Analysis | Product Spec | Manufacturing Spec |
|---|---|---|
| Crystallization Point | 135-139 deg F | 136-138 deg F |
| pH | 6.5-8.5 | 7.0-8.0 |
| VPC (Vapor Phase Chromatography) | | |
| PNT | 1.0-6.0 % | 3.0-4.0 % |
| CNT | 92.0-94.0 % | 93.0-93.5 % |
| DCNT | 1.5-7.5 % | 2.5-4.0 % |



AB0000118407/2

I-D. Washing The Product

After the chlorination is complete the batch is washed multiple times with water followed by one wash with a soda ash water solution. The washes will be carried out in R-N104 and R-N103. The water washes remove ferric chloride and dissolved HCl. The soda ash removes iodine and traces of phenolic compounds and leaves the product slightly alkaline.



AB0000118407/3

## II. Safety

### II-A. Chemicals

After reviewing the general description of the process the first thing to be done is to carefully study the material safety data sheets (MSDS) for all of the chemicals involved in the operation. These are listed below:

para-Nitrotoluene (PNT)

Chlorine ($Cl_2$)

Ferric Chloride ($FeCl_3$)

Iodine ($I_2$)

Sodium Thiosulfate
Sodium Sulfite

2-Chloro-4-Nitrotoluene (CNT)

Hydrogen Chloride (HCl)

Nitrogen ($N_2$)

Soda Ash ($Na_2CO_3$)

Caustic Soda (NaOH)

Thionyl Chloride ($SOCl_2$)

2-Chloro-4-Nitrotoluene (CNT)

Material safety data sheets are available to all operators and supervisors. As you study these sheets make notes of any questions you have so they can be answered during the training program.

Following are some safety highlights (not to be used as a substitute for MSDS).

### II-B. Chlorine

Chlorine is a highly toxic gas. Inhalation can cause death. It is most important for all operating personnel to have immediate access to a gas mask and self contained breathing apparatus (SCBA). A gas mask is sufficient for short term exposure but a SCBA must be used for longer periods. When engaged in operations involving potential release of chlorine, such as connecting and disconnecting tank cars, a gas mask should be worn.

If a leak occurs proper valves should be closed to stop the leak. Liquid chlorine must never be trapped in a pipeline because as the liquid temperature increases sufficient pressure can be generated to rupture the pipe. Liquid chlorine causes serious burns on contact with the body.



AB0000118407/4

II-C. Caustic Soda

Caustic Soda is one of the most dangerous industrial chemicals if it enters the eyes. It can result in permanent eye damage if not immediately flushed with water for at least 15 minutes. The operator should wear tight fitting goggles or full face shield any time he is engaged in an operation where caustic soda might be released.

II-D. Thionyl Chloride

Thionyl chloride, a liquid, is severely irritating and corrosive to the eyes, skin, and respiratory tract. Tight fitting goggles or full face shield should be used to protect the eyes when handling thionyl chloride, as well as a gas mask or self contained breathing apparatus to protect the respiratory system.

II-E. Ferric Chloride

Ferric chloride is strongly acid, particularly in contact with water. For this reason tight fitting goggles or full face shield should be worn when handling ferric chloride. Contact with the skin should be prevented as well.

II-F. Iodine

Iodine is highly toxic. The effects of its vapors are similar to chlorine. Tight fitting goggles or full face shield should be used and the skin should be protected.

II-G. Para-Nitrotoluene (PNT)

PNT, a yellow liquid, is moderately toxic. Avoid PNT exposure by ingestion, inhalation of vapors or contact with the skin.

II-H. 2-Chloro-4-Nitrotoluene (CNT)

CNT, a yellow liquid is similar to PNT in its hazard rating. It is moderately toxic and exposure by ingestion, inhalation of vapors, and contact with the skin should be avoided.

II-I. Hydrogen Chloride (HCl)

Hydrogen chloride gas is highly irritating to the skin and toxic by inhalation. Release of hydrogen chloride is not very likely in this process but if it occurs a gas mask should be used.

Note: The above highlights are not a substitute for the Material Safety Data Sheets. The MSDS should be studied in detail.

Note: The minimum protective equipment for any sampling operation is full face shield, apron, rubber gloves, rubber footwear, and hard hat.



AB0000118407/5

## III. Spill Control

III-A. Chlorine

Chlorine is a gas at atmospheric temperature and pressure. If a significant leak occurs the first step is to put on a gas mask or a self contained breathing apparatus. When thus protected appropriate valves should be closed to stop the leak.

If the leak cannot be stopped and the rate of leakage is sufficient to be a health hazard the area down wind must be vacated.

If the leak is at the tank car valves and it cannot be otherwise stopped it should be stopped by using a Chlorine Institute Emergency kit "C".

A leaking chlorine car must not be shipped out of the plant. It is illegal to do so.

III-B. Ferric Chloride

Rubber gloves, respirator with "F" type filters, tight fitting goggles, and rubber footwear should be worn.

Sweep up and shovel into containers.

Flush the spill area with a large amount of water.

III-C. Iodine

Wear rubber gloves, respirator with "F" type filters, tight fitting goggles, and rubber footwear.

Sweep up and shovel spilled material into closed containers.

Flush area with large amounts of water.

III-D. Para-nitrotoluene (PNT)

Wear a rain suit with self contained breathing apparatus and rubber footwear.

Shovel spilled material into closed containers.

Flush spill area with a large amount of hot water.

After cleaning up spill, shower, change to uncontaminated clothes, and report for a cyanosis check.

III-E. Soda Ash

Sweep up and shovel material into closed containers. Wear respirator with type "F" filter and leather or rubber gloves when handling Soda Ash.
Flush spill area with a large amount of water.



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III-F. Sodium Hydroxide

Wear tight fitting goggles or full face shield, full rain suit, and rubber footwear.

Flush spill area with water until surface of spill area tests no higher than 8 with pH paper.

III-G. Thionyl Chloride

Wear full face mask with air supply, full rain suit, rubber gloves, and rubber footwear.

Cover spilled material with Hazmat National Foam No. 2.

Flush spill area with a large amount of water.

III-H. 2-Chloro-4-Nitrotoluene (CNT)

Wear full rainsuit, rubber footwear, and self contained breathing air mask.

Absorb spilled material on oil-dri or sand and shovel into closed containers.

Flush the spill area with a large amount of hot water.

After cleaning up the spill, shower, change to uncontaminated clothes and report for cyanosis check.



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## IV. Operating Procedures

### IV-A Preparation of Caustic Solution for Scrubber and Treatment of Spent caustic Solution

IV-A.1. Confirm that T-N201, the scrubber tank is empty and discharge valve is closed.

Charge water to T-N201 until level reads _____%. Set valves so flow will be from T-N201 to pump, from pump through scrubber heat exchanger to scrubber, from scrubber back to T-N201. Note and record the level with circulation taking place.

IV-A.2. Open cooling water supply valve to the scrubber heat exchanger and check that cooling water return valve from the heat exchanger is open.

IV-A.3. Put on tight fitting goggles or full face shield. Set valves for flow from 50% caustic storage tank to T-N201. Start caustic pump and charge 50% caustic to T-N201 * until level increases to _____% while circulating through the scrubber cooler and scrubber column. When the new level is reached shut off the caustic pump.

IV-A.4. Allow the caustic solution to continue to circulate through the scrubber. After 10 minutes of circulation take a sample of the solution (with tight fitting goggles and other required sampling gear). Have the lab determine the caustic concentration. If below 17% add more caustic, if above 19% add more water.

As a guide add_____ inches of water to reduce the concentration by 1% * and add_____inches of 50% caustic to increase the concentration by 1%.

[redacted]



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IV-A.5. At the completion of each chlorination batch the scrubber liquor is transferred from scrubber tank T-N201 to T-N206 except for _____% on T-N201 level indicator. This amount will continue to be circulated through the scrubber to take care of off gases during the product wash steps.

IV-A.6. Prepare for the transfer to T-N206 by carrying out the following:

Check to be sure there is sufficient room in T-N206.

Shut off pump N206 and close the valve between its suction and T-N206.

Check to be sure pump N201 is running and set up to circulate through the scrubber.

IV-A.7. Open the valves between T-N206 and pump N201 except for the valve at pump N201 discharge to T-N206. Have the valving set for flow into the bottom of E-N206 and out the top to T-N206.

Open pump N201 discharge valve to T-N206 and transfer down to _____% on T-N201 level indicator. If necessary, partially close pump N201 discharge valve to the scrubber to develop enough pressure to complete the transfer to T-N206.

When the level in T-N201 is down to _____% close pump N201 discharge valve to T-N206 and fully open it's discharge valve to the scrubber, putting the scrubber on full circulation.

IV-A.8. Open cooling water valves to and from E-N206.

Set valves for circulation from T-N206, through E-N206, and back into T-N206.

Start pump N206 and continue circulating and cooling until the spent scrubber liquor is cooled down to at least _____ deg. F.

Note: T-N206 is merely used as a holding tank and a means of making the transfer from T-N201 to R-N102 where the spent scrubber liquor is treated. Since T-N206 is a glass lined vessel and the spent scrubber liquor contains caustic soda the liquor should not be held in T-N206 any longer than necessary to minimize attack on the glass.

IV-A.9. As soon as R-N102 is empty check to be sure it is vented and its bottom valve is closed.

Set up valving to transfer from T-N206 to R-N102 being sure all valves are closed that could allow material to go other than to R-N102.

Using pump N206 transfer the spent scrubber liquor to R-N102.

Turn on R-N102 agitator and open jacket water inlet and outlet valves.

Put on tight fitting goggles or full face shield, rubber apron, and rubber gloves in addition to standard safety gear and take a sample of the scrubber liquor. Take the sample to the lab and report to the lab the pounds of liquor in R-N102. The lab will calculate the quantity of sodium sulfite and _____% hydrochloric acid to be added to the batch.

IV-A.10. In addition to normal personal protective equipment put on the following:

Add the amount of sodium sulfite calculated by the lab to R-N102.

Add the quantity of 32 % hydrochloric acid calculated by the lab.

Allow the material to mix for _____ minutes. Put on the safety gear prescribed for the previous sampling of R-N102 and take another sample from R-N102. Take the sample to the lab for pH determination. If the pH is not between 7 and 10 add hydrochloric acid or caustic soda as prescribed by the lab.

After the pH is adjusted to 7 to 10 and the batch is cooled down to no higher than 140 deg. F transfer the batch through the filter to T-B102.

The material will be transferred from T-B102 to a waste water truck.

## IV-B. Connecting PNT Tank Car

IV-B.1. When a car of PNT is received place warning signs and derails at each end of the car.

IV-B.2. Install a steam trap on the condensate discharge of the car jacket (coil) if one is not already in place.

IV-B.3. Connect steam hose to the tank car jacket (coil). Be sure steam is reduced to ~~a pressure~~ no greater than the pressure rating on the tank car jacket (coil). 15 psig

IV-B.4. Apply steam to the car as needed to maintain temperature of contents between 140 deg. F and 175 deg. F.

IV-B.5. When preparing to transfer PNT to R-N105 connect hose between tank car and transfer line to R-N105. Leave the tank car discharge valve closed.

Turn steam on to hose jacket. Allow hose to become well warmed before attempting transfer.

See section IV-F. for instructions for transferring PNT from the tank car to R-N105.



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## IV-C.Disconnecting PNT Tank Car

The PNT tank car will be disconnected when it is empty or when it must be moved to accommodate switching another rail car.

IV-C.1. Check operating log to confirm that the transfer line has been blown clear.

IV-C.2. Put on a rainsuit, self contained breathing apparatus, and rubber gloves.

IV-C.3. Close the nitrogen valve to the tank car between the nitrogen supply and vent tee.

IV-C.4. Open the nitrogen vent valve and bleed all of the pressure from the car.

Disconnect the nitrogen hose from the car.

IV-C.5. Place a container, such as a 5 gallon bucket, under the drain valve in the transfer line.

IV-C.6. Close the valves on each side of the drain valve tee.

IV-C.7. Close the steam valve to the tank car jacket (coil), bleed off the steam pressure and disconnect the steam hose.

IV-C.8. Carefully and slowly open the drain valve until no more PNT drains into the bucket.

IV-C.9. Disconnect the flange between the drain tee and the valve at the tank car end of the transfer hose.

Note: Do not disconnect the flange on the hose side of the valve since this could allow trapped PNT to drain out.

IV-C.10. Shut off steam to the PNT hose.

IV-C.11. If the tank car is not empty leave any Cedar applied piping connected to the car if it is not in the way for switching. If the car is empty close the tank car unloading valve and remove all Cedar applied piping and retain for the next PNT car.

If the car is supposed to be empty confirm that it is truly empty by the following procedure:



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## IV-D. Connecting Chlorine Tank Car

IV-D.1. Chlorine is potentially extremely hazardous. The greatest danger is from a leak that releases large quantities of the gas to the atmosphere where it can be inhaled by personnel. Both gaseous and liquid chlorine are extremely irritating to the eyes and skin. The safety section of the operating instructions as well as the Material Safety Data Sheet for chlorine should be carefully studied.

IV-D.2. Confirm that the caustic scrubber system is in full operation. Have tight fitting goggles and a gas mask rated for chlorine service on your person.

IV-D.3. Place derails and warning signs at each end of the tank car. Be sure brakes are set and wheels blocked.

IV-D.4. Standard chlorine cars have two liquid discharge valves, two gas discharge valves, and one pressure relief valve, all located in the dome of the car. These are the only openings on the car.

Looking down on the dome the valve closest to the brake end of the car is No. 1, liquid valve. Going clockwise the next valve is No. 2, gas valve; next No. 3, liquid valve; next No. 4, gas valve. In the center is the pressure relief valve. On a DOT 105A300W car the relief valve is set to relieve at 225 psig. On a DOT 105A500W car it is set to relieve at 375 psig. The safety valve must never be disturbed or tampered with.

In our process chlorine will be taken through a liquid valve and converted to chlorine gas in a vaporizer. Section IV-J. provides instructions for start up of the vaporizer.

IV-D.5. A short 1 inch diameter pipe manifold has been prepared for use on the chlorine car. Connect this manifold to one of the liquid valves. Connect the unloading hose to the short manifold using a gaclock gasket. Be sure the gasket is in good condition. All piping must be clean, dry and free of oil.

IV-D.6. Do not open the tank car liquid valve until you have studied Section IV-J. of the operation instructions. That section deals with the operation of the vaporizer.



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## IV-E. Disconnecting Chlorine Tank Car

IV-E.1. When it is necessary to disconnect a chlorine tank car the chlorine transfer system must be purged in such a way to prevent chlorine release to the atmosphere when the chlorine hose is disconnected from the tank car liquid valve manifold. The procedure for this purging is contained in Section IV-K. of the operating procedures.

It may be necessary to disconnect the chlorine tank car because it is empty or to allow a railroad switching operation.

IV-E.2. After the transfer system has been purged put on tight fitting goggles, or a full face shield, and a gas mask equipped with cartridges specified for chlorine. Check to be sure the tank car liquid chlorine valve is closed. This valve should have been closed as part of the procedure described in Section IV-K. of the operating procedure for shutting down the chlorine vaporizer.



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## IV-F. Charging PNT to R-N105

IV-F.1. Check R-N105 to confirm that it is empty and dry. Check to confirm:

_____R-N105 discharge valve closed.
_____Steam to jacket valve closed.
_____Vent valve to heat exchanger E-N301 open.
_____Cooling water supply and return valves at E-N301 open.
_____Valve in condensate line from E-N301 to V-N101 open.
_____V-N101 drain valve closed.
_____V-N101 vent valve to scrubber open.
_____Nitrogen sparge valve to R-N105 closed.
_____Jacket drained and blown down.
_____Nitrogen transfer pressure valve closed.
_____Load cell read out zeroed.

IV-F.2. Confirm that temperature in the PNT car is between 175 and 185 deg. F, and that the hose from tank car to transfer line is properly connected and steam is on to transfer line tracing. Confirm that derails and warning signs are in place on each end of the tank car.

IV-F.3. Apply nitrogen to tank car until pressure is 30 (?) psig then close nitrogen valve.

IV-F.4. If the tank discharge valve is open, open all other valves in the pipe line between the PNT tank car and R-N105 except the charge valve at the reactor.

If the tank car discharge valve is not open, put on a full rain suit, self-contained breathing air mask, and rubber gloves in addition to standard safety gear.

Slowly open the tank car discharge valve and watch for leaks. If any occurs, close the valve until they are repaired.

Then open all other valves in the line between the tank car and R-N105 except the charge valve at R-N105.

IV-F.5. Make a final check of the load cell read out to confirm that it is zeroed and record the weight and time on the batch sheet.



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IV-F.6. Open the charge valve to R-N105 and allow CNT to flow until 18,350 lbs. have been charged, at which time close the charge valve.

IV-F.7. Close the valve closest to the tank car and connect nitrogen hose to the PNT transfer line. Open the nitrogen valve. Open the R-N105 charge valve and blow the transfer line until clear. (No further increase on reactor load cell read out). Close the nitrogen valve and the R-N105 charge valve. ?

IV-F.8. Make all required batch sheet entries such as time charge started, time ended, quantity charged, etc. Throughout the operation be sure to accurately record all data called for on the batch sheets. Make sure the entire batch sheet is filled out!



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## IV-G. Drying PNT

IV-G.1. After a full charge of PNT is in R-N105 start the agitator and open steam valve to jacket and check for proper steam trap operation. Heat PNT to 180 deg. F and maintain between 175 deg. F and 185 deg. F.

IV-G.2. Open nitrogen sparge valve and maintain a nitrogen flow rate of 1 cfm throughout the drying cycle.

IV-G.3. After 120 minutes take a sample of PNT to the lab for moisture determination. Take a sample and have the moisture checked every 60 minutes thereafter until the moisture content is less than 0.2% (2000 ppm). Experience may indicate more or less frequent sampling.

IV-G.4. After the batch is dried to less than 0.2% moisture close the steam valve to R-N105 jacket, open jacket drain valve, close condensate line valve, and allow jacket to drain.

IV-G.5. After jacket is drained close jacket drain valve, open cooling water return valve and cooling water supply valve.

Continue cooling the dried PNT until the temperature reaches 138 deg. F. Maintain the temperature between 130 deg. F. and 138 deg. F during the thionyl chloride addition.



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## IV-H. Thionyl Chloride Addition

IV-H.1. Close the nitrogen valve to R-N105 and vent R-N105 to V-N101.

Open valves between the vacuum pump and R-N105 and close the R-N105 vent valve.

Start vacuum pump and pull a vacuum on R-N105 to 350-400 millimeters.

IV-H.2. Put on a full face mask with air supply and rubber gloves and open thionyl chloride drum located on a platform scale. Insert lance on end of charge hose into drum. Open valve in thionyl chloride charge line to R-N105. Allow thionyl chloride to be sucked into the reactor until a total of 65 lbs. has been charged as measured by weight loss read on the platform scale.

Remove the lance from the thionyl chloride drum and let air suck through the charge hose only long enough to clear it of liquid then close the thionyl chloride charge valve. Air should not be sucked in longer than necessary in order to minimize the entrance of moisture with the air.

During the above operation hold the lance over an empty container to catch any drippage. Place the lance in this container until needed for the next charge. Seal the thionyl chloride container.

IV-H.3. Close the valves between the vacuum pump and R-N105 then shut off the pump.

IV-H.4. Carefully open the nitrogen valve to R-N105 and bring reactor pressure to between 0 and 5 psig. (Opening R-N105 vent to V-N101 condensers is avoided to prevent pulling moisture into R-N105).



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## IV-I. Transferring Dried PNT to R-N101

IV-I.1. Check to confirm the following:

_____ R-N101 jacket full of water with water supply ~~and return valves open.~~ valve closed

_____ R-N101 discharge valve closed.

_____ Valves between R-N101 and caustic scrubber open.

_____ Scrubber system charged with fresh batch of caustic solution and all valves set for circulating through the scrubber.

_____ Scrubber circulation pump on.

_____ Scrubber fan on.

_____ Water supply and return valves open at scrubber heat exchanger E-N201.

_____ Scrubber liquor temperature on control room read out normal at 80 deg. F to 190 deg.F.

_____ Scrubber liquor flow rate on control room read out normal at 40 gpm to 50 gpm. 35-40 preferred

IV-I.2. Open charge valve to top of R-N101. Zero R-N101 load cell readout.

IV-I.3. Open R-N105 discharge valve and maintain 2-5 psig nitrogen pressure on R-N105 until entire batch of dry PNT is transferred into R-N101.

IV-I.4. Close nitrogen valve to R-N105 and shut off R-N105 agitator.

Close R-N105 discharge valve and R-N101 charge valve.



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## IV-J. Starting Up Chlorine Vaporizer

IV-J.1. The chlorine vaporizer is a steam jacketed steel vessel. Liquid chlorine flows from the chlorine car to the vaporizer. Inside the vaporizer the liquid chlorine flows down a dip pipe to the bottom of the vaporizer. Heat from the steam jacket causes the chlorine to boil and the chlorine gas rises to the top section of the vaporizer and from there to the piping system that carries the gas to R-N101.

Liquid chlorine should never be confined in a vessel or piping that is not equipped with a relief valve or rupture disc. For example great care must be exercised to avoid trapping liquid chlorine in a pipe between two closed valves. If that happens and the chlorine temperature rises it could build up enough pressure to rupture the pipe. The vaporizer, as well as the chlorine tank car, is equipped with a pressure relief valve.

During chlorination, valving between the chlorine car and the vaporizer, and between the vaporizer and R-N101 will be open and 5 psig steam will be on the vaporizer jacket. If the chlorine valve controlling flow to R-N101 is closed nothing undesirable will happen. Any liquid in the vaporizer will boil and the chlorine gas will flow back into the car and condense in the large volume of liquid there. This is referred to as allowing the vaporizer to "float" on the car. It is safe to let the vaporizer with steam on the jacket float on the chlorine car between chlorination batches even if several hours elapse.

IV-J.2. Check to be sure the chlorine car is properly connected as described in Section IV-D.

If the tank car liquid valve is closed and has not been opened since the chlorine hose was connected this means the connections have not been checked for leaks.

Check to be sure all valves between the tank car and the vaporizer are closed.

Check to be sure the caustic scrubber is charged and operating. If the vaporizer relief valve opens chlorine will vent to the caustic scrubber.

Check to be sure the vaporizer outlet valve is closed as well as the chlorine flow control valve and the two valves between the flow control valve and R-N101. Thus all valves in the line between the vaporizer and R-N101



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will be closed with the possible exception of the chlorine pressure control valve.

Check to be sure the drain valve in the vaporizer outlet pipe is closed.

Check to be sure the drain valve and nitrogen connection valve on the tank car manifold are closed.

IV-J.3. If chlorine has not yet been drawn from the chlorine tank car since it was connected to the transfer system put on tight fitting goggles and a gas mask with cartridges rated for chlorine service or a full face gas mask, a full rain suit, and rubber gloves in addition to standard safety gear..

IV-J.4. Open the following valves in the sequence listed and check the valves and connection joints with ammonia as each valve is opened. If a leak is detected close the last valve opened until the leak is repaired then proceed.

Tank car liquid valve.

Valve at the tank car end of the chlorine hose.

Valve at the vaporizer end of the chlorine hose.

Note: Leave vaporizer inlet valve closed.

At this point if there are no leaks the gas mask may be removed and safety glasses substituted for the tight fitting goggles.

If chlorine has been drawn from the tank car since it was connected the connection joints will already have been tested for leaks. In this case steps in sections IV-J.3 and IV-J.4. need not be carried out but be sure the vaporizer inlet valve is closed.



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IV-J.5. Open the steam valve to the vaporizer steam jacket. Be sure the steam pressure does not exceed 10 psig. Be sure the steam trap is operating properly and air has been bled out of the steam jacket. Watch the pressure gauge on the vaporizer discharge line. If the pressure rises by more than 50 psig, close the steam valve. The pressure built up indicates liquid chlorine was left in the vaporizer. Notify the Supervisor and arrange to boil the liquid to the chlorine tank car.

IV-J.6. When the vaporizer has been heated to the point that a small amount of water splashed onto the jacket boils, begin very slowly to open the vaporizer inlet valve.

Watch the pressure gage in the line between the tank car and the vaporizer and the pressure gage on the vaporizer outlet line.

As liquid chlorine is admitted into the vaporizer the pressure in the vaporizer will rise. Continue to slowly open the vaporizer inlet valve until the pressure in the vaporizer equals the pressure in the line between the tank car and the vaporizer. At that point slowly move the valve to the full open position.

IV-J.7. Observe the pressure in the line between the chlorine gas automatic pressure control valve and R-N101. If that pressure is less than the pressure in the vaporizer open the valve between the chlorine pressure control valve and the vaporizer.

If the pressure is greater than that in the vaporizer open the valves in the line between the automatic pressure control valve and R-N101 to relieve the pressure, then open the valve between the chlorine pressure control valve and the vaporizer.

IV-J.8. Set the chlorine vapor pressure control valve to 30 psig.

IV-J.9. Start chlorine flow into R-N101 following the instructions in Section IV-L.

IV-J.10. The chlorine vaporizer must be operated in such a way as to discharge chlorine gas with at least 18 deg. F of super heat. This means the temperature of the gas must be at least 18 deg.



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F higher than the boiling point of chlorine at the pressure existing in the vaporizer. The degrees of super heat is determined by observing the temperature and pressure in the vaporizer.

It is necessary for the chlorine to be superheated to prevent liquid chlorine from entering R-N101 and causing a violent reaction.

IV-J.11. Following is a graph showing the vapor pressure of chlorine vs. temperature. The curve represents the boiling point of chlorine at a given pressure.

For example if the vaporizer pressure is 110 psig the absolute pressure is 125 psia. At this pressure the boiling point is 85 deg. F. In order to have 18 deg. F superheat the temperature in the vaporizer would need to be 103 deg. F (85 + 18).

After the normal vaporizer operating pressure range is established an easier to read table will be made up for determining degrees of superheat.

IV-J.12. During operation observe the degree of superheat frequently, at least as frequently as recorded on the batch sheet.

Any decrease in superheat must be investigated immediately because it probably means an accumulation of liquid in the vaporizer. Such accumulations at a superheat less than 18 deg. F may reach an excessive level.

Principal causes of the increase in liquid level in the vaporizer are:

Chlorine feed rate excessive (vaporizer doesn't have enough heating capacity to keep up with it). Can be corrected by reducing feed rate.

Restriction of steam flow to the vaporizer. Correct by eliminating restriction.

Steam condensate not getting away from the vaporizer steam jacket fast enough. Correct by being sure the steam trap is discharging properly and there is no restriction in the condensate line.

Air in the steam jacket. Vent off the air and be sure the automatic air vent is functioning properly.



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Fouling of the heat transfer surface in the vaporizer. Correction of this requires shutting down, disassembling, and cleaning the internal surfaces of the vaporizer. The cleaning should be done under the direction of the engineering department.

IV-J.13. A pressure transmitter is located in the chlorine vapor line between the vaporizer and R-N101. A pressure indicator - controller is located in the control room and should be set at 85 psig. 10# low, 40# high

The system also contains high pressure and low pressure sensors. If the pressure rises too high or falls too low an alarm will sound and the automatic vapor pressure control valve will close.

If this happens close the valve between the chlorine pressure control valve and the vaporizer. Leave valves between the vaporizer and the tank car open.

IV-J.14. Determine the cause of the excessively high or low pressure and correct it.

Some possible causes of low pressure are as follows:
Those listed in Section IV-J.12.
Chlorine car becoming empty.

Partially (or completely) closed valve between the tank car and the vaporizer. Correct by opening the valve.

Fouling of the chlorine line between the vaporizer and the tank car. This would require a shut down and cleaning or replacing the piping.

Closing of the chlorine tank car excess flow valve as a result of a sudden surge in the chlorine flow. With the chlorine flow shut off as it would be at this point and the vaporizer floating on the tank car the pressure will equalize on both sides of the excess flow valve and the valve ball will drop into the open position.

IV-J.15. Some possible causes of high pressure are as follows:

Closed or nearly closed valves in <u>both</u> the line between the vaporizer at R-N101 <u>and</u> between the vaporizer and the tank car. This could trap pressure in the system. The corrective action is to open appropriate valves to relieve the pressure either into R-N101 or into the tank car.



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Note: Remember that, normally, excessive pressure will not build up in the system if valving is closed between the vaporizer and R-N101 as long as the valves are open between the vaporizer and the tank car. Under these conditions pressure is relieved into the tank car.



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## IV-K. Shutting Down Chlorine Vaporizer

IV-K.1. Use this procedure between chlorination batches when the chlorine car does not need to be disconnected for switching. (IV-K.2. contains instructions to be used if the chlorine car is to be disconnected from the unloading line.)

Check to be sure steam is on the vaporizer and the vaporizer is hot.

Check to be sure all valves are open between the vaporizer and the chlorine car.

Close one or more valves between the vaporizer and the chlorination reactor (R-N101). the flow control valve & reactor block valve

This set up will allow the vaporizer to "float" on the chlorine tank car. Any liquid in the vaporizer will vaporizer into the chlorine car and the pressure in the vaporizer and the chlorine car will become equalized.

The system can be left in this mode between chlorination batches even for a period of several hours.

Note: The valves between the chlorine car and the vaporizer should never be open when the vaporizer is not hot. Otherwise liquid chlorine can accumulate in the vaporizer and cause serious problems later.

IV-K.2. Us this procedure is the chlorine car is to be disconnected. (The first three steps are the same as in IV-K.1.).

Check to be sure steam is on the vaporizer and the vaporizer is hot.

Check to be sure all valves are open between the vaporizer and the chlorine car.

Close one or more valves between the vaporizer and the chlorination reactor (R-N101).

The vaporizer pressure will rise slightly and force liquid chlorine back into the chlorine car.

After 5 or 10 minutes close the liquid chlorine inlet valve to the vaporizer and observe the vaporizer pressure gauge for 1 or 2 minutes. If the pressure does not rise (or rises slowly then remains steady) the vaporizer is

sufficiently free of liquid chlorine.

If the vaporizer pressure rises more than 50 psig or exceeds 200 psig when the liquid inlet valve is closed open the valve for 5 minutes and repeat the procedure if necessary until there is no excessive pressure rise when the liquid inlet valve is closed.

At this point the procedure can be carried out for disconnecting the chlorine car. If desired steam to the vaporizer can also be shut off.

## IV-L. Chlorinating PNT

Note: During the chlorination of PNT some one must be in the control room at all times monitoring and controlling the process.

Note: In addition to standard safety gear, rubber gloves, respirator with "F" type filters, tight fitting goggles, or full face shield, apron and rubber footwear must be worn when handling ferric chloride and Iodine.

IV-L.1. Start R-N101 agitator at low (59 rpm) speed.

IV-L.2. Maintain the batch temperature between 140 deg. F and 176 deg. F, with 172 deg. F preferred, during the entire chlorination step.

IV-L.3. Add 270 lbs. (2 drums) of ferric chloride to R-N101 through the charge pot.

Add 6.5 lbs. of iodine to R-N101 through the charge pot. Iodine will be pre-weighed and packaged in the lab. Iodine and Ferric Chloride do not take part in the reaction but catalyze the chlorination reaction).

IV-L.4. The minimum temperature (140 deg. F) must be maintained to prevent the batch from solidifying. The maximum temperature (176 deg. F) has been established by experience.

IV-L.5. Check to confirm the following:

Derails and warning signs in place on each end of the chlorine car.

Steam on to vaporizer and trap working properly.

Hose connection between chlorine car and piping in place and secure.

All drain and purge valves in the chlorine piping system that discharge to atmosphere closed.

Chlorine control valve to R-N101 closed.

Chlorine pressure controller (at control panel) set at 28 psig.

Chlorine flow controller (at control panel) set at zero lbs./hr.



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IV-L.6. Refer to Section IV-J. of the operating procedures for putting the chlorine vaporizer into operation and setting up to start chlorine flow to R-N101.

IV-L.7. Open manual valves between chlorine flow controller and R-N101.

Increase chlorine flow controller to 200 lbs./hr. Check out the entire system to insure that there are no chlorine leaks. If a leak is found close appropriate valving to stop the leak and do not proceed until the leak is repaired.

During chlorination monitor the chlorine pressure which should remain between 10 and 40 psig.

Monitor the scrubber liquor flow rate which should be between 10 and 50 gpm.

Monitor the scrubber liquor temperature which should be between 80 and 190 OF.

If any of these limits are exceeded take appropriate action. If help is needed notify the supervisor.

IV-L.8. Continue chlorinating at 1200 lbs./hr. for six (6) hours at which time take a sample from the reactor to the lab for a freeze point determination. The freeze point increases as chlorination proceeds.

Note: Wear a self-contained breathing air mask, rubber apron, rubber gloves, and rubber footwear, in addition to normal safety gear, while taking the sample.

Continue to take samples and have freeze point determined every _____.

IV-L.9. When the freeze point exceeds 129 deg. F reduce the chlorine rate to _____ lbs./hr. and take samples ~~to the lab~~ at least every 20 minutes.

IV-L.10. When the freeze point reaches 136 deg. F chlorination should be complete. The lab will confirm this by vapor phase chromatograph (VPC).

IV-L.11. When chlorination is complete set chlorine flow controller to zero and close the manual valve



AB0000118407/29

Dupont Chlorination

Cedar - West Helena
Dupont Chlorination
As of 6/29/50 7:00 AM

CC J Miles C Parker R Johns J Walker K Howard [redacted] J Porter G Satterfield B Fairchild B Oberle G Pratt

| Date Started | Date Finished | Batch No | PNT Used | Chlorine Used | Thionyl Chlo Used | Caustic Used | Soda Ash Used | Iodine Used | Ferric Acid Used | Sod Sulfite Used | HCL Used | 5140 ChT Prod | Waste/W Prod |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| November Totals | | | 327,660 | 190,000 | 220 | 235,673 | 60 | 53.0 | 4,760 | 20,200 | 39,739 | 476,460 | 647,900 |
| January Totals | | | 264,600 | 165,937 | 468 | 241,869 | 1,100 | 17.0 | 3,860 | 3,900 | 20,735 | 374,800 | 1,329,860 |
| February Totals | | | | | | | -100 | 138.0 | 195 | | | | 481,940 |
| May Totals | | | 240,750 | 122,400 | 626 | 160,870 | 275 | 78.0 | 5,470 | 2,775 | 2,340 | 264,980 | 113,660 |
| 30-May | 3-Jun | 21 | | | | | | | 270 | 426 | | 23,320 | |
| 31-May | 3-Jun | 22 | | 9,940 | 50 | 22,825 | 35 | 6.5 | 270 | | 8,000 | 23,540 | |
| 2-Jun | 3-Jun | 23 | 18,670 | 10,020 | 24 | 19,780 | 35 | 6.5 | 270 | | | 23,300 | |
| 3-Jun | 5-Jun | 24 | 18,850 | 10,220 | 57 | 21,325 | 25 | 6.5 | 270 | 400 | 10,300 | 23,090 | 22,460 |
| 4-Jun | 6-Jun | 25 | 18,720 | 10,300 | 61 | 19,187 | 35 | 6.5 | 270 | 400 | | 23,540 | 22,600 |
| 6-Jun | 10-Jun | 26 | 18,630 | 10,620 | 49 | 12,361 | 35 | 6.5 | 270 | 700 | | 22,170 | 22,170 |
| 6-Jun | 10-Jun | 27 | 18,750 | 10,980 | 62 | 19,662 | 25 | 6.5 | 270 | 700 | | 23,650 | 23,650 |
| 7-Jun | 20-Jun | 28 | 18,700 | 10,320 | 116 | 14,163 | 25 | 6.5 | 270 | 1,200 | 7,400 | 23,610 | |
| 10-Jun | 21-Jun | 29 | 18,750 | 10,340 | 25 | | 25 | 6.5 | 270 | 850 | | 23,460 | 22,790 |
| 18-Jun | 24-Jun | 30 | 18,650 | 6,550 | 12 | 13,392 | 25 | 4.5 | 168 | | | 15,810 | 22,850 |
| 20-Jun | 26-Jun | 31 | 6,340 | 6,880 | 26 | 500 | 25 | 4.5 | 270 | | | 14,500 | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month End Adjustments | 1,120 | -837 | | 55,477 | -465 | -92.0 | -419 | -200 | 162,661 | -50 | 1,276,610 |
| Current Month Totals | 166,870 | 94,263 | 481 | 198,572 | -175 | -31 | 2,470 | 4,475 | 188,261 | 240,070 | 1,411,820 |
| May & June Totals | 396,600 | 216,663 | 1,007 | 358,942 | 100 | 47 | 5,940 | 7,250 | 190,601 | 495,000 | 1,525,500 |
| Page Totals | 988,760 | 572,600 | 1,795 | 936,384 | 1,160 | 275 | 14,715 | 36,550 | 301,135 | 1,235,280 | 4,135,200 |
| Usage Factor lb/lb | 0.600 | 0.464 | 0.001 | 0.677 | 0.001 | 0.000 | 0.012 | 0.029 | 0.244 | | 3.346 |



AB0000118316/1

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

CHEMICALS AND PIGMENTS DEPARTMENT

June 25, 1990

Mr. Geoffrey L. Pratt
Director Custom Manufacturing
Cedar Chemical Corporation
24th Floor
5100 Poplar Avenue
Memphis, TN 38137

Dear Geoff:

Please change the specs for your production of 2-chloro, 4-nitro toluene to reflect the following:

| | |
|---|---|
| 2Cl4NT | 88% Min. |
| dichoro's | 5% Max |
| PNT | 3.5% +/- 2.5% |
| nitrophenol | 20 ppm Max. |
| pH | 7.5 Min. |

I've discussed these specs with Greg Satterfield and he expects no difficulty meeting them. He started to use these specs on June 20. Greg also anticipates shorter cycle times as a result of our request for "less chlorination".

Let me know if these specs present any problems.

Sincerely,

Elaine

Elaine A. Donald
Materials Manager

EAD:map

cc: John H. Miles, Jr., Cedar Chemical Corporation
Greg Satterfield, Cedar Chemical Corporation
R. E. Blackhall, Du Pont
J. A. Medaris, Du Pont
P. H. Smith, Du Pont

# CEDAR CHEMICAL CORPORATION

P.O. Box 2749. Hwy. 242 S. • West Helena, AR 72390
(501) 572-3701 • Fax No. 501-572-3795

1st Run

Bad Product - at West Helena

| | | | |
|---|---|---|---|
| Batches | 1-8 | GATX 19970 | 182,935 |
| Batch | 9 | Tank Truck | 23,040 |
| | | Total Bad Product | 205,975 |

Good Product

1st Run

| | | | |
|---|---|---|---|
| Batches | 10-16 | GATX 13733 | 161,300 |

Shipped 9/12/89

2nd Run

| | | | |
|---|---|---|---|
| Shipped | 11/14 | GATX 14459 | 178,100 |
| | 11/27 | UTLX 65931 | 138,800 |
| | 11/27 | UTLX 65934 | 90,900 |
| | | | 407,800 |

cc: John Miles
Greg S.
Tom L.
Ken H.
G. Pratt

MU-2500 REV. 5-83

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
CHAMBERS WORKS
DEEPWATER, NEW JERSEY 08023

CC: Tom Richard
Ken
Charlie
Joe P.

November 16, 1989

Mr. John Miles
Plant Manager
Cedar Chemical Corp.
West Helena, Arkansas 72390

Dear Mr. Miles:

Following our recent telephone conversation, I was given a letter regarding handling of the waste water generated by the 2C4NT process. I am enclosing a copy of this letter.

You should have been notified of this some months ago, and I have no explanation of why you were not.

We still plan to ship the bulk of this waste water by tank car; however, at least one car will have to be off-loaded to a tank trailer for the initial run.

DuPont will reimburse you for the cost involved in this off-loading and for the freight involved in shipping the tank trailers.

I recommend that you use S-J Transportation of Woodstown as they are registered waste haulers all the way through to and including N.J. Your contact would be Mike Remster at 609-769-2741. I can make the hauling arrangements if you desire.

Thank you for your cooperation.

Sincerely,

Paul H. Smith

Paul H. Smith
609-540-3595

PHS:swb
Attachment
5065M



AB0000117105/2

DuPont- P-Nitro Toulene 165

PROD GROUP FILE

PROD GROUP 114 ✓

PRODUCT MASTER LISTING 74 ✓ 574 ✓

CONSTANT FILE 790 ✓

ITEM 5140 ✓

CH-2 REV. 7-80

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

CHEMICALS AND PIGMENTS DEPARTMENT

cc: S. A. Hamdan
R. T. King
S. O. Rogers
D. P. Heintzelman
J. J. Gavigan
T. L. Hamberger
E. A. Donald

May 23, 1989

K. M. KAMENSKI

2 Cl-4$NO_2$ Toluene Cedar Toll

The letter from Cedar Chem detailing the above tolling arrangement had some loose ends in it. This letter will clarify (and should be attached to Cedar's letter) how we expect to handle billings for some of the items.

- We should order all the crudes except soda ash. You will establish blanket orders for chlorine and caustic which Cedar can "call off" against. Others will be one time orders shipped direct to West Helena.

- Liquid waste disposal will start by the material being tank trucked to an appropriate deep well site (TLH to define). Trucking and deep welling bills should be sent direct to Du Pont Chambers Works. Later Cedar may try to put a portion through their ponds.

- Since we are being billed $9M/day for the first campaign, it will be important that you come to an agreement with Cedar as to when you start and finish. Towards the end of the first campaign you will need to establish a normal lb/day rate to convert the daily charge to a $/lb charge for subsequent campaigns.

If for some reason there is a need to revise the above, you should formalize the change in a letter to be attached to Cedar's and this letter.

G. L. MC NEILL

GLM172:bhc

2C14NT 1988 PRODUCTION AND CONSUMPTIONS

| ITEM | STANDARD 1988 lbs/cwt | 1988 lbs | 1988 lbs/cwt | Cedar 1st CMPGN lbs | CEDAR Total lbs |
|---|---|---|---|---|---|
| Chlorine | 47.351 | 600,907 | 49.637 | 197,198 | 591,594 |
| Ferric Chloride Anhy | 1.127 | 15,680 | 1.295 | 5,146 | 15,437 |
| Iodine | 0.023 | 320 | 0.026 | 105 | 315 |
| Nitrogen, 10M cu ft+ | 1.511 | 18,292 | 1.511 | 6,003 | 18,009 |
| p-Nitrotoluene | 87.417 | 1,066,529 | 88.099 | 350,000 | 1,050,000 |
| Soda Ash Light + | 0.564 | 3,759 | 0.311 | 1,234 | 3,701 |
| Soda Caustic Liquid, 50% | 7.160 | 103,231 | 8.527 | | |
| Thionyl Chloride | 0.507 | 2,765 | 0.228 | 907 | 2,722 |
| 2C14NT | 100.000 | 1,210,601 | 100.000 | 397,280 | 1,191,839 |
| % YIELD (Molar Based PNT/2C14NT) | 91.4% | 90.7% | | 90.7% | 90.7% |

P.O.# LMD 956834Y

ACCTS PAYABLE

FAX 609-540-2663

## CEDAR INTERNAL CORRESPONDENCE

DATE: 05-18-89

TO: John Miles

FROM: Neil Robbins

CC.

SUBJECT:

THE START-UP NUMBER FOR DUPONT-P-NITRO TOULENE IS 0274-5250.

THE PRODUCT NUMBER FOR DUPONT-P-NITRO TOULENE IS 74.

cc: Charlie
Janice
Tom
Guinn
Ken
Joe Porter
Richard
Joel
Joe Forthman
Robert
Beaver
Greg
Russell
Floy
Dennis

BPC - 1140-A

May 19, 1989

To: Geoff Pratt From: Neil Robbins

Subject: Cost Estimate on
DuPont P-Nitro Toulene

Geoff I have enclosed a copy of our new cost estimation sheet that should be completed on each new potential project to reveiw the economics of the project by management. We are a little late on the DuPont project but need one completed.

If you would complete those blanks that you can answer and initial, then return to me as soon as possible.

I will return to you a copy of the final estimate for your reveiw and suggestions.

I have also included additional blank copies for all future projects for you to initiate and send to me so I can get the ball rolling on the estimation.

If you have any suggestions on a different format please advise, but I feel this is sufficient sense it follows the format that the actual cost will flow to our income statement and cost report.

Miles

CC: Tom
Kim
Joe
Doug
Neil
Charlie

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

May 12, 1989

Mr. Gordon L. McNeill
E.I. DuPont de Nemours & Company
Chemicals and Pigments Department
Wilmington, Delaware 19898

Dear Gordon:

Since today is May 12, it is time to make our proposal to you for the chlorination of p-nitro toluene. For three equal campaigns for a total of 1MM pounds beginning in late June 1989 we propose:

1) A one time plant modification fee not to exced $160M. A detailed breakdown of the costs would be provided with invoices and no markup is applied. An additional $35M would be required to install a continuous wash column intended to reduce aqueous waste. It will be necessary to conduct laboratory studies to enhance the probability of this approach being successful.

2) A daily processing fee of $9,000 to include all services except waste disposal and raw materials.

3) Cedar will provide raw materials other than the p-nitro toluene upon request at our cost plus five percent. Nitrogen is considered a raw material and would be metered to the project if needed.

4) Waste will be returned to DuPont for disposal or shipped to licensed commercial disposal sites approved by both parties. Cedar will make its best efforts to dispose of wastes in its onsite biological system and would share any cost savings with DuPont. Commercial deepwell disposal of aqueous waste is estimated to cost $0.32/gallon including freight.

5) Cedar will begin production with onsite technical direction by DuPont personnel. After a suitable trial period, Cedar would be willing to continue production using a fixed processing fee per pound of product and

warranty raw material consumption standards and product quality based upon parameters demonstrated in the trial.

We hope that this proposal will meet your economic criteria and we can proceed with the project. Please call if clarification of the proposal is needed, or if we need to explore a different approach.

Sincerely,

Geoffrey L. Pratt
Director Operations
Custom Manufacturing

/kt

**CEDAR INTERNAL CORRESPONDENCE**

DATE: 05-18-89

TO: John Miles

FROM: Neil Robbins

CC:

SUBJECT:

THE START-UP NUMBER FOR DUPONT-P-NITRO TOULENE IS 0274-5250.

THE PRODUCT NUMBER FOR DUPONT-P-NITRO TOULENE IS 74.

cc: Charlie
Janice
Tom
Guinn
Ken
Joe Porter
Richard
Joel
Joe Forthman
Robert
Beaver
Greg
Russell
Floy
Dennis

DuPont 2-Cl-4-NT Budget Capital Cost Estimate 5/9/89-TJL

| ITEM | COST | |
|---|---|---|
| I CHLORINE | | |
| A. Piping | 12,000 | |
| B. Vaporizer | 6,000 | |
| C. Instrumentation | 7,000 | |
| | | 25,000 |
| II PNT - R5/R6 | | |
| A. Piping repairs | 2,000 | |
| B. Piping to R1 | 12,000 | |
| | | 14,000 |
| III CHLORINATOR - R1 | | |
| A. Vent piping | 4,000 | |
| B. Instrumentation | 6,000 | |
| C. Piping to R2 - TFE | 14,000 | |
| | | 24,000 |
| IV HOLD VESSEL - R2 | | |
| A. Piping to wash column | 16,000 | |
| B. Pump | ~~5,000~~ | |
| C. Instrumentation | ~~4,000~~ | |
| | | 25,000 |
| V WATER TANK - V4 | | |
| A. Water piping | 3,000 | |
| B. Piping to column | 6,000 | |
| | | 9,000 |
| VI WASH COLUMN | | |
| A. Column | ~~6,000~~ | |
| B. Installation | ~~14,000~~ | |
| C. Insulation | ~~5,000~~ | |
| | | 25,000 |
| VII PRODUCT HOLD TANK | | |
| A. Carbonate chute | 8,000 | |
| B. Water piping | 3,000 | |
| C. Sightglass | 0 | |
| D. Piping to product car | 12,000 | |
| E. Piping to w/w car | 2,000 | |
| F. Piping from column | 5,000 | |
| | | 30,000 |
| VIII WATER HOLD TANK | | |
| A. Piping from column | 4,000 | |
| B. Instrumentation | 2,000 | |
| C. Piping to scrubber | 3,000 | |
| D. Piping to w/w car | 2,000 | |
| | | 11,000 |
| IX SCRUBBER | | |
| A. Heat exchanger | 3,000 | |
| B. Piping to w/w car | 3,000 | |
| | | 6,000 |
| SUB-TOTAL | | 169,000 |
| CONTINGENCY (10%) | | 16,900 |
| TOTAL | | $185,900 |

Subtract 35M



AB0000118287/2

DuPont 2-Cl-4-NT Budget Capital Cost Estimate 5/9/89-TJL

| ITEM | COST | |
|---|---|---|
| I CHLORINE | | |
| A. Piping | 12,000 | |
| B. Vaporizer | 6,000 | |
| C. Instrumentation | 7,000 | |
| | | 25,000 |
| II PNT - R5/R6 | | |
| A. Piping repairs | 2,000 | |
| B. Piping to R1 | 12,000 | |
| | | 14,000 |
| III CHLORINATOR - R1 | | |
| A. Vent piping | 4,000 | |
| B. Instrumentation | 6,000 | |
| C. Piping to R2 - TFE | 14,000 | |
| | | 24,000 |
| IV HOLD VESSEL - R2 | | |
| A. Piping to wash column | 16,000 | |
| B. Pump | 5,000 | |
| C. Instrumentation | 4,000 | |
| | | 25,000 |
| V WATER TANK - V4 | | |
| A. Water piping | 3,000 | |
| B. Piping to column | 6,000 | |
| | | 9,000 |
| VI WASH COLUMN | | |
| A. Column | 6,000 | |
| B. Installation | 14,000 | |
| C. Insulation | 5,000 | |
| | | 25,000 |
| VII PRODUCT HOLD TANK | | |
| A. Carbonate chute | 8,000 | |
| B. Water piping | 3,000 | |
| C. Sightglass | 0 | |
| D. Piping to product car | 12,000 | |
| E. Piping to w/w car | 2,000 | |
| F. Piping from column | 5,000 | |
| | | 30,000 |
| VIII WATER HOLD TANK | | |
| A. Piping from column | 4,000 | |
| B. Instrumentation | 2,000 | |
| C. Piping to scrubber | 3,000 | |
| D. Piping to w/w car | 2,000 | |
| | | 11,000 |
| IX SCRUBBER | | |
| A. Heat exchanger | 3,000 | |
| B. Piping to w/w car | 3,000 | |
| | | 6,000 |
| SUB-TOTAL | | 169,000 |
| CONTINGENCY (10%) | | 16,900 |
| TOTAL | | $185,900 |



AB0000118287/3

**CEDAR INTERNAL CORRESPONDENCE**

DATE: May 25, 1989

TO: Richard Johns

FROM: Guinn Cantrell

CC: Joel, Tom, Joe, Ken, Robert, John

SUBJECT: DuPont 2-Chloro-4-Nitrotoluene

Production Work Items

The following equipment in the MBC unit and associated piping need to be emptied, cleaned and readied for maintenance inspection and piping modifications:

| | |
|---|---|
| R-N105 | |
| R-N106 | T-N206 |
| R-N101 | V-N104 |
| R-N104 | V-N101 |
| R-N103 | E-N304 |
| R-N102 | E-N301 |

This work needs to be accomplished as soon as possible so as not to cause delays on work to be done by maintenance and outside contractors. Outside contractors will start modifications in first week of June. Your cooperation is needed and appreciated.

**CEDAR INTERNAL CORRESPONDENCE**

DATE: May 25, 1989

TO: Joe Forthman

FROM: Guinn Cantrell

CC: John Tom
Robert Ken
Richard Joel

SUBJECT: DuPont 2-Chloro-4-Nitrotoluene

Maintenance Work Items

The following equipment in the MBC unit needs to be inspected and a report of condition recorded. Repairs should be made as required:

| | | |
|---|---|---|
| R-N105 | V-N101 | |
| R-N106 | V-N104 | |
| R-N101 | E-N301 | |
| R-N104 | E-N304 | |
| R-N103 | P-N104 | (V-N104) |
| R-N102 | P-N206 | (T-N206) |
| T-N206 | | |

A memo was sent to production requesting the above equipment be prepared for inspection as soon as possible. Outside contractors should start piping modifications in unit the first week in June. Your cooperation is needed and appreciated.

Ken Charlie Joel
Joe Neil

**CEDAR INTERNAL CORRESPONDENCE**

DATE: 07/07/89

TO: Bill Eissler

FROM: Geoffrey Pratt

CC: John Miles
Willard Brown
Niven Morgan

SUBJECT: Custom Manufacturing Update

ICI

On June 27, a fifteen (15) day extension was signed to the current quarterly contract for Permethrin products. The extension will consume existing stocks of raw materials. ICI has projected future needs to be:

| | 1990 | 1991 | 1992 | 1993 |
|---|---|---|---|---|
| 2MM lbs. | | 1.6 | 1.1 | 0.9 |

They have asked for a proposal for a two year contract with an annual renewal option thereafter. The projected needs would use the Permethrin unit for:

| | 1990 | 1991 | 1992 | 1993 |
|---|---|---|---|---|
| months | 7-8 | 6-7 | 4-5 | 3-4 |

ICI is aware that we are considering the Permethrin unit for another project (DCA) and that continuing use for Permethin products would increase Cedar's capital cost for that project ($8-900M). They are sympathetic to our dilemma, but not to the extent of funding a resolution.

They will have additional needs for production in September and the fourth quarter of 1989. They cannot commit to this production until the broader issue of plant availability is resolved.

| | Revenue | Gross Margin |
|---|---|---|
| Budget 1989 | 0 | 0 |
| Actual | $1.4MM | $705M |

Rhone Poulenc

We have negotiated a production run of 95 metric tons (210,000 lbs.) of methylthiopinacalone oxime (MTPO) at a price of $4.90/lb. fob West Helena. This project will commence in mid August and take 75 days. Cedar will provide all raw materials, except monochloropinacalone, at a projected cost of $1.50/lb MTPO. The MTPO is used in Thiofanox a proprietary pesticide. Cedar made MTPO for Rhone Poulenc in 1985, 1986 and 1987 for $2.90/lb. Rhone Poulenc is having difficulty swallowing the price increase but this year has no alternative to Cedar. They have asked Cedar to consider a "more competitive price" for the future, they proposed $4.10/lb for 1989. We have indicated that future pricing will depend on the degree of commitment and forward scheduling they are prepared to make.

| | revenue | gross margin |
|---|---|---|
| Budget 1989 | 0 | 0 |
| Expected | $1MM | 250M |

Ortho (Lactofen)

On October 14, 1988 we were contacted by Jim Tellejohann of Ortho regarding production of Cobra Herbicide renamed Lactofen, which Chevron has purchased from PPG. The process has 4 steps and is very similar to the Tackle herbicide process Cedar conducted for Rhone Poulenc (first and last steps) in 1987 (RP-10 plant). On December 2, 1988 Jim and Nick Spiridakis visited West Helena and on a non confidential basis discussed the technology and project scope. On March 17, 1989 a confidentiality agreement was signed and on March 23 a technical package was received. On June 15 we submitted a preliminary proposal for a 3 year contract to make 500M, 750M, 1000M lb /year respectively. An investment of $400M will be required to modify Propanil/BSC (Unit #2) and RP10 (Unit #3). Total revenue for the 3 year contract would be $11.4MM with a gross margin of $6.6MM. The processing units would be occupied for 6 months each per year. The product will be marketed by "Valent" a joint venture between Ortho and Sumitomo. Sumitomo will market in the US and Ortho overseas. The possibility of a part in the venture for Cedar was raised and not rejected by Ortho.

## Phillips 66

### D-8/CO800

To date, 514165 lbs. of D-8 have been made (April 21-25), and 104,285 lbs of CO800 (May 3-5) which completes the current purchase order. Revenue from this purchase order is $125,872 (D-8 at $0.17/lb., CO-800 at $0.18/lb.) We need to raise the fees by $.02/lb on the next order.

| | Revenue | Gross Margin |
|---|---|---|
| Budgeted 1989 | $240M | 52M |
| Expected 1989 | $240M | 130M |

### MES

We have a purchase order for 255M lbs. of MES. The production began on May 11, and should be completed on July 9. Revenue from this order will be $237,005 and gross margin $48,250. A laboratory collaborative between Phillips and Cedar was completed to standardize assay results between the two laboratories, a problem in past production. Cedar has reduced Phillips waste disposal costs by modifying the wash procedures which allows us to treat waste in our biological system instead of offsite disposal. Phillips cost per pound of MES was reduced by $0.10 and Cedar's revenue was increased by $0.10 per pound of MES.

| | Revenue | Gross Margin |
|---|---|---|
| Budgeted 1989 revenue: | $126M | $29M |
| Expected 1989 revenue: | $402M | $79M |

### Driscal

We made a proposal for 2-400M lbs. of an emulsion polymer to commence in May, 1989. This is a single reactor operation with waste limited to that generated by final cleanup. Plant preparation would be $30M to be paid by Phillips. A daily fee of $9M and a $100M minimum would apply. Raw materials would be supplied mainly by Phillips. Raw materials supplied by Cedar (including nitrogen and deionized water) would be marked up five percent. If successful this product, which is part of a family of polymers, could extend our line of toll 'crack fillers'.

Update: Phillips has placed this project with a toller able to conduct the run at a lower cost.

Ethylyhioacetate

We have received a secrecy agreement to cover this project which is probably similar to MES in scope.

DUPONT MBC

247,770 lbs. was produced from December 16, 1988 to March 6, 1989. Total revenue was $449M in 1989 and $140M in 1988 for a total of $589M. This project was expected to produce 600 - 800 lbs. of MBC and take 60-80 days with projected revenue of $480 - $640M. Processing charges were all per diem; $9,000 during start-up, and $8,000 during stable production. Plant modification costs were estimated to be $50M which DuPont agreed to pay. Ultimately, DuPont paid $59,770 due to a documented scope change required by them. However, total plant preparation costs were $116,440 and Cedar absorbed the $56,670 difference. A major part of the underestimated cost was related to damage to the dryer vent filtration system and belt filter vacuum system from the Diphone production.

Of the total revenue, $52,361 was from onsite waste treatment (1,309,025 lbs. at $0.04) which was negotiated after the project started. DuPont's alternative cost is $0.0672/lbs. at their Belle, West Virginia site.

This project was plagued by unavailability of OPD, a raw material supplied by DuPont, and low productivity, 5,000-6,000 lbs/day versus DuPont's projected 16,000 lbs/day. DuPont is satisfied that the productivity is equipment controlled. They expect to order MBC again in the Spring of 1990.

| | Revenue | Gross Margin |
|---|---|---|
| Budget 1989 | $480M | 209M |
| Expected | $449M | 188M |

Chloronitrotoluene

We have reached agreement with Dupont on this project in which we will chlorinate paranitrotoluene using ferric chloride/iodine catalyst to produce 1MM lb/year of product in three campaigns. The project will commence in mid July. We will use the RP-10 unit. The plant preparation fee is $160M. The fee structure is the standard: client pays preparation fee up front, $9,000/day operating fee, waste disposal and raw material (including N2) at client's expense. DuPont (Gordon McNeill) has agreed to either deepwell the waste at a commercial site or return it to a DuPont plant. If Cedar can treat waste onsite, we will share the savings equally with Dupont. Dupont's economic constraints require greater than 30M lb/day for routine production which

relates to 3 x 14 day campaigns. This technology could be useful to make metachloroaniline a possible Cedar product. The chlorination equipment and experience will also be applicable to mucochloric acid another potential Cedar project.

| | Revenue | Gross Margin |
|---|---|---|
| Budget 1989 revenue: | $ 0 | $0 |
| Expected | $500M+ | $250 |

Phenylesters

We had a technical review of this project on July 6th which was delayed by a misunderstanding within Dupont. Dupont requires a preliminary proposal by July 14th! The project to make sodium n-nonaoyloxyacetate p-pheny sulfonate (NOGPS) will consume the entire RP-10 unit with the addition of large solids separation equipment (filters, centrifuge) and solvent recovery by distillation. Dupont will pay the capital cost up front. This is a substantial new product for Dupont and they are seeking a 3 year commitment. They expect the sales volume to exceed our current capabilities by an order of magnitude and could probably build their own plant during the 3 year toll period. However, they have not ruled out a longer term proposal from Cedar in the future. This project is estimated to generate sales of $4MM per annum with a gross margin of $2MM (order of magnitude).

OR-CAL

Sectagon

The contract price for Sectagon is $1.60/gallon for the first quarter of 1989. Cedar credits OR-CAL $0.45/lb amine (x conversion factor of 0.86 #amine/#Sectagon) and $0.23/lb carbon bisulfide (x conversion factor of 2.05) for raw material provided by OR-CAL. There is a $.10/gallon drumming charge. Two production campaigns were completed between January 19 to February 13 (180045 gallons) and between March 31 and April 15 (129804 gallons) for a total of 309,849 gallons versus the 1989 budget of 1MM gallons. Additional production would begin in the Fall. Billing YTD is $355,265, which is distorted compared to budget due to the inclusion of raw materials and packaging supplies under the modified contract. Additional production of 2-700M gallons is now being discussed for October.

| | Revenue | Gross Margin |
|---|---|---|
| Budgeted 1989 | $500M | $143M |
| Expected | $500M | 87M |
| Actual YTD revenue: | $170M | 30M |
| | (1989 budget basis) | |

ALBRIGHT AND WILSON

This project was to produce 3-5MM lb/year of Briquest products; phosphonates, and diphosphonic acid derivatives, over a 2-3 year period. A secrecy agreement was signed and a technology exchange made. Modification of the RP-10 unit would have cost $350M. We proposed that Albright and Wilson pay this capital cost plus $9M/operating day. Albright and Wilson would provide all raw material and pay for waste disposal. Albright and Wilson responded with a requirement of no more than $5M/operating day in order to adjust their total costs to less than $.20/lb at the production rate for our 4M gallon reactors. We declined to consider this since the economics could not support the committment of resources and risk involved. Also, the chemistry involved is not in our prime areas of interest. Albright and Wilson indicated they had found a toll producer who was willing to meet their cost constraints. This project is terminated

Projected Revenue: $450M - $750M for two years

MITSUI

We were contacted by letter on December 28, 1988 by Mitsui regarding production of a new propriety herbicide. We expressed interest in the project and was visited on March 28 by Mr. Fumiaki Yamaguchi, manager of the Agrochemicals Department. He provided a non confidential disclosure of project scope and technology from which we prepared a preliminary proposal on May 22, 1989. We estimated that a plant to produce 1800 metric tons /year of their herbicide UMP488 using their six step process would cost $10MM. Our proposal was based on revenue of $9MM /year and a gross margin of $6.9MM/year. To accommodate growth years at 400 metric tons /year we could use the RP-10 process unit to produce intermediates 1 & 2, then process them to intermediates 3 & 4, and finally convert 3 & 4 to intermediate 5 and end product. This would use the process unit for 9 months/year with a projected fee of $10/Kg. Revenue would be $4MM/year and gross margin $2MM/year. Investment for the growth phase would be $1-2MM. There is another $1MM/year in revenue available by producing two raw materials for this project. Mr. Yamaguchi will return in late July to discuss the next phase of this project which will include confidential disclosure of the technology and laboratory feasibility trials by Cedar. The possibility of a joint venture on the project has been mentioned to Yamaguchi with a positive response on his part. Mitsui likely will seek a partner to market the herbicide in the U.S.

AIR PROJECTS

This project would produce 500-1000M lb of an acrylated styrene resin over an eighteen month period beginning in mid-summer, 1989. The project would use the 3M gallon Propanil reactor and flaker. Estimated plant time 30-60 days. A secrecy agreement is signed and a technical data package has been received. A technical review with the client was held on (May 9). We are preparing a capital estimate for the project.

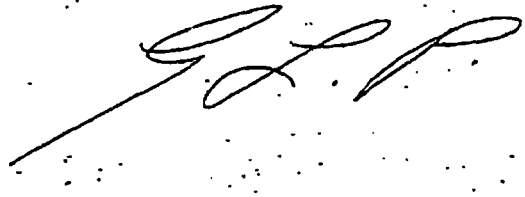
| | |
|---|---|
| Budgeted 1989 revenue: | $ 0 |
| Potential 1989 revenue: | $300M - 600M |

MONSANTO EP-560

This project would produce a phenol/formaldehyde resin used as a drum and pipe coating. The contract would be multiyear with volumes: 750M lbs - 1989, 1.5MM lbs - 1990, 2-3MM lb - 1991, and beyond. The toll fee must be in the $.50 - $.80/lb range. The work would be carried out in the 3M gallon Propanil reactor with a plant modification cost of $250M. The largest single cost would be for a pressure leaf filter. This project is not in our prime areas of technical interest, but would be a constant user of the second half of the year for Propanil equipment. We made a proposal on May 17 for Monsanto to pay the capital up front and our standard processing fee of $9M/day.

| | |
|---|---|
| Budgeted 1989 revenue: | $ 0 |
| Potential 1989 revenue: | $600M |

Update: Monsanto has found a lower cost toller and the project is closed.



Tolling Estimate

Cedar - West Helena
Tolling Cost Estimate
DuPont Chloronitro / Toulene CNT

Date 5/31/89

| | | | | Initials | |
|---|---|---|---|---|---|
| Estimated lbs or gals of Production | | Lbs | 1,000,000 | G P | Estimated Months to run |
| | | | | G P | 1 1/2 months |
| Estimated Revenue on Production | (45 days x 9,000) | | 405,000 | G P | |

Cost Elements:

| Raw Materials | | | | | |
|---|---|---|---|---|---|
| Description | lb/lb or gal | cost per lb R/M | cost per lb/gl Prod | Total Cost | |
| A. Supplied by Dupont | | | 0.000 | 0 | |
| B. | | | 0.000 | 0 | |
| C. | | | 0.000 | 0 | |
| D. | | | 0.000 | 0 | |
| E. | | | 0.000 | 0 | |
| F. | | | 0.000 | 0 | |
| G. | | | 0.000 | 0 | |
| Total Raw Material Cost | | | 0.000 | 0 | |
| Direct Costs | | | | | |
| Ordinary Supplies | | | | 1,350 | N R |
| Rentals | | | | 940 | N R |
| Outside Labor | | | | 800 | N R |
| Maint Supplies | | | | 14,200 | N R |
| Nitrogen | CF | 1,700,000 | | (430) | N R |
| Gas | MCF | 2,800 | | 8,500 | N R |
| Power | KWH | 310,000 | | 18,600 | N R |
| Start-up | | | | | |
| Shut-down | | | | 5,000 | |
| Other | | | | 1,350 | N R |
| Containers | | | | | |
| Sub Total | | | | 50,310 | |
| Fixed Costs | | | | | |
| Salaries | | | | 14,200 | N R |
| Wages | No Operators | 2/ shifts | | 35,500 | J M |
| Fringes | | | | 20,500 | N R |
| Safety | | | | | |
| Environmental | | | | | |
| Ins & Taxes | | | | 14,000 | N R |
| Sub Total | | | | 84,200 | |
| Plant O/H | | | | 47,000 | N R |
| Plant Admin | | | | 13,000 | N R |
| Depr | Plant | Diphone C | | 50,000 | N R |
| Sub Total | | | | 110,000 | |
| Total | | | | 244,510 | |
| Expected Plant Profit | | | | 160,490 | |

John Please advise as to what project this is similar to and answer any of the checked letters. Neil

Similar to MBC

To: Neil R.

Tolling Estimate
S/U - early July

Cedar - West Helena
Tolling Cost Estimate
DuPont ~~P-Nitro~~ Toulene (CNT)
CHLORONITRO

Date 5/25/89

Initials

Estimated Months to run

Estimated lbs or gals of Production

Estimated Revenue on Production

Cost Elements:

| Raw Materials Description | lb/lb or gal | cost per lb R/M | cost per lb/gl Prod | Total Cost |
|---|---|---|---|---|
| A. | | | 0.000 | 0 |
| B. | | | 0.000 | 0 |
| C. | | | 0.000 | 0 |
| D. | | | 0.000 | 0 |
| E. | | | 0.000 | 0 |
| F. | | | 0.000 | 0 |
| G. | | | 0.000 | 0 |
| Total Raw Material Cost | | | 0.000 | 0 |

| | | | |
|---|---|---|---|
| Direct Costs | | | |
| Ordinary Supplies | | | 654 |
| Rentals | | | 625 |
| Outside Labor | | | 516 |
| Maint Supplies | | | 9,416 |
| Nitrogen | CF | | |
| Gas | MCF | per MBC ✓ | 5,654 |
| Power | KWH | per MBC ✓ | 9,297 |
| Start-up | | | |
| Shut-down | | | |
| Other | | | 893 |
| Containers | | | – |
| Sub Total | | | 0 |
| Fixed Costs | | | |
| Salaries | | | 9,462 |
| Wages | No. Operators | 2/shift ✓ | 23,637 |
| Fringes | | | 13,630 |
| Safety | | | – |
| Environmental | | | – |
| Ins & Taxes | | | 8,861 |
| Sub Total | | | 0 |
| Plant O/H | | | 31,305 |
| Plant Admin | | DIPHONE C | 5,481 |
| Depr | Plant | P-10 ✓ | 33,358 |
| Sub Total | | | 0 |
| Total | | | 0 |
| Expected Plant Profit | | | 0 |

Cedar - West Helena
Tolling Cost Estimate
Chloronitrotoluene

Date 5-13-87

Initials

Estimated lbs or gals of Production 1MM

Estimated Months to run 3 x 15 day run per year.

Estimated Revenue on Production $4M /day

Cost Elements:

plus cumbrous actual capital cost estimated to be $160 (not to exceed)

| Raw Materials Description | lb/lb or gal | cost per lb R/M | cost per lb/gl Prod | Total Cost | |
|---|---|---|---|---|---|
| A. paranitrotoluene | | | 0.000 | 0 | Dupont supplied |
| B. chlorine | | | 0.000 | 0 | Maybe Dupont supplied |
| C. ferric chloride | | | 0.000 | 0 | Probably Cedar supplied |
| D. iodine | | | 0.000 | 0 | |
| E. thionyl chloride | | | 0.000 | 0 | see J Miles |
| F. soda ash | | | 0.000 | 0 | |
| G. caustic 50% | | | 0.000 | 0 | |
| Total Raw Material Cost | | | 0.000 | 0 | |

See Ken.

| | | | |
|---|---|---|---|
| Direct Costs | | | |
| Ordinary Supplies | | | |
| Rentals | | | |
| Outside Labor | | | |
| Maint Supplies | | | |
| Nitrogen | CF | | cost plus 5% |
| Gas | MCF | | |
| Power | KWH | | |
| Start-up | | | |
| Shut-down | | | |
| Other | | | |
| Containers | | | |
| Sub Total | | | 0 |
| Fixed Costs | | | |
| Salaries | | | |
| Wages | No Operators | | |
| Fringes | | | |
| Safety | | | |
| Environmental | | | |
| Ins & Taxes | | | |
| Sub Total | | | 0 |
| Plant O/H | | | |
| Plant Admin | | | |
| Depr | Plant | | |
| Sub Total | | | 0 |
| Total | | | 0 |
| Expected Plant Profit | | | 0 |

Waste billed at cost unless we can dispose in biosystem in which case we have savings.

G.L.P.

AB0000065622/3

TO: DuPont Operators July 24, 1989

FROM: Tom Lodice

DUPONT CNT

PRODUCTION NOTES

We are currently having trouble with the chlorination due to moisture getting in R-N101 and de-activating the catalyst. On batch 4, the flow totalizer indicated that we had added more chlorine than the reactor weight or analysis had indicated. The weight indicated on the totalizer was probably correct and we were not reacting the chlorine effectively due to partial contamination of the catalyst with water.

During the early stages, the chlorine should be added at a rate of about 1100 to 1200 lbs. per hour with the cooling water opened about 75% in order to prevent the reactor temperature from rising. If the reactor temperature falls or if very little cooling is required, there is a chance that the chlorine is not being utilized effectively.

In order to minimize the potential for moisture contamination, you will need to abide by the following procedures until advised otherwise:

1. After transferring R-N101 to R-N104, keep 30 psig nitrogen pressure on R-1 until after the water flush is charged to R-4. After the water flush is transferred to R-4, drain the pipe under R-1 into a bucket to insure that there is no water remaining in the pipe.
2. Always keep a nitrogen purge going to R-N101 through the 3/8" tubing by the pressure gauge. When stopping the chlorine flow, open the nitrogen valve on the dip pipe and continue to purge. This is particularly important when the reactor is cooling down in order to prevent sucking moisture back into the reactor from the scrubber.
3. When venting any other reactor, always bleed the pressure off very slowly in order to prevent blowing moisture into R-N101.
4. Before taking any samples, always use vacuum and nitrogen pressure to remove any moisture which may be present in the sightglass.
5. After charging ferric chloride and iodine, remove the charge chute and clean and dry it. Clean the top of the 8" ball valve and install a blind on top of the valve in order to prevent the possibility of moisture entering the reactor through the valve.

I know that some of these measures may seem like overkill, but we can't afford any more production time lost to wet catalyst. If any of you have any other suggestions or comments, let Ken or myself know as soon as possible.

Tom Lodice

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Cedar - West Helena | | | | CC: | J Miles | | K Howard | | R Fairchild | | | | |
| 2 | Dupont Chlorination | | | | | C Parker | | T Lodice | | B Oberle | | | | |
| 3 | As of | 7/30/89 | | | | R Johns | | J Porter | | | | | | |
| 4 | | | | | | J Walker | | G Satterfield | | | | | | |
| 5 | | | | | | | | | | | | | | |
| 6 | Date | Date | Batch | PNB | Chlorine | Thionyl Chl | Caustic | Soda Ash | Iodine | Ferric Acid | Sod Sulfide | HCL | PNT | Waste/W |
| 7 | Started | Finished | No | Used | Used | Used | Used | Used | Used | Used | Used | Used | Prod | Prod |
| 8 | 17-Jul | 20-Jul | 1 | 18,310 | 10,072 | | 11,400 | 27 | 6.5 | 270 | | 4,325 | 22,620 | 12,500 |
| 9 | 18-Jul | 23-Jul | 2 | 18,310 | 9,480 | 200 | 12,446 | 40 | 6.5 | 270 | | 5,700 | 22,680 | |
| 10 | 20-Jul | 23-Jul | 3 | 18,280 | 9,980 | 85 | | 25 | 6.5 | 270 | 180 | | 22,880 | 200,995 |
| 11 | 21-Jul | 24-Jul | 4 | 18,300 | 9,460 | 97 | 14,926 | 32 | 6.5 | 270 | 77 | | 22,800 | |
| 12 | 24-Jul | 25-Jul | 5 | 18,300 | 9,820 | 73 | 930 | 26 | 6.5 | 270 | 200 | 10 | 23,010 | |
| 13 | 24-Jul | 26-Jul | 6 | 18,350 | 12,860 | 97 | 1,020 | 69 | 6.5 | 270 | 380 | | 22,890 | |
| 14 | 26-Jul | 27-Jul | 7 | 18,430 | 13,194 | 66 | 1,440 | 40 | 6.5 | 270 | 220 | 200 | 23,540 | |
| 15 | 26-Jul | 30-Jul | 8 | 18,320 | 13,618 | 61 | 1,738 | 27 | 6.5 | 270 | 500 | | 22,805 | |
| 16 | 27-Jul | | 9 | 18,370 | | | | | | | | | | |
| 17 | 30-Jul | | 10 | 5,850 | | | | | | | | | | |
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| 45 | | | | | | | | | | | | | | |
| 46 | | | | | | | | | | | | | | |
| 47 | Page Totals | | | 170,620 | 88,254 | 678 | 43,302 | 285 | 52.0 | 2,160 | 1,537 | 10,235 | 182,935 | 213,495 |
| 48 | Usage Factor lb/lb | | | 0.933 | 0.482 | 0.004 | 0.237 | 0.002 | 0.0 | 0.012 | 0.008 | 0.056 | | 1.167 |

CEDAR INTERNAL MEMO
WEST HELENA PLANT

DATE: 10/11/89

TO: File

FROM: John Miles

CC: R. Tomblin
B. Eissler
G. Pratt
K. Howard
T. Lodice
C. Parker
N. Robbins
G. Satterfield

RE: DuPont CNT campaign

1. Karl Kaminski advised me this morning that the two T/C of PNT on hand would be all that we would receive for the balance of this year, due to PNT supply shortage. We should proceed to run these ASAP, using bulk thionyl chloride.

2. DuPont will arrange to have the tank truck of CNT incinerated and the drum thionyl chloride returned.

3. Kaminski said that DuPont estimated a requirement of 1MM pounds for 1990 and would arrange a meeting soon to discuss the program with us.

CEDAR INTERNAL MEMO
WEST HELENA PLANT

DATE: 9/5/89

TO: Neil Robbins

FROM: John Miles

CC: G. Pratt
C. Parker
R. Tomblin

RE: Sectagon

1. We agreed to purchase a truckload of Metham- Na from ICIA to meet a delivery requirement of BBM ahead of our production schedule. The material should be billed to OrCal at $1.69 per gallon plus any freight and demurrage. ICIA will bill us at $3.35 plus freight and demurrage. Do not let OrCal know what we paid for the product.

2. Geoff Pratt has talked with DuPont and they have tentatively agreed to pay us for an additional 5 days to compensate us for the extra cost of the purchased material and the costs of plant modifications to allow production of Sectagon and CNT on a quick change campaign basis.

DUPONT CHLORINATION DAILY LAB REPORT

| RN105 —— PNT DRYING | | | RN101 COMPLETION | | | | RN103 FINAL ASSAY | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | BATCH | 0.2MAX % WATER | 92% MIN % CNT | 1-6% %PNT | 135-139°F CRYST. PT. | 1.5-7.5% %DCNT | 6.5-8.5 PH | 1-6% %PNT | 1.5-7.5% %DCNT | 135-139°F CRYST. PT | HOT OR COLD | 92%MI %CNT |
| 5/22/90 | CNT050015 | 0.055 | 92.6 | 1.95 | 136.8 | 5.2 | 6.8 | 1.8 | 4.6 | 136.8 | HOT | 93.6 |
| 5/23/90 | CNT050016 | 0.04 | 92.2 | 2.8 | 136.8 | 4.6 | 6.7 | 2.5 | 4.2 | 136.8 | | 93.3 |
| 5/26/90 | CNT050017 | 0.02 | 90.6 | 1.5 | 136.6 | 7.5 | 7.4 | 1.1 | 5.6 | 136.6 | | 93.3 |
| 5/27/90 | CNT050018 | 0.04 | 92.4 | 2.8 | 136.6 | 4.6 | 7.9 | 2.3 | 4.6 | 136.6 | | 92.8 |
| 5/28/90 | CNT050019 | 0.05 | 93.0 | 1.1 | 136.8 | 5.7 | 6.2 | 1.1 | 5.9 | 136.8 | | 93.0 |
| 5/29/90 | CNT050020 | 0.04 | 92.8 | 2.3 | 137.0 | 4.7 | 6.4 | 2.4 | 5.00 | 137.0 | HOT | 92.5 |
| 5/30/90 | CNT050021 | 0.03* | 92.1 | 2.7 | 136.4 | 5.1 | 6.5 | 2.1 | 5.0 | 136.4 | | 92.9 |
| 5/31/90 | CNT050022 | 0.04 | 92.4 | 1.9 | 136.6 | 5.5 | 6.8 | 1.7 | 4.9 | 136.6 | | 93.3 |
| 6/1/90 | CNT060023 | 0.02 | 93.0 | 2.2 | 136.8 | 4.7 | 7.3 | 2.4 | 5.0 | 136.8 | | 92.5 |
| 6/4/90 | CNT060024 | 0.05 | 92.1 | 2.4 | 136.8 | 5.2 | 6.9 | 2.2 | 4.9 | 136.8 | | 92.9 |
| 6/4/90 | CNT060025 | 0.05 | 92.6 | 3.0 | 137.4 | 4.3 | 10.0 | 2.6 | 4.0 | 137.4 | HOT | 93.3 |
| 6/5/90 | CNT060026 | 0.04 | 92.7 | 1.3 | 136.6 | 5.7 | 7.2 | 1.3 | 6.0 | 136.6 | | 92.7 |
| 6/6/90 | CNT060027 | 0.05 | 91.7 | 1.2 | 136.2 | 5.6 | 7.2 | 0.5 | 6.4 | 136.2 | | 92.9 |
| 6/7/90 | CNT060028 | 0.03 | 92.1 | 2.0 | 136.4 | 5.8 | 6.6 | 1.5 | 4.8 | 136.4 | | 93.0 |
| 6/9/90 | CNT060029 | 0.02 | 92.6 | 2.2 | 135.8 | 4.7 | 7.1 | 2.0 | 5.1 | 135.8 | | 92.6 |
| 6/19/90 | CNT060030 | 0.01 | 92.1 | 3.2 | | 4.3 | 6.6 | 3.1 | 4.2 | | | 92.3 |
| 6/21/90 | CNT060031 | 0.035 | 92.5 | 3.1 | | 4.1 | 7.3 | 3.0 | 4.2 | | HOT | 92.7 |

* CHANGED DATA

6/23/89 - TJL

## Alarms

(180°F) R-1 High Temp - From Chessell (or press. switch.

(140°F) R-1 Low Temp - From Chessell (or press. switch)

(210°F) Scrubber High Temp. - From Chessel (or press. switch)

(35gpm) Scrubber Low Flow - From Newport Meter

(30psig) Chlorine Low Press. - From Foxboro 760

Chlorine Low Flow - From Foxboro Batcher

120 Chlorine Low Temp. - From Chessell (or press. switch

(100psig) Chlorine High Press. - From Foxboro 760

(15psig) R-1 High Press - From Press switch

250 Chlorine High Temp. - From Chessell (or press. switch)

Miles

cc: Tom
Kim
Joe
Greg
Neil
Charlie

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

May 12, 1989

Mr. Gordon L. McNeill
E.I. DuPont de Nemours & Company
Chemicals and Pigments Department
Wilmington, Delaware 19898

Dear Gordon:

Since today is May 12, it is time to make our proposal to you for the chlorination of p-nitro toluene. For three equal campaigns for a total of 1MM pounds beginning in late June 1989 we propose:

1) A one time plant modification fee not to exced $160M. A detailed breakdown of the costs would be provided with invoices and no markup is applied. An additional $35M would be required to install a continuous wash column intended to reduce aqueous waste. It will be necessary to conduct laboratory studies to enhance the probability of this approach being successful.

2) A daily processing fee of $9,000 to include all services except waste disposal and raw materials.

3) Cedar will provide raw materials other than the p-nitro toluene upon request at our cost plus five percent. Nitrogen is considered a raw material and would be metered to the project if needed.

4) Waste will be returned to DuPont for disposal or shipped to licensed commercial disposal sites approved by both parties. Cedar will make its best efforts to dispose of wastes in its onsite biological system and would share any cost savings with DuPont. Commercial deepwell disposal of aqueous waste is estimated to cost $0.32/gallon including freight.

5) Cedar will begin production with onsite technical direction by DuPont personnel. After a suitable trial period, Cedar would be willing to continue production using a fixed processing fee per pound of product and

warranty raw material consumption standards and product quality based upon parameters demonstrated in the trial.

We hope that this proposal will meet your economic criteria and we can proceed with the project. Please call if clarification of the proposal is needed, or if we need to explore a different approach.

Sincerely,

Geoffrey L. Pratt
Director Operations
Custom Manufacturing

/kt

Cedar - West Helena
Dupont - CNT Production Cost
As of 2/22/90

| Description | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | 89 Y-T-D | Jan | Total | Per Unit Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lbs Produce | | | 182,935 | 115,660 | 69,740 | | 415,480 | | 783,815 | 324,800 | 1,108,615 | |
| $ Sales | | 88,998 | 211,502 | 153,509 | 37,074 | | 189,000 | 48,159 | 728,242 | 126,420 | 854,662 | 0.7709 |
| Ordinary Supplies | | | 2,130 | 188 | 12 | | 6 | 718 | 3,054 | | 3,054 | 0.0028 |
| Rentals | | | | | | 50 | 225 | (225) | 50 | | 50 | 0.0000 |
| Outside Labor | | 100 | | 2,531 | 419 | 568 | 14 | 696 | 4,328 | | 4,328 | 0.0039 |
| Maint Supplies | | 9 | 3,847 | 3,964 | 3,284 | 2,913 | 5,657 | 2,324 | 21,998 | 1,767 | 23,765 | 0.0214 |
| Gas | | | | | | | 2,588 | (45) | 2,543 | 2,877 | 5,420 | 0.0049 |
| Power | | | 2,480 | 7,014 | 1,167 | 631 | 7,652 | 947 | 19,891 | 8,811 | 28,702 | 0.0259 |
| Other | | | 418 | 396 | 38 | | 582 | 347 | 1,759 | | 1,759 | 0.0016 |
| Start-up Cost | 580 | 88,418 | 89,146 | (454) | 640 | 100 | 333 | 305 | 178,068 | | 178,068 | 0.1615 |
| Direct Cost | 580 | 88,527 | 98,021 | 13,839 | 5,558 | 4,262 | 17,037 | 5,067 | 232,691 | 13,445 | 246,136 | 0.2220 |
| Salary | | 45 | 8,185 | 3,845 | 1,932 | 755 | 18,197 | 1,288 | 35,245 | 7,494 | 42,739 | 0.0386 |
| Wages | | 110 | 16,828 | 7,741 | 4,385 | 1,806 | 35,646 | 3,217 | 70,713 | 18,261 | 88,974 | 0.0803 |
| Fringes | | 56 | 9,733 | 2,131 | 2,872 | 1,145 | 20,257 | 1,605 | 37,600 | 12,177 | 49,777 | 0.0449 |
| Plant People Cost | 0 | 211 | 34,746 | 13,717 | 8,989 | 3,708 | 76,100 | 6,109 | 143,558 | 37,932 | 181,490 | 0.1637 |
| Overhead | | | 33,900 | 16,560 | 6,327 | 3,136 | 83,603 | 6,884 | 150,210 | 34,592 | 184,802 | 0.1667 |
| Admin | | 4,798 | 10,519 | 5,027 | 3,297 | | 34,831 | 3,756 | 62,028 | 12,925 | 74,953 | 0.0676 |
| Depr | | | 22,272 | 22,272 | 2,970 | 5,748 | 22,272 | 5,122 | 80,656 | 15,999 | 96,655 | 0.0872 |
| Insurance | | | 11,593 | 11,593 | 163 | (6,922) | (7,767) | (1,877) | 6,783 | 3,080 | 9,863 | 0.0089 |
| Fixed Cost | 0 | 4,798 | 78,284 | 55,452 | 12,757 | 1,962 | 132,739 | 13,885 | 299,677 | 66,596 | 366,273 | 0.3304 |
| Total Cost | 580 | 93,536 | 211,051 | 82,808 | 27,284 | 9,930 | 226,876 | 24,861 | 875,926 | 117,973 | 793,899 | 0.7161 |
| Gross Margin | (580) | (4,538) | 451 | 70,701 | 9,790 | (9,930) | (36,876) | 23,298 | 52,316 | 8,447 | 60,763 | 0.0548 |



ABR00006912/1

Cedar - West Helena
Dupont - CNT Production Cost & Estimated Cost
As of 2/22/90

| Description | Actual 89-90 $ | Actual 89-90 Per Unit | Estimate $ | Estimate Per Unit | Estimate $ | Estimate Per Unit | Estimate $ | Estimate Per Unit | Estimate $ | Estimate Per Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| Lbs Produce | 1,108,615 | | 1,300,000 | | 1,300,000 | | 1,300,000 | | 1,300,000 | |
| $ Sales | 854,662 | 0.7709 | 1,248,483 | 0.9588 | 1,150,600 | 0.8851 | 1,068,414 | 0.8219 | 997,187 | 0.7671 |
| Ordinary Supplies | 3,054 | 0.0028 | 3,640 | 0.0028 | 3,640 | 0.0028 | 3,640 | 0.0028 | 3,640 | 0.0028 |
| Rentals | 50 | 0.0000 | 0 | | 0 | | 0 | | 0 | |
| Outside Labor | 4,328 | 0.0039 | 5,070 | 0.0039 | 5,070 | 0.0039 | 5,070 | 0.0039 | 5,070 | 0.0039 |
| Maint Supplies | 23,755 | 0.0214 | 27,820 | 0.0214 | 27,820 | 0.0214 | 27,820 | 0.0214 | 27,820 | 0.0214 |
| Gas | 5,420 | 0.0049 | 9,490 | 0.0073 | 9,490 | 0.0073 | 9,490 | 0.0073 | 9,490 | 0.0073 |
| Power | 28,702 | 0.0259 | 33,670 | 0.0259 | 33,670 | 0.0259 | 33,670 | 0.0259 | 33,670 | 0.0259 |
| Other | 1,759 | 0.0016 | 2,080 | 0.0016 | 2,080 | 0.0016 | 2,080 | 0.0016 | 2,080 | 0.0016 |
| Start-up Cost | 179,088 | 0.1615 | 1,430 | 0.0011 | 1,430 | 0.0011 | 1,430 | 0.0011 | 1,430 | 0.0011 |
| Direct Cost | 246,136 | 0.2220 | 83,200 | 0.0640 | 83,200 | 0.0640 | 83,200 | 0.0640 | 83,200 | 0.0640 |
| Salary | 42,739 | 0.0386 | 53,170 | 0.0409 | 53,170 | 0.0409 | 53,170 | 0.0409 | 53,170 | 0.0409 |
| Wages | 88,974 | 0.0803 | 110,630 | 0.0851 | 110,630 | 0.0851 | 110,630 | 0.0851 | 110,630 | 0.0851 |
| Fringes | 49,777 | 0.0449 | 61,880 | 0.0476 | 61,880 | 0.0476 | 61,880 | 0.0476 | 61,880 | 0.0476 |
| Plant People Cost | 181,490 | 0.1637 | 225,680 | 0.1736 | 225,680 | 0.1736 | 225,680 | 0.1736 | 225,680 | 0.1736 |
| Overhead | 184,802 | 0.1667 | 223,210 | 0.1717 | 223,210 | 0.1717 | 223,210 | 0.1717 | 223,210 | 0.1717 |
| Admin | 74,953 | 0.0676 | 90,480 | 0.0696 | 90,480 | 0.0696 | 90,480 | 0.0696 | 90,480 | 0.0696 |
| Depr | 96,655 | 0.0872 | 113,360 | 0.0872 | 113,360 | 0.0872 | 113,360 | 0.0872 | 113,360 | 0.0872 |
| Insurance | 9,863 | 0.0089 | 11,960 | 0.0092 | 11,960 | 0.0092 | 11,960 | 0.0092 | 11,960 | 0.0092 |
| Fixed Cost | 366,273 | 0.3304 | 439,010 | 0.3377 | 439,010 | 0.3377 | 439,010 | 0.3377 | 439,010 | 0.3377 |
| Total Cost | 793,899 | 0.7161 | 747,890 | 0.5753 | 747,890 | 0.5753 | 747,890 | 0.5753 | 747,890 | 0.5753 |
| Gross Margin | 60,763 | 0.0548 | 498,593 | 0.3835 | 402,710 | 0.3098 | 320,524 | 0.2466 | 249,297 | 0.1918 |
| Gross Margin % | 7.11% | | 40.00% | | 35.00% | | 30.00% | | 25.00% | |



AB00006612/2

cc: Charlie
Neil
Tom

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

May 4, 1990

Mr. R. A. Blackhall
E. I. du Pont de Nemours & Co.
P. O. Box 80015, Barley Mill Plaza
Wilmington, DE 19898

Dear Bob:

We are pleased to resubmit Cedar's proposal for the chlorination of PNT based upon our meeting in Wilmington on April 18:

It has been difficult to analyze the 1989 chlorinated PNT campaigns for productivity, which is the key to Cedar's fixed price proposal, due to the disruptions. However we have targeted a rate of 21277M lb/day for the 1990 campaigns projected in Elaine Donald's letter of March 16, 1990. This is an 18% higher rate than we have consistently reached. Thus the 500M lb campaigns will require 23.5 days each plus 3 days for preparation and cleanout.

Cedar's processing fee for 1990 is $10M/day and the cost of each campaign will be $265M or 53 cents/lb of chlorinated PNT. As previously, the processing fee excludes raw materials and waste treatment. If Cedar were to provide the chlorine, the fee would be 54.2 cents/lb of chlorinated PNT.

The campaign length is critical to the maintenance of productivity, and thus Cedar would have to requote for campaigns which are shorter than 450M lbs of chlorinated PNT. The fixed unit price is based on the assumption that there is no interruption in processing due to items under Duponts' control such as PNT supply. Should such an interruption occur, Cedar would require standby compensation of $9000/day. However, Dupont would have the option of declaring the campaign complete in which case the per diem would cease.

We have agreed to review this proposal based upon actual experience for the first run that you have approved, and which Cedar will start in about one week. For this run Cedar will provide the chlorine.

We appreciate your continuing business.

Sincerely,

Geoffrey L. Pratt
Director Custom Manufacturing

mc

cc: Paul H. Smith, du Pont
Elaine A. Donald, du Pont

bcc: Bill Eissler
John Miles

Neal R.
Tom L

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

April 3, 1990

Mr. R. A. Blackhall
E. I. du Pont de Nemours & Co,
P. O. Box 80015, Barley Mill Plaza
Wilmington, DE 19898

Dear Bob:

It has been difficult to analyze the 1989 chlorinated PNT campaigns for productivity, which is the key to Cedar's fixed price proposal, due to the disruptions. However we have targeted a rate of 20M lb/day for the 1990 campaigns projected in Elaine Donald's letter of March 16, 1990. This is a 10% higher rate than we have consistently reached. Thus the 500M lb campaigns will require 25 days each plus 3 days for preparation and cleanout.

Cedar's processing fee for 1990 is $10M/day and the cost of each campaign will be $280M or 56 cents/lb of chlorinated PNT. As previously, the processing fee excludes raw materials and waste treatment. If Cedar were to provide the chlorine, the fee would be 57.2 cents/lb of chlorinated PNT.

The campaign length is critical to the maintenance of productivity, and thus Cedar would have to requote for campaigns which are shorter than 400M lbs. The fixed unit price is based on the assumption that there is no interruption in processing due to items under Duponts' control such as PNT supply. Should such an interruption occur, Cedar would require standby compensation of $9000/day. However, Dupont would have the option of declaring the campaign complete in which case the per diem would cease.

We hope that this proposal is satisfactory and we will enjoy your business in 1990. Please call, if clarification of this proposal is required.

Sincerely,

Geoffrey L. Pratt mc

Geoffrey L. Pratt
Director Custom Manufacturing

mc
cc: Paul H. Smith, du Pont
Elaine A. Donald, du Pont

bcc: W. Eissler
John Miles

J. Miles

cc: Charlie
Neil

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

July 9, 1990

Mr. R. A. Blackhall
E. I. du Pont de Nemours & Co.
P. O. Box 80015, Barley Mill Plaza
Wilmington, DE 19898

Dear Bob:

This letter will confirm our conversation on the most recent campaign to produce CNT for du Pont.

The campaign began on May 14 and ended on June 25 with a total production of 495,050 pounds of CNT. This gives an overall campaign average of 11,787 pounds per day. This is substantially lower than our target of 21,277 pounds per day. However, we have identified a total of fifteen days of delays due to logistics or maintenance which we feel can be corrected in the future. Discounting the effect of these delays, the average becomes 17,680 pounds per day. This is approximately the rate achieved during prior campaigns after discounting for avoidable logistical problems and thus we may be approaching the upper limits of productivity for this project using the current equipment. However, Cedar proposes to complete the two remaining projected campaigns for 1990 at a fixed fee of $.53 per pound of CNT as long as the parameters noted in my previous proposal of May 4, 1990 are recognized. Thus, Cedar will take the responsibility to improve productivity in order to meet the fee target presented in the May 4 letter.

At our previous meeting on this project, we discussed a multi-year contract, and Cedar would be willing to enter into such an agreement. We would suggest that a fee escalator be included in any multi-year contract using a mutually acceptable formula to avoid the stepped adjustment which we made for 1990. A possible formula is attached.

We are looking forward to our discussions on July 25, 1990 in Wilmington. It is our understanding that you are currently projecting July 30 as a starting date for the next campaign which will be roughly 500,000 pounds in quantity.

Please advise, if there are any major issues that we need to discuss before our July 25 meeting, so that we can avoid any delays in beginning the next campaign.

Sincerely,

Geoffrey L. Pratt
Director Operations
Custom Manufacturing

mc

Enclosure

cc: Paul H. Smith, duPont
Elaine A. Donald, duPont
William Eissler
John Miles

## SUGGESTED FEE ESCALATION FORMULA

$$\frac{\text{Current Fee}}{100} \left\{ 100 + 0.5(\%\text{increase in lead operator wage}) + 0.5(\%\text{increase in PPI}) \right\}$$

MU-2500 REV. 5-83

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
CHAMBERS WORKS
DEEPWATER, NEW JERSEY 08023

CC: R. T. King, Wilmington
S. A. Hamdan, Wilmington
D. P. Heintzelman, Wilmington
T. L. Hamberger, Wilmington
E. A. Donald, Wilmington
J. M. Anderson, Jr., Chs Wks
S. O. Rogers, Chs Wks
P. H. Smith, Chs Wks

July 5, 1989

Mr. Tom Lodice
Cedar Chemical Corporation
P. O. Box 2749
West Helena, AR 72390

Dear Tom:

Based on your attached letter and our review of the equipment set, please proceed with the required waste water handling modifications. These modifications should not exceed $5,500 without additional approval.

Sincerely,

Karl F. Kamenski

Karl F. Kamenski

KFK:bml
5030U
Attach.



AB0000065616/1

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

June 20, 1989

REPLY TO: P. O. BOX 2749
WEST HELENA, AR 72390
(501) 572-3701

Karl Kamenski
AI&V Dept.
E.I.DuPont & Co.
Chambers Works
Deepwater, NJ 08023

Dear Karl,

In accordance with our conversations regarding the handling of the wastewater from the 2-Cl-4-NT process, we propose to treat the waste streams as follows:

1) The first 2 washes will be neutralized to a pH of 7 to 10 in a 3000 gallon glass-lined reactor and then transferred to a railcar for shipment back to DuPont.
2) The third wash will remain in the reactor to be used as the first wash for the next batch.
3) The soda ash wash will be transferred to a 3000 gallon glass-lined reactor where it will be cooled, filtered, and transferred to a 20,000 gallon tank for deepwell disposal by truck.
4) The scrubber liquor will be held in a 5,000 gallon tank and then transferred to a 3,000 gallon reactor where it will be neutralized with hydrochloric (or sulfuric) acid and sodium sulfite prior to transfer to the 20,000 gallon tank used to hold the soda ash wash water.

In order to handle the waste as described, we will be required to modify the piping as follows:

1) We will install bag filters on the soda ash wash water line to the wastewater tank in order to remove solidified product from the wastewater prior to deepwell disposal. The cost for this modification is estimated to be $1800.
2) We will install new piping to transfer ferric hydroxide wastewater to railcars in order to prevent contamination of the "deepwell wastes" with ferric hydroxide slime. The cost for this modification is estimated to be $3,700.

Please advise me as to whether or not these changes are acceptable and we will get these modifications completed as soon as possible.

Thanks for your help and I'll look forward to seeing you on Thursday.

Sincerely,

Tom Lodice TJL

MU-2500 REV. 5-83

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
CHAMBERS WORKS
DEEPWATER, NEW JERSEY 08023

CC: R. T. King, Wilmington
S. A. Hamdan, Wilmington
D. P. Heintzelman, Wilmington
T. L. Hamberger, Wilmington
E. A. Donald, Wilmington
J. M. Anderson, Jr., Chs Wks
S. O. Rogers, Chs Wks
P. H. Smith, Chs Wks

July 5, 1989

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Cedar Chemical Corporation
P. O. Box 2749
West Helena, AR 72390

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Sincerely,

Karl F. Kamenski

Karl F. Kamenski

KFK:bml
5030U
Attach.



AB0000118399/1

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

June 20, 1989

REPLY TO: P. O. BOX 2749
WEST HELENA, AR 72390
(501) 572-3701

Karl Kamenski
AI&V Dept.
E.I.DuPont & Co.
Chambers Works
Deepwater, NJ 08023

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Thanks for your help and I'll look forward to seeing you on Thursday.

Sincerely,

Tom Lodice TJL

DUPONT

E. I. DU PONT DE NEMOURS & CO., (INC.)

PURCHASE ORDER

Materials & Logistics Dept. cc: Charlie Neil Tom Kim
Wilmington, DE 19898

LMD-956834Y
PURCHASE ORDER NO. | ALT NO.

RELEASE NUMBER

SITE NO. | TAX CODE | DIRECT ALL INQUIRES

DATE OF ORDER 6/7/89

ISSUED BY T. L. Hamberger

PAGE 1 OF 1

TERMS OF PAYMENT Net 30 days

REQUIRED SHIP DATE | PROMISED SHIP DATE

F.O.B. DEST. (DELTD) SHIP PT.

PREPAID | OTHER (SEE BELOW)
PREPAID ADDED | COLLECT*

* IF COLLECT, Mail Freight Bill To:
FMIS

FREIGHT TERMS (If Ship Pt. Show City & State) FREIGHT TERMS

VENDOR CODE

PAYEE CODE

Cedar Chemical Corporation
24th Floor
5100 Poplar Avenue
Memphis, TN 38137
Attn: G. L. Pratt

SHIP TO

E. I. DU PONT DE NEMOURS & COMPANY

ORDER NO. LMD-956834Y

SHIP VIA:

**INSTRUCTIONS TO VENDOR**

PLEASE ENTER OUR ORDER AS SPECIFIED BELOW SUBJECT TO CONDITIONS AND INSTRUCTIONS LISTED ON BOTH THE FACE AND REVERSE SIDE OF THIS PURCHASE ORDER.

1. IF PRICE, TERMS, REQUIRED SHIPPING DATE OR OTHER CONDITIONS AND INSTRUCTIONS ARE NOT ACCEPTABLE IMMEDIATELY ADVISE INDIVIDUAL INDICATED BY RED ARROW ABOVE.
2. FURNISH COMPLETE SHIPPING INFORMATION AND INCLUDE 2 COPIES OF PACKING LIST WITH EACH SHIPMENT. SHOW PURCHASE ORDER NUMBER ON EACH PACKAGE, PACKING LIST, BILL OF LADING, INVOICE AND ALL CORRESPONDENCE.
3. MAIL YOUR INVOICE TO ADDRESS INDICATED BELOW.

E. I. du Pont de Nemours & Co.
Attn: Accounts Payable Section
Misc. Stores/Chambers Works
Deepwater, NJ 08023

4. DO NOT INCLUDE U.P.S. OR PARCEL POST. DO NOT DECLARE AIR EXPRESS AND AIR FREIGHT IN EXCESS OF $50.00. IF LOWER CHARGES RESULT TO DUPONT, DECLARED VALUE SHALL NOT EXCEED LOWEST AMOUNT IN APPLICABLE TARIFF.

| ITEM | QUANTITY | UNIT | DESCRIPTION | UNIT PRICE | AMOUNT |
|---|---|---|---|---|---|

To cover CONTRACTOR'S cost to perform chlorination of p-nitro toluene during the period 6/1/89 through 5/31/90 in accordance with DU PONT'S technical package dated 5/22/89 and CONTRACTOR'S proposal dated 5/12/89. DU PONT will provide crude materials except soda ash and nitrogen.

Contract Administrator: K. F. Kamenski

DO NOT WRITE BEYOND THIS LINE

CONFIRMING TO: BY: DATE

AB0000118350/1

This document when properly executed shall constitute a Contract between E. I. DU PONT DE NEMOURS AND COMPANY (DU PONT) and CEDAR CHEMICAL CORPORATION (CEDAR) covering the services described herein for DU PONT.

SERVICES - CEDAR shall, except to the extent otherwise expressly stated herein, furnish all labor, supervision, materials, tools, equipment, facilities and services to properly and efficiently do all things necessary to perform chlorination of p-nitro toluene in accordance with DU PONT'S technical package provided March 22, 1989, which is included herein by reference, and CEDAR'S proposal dated May 12, 1989, which is included herein as Exhibit "A". DU PONT will provide crude materials except soda ash and nitrogen.

COMPENSATION - DU PONT will pay CEDAR per Exhibit "A" dated May 12, 1989.

TERMS OF PAYMENT - Net thirty (30) days upon receipt of a properly prepared and correct invoice.

PERIOD OF AGREEMENT - June 1, 1989 - May 31, 1990.

SECRECY - The Confidential Information Agreement between the parties dated February 28, 1989 applies to the performance of this Agreement.

GENERAL CONDITIONS - In accordance with DU PONT'S Standard Terms & Conditions EM-6685, Rev. 12/88, which are attached hereto and made a part hereof.

COPIES OF INVOICES - Mail four (4) copies of your invoices to:

E. I. du Pont de Nemours and Company
Accounts Payable Section
Misc. Stores/Chambers Works
Deepwater, NJ 08023

ENTIRETY - This document and any specifically referred to herein embody the entire agreement between the parties; and there are no agreements, understandings, conditions, warranties or representations, oral or written, express or implied, which are not merged herein. No modification shall be effective unless in writing, signed by both parties.

Please signify your acceptance by signing below; and return the "WILM. M&L DEPT. COPY" to T. L. Hamberger, E. I. du Pont de Nemours and Company, Materials and Logistics Department, Room B-7272, Wilmington, Delaware 19898.

CEDAR CHEMICAL CORPORATION

BY: [signature]

TITLE: VP & Gen Mgr

DATE: June 14, 1989

E. I. DU PONT DE NEMOURS AND COMPANY

BY: [signature]

R. J. [illegible]
SENIOR PU[illegible] AGENT
CONTRACT[illegible] ON

TITLE:

DATE: JUN - 9 1989

CONTRACT ADMINISTRATOR(S): K. F. Kamenski-C&P-Chambers Works

EXHIBIT "A"

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

May 12, 1989

Mr. Gordon L. McNeill
E.I. DuPont de Nemours & Company
Chemicals and Pigments Department
Wilmington, Delaware 19898

Dear Gordon:

Since today is May 12, it is time to make our proposal to you for the chlorination of p-nitro toluene. For three equal campaigns for a total of 1MM pounds beginning in late June 1989 we propose:

1) A one time plant modification fee not to exced $160M. A detailed breakdown of the costs would be provided with invoices and no markup is applied. An additional $35M would be required to install a continuous wash column intended to reduce aqueous waste. It will be necessary to conduct laboratory studies to enhance the probability of this approach being successful.

2) A daily processing fee of $9,000 to include all services except waste disposal and raw materials.

3) Cedar will provide raw materials other than the p-nitro toluene upon request at our cost plus five percent. Nitrogen is considered a raw material and would be metered to the project if needed.

4) Waste will be returned to DuPont for disposal or shipped to licensed commercial disposal sites approved by both parties. Cedar will make its best efforts to dispose of wastes in its onsite biological system and would share any cost savings with DuPont. Commercial deepwell disposal of aqueous waste is estimated to cost $0.32/gallon including freight.

5) Cedar will begin production with onsite technical direction by DuPont personnel. After a suitable trial period, Cedar would be willing to continue production using a fixed processing fee per pound of product and

warranty raw material consumption standards and product quality based upon parameters demonstrated in the trial.

We hope that this proposal will meet your economic criteria and we can proceed with the project. Please call if clarification of the proposal is needed, or if we need to explore a different approach.

Sincerely,

Geoffrey L. Pratt
Director Operations
Custom Manufacturing

/kt

Tolling Estimate

Cedar - West Helena
Tolling Cost Estimate
DuPont Chloronitro / Toulene CNT

| | | | | Initials | Date |
|---|---|---|---|---|---|
| Estimated lbs or gals of Production | | Lbs | 1,000,000 | G P | Estimated l |
| | | | | G P | 1 1/2 montl |
| Estimated Revenue on Production | (45 days x 9,000) | | 405,000 | G P | |

Cost Elements:

| Raw Materials | | | | |
|---|---|---|---|---|
| Description | lb/lb or gal | cost per lb R/M | cost per lb/gl Prod | Total Cost |
| A. Supplied by Dupont | | | 0.000 | 0 |
| B. | | | 0.000 | 0 |
| C. | | | 0.000 | 0 |
| D. | | | 0.000 | 0 |
| E. | | | 0.000 | 0 |
| F. | | | 0.000 | 0 |
| G. | | | 0.000 | 0 |
| Total Raw Material Cost | | | 0.000 | 0 |

| | | | | | |
|---|---|---|---|---|---|
| Direct Costs | | | | | |
| Ordinary Supplies | | | | 1,350 | N R |
| Rentals | | | | 940 | N R |
| Outside Labor | | | | 800 | N R |
| Maint Supplies | | | | 14,200 | N R |
| Nitrogen | CF | 1,700,000 | | (430) | N R |
| Gas | MCF | 2,800 | | 8,500 | N R |
| Power | KWH | 310,000 | | 18,600 | N R |
| Start-up | | | | | |
| Shut-down | | | | 5,000 | |
| Other | | | | 1,350 | N R |
| Containers | | | | | |
| Sub Total | | | | 50,310 | |
| Fixed Costs | | | | | |
| Salaries | | | | 14,200 | N R |
| Wages | No Operators | 2/ shifts | | 35,500 | J M |
| Fringes | | | | 20,500 | N R |
| Safety | | | | | |
| Environmental | | | | | |
| Ins & Taxes | | | | 14,000 | N R |
| Sub Total | | | | 84,200 | |
| Plant O/H | | | | 47,000 | N R |
| Plant Admin | | | | 13,000 | N R |
| Depr | Plant | Diphone C | | 50,000 | N R |
| Sub Total | | | | 110,000 | |
| Total | | | | 244,510 | |
| Expected Plant Profit | | | | 160,490 | |

Tolling Estimate

5/31/1989

Months to run
hs

Tolling Estimate

Cedar - West Helena
Tolling Cost Estimate
DuPont Chloronitro / Toulene CNT

| | | | | | Initials | Date |
|---|---|---|---|---|---|---|
| Estimated lbs or gals of Production | | | Lbs | 1,000,000 | G P | Estimated I |
| | | | | | G P | 1 1/2 montl |
| Estimated Revenue on Production | | (45 days x 9,000) | | 405,000 | G P | |
| Cost Elements: | | | | | | |
| Raw Materials | | cost per | cost per | Total Cost | | |
| Description | lb/lb or gal | lb R/M | lb/gl Prod | | | |
| A. Supplied by Dupont | | | 0.000 | 0 | | |
| B. | | | 0.000 | 0 | | |
| C. | | | 0.000 | 0 | | |
| D. | | | 0.000 | 0 | | |
| E. | | | 0.000 | 0 | | |
| F. | | | 0.000 | 0 | | |
| G. | | | 0.000 | 0 | | |
| Total Raw Material Cost | | | 0.000 | 0 | | |
| Direct Costs | | | | | | |
| Ordinary Supplies | | | | 1,350 | N R | |
| Rentals | | | | 940 | N R | |
| Outside Labor | | | | 800 | N R | |
| Maint Supplies | | | | 14,200 | N R | |
| Nitrogen | CF | 1,700,000 | | (430) | N R | |
| Gas | MCF | 2,800 | | 8,500 | N R | |
| Power | KWH | 310,000 | | 18,600 | N R | |
| Start-up | | | | | | |
| Shut-down | | | | 5,000 | | |
| Other | | | | 1,350 | N R | |
| Containers | | | | | | |
| Sub Total | | | | 50,310 | | |
| Fixed Costs | | | | | | |
| Salaries | | | | 14,200 | N R | |
| Wages | No Operators | 2/ shifts | | 35,500 | J M | |
| Fringes | | | | 20,500 | N R | |
| Safety | | | | | | |
| Environmental | | | | | | |
| Ins & Taxes | | | | 14,000 | N R | |
| Sub Total | | | | 84,200 | | |
| Plant O/H | | | | 47,000 | N R | |
| Plant Admin | | | | 13,000 | N R | |
| Depr | Plant | Diphone C | | 50,000 | N R | |
| Sub Total | | | | 110,000 | | |
| Total | | | | 244,510 | | |
| Expected Plant Profit | | | | 160,490 | | |

Tolling Estimate

5/31/1989

Months to run
hs

CH-1 REV. 7-80

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

CHEMICALS AND PIGMENTS DEPARTMENT

March 22, 1989

Mr. Geoffrey Pratt
Cedar Chemical Corp.
5100 Poplar Avenue
Memphis, TN 38137

Dear Geoff:

Thanks for returning the signed Secrecy Agreement covering aromatic chlorinations. We have two in mind:

1. Chlorination of p-nitro toluene to 2 chlor, 4 nitro toluene.

2. Chlorination and recrystallization of p-nitro sodium phenolate to 2,6 dichloro, 4 nitro phenol.

You have the data package on the second product and enclosed is the data package for the first. These are given to you under the terms of the above Secrecy Agreement signed 3/21/89.

I think compound 1 has the most potential for a fit. We will need about 1MM lb/yr split into 2 or 3 campaigns. We would like the first to start in late June. As we discussed PNT would be supplied to you in tank cars and the 2 Cl, 4N toluene would be taken from you in other tank cars supplied by us. When you have had a chance to review the data package and evaluate your capital needs as well as a high spot conversion cost, please call me, (302)774-5920, and we can discuss. Another contact for additional technical detail is Joyce Finkle (609)540-3091.

We are looking for a way to handle the second compound in-house and should know in a week if we are successful. I would ask, however, that you give a quick look at the data package to assess the fit. Our first interest will probably be to get some of our own crude material recrystallized and then expand into chlorination in the late summer or fall. I would anticipate one campaign (1-2 months) for this product. You have been talking to Carl Chen and Bill Chang on this possibility. Another person who is working closely on this is Wayne Ely (609)540-4098. Doo May 609 540 4391

Look forward to hearing from you soon.

Sincerely,

Gordon

Gordon L. McNeill

GLM154.doc
Enclosure

cc: S. A. Hamdan
T. A. Bartolec
G. L. Thayer
J. T. Finkle, C.W.
W. B. Ely, J.L.

# 2-CHLORO-4-NITROTOLUENE CRUDE

## TECHNICAL PACKAGE

# 2-CHLORO-4-NITROTOLUENE CRUDE

## TECHNICAL PACKAGE

### Table of Contents

ection


1. Chemistry/Reaction
2. Process Summary
3. Raw Materials
4. Material Hazards and Properties
5. Material Toxicity
6. Equipment Description
7. Equipment Flow Sheet
8. Operating Steps and Conditions
9. Waste Streams and Associated Hazards


ppendix

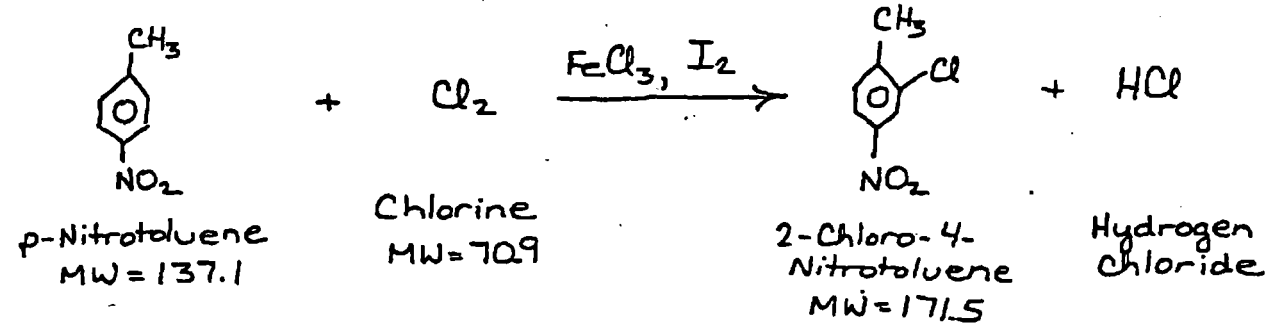

A. Material Safety Data Sheets
B. Test Methods
C. Raw Material Specifications

## . CHEMISTRY

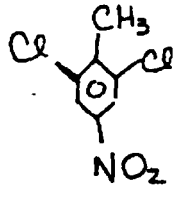
-Chloro-4-nitrotoluene crude product is the result of the hlorination of para-nitrotoluene. This is accomplished by assing chlorine gas into the dry liquid p-nitrotoluene at 75 C n a glass-lined chlorinator. Ferric chloride and iodine atalyze the reaction. Chlorination is continued until the esired mixture of 2-chloro-4-nitrotoluene (2Cl4NT), -nitrotoluene (PNT) and dichloronitrotoluene is achieved as etermined by the freezing point of the reaction mass.

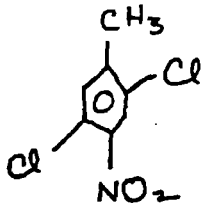
he chlorinated reaction mass is washed successively with water nd soda ash solution. The water washes remove ferric chloride nd dissolved hydrogen chloride. The soda ash wash removes odine and traces of phenolic compounds from the reaction mass nd leaves the product slightly alkaline.

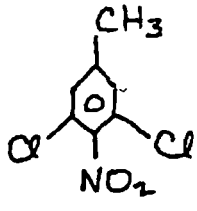
EACTION




The product also contains small amounts of unreacted p-nitotoluene and dichloronitrotoluenes.



## PROCESS SUMMARY

ara-nitrotoluene is measured out into a measuring/drying tank here it is heated and sparged with nitrogen. The PNT is then ransferred into a chlorinator where thionyl chloride is added to urther dry the material. Ferric chloride and iodine are added o catalyze the chlorination which is continued until the desired ixture of 2Cl4NT, PNT and dichloronitrotoluene is achieved.

## PECIFICATION

| apor Phase hromatograph (VPC): | Limits | Method* |
|---|---|---|
| 2-Cl-4NT | 93.0 +/- 1.0% | C4400.165.01.CWP |
| PNT | 3.5 +/- 2.5% | |
| 2,6-Dichloronitrotoluene | 4.5 +/- 3.0% | |
| rystallization Point | 57.0-59.6 C | F3100.155.01.CW |
| H (of an aqueous extract) | 7.5 +/- 1.0 | C4400.280.01.CWP |

* See Appendix B for Test Methods

## RAW MATERIALS

P-Nitrotoluene will be supplied by DuPont. It is available
tank truck or in drums.

ne following raw materials can be purchased commercially and
ill be supplied by the contractor**:

- Chlorine
- Anhydrous Ferric Chloride
- Iodine
- Thionyl Chloride
- Soda Ash Light
- Liquid Caustic Soda, 50%
- Nitrogen

* See Appendix C for Raw Material Specifications

## . MATERIAL HAZARDS AND PROPERTIES

AZARDS

HLORINE: A highly toxic, heavy greenish gas (b.p. -34.6 C, m.p. 101 C) which is irritating to the mucous membranes and other issues. Inhalation causes severe pulmonary edema and death fter short exposure at 50 ppm concentration in air. Liquid hlorine is a yellow-green, fuming substance which causes serious urns on contact with the body. Chlorine is a nonflammable but s classified as a moderate fire hazard because of its reaction ith organic materials and powdered metals.

iquid chlorine must never be trapped in a pipeline as its volume ncreases rapidly with increase in temperature and may cause ylinder or pipeline to rupture. Reactions with reducing agents roduce slight explosion. It reacts with water or steam to roduce highly toxic and corrosive fumes of HCl.

EAR SELF-CONTAINED BREATHING APPARATUS (SCBA) AND FULL NEOPRENE CID SUITS, DEFINED AS JACKET, PANTS, GLOVES, BOOTS AND HOOD.

-CHLORO-4-NITROTOLUENE: A yellow liquid. F.P. 57-59.6 C, b.p. 60 C, sp. gr. 1.27 at 70 C. It is moderately toxic and should e assumed to be cyanogenic. Avoid exposure by ingestion, inhalation of vapors or contact with the skin. It is a moderate fire hazard; on decomposition it may emit toxic fumes. The auto-decomposition temperature is 325 C; however, tests conducted with PNT, chlorine and dispersed catalyst (FeC13 and I2) decomposed at temperatures as low as 272 C. Sodium carbonate, iron powder, ferric chloride and rust all lower the ADT of 2-chloro-4-nitrotoluene. All decompositions witnessed occurred above 260 C.

FERRIC CHLORIDE (ANHYDROUS): Strongly acidic, particularly in contact with water. It evolves heat upon contact with water or alcohol; hydrochloric acid fumes may be noted. It can be an allergen and may stain the skin. It is a black-brown, hygroscopic solid which cakes readily; sp. gr. 2.90; m.p. 306C; decomposes at 315 C. Noncombustible.

WEAR A COMFO A RESPIRATOR WITH "F" TYPE FILTER.

HYDROCHLORIC ACID: A colorless to light yellow, volatile, fuming aqueous solution. It is strongly corrosive but neither flammable nor corrosive. It is highly irritating to the skin, toxic by ingestion or inhalation of vapor. A concentration of 35 ppm irritates the eyes, throat and respiratory system; concentrations above 300 ppm result in pulmonary edema, and often laryngeal spasm. Mists of HCl are less harmful than the gas, since no

ehydrating action is involved. HCl reacts with basic material enerating a large amount of heat.

YDROGEN CHLORIDE ANHYDROUS: A colorless gas which fumes readily n the presence of moist air; m.p. -115 C, b.p. -85.1 C, sp. gr. .639 (gas at 0 C), 1.194 (liquid at -36 C). Vapor pressure 606 si at 25 C. It is strongly corrosive but neither flammable nor xplosive. It is highly irritating to the skin, and toxic by nhalation (especially irritating to mucous membranes and espiratory tract).

ODINE: A gray-black crystal which sublimes readily; m.p. 113.6C sublimes), b.p. 184 C, sp. gr. 4.93 at 20 C. It is highly oxic. The effect of iodine vapor is similar to chlorine or romine. It is highly irritating to the eyes, lungs and skin. void contact by wearing rubber gloves and goggles.

EAR A COMFO II RESPIRATOR WITH "F" TYPE FILTER.

-NITROTOLUENE: A yellow liquid. F.P. 52 C, b.p. 238 C, flash oint 106 C, sp. gr. 1.139 at 55 C. PNT is a moderately toxic aterial, but is not a serious cyanogenic hazard. Avoid PNT xposure by ingestion, inhalation of vapors or contact with the kin. PNT is not a class B poison or a corrosive liquid. It is a moderate fire hazard when exposed to heat or flame. On decomposition, PNT emits toxic fumes. The auto-oxidation temperature of PNT is 390 C; however, tests conducted with PNT, chlorine and dispersed catalyst (FeCl3 and I2) decomposed at temperatures as low as 272 C. PNT is an oxidizing agent and may react violently with reducing agents.

SODA ASH (SODIUM CARBONATE): A white, crystalline powder, melting point 851 C with decomposition. It is an alkaline, water soluble, dusty powder which can cause dermatitis on sensitive people and be moderately irritating if ingested or inhaled. In contact with acids, carbon dioxide is liberated and foaming takes place.

WEAR A COMFO II RESPIRATOR WITH "F" TYPE FILTER.

SODA CAUSTIC LIQUID: A colorless liquid. The specific gravity of 50% caustic is 1.53 at 20 C. It is extremely corrosive in contact with all body tissue, whether as liquid or mist, and even in dilute solution. It is nonflammable, but generates heat when mixed with acids or water.

THIONYL CHLORIDE: A fuming, pale yellow liquid with a very pungent odor. F.P. -104.5 C, b.p. 77 C, sp. gr. 1.63. It is

everely irritating and corrosive to the eyes, skin and espiratory tract. Thionyl chloride can react violently with lkalies, water and reducing agents releasing toxic gases. It is ot flammable but can generate hydrogen gas in the presence of teel and water.

**IR MASK MUST BE WORN WHEN OPENING DRUMS AND CONNECTING PIPING.**

## . MATERIAL TOXICITY

HLORINE: Hazardous liquid and gas under pressure. Causes evere eye and skin burns. Harmful if inhaled; causes damage to ose, throat and lungs.

Inhalation 1 hour LC50: 293 ppm in rats

xposure limits:

AEL: 0.5 ppm - 8 hour Time Weighted Average (TWA)
TLV: 1 ppm, 3 mg/m3
STEL 3 ppm, 9 mg/m3
PEL: 1 ppm, 3 mg/m3 - Ceiling

!-CHLORO-4-NITROTOLUENE: Harmful if inhaled or absorbed through :he skin; reduces blood's oxygen carrying capacity. Symptoms may ›e delayed. Causes skin and eye irritation.

Oral LD50: 1499 mg/kg in rats

Exposure limits:

TLV: None Established
PEL: None Established

FERRIC CHLORIDE (ANHYDROUS): Contact can cause irritation or corrosive burns to human tissue. Contact with eyes may cause irritation and may be corrosive resulting in permanent visual loss unless removed quickly by thorough irrigation with water. Moderate skin irritant. Ingestion may cause severe liver and/or kidney damage. High heat of solution (353 Btu/lb) can cause severe burns if in contact with moist skin or mucous tissue.

Toxicity:

Oral LD50 (rat): 1932 mg/kg
Dermal (rabbit): caused erythema to skin

Exposure limits:

TLV: None established
PEL: None established

HYDROGEN CHLORIDE ANHYDROUS: Causes skin and eye burns. Harmful if inhaled; extremely irritating to nose, throat and lungs.

Inhalation 1 hour LC50: 3124 ppm in rats

xposure limits:

AEL: 5 ppm - 15 min. TWA
TLV: 5 ppm, 7 mg/m3 - Ceiling
PEL: 5 ppm, 7 mg/m3 - Ceiling

YDROCHLORIC ACID: Causes skin and eye burns. Causes irritation f nose, throat and lungs.

Inhalation 1 hour LC50: 3124 ppm in rats

xposure limits:

AEL: 5 ppm - 15 min TWA
TLV: 5 ppm, 7 mg/m3 - Ceiling
PEL: 5 ppm, 7 mg/m3 - Ceiling

ODINE: Contact can cause severe irritation and burns to eyes, kin, upper respiratory tract and lungs. Single dose oral oxicity is high. Ingestion may cause burns of mouth and throat.

Exposure limits:

TLV: 0.1 ppm - Ceiling
PEL: 0.1 ppm - Ceiling

P-NITROTOLUENE: Harmful if inhaled or absorbed through skin. Reduces blood's oxygen carrying capacity.

Inhalation 1 hour ALC: >41 ppm in rats
Skin absorption ALD: >200 mg/kg in rabbits
Oral LD50: 2144 mg/kg in rats

Exposure limits:

OSHA 8 hour (TWA): 5 ppm or 30 mg/m3
TLV (TWA): 2 ppm or 11 mg/m3 for all isomers of nitrotoluene

Both limits have "SKIN" notation indicating that liquid and vapor are capable of penetrating the skin and mucous membrane. Control of vapor inhalation alone may not be sufficient to prevent absorption of an excessive dose.

SODA ASH (SODIUM CARBONATE): Inhalation of product dust may irritate nose, throat and lungs. Although low in toxicity, ingestion can be harmful - consult a physician. May irritate mouth, esophagus, stomach, etc.

ORAL LD50 (rat): 4000 mg/kg

May cause skin irritation from prolonged contact. May irritate

r burn eyes.

xposure limits:

AEL: 5 mg/m3 - 8 hour TWA
TLV: None Established.
PEL: None Established.

ODA CAUSTIC LIQUID: Corrosive to the skin, eyes and mucous embranes.

Oral ALD: rabbits, 500 mg/kg

Exposure limits:

AEL: 2 mg/m3 (15 min TWA)
TLV: 2 mg/m3 - Ceiling
PEL: 2 mg/m3

THIONYL CHLORIDE: Severely irritating and corrosive to the eyes, skin and respiratory tract. Repeated exposure to vapor may cause chronic respiratory irritation. Significant overexposure to vapors can cause delayed pulmonary edema. Direct contact with the liquid may cause severe damage to the skin and eyes.

In the presence of moisture, thionyl chloride decomposes into hydrogen chloride and sulfur dioxide which are toxic and constitute serious toxicity hazards.

Lethal dose by inhalation in cats is reported as 17.5 ppm for 20 minutes.

Exposure limits:

AEL: None Established
TLV: 1 ppm, 5 mg/m3 - Ceiling
PEL: None Established

OTHER OCCUPATIONAL HEALTH CONSIDERATIONS

Process does not present additional Occupational Health Concerns.

## . EQUIPMENT DESCRIPTION

PNT Storage Tank: A heated storage tank capable of holding the NT between 55 C and 70 C. Materials of construction to be arbon steel, 300/400 series stainless steel, Hastelloy B/C or itanium.

PNT Drying Tank: A heated tank capable of holding the PNT t 85 C. The tank must be equipped with a nitrogen sparger. aterials of construction to be carbon steel, 300/400 series tainless steel, Hastelloy B/C or titanium. The tank must be quipped with a scrubber to remove PNT vapors from the nitrogen.

Chlorinator: An agitated tank equipped with cooling coils or acket to remove the heat of reaction ( H = -31,000 Pcu/lb-mole 'NT). The tank must be equipped with a chlorine sparger. laterials of construction to be glass-lined steel or Hastelloy C. 'ower input for the existing chlorinator is 4 Hp/1000 gallons to provide adequate heat transfer in the glass-lined vessel.

Wash Tank: An agitated and heated tank capable of holding the reaction mass at 55 C - 70 C. The capacity of the tank should be large enough to hold the reaction mass and an equal volume of water. The existing material of construction is glass-lined steel. The tank must be equipped with a siphon leg and jet to remove the water (top layer) from the 2Cl4NT.

Product Storage Tank: A heated storage tank capable of holding the 2-Cl-4-NT between 65 C and 80 C. Materials of construction to be carbon steel, 300/400 series stainless steel, Hastelloy B/C or titanium. If a product storage tank is not available, the product can be transferred directly to a tank car.

Chlorine Vaporizer: A heat exchanger capable of vaporizing at least 1000 lb./hr. of liquid chlorine. The vaporizer must be instrumented sufficiently to prevent liquid chlorine from being fed to the chlorinator. (It has been calculated that a one minute perturbation of liquid chlorine to the chlorinator would raise the temperature in the vessel to 387 C, which is well above the autodecomposition temperature of PNT.)

HCl Scrubber: A water scrubber, typically of jet design, to remove 90% - 95% of the HCl generated in the chlorination. A high scrubbing efficiency is required to avoid overloading the chlorine scrubber.

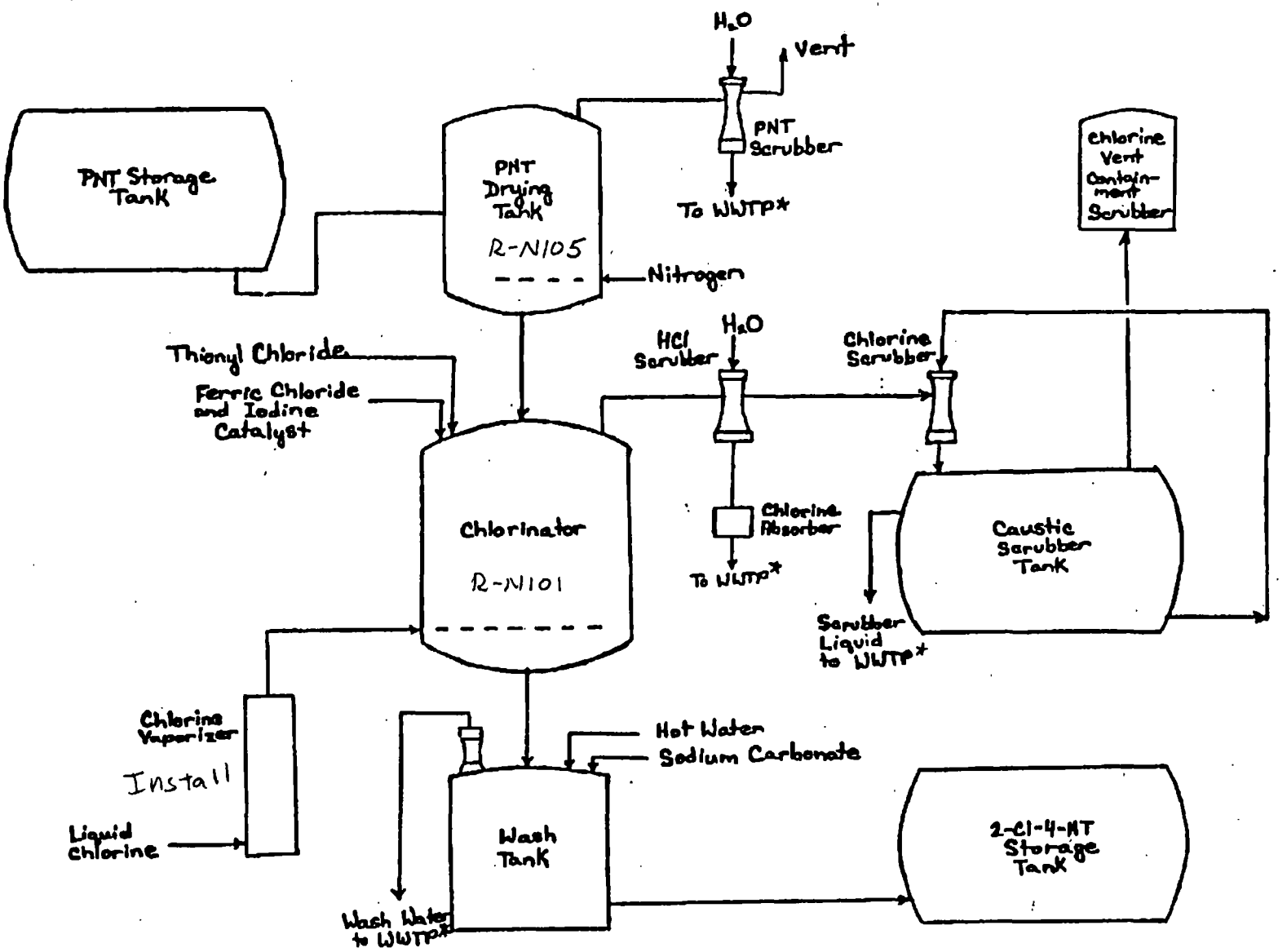
Chlorine Scrubber: A scrubber circulating caustic solution to remove chlorine and residual HCl from the HCl scrubber off-gas. Scrubber efficiency should be about 95% on both HCl and chlorine.

Caustic Scrubber Tank: A tank equipped with either cooling coils or jacket to remove the heat of reaction. Caustic solution must be maintained at 30 C - 50 C. Materials of construction to

ıe carbon steel or better.

Chlorine Absorber: An absorber capable of separating small ımounts of entrained chlorine in the liquid discharged from the ICl scrubber and venting it through a stack.

Chlorine Vent Containment Scrubber: A scrubber to remove :hlorine released from the chlorine vaporizer, chlorinator relief ralve vents and also any unscrubbed chlorine from the chlorine ;crubber vent.




*NOTE: WWTP = Waste Water Treatment Plant

Bottom ~ 50 ft2
300gal

1500gal 4' Straight side

101 ft2
50

## . OPERATING STEPS AND CONDITIONS

NT MEASURING AND DRYING:

. Transfer the p-nitrotoluene to the drying tank.

. Heat the p-nitrotoluene to 82.5 C for drying. (Limits: inimum, 80 C; maximum, 85 C).

The minimum temperature is to facilitate drying. The maximum temperature is to avoid lost time in cooling the charge prior to chlorination.

. Sparge dry nitrogen through the PNT at 1 SCFM.

. Continue nitrogen sparging until the moisture content of the )-nitrotoluene is less than 0.2% (2000 ppm H2O) as measured by Orchem Method 2-14-3B)***.

. Transfer the dried PNT to the chlorinator.

. Cool the reactor and contents to 76 C or lower and calculate the amount of thionyl chloride to be added as follows:

Multiply the weight of the charged p-nitrotoluene by the % water reported in the analysis for Step 4. The product will be total pounds of water to react.

Multiply the pounds of water to be reacted by the ratio:

$$\frac{\text{(MW of thionyl chloride)}}{\text{(MW of water)}} = 6.61$$

Example:

7753 lb. of PNT added
% water in Step 4 = 0.15%

7753 * 0.0015 = 11.63 lb. H2O present
11.63 * 6.61 = 76.87 lb. thionyl chloride to be added

Add the calculated amount of thionyl chloride to the reactor contents, seal the vessel, stir for 15 minutes and proceed to Step 7.

Water reacts with the catalyst and slows the chlorination.

CHLORINATION:

7. Add 1.29% +/- 0.13% ferric chloride and 0.026% +/- 0.0026% iodine, based on pounds of p-nitrotoluene, to the charge.

For example, a charge size of 7753 lbs. of PNT requires 100 +/- 10 lb. ferric chloride and 2 +/- 0.2 lb. iodine.

These materials catalyze the reaction.

. Chlorination temperature: 60 C minimum, 80 C maximum; referred 77.5 C.

The minimum temperature is to prevent crystallization of the reaction mass.

The maximum temperature is the maximum demonstrated of the DuPont process.

. Chlorine feed rate: 0-900 lb./hr. of chlorine vapor.

This range is based on DuPont experience with a charge size of 7753 lb. PNT.

.0. Sample the charge and determine the freeze point after six iours of chlorination.

Freeze point analysis will help to determine the amount of chlorine needed to complete the chlorination. As many as three such samples may be needed; more can be taken as required.

Sampling procedure is as follows: using a Centigrade thermometer, gently stir sample. Observe temperature as the sample cools. Temperature will fall to a minimum and kick back to a higher value where it will level out as the charge freezes. This stabilized temperature is the freeze point.

After the initial freezing point is run, additional samples should be taken periodically to monitor the progress of the chlorination. When the freezing point exceeds 54 C, reduce the chlorination rate by 15 to 35% and take samples at least every 20 minutes until a freezing point of at least 57.8 is achieved. The chlorination should be complete at this point.

If chlorination is not complete after addition of chlorine, add up to 50% of the ferric chloride and iodine amount in Step 7 to the charge and continue chlorination to the desired level.

WASHING:

11. Add 70-75 C water to the wash tank. Based on the amount of PNT added initially, add 66.7 +/- 2.1% water; based on the amount of pure 2C14NT produced by the chlorination, add 58.2 +/- 1.9% water.

For example, a charge size of 7753 lb. PNT chlorinated to

630 gal.

produce 8886 lb. 100% 2Cl4NT, requires 5,170 +/- 165 lb. of 80 C water.

The minimum amount limit set on wash water is to provide adequate washing without increasing overall cycle time. The maximum limit is to avoid excessive solubility losses.

The minimum temperature limit is set to prevent freezing. The maximum is to minimize vent losses and avoid fuming.

12. When chlorination is complete, transfer the charge to the washing vessel.

13. Agitate the water wash and reaction mass for at least 15 minutes.

14. Settle for at least 30 minutes.

15. Siphon off the water layer (top) from the 2-chloro-4-nitrotoluene layer (bottom).

16. Repeat Step 11 and Steps 13 through 15 until less than 0.2% "acidity as HCl" is present.

DuPont experience has shown that four washes are usually sufficient.

Note: The purpose of the water washing steps is to remove HCl and ferric chloride prior to the subsequent soda ash wash. If this limit is not met, the soda ash wash will not satisfactorily remove iodine from the product.

17. Add soda ash light to the charge with agitation. Based on the PNT added initially, add 0.065-1.29%, preferred 0.13% soda ash. Based on the pure 2Cl4NT produced by the chlorination, add 0.056-1.13%, preferred 0.11% soda ash.

For example, a charge size of 7753 lb. PNT chlorinated to produce 8886 lb. of 100% 2Cl4NT, requires 5 lb. minimum, 100 pounds maximum, preferred 10 pounds soda ash.

NEVER ADD CAUSTIC SODA (SODIUM HYDROXIDE): caustic soda will cause the formation of nitrophenols or nitrophenol sodium salts which may result in fire or explosion.

The minimum limit on the amount of soda ash is to provide enough sodium carbonate to remove iodine (as iodide) from the product and meet the pH specification. The maximum limit is to control nitrophenol sodium salt formation if excessive nitrophenols are present.

18. Add 80 C water in the amount specified in Step 11 to the charge while maintaining agitation.

9. Settle for at least 30 minutes.

0. Check the wash water (top layer) for pH using Tridicator aper. If the pH is 7.5 or higher proceed to Step 22.

1. If the pH lower limit was not achieved, repeat Step 15 and teps 17 through 20.

Do not exceed the maximum amount of soda ash specified in Step 17.

2. Siphon off the water layer (top) from the 2-chloro-4-nitro- oluene (bottom).

3. The finished 2-chloro-4-nitrotoluene product is sampled for apor Phase Chromatograph, freezing point and pH in accordance ith the following specifications***:

PECIFICATION

| apor Phase hromatograph (VPC): | Limits | Method |
|---|---|---|
| 2-Cl-4NT | 93.0 +/- 1.0% | C4400.165.01.CWP |
| PNT | 3.5 +/- 2.5% | |
| 2,6-Dichloronitrotoluene | 4.5 +/- 3.0% | |
| rystallization Point | 57.0-59.6 C | F3100.155.01.CW |
| H (of an aqueous extract) | 7.5 +/- 1.0 | C4400.280.01.CWP |

24. Transfer 2Cl4NT product to the product storage tank held at a storage temperature of 65 C minimum, 80 C maximum, preferred 70 C.

The minimum temperature is to prevent freezing (f.p. of 2Cl4NT 57.0-59.6 C). The maximum temperature is to decrease vent losses and avoid fuming. At a temperature above 85 C, the product slowly dechlorinates.

***See Appendix B for Test Methods

## 2 Cl $4NO_2$ Toluene

### Estimated Raw Material Consumptions
(lb/lb 2Cl $4NO_2$ Toluene)

| Raw Material | Consumption |
|---|---|
| p-nitrotoluene | .85 |
| Chlorine | .45 |
| Ferric Chloride (Anhyd.) | .0125 |
| Iodine | .0003 |
| Thionyl chloride | .003 |
| Soda ash light | .005 |
| 50% caustic (as 100%) | ~~.05~~ .085 |

## ). WASTE STREAMS AND ASSOCIATED HAZARDS

)uPont has essentially four waste streams from the 2-chloro-4-iitrotoluene process:

l. The p-nitrotoluene drying tank emits PNT due to air iisplacement during tank filling, heating and nitrogen purging. Fhe atmospheric stream consists of 91.8 wt% water and 8.2 wt% ?NT, that is, with a PNT charge size of 7753 lb PNT, the stream :onsists of 7.5 lb. water and 0.67 lb. of PNT (DuPont stream).

Fhe stream is scrubbed by a standard scrubber (described in the Equipment Section). The effluent is sent to the internal waste water treatment plant.

Associated Hazards: Due to trace of PNT, may be slightly toxic and irritating to the skin and respiratory system.

2 & 3. The chlorinator emissions, due to filling, heating and chlorination are scrubbed by a water and a caustic scrubber in series (see attached equipment description and flow sheet sections), each producing its own waste stream. The atmospheric stream consists of the following:

| Component | Weight % | lbs. in DuPont Process (lbs./charge) |
|---|---|---|
| Sulfur Dioxide | 2.4 | 55 |
| p-Nitrotoluene | 1.5 | 34 |
| Chlorine | 3.6 | 80 |
| Water | 0.1 | 2 |
| 2Cl4NT | 0.2 | 4 |
| HCl | 92.2 | 2079 |

After having been scrubbed, the effluent is sent to the internal waste water treatment plant.

Associated Hazards (after scrubbers): Irritant/hazard to eyes, skin, respiratory system. Avoid exposure by ingestion, inhalation of vapors or contact with skin. May be cyanotic. Caustic scrubber tank waste stream may be corrosive to body tissue due to sodium hydroxide.

4. The effluent from the washing steps is treated, as is, at the internal waste water treatment plant. The effluent consists of the following:

| Component | Weight % | lbs. in DuPont Process (lbs./charge) |
|---|---|---|

| | | |
|---|---|---|
| Ferric Chloride | 0.39 | 100 |
| 2Cl4NT | 0.13 | 35 |
| Sodium Carbonate | 0.03 | 9 |
| Sodium Iodide | 0.01 | 2 |
| Wash Water | 99.44 | 25,824 |

Associated Hazards: Due to the small percentages of 2Cl4NT, ferric chloride, sodium carbonate and sodium iodide, may be corrosive to the skin, eyes and respiratory system. May be cyanotic. May be toxic.

DUPONT

Materials & Logistics Dept. cc: Charlie
Wilmington, DE 19898 Neil
Tom
Ken

ISSUED BY: T. L. Hamberger

LMD-956834Y
PURCHASE ORDER NO. | ALT NO.

RELEASE NUMBER

PAGE 1 OF 1

SITE NO. | TAX CODE | DIRECT ALL INQUIRIES

DATE OF ORDER: 6/7/89

TERMS OF PAYMENT: Net 30 days

REQUIRED SHIP DATE | PROMISED SHIP DATE

F.O.B. DEST. (DEL'D) SHIP PT.

PREPAID | PREPAID ADDED | OTHER (SEE BELOW) | COLLECT*

FREIGHT TERMS (If Ship Pt. Show City & State) FREIGHT TERMS

* If COLLECT, Mail Freight Bill To:
FMIS
[illegible]
WILMINGTON, DE 19899

INSTRUCTIONS TO VENDOR

PLEASE ENTER OUR ORDER AS SPECIFIED BELOW SUBJECT TO CONDITIONS AND INSTRUCTIONS LISTED ON BOTH THE FACE AND REVERSE SIDE OF THIS PURCHASE ORDER.

1. If PRICE, TERMS, REQUIRED SHIPPING DATE OR OTHER CONDITIONS AND INSTRUCTIONS ARE NOT ACCEPTABLE IMMEDIATELY ADVISE INDIVIDUAL INDICATED BY BID ABOVE.
2. FURNISH COMPLETE SHIPPING INFORMATION AND INCLUDE 3 COPIES OF PACKING LIST WITH EACH SHIPMENT. SHOW PURCHASE ORDER NUMBER ON EACH PACKAGE, PACKING LIST, BILL OF LADING, INVOICE AND ALL CORRESPONDENCE.
3. MAIL YOUR INVOICE TO ADDRESS INDICATED BELOW.

E. I. du Pont de Nemours & Co.
Attn: Accounts Payable Section
Misc. Stores/Chambers Works
Deepwater, NJ 08023

4. DO NOT INSURE U.P.S. OR PARCEL POST. DO NOT DECLARE AIR EXPRESS AND AIR FREIGHT IN EXCESS OF $50,000. IF LOWER CHARGES RESULT TO DUPONT, DECLARED VALUE SHALL NOT EXCEED LOWEST AMOUNT IN APPLICABLE TARIFF.

VENDOR CODE

PAYEE CODE

Cedar Chemical Corporation
24th Floor
5100 Poplar Avenue
Memphis, TN 38137
Attn: G. L. Pratt

SHIP TO

E. I. DU PONT DE NEMOURS & COMPANY

ORDER NO. LMD-956834Y

SHIP VIA:

| ITEM | QUANTITY | UNIT | DESCRIPTION | UNIT PRICE | AMOUNT |
|---|---|---|---|---|---|
| | | | To cover CONTRACTOR'S cost to perform chlorination of p-nitro toluene during the period 6/1/89 through 5/31/90 in accordance with DU PONT'S technical package dated 5/22/89 and CONTRACTOR'S proposal dated 5/12/89. DU PONT will provide crude materials except soda ash and nitrogen. | | |
| | | | Contract Administrator: K. F. Kamenski | | |

DO NOT WRITE BEYOND THIS LINE

CONFIRMING TO:

BY:

DATE:

AB0000065618/1

This document when properly executed shall constitute a Contract between E. I. DU PONT DE NEMOURS AND COMPANY (DU PONT) and CEDAR CHEMICAL CORPORATION (CEDAR) covering the services described herein for DU PONT.

SERVICES - CEDAR shall, except to the extent otherwise expressly stated herein, furnish all labor, supervision, materials, tools, equipment, facilities and services to properly and efficiently do all things necessary to perform chlorination of p-nitro toluene in accordance with DU PONT'S technical package provided March 22, 1989, which is included herein by reference, and CEDAR'S proposal dated May 12, 1989, which is included herein as Exhibit "A". DU PONT will provide crude materials except soda ash and nitrogen.

COMPENSATION - DU PONT will pay CEDAR per Exhibit "A" dated May 12, 1989.

TERMS OF PAYMENT - Net thirty (30) days upon receipt of a properly prepared and correct invoice.

PERIOD OF AGREEMENT - June 1, 1989 - May 31, 1990.

SECRECY - The Confidential Information Agreement between the parties dated February 28, 1989 applies to the performance of this Agreement.

GENERAL CONDITIONS - In accordance with DU PONT'S Standard Terms & Conditions EM-6685, Rev. 12/88, which are attached hereto and made a part hereof.

COPIES OF INVOICES - Mail four (4) copies of your invoices to:

E. I. du Pont de Nemours and Company
Accounts Payable Section
Misc. Stores/Chambers Works
Deepwater, NJ 08023

ENTIRETY - This document and any specifically referred to herein embody the entire agreement between the parties; and there are no agreements, understandings, conditions, warranties or representations, oral or written, express or implied, which are not merged herein. No modification shall be effective unless in writing, signed by both parties.

Please signify your acceptance by signing below; and return the "WILM. M&L DEPT. COPY" to T. L. Hamberger, E. I. du Pont de Nemours and Company, Materials and Logistics Department, Room B-7272, Wilmington, Delaware 19898.

CEDAR CHEMICAL CORPORATION

BY: [signature]

TITLE: VP & Gen Mgr

DATE: June 14 1989

E. I. DU PONT DE NEMOURS AND COMPANY

BY: [signature]

R. J. DE STEF... SENIOR PL... CONTRACT... AGENT ...N

TITLE:

DATE: JUN - 0 1989

CONTRACT ADMINISTRATOR(S): K. F. Kamenski-C&P-Chambers Works

EXHIBIT "A"

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-3348

May 12, 1989

Mr. Gordon L. McNeill
E.I. DuPont de Nemours & Company
Chemicals and Pigments Department
Wilmington, Delaware 19898

Dear Gordon:

Since today is May 12, it is time to make our proposal to you for the chlorination of p-nitro toluene. For three equal campaigns for a total of 1MM pounds beginning in late June 1989 we propose:

1) A one time plant modification fee not to exced $160M. A detailed breakdown of the costs would be provided with invoices and no markup is applied. An additional $35M would be required to install a continuous wash column intended to reduce aqueous waste. It will be necessary to conduct laboratory studies to enhance the probability of this approach being successful.

2) A daily processing fee of $9,000 to include all services except waste disposal and raw materials.

3) Cedar will provide raw materials other than the p-nitro toluene upon request at our cost plus five percent. Nitrogen is considered a raw material and would be metered to the project if needed.

4) Waste will be returned to DuPont for disposal or shipped to licensed commercial disposal sites approved by both parties. Cedar will make its best efforts to dispose of wastes in its onsite biological system and would share any cost savings with DuPont. Commercial deepwell disposal of aqueous waste is estimated to cost $0.32/gallon including freight.

5) Cedar will begin production with onsite technical direction by DuPont personnel. After a suitable trial period, Cedar would be willing to continue production using a fixed processing fee per pound of product and

warranty raw material consumption standards and product quality based upon parameters demonstrated in the trial.

We hope that this proposal will meet your economic criteria and we can proceed with the project. Please call if clarification of the proposal is needed, or if we need to explore a different approach.

Sincerely,

Geoffrey L. Pratt
Director Operations
Custom Manufacturing

/kt

N. Robbins

Duplicate

DU PONT

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED

WILMINGTON, DELAWARE 19898

November 15, 1990

MATERIALS AND LOGISTICS DEPARTMENT

Mr. Geoffrey L. Pratt
Cedar Chemical Corporation
5100 Poplar Avenue
24th Floor
Memphis, TN 38137

Dear Mr. Pratt:

REFERENCE is made to the Agreement entered into June 1, 1989 between E.I. DU PONT DE NEMOURS & COMPANY (DU PONT) and CEDAR CHEMICAL CORPORATION (CEDAR) relative to perform chlorination of p-nitro toluene for DU PONT'S Chambers Works, Deepwater, NJ, plant. It is hereby mutually agreed to amend the aforesaid Agreement in the following manner effective June 1, 1990:

PERIOD OF AGREEMENT

(Extend the term of this Agreement from ending May 31, 1990 to ending December 31, 1991.)

CONTRACT ADMINISTRATOR

(Change contract administrator from K.F. Kamenski to Paul Smith.)

COMPENSATION

(Replace Exhibit "A" dated 5/12/89 in its entirety with Exhibit "A" dated 8/14/90 with the exception of the paragraph relative to a formula for adjusting processing fees. It is agreed to meet for the purpose of adjusting processing fees at least two (2) months prior to the expiration of this Agreement or extensions thereof.)

ALL OTHER TERMS and conditions of the current Agreement, except as modified in the above manner, shall continue in full force and effect.

Please indicate your acceptance of this amendment by signing both copies in the space provided below and return the copy marked "WILM. ML&S COPY" to R.A. Blackhall, E.I. du Pont de Nemours & Company, Materials, Logistics & Services, PO Box 80015, BMP-15-1284, Wilmington, Delaware 19898.

| CEDAR CHEMICAL CORPORATION | E.I. DU PONT DE NEMOURS & COMPANY |
|---|---|
| BY: Geoffrey L Pratt | BY: R W Blackhall |
| TITLE: Director Custom Mfg | TITLE: Mgr - Contracting |
| DATE: 11/20/90 | DATE: 11/16/90 |

AB0000065599/1

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

August 14, 1990

AUG 21 1990

Mr. R. A. Blackhall
E. I. du Pont de Nemours & Co.
P. O. Box 80015: Barley Mill Plaza
Wilmington, DE 19898

Dear Bob:

As a follow up to our meeting of July 25, 1990, we are pleased to submit Cedar's proposal for the chlorination of PNT for the remainder of 1990:

1. A plant preparation and cleanup fee of $30,000 for each production campaign.

2. A processing fee per pound of CNT based upon a per diem processing fee of $10,000 divided by the productivity target of 21,277 pounds per day.

3. The above pricing formulas would apply for all quantities down to a minimum of two cars of PNT (approximately 250,000 pounds).

4. Stand by compensation of $9,000 per day for interruptions in Cedar's production due to items under du Pont's control such as the PNT supply. Du Pont would continue to have the option of declaring the campaign complete in which case the per diem would cease and the campaign would terminate.

5. Cedar will provide chlorine, if requested by du Pont for a price of 1.2 cents per pound of CNT during 1990.

You were to provide a formula for adjusting the above processing fees for inflation which would be triggered in 1991.

Cedar will provide du Pont with copies of Certificates of Analysis on each lot of CNT in a product rail car, such copies to be faxed to them at the time the car is shipped to the attention of Paul Smith at 609-540-3177 with a second copy to 609-540-4498.

Cedar will continue to fax the records of car weights and receiving reports as they have in the past.

Bob. I hope that this covers accurately the issues that we discussed and that we can develop a multi-year contract. Please let me know, if there is additional information that I can provide.

Sincerely,

Geoffrey L. Pratt
Director Operations
Custom Manufacturing

mc

cc: Paul H. Smith
Elaine A. Donald

cc. Frank
Neil
Gene

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

November 15, 1990

MATERIALS AND LOGISTICS DEPARTMENT

Mr. Geoffrey L. Pratt
Cedar Chemical Corporation
5100 Poplar Avenue
24th Floor
Memphis, TN 38137

Dear Mr. Pratt:

REFERENCE is made to the Agreement entered into June 1, 1989 between E.I. DU PONT DE NEMOURS & COMPANY (DU PONT) and CEDAR CHEMICAL CORPORATION (CEDAR) relative to perform chlorination of p-nitro toluene for DU PONT'S Chambers Works, Deepwater, NJ, plant. It is hereby mutually agreed to amend the aforesaid Agreement in the following manner effective June 1, 1990:

PERIOD OF AGREEMENT

(Extend the term of this Agreement from ending May 31, 1990 to ending December 31, 1991.)

CONTRACT ADMINISTRATOR

(Change contract administrator from K.F. Kamenski to Paul Smith.)

COMPENSATION

(Replace Exhibit "A" dated 5/12/89 in its entirety with Exhibit "A" dated 8/14/90 with the exception of the paragraph relative to a formula for adjusting processing fees. It is agreed to meet for the purpose of adjusting processing fees at least two (2) months prior to the expiration of this Agreement or extensions thereof.)

ALL OTHER TERMS and conditions of the current Agreement, except as modified in the above manner, shall continue in full force and effect.

Please indicate your acceptance of this amendment by signing both copies in the space provided below and return the copy marked "WILM. ML&S COPY" to R.A. Blackhall, E.I. du Pont de Nemours & Company, Materials, Logistics & Services, PO Box 80015, BMP-15-1284, Wilmington, Delaware 19898.

| CEDAR CHEMICAL CORPORATION | E.I. DU PONT DE NEMOURS & COMPANY |
|---|---|
| BY: Geoffrey L Pratt | BY: [signature] |
| TITLE: Director Custom Mfg | TITLE: Mgr - Contracting |
| DATE: 11/20/90 | DATE: 11/16/90 |

AB0000065596/1

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

August 14, 1990

AUG 21 1990

Mr. R. A. Blackhall
E. I. du Pont de Nemours & Co.
P. O. Box 80015, Barley Mill Plaza
Wilmington, DE 19898

Dear Bob:

As a follow up to our meeting of July 25, 1990, we are pleased to submit Cedar's proposal for the chlorination of PNT for the remainder of 1990:

1. A plant preparation and cleanup fee of $30,000 for each production campaign.

2. A processing fee per pound of CNT based upon a per diem processing fee of $10,000 divided by the productivity target of 21,277 pounds per day.

3. The above pricing formulas would apply for all quantities down to a minimum of two cars of PNT (approximately 250,000 pounds).

4. Stand by compensation of $9,000 per day for interruptions in Cedar's production due to items under du Pont's control such as the PNT supply. Du Pont would continue to have the option of declaring the campaign complete in which case the per diem would cease and the campaign would terminate.

5. Cedar will provide chlorine, if requested by du Pont for a price of 1.2 cents per pound of CNT during 1990.

You were to provide a formula for adjusting the above processing fees for inflation which would be triggered in 1991.

Cedar will provide du Pont with copies of Certificates of Analysis on each lot of CNT in a product rail car, such copies to be faxed to them at the time the car is shipped to the attention of Paul Smith at 609-540-3177 with a second copy to 609-540-4498.

Cedar will continue to fax the records of car weights and receiving reports as they have in the past.

Bob. I hope that this covers accurately the issues that we discussed and that we can develop a multi-year contract. Please let me know, if there is additional information that I can provide.

Sincerely,

Geoffrey L. Pratt
Director Operations
Custom Manufacturing

mc

cc: Paul H. Smith
Elaine A. Donald

EM-6670-C7 REV. 11/87

DUPONT

# E. I. DU PONT DE NEMOURS & CO., (INC.)

Materials and Logistics Department
Wilmington, Delaware 19898

LMD-956834-Y | 1
PURCHASE ORDER NO. | ALT. NO.

SITE NO. | TAX CODE | DIRECT ALL PRODUCERS

10/15/90
DATE OF ORDER

ISSUED BY: R.A. Blackhall

RELEASE NUMBER

PAGE . OF

Net 30
TERMS OF PAYMENT

REQUIRED SHIP DATE | PROMISED SHIP DATE

F.O.B. ☐ DEST. (DEL'D) ☐ SHIP PT

FREIGHT TERMS (If Ship Pt. Show City & State)

☐ PREPAID ☐ PREPAID ADDED ☐ OTHER (SEE BELOW) ☐ COLLECT

FREIGHT TERMS

• IF COLLECT, Mail Freight Bill To:

VENDOR CODE

PAYEE CODE

Cedar Chemical Corporation
5100 Poplar Avenue
24th Floor
Memphis, TN 38137
Attn: Mr. G.L. Pratt

E. I. DU PONT DE NEMOURS & COMPANY

Include P.O. No. as part of address

PLEASE ENTER OUR ORDER AS SPECIFIED BELOW SUBJECT TO CONDITIONS AND INSTRUCTIONS LISTED ON BOTH THE FACE AND REVERSE SIDE OF THIS PURCHASE ORDER.

IF PRICE, TERMS, REQUIRED SHIPPING DATE OR OTHER CONDITIONS AND INSTRUCTIONS ARE NOT ACCEPTABLE IMMEDIATELY ADVISE INDIVIDUAL INDICATED BY RED ARROW ABOVE

FURNISH COMPLETE SHIPPING INFORMATION AND INCLUDE 2 COPIES OF PACKING LIST WITH EACH SHIPMENT. SHOW PURCHASE ORDER NUMBER ON EACH PACKAGE, PACKING LIST, BILL OF LADING, INVOICE AND ALL CORRESPONDENCE.

.... MAIL YOUR INVOICE TO ADDRESS INDICATED BELOW:

☐ E.I. du Pont de Nemours & Co
Mis. Stores/Chambers Works
☐ Deepwater, NJ 08023
Attn: A/P Section

DO NOT INSURE U.P.S. OR PARCEL POST. DO NOT DECLARE AIR EXPRESS AND AIR FREIGHT IN EXCESS OF $5000. IF LOWER CHARGES RESULT, DUPONT DECLARED VALUE SHALL NOT EXCEED LOWEST AMOUNT IN APPLICABLE TARIFF

SHIP VIA:

| ITEM | QUANTITY | DESCRIPTION (NOUN, ADJECTIVE, MANUF. NAME & NO.) | PRICE |
|---|---|---|---|

## ALTERATION #1

RECEIVED
DEC 4 1990
Ans'd.....

Alteration #1 issued to PO #LMD-956834-Y for chlorination of p-nitro toluene to change the following:

PERIOD OF AGREEMENT: From - 6/1/89 thru 5/31/90
To - 6/1/89 thru 12/31/91

CONTRACT ADMINISTRATOR: Change from K.F. Kamenski to Paul Smith (609) 299-5000 X 3593.

Compensation: Replace Exhibit "A" dated 5/12/89 with Exhibit "A" dated 8/14/90, attached hereto and made a part hereof.

NOT ATTACHED

DO NOT WRITE BEYOND THIS LINE

NO OTHER CHANGES.

BY. DATE

AB0000065594/1

N. Robbins

EM-6670-C7 REV. 11/87

DUPONT

# E. I. DU PONT DE NEMOURS & CO., (INC.)

Materials and Logistics Department
Wilmington, Delaware 19898

LMD-956834-Y | 1
PURCHASE ORDER NO. | ALT. NO.

SITE NO. | TAX CODE | DIRECT ALL INQUIRIES

10/15/90
DATE OF ORDER

ISSUED BY: R.A. Blackhall

RELEASE NUMBER

PAGE OF

Net 30
TERMS OF PAYMENT

REQUIRED SHIP DATE | PROMISED SHIP DATE

F.O.B. ☐ DEST. (DEL'D) ☐ SHIP PT

PREPAID | PREPAID ADDED | OTHER (SEE BELOW) | COLLECT*

FREIGHT TERMS (If Ship Pt. Show City & State) FREIGHT TERMS

* IF COLLECT, Mail Freight Bill To:

VENDOR CODE

PAYEE CODE

Cedar Chemical Corporation
5100 Poplar Avenue
24th Floor
Memphis, TN 38137
Attn: Mr. G.L. Pratt

E. I. DU PONT DE NEMOURS & COMPANY

Include P.O. No. as part of address

PLEASE ENTER OUR ORDER AS SPECIFIED BELOW SUBJECT TO CONDITIONS AND INSTRUCTIONS LISTED ON BOTH THE FACE AND REVERSE SIDE OF THIS PURCHASE ORDER.

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☐ E.I. du Pont de Nemours & Co.
☐ Mis. Stores/Chambers Works
Deepwater, NJ 08023
Attn: A/P Section

DO NOT INSURE U.P.S. OR PARCEL POST DO NOT DECLARE AIR EXPRESS AND AIR FREIGHT IN EXCESS OF $50.00. IF LOWER CHARGES RESULT TO DUPONT, DECLARED VALUE SHALL NOT EXCEED LOWEST AMOUNT IN APPLICABLE TARIFF

SHIP VIA:

| ITEM | QUANTITY | DESCRIPTION (NOUN, ADJECTIVE, MANUF. NAME & NO.) | PRICE |
|---|---|---|---|

## ALTERATION #1

RECEIVED
DEC 4 1990
Ans'd.....

Alteration #1 issued to PO #LMD-956834-Y for chlorination of p-nitro toluene to change the following:

PERIOD OF AGREEMENT: From - 6/1/89 thru 5/31/90
To - 6/1/89 thru 12/31/91

CONTRACT ADMINISTRATOR: Change from K.F. Kamenski to Paul Smith (609) 299-5000 X 3593.

Compensation: Replace Exhibit "A" dated 5/12/89 with Exhibit "A" dated 8/14/90, attached hereto and made a part hereof.

NO OTHER CHANGES.

DO NOT WRITE BEYOND THIS LINE

CONFIRMING TO: BY: DATE:

Lavvate

# A G R E E M E N T

As an inducement to E. I. *DU PONT DE* NEMOURS & COMPANY (DU PONT) to enter into an Agreement, dated May _____, 1975, (AGREEMENT) with EAGLE RIVER CHEMICAL CORPORATION (EAGLE RIVER) for the processing of certain chemicals into PRODUCT 10 insecticide and for other good and valuable consideration, the receipt of which is hereby acknowledged, VERTAC, INCORPORATED (VERTAC), of Billings, Montana, the parent company of EAGLE RIVER:

(1) guarantees the performance of all obligations of EAGLE RIVER under the terms of said AGREEMENT,

(2) agrees to pay to DU PONT on demand all losses, damages, expenses, court costs and attorneys' fees which may be suffered by DU PONT as a result of any default or failure of EAGLE RIVER to perform, promptly and completely when due, any and all of its covenants and obligations of every nature and kind whatsoever under the said AGREEMENT,

(3) agrees to indemnify and hold harmless DU PONT for any loss suffered by DU PONT due to the failure of EAGLE RIVER to pay in accordance with the terms of said AGREEMENT any judgment or liability of any nature whatsoever arising

out of or in connection with operations of EAGLE RIVER under said AGREEMENT, and

(4) agrees to reimburse DU PONT for or indemnify and hold harmless DU PONT from any amortization payment as provided in Article 3, COMPENSATION, of said AGREEMENT that DU PONT is required to pay after an event of default by EAGLE RIVER and subsequent termination by DU PONT as provided in Article 6, DEFAULT, of said AGREEMENT, provided that DU PONT notifies VERTAC of such default at the same time as its notification to EAGLE RIVER as provided in Article 6 of said AGREEMENT.

VERTAC, INC.

By: _____

ATTEST:

_____

It is understood that EAGLE RIVER will stand ready to operate the facilities 330 days per year with 35 days downtime for plant maintenance and repair. However, if EAGLE RIVER's facilities are unavailable for Product 10 production for less than 330 days per year for any cause not directly attributable to DU PONT, then DU PONT will not pay EAGLE RIVER any charges for any days less than 330 days per year that EAGLE RIVER is unable to produce Product 10.

It is anticipated but not guaranteed that DU PONT will require EAGLE RIVER's services to manufacture Product 10 under this Agreement for a period of approximately 24 to 36 months. During the term of this Agreement, EAGLE RIVER agrees to manufacture other products for DU PONT for a mutually agreed upon compensation or maintain the facility on a stand-by basis until such time as DU PONT notifies EAGLE RIVER in writing that no further manufacturing will be required. DU PONT will continue to make amortization payments as defined herein until all such payments have been made or the Agreement is terminated as provided in Article 5. TERM OF AGREEMENT.

B. Amortization Payments - DU PONT agrees to amortize a portion of the cost of EAGLE RIVER's facility as defined in Exhibit "E", as amended, attached hereto and made a part hereof, including the cost of associated equipment and the installation thereof. The amounts to be amortized shall be:

1. $1,250,000 - DU PONT will amortize said sum over a period of five (5) years, payable in sixty (60) successive monthly installments with first payment made September 1975. Monthly payments shall be equal to an amount sufficient to amortize a note of $1,250,000 bearing interest at a rate equal to the prime interest rate charged by the First National Bank of Phillips County, Helena, Arkansas, or ten (10) percent per annum, whichever is lower. Each installment shall be one-sixtieth (1/60) of $1,250,000 plus applicable interest on the unamortized balance. DU PONT will have the option to pay the unamortized balance at any time without charge for accelerating payments. DU PONT acknowledges and has agreed to EAGLE RIVER assigning its rights to said amortization payments as security for a loan to finance the construction herein covered.

# PROMISSORY NOTE

$ 1,250,000.00

Helena, Arkansas

Sept. 3 19 75

FOR VALUE RECEIVED, the undersigned, or either of us, promise to pay to FIRST NATIONAL BANK OF PHILLIPS COUNTY, Helena, Arkansas or order, the principal sum of One Million Two Hundred Fifty Thousand and no/100 ——— Dollars ($ 1,250,000.00 ), with interest from date on said sum or unpaid balance thereof at the rate of Ten percent ( 10 %) per annum, payable monthly, said principal and interest being payable on an amortization plan of Sixty ( 60 ) monthly installments of Twenty-six Thousand Five Hundred Sixty-two and 00/100 Dollars ($ 26,562.00 ) each, the first being payable on the 15th day of October ,1975 , and one installment being payable on the 15th day of each and every successive month thereafter for Fifty-nine ( 59 ) months. The makers hereof shall have the privilege of prepayment of said Note by paying only the unpaid principal and accrued interest to the Date of such prepayment. The said principal and interest shall be payable at the First National Bank of Phillips County, 502 Cherry Street, Helena, Arkansas or at such other place as the holder hereof may designate in writing.

If default be made in the payment of any installment under this note, and if the default is not made good prior to the due date of the next such installment, the entire principal sum and accrued interest shall at once become due and payable without notice at the option of the holder of this note. Failure to exercise this option shall not constitute a waiver of the right to exercise the same in the event of any subsequent default.

Presentment, protest and notice are hereby waived, and the makers agree to all extensions and partial payments, before or after maturity, without prejudice to the holder.

The makers, signers, endorsers hereof agree that in case payment of this note shall not be made at maturity, and the same is placed in the hands of any attorney for collection, they will pay the costs of collecting this note, including an attorney's fee of ten percent (10%) of principal and interest remaining unpaid.

EAGLE RIVER CHEMICAL CORPORATION

BY: _____
President

BY: _____
Secretary

Collateral: Real Estate Deed of Trust of even date herewith, Assignment, and Security Agreement

_____
Jerry Williams personally

MANUFACTURING COST/PRODUCT 10 Revised 6-29
1,200,000 GALS/YEAR CAPACITY @ 330 DAYS/YEAR OPERATION R.A

| | MAX. USAGE PER GALLON | MAXIMUM COST VARIABLE COST/GALLON | MAXIMUM COST FIXED PER MONTH | STAND-BY COST/MONTH |
|---|---|---|---|---|
| **Raw Material Usage** | | | | |
| Slurry (as 100% MTAAO) | 1.33 | -- | -- | |
| Methyl Isocyanate | 0.75 | -- | -- | |
| Methanol | 5.25 | -- | -- | |
| Methylene $Cl_2$ | 0.70 (1) | ~~0.1313~~ (3) | -- | |
| **Utilities** | | | | |
| Electricity | | $0.05 | $1,500 | |
| Steam | | 0.023 | 740 | |
| Water | | 0.0022 | 100 | |
| Nitrogen | | 0.019 | 450 | |
| Natural Gas | | -- | 700 | |
| Sub Total | | $0.0942 ✓ | $3,490 | $450 |
| **Operating Labor** | | | | |
| Operating | | -- | $ 9,800 | |
| Packaging | | $0.08 | 4,800 | |
| Sub Total | | $0.08 ✓ | $14,600 | $2,433 (2) |
| **Maintenance** | | | | |
| Repair Labor | | -- | $ 4,500 | |
| Maintenance Materials | | -- | 4,500 | |
| Maintenance Overhead | | -- | 2,000 | |
| Sub Total | | -- | $11,000 | $2,000 |
| **Miscellaneous Operating Expenses** | | | | |
| Supervision & Clerical | | -- | $3,000 | $2,000 |
| Operating Materials | | $0.0055 | 1,000 | |
| Laboratory | | -- | 5,000 | 1,750 |
| Shipping & Handling | | -- | 400 | |
| Sub Total | | $0.0055 ✓ | $9,400 | $3,750 |
| **Administrative Overhead** | | | | |
| Sub Total | | -- | $6,800 | $4,000 |
| **Waste Disposal** | | | | |
| Sub Total | | $0.28 ✓ | -- | -- |
| TOTAL | | 0.5710 ~~$0.4597~~ | $45,290 | $12,633 |

1) 1.10 - Month of April
0.90 - Month of May
0.70 - Month of June (will remain at this level provided significant additional investment is not required)

2) One time charge for stand-by

(3) Based on $0.1875/lbs purchase price

Phone: (501) 572-3701

P. O. Box 2648

# Eagle River Chemical Corp.

Highway 242

WEST HELENA, ARKANSAS 72390

## VARIABLE COST

| MONTH | TOTAL GALLONS BILLED | VARIABLE COST BILLED | VARIABLE COST SHOULD BE BILLED | DIFFERENCE | TOTAL |
|---|---|---|---|---|---|
| APRIL | 33325 | (.2526) | .5910 | .33 | 10,997.25 |
| MAY | 81521 | (.2526) | .5910 | .33 | 26,901.93 |
| JUNE | 50976 | (.2526) | .5910 | .33 | 16,822.08* |
| | 165822 | (.2526) | .5910 | .33 | 54,721.26 |

## FIXED COST

| MONTH | FIXED COST BILLED | FIXED COST SHOULD BE BILLED | DIFFERENCE | |
|---|---|---|---|---|
| APRIL | (46,283.15) | 45,290.00 | (993.15) | |
| MAY | (46,282.60) | 45,290.00 | (992.60) | |
| JUNE | (23,141.30) | 22,645.00 | (496.30) | *(2,482.05) |

ADDITIONAL BILLING 52,239.21

* JUNE COST BASED ON MID-MONTH BILLING. JUNE END OF MONTH BILLING WILL BE BASED ON NEW EXHIBIT C .

Phone: (501) 572-3701

P. O. Box 2648

# Eagle River Chemical Corp.

Highway 242

WEST HELENA, ARKANSAS 72390

June 29, 1976

MR. M.E. STEVENS
PRODUCTION SUPERINTENDENT
E.I. DU PONT
P.O. BOX 347
LA PORTE, TEXAS 77571

REFERENCE: A.G. ROHRER LETTER OF 6/23/76,
LIQUID CHROMATOGRAPH IMPROVEMENTS

Eagle River agrees with Du Pont's proposal to pay half the cost of modifying one LC. We will purchase the necessary equipment and then bill Du Pont for 50% of the total installed cost (Estimated total cost - $4M). Please send your purchase order to cover your portion to Mike McKellar at Eagle River.

Thank you

John H. Miles

JHM:rvk

cc: J.W. Shackelford
Larry Conaway
Mike McKellar
Bob Fabian
H. E. Burman du Pont, Wilmington
A. G. Rohrer du Pont, La Porte

VERTAC CONSOLIDATED
A MEMBER OF THE VERTAC GROUP

SUITE 2414 • 1 [illegible] POPLAR
MEMPHIS, TN 38137

INTER-OFFICE CORRESPONDENCE

DATE: JUNE 28, 1976

TO: BILL SHACKELFORD

FROM: BOB FABIAN

SUBJECT: PRODUCT 10 COSTS & TECHNICAL PROGRAM

REPLY REQUESTED BY (DATE)

This memo is to firm up a program for getting Product 10 cost situation in better shape and re-opening Exhibit C effective July 1.

(1) Dee Baugh will be visiting with Mike McKellar on June 30 to review the cost accounting program at Eagle River. I don't plan to be at the plant but Dan Palmer may want to sit in on this review. Dee will be looking to see how we have implemented the program we discussed with DuPont on April 1 and what some of the key manufacturing cost elements have been during the second quarter.

(2) I have asked John Miles to develop an Exhibit C-2 which we will propose to become effective on July 1. We should be prepared to defend all cost elements which we know DuPont will consider to be too high, e.g. maintenance, packaging, overheads, etc. Also, raw material usages may have to be adjusted again, specifically $MeCl_2$ if we feel we can't meet the 0.7 lbs./lbs. product. It would be desirable to have this revised exhibit by July 2.

(3) Frank Maderich, Hank Burman and several LaPorte people want to visit Eagle River on July 8 to review all cost areas and specifically waste treatment, maintenance, and raw material usages. I agreed tentatively to this date and told Frank that I would be there, and possibly also Ray. At this meeting, we should present an Exhibit C-2 for the 3rd quarter and decide what basis will be used for the so-called "maximum" limits.

We will have an approved, revised Exhibit C-1 for the 2nd quarter by June 29. Hopefully, our "end-of-June" invoice can be on a current basis and we can collect the outstanding monies for the 2nd quarter.

BOB FABIAN

/et
CC: Ray Guidi
Dan Palmer
John Miles
Mike McKellar

c97 D
J. Miller
Mike McK.

TO: Bill Shackleford
Bob Fabian

FROM: John O'Neill

SUBJECT: DuPont Lannate Contract

DATE: July 14, 1976

---

The July 8th meeting on subject with DuPont representatives suggests that more diligent contract administration is imperative, on our part, if we are to maximize the profits resulting from this operation.

On the assumption that the undated, unsigned copy of the agreement in my possession conforms with the actual agreement, I have a number of questions for which I would like to have answers so that I may better understand our current position with DuPont and plan for further negotiations.

First, my impression is that the contract is very simple and clear and that there should be no reason for us not to make the anticipated profit if we manufacture in a competent fashion, maintain proper cost records and conform to the contract provisions for obtaining full and proper cost reimbursements. From the referenced meeting I am not convinced we are meeting these criteria.

It is apparent that many people were involved in the contract negotiations and implementation other than those now responsible for performance. I think it would be helpful, therefore, if we trace the history of contract administration to pinpoint any past omissions that must be corrected in order to properly recover our costs now and in the future. I also recommend a very vigorous, self-examination of our manufacturing operation to be assured that we are not asking DuPont to cover costs for a less than properly efficient operation and that we end up with convincing documentation of costs, if we truly have a right to claim them.

With respect to contract administration I have a number of questions. If we were remiss in claiming increased costs following the initial 90 days of operation or on the permitted quarterly or annual schedule, in the manner set forth in the contract, please so indicate. If we did conform please supply me with copies of the documents provided DuPont.

My questions follow:

1. Clause 1, page 3. What was the official "start-up date"?

2. Clause 1, page 3. Was DuPont advised 90 days after the "start-up date" of the actual capacity of the facility - if so what is the figure?

3. Clause 2, page 3 - 4. Does DuPont furnish Eagle River with quarterly production forecasts?

4. Clause 3, page 4. Provides for Eagle River to adjust costs each calendar quarter effective January, April, July and October on 30 days' prior written notice for costs other than Item 6, miscellaneous operating cost, and Item 7, administrative overhead. Has Eagle River sought cost increases as provided? If so, supply me with a copy of same.

5. Clause 3, page 4. Provides for automatic adjustments in Items 6 and 7 annually, effective January 1 up to a maximum established by mutual agreement within 30 days following the first 90 days of operation. Was an agreement reached on costs allowed for these items as provided? What are they? How has Eagle River attempted to get increases in Items 6 and 7, if not as provided above?

6. Clause 3, page 5. Provides for re-establishing stand-by charges within 30 days following the first 90 days of operation and "Exhibit C" is footnoted to permit re-establishing maximum consumptions and maximum cost on the same basis. Was this done? If so, what are the agreed to figures?

7. Clause 14. Provides that DuPont will be reimbursed if requested in writing, for any raw material consumption in any one quarter in excess of the maximums provided in "Exhibit C". Has DuPont at any time requested in writing that it be reimbursed as provided for in this clause? Would they have a basis for a claim?

8. Exhibit F. Provides that Vertac (Eagle River), will maintain confidential all Technical Information, designated in writing by DuPont to be confidential, for ten years. Does Eagle River maintain a properly secured file of said disclosures? Does Eagle River have Secrecy Agreements with its management and technical personnel providing that they conform with Exhibit F? Was any technical disclosure made to OSHA representatives that could be construed by DuPont to be in violation of this agreement?

9. Clause 13. Requires Eagle River to comply with all applicable laws, etc., at the risk of DuPont terminating the agreement. Has the transfer of waste to PCI created a real or potential liability in this respect?

10. Clause 12. Provides that Eagle River recognize that hazards may be involved in performing the contract and it holds DuPont harmless for any act or omission by Eagle River. At the July 8th meeting DuPont indicated it would ask that the "package" supplied by them be made a part of the contract. In view of the contractural responsibility taken by Eagle River I would be surprised if they take this action. If they do propose amending the contract on this point, do you believe it to be to our advantage to accept? In the meantime please provide me with this "package" as requested at the meeting.

11. From Bob Fabian's letter and the penciled proposed "Exhibit C 2" provided by Eagle River at the July 8th meeting I must assume that many of the provisions for cost adjustment referred to above were not sought in compliance with the contract terms. If this is true it would probably be advisable to openly seek an amendment to the agreement to put it on a manageable basis, for the remainder of the contract period. This would include a new basis, if necessary for, all costs provided for in Clause 3 and require agreement on a new "Exhibit C".

My suggestion is that Bob Fabian and I visit Eagle River the week of July 19th for a detailed examination of all permitted costs and that we prepare for contract renegotiation.

Prior to the meeting I would appreciate receiving your comments on my questions. I believe these answers are essential in order to map out a plan of action for dealing with DuPont and to have a strong and knowledgeable negotiating position.

Eagle River should prepare a new recommended "Exhibit C" with sufficient support data to provide the negotiators with proper ammunition to get DuPont's agreement. The arguments in Bob's letter and those made at the July 8th meeting are not persuasive. The agenda for the meeting should include the following:

I. Basic capacity rating for contract cost determination.

II. Maximum raw material usage per gallon.

(Any proposal to up this base must be supported by documented, usage figures and sound technical reasoning. In the case of Methylene Chloride the plant must show that it is concerned that the usage far exceeds original limits. It must identify all potential loss areas and have plans of action to curb the loss. If a reasonable search is launched to find and eliminate the outflow we can undoubtedly get an interim agreement that we can live with. Note Carefully, DuPont can bill us for usage now exceeding the agreed maximum usage.)

III. Utility costs

Proposals to up the maximum variable and fixed costs should be documented item by item. Plausible technical explanations are needed. Why are some of the changes asked for? For example - Was the DuPont technology misleading? Were miscalculations involved in the original estimates? Is there waste? Is the consumption measured and real or an estimate or allocation?

IV. Operating costs

I.E. work is necessary to support packaging costs.

V. Maintenance

DuPont claims costs are excessive. In reality the fixed cost per gallon has less variance from the original agreement than many of the other cost items. Never the less this cost should be supported. Are we continuously repairing something that should be redesigned and replaced. At our meeting we should go thru the maintenance log for the past 90 days to gain assurance that the maintenance is real and needed and is being performed in a competent manner.

VI. Miscellaneous operating expense

Eagle River is asking for very substantial cost allowances over the original contract allowance and, for instance, in the case of supervision and clerical a doubling of the allowance negotiated only 3 months ago. The same type of questions must be answered here as asked in the case of utility costs. Why the difference? Why necessary? Is it measured and real? What do you give up if you take it back to the earlier allowances?

Please understand that my questions and challenge of costs and procedures are made solely for the purpose of developing the strongest negotiating position possible. DuPont can be dealt with and we will get everything we should. We must know that we have a sound and reasonable basis for each request. If we approach the table in a professional manner with answers in hand for all reasonable questions we will get everything that we should. If we do not, they have every right to hold us to the original agreement since this is the basis on which they chose to contract with us and we have not sought remedies as provided for in the agreement.

J. O'Neill

John O'Neill
Vice President of Planning & Development

JO/cm

cc: A. Malone
D. Palmer

# PRODUCT 10

# OPERATING MANUAL

# VERTAC INC. EAGLE RIVER PLANT

Scott M. Parker
June, 1975

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PRODUCT 10 - OPERATING MANUAL

SECTION 1.0 SUMMARY

1.1 Product 10 is to be manufactured in VERTAC'S Eagle River facility for Dupont using the latter's process. Plant design and construction is by VERTAC with Dupont's advice and recommendation. All raw materials with the exception of the solvent, methylene chloride, are to be furnished by Dupont. Likewise, all packaging materials are to be furnished by Dupont. Design capacity of the plant is 1,000,000 gallons of formulation per year operating on a 24 hour 7 day week base . The process is batch type with one basic chemical reaction and several physical operations. Pressure and temperatures are moderate but the process involves personnel & equipment hazards due to the corrosiveness and flamability of the reactants and the severe toxicity of the final product. A brief description of the process follows. Detailed operating procedures are covered in sections 2.0 and 3.0.

1.2 Crude MTAAO as a 11-13% slurry in KCL brine will be received from Dupont in tank cars and/or tank trucks. The slurry will be stored in an agitated tank so as to maintain uniformity in the feed to R-101 reactor. The crude slurry is charged to the reactor batchwise, with measurement by load cells under R-101. The slurry is then concentrated by boiling off about 20 weight percent of the charge. The boil off is done under vacuum to limit temperature rise to 130°-140°F (55-60°C). The distillate,consisting mainly of water plus some malodorous organics,is collected for disposal (by others).



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1.3 Following distillation, vacuum is broken and the concentrate cooled to about 85°-90°F (30-32°C). Three extractions are then carried out batchwise in R-101 using methylene chloride as solvent. In each case, the sequence is to add a measured weight of solvent, agitate, and settle. Methylene chloride is then drawn off as the bottom phase from R-101 by means of sight glasses in the outlet piping. A conductivity probe is also provided to aid in detecting the phase interface. The extract from the first extraction is sent to R-102 for further processing. The second and third extracts are combined in a receiver and used for the first extraction in the succeeding batch. Following the third extraction, the raffinate is discarded to the waste system.

1.4 The extract in R-102 is analysed for MTAAO content and from this, the required weight of reactant #1 is calculated. The extract is then concentrated to 20-25% MTAAO by boiling off excess solvent. The solvent is condensed and collected for recycle to the succeeding batch. Following concentration, reactant #1 is slowly added to R-102 with agitation and with the reflux condenser in operation to maintain temperature about 115°F (46°C). The reactor is agitated and refluxed for an additional time period following completion of reactant #1 addition and then checked for unreacted MTAAO. If some is present, additional reactant #1 is added and the procedure repeated until the reaction is complete. Following this, the solvent is boiled off first atmospherically and then under vacuum so as to maintain temperature in the range 112-122°F (45-50°C). The hot methonyl melt is then transferred to the formulation tank, using a formulating agent flush to keep the transfer line clean.

1.5 The formulation tank is equipped with an agitator, a pump around cooler and a gauge glass. Following transfer from R-102, sufficient formulating agent is added to T-109 to maintain fluidity so that the solution can be circulated through the cooler. After cooling to 85-95°F (30-35°C) the solution is sampled and analyzed. Following this, additional formulating agent is added using the sight glass to bring the formulation to the correct concentration. Then coloring agent and filter aid are added and the formulation transferred through polishing filter F-101 to the packaging and hold tank, T-110. Finished formulation is pumped from here to a Crandall filling machine located in the packaging building. Here, the product is loaded semi-automatically into 1 and 5 gallon plastic containers.



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## SECTION 2.0 GENERAL OPERATING PROCEDURES

### 2.1 SLURRY TRANSFER

2.1.1. Take slurry sample from P-105 circulating loop and have run for % MTAAO.

2.111 If MTAAO betwen 10.5 - 12.5% , proceed as 2.1.2

2.112 If MTAAO out of above range, make batch size adjustment as per calculations in appendix.

2.1.2. Line up slurry piping from T-105 to R-101 and start transfer of slurry to R-101. Be sure agitator is running, vessel outlet is closed and vent to flare is open. Also, zero weight indicator W/ R-101.

2.1.3. Transfer 16385 ± 10 lbs. of slurry to R-101. Note weight transferred on log.

2.1.4. When transfer is complete stop flow with board mounted valve FCV-101A.

2.1.5. With pump P-105 stopped, water flush slurry transfer line for 1-2 minutes. Flush both to R-101 and also, the recirulation loop back to T-105.

2.1.6. After flushing, record final R-101 weight in log and return P-105 to recirculation.



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2.2 SLURRY CONCENTRATION

2.2.1 Close R-101 vent to flare and line up flow thru H-101 and H-103. Commission cooling water to these units,

2.2.2 Line up flows from H-101 to T-114 and from H-103 to R-103 also, be sure vents are open on T-114 and R-103.

2.2.3 Commission steam to J-101 jet ejectors and start pulling vacuum on R-101.

2.2.4 As soon as jets start to pull as shown on pressure recorder PR - R101, line up steam to and condensate from R-101 jacket.

2.2.5 Start steam flow to R-101 using board mounted controller TIC- R101.

2.2.6 Continue evacuating and heating R-101. Operation should steady out at about 90-100 MM Hg pressure and 120-130°F temperature. Do not allow temperature to exceed 140°F or decomposition will take place.

2.2.7 Boil off about 20% by weight of the original R-101 contents. Check T-114 and R-103 occasionally to see that the distillate is free from entrained MTAAO. If latter shows up in distillate, reduce steam rate immediately .

2.2.8 When boil off is complete, valve off steam to R-101 jacket and to jets J-101 and allow vacuum to break. Record final weight of R-101 in log.

2.2.9 After vacuum has broken, vent R-101 to flare and start recirculating using pump P-101. Also start cooling water to R-101 jacket .

2.3.0 Take sample from connection on recirulation loop and have



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run for KCL/water ratio.

2.3.1 If ratio does not ex eed 1:4 proceed.

2.3.2 If ratio exceeds 1:4 calculate dilution water required as per appendix.

2.3.3 Add dilution water, allow mix to agitate and recirculate for 15 minutes and recheck KCL/$H_2O$ ratio before proceeding. Add additional water if necessary to get ratio to 1:4 or less.



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2.4.0 SOLVENT EXTRACTION

2.4.1 After KCL water adjustment is made, continue cooling R-101 with agitation and recirculation until temperature is 86-92°F (30-33°C).

2.4.2 Line up extract circuit from T-104 thru P-104 to R-101.

2.4.3 With R-101 agitator on and P-101 recirculating, transfer extract from T-104 to R-101 by starting P-104 and opening board operated valve FCV- R101C.

2.4.4 Continue transfer until 13100 ± 10 lbs. of extract have been pumped to R-101.

2.4.5 If there is insufficient extract in R-101, stop pump P-104 and close FCV-R-101C.

2.4.6 Then line up fresh solvent circuit from tank car to R-101. Be sure nitrogen pad is connected to tank car.

2.4.7 Start fresh solvent flow to R-101 by opening board mounted valve FCV-101 B.

2.4.8 Admit sufficient fresh solvent to bring total extract weight to 13,100 ± 10 lbs. Stop fresh solvent flow via FCV-R-101B, then close off block valves on circuit from tank car. Record weights of fresh solvent and extract in log book.

2.4.9 Allow R-101 to agitate and recirculate for 20 minutes after solvent addition.

2.5.0 Then stop agitator and P-101 pump;allow phases to settle for 20 minutes meantime line up circuit for transfer from R-101 to R-102.

2.5.1 With P-101 on recirculation circuit and with discharge



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valve pinched down, start P-101 and slowly draw R-101 down until sight glass on P-101 discharge shows clear organic phase.

2.5.2 Then switch valves on P-101 discharge from recirculation to transfer to R-102.

2.5.3 Put P-101 switch in AUTO position and continue transfer of organic phase to R-102. Observe flow through sight glasses on pump suction and discharge. Sample flow to R-102 thru connection on P-101 discharge.(See 2./.2)

2.5.4 When aqueous phase reaches R-101 outlet, it should be sensed by the conductivity probe LC1-R101. This in turn will activate the PANALARM and with P-101 in the AUTO control mode will stop the pump. If P-101 switch is in MANUAL position, the alarm will sound but the pump will be unaffected.

2.5.5 The sensing probe is a back up rather than a primary control and thus the operator will have to spend full time at the unit during the decanting steps to insure good phase separation.

2.5.6 As soon as aqueous phase appears in each sight glass, the valves on P-101 are reset from transfer to recirculation.

2.5.7 Total ORGANIC TRANSFERRED to R-102 should be noted on both R-101 and R-102 logs, using the respective weighing systems. (It is important from accountability standpoint to record both weight transferred from R-101 and the weight received by R-102.)

2.5.8 Line up flow of recycle solvent from T-108 thru P-108 to R-101.



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2.5.9 With R-101 on recirculation and agitator running, transfer 6550 ± 10 lbs of solvent from T-108 to R-101.

2.6.0 Repeat steps 2.4.9 thru 2.5.6 except that transfer from R-101 is made to T-104 instead of to R-102.

2.6.1 Repeat 2.5.9 - 2.6.0 with an additional 6550 ± 10 lbs. of recycle solvent. If there is insufficient recycle solvent in T-108 make up to 6550 lbs, use fresh solvent from tank car. Note total weights transferred in log.

2.6.2 In making final phase separation following third extraction, make break so as to carry some aqueous phase to T-104 rather than leave organic in R-101. This will limit solvent losses to wash and will not affect process since T-104 contents are recycled.

2.6.3 After all organic is transferred to T-104, note weight in R-101. Then set valves so as to pump all remaining aqueous phase (raffinate)in R-101 to waste pond.

2.6.4 At this point, the batch has been transferred to R-102, the enriched extract is in T-104 and R-101 is ready for the next cycle.



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2.7.0 MTAAO CONCENTRATION

2.7.1 After completing transfer of the batch from R-101 to R-102 close off R-102 vents and start agitator.

2.7.2 The sample collected during transfer should be analyzed for % solids and methomyl to MTAAO ratio. From these data, plus the batch weight shown on WI-R-102, the correct MENCO charge is calculated. See appendix for calculation method . Record calculated weight on log.

2.7.3 Meanwhile, while awaiting batch analysis, line up vapor circuit from R-102 thru H-102 and H-104 to vent flare. Commission cooling water to H-102 and brine to H-104. Set H-102 outlet valves so that all condensate goes to T-108.

2.7.4 Admit steam to R-102 jacket by means of board mounted controller TIC-R-102. Boil off 5000 - 6000 lbs. of solvent from R-102 to T-108. Regulate steam flow through TIC-R-102 and do not let R-102 temperature exceed 122°F (50°) during boil off.

2.7.5 When concentation is completed, either through boil off of 6000 lbs or batch temperature reaching 122°F decommission steam to R-102 jacket and start cooling water.

2.7.6 Close off vapor flow to H-104, and reset valves on H-102 liquid outlet so condensate returns to R-102.



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2.8.0 MIC ADDITION

2.8.1 Add about 5 lbs of 50% NaOH to R-102 through the drop funnel connection.

2.8.2 Check sight glass level in T-113 tank and be sure there is sufficient MIC to make up batch. T-113 should have vent closed and a nitrogen pad of 5-15 psig.

2.8.3 Start MIC addition to R-102 by means of board mounted valve FCV-R-102 . This valve is interlocked so that it will not open unless R-102 agitator is also running.

2.8.4 Maintain cooling water to R-102 jacket and monitor MIC addition through weight shown on Wi-R-102. Pinch on throttle valve in MIC line so as to spread MIC addition over about 60 minute period.

2.8.5 Maintain R-102 temperature 112-118°F (44-48°C) range during MIC addition by means of MIC addition rate plus reflux and jacket cooling.

2.8.6 When the calculated amount of MIC has been added stop flow with FCV- R102. Continue refluxing and agitation for additional 60 minutes.

2.8.7 Sample R-102 through connection on bottom outlet and have run for unreacted MTAAO.

2.8.7.1 If none present, reaction is complete and batch is ready for solvent exchange step.

2.8.7.2 If unreacted MTAAO is present; additional MIC must be added in accordance with calculations. Allow 20 minutes reflux and agitation time following each MIC "shot"; then re-check for MTAAO. Repeat procedure until test shows no unreacted MTAAO.



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## 2.9.0 SOLVENT EXCHANGE

2.9.1 Reset valving to permit vapor flow through H-102 and H-104 in series with venting to flare. Condensate from both H-102 and H-104 will be collected in T-108, as per the previous distillation.

2.9.2 Switch from cooling water to steam on R-102 jacket and commence solvent boil off. Continue boiling off atmospherically until R-102 temperature reaches 122-127°E (50-53°C).

2.9.3 Water is then added via hose through the dropping funnel connection on R-102, sufficient for the final formulation. Normally, this will be in the range 855-865 lbs. Log amount added.

2.9.4 R-102 is then closed off, including the vent from H-104 to the flare. Line up vapor flow thru ejectors J-102 to H-105 and hence, to T-111. Make sure there is brine flow to H-104.

2.9.5 Commission ejectors and continue boil off until final conditions of 90-100 mm Hg pressure in R-102 and 113-122°F(45-50°C) temperature in H-104 condensate outlet are reached. At this point, the solvent boil off is complete and the batch ready for transfer to formulation.

2.9.6 Close off R-102 vapor line and break vacuum with nitrogen from 15 psig header. Decommission steam to R-102 jacket and to ejectors J-102. Close vent on T-108 and pad with low pressure nitrogen.

2.9.7 Line up circuit from R-102 bottom outlet to T-109. Be sure hot water tracing on transfer line is operating.



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2.9.8. Transfer methomyl melt from R-102 thru P-102 to T-109. Keep agitators in both vessels running during transfer.

2.9.9 When transfer is complete close valve in R-102 bottom and flush circuit for about 5 minutes using flushing connection just below R-102 outlet. Flush may also be used to break plugs during transfer but R-102 outlet valve must always be closed during flushing to prevent formulating agent from getting into R-102. Close down transfer circuit after flush and note weight transferred (Wi-R102 weight before and after) on log.

3.0.0 FORMULATION

3.1.0. Recircualte batch in T-109 through P-109 and H-106. Be sure cooling water is commissoned to latter. Cool batch to 85-90°F (30-35°C).

3.2.0. While batch is cooling, sample through connection on P-109 discharge and have run for % methomyl & specific gravity @ 85°F. From this data and the gauge reading on LG-109(at 85°F) the required volume of formulating agent can be calculated (see appendix). List data for formulation addition in log.

3.3.0. Add formulation agent to required level on LG-109 while agitating and recirculating batch. Sample and have rechecked for % methomyl and gravity after allowing 15-20 minutes mixing.

3.3.1. If methomyl concentration is within 24.0-25.0% proceed as per 3.4.

3.3.2 If concentration exceeds 25.0% add more formulating agent, mix and re-test.

3.3.3 If concentration is below 24.0 % calculate methomyl solid



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required (see appendix) and add through knife valve port. Allow to mix 30 minutes before re-testing.

3.3.4. When concentration and temperature are correct, valve off H-106 pipe loop and recirculate through filter F-101.

3.3.5 Weigh out following and add to T-109 through knife gate addition port:

Filter aid = 8.6 lbs.

Coloring agent = 3.2 lbs.

3.3.6. Recirculate through F-101 until samples taken from the connection downstream of F-101 are clear . Then sample to have complete batch analysis run. Record batch number & results.

3.3.7. If batch is on spec.,line up circuit to T-110 and transfer batch.

3.3.8. If batch is off spec., consult foreman.



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## SECTION 4.0 SPECIAL PROCEDURES

### 4.1 TRANSFER OF MIC(MENCO) FROM DRUMS TO T-113

4.1.1 MIC is very flammable and irritating and the operator must be thoroughly familiar with the safety hazards involved (see section 5.0) before handling it.

4.1.2 MIC is shipped in stainless steel 55 gallon returnable drums. The drums will be brought to the area, on fork lift and hoisted to the working platform via a drum hoist.

4.1.3 The protective equipment listed below will be worn by all operators assigned to MIC transfer starting at the drum hoist and continuing until the empty drums have been completely emptied and decontaminated.

4.1.3.1. Heavy duty rubber rain suit, including head gear

4.1.3.2. Fresh-air demand mask(Scott Air Pack or equal).

4.1.3.3 Chemically resistant rubber gloves and boots.

4.1.4. Before starting the drum transfer the MIC operator should check with the board operator and make sure that the transfer will not interfere with the batch cycle.

4.1.5. Next, determine how many MIC drums are needed to refill T-114 from the markings on the tank gauge glass . The range will be from 1 drum minimum to 6 maximum.

4.1.6. The required number of drums are then brought to the area and lifted to the work platform using drum hoist M-101.

4.1.7. The first drum is then placed on the drum dolly and moved to the unloading spot. The bungs are carefully removed, using the"elephant trunk" connected to the vent manifold to



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pick up any fumes emitted from the open bungs.

4.1.7.1. The outer bung opening is then connected to the MIC transfer hose to T-113. The inner opening is similarly connected the the low pressure nitrogen hose.

4.1.7.2. Open vent valve on T-113, apply 5-15 psig nitrogen pressure to drum to start transfer of MIC.

4.1.7.3. When drum is nearly empty, it should be tipped on the dolly to insure complete drainage. After drum is emptied, it is returned to the upright position, removed from the dolly and the bungs replaced.

4.1.7.4. The drum is then replaced with a full one and the procedure repeated until all drums have been unloaded into T-113. Then close vent on T-113 to maintain 5-15PSI nitrogen pad.

4.1.7.5. The empty drums are then weighed on the scale and checked against the tare weights to insure that they contain no more than 3 lbs MIC. Drums that exceed this are returned to the dolly for a second transfer to T-113.

4.1.8. When drums are completely drained to T-113 the board operator should be notified that the transfer is complete and the number of drums transferred noted in the log.

4.1.9. The empty drums are then removed to the drum washing station for decontamination in accordance with the procedure following.



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## 4.2. PROCEDURE FOR DECONTAMINATING DRUMS

4.2.1. In all procedures that follows, the operators must wear full protective gear as covered in sections 4.1.3.1 thru 4.1.3.3.

4.2.2. Empty drums which contain less than 3 lbs of residual MIC are decontaminated as follows:

4.2.1.1. Stand drum upright in curbed drum washing area.

4.2.1.2. Remove both bungs and flush drum with water hose through one bung.

4.2.1.3. Flush drum with full hose flow for 10 minutes.

4.2.1.4. Drum may then be returned to supplier. Always with bungs removed.

4.2.3. Drums which for any reason, contain more than 3 but less than 20 lbs of MIC are decontaminated as follows:

4.2.2.1. Refer to attached figure 1 for set up .

4.2.2.2. Water flow to the drum is throttled to about 5 gal/minute. Care should be taken here to avoid blowing out the rubber stoppers by too high water flow.

4.2.2.3. While the drum is being filled the drum temperature should not rise above 100°F (barely warm to touch).

4.2.2.4. If it does, immediately stop inflow of water and flood outside of drum to cool down. Then resume decontamination carefully.

4.2.2.5. See memo attached.

4.2.2.6. After all MIC has been displaced increase water flow to 25-50 gpm and flush for 5 minutes.

4.2.2.7. Drum is then ready to be returned to vendor.

-Again bungs must be removed.



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## PROCEDURE FOR DECONTAMINATING EMPTY METHYL ISOCYANATE DRUMS

The following procedure was used to successfully decontaminate returned empty drums of MIC (methyl isocyanate) at the Union Carbide Institute Plant.

1. Empty drums which contained only MIC vapor were successfully flushed with city water, the temperature of which was about 55°F. Fresh air mask, helmet, raincoat, and rubber gloves were worn by the operator to prevent any contact with the MIC. Both bungs were removed and water at approximately 100 gallons per minute was pumped into the drum. The very small amount of MIC vapor was allowed to dissipate to the atmosphere. This must be done in an open area and a windy day is preferable.

   This procedure was successfully used when the drums weighed up to three pounds over tare.

2. If more than 20 pounds of MIC are left in a drum, it should be emptied again.

---

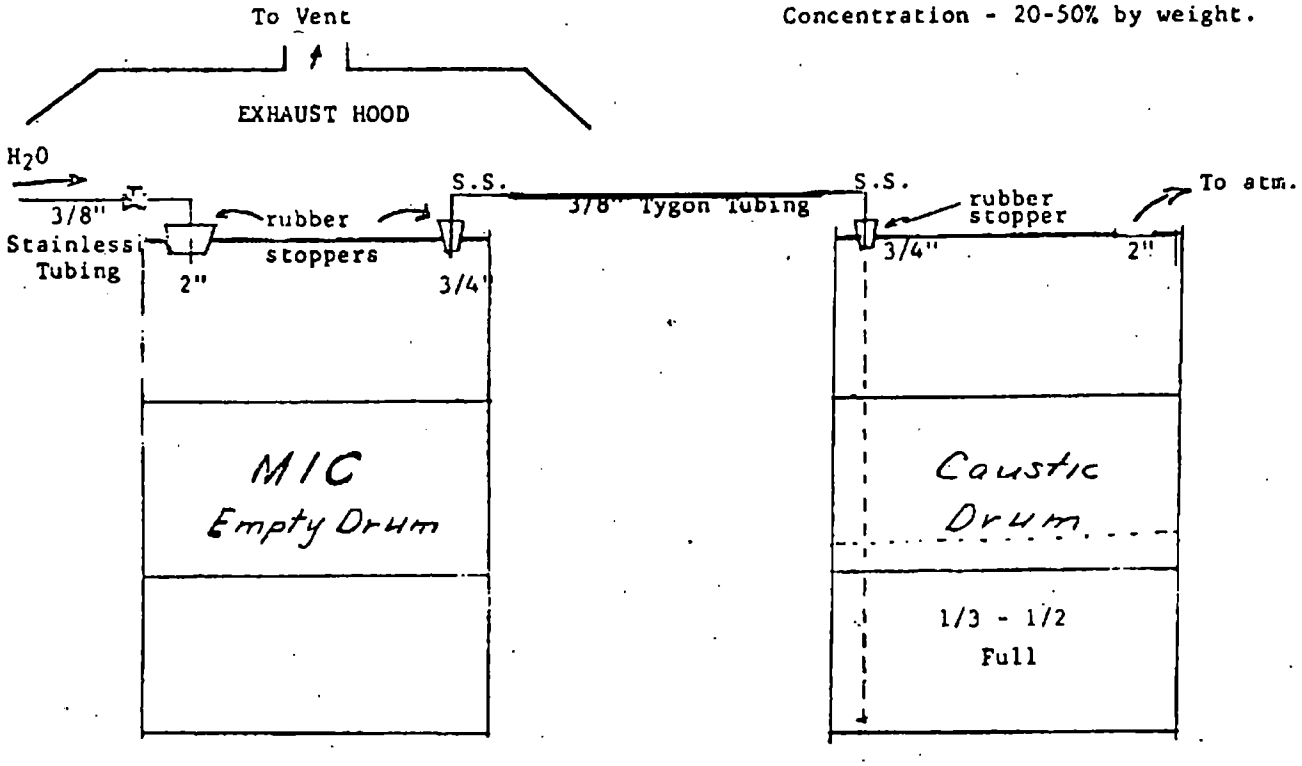
3. When the drums weighed from 3 to 20 pounds over tare, the following procedure was used and is recommended:

FIGURE 1

Water temperature - Less than 68°F.

Caustic (sodium hydroxide) - Temperature less than 68°F.

Concentration - 20-50% by weight.




The exhaust hood may be eliminated if the venting can be accomplished in an open area on a windy day.

4.2.4. Drums containing more than 20 lbs. MIC must be drained into T-113 before starting any decontamination procedures.

4.3. CLEANING FILTER F-101

4.3.1 The need for cleaning the filter will be evidence by (a) increasing pressure drop across the unit (b) decreased flow during transfer. When this occurs the filter should be cleaned as soon as the batch is transferred. (It is much easier to clean the filter while it is still passing liquid than to wait until it completely stops flow).

4.3.2. After completing transfer of the last batch, as indicated above, set the valving to permit recirculation from T-109 thru F-101 to T-109.

4.3.3. Add 400-500 gallons of formulating agent to T-109 and re-circulate for about 20 minutes.

4.3.4. Stop pump P-109, valve off filter outlet and blow residual formulating agent from filter with nitrogen via connection to filter outlet.

4.3.5. Then close valve at filter inlet, connect water hose to inlet connection and sewer hose to exit connection. Flush filter with water for 10 minutes.

4.3.6. Remove water hose from filter inlet connection and replace with sewer hose. Back blow residual water from filter with nitrogen.

4.3.7. After releasing nitrogen pressure , filter may be opened for manual removal of solids.

4.3.8. Install new filter papers, Close up filter and leak test with water pressure to 30-50 psig.

4.3.9. Blow test water from filter and recommission for service.



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## 4.4. WASTE HANDLING

4.4.1 Raffinate waste is drawn from R-101 and pumped to the lagoons, as discussed earlier.

4.4.2 Distillate waste from the R-101 boil off collects mainly in R-103. Some heavy distillate also collects in T-114 during boil off.

4.4.3 Once per day, the distillate waste from both R-103 and T-119 are transferred to the waste hold tank T-122 using nitrogen pressure.

4.4.4. The collected waste in T-122 tank is transferred to tank trucks, via pump P-103, periodically and hauled away for disposal by others.

## 4.5. OFF SPEC. BATCHES

4.5.1. Whenever a batch in T-109 is judged off spec. the foreman should be notified before any procedure is started . Then, possibly in consultation with the plant chemist, a procedure for handling the batch will be worked out. The following is intended only as a guide in handling some of the more common problems.

4.5.2. If the batch is only slightly off spec,first consideration should be given to blending off the batch in T-110, if at all possible.

4.5.3. If batch is greatly off spec, it should be dropped to T-107, the waste hold tank. From here, the batch can be pumped to either R-102 for moderate re-working and/or blending or,back to R-101 for a complete re-work.



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## SECTION 5.0 SAFTEY HAZARDS

### 5.1. METHYL ISOCYANATE

| | |
|---|---|
| Boiling Point: | 38°C |
| Flash Point: (TOC) | <0°F |
| Autoignition Temperature: | 535°C |
| Explosive limits, in air, % by vol. | |
| Upper | 26 |
| Lower | 5.3 |
| Molecular Weight: | 57.05 |
| TLV(AGGIH, 1974), skin | 0.02 ppm |

#### 5.1.1. Fire and Explosion Hazards

Methyl isocyanate is highly flammable, and it forms explosive mixtures with air over a wide range of concentrations. Its high volatility makes it especially hazardous. Methyl isocyanate must be kept away from heat or sources of ignition. Equipment design and handling procedures must conform to accepted standard practices regarding highly flammable compounds. Methyl isocyanate must be stored only in contact with proven inert materials of construction, such as glass, stainless steel, and Teflon. The presence of iron, in particular, can promote explosive-type polymerizations. Strong bases may also catalyze runaway reactions. Isocyanates are extremely reactive toward ammonia, amines, water, and alcohols. Accidental mixing with such substances must be rigourously avoided.

#### 5.1.2. Health Hazards (From Union Carbide Literature)

Methyl isocyanate is a hazardous material by all means of contact, and since it has a high vapor pressure, inhalation of the material can easily occur if it is improperly handled. Although the "tear gas" effects of the vapor are extremely unpleasant, this property cannot be used as a means to alert personnel to exposure to chronically toxic concentrations of methyl isocyanate. Methyl isocyanate is an ICC Class B poison by inhalation as



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defined in the regulations and is intensely irritating to breathe. It causes severe bronchospasm and asthma-like breathing. Sensitization may occur, after which traces of vapor cause true attacks of asthma. Although it does not quite meet the standards that define a poison by swallowing or skin contact, the difference is so small that methyl isocyanate should be also regarded as an oral and contact poison. Skin contact can cause severe burns, and the liquid will seriously injure the eyes even when it is diluted with a nontoxic liquid to a one percent concentration. Like other isocyanates (TDI, for example) methyl isocyanate causes sensitization in animals. Since exposure of a group of test animals to traces of methyl isocyanate sensitized the skin of all the animals, such sensitization could probably be expected to occur in humans.

Stringent precautions must be observed to eliminate any possibility of human contact with methyl isocyanate.

Single oral dose in Rats: $LD_{50}$-- 71 mg/k

Single skin penetration in Rabbits: $LD_{50}$-- 0.22 ml/k

Single inhalation by Rats: $LD_{50}$-- 0.103 mg/L (44 ppm)
2 mg/L inhaled for 1 hour killed
6/6 Rats

Skin irritation in Rabbits: undiluted caused severe burns 10% solution caused irritation

Eye injury in Rabbits: severe corneal injury from the liquid and from a 1% solution in Deobase.

5.1.3. Necessary Precautions

Standard precautions to handle a highly flammable material will be adequate to protect against fire hazards from ethyl isocyanate. However, more than ordinary precautions will be needed to maintain the concentration of methyl



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isocyanate in the air of the process room at or below the established TLV. Storage tanks, transfer lines and vessels where methyl isocyanate (or solutions) are handled must be designed and constructed so that no uncontrolled release of vapors to the air is possible. In addition, good building ventilation is necessary. When there is risk of exposure to isocyanate vapors, personnel must be completely isolated from the atmosphere by wearing appropriate protective clothing. Air-line masks and portable breathing equipment, as well as safety showers and eye washing stations should be strategically placed throughout the building and storage areas for emergencies. The possibility of permanent eye damage is particularly worthy of notice.

## 5.2. Methomyl Finished Product

### 5.2.1. Toxicity Information

Methomyl insecticide is highly toxic and may be fatal if swallowed or inhaled. The $LD_{50}$ for methomyl by oral administration to fasted male and female white rats is 17 and 24 mg/kg, respectively. There was no clinical evidence of cumulative toxicity when 10 doses of the chemical were administered orally to male rats at 5.1 mg/kg x day over a 14 day period. The ALC (Approximate Lethal Concentration) of methomyl of 4.6 microns mean particle size suspended in air was 0.30 mg/liter for rats upon 4 hours exposure.

The compound is not a skin irritant nor a serious eye irritant. Eye irritation studies with rabbits showed only mild conjunctivitis and no corneal injury. Extremely small quantities, as low as 0.01 mg., in a rabbit eye cause temporary constriction of the pupil.

When methomyl was applied to the intact skin of rabbits for 24 hours at dosages of 1000 mg/kg in water as a 5% solution, 1500 mg/kg in water at a 26% concentration and 1500 mg/kg in "cellosolve" at a 26% concentration,



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no deaths occurred indicating the ALD to be greater than these dosages. In a similar test with methomyl in dimethyl phthalate using a 26% supersaturated solution and a dosage of 1500 mg/kg, the animal died within two days.

In subacute skin absorption toxicity tests on rabbits, with doses of 200 mg/kg applied as a 5% aqueous solution for 6 hours per day, 5 times a week for three weeks, no deaths occurred in the group of 10 rabbits with intact skin but two died in another group of 10 animals which had abraded skin.

In connection with the skin absorption toxicity of methomyl, it should be noted that the response of humans may possibly be different than that of the animals tested. Skin absorption has not been ruled out as a possible cause of complaints of illness attributed to methomyl at the SLM operation at Belle.

Atropine is an antidote for methomyl poisoning and should be administered as directed by the plant physician. Morphine or 2-PAM should not be used.

5.3. MTAAO (S-methyl-N-hydroxythioacetimidate)

Will exist in the process in the impure and purified slurries and as a wet and dry solid.

5.3.1. Fire and Explosion Properties

MTAAO has a very low vapor pressure and therefore is not a serious fire hazard. It will burn, however, if exposed to an open flame and will produce obnoxious and probably toxic fumes.

Test data show MTAAO to be sensitive to confined heating, decomposing explosively at 133°C. The material, however, is not sensitive to initiation by impact. The test results (Explosives Department, 3/1/65) are summarized below.



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"EXHIBIT C" 8/12/76

MANUFACTURING COST/PRODUCT 10

1,200,000 GALS/YEAR CAPACITY @ 330 DAYS/YEAR OPERATION

| | MAX. USAGE PER GALLON | MAXIMUM COST VARIABLE COST/GALLON | MAXIMUM COST FIXED PER MONTH | STAND-BY COST/MONTH |
|---|---|---|---|---|
| **Raw Material Usage** | | | | |
| Slurry (as 100% PTAAO) | 1.33 | | | |
| Methyl Isocyanate | 0.75 | | | |
| Methanol | 5.25 | | | |
| Methylene $Cl_2$ | 0.70 (1) | .1313 | | |
| **Utilities** | | | | |
| Electricity | | .05 | $ 1,500 | |
| Steam | | .023 | 740 | |
| Water | | .0022 | 100 | |
| Nitrogen | | .019 | 450 | |
| Natural Gas | | — | 700 | |
| Sub Total | | | 3,490 | $ 450 |
| **Operating Labor** | | | | |
| Operating | | — | 10,757 * | |
| Packaging | | .08 | 4,800 * | |
| Sub Total | | | 15,557 | 2,433 |
| **Maintenance** | | | | |
| Repair Labor | | | 4,500 | |
| Maintenance Materials | | | 4,500 | |
| Maintenance Overhead | | | 2,000 | |
| Sub Total | | | 11,000 | 2,000 |
| **Miscellaneous Operating Expenses** | | | | |
| Supervision & Clerical | | | 7,260 * | 2,050 |
| Operating Materials | | .0055 | 1,000 | |
| Laboratory | | | 5,000 | 1,750 |
| Shipping & Handling | | | 400 | |
| Sub Total | | | 13,660 | 3,750 |
| **Administrative Overhead** | | | | |
| Sub Total | | | 7,288 * | |
| **Waste Disposal** | | | | |
| Sub Total | | .28 | — | — |
| **TOTAL** | | | $ 50,995 | $ 12,633 |

1) 1.10 - Month of April
0.90 - Month of May
0.70 - Month of June (will remain
additional investment is

* Detail analyses attached

2) One time charge for stand-by

(a) Based on $0.1875/lbs purchase,

## COMPUTATION OF OVERHEAD ALLOCATIONS

| PROCESS | | DIRECT LABOR HOURS | % to TOTAL |
|---|---|---|---|
| Propanil-Operator | - 2 men x 4* x 173.3** = | 2772.8 | |
| Propanil-Pkg. | - 3 men x 173.3 = | 519.9 | |
| | Sub Total = | 3292.7 | .229 |
| Basalin-Operator | - 2 men x 4 x 173.3 = | 2772.8 | |
| Basalin-Pkg. | - 3 men x 173.3 = | 519.9 | |
| | Sub Total = | 3292.7 | .229 |
| Product 10 Operator | - 2 men x 4 x 173.3 = | 2772.8 | |
| Product 10 Truck Unloaders | - 2 men x 173.3 = | 346.0 | |
| Product 10 Pkg. | - 11 men x 173.3 = | 1906.3 | |
| | Sub Total = | 5025.1 | .349 |
| Mobil Operators | - 2 men x 4 x 173.3 = | 2772.8 | .193 |
| | Total Direct Labor Hours | 14383.3 | 1.00 |

* - 4 week shift cycle
** - Average Monthly hours-(52 wk.) (40 hr.) ÷ (12 mo.)

EAGLE RIVER CHEMICAL

COMPUTATION OF OPERATING LABOR

LEAD OPERATORS

| | | |
|---|---|---|
| STRAIGHT TIME WAGES | | 3,847 |
| (.5) SHOWER TIME | | 360 |
| 6TH DAY | | 92 |
| TOTAL WAGES | | 4,299 |
| FRINGES | x | 1.2 |
| TOTAL WAGES & FRINGES | | $5,158 |

OPERATORS

| | | |
|---|---|---|
| STRAIGHT TIME WAGES | | 2,497 |
| (.5) SHOWER TIME | | 234 |
| 6TH DAY | | 59 |
| TOTAL WAGES | | 2,790 |
| FRINGES | x | 1.20 |
| TOTAL WAGES & FRINGES | | $3,348 |

TRUCK UNLOADERS

| | | |
|---|---|---|
| STRAIGHT TIME WAGES | | 1,747 |
| (.5) SHOWER TIME | | 129 |
| TOTAL WAGES | | 1,876 |
| FRINGES | x | 1.20 |
| TOTAL WAGES & FRINGES | | $2,251 |

| | |
|---|---|
| TOTAL OPERATING LABOR | $10,757 |

EAGLE RIVER CHEMICAL

COMPUTATION OF STRAIGHT TIME LABOR

LEAD OPERATORS

| | |
|---|---|
| (1) (365 DAY) (24 HR) | 8,760 HR |
| (2) (8760 HR) ÷ (12 MO.) | 730 HR/MO |
| (3) (730 HR) ($5.27) | $3,847 |

OPERATORS

| | |
|---|---|
| (1) (365 DAY) (24 HR) | 8,760 HR |
| (2) (8760 HR) ÷ (12 MO) | 730 HR/MO |
| (3) (730 HR) ($3.42) | $2,497 |

TRUCK UNLOADERS

| | |
|---|---|
| (1) (52 WK) (5 DAY) | 260 DAY |
| (2) (260 DAY) (16 HR) | 4,160 HR |
| (3) (4160) ÷ (12 MO) | 347 HR |
| (4) (347 HR) ($3.95) | $1,370 |

EAGLE RIVER CHEMICAL

COMPUTATION OF SHOWER TIME

LEAD OPERATORS

| | | |
|---|---|---|
| (1) (365 DAY) (1.5 HR) | | 548 HR |
| (2) (548 HR) ($7.90) | $4,329 | |
| (3) (4329) ÷ (12 MO) | $ 360 | |

OPERATORS

| | | |
|---|---|---|
| (1) (365 DAY) (1.5 HR) | | 548 HR |
| (2) (548 HR) ($5.13) | $2,811 | |
| (3) ($2811) ÷ (12 MO) | $ 234 | |

TRUCK UNLOADERS

| | | |
|---|---|---|
| (1) (260 DAY) (1 HR) | | 260 HR |
| (2) (260 HR) (5.93) | $1,541 | |
| (3) ($1541) ÷ (12 MO) | $ 129 | |

EAGLE RIVER CHEMICAL

COMPUTATION OF 6TH DAY O/T

LEAD OPERATORS

(1) (52 WK) (8 HR) (2.64) ÷ (12 MO) $92

OPERATORS

(1) (52 WK) (8 HR) (1.71) ÷ (12 MO) $59

EAGLE RIVER CHEMICAL

AVERAGE WAGES COMPUTATION

LEAD OPERATORS

| | |
|---|---|
| JAMES RAWLINGS | 5.12 |
| LARRY McCLAIN | 5.32 |
| LUCKY WOODRUM | 5.32 |
| JAMES F. WELLS | 5.32 |
| | 21.08 ÷ 4 = 5.27 |

OPERATORS

| | |
|---|---|
| FRANK WELLS | 3.10 |
| DENNY GOMEZ | 3.81 |
| JAMES GRIFFIN | 3.40 |
| ALLEN WOODRUM | 3.40 |
| | 13.71 ÷ 4 = 3.42 |

TRUCK UNLOADERS

| | |
|---|---|
| VICTOR MINOR | 3.95 |
| DAVID WALKER | 3.95 |
| | 7.90 ÷ 4 = 3.95 |

# ANALYSIS OF PACKAGING

| PACKAGING | (4 MO) YTD (1) |
|---|---|
| SALARY | 2344 |
| PAYROLL TAXES | 247 |
| WAGES | 37352 |
| PAYROLL TAXES | 3576 |
| | 43519 ÷ 4 = $10879 |

BASED ON 80,000 GALLON IN SALES TO E.I. DU PONT THE BILLING WOULD BE:

EXHIBIT C

| | | |
|---|---|---|
| V.C. = | 80,000 X .08 = | $6400 |
| F.C. = | | 4800 |
| | TOTAL | $11200 |

THEREFORE WE FEEL IT BEST TO LEAVE THE PACKAGING AT ITS PRESENT AMOUNT UNTIL FURTHER STUDY.

(1) PER ''UNIT COST REPORT BY COST CENTER'' PG. 82.

REFERENCE - E.I. DU PONT CONTRACT - MATERIAL AND FACILITIES (SEE ATTACHED).

STATES THAT E.I. DU PONT WILL FURNISH AT NO COST TO EAGLE RIVER CHEMICAL THE REQUIRED PACKAGING MATERIAL, HOWEVER EAGLE RIVER CHEMICAL HAS BEEN INCURRING APPROXIMATELY $525 PER MONTH FOR PACKAGING MATERIAL COSTS (STAPLES, PAPER TOWELS, WIPING CLOTHES, ETC.)

WHEREAS, EAGLE RIVER and DU PONT mutually agree that sufficient know-how exists to produce Lannate® L methomyl insecticide (hereinafter referred to as Product 10) from MTAAO slurry and methyl isocyanate provided by DU PONT and EAGLE RIVER has expressed an interest in installing necessary facilities to accomplish this manufacture and;

WHEREAS, DU PONT has expressed a need for Product 10 for the time, in the manner, and upon the terms and conditions set forth;

NOW, THEREFORE, in consideration of the premises and of the mutual covenants hereinafter set forth, the parties hereto mutually agree as follows:

1. MATERIAL AND FACILITIES

DU PONT will furnish, at no cost to EAGLE RIVER, the required quantity of MTAAO slurry, methyl isocyanate, methanol, coloring agent, filter aid and packaging materials necessary to produce, package, and label such quantities of Product 10 as DU PONT elects to have produced hereunder, subject to the limitations set forth below. Shipments of above raw materials will be f.o.b. EAGLE RIVER's plant near West Helena Arkansas, at which point title to the said materials shall vest in EAGLE RIVER and EAGLE RIVER agrees that said materials will be used to

see also par. 14 on page 11

WILM. E. & M. DEPT. COPY

## SUPERVISION & CLERICAL COMPUTATION

A. SHIFT SUPERVISORS

(1) ($278/MAN) (4 MEN) (52 WKS) = $57,824

(2) (57824) ÷ (12 MO) = $4,819

(3) (4819) (.349) = $1,682

(4) (1682) (1.2) = $2,018

B. DAY SUPERVISOR

(1) ($288) (52 WKS) = $14,976

(2) (14976) ÷ (12MO) = $1,248

(3) (1248) (1.2) = $1,497

C. PRODUCTION CLERK

(1) (4.72/HR) (40HR) (52 WKS) = $9,818

(2) (9818) ÷ (12MO) = $818

(3) (818) (.349) = $285

(4) (285) (1.2) = $342

D. ACCOUNTANTS

(1) ($3916) (.349) = $1367

(2) (1367) (1.2) = $1640

E. CLERK/SECRETARYS

(1) ($703) (52 WK) = $36,556

(2) (36556) ÷ (12MO) = $3,046

(3) ($3046) (.349) = $1063

(4) (1063) (1.2) = $1276

F. PRODUCTION SUPERINTENDENT

(1) ($1622) (.26) = $406

(2) ($406) (1.2) = $487

TOTAL : $7,260

# SUPERVISION & CLERICAL WAGES

| | | |
|---|---|---|
| A. | ANDY SEEMAN | $283 |
| | JOEL WALKER | $265 |
| | MELVIN HAYNES | $288 |
| | BOBBY VALLUN | $277<br>1113 ÷ 4 = $278 |
| B. | RICHARD JOHNS | $288 |
| C. | CHARLIE PARKER | $4.72/HR |
| D. | DAVID STROUD | $1,333 |
| | BYRON FURR - 250 X 52 WK ÷ 12 | 1,083 |
| | MIKE MCKELLAR | 1,500 |
| | | $3,916 |
| E. | BETH RHODENIZER | 198 |
| | RETA VONKANEL | 173 |
| | SHIRLEY JUMPER | 178 |
| | DEVORA GIBSON | 154 |
| F. | JOHN HOLCOMB (300) | 1,622 |

## ADMINISTRATIVE OVERHEAD

| | | |
|---|---|---|
| 1. | PLANT MANAGEMENT AND SALARIES | $1744 |
| 2. | SAFETY WAGES AND SALARIES | 2136 |
| 3. | ENGINEERING | * |
| 4. | TAXES AND INSURANCE | 438 |
| 5. | TELEPHONE, POSTAGE, OFFICE SUPPLIES | 804 |
| 6. | LEGAL AND AUDIT | 247 |
| 7. | AUTOMOBILE EXPENSES | 96 |
| 8. | ADMINISTRATIVE UTILITIES | 60 |
| 9. | PURCHASING | 454 |
| 10. | DATA PROCESSING | 349 |
| 11. | TRAVEL | 200 |
| 12. | CORPORATE | 500 ** |
| | | 7028 |
| | ADJUSTMENT FOR AVERAGE WAGE INCREASES | 260*** |
| | | $7288 |

* (DIRECT CHARGES AS APPROVED BY E.I. DU PONT)

** (FOR CENTRAL PERSONNEL, PURCHASING, CONTRACT ADMINISTRATION, ETC.)

*** ADJUSTMENT FOR AVERAGE WAGE INCREASES

| | |
|---|---|
| PLANT MANAGEMENT | $1744 |
| SAFETY & SECURITY | 2136 |
| PURCHASING | 454 |
| | 4334 |
| | X .12 |
| | $ 520 (ANNUALLY) |
| | ÷ 2 |
| | $ 260 (AVERAGE PER MONTH FOR FOLLOWING YEAR |

# ADMINISTRATIVE DETAIL

1. PLANT MANAGEMENT

($4,169) X (.349) X (1.2)---------- 1744

2. SAFETY SECURITY WAGES & SALARIES

SAFETY DIRECTOR
($254/MO) (52WK)---------- 13208
($13208) ÷ (12MO)---------- 1100
(1100) (.349)---------- 384
(384) (1.2)---------- 460

FOUR (4) WASH ROOM ATTENDANTS
(365 DAYS) (24HR)---------- 8760 HR
(8760 HR) ÷ (12MO)---------- 730 HR
(730 HR) ($3.60)----------$2628
($2628) (.349)---------- 918
($918) (1.2)----------$1101

ONE (1) GUARD
(260 DAY) (10 HR)---------- 2600 HR
(2600 HR) ($3.16)----------$8216
($8216) ÷ (12MO)---------- 684/MO

(260 DAY) (2 HR)---------- 529 HR
(520 HR) ($1.58)----------$ 822
($822) ÷ (12 MO)----------$ 68

($684 + 68---------- 752
($752) (.349)---------- 262
($262) (1.2)----------$ 314

ONE (1) JANITOR
(260 DAY) (8HR)---------- 2080 HR
(2080HR) ÷ (12MO)---------- 173
(173 HR) X (361)----------$ 625
($625) (.349)---------- 218
(218) (1.2)---------- 261

TOTAL SAFETY AND SECURITY----------$2136

3. ENGINEERING (DIRECT CHARGES AS APPROVED BY E.I. DU PONT)

4. TAXES & INSURANCE

GENERAL TAX AND INSURANCE ($127MO) (.349)----------$ 44
UMBRELLA ($13568) ÷ (12 MO) = $1130
($1130) (.349)----------394
438

5. TELEPHONE, POSTAGE, OFFICE SUPPLY

TELEPHONE (4 MO X 70 AVERAGE)----------1704
POSTAGE (4 MO X 70 AVERAGE)---------- 126
SUPPLIES (4 MO X 70 AVERAGE)----------474
2304
X .349
$804

6. LEGAL AND AUDIT

ESTIMATE - ($8500) ÷ (12 MO) ----------$708
($708MO)(.349)----------$247

7. AUTOMOBILE EXPENSE

CAR RENTAL ----------274
X .349
$ 96

8. ADMINISTRATIVE UTILITIES

ELECTRICITY ( 4MO X 70 AVERAGE) ($173) (.349)-------- 60

9. PURCHASING

B.W. SALARY($1083)(.349)(1.2)----------$454

10. DATA PROCESSING

APPROXIMATELY ($1000/MO)(.349)----------$349

11. TRAVEL EXPENSE - ESTIMATED TRAVEL

FOR MEETING WITH DU PONT----------$200

8/12/76

"EXHIBIT C"

MANUFACTURING COST/PRODUCT 10

1,200,000 GALS/YEAR CAPACITY @ 330 DAYS/YEAR OPERATION

| | MAX. USAGE PER GALLON | MAXIMUM COST VARIABLE COST/GALLON | MAXIMUM COST FIXED PER MONTH | STAND-BY COST/MONTH |
|---|---|---|---|---|
| **Raw Material Usage** | | | | |
| Slurry (as 100% PTAAO) | 1.33 | | | |
| Methyl Isocyanate | 0.75 | | | |
| Methanol | 5.25 | | | |
| Methylene $Cl_2$ | 0.70 (1) | .1313 | | |
| **Utilities** | | | | |
| Electricity | | .05 | $ 1,500 | |
| Steam | | ~~.023~~ | 740 | |
| Water | | .00022 | 100 | |
| Nitrogen | | .019 | 450 | |
| Natural Gas | | — | 700 | |
| Sub Total | | | 3,490 | $ 450 |
| **Operating Labor** | | | | |
| Operating | | — | 10,757 * | |
| Packaging | | .08 | 4,800 * | |
| Sub Total | | | 15,557 | 2,433 |
| **Maintenance** | | | | |
| Repair Labor | | | 4,500 | |
| Maintenance Materials | | | 4,500 | |
| Maintenance Overhead | | | 2,000 | |
| Sub Total | | | 11,000 | 2,000 |
| **Miscellaneous Operating Expenses** | | | | |
| Supervision & Clerical | | | 7,260 * | 2,000 |
| Operating Materials | | .0055 | 1,000 | |
| Laboratory | | — | 5,000 | 1,750 |
| Shipping & Handling | | | 400 | |
| Sub Total | | | 13,660 | 3,750 |
| **Administrative Overhead** | | | | |
| Sub Total | | | 3,788 * | |
| **Waste Disposal** | | | | |
| Sub Total | | .28 | — | — |
| **TOTAL** | | | $ 50,995 | $ 12,633 |

1) 1.10 - Month of April
0.90 - Month of May
0.70 - Month of June (will remain
additional investment is

2) One time charge for stand-by

(3) Based on $0.1875/lbs purchase,

* Detail analyses attached

## COMPUTATION OF OVERHEAD ALLOCATIONS

| PROCESS | | DIRECT LABOR HOURS | % to TOTAL |
|---|---|---|---|
| Propanil-Operator | - 2 men x 4* x 173.3** = | 2772.8 | |
| Propanil-Pkg. | - 3 men x 173.3 = | 519.9 | |
| | Sub Total = | 3292.7 | .229 |
| Basalin-Operator | - 2 men x 4 x 173.3 = | 2772.8 | |
| Basalin-Pkg. | - 3 men x 173.3 = | 519.9 | |
| | Sub Total = | 3292.7 | .229 |
| Product 10 Operator | - 2 men x 4 x 173.3 = | 2772.8 | |
| Product 10 Truck Unloaders | - 2 men x 173.3 = | 346.0 | |
| Product 10 Pkg. | - 11 men x 173.3 = | 1906.3 | |
| | Sub Total = | 5025.1 | .349 |
| Mobil Operators | - 2 men x 4 x 173.3 = | 2772.8 | .193 |
| | Total Direct Labor Hours | 14383.3 | 1.00 |

* - 4 week shift cycle
** - Average Monthly hours-(52 wk.) (40 hr.) ÷ (12 mo.)

EAGLE RIVER CHEMICAL

COMPUTATION OF OPERATING LABOR

LEAD OPERATORS

| | | |
|---|---|---|
| STRAIGHT TIME WAGES | | 3,847 |
| (.5) SHOWER TIME | | 360 |
| 6TH DAY | | 92 |
| TOTAL WAGES | | 4,299 |
| FRINGES | X | 1.2 |
| TOTAL WAGES & FRINGES | | $5,158 |

OPERATORS

| | | |
|---|---|---|
| STRAIGHT TIME WAGES | | 2,497 |
| (.5) SHOWER TIME | | 234 |
| 6TH DAY | | 59 |
| TOTAL WAGES | | 2,790 |
| FRINGES | X | 1.20 |
| TOTAL WAGES & FRINGES | | $3,348 |

TRUCK UNLOADERS

| | | |
|---|---|---|
| STRAIGHT TIME WAGES | | 1,747 |
| (.5) SHOWER TIME | | 129 |
| TOTAL WAGES | | 1,876 |
| FRINGES | X | 1.20 |
| TOTAL WAGES & FRINGES | | $2,251 |

| | |
|---|---|
| TOTAL OPERATING LABOR | $10,757 |

EAGLE RIVER CHEMICAL

COMPUTATION OF STRAIGHT TIME LABOR

LEAD OPERATORS

| | |
|---|---|
| (1) (365 DAY) (24 HR) | 8,760 HR |
| (2) (8760 HR) ÷ (12 MO.) | 730 HR/MO |
| (3) (730 HR) ($5.27) | $3,847 |

OPERATORS

| | |
|---|---|
| (1) (365 DAY) (24 HR) | 8,760 HR |
| (2) (8760 HR) ÷ (12 MO) | 730 HR/MO |
| (3) (730 HR) ($3.42) | $2,497 |

TRUCK UNLOADERS

| | |
|---|---|
| (1) (52 WK) (5 DAY) | 260 DAY |
| (2) (260 DAY) (16 HR) | 4,160 HR |
| (3) (4160) ÷ (12 MO) | 347 HR |
| (4) (347 HR) ($3.95) | $1,370 |

EAGLE RIVER CHEMICAL

COMPUTATION OF SHOWER TIME

LEAD OPERATORS

| | | |
|---|---|---|
| (1) (365 DAY) (1.5 HR) | 548 | HR |
| (2) (548 HR) ($7.90) | $4,329 | |
| (3) (4329) ÷ (12 MO) | $ 360 | |

OPERATORS

| | | |
|---|---|---|
| (1) (365 DAY) (1.5 HR) | 548 | HR |
| (2) (548 HR) ($5.13) | $2,811 | |
| (3) ($2811) ÷ (12 MO) | $ 234 | |

TRUCK UNLOADERS

| | | |
|---|---|---|
| (1) (260 DAY) (1 HR) | 260 | HR |
| (2) (260 HR) (5.93) | $1,541 | |
| (3) ($1541) ÷ (12 MO) | $ 129 | |

EAGLE RIVER CHEMICAL

COMPUTATION OF 6TH DAY O/T

LEAD OPERATORS

(1) (52 WK) (8 HR) (2.64) ÷ (12 MO) $92

OPERATORS

(1) (52 WK) (8 HR) (1.71) ÷ (12 MO) $59

EAGLE RIVER CHEMICAL

AVERAGE WAGES COMPUTATION

LEAD OPERATORS

| | |
|---|---|
| JAMES RAWLINGS | 5.12 |
| LARRY MCCLAIN | 5.32 |
| LUCKY WOODRUM | 5.32 |
| JAMES F. WELLS | 5.32 |
| | 21.08 ÷ 4 = 5.27 |

OPERATORS

| | |
|---|---|
| FRANK WELLS | 3.10 |
| DENNY GOMEZ | 3.81 |
| JAMES GRIFFIN | 3.40 |
| ALLEN WOODRUM | 3.40 |
| | 13.71 ÷ 4 = 3.42 |

TRUCK UNLOADERS

| | |
|---|---|
| VICTOR MINOR | 3.95 |
| DAVID WALKER | 3.95 |
| | 7.90 ÷ 4 = 3.95 |

# ANALYSIS OF PACKAGING

| PACKAGING | (4 MO) YTD (1) |
|---|---|
| SALARY | 2344 |
| PAYROLL TAXES | 247 |
| WAGES | 37352 |
| PAYROLL TAXES | 3576 |
| | 43519 ÷ 4 = $10879 |

BASED ON 80,000 GALLON IN SALES TO E.I. DU PONT THE BILLING WOULD BE:

EXHIBIT C

| | | | | |
|---|---|---|---|---|
| V.C. = | 80,000 | X .08 | = | $6400 |
| F.C. = | | | | 4800 |
| | TOTAL | | | $11200 |

THEREFORE WE FEEL IT BEST TO LEAVE THE PACKAGING AT ITS PRESENT AMOUNT UNTIL FURTHER STUDY.

(1) PER ''UNIT COST REPORT BY COST CENTER'' PG. 82.

REFERENCE - E.I. DU PONT CONTRACT - MATERIAL AND FACILITIES (SEE ATTACHED).

STATES THAT E.I. DU PONT WILL FURNISH AT NO COST TO EAGLE RIVER CHEMICAL THE REQUIRED PACKAGING MATERIAL, HOWEVER EAGLE RIVER CHEMICAL HAS BEEN INCURRING APPROXIMATELY $525 PER MONTH FOR PACKAGING MATERIAL COSTS (STAPLES, PAPER TOWELS, WIPING CLOTHES, ETC.)

WHEREAS, EAGLE RIVER and DU PONT mutually agree that sufficient know-how exists to produce Lannate® L methomyl insecticide (hereinafter referred to as Product 10) from MTAAO slurry and methyl isocyanate provided by DU PONT and EAGLE RIVER has expressed an interest in installing necessary facilities to accomplish this manufacture and;

WHEREAS, DU PONT has expressed a need for Product 10 for the time, in the manner, and upon the terms and conditions set forth;

NOW, THEREFORE, in consideration of the premises and of the mutual covenants hereinafter set forth, the parties hereto mutually agree as follows:

1. MATERIAL AND FACILITIES

DU PONT will furnish, at no cost to EAGLE RIVER, the required quantity of MTAAO slurry, methyl isocyanate, methanol, coloring agent, filter aid and packaging materials necessary to produce, package, and label such quantities of Product 10 as DU PONT elects to have produced hereunder, subject to the limitations set forth below. Shipments of above raw materials will be f.o.b. EAGLE RIVER's plant near West Helena Arkansas, at which point title to the said materials shall vest in EAGLE RIVER and EAGLE RIVER agrees that said materials will be used to

See also par. 14 on page 11

WILM. E. & M. DEPT. COPY

# SUPERVISION & CLERICAL COMPUTATION

A. SHIFT SUPERVISORS

(1) ($278/MAN) (4 MEN) (52 WKS) = $57,824

(2) (57824) ÷ (12 MO) = $4,819

(3) (4819) (.349) = $1,682

(4) (1682) (1.2) = $2,018

B. DAY SUPERVISOR

(1) ($288) (52 WKS) = $14,976

(2) (14976) ÷ (12MO) = $1,248

(3) (1248) (1.2) = $1,497

C. PRODUCTION CLERK

(1) (4.72/HR) (40HR) (52 WKS) = $9,818

(2) (9818) ÷ (12MO) = $818

(3) (818) (.349) = $285

(4) (285) (1.2) = $342

D. ACCOUNTANTS

(1) ($3916) (.349) = $1367

(2) (1367) (1.2) = $1640

E. CLERK/SECRETARYS

(1) ($703) (52 WK) = $36,556

(2) (36556) ÷ (12MO) = $3,046

(3) ($3046) (.349) = $1063

(4) (1063) (1.2) = $1276

F. PRODUCTION SUPERINTENDENT

(1) ($1622) (.26) = $406

(2) ($406) (1.2) = $487

TOTAL : $7,260

# SUPERVISION & CLERICAL WAGES

| | | |
|---|---|---|
| A. | ANDY SEEMAN | $283 |
| | JOEL WALKER | $265 |
| | MELVIN HAYNES | $288 |
| | BOBBY VALLUN | $277 |
| | | 1113 ÷ 4 = $278 |
| B. | RICHARD JOHNS | $288 |
| C. | CHARLIE PARKER | $4.72/HR |
| D. | DAVID STROUD | $1,333 |
| | BYRON FURR - 250 X 52 WK ÷ 12 | 1,083 |
| | MIKE MCKELLAR | 1,500 |
| | | $3,916 |
| E. | BETH RHODENIZER | 198 |
| | RETA VONKANEL | 173 |
| | SHIRLEY JUMPER | 178 |
| | DEVORA GIBSON | 154 |
| F. | JOHN HOLCOMB (300) | 1,622 |

## ADMINISTRATIVE OVERHEAD

| | | |
|---|---|---|
| 1. | PLANT MANAGEMENT AND SALARIES | $1744 |
| 2. | SAFETY WAGES AND SALARIES | 2136 |
| 3. | ENGINEERING | * |
| 4. | TAXES AND INSURANCE | 438 |
| 5. | TELEPHONE, POSTAGE, OFFICE SUPPLIES | 804 |
| 6. | LEGAL AND AUDIT | 247 |
| 7. | AUTOMOBILE EXPENSES | 96 |
| 8. | ADMINISTRATIVE UTILITIES | 60 |
| 9. | PURCHASING | 454 |
| 10. | DATA PROCESSING | 349 |
| 11. | TRAVEL | 200 |
| 12. | CORPORATE | 500 ** |
| | | 7028 |
| | ADJUSTMENT FOR AVERAGE WAGE INCREASES | 260*** |
| | | $7288 |

* (DIRECT CHARGES AS APPROVED BY E.I. DU PONT)

** (FOR CENTRAL PERSONNEL, PURCHASING, CONTRACT ADMINISTRATION, ETC.)

*** ADJUSTMENT FOR AVERAGE WAGE INCREASES

| | |
|---|---|
| PLANT MANAGEMENT | $1744 |
| SAFETY & SECURITY | 2136 |
| PURCHASING | 454 |
| | 4334 |
| | X .12 |
| | $ 520 (ANNUALLY) |
| | ÷ 2 |
| | $ 260 (AVERAGE PER MONTH FOR FOLLOWING YEAR |

## ADMINISTRATIVE DETAIL

1. PLANT MANAGEMENT

($4,169) X (.349) X (1.2)---------- 1744

2. SAFETY SECURITY WAGES & SALARIES

SAFETY DIRECTOR
($254/MO) (52WK)---------- 13208
($13208) ÷ (12MO)---------- 1100
(1100) (.349)---------- 384
(384) (1.2)---------- 460

FOUR (4) WASH ROOM ATTENDANTS
(365 DAYS) (24HR)---------- 8760 HR
(8760 HR) ÷ (12MO)---------- 730 HR
(730 HR) ($3.60)----------$2628
($2628) (.349)---------- 918
($918) (1.2)----------$1101

ONE (1) GUARD
(260 DAY) (10 HR)---------- 2600 HR
(2600 HR) ($3.16)----------$8216
($8216) ÷ (12MO)---------- 684/MO

(260 DAY) (2 HR)---------- 529 HR
(520 HR) ($1.58)----------$ 822
($822) ÷ (12 MO)----------$ 68

($684 + 68---------- 752
($752) (.349)---------- 262
($262) (1.2)----------$ 314

ONE (1) JANITOR
(260 DAY) (8HR)---------- 2080 HR
(2080HR) ÷ (12MO)---------- 173
(173 HR) X (361)----------$ 625
($625) (.349)---------- 218
(218) (1.2)---------- 261

TOTAL SAFETY AND SECURITY----------$2136

3. ENGINEERING (DIRECT CHARGES AS APPROVED BY E.I. DU PONT)

4. TAXES & INSURANCE

GENERAL TAX AND INSURANCE ($127MO) (.349)----------$ 44
UMBRELLA ($13568) ÷ (12 MO) = $1130
($1130) (.349)----------394
438

5. TELEPHONE, POSTAGE, OFFICE SUPPLY

TELEPHONE (4 MO X 70 AVERAGE)----------1704
POSTAGE (4 MO X 70 AVERAGE)---------- 126
SUPPLIES (4 MO X 70 AVERAGE)---------- 474
2304
X .349
$804

6. LEGAL AND AUDIT

ESTIMATE - ($8500) ÷ (12 MO) ----------$708
($708MO)(.349)----------$247

7. AUTOMOBILE EXPENSE

CAR RENTAL ----------274
X .349
$ 96

8. ADMINISTRATIVE UTILITIES

ELECTRICITY ( 4MO X 70 AVERAGE) ($173) (.349)-------- 60

9. PURCHASING

B.W. SALARY($1083)(.349)(1.2)----------$454

10. DATA PROCESSING

APPROXIMATELY ($1000/MO)(.349)----------$349

11. TRAVEL EXPENSE - ESTIMATED TRAVEL

FOR MEETING WITH DU PONT----------$200

B-11120

DUPONT
ESTABLISHED 1902

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED

HOUSTON PLANT
P. O. BOX 347, LA PORTE, TEXAS 77571

BIOCHEMICALS DEPARTMENT

cc: J.W. Shackelford
~~L. Conaway~~
G. Mather

Houston Plant
July 22, 1976

John Miles
Production Superintendent
Eagle River Chemical Co.
West Helena, Arkansas

Product 10 Safety Information

To assist you in the safe manufacture of Product 10 the following information is attached.

1) Letter by S.I. Gleich to S. Parker describing Product 10 safety precautions.

2) A portion of the Union Carbide "Product Information" booklet concerning methyl isocyanate handling and safety measures.

3) Material Hazards Cards for methanol, methylene chloride, MTAAO, and "Lannate" L.

4) A paper entitled "Information for Physicians Regarding Symptomatology and Treatment in "Lannate" Methomyl Insecticide Poisoning Cases".

The first two items were previously transmitted to you. Both are thorough and require no further explanation.

The hazards cards provide a quick and concise safety guide for materials you use in making Product 10. I suggest you keep these cards handy for use by personnel involved with "Lannate" L.

Item 4 of the above list contains information for a physician when checking for or treating a methomyl exposure.

If you have questions about any of this material, please call.

Sincerely,

A.G. Rohrer
Engineer-Technical

AGR/pp
Attachments



ADEQ0022367/1

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
HOUSTON PLANT
P. O. BOX 347, LA PORTE, TEXAS 77571

BIOCHEMICALS DEPARTMENT

6/12

May 30, 1975

Mr. Scott Parker
Engineering Director
Vicksburg Chemical Co.
P. O. Box 3
Vicksburg, Ms. 39180

Dear Scott:

Contained in this letter is toxicity information, safety precautions to avoid methomyl exposure, and methods for treatment of persons who are exposed. This information will be necessary to safely operate the Product 10 facility at Eagle River. Please call with any questions.

Sincerely,

Steve

S. I. Gleich
Area Engineer - Technical

Attachments
SIG:ps

# PRODUCT 10 TOXICITY INFORMATION

The information contained herein refers primarily to "Lannate"-L (Product 10) and the hazards associated with handling it. We remind you, however, that methomyl is present, in solution, in several other process streams.

These streams include the MCl extract from R101, the MCl solution from R102 after MeNCO reaction and the aqueous solution from R102 after solvent exchange. These process streams should be handled with the same precautions as the product.

Since methomyl is always in solution during the Product 10 process, workers will generally not contact the solid.

## A. Toxicity

In pure form, methomyl is a granular solid. It is the active ingredient in Product 10 where it is dissolved in methanol and water.

### 1. Oral-Pure Solid

Methomyl is highly toxic and may be fatal if it, or its solutions are swallowed or inhaled. The oral $LD_{50}$ (of pure methomyl) to fasted white rats is about 20 mg/kg. There was no clinical evidence of cumulative toxicity when 10 doses of the chemical were administered orally to male rats at 5.1 mg/kg per day over a 14 day period.

### 2. Oral-"Lannate" - L

"Lannate" - L is moderately toxic when taken orally. It has an $LD_{50}$ of 130 mg/kg when tested with male rats.

### 3. Inhalation

The acute inhalation toxicity of "Lannate" - L was determined by exposing male rats to an aerosol of the material for one hour. The ALC (approximate lethal concentration) was found to be 0.17 mg/L on a methomyl basis. Because of the very low vapor pressure of methomyl ($5 \times 10^{-5}$ mm Hg at 25°C) the toxicity hazard from methomyl vapors at room temperature is negligible. Vapors above "Lannate" - L will contain methanol, however. Methanol has a TLV of 200 ppm.

A. Toxicity (Continued)

4. Skin and Eye

The $LD_{50}$ of "Lannate"-L by skin absorption determined by test with rabbits (intact skin), is 5880 mg/kg. "Lannate"-L produced no skin irritation or sensitization when tested on intact quinea pig skin at concentrations up to 100% strength. Operating experience in our "Lannate"-L packaging facilities at Houston suggests that hot weather increases the possibility that contact with "Lannate"-L will cause development of exposure symptoms. This is probably because increased sweating opens the body pores more, and in turn increases exposure susceptibility.

Eye irritation tests with rabbits indicate "Lannate" -L is irritating to the eyes and causes toxic symptoms when 0.1 ml of the undiluted material is applied.

5. Methanol Hazards

The solvent methanol is a severe fire and health hazard by itself. It's properties, discussed in MCA Safety Data Sheet SD-22, should be reviewed with equal care to those shown in this letter for methomyl. Personnel should be protected equally from methanol and methomyl exposures.

B. Symptoms of Exposure

Methomyl poisoning produces effects associated with anti-chlorinesterase activity which may include weakness blurred vision, headache, nausea, abdominal cramps, discomfort in the chest, constriction of pupils, sweating, slow pulse and muscle tremors.

Operating experience has shown that the most prevalent symptoms of methomyl exposure are constricted pupils (known as "little eye") and/or nausea.

C. Treatment for Exposure

In case of accidental contact, wash skin with plenty of soap and water. Avoid hot water. For eyes, flush with water for 15 minutes and get medical attention. Remove and wash contaminated clothing before reuse. Action should be taken immediately after exposure. Minutes separate successful from unsuccessful decontamination.

C. Treatment for Exposure (Continued)

If the solution is swallowed, give a tablespoon of salt in a glass of warm water (warm soapy water may also be used) and repeat until vomit fluid is clear. Have the patient lie down and keep quiet. If he is not breathing, start artificial respiration immediately. Never give anything by mouth to an unconscious person. Call a physcian as soon as possible.

If warning symptoms appear (Section B this letter), before the physician arrives, immediately swallow two atropine tablets (each 1/100 gr); thereafter, every 10 to 15 minutes, take one atropine tablet (1/100 gr) until the throat becomes dry and the skin becomes dry and flushed. Take additional tablets as necessary to maintain a moderately dry throat and dry flushed skin until the physician arrives.

We have attached a copy of the pertinent section from the "Lannate"-L product label for further details of treatment (Exhibit A).

D. Operating Precautions

Care must be used so that personnel do not breathe or swallow solutions containing methomyl, and do not get material in their eyes, or on their skin or clothing. Equipment used for handling methomyl solutions should be free of leaks. Any leaks, no matter how small, should be fixed immediately. Where product must be handled in the open, adequate ventilation must be provided to protect workers against methanol vapors or inadvertent spraying of the product.

Housekeeping should be scrupulous. Any spill of product or other methomyl solution should be cleaned up immediately. Clothing worn while working with methomyl should be removed at the end of the workday and laundered before reuse. Personnel should wash hands and face thouroughly after handling the product and before eating or smoking. Eating or smoking areas should be isolated from the working area. Employees should be adequately warned about the dangers of using the product containers for their own personal use.

Protective equipment for workers packing product should include goggles, rubber gloves, and aprons. Workers who clean up a spill should wear rubber boots during the clean up operation.

Any process lines needing repair which may have contained methomyl should be adequately decontaminated before mechanics are permitted to work on them. Mechanics should wear goggles and rubber gloves when breaking a line and rubber gloves for the rest of the job.

Safety showers and eye wash stations should be easily accessible to all workers.

DU PONT

REG. U.S. PAT. OFF.

# Lannate® L

## METHOMYL INSECTICIDE

**Water Soluble Liquid** 1 GALLON CONTAINS 1.8 LBS. METHOMYL

**ACTIVE INGREDIENT:** Methomyl
S-methyl-N-[(methylcarbamoyl)oxy]thioacetimidate ..... **24%**
**INERT INGREDIENTS** ..... **76%**
U.S. Pat. 3,576,834 EPA Reg. No. 352-370-AA

Keep out of reach of children

## DANGER ☠ POISON

**FLAMMABLE. CONTAINS METHANOL.**
**MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED.**
**POISONOUS IF INHALED. CAUSES EYE DAMAGE.**

**Do not breathe vapors or spray mist.**
**Do not get in eyes, on skin, on clothing.**
**Use with adequate ventilation.**
**Keep away from heat, sparks, and open flame.**
**Keep container closed.**
In case of contact, wash skin with plenty of soap and water; for eyes, flush with water for 15 minutes and get medical attention; remove and wash contaminated clothing before re-use.

## ANTIDOTE AND FIRST AID

**ATROPINE IS AN ANTIDOTE—CONSULT PHYSICIAN FOR EMERGENCY SUPPLY OF 1/100 GRAIN ATROPINE TABLETS. CALL A PHYSICIAN AT ONCE IN ALL CASES OF SUSPECTED POISONING.**

**If swallowed,** give a tablespoonful of salt in a glass of warm water and repeat until vomit fluid is clear. **If inhaled,** remove from exposure. Have patient lie down and keep quiet. If patient is not breathing, start artificial respiration immediately. **Never give anything by mouth to an unconscious person.**

**If warning symptoms appear** (See **warning symptoms** below), before physician arrives, immediately swallow two atropine tablets (each 1/100 gr.), thereafter, every 10 to 15 minutes, take one atropine tablet (1/100 gr.) until throat becomes dry and skin becomes dry and flushed. Take additional tablets as necessary to maintain a moderately dry throat and dry, flushed skin until physician arrives.

## NOTE TO PHYSICIAN

**WARNING SYMPTOMS**—Methomyl poisoning produces effects associated with anticholinesterase activity which may include weakness, blurred vision, headache, nausea, abdominal cramps, discomfort in the chest, constriction of pupils, sweating, slow pulse, muscle tremors.

**TREATMENT**—Atropine sulfate should be used for treatment. Administer repeated doses. 1.2 to 2.0 mg. intravenously every 10 to 30 minutes until full atropinization is achieved. Maintain atropinization until the patient recovers. Artificial respiration or oxygen may be necessary. Allow no further exposure to any cholinesterase inhibitor until recovery is assured. Do not use morphine or 2-PAM.

---

**IMPORTANT**—When mixing spray, loading, applying or otherwise handling wear protective clothing, goggles, and a mask or respirator suitable for protection against methomyl vapors or spray mist such as: Willson Products "Agri-Tox" R-533 Felt 11-P Cartridge or Mine Safety Appliances type H "Comfo" Wear clean clothes daily. Wash thoroughly after handling and before eating or smoking. Do not contaminate or store near feed or foodstuffs.
Not for use or storage in or around the home. Keep animals and unprotected persons out of operational areas during treatment and while there is danger of drift. Do not re-use container; bury when empty. This product is toxic to fish, birds and other wildlife. Keep out of any body of water. Do not apply where runoff is likely to occur. Do not apply when weather conditions favor drift from areas treated. Do not contaminate water by cleaning of equipment, or disposal of wastes. This product is toxic to bees and should not be applied when bees are actively visiting the area.

Do not subject to temperatures below 32°F.

E. I. DU PONT DE NEMOURS & CO. (INC.)

## DIRECTIONS

Du Pont "Lannate" L Methomyl Insecticide should be used only in accordance with recommendations on this label, or in separate published Du Pont recommendations available through local dealers.

"Lannate" L is a water soluble liquid to be diluted with water for application by conventional tractor-mounted spray equipment. Use only in commercial plantings, do not use in home plantings.

**SPRAY PREPARATION**—Fill spray tank ¼ to ½ full of water. Add "Lannate" L directly to spray tank and mix thoroughly, using mechanical or hydraulic means. do not use air agitation.

**APPLICATION**—Apply at the recommended rates when insects first appear. Unless otherwise noted, continue applications at 5- to 7-day intervals or as needed. Use sufficient water to obtain thorough, uniform coverage. Apply the low rates on small plants, small worms and light infestations of insects. Use intermediate rates on larger worms and heavier infestations of insects. Use 1 to 3 applications of the highest recommended rate for controlling severe infestations. Thereafter, use the lowest rate possible to maintain control.

**NOTICE TO BUYER**—Seller warrants that this product conforms to the chemical description on the label thereof and is reasonably fit for purposes stated on such label only when used in accordance with directions under normal use conditions. This warranty does not extend to use of this product contrary to label use directions, or under abnormal use conditions, or under conditions not reasonably foreseeable to seller; buyer assumes all risk of any such use. Seller makes no other warranties, express or implied.

| CROPS | INSECTS | QUARTS PER ACRE | LAST APPLICATION TO HARVEST—DAYS |
|---|---|---|---|
| Broccoli Cauliflower | Cabbage Looper, Imp. Cabbageworm, Diamondback Moth | ½-1* | 7 |
| | | 1-2* | 14 |
| Cabbage | Cabbage Looper, Imp. Cabbageworm, Diamondback Moth | ½-2* | 1 |
| Brussels Sprouts | Cabbage Looper, Imp. Cabbageworm | 1-2* | 14 |
| Celery | Cabbage Looper | 2 | 14 |
| Lettuce (Head) | Cabbage & Alfalfa Loopers, Beet Armyworm | ½-1 | 7 |
| | | 1-2 | 10 |
| Peanuts**—East of Miss. River | Corn Earworm (up to 3 applns. or as needed) | ½-2 | 21 |
| Pepper | Green Peach Aphids | 1 | 10 |
| Potato | Tuberworm, Cabbage Looper | 1 | 14 |
| | Aphids | 1-2 | |
| | Leafhoppers, Flea Beetles East of Miss. River | 1 | |
| Sweet Corn | Earworm—Whorl as needed | ⅜-1 | 0 (ears) 3 (forage) |
| | Earworm—Ears 1-3 days or as needed | ½-1 | |
| | Fall Armyworm, European Corn Borer—Ears 1-3 days or as needed | 1 | |
| Tomato | Tomato Fruitworm, Aphids, Cabbage Looper, Beet Armyworm | 1 | 1 |
| | | over 1-2 | 2 |
| Tobacco (Except Shade) | Flea Beetle, Hornworm | ½-1 | 7 (flue cured) 14 (air or fire cured) |
| | Budworm (2-3 applns. before flower buds open), Cabbage Looper, Aphids | 1 | |
| Chrysanthemums | Cabbage Looper, Corn Earworm, Beet Armyworm, Thrips (weekly) | ½-1 qt. per 100 gals | — |

*Add wetting agent. **Do not feed treated vines to livestock.

ADEQ0022367/6

DON'T SAY IT—WRITE IT

DATE 6/2/75

TO Scott Parker

AT Vicksburg Chemical

FROM Steve Gleich

cc: PWW

## MENCO INFO

You may find the attached information useful. We would have given it to you sooner but just received it ourselves from a non-Veritac related person.

# METHYL ISOCYANATE $CH_3N=C=O$

## PHYSICAL PROPERTIES

Determined on purified samples

| | |
|---|---|
| Molecular Weight | 57.05 |
| Apparent Specific Gravity at 20/20°C. | 0.9599 |
| ΔSp. Gr./Δt. at 10 to 40°C. | 0.00147 per °C. |
| Boiling Point at 760 mm. Hg | 39.1°C. |
| at 300 mm. Hg | 16.7°C. |
| at 10 mm. Hg | −40°C. |
| Δb.p./Δp. at 750 to 770 mm. Hg | 0.035°C. per mm. Hg |
| Vapor Pressure at 20°C. | 348 mm. Hg |
| Solubility in Water at 20°C. | about 6.7% by wt.[a] |
| Solubility of Water In at 20°C. | about 1.2% by wt.[a] |
| Critical Pressure | 55 Atm. |
| Critical Temperature | 218°C. |
| Viscosity at 0°C. | 0.35 cps. |
| at 20°C. | 0.25 cps. |
| Freezing Point | <−80°C. |
| Heat of Vaporization at 1 atm. | 223 B.t.u. per lb. |
| Heat of Combustion at 25°C. | 8,041 B.t.u. per lb. |
| Flash Point, Tag open cup (ASTM Method D 1310) | <0°F.[b] |

(a) Reacts slowly
(b) Commercial material

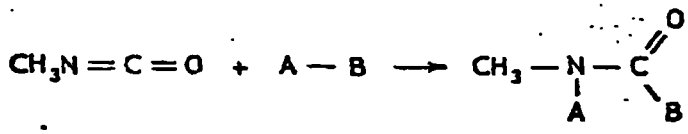
November, 1967
F-41443

SEVIN, SIRVATE, and UNION CARBIDE are trade marks of Union Carbide Corporation.

This information is not to be taken as a warranty or representation for which we assume legal responsibility nor as permission or recommendation to practice any patented invention without a license. It is offered solely for your consideration, investigation and verification.

Methyl isocyanate is an intermediate in the preparation of carbamate pesticides and should prove of interest in many other applications where special heterocyclic derivatives and polymers are needed.

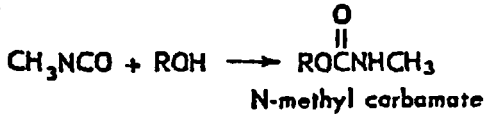
In general, most reagents that attack methyl isocyanate will add to the N=C bond to form N-methylcarbamoyl derivatives:



## REACTIONS

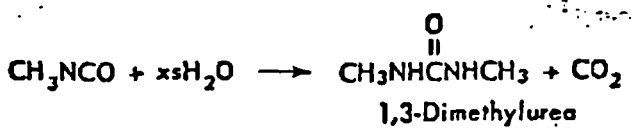
### ADDITION OF ACTIVE HYDROGEN COMPOUNDS

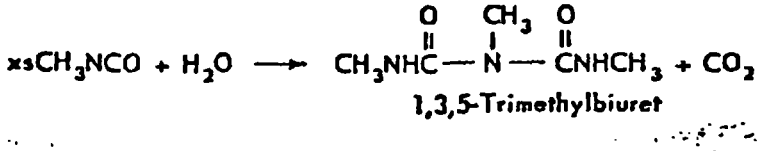
#### Hydroxy Compounds




This reaction takes place smoothly with a variety of hydroxy compounds. Alcohols and phenols are often quantitatively converted to the carbamate, although a catalyst, such as a tertiary amine or a dialkyl tin dicarboxylate, is usually required to produce complete reaction within a reasonable period.[1,2,3] Other functional groups may be present, if they are unreactive towards methyl isocyanate. SEVIN Carbaryl Insecticide and SIRMATE Herbicide are among the useful products obtained by reaction with hydroxy compounds.

Water reacts with methyl isocyanate to form carbon dioxide and water-soluble ureas or biurets.

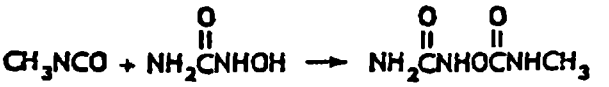


The reaction is slow at 20°C.; but, because of the heat produced, the reaction rate rapidly increases to the point of violent boiling. The presence of acids or bases greatly increases the rate of the reaction.[32]

The reaction of methyl isocyanate with carboxylic acids has not been described, but it can be expected to behave as other isocyanates. They form unstable, mixed anhydrides:

Other hydroxy compounds, such as enols, oximes and hydroxylamines, also produce N-methylcarbamates:

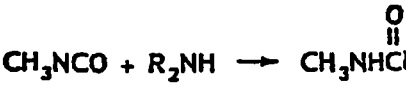


Ref. : 22

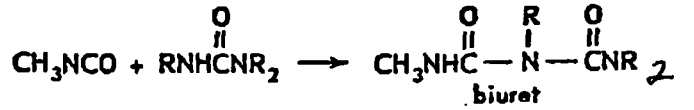
It would be expected that analogous thiocarbamates could be obtained from S-H compounds.[3]

N-H Compounds

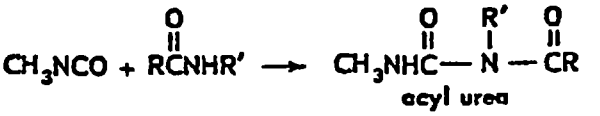
Ammonia and primary and secondary amines react rapidly at ambient temperatures without a catalyst:[1,2,3]



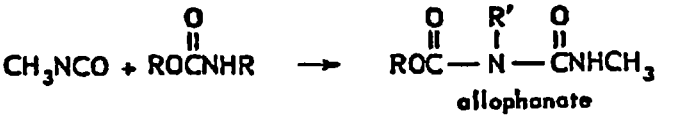
Methyl isocyanate will carbamoylate amides, ureas, or carbamates at higher temperatures:



biuret

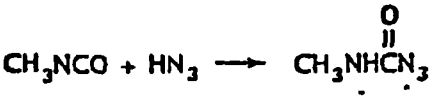


acyl urea

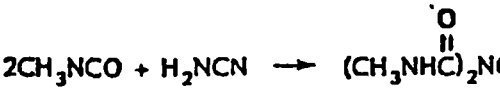


allophonate

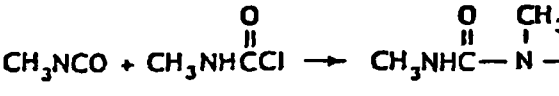
A number of other N-H compounds will react with methyl isocyanate:



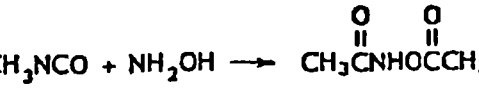
Ref. : 5



Ref. : 6



Ref. : 15 and 32



Ref. : 22

### Acids

Anhydrous acids add to methyl isocyanate to form N-methylcarbamoyl compounds:

$$CH_3NCO + HCl \rightleftharpoons CH_3NHC(=O)Cl$$ Ref. : 32

The methylcarbamoyl chloride dissociates into the reactants on heating and slowly changes to other products upon standing.[32]

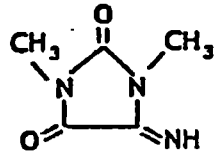
With concentrated sulfuric acid, the carbamoyl compound would be expected to decompose to form methylsulfamic acid:[7]

$$CH_3NCO + H_2SO_4 \longrightarrow CH_3NHSO_3H$$

Hydrogen cyanide is reported to react with methyl isocyanate:[5]

$$CH_3NCO + HCN \longrightarrow CH_3NHC(=O)CN$$

A second mole of methyl isocyanate will react if added;[5] later work[31] indicates that a cyclic product is obtained:



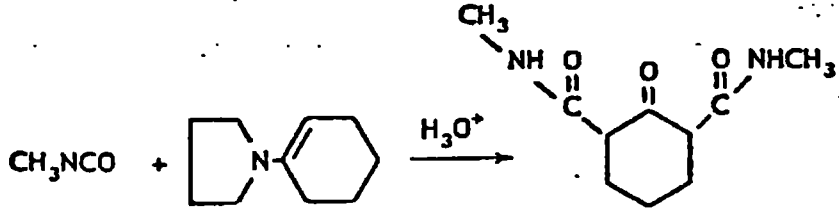
### C-H Compounds

Methyl isocyanate would be expected to react with active methylene compounds to form N-methylamides:[3]

$$CH_3NCO + Na^{\oplus}\,{}^{\ominus}CH(Y)_2 \longrightarrow (Y)_2CHC(=O)NHCH_3$$

$$Y = -COOR, -COR, \text{or} -CN$$

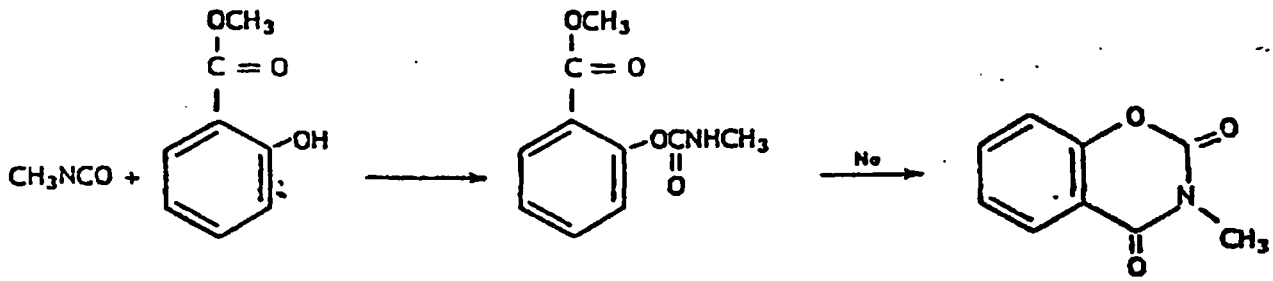
With enamines, the following would probably occur:



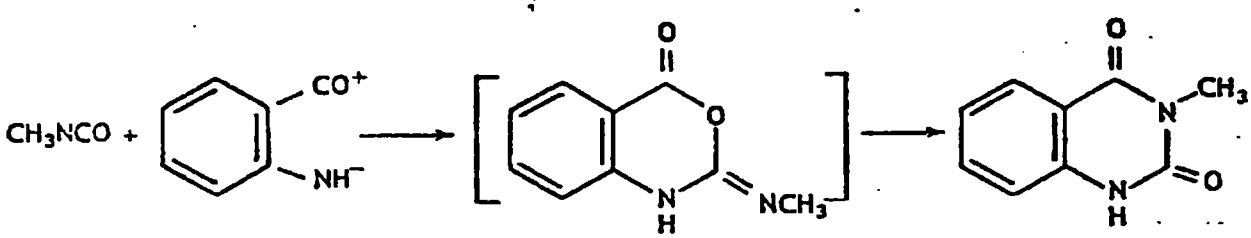
Ref. : 8,9,16

### Cyclizations

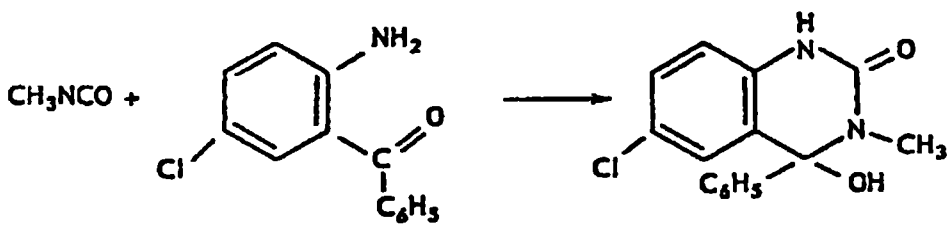
If methyl isocyanate is used to carbamoylate a difunctional molecule, the derivative may be made to cyclize:



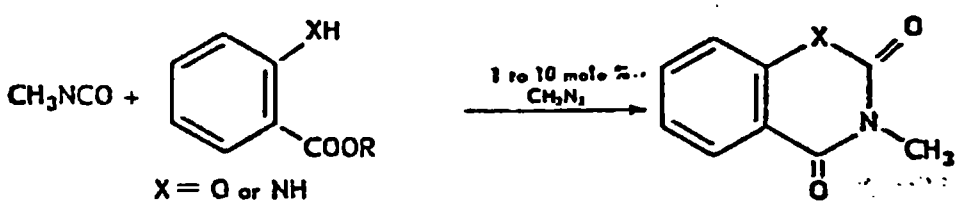

In other cases, cyclization occurs along with addition: Ref.: 14



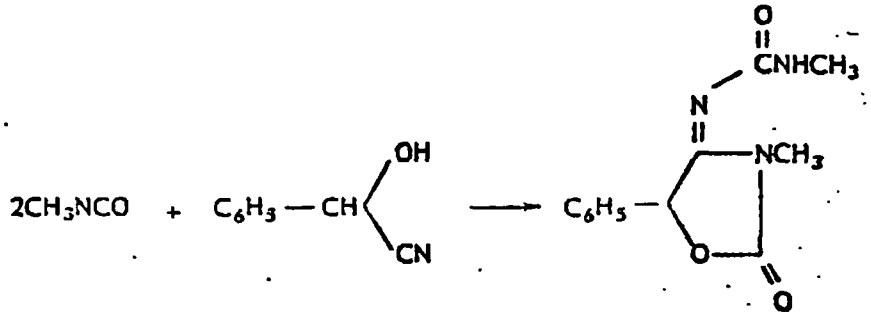

Ref.: 13




Ref.: 28



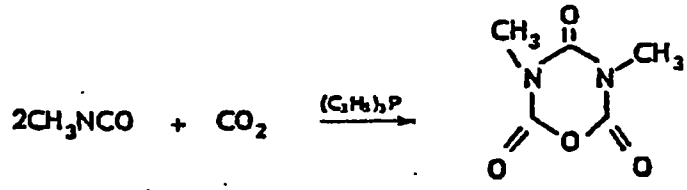

Ref.: 29



Ref.: 31

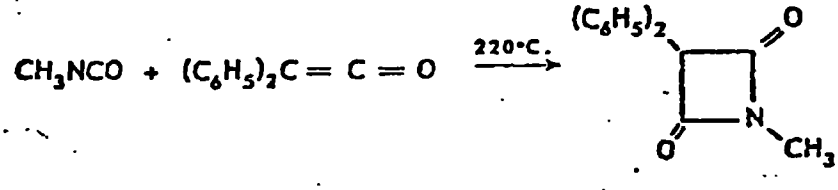
## REACTIONS WITH UNSATURATED COMPOUNDS

Alkyl isocyanates react with some unsaturated compounds to form cyclic addition products,[3] but only a few unsaturated compounds have been found to react with methyl isocyanate. In the presence of triethylphosphine (catalyst), and at room temperature, methyl isocyanate did not react with carbon oxysulfide, carbon disulfide, phenyl isothiocyanate, acetonitrile, nitromethane, quinone, ethylene, acetylene, dimethylketene, or diphenylketene; with aldehydes, carbon suboxide, aldoketenes or cyanic acid, gummy polymers resulted;[5] but with carbon dioxide a product resulted:[4]



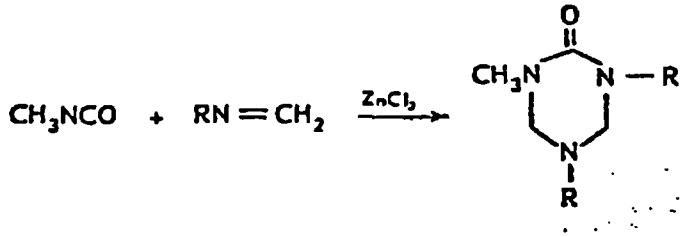
Diazomethane formed an amorphous solid with methyl isocyanate.[5]

At elevated temperatures, diphenylketene reacts as follows with methyl isocyanate:



Ref. : 24

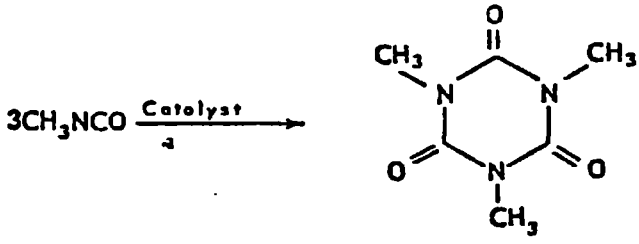
From analogous results obtained with other isocyanates, methyl isocyanate would be expected to react with azomethines:



Ref. : 8

## POLYMERIZATION

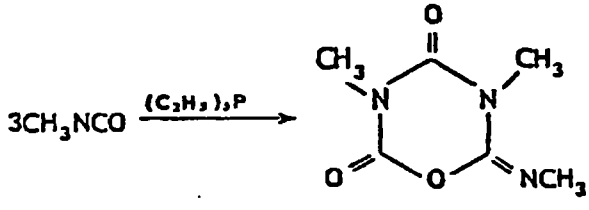
Purified methyl isocyanate will react with itself under the influence of a catalyst to form either a cyclic trimer (trimethyl isocyanurate) or a high molecular weight polymer. The type of polymer formed depends on the catalyst, the catalyst concentration, the temperature, and the methyl isocyanate concentration. Strong bases such as sodium hydroxide, sodium methoxide, and sodium acetate;[3,4] certain metal chlorides, such as ferric chloride and stannic chloride;[32] and some other compounds listed below catalyze trimerization:



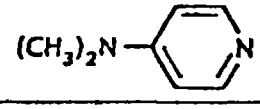

Methyl Isocyanate Trimer
(Trimethyl Isocyanurate)

Since the reaction is quite exothermic (51 Kcal/mole of trimer formed), contamination of methyl isocyanate with traces of these catalysts can cause violent reactions. ***Storage of commercial methyl isocyanate in carbon steel, tin, or copper containers must be avoided since such catalysts are formed from these metals upon standing.***

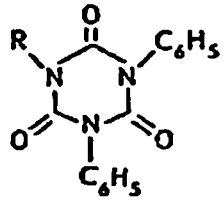
Triethylphosphine catalyzes the formation of an isomeric trimer, it is reported:[4]




### ACTIVITY OF TRIMERIZATION CATALYSTS

| Catalyst (1 to 3% in methyl isocyanate) | Time required for complete trimerization | References |
|---|---|---|
| $NaOCH_3$ | 10 minutes | 32 |
| $(C_6H_5)_3AsO$ | 15 minutes | 21 |
| $(C_2H_5)_3P$ | 1 hour | 4 |
| $FeCl_3$ | 1 hour | 32 |
| $SnCl_4$ | 1.5 hours | 32 |
| $(C_4H_9)_3SnOSn(C_4H_9)_3$ | 62 hours | 25 |
|  | 4 weeks | 25 |

The mode of action of the bis-tributyltin oxide has been studied.[25] By forming an isocyanate catalyst intermediate and reacting it with other isocyanates, mixed trimers could be formed:[25]






ADEQ0022367/14

A radiation-induced polymerization of methyl isocyanate has been reported.[19] Other polymers of alkyl monoisocyanates have been reported,[27] and a recent patent[30] reports that a tough, high-melting polymer can be produced specifically from methyl isocyanate.

## MISCELLANEOUS REACTIONS

**Chlorination:**

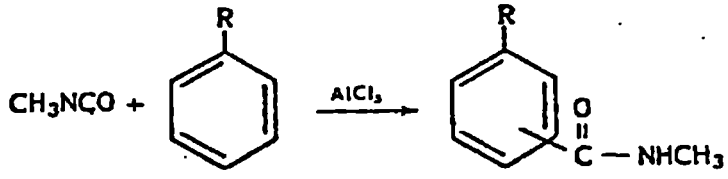
$$CH_3NCO + PCl_5 \xrightarrow{POCl_3} CH_3NCCl_2 + POCl_3$$ Ref. : 10

Addition of organometallic compounds to methyl isocyanate should produce N-methyl amides:

$$CH_3NCO + \begin{matrix} RMgX \\ or \\ RLi \end{matrix} \xrightarrow{H_2O} CH_3NHC(=O)R$$ Ref. : 3

$$CH_3NCO + (C_2H_5)_3Al \xrightarrow{H_2O} CH_3CH_2C(=O)NHCH_3$$ Ref. : 12,26

Isocyanates have been used in the Friedel-Crafts reaction.[11] Methyl isocyanate should produce N-methylbenzamides:



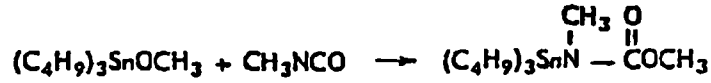

Silicon compounds add to methyl isocyanate; silylamine and silizane derivatives have been observed:

$$CH_3NCO + C_6H_5NHSi(CH_3)_3 \longrightarrow \begin{matrix} C_6H_5NC(=O)NHCH_3 \\ | \\ Si(CH_3)_3 \end{matrix}$$ Ref. : 17

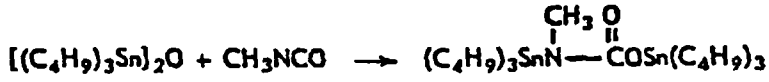
$$CH_3NCO + \begin{matrix} C_6H_5NSi(CH_3)_3 \\ | \\ CH_3 \end{matrix} \longrightarrow \begin{matrix} C_6H_5N-C(=O)-NCH_3 \\ | \qquad\quad | \\ CH_3 \quad Si(CH_3)_3 \end{matrix}$$

$$CH_3NCO + CH_3N\begin{matrix} \diagup Si(CH_3)_3 \\ \diagdown Si(CH_3)_3 \end{matrix} \longrightarrow \begin{matrix} CH_3N-C(=O)-NCH_3 \\ | \qquad\quad | \\ Si(CH_3)_3 \quad Si(CH_3)_3 \end{matrix} \xrightarrow{CH_3NCO} \begin{matrix} CH_3NC(=O)-N(CH_3)-CNCH_3 \\ | \qquad\qquad\quad | \\ Si(CH_3)_3 \qquad Si(CH_3)_3 \end{matrix}$$

Organotin derivatives:



Ref.: 23



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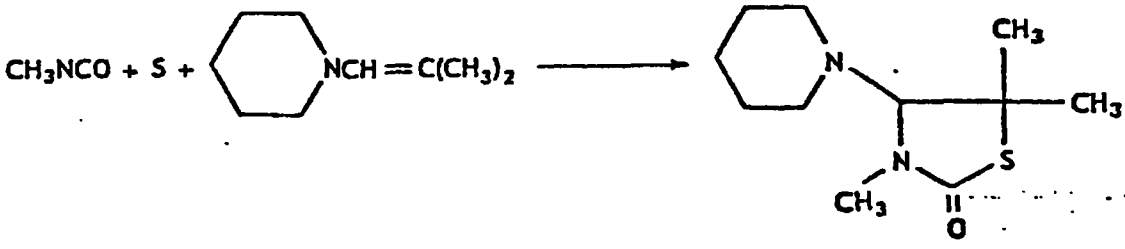
Three component reactions:



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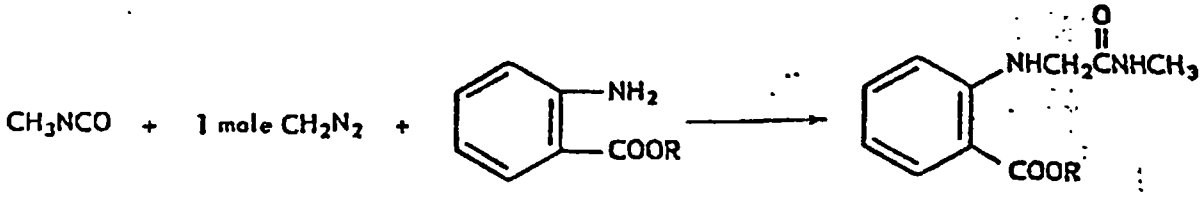

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## STORAGE AND HANDLING

Methyl isocyanate is reactive, toxic, volatile, and flammable. Safe storage and handling require special precautions.

For purposes of transportation, methyl isocyanate is classified by the Bureau of Explosives as a flammable, poisonous liquid and requires both the Red flammable label and Poison B label.

Materials known to be safe for storage and handling are stainless steel, nickel, "Teflon," and glass-lined equipment. Any other material may be unsuitable, *and possibly dangerous* for methyl isocyanate service. Iron or steel, zinc or galvanized iron, copper and its alloys, and tin should not be used.

Because of the hazardous properties of both its liquid and vapor, methyl isocyanate must be kept confined within closed equipment. To exclude moisture and air, the vapor space of tanks and reactors should be blanketed with dry nitrogen having a maximum dew point of −40°F. or C.

Materials that might catalyze a reaction must be excluded. For further information on reactants and catalysts, see the discussion on reactions in this bulletin. Tanks and lines used for storage or transfer of methyl isocyanate should contain only methyl isocyanate or *dry* nitrogen; no common lines or pumps used for other products should be used for methyl isocyanate.

If liquid methyl isocyanate is spilled or must be disposed of, it should be treated to produce controlled decomposition. Vapors should not be vented to the atmosphere; they should also be decomposed. Men working in areas where methyl isocyanate is handled must be informed of its hazardous nature and must have and use protective clothing and equipment.

This information is purposely general in nature. Detailed information is available. In addition, our specialists should be consulted early in the design of any project concerning storage and handling of methyl isocyanate.

## PRECAUTIONARY LABELING

**DANGER!**

**EXTREMELY FLAMMABLE**
**BREATHING OF VAPOR HARMFUL OR FATAL**
**LIQUID CAUSES EYE INJURY AND SKIN BURNS**
**ABSORPTION THROUGH SKIN HARMFUL**

Do not breathe vapors.
Do not get in eyes, on skin or on clothing.
Keep away from heat, sparks and fire.
Do not leave container open.

**POISON!**

**CALL A PHYSICIAN**

IF INHALED — Remove patient to fresh air, give artificial respiration if not breathing. Give oxygen if breathing is difficult.

IN CASE OF CONTACT:
CLOTHING—Remove contaminated clothing and shoes at once. Wash thoroughly before re-use.
EYES AND SKIN—Immediately flush with plenty of water for at least 15 minutes. Get medical attention for eyes.

**IMPORTANT** — Immediately fill container with water and drain.
*Immediately reseal empty tank cars without cleaning.*

**FOR INDUSTRY USE ONLY**

## TOXICOLOGICAL PROPERTIES

Methyl isocyanate is a hazardous material by all means of contact. Since it has a high vapor pressure, inhalation of the material can easily occur if it is improperly handled. Although the "tear gas" effects of the vapor are extremely unpleasant, this property cannot be used as a means to alert personnel to exposure to chronically toxic concentrations of methyl isocyanate. Methyl isocyanate is a poison by inhalation[33,34] as defined in ICC regulations and is intensely irritating to breathe. It causes severe bronchospasm and asthma-like breathing. Sensitization may occur, after which traces of vapor cause true attacks of asthma. Although it does not quite meet the standards that define a poison by swallowing or skin contact, the difference is so small that methyl isocyanate should also be regarded as an oral and contact poison.[33,34] Skin contact can cause severe burns. The liquid will seriously injure the eyes, even when it is diluted with a non-toxic liquid to a one percent concentration. Like other isocyanates (TDI, for example), methyl isocyanate causes sensitization in animals.[34] Since exposure of a group of test animals to traces of methyl isocyanate sensitized the skin of all the animals, such sensitization could probably be expected to occur in humans. The same series of experiments[34] also demonstrated that a cross sensitization to other isocyanates will develop.

***Stringent precautions must be observed to eliminate any possibility of human contact with methyl isocyanate.***

## AVAILABILITY

Large quantities of methyl isocyanate are available on reasonable notice. Drums are available now. Sample shipments are made in special eight-ounce bottles packed in lug-locked sealed cans.



ADEQ0022367/18

## REFERENCES


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# REACTIVE CHEMICALS MANUAL DATA SHEET

UNION CARBIDE CORPORATION
CHEMICALS DIVISION

Chemical Name METHYL ISOCYANATE(MeNCO)
Random (IBM) Number 9142


Empirical Formula

$C_2 H_3 NO$

Synonyms

Methyl ester of isocyanic acid

## A. PHYSICAL PROPERTIES

1. Flammability Properties
   a. Flammability limits, in air, 760 mm.
      Upper--(Calc. by D. H. Way)---------- 16 vol.%
      Lower--(Calc. by D. H. Way)---------- 3.5 Vol.%
   b. Flammability limits, at operating conditions
      (_____ psig at _____ °C)
      Upper---------- * Vol.%
      Lower---------- * Vol.%
   c. Flash Point
      Open cup---------- <0 °F
      Closed cup---------- * °C
   d. Autoignition temperature---------- * °C

2. Boiling Point and Vapor Pressure
   a. Boiling point, 760 mm.---------- 39.1 °C
      300 mm.---------- 16.7 °C
      50 mm.---------- -17.0 °C
      10 mm.---------- -40 °C
   b. Vapor pressure, 20°C---------- 348 mm.
      °C---------- mm.
   c. Critical pressure---------- 55 atm
   d. Critical temperature---------- 218 °C

3. Solubility
   a. Solubility in water, 20°C Reacts slowly, but heat of reaction % by wt.
   b. Solubility of water in, 20°C will increase rate of reaction % by wt.

4. Thermal Properties
   a. Specific heat (liquid), 68 °F---------- 0.443 Btu/lb./°F
   b. Heat of vaporization, 40 °C---------- 222.6 Btu/lb.
   c. Heat of fusion, _____ °C---------- * Btu/lb.

5. Specific Gravity
   a. Specific gravity, 20°C---------- 0.9599
   b. Coefficient of expansion, 20°C---------- 0.00148 per °C

6. Absolute viscosity, 0 °C---------- 0.35 centipoises
   20 °C---------- 0.25 centipoises

7. Freezing Point---------- less than -80 °C

8. Molecular Weight---------- 57.05

*Data not available.

## B. DESCRIPTION OF REACTIVITY

Type - Reacts with active hydrogen compounds with evolution of heat.

a. Chemical equations

acids (1) $HX + MeNCO \longrightarrow MeNHCO\text{-}X$

amines (2) $R_2NH + MeNCO \longrightarrow R_2NC(=O)NHMe$

water (3) $H_2O + MeNCO \longrightarrow MeNHC(=O)\text{-}NHMe$

alcohol & phenols (4) $ROH + MeNCO \longrightarrow MeNH\text{-}C(=O)\text{-}OR$

strong bases anhydrous (5) $MeNCO \xrightarrow{\text{Catalyst (B)}} (MeNCO)_3$ (Trimer)

b. Heat of reaction - All of the reactions above are exothermic. Reaction 5 produces 537 BTU/lb of MeNCO reacted; reaction 1 with the use of HCl produces approximately 280 BTU/lb of MeNCO reacted.

c. Rate of reaction - Reactions 1 and 2 are very fast. Reactions 3 and 4 are slow at ambient temperatures and in the absence of catalysts (amines or tin compounds). The rate of reaction 5 is strongly dependent on kind and amount of catalyst. Traces of NaOR produce very rapid reaction (minutes); $Ca(OH)_2$ produces measurable $(MeNCO)_3$ after months.

## C. CATALYTIC AGENTS

Specific catalysts

a. Trimerization reaction is catalyzed by $E+_3P$, Bases (e.g. NaOMe, NaOAc, (R+N) OH, etc.), Oxalic acid, Lewis acids (e.g. $FeCl_2$ or $FeCl_3$, $ZnCl_2$, $AlCl_3$, etc.). See "M."

b. Tertiary amines (including pyridine) cause an insoluble white polymer to form on surfaces in the vapor.

c. Per cent

(1) As little as 50 ppm with some catalysts.

(2) One tenth percent shows polymer formation.

d. Temperature

(1) Trimerization rate is strongly dependent on temperature (with $FeCl_3$ catalyst the rate was 200 times slower at 0°C than at 25°C).

(2) Unknown.

## D. MATERIALS OF CONSTRUCTION FOR STORAGE AND HANDLING

1. Safe - Stainless steel #304 and #316, MONEL metal, nickel, glass, Teflon,

D. MATERIALS OF CONSTRUCTION FOR STORAGE AND HANDLING (continued)

2. Unsafe - Carbon steel, copper, polyethylene, essentially all elastomers.

Reason - Steel and copper react slowly with traces of methylcarbamoyl chloride (produces HCl) to form an active trimerization catalyst. Methyl isocyanate diffuses through polyethylene. Elastomers are attacked.

E. PEROXIDE FORMATION

Does not form peroxides.

F. DETECTION OF HAZARDOUS CONDITIONS

1. Analyses (laboratory and unit methods) - Methods required are those required to detect trimerization potential of refined MeNCO.

   a. Impurities - Methyl carbamoyl chloride - method is available.

   b. Catalysts - Iron can probably be determined by a colorimetric method or by emmision spectroscope. A method is under development.

   c. Decomposition products - An IR method for trimer detection is available (determines as little as 0.04% trimer).

2. Observation - In the presence of steel and methyl-carbamoyl chloride the MeNCO slowly turns light green. Deepening of the color indicates a greater potential for trimerization. Just as rapid trimerization begins, the MeNCO turns a tan color, and the mixture becomes rust colored as trimer is formed in quantity. No changes in the color of the MeNCO occur in the copper catalyzed trimerization.

G. METHOD OF PREVENTING REACTIVITY HAZARDS

1. MeNCO must not be allowed to contact active hydrogen compounds (see Sec. B-a). If contact inadvertently occurs the mixture should (1) be cooled, if possible, or (2) diluted with an inert solvent, such as MEK, acetone, chloroform, or toluene.

2. To prevent trimerization of MeNCO on contact with steel, MeNCO should be kept free of acids.

If the trimerization does begin, the reaction can be moderated by cooling the MeNCO. Addition of dimethyl acid pyrophosphate (0.1 per cent will saturate the MeNCO) will nearly stop the reaction. MeNCO that must contact steel should be inhibited with dimethyl acid pyrophosphate.

## H. METHODS OF REACTION CONTROL

1. Temperature - Cooling.

2. Pressure - None.

3. Precautions for shock, light, etc. - Not applicable.

4. Dumping - Reacting mixtures should be dumped into large volumes of ammonia solution (preferably in MeOH or acetone) or aqueous caustic.

5. Neutralization - See "G."

## I. HANDLING CONDITIONS

1. Unfavorable (i.e. shock, heat, light, overpressure) - Pure methyl isocyanate is stable to heat, light, and moderate pressures.

2. Waste disposal methods - Treat with caustic, sewer caustic layer, and burn remainder.

## J. HEALTH HAZARDS

1. Inhalation - Extremely irritating - Respiratory protection mandatory. If exposure results in apnea, needs mouth-to-mouth resuscitation after removal from contaminated atmosphere. Take to Medical Department. Medical treatment under direction of M.D. is $O_2$ under positive pressure and symptomatic and supportive therapy mandatory.

2. Ingestion - Extremely irritating - If swallowed, drink one pint $H_2O$ followed by emetic. After emesis, drink one pint water and bring victim to physician. Needs gastric lavage and symptomatic and supportive therapy mandatory.

3. Skin contact - Immediately remove contamination with copious amounts of soap and water. Exposures must be reported to Medical Department because MeNCO probably a strong sensitizing agent.

4. Eye hazard - After exposure, immediate use of eyebath for at least 10 minutes and then report to Medical Department.

5. Industrial hygiene practices

   a. Recognition - Methyl isocyanate is a strong lacrimator but this should not be relied upon for safe handling. The odor is detectable only for a short period of time (less than 30 seconds) in atmospheres of 5 parts per million.

5. Industrial hygiene practices (continued)

The compound boils at 38 to 39° C. which gives 100% pure MeNCO vapor. Moisture must be kept out, for water or acid in methyl isocyanate generates carbon dioxide - will rupture containers.

The vapor pressure is 348 at 20° C. so saturated vapor is about 450,000 ppm at this temperature. Instant death will occur if saturated vapors are breathed.

b. Evaluation - A rigorous air sampling program should be performed during start-up of new facilities. This program should be under the direction of the industrial hygienist who will evaluate the findings and make recommendations. A periodic sampling program should be conducted to assure that MeNCO vapors are maintained below the Threshold Limit Value of 0.02 ppm (tolylene di-isocyanate) until an established limit is available.

c. Recommended control procedures:

(1) Enclosure of all processes should be practiced.

(2) Process ventilation should be available.

(3) This is an exceedingly hazardous chemical when breathed or contacted with the eyes.

(a) Approved air-supplied respiratory protection must be worn while handling methyl isocyanate.

(b) Skin and eye contact must be avoided. Approved protective clothing should be worn by operating personnel.

(c) Maintenance personnel should be protected from MeNCO while performing work on equipment in process units. Equipment should be thoroughly decontaminated before taking to maintenance shops for repair.

(4) All exposed personnel should be seen by a physician.

## K. FIRE FIGHTING CONSIDERATIONS

1. Type extinguisher - Dry chemicals, $CO_2$, water spray.

2. Unsafe methods - None known.

# METHYL ISOCYANATE

## TOXICOLOGICAL PROPERTIES

Methyl isocyanate is a hazardous material by all means of contact, and since it has a high vapor pressure, inhalation of the material can easily occur if it is improperly handled. Although the "tear gas" effects of the vapor are extremely unpleasant, this property cannot be used as a means to alert personnel to exposure to chronically toxic concentrations of methyl isocyanate. Methyl isocyanate is an ICC Class B poison by inhalation as defined in the regulations and is intensely irritating to breathe. It causes severe bronchospasm and asthma-like breathing. Sensitization may occur, after which traces of vapor cause true attacks of asthma. Although it does not quite meet the standards that define a poison by swallowing or skin contact, the difference is so small that methyl isocyanate should be also regarded as an oral and contact poison. Skin contact can cause severe burns, and the liquid will seriously injure the eyes even when it is diluted with a nontoxic liquid to a one percent concentration. Like other isocyanates (TDI, for example) methyl isocyanate causes sensitization in animals. Since exposure of a group of test animals to traces of methyl isocyanate sensitized the skin of all the animals, such sensitization could probably be expected to occur in humans.

Stringent precautions must be observed to eliminate any possibility of human contact with methyl isocyanate.

Single oral dose in Rats: $LD_{50}$ -- 71 mg/k

Single skin penetration in Rabbits: $LD_{50}$ -- 0.22 ml/k

Single inhalation by Rats: $LD_{50}$ -- 0.103 mg/L (44 ppm)
2 mg/L inhaled for 1 hour killed 6/6 Rats

Skin irritation in Rabbits: undiluted caused severe burns
10% solution caused irritation

Eye injury in Rabbits: severe corneal injury from the liquid and from a 1% solution in Deobase.

APPENDIX "B"

# IMPORTANCE OF PREVENTING CONTAMINATION OF MIC

I. Trimerization

1. Trimerization of MIC to trimethyl isocyanurate is catalyzed by iron, steel, zinc, copper and tin.

2. MIC can be exposed to stainless steel, nickel and aluminum without trimerization occurring.

3. Trimerization is exothermic to the extent of 540 BTU per pound. ✓

4. There is an induction period which depends on temperature, surface to volume ratio, the metal, and the proportion of hydrolyzable chloride present in the MIC.

5. The induction period is characterized by slow formation of trimer and coloration of the MIC. Eventually, the reaction becomes violent because the high heat of trimerization increases the temperature of the MIC, thus increasing the reaction rate. The low boiling point of MIC makes the reaction particularly likely to rupture containers.

6. By maintaining MIC temperature below -10°C, trimerization can be prevented, even in the presence of large amounts of catalysts. (0.35% trimer at 6°C after 40 days. None at -40°C.)

7. Compounds of the metals which are catalytic will also catalyze trimerization.

8. Strong bases, including amines, also catalyze trimerization of MIC.

II. Polymerization

1. Linear polymerization of MIC vapor is catalyzed by amines. $CO_2$ inhibits this.

2. Very pure liquid MIC, containing no chlorides, polymerizes spontaneously to a linear polymer.

3. This polymerization can be catalyzed by dimethylaniline, and presumably other amines.

4. Exothermic heat of polymerization is 345 BTU per pound.

b. Four 1 piece suits complete with integral head, face shield and fresh air masks for work of more hazardous nature. Offers complete liquid exposure protection and fresh air supply.

8. Toxic Gas Alarms.

a. Local
b. Plant.

# APPENDIX "D"

## PROCEDURE FOR HANDLING AN MIC SPILL OUTSIDE OF A PLANT

### GENERAL GUIDELINES

A. If there is a tank car rupture and a fire, let the MIC burn while protecting adjacent property.

B. If there is a tank car rupture and no fire, do the following:

1. Evacuate the area.
   Size of the area depends on prevailing wind, temperature, size of spill, surrounding terrain, etc.

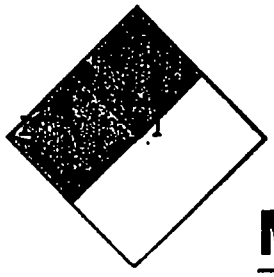
2. Ignite the MIC car if it can be safely done.

3. If the spill can't be ignited - do the following:

   a) Cover with activated carbon (available at a water treating facility).

   b) React with water using some basic material such as caustic, lime, or ammonia to accelerate the reaction.

4. If there is a small leak flood with water until the leak is stopped or its contents can be transferred.



No. BE-13.04

# MATERIAL HAZARDS CARD

**MATERIAL NAME(S):** METHANOL (METHYL ALCOHOL)

**DESCRIPTION:** CLEAR, COLORLESS LIQUID

**HANDLING, STORAGE:** SEE OPERATING INSTRUCTIONS. USE STEEL OR GLASS CONTAINERS.

## HAZARDS

**FIRE:** FLAMMABLE - MAY BE IGNITED BY HEAT, SPARKS OR OPEN FLAME.

**EXPOSURE:** VAPOR HARMFUL

**REACTIVITY:** NOT DANGEROUSLY REACTIVE

## IN CASE OF

| ACCIDENT | DO THIS |
|---|---|
| SPILL OR LEAK | SHUT OFF IGNITION. NO SMOKING OR FLARES. KEEP PEOPLE AWAY. SHUT OFF LEAK IF WITHOUT RISK. FLUSH AREA WITH WATER SPRAY. |
| FIRE | N SMALL FIRE USE DRY CHEMICAL OR CARBON MONOXIDE. N LARGE FIRE USE WATER SPRAY OR "ALCOHOL" FOAM. OOL TANK WITH WATER IF EXPOSED TO FIRE. |
| EXPOSURE | EMOVE TO FRESH AIR. |

**MATERIAL NAME(S):** METHANOL (MeOH)

**REFERENCES:**

MCA CHEM CARD CC-69
MCA SAFETY DATA SHEET SD-22
DU PONT METHANOL UNLOADING, HANDLING AND STORAGE SYSTEMS BULLETIN A-13385

## PHYSICAL PROPERTIES:

BOILING POINT, 760 MM.....64.5°C (148°F)
FLASH POINT, T.C.C.....12°C (54°F)
T.O.C.....16°C (61°F)
SPECIFIC GRAVITY 20/40°C .....0.7910

## CHEMICAL PROPERTIES:

CORROSIVITY.....NONCORRSIVE AT NORMAL ATMOSPHERIC TEMPERATURES
EXCEPTION - LEAD AND ALUMINUM
HYGROSCOPICITY .....NONE
LIGHT SENSITIVITY.....NONE
REACTIVITY.....NOT DANGEROUSLY REACTIVE.
SOLUBILITY.....MISCIBLE IN ALL PROPORTIONS WITH WATER

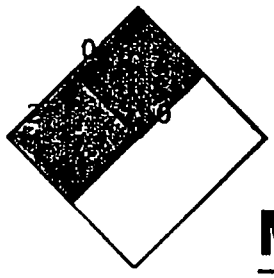
## FIRE & EXPLOSION DATA:

FLAMMABLE LIMITS, PERCENT BY VOLUME IN AIR AT STP: 7.3 TO 36

AUTOIGNITION TEMPERATURE: 470° C (878°F)

## HEALTH DATA:

THRESHOLD LIMIT IN AIR: 200 PPM BY VOLUME
262 MILLIGRAMS PER CUBIC METER



Hous-16
No._____

# MATERIAL HAZARDS CARD

**MATERIAL NAME(S):** Methylene Chloride, Dichloromethane, "MCl"

**DESCRIPTION:** Clear, colorless highly volatile liquid with pleasant, ethereal odor.

**HANDLING, STORAGE:** Stored in carbon steel tanks.

## HAZARDS

**FIRE:** Practically nonflammable and nonexplosive at ordinary temperatures, but at higher temperatures under favorable laboratory test conditions, it is capable of forming weakly combustible mixtures with air.

**EXPOSURE:** Vapor inhalation may produce nausea, dizziness, headaches. Skin contact will cause excessive dryness and skin cracking (defatting).

**REACTIVITY:** Reacts with aluminum, titanium, and strong basic salts.

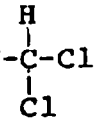
## IN CASE OF

| ACCIDENT | DO THIS |
|---|---|
| SPILL OR LEAK | Spills should be cleaned up immediately. In high vapor concentrations, wear breathing air mask Use mops, rags to soak up leaks, spills, then place them out of doors where they can be dried safely. Wear splash-proof goggles and gloves. |
| FIRE | Practically non flammable. Spray MCl tank with water if exposed to fire. If MCl fire occurs, wear air demand mask to fight fire and use any type fire fighting apparatus. Beware of toxic fumes (phosgene) see "HEALTH DATA" section. |
| EXPOSURE | Eye and skin exposure - flush with copious quantities of water.<br>Vapor inhalation - remove from fumes to fresh air If overcome, apply artificial respiration and call physican.<br>Ingestion - Induce vomiting, call physician. |

## MATERIAL NAME(S): Methylene Chloride, Dichloromethane, "MCl"

CHEMICAL FORMULA: $CH_2Cl_2$

CHEMICAL STRUCTURE:



## REFERENCES:


MCA Safety Data Sheet SD-86 (July, 1962)
Lange-Handbook of Chemistry (Tenth edition)
DuPont - Electrochemicals Dept., Chlorine Products Bulletins 524-1267 and 526-659
Underwriters Laboratories Report MH-2375, Nov., 1933


## PHYSICAL PROPERTIES:

STATE: Liquid

COLOR: Clear, water white

ODOR: Pleasant, aromatic, faintly ethereal

DENSITY: 1.326 g/cc @ 20/4°C

MELTING POINT: -96.7°C

BOILING POINT: +39.8°C

## CHEMICAL PROPERTIES:

MOLECULAR WEIGHT: 85.0

CORROSIVE: Noncorrosive at normal temperatures when moisture free. In contact with water especially at elavated temperatures, MCl will corrode iron, some stainless steels, copper, nickel and /other metals

SOLUBILITY IN $H_2O$: 2% at 20°C (immiscible)

SOLUBILITY IN ALCOHOLS: Infinite

## FIRE & EXPLOSION DATA:

FLASH POINT: Not found

AUTO IGN. TEMP.: 1224°F

AUTO DECOMP. TEMP.: Not found

LOWER EXPL. LIMIT: 15.5% volume)

UPPER EXPL. LIMIT: 66.0% volume)

MIN. IGNITION ENERGY: Not found

(dp/dt) max.: Not found

in oxygen only under pressure

## HEALTH DATA:

ALD: Not found

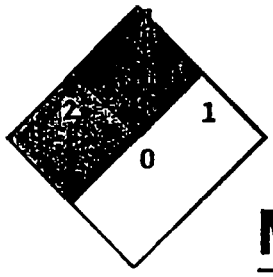
$LD_{50}$: Not found

TLV: 500 ppm

DETECTION THRESHOLD: 25 - 50 ppm

EXPOSURE SYMPTOMS: Not found

MAJOR SAFETY CONSIDERATION: MCl is an anesthetic, chief hazard is loss of consciousness following vapor inhalation at elevated temperatures,




No._____

# MATERIAL HAZARDS CARD

**MATERIAL NAME(S):** MTAAO, (S-methyl-N-hydroxy thioacetimidate)

**DESCRIPTION:** White crystals at room temperature but usually in a solution of water or methylene chloride.

**HANDLING, STORAGE:** Handle as a corrosive, toxic liquid. For sampling, wear rubber gloves and goggles.

## HAZARDS

**FIRE:** MTAAO has a very low vapor pressure and is not a serious fire hazard. However if exposed to open flame, it will burn, forming obnoxious and potentially toxic fumes.

**EXPOSURE:** Vapors not strong but common solvent (methlene chloride) may cause respiratory irritation.

**REACTIVITY:** Not highly reactive with most common gases or metals.

## IN CASE OF

| ACCIDENT | DO THIS |
|---|---|
| SPILL OR LEAK | Isolate area. Keep upwind. If necessary to enter spill area, wear full protective clothing and a self-contained breathing apparatus. Wash spill with copious amounts of water. |
| FIRE | Avoid fumes which are obnoxious and potentially toxic. Extinguish fire with water or foam. |
| EXPOSURE | Immediately flush exposed area with water for at least 15 minutes. If not breathing, apply artificial respiration. Call a physician. Remove contaminated clothing. Keep patient at rest. |

## MATERIAL NAME(S):

MTAAO ( S-methyl-N-hydroxythioacetimidate )

## REFERENCES:

Product 10 Operating Instructions, 1975

## PHYSICAL PROPERTIES:

Melting Point: 91-92°C
Boiling Point: Not Available
Vapor Pressure @ 25°C: Not Available

## CHEMICAL PROPERTIES:

Chemical Formula: $C_3H^7SNO$

Molecular Weight: 105.2

Reacts with methyl isocyanate to form methomyl.

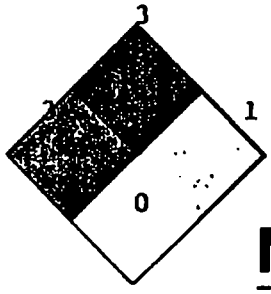
## FIRE & EXPLOSION DATA:

Fire: Burns in open flare to form obnoxious and potentially toxic fumes.

Explosion: Decomposes explosively when confined heating above 130°C is applied.

## HEALTH DATA:

Approximate Lethal Dose: 670 mg/Kg
Causes eye irritation, but effects are reversible.
MTAAO shows no cumulative oral toxicity.




No._____

# MATERIAL HAZARDS CARD

**MATERIAL NAME(S):** "Lannate" L Methomyl Insecticide

**DESCRIPTION:** "Lannate" L is a 25% solution of methomyl in 90% methanol - 10% water.

**HANDLING, STORAGE:** "Lannate" L is packed in 1 gal and 5 gal containers and is shipped in bulk. It is handled in 300 series stainless steels and in some plastics.

## HAZARDS

**FIRE:** "Lannate" L is flammable, producing toxic and obnoxious fumes on combustion.

**EXPOSURE:** Methomyl is a cholinesterase inhibitor. Most rapid and pronounced toxic effects are caused by oral ingestion.

**REACTIVITY:** Methomyl decomposes on strong heating. It is sensitive to confined heating and may explode at temperatures above 136°C (277°F).

## IN CASE OF

| ACCIDENT | DO THIS |
|---|---|
| SPILL OR LEAK | [illegible] spread where possible. Avoid all use of fires or flames and protect from other ignition sources. Clean up spill in best practicable manner. If outside sp occurs try to avoid contaminating natural waters: methom is fatal to marine animals in concentrations as low as 10 ppm. |
| FIRE | Water is an effective fire-fighting agent; it is complete miscible with "Lannate" L. |
| EXPOSURE | Seek medical help immediately. Atropine sulfate is an effective antidote and may be administered orally or intravenously. |

IC-20842 [illegible] Houston [illegible] 11/20/

## MATERIAL NAME(S):

"Lannate" L Methomyl Insecticide: a 25% solution of methomyl in 90% methanol - 10% water. (1.8 lb/gal)
Methomyl: S-methy-N-[(methylcarbamoyl)oxy]thioacetimidate.

## REFERENCES:

Product 10 Operating Instructions, 1975

## PHYSICAL PROPERTIES:

Physical State: Liquid

Color: Dark Brown

Incipient Crystallization Temperature: - 2°C (28°F)

Density: 7.4 lb/gal

Boiling Point: 70°C (159°F)

## CHEMICAL PROPERTIES:

Molecular Weight: 162

Miscibility with Water: Total

## FIRE & EXPLOSION DATA:

Flash Point: 14°C (58°F)

Auto-decomposition Temperature: 136°C (277°F)

Methanol from "Lannate" L will form explosive mixtures with air; explosive limits are 6.7% to 36.5% methanol. These vapor compositions will be in equilibrium with "Lannate" L at temperatures of 11°C (52°F) and 44°C (111°F).

## HEALTH DATA:

Approximate Lethal Dose: 9 ml (0.3 oz) orally (in a 180 lb man)

Symptoms: headache, nausea, weakness, pupillary constriction, diarrhea. (More rapid and pronounced toxic effects are caused by oral ingestion.)

Antidote: atropine sulfate, administered orally or intravenously.

(Inhalation of methanol vapors can cause dizziness, intoxication, etc. Oral ingestion of methanol may cause blindness.)

## Information for Physicians Regarding Symptomatology and Treatment in "Lannate" Methomyl* Insecticide Poisoning Cases

Methomyl is a carbamate-type insecticide with a high degree of acute toxicity. Its toxic effects are related to the inhibition of blood and tissue cholinesterases and thus to an accumulation of excessive amounts of acetycholine in effector organs. Overexposure to methomyl would not be expected to result in a toxic effect to a specific organ in the usual sense of the word, such as a toxic hepatitis.

Methomyl intoxication would most likely occur from exposure to the dust or spray mist or it could occur if ingested. Methomyl is not readily absorbed through the intact skin.

### Signs and Symptoms

Signs and symptoms which may be expected to occur in the less severe poisoning cases are as follows:

1. Constriction of pupils (miosis)
2. Sweating, profuse
3. Weakness
4. Slow pulse
5. Nausea and vomiting
6. Muscle tremors
7. Blurred vision
8. Abdominal cramps and diarrhea

The exact order of onset of these signs and symptoms will vary but those given here are among the first to occur following over-exposure to this material. Clinical evidence of methomyl intoxication generally becomes apparent within a matter of minutes to within an hour following the exposure, the exact time depending on the severity and route of exposure.

* Methomyl is the common name for S-methyl-N-[(methylcarbamoyl)oxy] thioacetimidate

Since methomyl is a cholinesterase inhibitor, presumably any of the signs and symptoms associated with cholinesterase inhibition could occur and would depend on the severity and type of exposure. These are outlined in Table 1.

## Diagnosis

Diagnosis of methomyl intoxication can be made from a history of exposure followed by the onset of all or more likely some of the signs and symptoms listed in Table 1. The diagnosis can be confirmed by measuring the activity of the blood cholinesterases using an appropriate method such as the Ellman method.* However, the cholinesterase activity with this class of compounds may return to normal very rapidly after exposure; therefore a normal level does not disprove the diagnosis.

Some of the commonly used methods of determining acetycholinesterase activity in cases of organophosphorous intoxication are not desirable for this determination in cases involving carbamates. These methods involve measurements of change in pH and are patterned after the method originally described by Michel.**

## Medical Management

The treatment of methomyl intoxication may be summarized as follows:

1. Termination of exposure.

In the case of an inhalation exposure, remove person to an uncontaminated atmosphere. In case of contact, remove contaminated clothing and wash promptly contaminated skin or eyes with copious amounts of water. If ingestion has occurred, gastric lavage should be performed.

2. Atropine administration.

The appearance of any local or systemic signs or symptoms of anticholinesterase poisoning calls for the immediate use of atropine. This drug is antidotal because it inhibits the action of acetycholine at its many sites of action, with the exception of the voluntary muscles.

* G. L. Ellman, K. D. Courtney, V. Adrees and R. M. Featherstone, Biochem. Pharmacol., 7:88 (1961).

** H. O. Michel, J. Lab. Clin. Med., 34:1564 (1949).

In mild intoxication, 1.2 to 2 mg of atropine should be administered intramuscularly or intravenously initially and repeated at 10- to 30-minute intervals until symptoms are relieved and full atropinization (dry skin and dry mouth) is achieved. Maintain a mild degree of atropinization until patient recovers. In the mildest of cases, atropinization might be maintained by oral or sublingual administration of atropine tablets, 1/100 gr. (0.6 mg), as indicated by the recurrence of symptoms.

In severe intoxication, the initial atropine dosage should be 2 to 4 mg intravenously, with repeated intravenous administration of 2 mg every three to ten minutes until signs and symptoms disappear.

Note: 2-PAM (pyridine-2-aldoxime methiodide) should not be used in the treatment of methomyl poisoning since animal studies have shown it to be ineffective as an antidote not only for methomyl but other carbamate insecticides as well.

In addition, morphine and other respiratory depressants are contraindicated.

3. Removal of secretions and maintenance of open airway.

Whenever necessary, steps should be taken to remove excessive secretions from the respiratory tract and to maintain an open airway. These procedures include suction and the possible insertion of an endotracheal tube.

4. Artificial respiration when necessary.

In the severe intoxication cases, artificial respiration or oxygen administration may be necessary.

5. Alleviation of convulsions if these interfere with respiration and are not relieved by atropine.

Administer trimethadion (Tridione), 1 gram intravenously every 15 minutes up to a maximum of 5 grams, or sodium thiopental (2.5% solution) intravenously. Convulsions would not be expected except in the most severe intoxication.

Note to physician: Allow no further exposure to any cholinesterase inhibitors until full recovery is assured. Measurement of blood cholinesterase activity may be useful in this regard.

Detailed information concerning the treatment of intoxication by cholinesterase inhibitors is available in the following sources:

(1) B. Holmstedt, Pharmacol. Rev., 11:567 (1959).

(2) G. B. Koelle, Handbuch. Exp. Pharm., XV:1006 (1963).

First Aid

The following steps should be taken before the arrival of a physician:

(1) If swallowed, induce vomiting by giving warm salt water (a tablespoonful of salt in a glass of water) and repeat until vomit fluid is clear.

(2) If inhaled, remove person from exposure, have him lie down and keep quiet.

(3) In case of contact, remove contaminated clothing and wash contaminated skin or eyes with copious amounts of water.

(4) If patient has difficulty in breathing, start artificial respiration immediately.

(5) Give two tablets of atropine, each 1/100 gr. (0.6 mg), orally or by dissolving under the tongue if they are available at hand. Thereafter, every 10 to 15 minutes, give one atropine tablet repeatedly until throat and skin become dry. Give additional tablets as necessary to maintain dry throat and skin.

Haskell Laboratory
E. I. du Pont de Nemours & Company
Wilmington, Delaware

TABLE 1

SIGNS AND SYMPTOMS OF ANTICHOLINESTERASE POISONING*

| Site of action | Signs and symptoms |
|---|---|
| | **Following local exposure** |
| Pupils | Miosis, marked, usually maximal (pin-point), sometimes unequal |
| Ciliary body | Frontal headache, eye pain on focusing, slight dimness of vision, occasional nausea and vomiting |
| Conjunctivae | Hyperaemia |
| Nasal mucous membranes | Rhinorrhea, hyperaemia |
| Bronchial tree | Tightness in chest, sometimes with prolonged wheezi expiration suggestive of bronchoconstriction or increased secretion, cough |
| Sweat glands | Sweating at site of exposure to the liquid |
| Striated muscle | Fasciculations at site of exposure to the liquid |
| | **Following systemic absorption** |
| Bronchial tree | Tightness in chest, with prolonged wheezing expirat suggestive of bronchoconstriction or increased secretion, dyspnea, slight pain in chest, increa bronchial secretion, cough |
| Gastro-intestinal system | Anorexia, nausea, vomiting, abdominal cramps, epigastric and substernal tightness (? cardiospa with "heartburn" and eructation, diarrhea, tenesmus, involuntary defecation |
| Sweat glands | Increased sweating |
| Salivary glands | Increased salivation |
| Lachrymal glands | Increased lachrymation |
| Heart | Slight bradycardia |
| Pupils | Slight miosis (occasionally unequal), later more marked |
| Ciliary body | Blurring of vision |
| Bladder | Frequent or involuntary micturition |
| Striated muscle | Easy fatigue, mild weakness, muscular twitching, fasciculations, cramps, generalized weakness including muscles of respiration, with dyspnea and cyanosis |

TABLE 1 (Contd.)

SIGNS AND SYMPTOMS OF ANTICHOLINESTERASE POISONING*

| Site of action | Signs and symptoms |
|---|---|
| | Following systemic absorption |
| Sympathetic ganglia | Pallow, occasional elevation of blood pressure |
| Central nervous system | Giddiness; tension; anxiety; jitteriness; restlessness; emotional lability; excessive dreaming; insomnia; nightmares; headache, tremor; apathy; withdrawal and depression; bursts of slow waves of elevated voltage in EEG especially on overventilation; drowsiness, difficulty in concentrating; slowness of recall; confusion; slurred speech; ataxia; generalized weakness; coma with absence of reflexes; Cheyne-Stokes respiration; convulsion depression of respiratory and circulatory centr with dyspnea, cyanosis, and fall in blood press |

* From B. Holmstedt, Pharmacol. Rev., 11, 567 (1959) as cited in WHO Technical Report Series No. 227, Toxic Hazards of Pesticides to Man, p. 14 (1962).

VERTAC CONSOLIDATED
A MEMBER OF THE VERTAC GROUP
SUITE 2414 • 5100 POPLAR
MEMPHIS, TN 38137

Copy to
J Miles ✓
Mike McK

INTER-OFFICE CORRESPONDENCE

DATE: July 30, 1976

TO: J. W. Shackelford

FROM: J. J. O'Neill

SUBJECT: DUPONT CONTRACT

REPLY REQUESTED BY (DATE)

Subject negotiating meeting is set for August 17 in Wilmington. I request your cooperation in developing a proposal and providing supporting data by August 12, on which date, with your concurrence, we will meet at Eagle River to finalize our position.

In preparing a proposal i.e., a new Exhibit C, please take into account that there is in existence a contract between DuPont and Vertac that is not open-ended. It is negotiable only as provided in the contract and within the "maximums" agreed to at the signing. To date, DuPont has agreed to pay certain costs exceeding the "maximums" but they had no obligations to do so. It is quite apparent they will give very little more, if any, and will in fact back us down from the figures established in Exhibit C - revision of 6/29/76 unless very persuasive evidence is supplied to support the reasonableness of our request.

It is our position that it is not in the company's best interest to ask DuPont to cover costs resulting from mistakes made by us in estimating the cost basis for the contract or for costs resulting from inefficiencies due to equipment design or operating practice. We will only ask for excess costs if we can establish that the fault is DuPont's or one that is shared by both of us.

All costs to be specified in Exhibit C fall in at least four important and distinct categories. As a starter I would like to ask that you supply me by August 4th your classification of the Exhibit C cost items as follows:

(1) Usage and/or cost at or below original Exhibit C maximums for which there appears to be no disagreement between the companies.

(2) Usage and/or cost at or below original Exhibit C maximums which are being questioned by DuPont and require justification by us.

(3) Usage and/or cost above original Exhibit C maximum but accepted by DuPont as reasonable (i.e., revision of 6/29) and need no further justification by us.

(4) Usage and/or cost above original Exhibit C maximum, whether or not provided for in the 6/29 revision, that are being questioned by DuPont and require justification by us.

If we concur there is reason to believe that certain of the cost items fall into categories 1 and 3, we will give little or no attention to them at this time.

We must work between now and the 12th to provide all reasonable support data for items in category 2. Our major problem is the category 4 items. I hope that all such items were treated at our meeting of July 23 and that your organization is at work to arrive at a figure for both usage and current costs that we will feel can justifiably be laid on DuPont.

We must be convinced we have a reasonable basis for asking, that is, it is not an excess cost due to a mistake made solely by Vertac in estimating costs for the contract nor due to inefficient operation brought about by a plant design deficiency or poor operating practice for which the fault lies solely with us.

The first of next week I would like to review the category 4 items with you by phone and lay out a plan for arriving at the figure to be asked and the nature of the support data we will need for our meeting with DuPont.

J. O'Neill

JJO/gn

cc: K. Dale
R. Guidi
R. Fabian
D. Palmer

VERTAC CONSOLIDATED
A MEMBER OF THE VERTAC GROUP
SUITE 2414 • 5100 POPLAR
MEMPHIS, TN 38137

INTER-OFFICE CORRESPONDENCE

DATE: AUGUST 19, 1976

TO: MEMO FOR RECORD

FROM: J. O'NEILL

SUBJECT: DU PONT PRODUCT 10 CONTRACT

REPLY REQUESTED BY (DATE)

Met with H. E. Burman, Frank Maderich and Gordon McNeill, Lannate Product Manager on August 17, to discuss Exhibit C. Charles Lansberry joined the group for lunch. Meeting notes follow:

1. Raw Materials

The only issue is Methylene Chloride usage. Du Pont will not accept our proposal for 1.0 pound per gallon of product and stands firm on a maximum of 0.7 pounds per gallon of product. Subject was discussed at length. Du Pont holds that Eagle River reacted slowly to the problem and that it has not yet approached it in a professional manner. They cite the recent addition of an orifice to control flow and minimize flashing as so elementary it should have been done months ago and that this recent action strengthens their opinion that Eagle River has not, in the past, given this problem the study it deserves. They further stated their opinion that the work of Joe Porter on the activated carbon waste treatment is an example of a gross misuse of technical resources when such a major problem with methylene chloride losses exists. We certainly do not have their sympathy.

I advised them that Eagle River felt that Du Pont had not cooperated sufficiently and that on a number of occasions Eagle River had advised me that Du Pont had approved the plant design. All Du Pont personnel quickly advised that Du Pont had not and never would "approve" the design of anyones plant. The lack of engineering services in Du Pont at the time is the reason they sought an outside contractor. They then pulled from the file a letter of February 27, 1975, from Larry Graybill which stated,

> "We are in agreement that the engineering information furnished at the meeting is in agreement with the process as outlined by Du Pont personnel. Your people will go over in more detail to make sure that the P & ID accurately reflects the process as they know it. Your people will make no effort at sizing for other engineering judgement."

The following understanding was reached.

1) They will not pay for more than 0.7 pounds of methylene chloride per gallon of finished product.

2) They will pay, retroactive to July 1, 1976, for any methylene chloride the Eagle River process "consumes" above 0.7 pounds per gallon if proof of the use is established by a competent material balance study.

3) They will cooperate and will agree to the procedure and testing program to be followed to establish the material balance. I required this agreement so that they can not reject our finding as inadequate, after we complete the study.

2. Utilities

They accept our proposed consumption figures with the provision that after the nitrogen meter is installed they will want to be billed for actual consumption if it is less than the agreed to consumption figure.

They asked that we provide them with our present unit costs for utilities to provide a base for future escalation.

Maderich argued at length against accepting the $100 per month add on fixed cost for fire protection, but our proposal was accepted.

3. Operating Labor

They accept the fact that wage increases will occur and asked that we provide the base for the present quarter and that we adjust quarterly in the future. I agreed.

Packaging labor was discussed at length. As expected, they asked why we had not escalated this figure. They accept the present formula but want the current base so that we can also escalate this quarterly, if there is a need.

The problem they find with packaging costs is the add on charges we have been making for special packaging services. They cite that some of our billings are for less than the Du Pont cost of writing a purchase order. Their stand is that the previously negotiated packaging cost should provide for most of the "unusual" packaging conditions and that they are really paying the total cost of maintaining the eleven man packaging crew. Any excess time the crew has is gravy for us. They are willing to pay for packaging requests from their manufacturing department only if we establish that we can not do the job with the regular crew and that we either have to pay for extra help or overtime.

Eagle River will have to examine all Du Pont requests and before doing the job, establish with Du Pont that it will require additional help or overtime for the present crew.

4. Maintenance

This also was discussed at length. Burman still wanted a variable cost component but this was disposed of.

They accept, reluctantly the present staff but also want the present base costs so that there can be quarterly escalation.

5. Miscellaneous Operating Labor

Discussion combined with Number 6 below.

6. Administrative Overhead

This was the principal and most time consuming discussion. They accept the $500 add on cost for packaging materials. Their position on the combined expense items was eloquently argued by both Burman and Maderich. They contend that the contract, as is their custom, was negotiated in good faith on the basis that raw materials, utilities, operating labor and maintenance float and must be established for each contract with usages to be established based on experience utilizing good operating practice. They contend their contractor is not expected to take a contract and specifically that Eagle River should not have taken a contract with out a firm commitment to perform with the supervision and clerical costs, laboratory costs and administrative overhead established by the contract. If we made a mistake it is our own fault and they will not give up any part of their forcasted profit to bail us out.

I argued that the original supervision and clerical costs, namely $916 per month was so far out of line with reality that Du Pont should have recognized it as an obvious calculation mistake. (We are now asking $8610 for this service.) They responded that they were led to believe Eagle River was constructing a $7,000,000 plant and accordingly believed the $916 represented a proper allocation.

In any case they stand firm on the proposition that any mistakes we made in proposed overhead and other miscellaneous services should come from the 50¢ per gallon profit they are paying us rather than from their profit. They explained in detail the procedure that was followed to obtain management approval of the commitment to Eagle River on capital costs and operating costs. Since they cannot raise the selling price of the product, any excess cost they accept from us over the original proposal shrinks their own profit and lowers their promised return on investment. They contend they have given too much already in allowing miscellaneous fixed expenses to go from the original $5381 to $9400 and overhead from $6183 to $6800.

The only basis on which they will accept our claimed full cost is if we renegotiate the Eagle River profit allowance of 50¢ per gallon since this is the only Eagle River contract item that has remained constant. They refuse to go further.

They will accept escalation for Items 5 and 6 as established on June 29, 1976, at a rate of 10% for the year without question. If we insist on a larger figure it will have to go to their corporate economist.

SUMMARY

From the above comments it is apparent that documentation is needed as follows:

1. Raw Materials:

    a) Material Balance for Methylene Chloride

2. Utilities

a) Unit cost for 3rd quarter for all components.

3. Operating Labor

a) Present operating labor cost - for 3rd quarter and for base for further quarterly escalation.

b) Same for packaging labor.

4. Maintenance

a) Same as for 3 a. above.

5. Miscellaneous Operating Expenses

6. Administrative Overhead

a) Documentation to support inflation if we want more than 10%.

7. Waste Disposal

They accept our proposal to invoice them at the actual cost. They expect we will use the lowest cost disposal company. They do not want us to be putting additional material into Pollution Controls.

John J. O'Neill

JJO/cm

cc: R. A. Guidi
J. W. Shackleford
D. M. Palmer
R. Fabian
K. Dale

VERTAC CONSOLIDATED
A MEMBER OF THE VERTAC GROUP
SUITE 2414 • 5100 POPLAR
MEMPHIS, TN 38137

INTER-OFFICE CORRESPONDENCE

DATE: August 19, 1976

TO: R. A. Guidi

FROM: J. J. O'Neill

SUBJECT: PRODUCT 10 CONTRACT

REPLY REQUESTED BY (DATE)

Attached is a full report of the August 17 meeting at DuPont on subject.

(1) Raw Materials

DuPont will pay for all methylene chloride consumption, effective July 1, 1976, if we establish by a competent material balance study, that it is needed for the process and is not being wasted due to inadequate recovery equipment, improper operation or improper material handling.

At the projected output of about 70,000 gallons per month we face the following problem:

| | |
|---|---|
| Pounds of Methylene Chloride paid for by DuPont | 49,000 |
| Pounds of Methylene Chloride lost at 1.0 lb. / gal. | 70,000 |
| Pounds not paid for | 21,000 |

21,000 x $0.1975 = $ 4147/Mo.

Should the material balance study establish, for example, that 0.8 lb/gallon is consumed, our unrecovered cost, until we stop losing the solvent will be $ 2765/month as of July 1.

The following action is a must on the highest priority.

1. Establish Material Balance Procedure
2. Collect Data
3. Establish "consumption" and identify points of loss.
4. Eliminate loss or pay for the extra solvent.

(2) Utilities

(3) Operating Labor

(4) Maintenance

DuPont accepts essentially as claimed by Eagle River.

(5) Miscellaneous Operating Expense

(6) Administrative Overhead

DuPont claims it contracted with Eagle River on the basis that costs 1 - 4 were to be set after start-up and that they are escalatable.

DuPont further claims its contracted, as is its custom, for fixed costs 5 and 6 as proposed by Eagle River and agreed to at contract signing and that they are not negotiable. They do agree to provide an inflation factor of 10 % for the next twelve (12) month period.

The significance of this is as follows:

| ITEM | Orig. Contract | Rev.6/29 | Proposed 8/17 |
|---|---|---|---|
| 5. Miscellaneous Operating Expense | | | |
| Supervisors and Clerical | 916 | 3,000 | 8,610 |
| Operating Materials | 241 | 1,000 | 1,000 |
| Laboratory | 1,266 | 5,000 | 5,264 |
| Shipping and handling | 2,958 | 400 | 900 |
| Sub Total | $ 5,381 | $ 9,400 | $ 15,774 |
| 6. Administrative O/H | 6,183 | 6,800 | 8,370 |
| Total | $11,564 | $16,200 | $ 24,144 |

DuPont contends it gave up $4,636 of its planned monthly profit on the 6/29 revision of which, $1,497 was for a day supervisor which they accepted. They insist that if our Item 5 and 6 costs have gone up, the difference over that accepted by them on 6/29 should be out of our profit of 50 cents per gallon - ($35,000 per month). If we accept this position our contract profit will be reduced by $ 7,444 per month (they have accepted $500 for packaging supplies). Our "new" profit would be $27,556 per month or 39.4 cents per gallon.

Summary

At 70,000 gallons per month our scheduled profit of $35,000 will be reduced by about $7,500 for excessive miscellaneous costs and overhead and $3,000 - $4,000 for methylene chloride losses.

In addition to the methylene chloride study a determination must be made as to the proper supervisor, clerical, and management costs to properly sustain Eagle River at its present sales level.

J. J. O'Neill

JJO/gn

cc: D. Palmer - J. W. Shackelford

Bill — 9-21-79

duPont contract says to invoice Methylene Chloride "at actual cost to Eagle River based upon agreed to consumption rates" of .7 lb/gal. This I had been doing using billing cost of .18281 per gal.

Revised exhibit "C", 1-1-79, states we should bill at .1715 per gal. However I invoiced at actual cost, per contract, which was .18281/gal. *Dave, would you show me where our actual cost was ever .2612 (.18281 ÷ .7). Byron

Byron issued credit to duPont 3/12/79 for $1,471.45 "to correct cost of Methylene Chloride billing" and said correct billing price should be .16975/gal (which is .2425 x .7) and which is .00175/gal less than the revised exhibit "C". So I have been invoicing duPont @ .16975/gal.

This morn. Byron gave me a copy of Diamond's 9/13/79 invoice invoicing us at .2575/lb.

Should I increase invoice price to duPont from .16975 to .18025 ?? or what??

.2575 x .7

Dave

Byron - Bill said "yes"

B

AB0000065756/1

# Eagle River Chemical Corp.

Highway 242

WEST HELENA, ARKANSAS 72390

JANUARY 6, 1977

TO: J. W. SHACKELFORD
FROM: LARRY CONAWAY

SUBJECT: LAB MONTHLY REPORT, DECEMBER, 1976

## I. BASALIN

ALTHOUGH EAGLE RIVER LAB HAS ALL THE NECESSARY ANALYTICAL EQUIPMENT AND MOST OF THE REQURED BASF ANALYTICAL METHODS, WE WOULD REQUIRE 3-4 WEEKS TO PREPARE FOR BASALIN STARTUP AFTER RECEIPT OF KEY ADALYTICAL STANDARDS & CURRENT ANALYTICAL METHODS FROM BASF. THIS TIMESPAN WILL ALLOW US TO FIT THE ANALYTICAL METHODS TO OUR INSTRUMENTATION, CALIBRATE OUR METHODS & VERIFY THAT THE SYSTEMS ARE FUNCTIONING PROPERLY.

## II. DCNB/DCA/PROPANIL

NO ACTIVITY.

## III. LANNATE

Q.C. AS USUAL. TOTAL OF 293 SAMPLES ANALYZED IN DECEMBER. REFER TO ATTACHED PRODUCT 10 ANALYTICAL SURVEY SHEET FOR STATISTICAL DETAILS. NOTE THAT % METHOMYL ANALYSIS INDICATES LITTLE INCREASE FROM III B -V SAMPLES. THIS CAN BE INTERPRETED TO INDICATE THAT THERE IS LESS CONCENTRATION OF PRODUCT DUE TO EVAPORATION OF METHANOL SOLVENT DUE TO SWEEP ON TANKS. PROBABLY COOL WEATHER HAS REDUCED METHANOL EVAPORATION RATE; IN ANY EVENT, CONSERVATION VENTS ON T-109 & T-110 WILL HELP THIS SITUATION WHEN WARM WEATHER COMES AGAIN. THE EXPENSE WILL BE NEGLIBLE & WILL PAY FOR ITSELF BY VIRTUE OF MORE GALLONS OF LANNATE DUE TO LESS EVAPORATION OF METHANOL.

RATHER THAN SAMPLING MTAAO SLURRY TANK FOR % MTAAO AND ADJUSTIING METHYLENE CHLORIDE EXTRACT SOLVENT AMOUNT PROPORTIONATELY TO REDUCE LOSS OF EXCESS $MECL_2$ AS JIM STONE RECOMMENDED TO DUPONT, AL ROHRER OF DUPONT RECOMMENDS THAT WE CONCENTRATE OUR METHYLENE CHLORIDE EXTRACT TO APPROXIMATELY 28% MTAAO BY WEIGHT PRIOR TO METHYL ISOCYANATE ADDITION. HE RECOMMENDS ALSO THAT WE KEEP A CONSTANT CHARGE AMOUNT OF SLURRY INDEPENDENT OF MTAAO CONTENT, AND THAT WE USE ALSO A CONSTANT AMOUNT OF $MECL_2$ IN OUR EXTRACTION. HIS RECOMMENDATION IS BASED ON THE ASSUMPTION THAT THE $MECL_2$ LOSS IS VIRTUALLY ALL IN THE VACUUM STRIP STEP AND, IF THERE IS LESS $MECL_2$ GOING INTO THE STRIP STEP, THE LOSSES OF $MECL_2$ SHOULD BE LOWERED. AL'S RECOMMENDATION IS SOUND IN MY OPINION AND WOULD AVOID AN EXTRA OBNOXIOUS SAMPLE AND ASSOCIATED WORKLOAD FOR THE LAB. THIS COULD BE DONE ON A PLANT TEST

BASIS VERY EASILY TO VERIFY ITS UTILITY.

IV. NBE

TOTAL OF 453 NBE PROCESS SAMPLES ANALYZED IN DECEMBER-WRITER CONFERRED WITH MOBIL MT. PLEASANT LAB ON CBE ANALYTICAL METHOD IMPROVEMENTS. A LONGER COLUMN APPEARS TO BE THE SOLUTION. THIS COLUMN WILL BE ORDERED. NO GRIEVOUS PROBLEMS IN THE LAB.

V. THIOFANOX

133 SAMPLES ANALYZED FROM THE TFX PLANT IN DECEMBER. NO PARTICULAR PROBLEMS IN THIS LAST TFX CYCLE (FOR AWHILE). REFER TO JOE PORTER'S REPORT FOR STATISTICAL DETAILS.

VI. CUSTOM WORK

NONE IN DECEMBER. MEA DISTILLATION SCHEDULED FOR MID-JANUARY.

VII. FACILITIES

LITTLE ACTIVITY OTHER THAN HOUSEKEEPING. LAB SUMP PUMP NOT YET INSTALLED. DRY INSTRUMENT AIR NOT YET ROUTED TO LAB. FLOOR STILL NEEDS PAINTING.

VIII. WASTEWATER/AIR/LAB SAFETY

REFER TO JOE PORTER'S REPORT FOR ENVIRONMENTAL INFORMATION. TFX DEEP-WELL INJECTION WASTE ANALYZED AND FOUND TO BE OVERSATURATED WITH SALTS WHICH MAY INTERFERE WITH TRUCK LOADING/UNLOADING. WRITER DISCUSSED THIS PROBLEM WITH JOHN MILES AND JOE PORTER AND SET UP A DILUTION STUDY ON A LAB SCALE. FINDINGS WERE THAT EVEN WITH A 25% DILUTION, WASTE SOLIDS FORMED AT 10°C. IT WAS THEN DETERMINED THAT HEATING OF WASTE IN TRUCK MIGHT PREVENT TROUBLESOME SOLID FORMATION. NO ACCIDENTS IN LAB IN DECEMBER.

IX. MISCELLANEOUS

P-10 COOLING TOWER FUNCTIONING FAIRLY WELL BUT NEEDS THE FOLLOWING CHANGES:

1. HELENA WATER SUPPLY
2. THOROUGH CLEANING OF BASIN WITH A GOOD CENTRIFUGAL PUMP AND HOSE (BASIN WAS PARTLY CLEANED OF DEBRIS BUT PROBLEMS WERE ENCOUNTERED WITH COLLAPSING HOSE, LOW SUCTION PUMP).
3. INSTALLATION OF CYCLIC TIMERS AND NEW CHEMICAL FEED PUMP HEADS SO THAT CONCENTRATED CHEMICALS MAY BE ADDED OVER LONG TIME PERIODS WITHOUT REFILL.

THE WORST PROBLEM WE NOW HAVE WITH THE COOLING TOWERS IS THE DEBRIS IN THE BASINS WHICH CLOGS UP HEAT EXCHANGERS AND PROVIDES SITES FOR SCALE GROWTH AS A RESULT OF HIGH HEAT AND IMPEDED FLOW OF WATER.

BOILERS NEED CLOSER SCRUTINY AND-

1. FILMING AMINE ADDED TO PREHEATER WATER (MORPHOLINE) WATER.
2. HIGHER PREHEATER WATER TEMP TO REMOVE MORE DISSOLVED OXYGEN AND AVOID CORROSION PROBLEMS.
3. REGULAR ANALYSIS SCHEDULE.

SEE ATTACHED PERSONNEL TIME SURVEY. 98 SPECIAL ANALYSES PERFORMED IN DECEMBER.

X. OBJECTIVES FOR JANUARY, 1977

A. BOILER ANALYTICAL SCHEDULE

B. FINISH RAW MATERIAL SPEC. SHEETS ( 3/4 COMPLETE NOW)

C. PAINT LAB FLOOR

D. PREPARE FOR PROPANIL

E. ASSIST IN TIMER AND CHEMICAL PUMP SET-UP FOR P-10 COOLING TOWER.

# LAB HOURLY PERSONNEL SURVEY
DECEMBER, 1976

## I. REGULAR TIME

1400 REGULAR HOURS SCHEDULED EXCLUDING HOLIDAY/VACATION VS. 1360 HRS.

120 REGULAR HOURS SCHEDULED FOR VACATION VS. 120 HRS. TAKEN

320 REGULAR HOURS SCHEDULED FOR 5 HOLIDAYS VS. 320 HRS. GIVEN

TOTAL (1840) REGULAR HOURS SCHEDULED VS. 1800 HRS. ACTUAL

## II. OVERTIME

24 HOURS O.T. SCHEDULED FOR BLOOD TEST/MTG VS. 13.5 HR. TAKEN

-- HOURS O.T. SCHEDULED FOR ILLNESS VS. 48 HR TAKEN

80 HOURS O.T. SCHEDULED FOR 6TH DAY VS. 80 HR TAKEN

280 HOURS O.T. SCHEDULED FOR 5 HOLIDAYS VS. 280 HRS. TAKEN

105 HOURS O.T SCHEDULED FOR SHOWERS VS. 96.5 HRS. TAKEN

120 HOURS O.T. SCHEDULED FOR VACATION VS. 120 HRS. TAKEN

609 TOTAL HOURS O.T. SCHEDULED VS. 638 HOURS ACTUAL

CC: J. MILES
J. PORTER
R. WEST
L. CONAWAY (2)

# MONTHLY ANALYTICAL SURVEY

NBE PLANT

MONTH Dec. 197

| TYPE SAMPLE | TYPE ANALYSIS | SPECS | NO. ANALYZED | MIN. | MAX. | AVG. | SPECIAL REMARKS |
|---|---|---|---|---|---|---|---|
| CBE RAW MATERIAL | % M-CBE | 93.0 MIN | 10 | 94.33 | 97.29 | 95.94 | |
| $HNO_3$ RAW MATERIAL | % $HNO_3$ | 97.5 MIN | 4 | 97.0 | 99.27 | 98.51 | |
| $H_2SO_4$ RAW MATERIAL | % $H_2SO_4$ | 98.0 MIN | 12 | 97.89 | 99.75 | 98.85 | |
| AMMONIUM SULFATE WASTE | % ORGANIC | | 12 | .0368 | .11 | .0734 | |
| SPENT ACID | % NBE | 0.2 MAX | 7 | 0 | 1.98 | .73 | |
| | % $H_2SO_4$ | ≥ 80.0 | | 79.42 | 83.74 | 82.17 | |
| FINISHED PRODUCT VM-102A | % NBE | ≥ 82.0% | 42 | 81.00 | 85.64 | 83.41 | |
| | % CBE | ≤ 1.0 | | 0 | .31 | .063 | |
| | % EDC | ≤ 0.5 | | .103 | .54 | .32 | |

# MONTHLY ANALYTICAL SURVEY

MONTH OF Dec, 1926

PRODUCT 10

| TYPE SAMPLE | TYPE ANALYSIS | SPECS | NO. ANALYZED | MIN | MAX | AVG. | SPECIAL REMARKS |
|---|---|---|---|---|---|---|---|
| FINISHED BATCHES (IIIB) | % METHOMYL | 24.2-25.0 | 28 | 23.92 | 25.0 | 24.53 | |
| | % $H_2O$ | 6.0-7.6 | | 6.1 | 7.97 | 6.716 | |
| | % T | 60-80 | | 84 | 61 | 68.2 | |
| | PURITY | ≥ 95.0 | | 95.72 | 98.65 | 97.25 | |
| | CORR. SP. GR. | | | .8949 | .9029 | .8973 | |
| FINISHED PRODUCT COLD TANK (IV) | % METHOMYL | 24.2-25.0 | 31 | 24.10 | 26.94 | 24.78 | |
| | % $H_2O$ | 6.0-7.6 | | 6.15 | 7.53 | 6.81 | |
| | % T | 60-80 | | 65 | 78 | 74.3 | |
| | CORR. SP. GR. | | | .8946 | .9002 | .8973 | |
| PACKAGING R.C. (V) | % METHOMYL | 24.2-25.0 | 19 | 24.11 | 25.89 | 24.75 | |
| | % $H_2O$ | 6.0-7.6 | | 6.04 | 8.0 | 6.82 | |
| | % T | 60-80 | | 68 | 79 | 72.5 | |
| | CORR SP. GR. | | | .8955 | .8995 | .8970 | |
| MTAAO SLURRY TRUCK | PH | 6-8 | 25 | 5.95 | 10.5 | 8.20 | |
| IIA | EXCESS MIC | ≤ 0.5 | 53 | .242 | 1.71 | .8045 | |
| RAFFINATE (IB) | % MTAAO | ≤ 0.2 | 3 | .0091 | .19 | .09 | |
| | % $MeCl_2$ | | | | | | |
| PACKAGING WEIGHT CHK. | AVG % | ≤ 1.0 | 19 | [illegible] | -2.[illegible] | +.31 | |

VERTAC, INC.
SUITE 2414 • 5100 POPLAR
MEMPHIS, TN 38137 • 901-767-6851

INTER-OFFICE CORRESPONDENCE

DATE: February 16, 1977

TO: L. E. HARCROW, B. F. McAVOY, J. A. MITCHELL, J. W. SHACKELFORD

FROM: C.P. BOMAR

SUBJECT: DuPont Product 10 Agreement

REPLY REQUESTED BY (DATE)

Attached is a copy of the February 11, 1977 amendment to the Product 10 Agreement as signed by DuPont. If you approve of this amendment, please indicate your acceptance in the space provided below and return this memo to me.

The final signed Vertac copy will be circulated for your initials later.

C. P. BOMAR

A C C E P T E D:

BY: J. W. Shackelford

DATE: Feb. 20, 1977

/em

CC: R. A. Guidi
J. J. O'Neill

[redacted]

EM-

DU PONT

ESTABLISHED 1802

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

ENERGY AND MATERIALS DEPARTMENT

Returned cover to Pat B. 2-21-77 indicating approval - S

February 11, 1977

MR. JOHN J. O'NEILL
EAGLE RIVER CHEMICAL CORPORATION
C/O VERTAC CONSOLIDATED
5100 POPLAR - SUITE 2414
MEMPHIS, TENNESSEE 38137

Dear Mr. O'Neill:

Reference is made to the Agreement between our two companies dated June 1, 1975 (hereinafter Agreement) relative to the manufacture of Lannate® L Methomyl. It is hereby mutually agreed to amend the aforesaid Agreement in the following manner effective July 1, 1976.

3. COMPENSATION - Delete this Article in its entirety and in lieu thereof insert the following:

3. COMPENSATION

A. Manufacturing Costs - The manufacturing costs for Product 10 are summarized in Exhibit "C", attached hereto and made a part hereof. All units of consumption (usage per gallon) including number of operators are fixed for the period of Agreement. It is agreed that EAGLE RIVER may adjust costs as follows:

1. Methylene Chloride - Invoiced monthly at actual cost to EAGLE RIVER based on agreed to consumption rates.

2. Utilities & Operating Labor - Costs may be adjusted each January 1 or July 1 on sixty (60) days' prior written notice to reflect actual increases or decreases in costs.

3. All Other Items - May be adjusted every twelve (12) months, effective July 1, based on actual increases or decreases in costs provided sixty (60) days' prior written notice of the adjustment is given to DU PONT.

If EAGLE RIVER's facilities are shut down at DU PONT's direction, DU PONT agrees to pay EAGLE RIVER as total compensation standby charges in accordance with Exhibit "C".

[redacted]

There's a world of things we're doing so well

It is understood that EAGLE RIVER will stand ready to operate the facilities 330 days per year with 35 days downtime for plant maintenance and repair. However, if EAGLE RIVER's facilities are unavailable for Product 10 production for less than 330 days per year for any cause not directly attributable to DU PONT, then DU PONT will not pay EAGLE RIVER any charges for any days less than 330 days per year that EAGLE RIVER is unable to produce Product 10.

It is anticipated but not guaranteed that DU PONT will require EAGLE RIVER's services to manufacture Product 10 under this Agreement for a period of approximately 24 to 36 months. During the term of this Agreement, EAGLE RIVER agrees to manufacture other products for DU PONT for a mutually agreed upon compensation or maintain the facility on a stand-by basis until such time as DU PONT notifies EAGLE RIVER in writing that no further manufacturing will be required. DU PONT will continue to make amortization payments as defined herein until all such payments have been made or the Agreement is terminated as provided in Article 5. TERM OF AGREEMENT.

B. Amortization Payments - DU PONT agrees to amortize a portion of the cost of EAGLE RIVER's facility as defined in Exhibit "E", as amended, attached hereto and made a part hereof, including the cost of associated equipment and the installation thereof. The amounts to be amortized shall be:

1. $1,250,000 - DU PONT will amortize said sum over a period of five (5) years, payable in sixty (60) successive monthly installments with first payment made September 1975. Monthly payments shall be equal to an amount sufficient to amortize a note of $1,250,000 bearing interest at a rate equal to the prime interest rate charged by the First National Bank of Phillips County, Helena, Arkansas, or ten (10) percent per annum, whichever is lower. Each installment shall be one-sixtieth (1/60) of $1,250,000 plus applicable interest on the unamortized balance. DU PONT will have the option to pay the unamortized balance at any time without charge for accelerating payments. DU PONT acknowledges and has agreed to EAGLE RIVER assigning its rights to said amortization payments as security for a loan to finance the construction herein covered.

[redacted]

2. $72,000 - DU PONT agrees to pay directly to EAGLE RIVER an amount not to exceed seventy-two thousand dollars ($72,000) for additional equipment that will increase EAGLE RIVER's capacity to 1.2 million gallons of Product 10 per year. DU PONT will pay the $72,000 over a two (2) year period in twenty-four (24) equal monthly payments. First payment was made in June 1976.

First Invoice issued 6-1-76 #2351 for $3000.00 DL

C. Add-On Charge - In addition to all other costs, DU PONT agrees to pay EAGLE RIVER an add-on charge of $0.50 per gallon for the first one (1) million gallons of Product 10 produced in any contract year and $0.25 per gallon for every gallon of Product 10 produced over the initial one (1) million gallons in any contract year. The add-on charges are firm until July 1, 1977. Thereafter, either party may request annually to renegotiate the add-on charges with thirty (30) days' prior written notice.

All other terms and conditions remain the same.

Please signify your acceptance of the above by signing in the space provided below and returning the copy marked "WILM. E&M DEPT. COPY" to H. E. Burman.

Very truly yours,

E. I. DU PONT DE NEMOURS AND COMPANY

BY H. E. Burman

TITLE Vice President and General Manager, Petrochemicals Department

DATE February 11, 1977

ACCEPTED:

VERTAC CONSOLIDATED

BY _____

TITLE _____

DATE _____

[redacted]

# EXHIBIT "C"

## For the Period: 7/1/76 - 12/31/76

Manufacturing Cost/Product 10

1,200,000 gallons/year capacity @ 330 day/year operation

| | USAGE PER GALLON | UNIT COST $ | VARIABLE COST/GALLON $ | FIXED COST PER MONTH $ | (1) STAND-BY COST/MONTH |
|---|---|---|---|---|---|
| 1. RAW MATERIAL USAGE | | | | | |
| Slurry (as 100% MTAAO) | 1.33 | - | | | |
| Methyl Isocyanate | 0.75 | - | | | |
| Methanol | 5.25 | - | | | |
| Methylene Chloride | 0.70(2) | 0.1975 | 0.13825 | | |
| 2. UTILITIES | | | | | |
| Electricity | 1.72 KWH | 0.02900 | 0.04988 | 1,500 | Net Billin |
| Steam | 13.10 lbs. | 0.00175 | 0.02293 | 740 | |
| Water | 4.15 gal. | 0.00053 | 0.00220 | 200 | |
| Nitrogen | 7.55 SCF | 0.00367 | 0.02771 | 450 | 450 |
| Natural Gas | 876 MSCF(3) | 0.81000 | - | 710 | |
| Sub Total | | | 0.10272 | 3,600 | 450 |
| 3. OPERATING LABOR | | | | | |
| Operating | | | - | 10,305 | |
| Packaging | | | 0.08000 | 4,800 | |
| Sub Total | | | 0.08000 | 15,105 | 2,555 |
| 4. MAINTENANCE | | | | | |
| Repair Labor | | | | 4,500 | |
| Maintenance Mat. | | | | 4,500 | |
| Maintenance O/H | | | | 2,000 | |
| Sub Total | | | - | 11,000 | 2,100 |
| 5. MISCELLANEOUS OPERATING EXPENSE | | | | | |
| Supervision & Clerical | | | | 3,150 | 2,100 |
| Operating Materials | | | 0.00550 | 1,050 | - |
| Laboratory | | | | 5,250 | 1,838 |
| Shipping & Handling | | | | 900 | |
| Sub Total | | | 0.00550 | 10,350 | 3,938 |
| 6. ADMINISTRATIVE O/H | | | | | |
| Sub Total | | | - | 7,140 | 4,200 |
| 7. WASTE DISPOSAL | | | | | |
| Sub Total | | | (4) | - | - |
| TOTAL | | | $0.32647 | $47,195 | $13,243 |

(1) For declared six months (min.) period; charge for shorter periods will be negotiated.

(2) Subject to retroactive adjustment to 7/1/76 upon establishing consumption by material balance.

(3) Monthly consumption.

(4) To be billed at cost from mutually acceptable disposal companies, but not to exceed $0.28 per gallon of Product 10.

[redacted]

EFFECTIVE JULY 1, 1976

# EXHIBIT "C"

## For the Period: 1/1/77 - 6/30/77

Manufacturing Cost/Product 10

1,200,000 gallons/year capacity @ 330 day/year operation

| | USAGE PER GALLON | UNIT COST $ | VARIABLE COST/GALLON $ | FIXED COST PER MONTH $ | STAND-COST/MO |
|---|---|---|---|---|---|
| 1. RAW MATERIAL USAGE | | | | | |
| Slurry (as 100% MTAAO) | 1.33 | - | | | |
| Methyl Isocyanate | 0.75 | - | | | |
| Methanol | 5.25 | - | | | |
| Methylene Chloride | 0.70(2) | 0.1975 | 0.13825 | | |
| 2. UTILITIES | | | | | |
| Electricity | 1.72 KWH | 0.03099 | 0.05330 | 1,500 | Net Bill |
| Steam | 13.10 lbs. | 0.00334 | 0.04375 | 740 | |
| Water | 4.15 gal. | 0.00056 | 0.00232 | 200 | |
| Nitrogen | 7.55 SCF | 0.00367 | 0.02771 | 450 | 450 |
| Natural Gas | 876 MSCF(3) | 1.13800 | - | 997 | |
| Sub Total | | | 0.12708 | 3,887 | 450 |
| 3. OPERATING LABOR | | | | | |
| Operating | | | - | 10,820 | |
| Packaging | | | 0.08000 | 5,280 | |
| Sub Total | | | 0.08000 | 16,100 | 2,555 |
| 4. MAINTENANCE | | | | | |
| Repair Labor | | | | 4,500 | |
| Maintenance Mat. | | | | 4,500 | |
| Maintenance O/H | | | | 2,000 | |
| Sub Total | | | - | 11,000 | 2,100 |
| 5. MISCELLANEOUS OPERATING EXPENSE | | | | | |
| Supervision & Clerical | | | | 3,150 | 2,100 |
| Operating Materials | | | 0.00550 | 1,050 | - |
| Laboratory | | | | 5,250 | 1,838 |
| Shipping & Handling | | | | 900 | |
| Sub Total | | | 0.00550 | 10,350 | 3,938 |
| 6. ADMINISTRATIVE O/H | | | | | |
| Sub Total | | | - | 7,140 | 4,200 |
| 7. WASTE DISPOSAL | | | | | |
| Sub Total | | | (4) | - | - |
| TOTAL | | | $0.35083 | $48,477 | $13,243 |

(1) For declared six months (min.) period; charge for shorter periods will be negotiated.

(2) Subject to retroactive adjustment to 7/1/76 upon establishing consumption by material balance.

(3) Monthly consumption.

(4) To be billed at cost from mutually acceptable disposal companies, but not to exceed $0.28 per gallon of Product 10.

[redacted]

Effective January 1, 1979

EXHIBIT "C"

For the Period: 1/1/79 - 6/30/79

Manufacturing Cost/Product 10
1,200,000 gallons, year capacity @ 330 day/year operation

| | USAGE PER GALLON | UNIT COST $ | VARIABLE COST/GALLON $ | FIXED COST PER MONTH $ | (1) STAND-I COST/MO |
|---|---|---|---|---|---|
| 1. RAW MATERIAL USAGE | | | | | |
| Slurry (as 100% MTAAO) | 1.33 | - | | | |
| Methyl Isocyanate | 0.75 | - | | | |
| Methanol | 5.25 | - | | | |
| Methylene Chloride | 0.70 | 0.2450 | 0.1715 | | |
| 2. UTILITIES | | | | | |
| Electricity | 1.72KWH | 0.03161 | 0.05437 | 1,530 | Net 3 |
| Steam | 13.10 lbs. | 0.00373 | 0.04886 | 826 | |
| Water | 4.15 gal. | 0.00058 | 0.00241 | 208 | |
| Nitrogen | 7.55 SCF | 0.00395 | 0.02982 | 450 | 450 |
| Natural Gas | 876 MSCF (2) | 1.31200 | - | 1,149 | |
| Sub Total | | | 0.13546 | 4,163 | 450 |
| 3. OPERATING LABOR | | | | | |
| Operating | | | | 11,902 | |
| Packaging | | | 0.08800 | 5,808 | |
| Sub Total | | | 0.08800 | 17,710 | 2,555 |
| 4. MAINTENANCE | | | | | |
| Repair Labor | | | | 4,950 | |
| Maintenance Mat. | | | | 4,700 | |
| Maintenance O/H | | | | 2,200 | |
| Sub Total | | | - | 11,850 | 2,100 |
| 5. MISCELLANEOUS OPERATING EXPENSE | | | | | |
| Supervision & Clerical | | | | 3,475 | 2,100 |
| Operating Materials | | | 0.01500 | 1,050 | - |
| Laboratory | | | | 5,250 | 1,838 |
| Shipping & Handling | | | | 990 | |
| Sub Total | | | 0.01500 | 10,765 | 3,938 |
| 6. ADMINISTRATIVE O/H | | | | | |
| Sub Total | | | - | 7,140 | 4,200 |
| 7. WASTE DISPOSAL | | | (3) | - | - |
| Sub Total | | | | | |
| TOTAL | | | 0.40996 | $51,628 | $13,243 |

(1) For declared six months (min.) period; charge for shorter periods will be negotiated.
(2) Monthly consumption.
(3) To be billed at costs from mutually acceptable disposal companies, but not to exceed $0.28 per gallon of Product 10, including on-site disposal costs at Eagle River.

11-15-79

VERTAC, INC.

SUITE 2414 • 5100 POPLAR
MEMPHIS TN 38137 • 901-767-6851

copy for Byron Dave Homer Jeff Joe George M

INTEROFFICE CORRESPONDENCE

DATE: January 9, 1979

TO: J. W. Shackelford

FROM: C. P. Bomar

SUB:

REPLY REQUESTED BY (DATE):

Bill, this is just a reminder that we have escalated our charges to DuPont for the Lannate production in accordance with our contract. Attached is a copy of Exhibit C outlining the new billing rate.

While DuPont originally indicated some degree of argument about the revised billing, we have heard nothing further on this; therefore, you should proceed to use revised Exhibit C.

/ts

cc: G. F. Gammal
R. A. Guidi
J. F. Mather
E. A. Munoz

# Basis For Exhibit C1

## I. Design Capacity of Plant Is Now 1,200,000 Gal/yr As Per Case I Lannate Expansion

## II. Exhibit C1

### 1. Raw Materials

| | V.U.C. |
|---|---|
| A. Slurry (as 100% MTAAO) | 1.33 |
| B. MIC | 0.76 |
| C. MeOH | 5.25 |
| D. $MeCl_2$ | 1.10 |

(1) Unit consumption of materials supplied by DuPont are those given as reasonable by J. Bozia & D. Baugh in their claim for over-consumption. While actual consumptions are higher than this, Eagle River will agree with these limits for the quarter, April May & June, 1976.

(2) $MeCl_2$ consumption is a estimate based on the presumption that the vent condenser installed during the recent TAR will reduce $MeCl_2$ over-consumption by ~90%. Unit cost = 1.1 #/Gal x $0.1875/lb = 0.2063 ¢/

## 2 Utilities

| | V.C. | F.C. |
|---|---|---|
| A. Electricity | .05 | .015 |
| B. Steam | .04 | .0074 |
| C. Water | .0022 | .0010 |
| D. $N_2$ | .019 | .0045 |
| E. Natural Gas | — | .0070 |

(1) Electricity
Fixed cost = 50% of theoretical cost for fixed electrical users (150 HP)
Variable cost reflects actual costs less fixed cost above.

(2) Steam
Fixed cost reflects increase of estimated usage from 6.61 to 12.9 #/GAL
An additional 300 HP boiler has been installed since Lannate start-up to improve steam reliability
Variable cost reflects increased estimated usage noted above & also corrects for increased steam cost.

3/5

③ Water
Variable cost same as Exhibit C.
Fixed cost reflects actual costs less variable cost.

④ $N_2$
Fixed cost is same as Item 4 ($N_2$ system rental) in Exhibit C.
Variable cost is based on estimated usage of 10,000 SCF per batch.

⑤ Natural Gas
Fixed cost based on 1200 SCFH consumption in flare.

## 3 Operating labor

A. Operations

| | | |
|---|---|---|
| 1. Lead operator - | 720 hr/mo × $6.00/hr | = 4320 |
| 2. Operator - | 720 hr/mo × 4.60/hr | = 3312 |
| 3. Truck unload - | 360 hr/mo × 4.60/hr | = 1656 |
| | | $9288 |
| 4. 5.5% for O.T. & shower time | | 512 |
| | | $9800 |

B. Packaging labor - filling 1 gal - 4200 gal/d

8 men × 10 hr/day × 4.06 l/hr × 4⅓ × 5 (21.65) = 7032
2 men × 10 hr/day × 5.32 × 21.65 = 2304
9336

Assume ~50% fixed cost = $4800

Variable cost is based on recovery of actual costs less fixed cost above.

4 Nitrogen System Rental

Included in fixed cost for $N_2$ (2D)

5 Maintenance

Total of $12,000/mo per direction of Ray Guidi @ Wilmington meeting. Apportioned per Jim Miles experience.

6 Misc. Operating Expense

A. Supervision & clerical - includes supt., dedicated day supv., shift supv., prod. clerk, accounting & office clerical $6100

51

B. Operating materials – includes Aldor 1052 – $150, Tide & bleach – $80, safety supplies – $300, hoses – $370, office supplies – $50 — $155

C. Laboratory – includes technicians – $3500 (25.1 h/d), supervision – $900, reagents – $400, equipment – $200 — $5000

D. Shipping & handling – includes misc. warehousing & transport of pkg materials. — $400

7 Administrative overhead — $8000

Based on actual costs. Includes plant manager, engineering, legal ~~fees~~ audit, and others

8 Waste Disposal

Variable cost based on actual cost as previously presented

copy for Byron Dave Homer Jeff Joe George M

VERTAC, INC. SUITE 2414 • 5100 POPLAR MEMPHIS, TN 38137 • 901/767-6651

INTER OFFICE CORRESPONDENCE

DATE
January 9, 1979

TO
J. W. Shackelford

FROM
C. P. Bomar

SUBJECT

REPLY REQUESTED BY (DATE)

Bill, this is just a reminder that we have escalated our charges to DuPont for the Lannate production in accordance with our contract. Attached is a copy of Exhibit C outlining the new billing rate.

While DuPont originally indicated some degree of argument about the revised billing, we have heard nothing further on this; therefore, you should proceed to use revised Exhibit C.

/ts

cc: G. B. Gammal
R. A. Guidi
G. F. Mather
E. A. Munoz

Effective January 1, 1979

EXHIBIT "C"

For the Period: 1/1/79 - 6/30/79

Manufacturing Cost/Product 10
1,200,000 gallons, year capacity @ 330 day/year operation

| | USAGE PER GALLON | UNIT COST $ | VARIABLE COST/GALLON $ | FIXED COST PER MONTH $ | (1) STAND-BY COST/MONT |
|---|---|---|---|---|---|
| 1. RAW MATERIAL USAGE | | | | | |
| Slurry (as 100% MTAAO) | 1.33 | - | | | |
| Methyl Isocyanate | 0.75 | - | | | |
| Methanol | 5.25 | - | | | |
| Methylene Chloride | 0.70 | 0.2450 | 0.1715 | | |
| 2. UTILITIES | | | | | |
| Electricity | 1.72KWH | 0.03161 | 0.05437 | 1,530 | Net Bill |
| Steam | 13.10 lbs. | 0.00373 | 0.04886 | 826 | |
| Water | 4.15 gal. | 0.00058 | 0.00241 | 208 | |
| Nitrogen | 7.55 SCF | 0.00395 | 0.02982 | 450 | 450 |
| Natural Gas | 876 MSCF (2) | 1.31200 | - | 1,149 | |
| Sub Total | | | 0.13546 | 4,163 | 450 |
| 3. OPERATING LABOR | | | | | |
| Operating | | | | 11,902 | |
| Packaging | | | 0.08800 | 5,808 | |
| Sub Total | | | 0.08800 | 17,710 | 2,555 |
| 4. MAINTENANCE | | | | | |
| Repair Labor | | | | 4,950 | |
| Maintenance Mat. | | | | 4,700 | |
| Maintenance O/H | | | | 2,200 | |
| Sub Total | | | - | 11,850 | 2,100 |
| 5. MISCELLANEOUS OPERATING EXPENSE | | | | | |
| Supervision & Clerical | | | | 3,475 | 2,100 |
| Operating Materials | | | 0.01500 | 1,050 | - |
| Laboratory | | | | 5,250 | 1,838 |
| Shipping & Handling | | | | 990 | |
| Sub Total | | | 0.01500 | 10,765 | 3,938 |
| 6. ADMINISTRATIVE O/H | | | | | |
| Sub Total | | | - | 7,140 | 4,200 |
| 7. WASTE DISPOSAL | | | (3) | - | - |
| Sub Total | | | | | |
| | | | 0.02127 | 25,814 | 6621.22 |
| TOTAL | | | 0.~~40996~~ | $51,628 | $13,243 |

(1) For declared six months (min.) period; charge for shorter periods will be negotiated.
(2) Monthly consumption.
(3) To be billed at costs from mutually acceptable disposal companies, but not to exceed $0.28 per gallon of Product 10, including on-site disposal costs at Eagle River.

INTER-OFFICE CORRESPONDENCE

SUITE 2414 • 5100 POPLAR
MEMPHIS, TN 38137 • 901-767-6851

DATE: 11-6-78

TO: P. Bomar

FROM: L.E. Harcrow

SUBJECT

REPLY REQUESTED BY (DATE)

The price of Methylene Chloride as of November 8th will be $.245/lb., an increase of $.0125. The delivered price to Eagle River will be as follows:

| | Per LB. |
|---|---|
| MATERIAL COST from .2225 .0125 | $.24500 |
| FREIGHT ($~~.035~~ .0149 Eg. of $.02=) | $.01490 .01615 |
| MISC UNLOADING CHANGES | $.00125 |
| TOTAL DEL'D PRICE | $.26115 x.7 = .18281 |

[redacted]

Lannate L

Eagle River

MONTH END INVENTORY REPORT
PERIOD 7-25-80 THRU _____

| *CONSUMPTIONS: | 58527 MTA Slurry as 100% | AO Comm. | 20163 Methanol | 58526 Methomyl Tech | S/S Drums | Flex-Spouts | 20165 Hyflo Supercel | 24066 Methyl Isocyanate Pounds | Drs |
|---|---|---|---|---|---|---|---|---|---|
| A. STOCK LAST REPORT | | | -0- | 13,117 | 119 | | 250 | | |
| B. RECEIPTS | | | | 220 | 2 | contained | | | |
| C. CONSUMPTION | | | | 12,897 | 117 | Shipped Bo. LC | | | |
| D. STOCK THIS REPORT | | | | -0- | | | | | |

| | 47310 1 Gal Jugs | 47309 Caps for 1 Gal Jugs | 47329 KD Ctns for 4/1 | 47316 5 Gal Ctn Pkg | 5 Gal. Pails | 30 Gal. Drums | 23984 Marasperse CB | 55 Gal |
|---|---|---|---|---|---|---|---|---|
| A. STOCK LAST REPORT | 1116 | 6,000 | 450 | | | | 60 | |
| B. RECEIPTS | 6336 | 16,800 | 2400 | | | | | 3 |
| C. CONSUMPTION | | | | | | | | |
| D. STOCK THIS REPORT | | | | | | | | -0- |

*CONSUMPTIONS:

A + B - D = C

| **PRODUCTIONS: | 63507 Lannate L Bulk | 4/1 Gal. | 5 Gal. | 30 Gal. | 55 Gal | | |
|---|---|---|---|---|---|---|---|
| A. STOCK THIS REPORT | -0- | | | | | | |
| B. SHIPMENTS | 7,688 | 7,342 | | | 346 | | |
| C. RECEIPTS | | | | | | | |
| D. STOCK LAST REPORT | 10,367 | -0- | | | -0- | | |
| E. PRODUCTION | <2,679> | 7,342 | | | 346 | | |

**PRODUCTIONS

A + B - (C + D) = E

Copy mailed James O'Reilly 12-5-80 per his request.

AB0000065742/1

# VERTAC CHEMICAL CORP.

## JOURNAL VOUCHER

| Account Name | Account Number | | Subsidiary Ledger | | General Ledger | |
|---|---|---|---|---|---|---|
| | Subsid. | Control | Debit | Credit | Debit | Credit |
| | | | Ed Jolly | | | |
| | | | [illegible] | [illegible] | 10,367 gal | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | James O'Reilly | | | |
| | | | | | 713 471 | 2771 |
| | | | | | Ext | 1286 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

B-11120

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
HOUSTON PLANT
P. O. BOX 347, LA PORTE, TEXAS 77571

BIOCHEMICALS DEPARTMENT

cc: J.W. Shackelford
~~L. Conaway~~
G. Mather

Houston Plant
July 22, 1976

John Miles
Production Superintendent
Eagle River Chemical Co.
West Helena, Arkansas

Product 10 Safety Information

To assist you in the safe manufacture of Product 10 the following information is attached.

1) Letter by S.I. Gleich to S. Parker describing Product 10 safety precautions.

2) A portion of the Union Carbide "Product Information" booklet concerning methyl isocyanate handling and safety measures.

3) Material Hazards Cards for methanol, methylene chloride, MTAAO, and "Lannate" L.

4) A paper entitled "Information for Physicians Regarding Symptomatology and Treatment in "Lannate" Methomyl Insecticide Poisoning Cases".

The first two items were previously transmitted to you. Both are thorough and require no further explanation.

The hazards cards provide a quick and concise safety guide for materials you use in making Product 10. I suggest you keep these cards handy for use by personnel involved with "Lannate" L.

Item 4 of the above list contains information for a physician when checking for or treating a methomyl exposure.

If you have questions about any of this material, please call.

Sincerely,

A.G. Rohrer
Engineer-Technical

AGR/pp
Attachments



ADEQ0022367/1

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED

HOUSTON PLANT
P. O. BOX 347, LA PORTE, TEXAS 77571

BIOCHEMICALS DEPARTMENT

6/12

May 30, 1975

Mr. Scott Parker
Engineering Director
Vicksburg Chemical Co.
P. O. Box 3
Vicksburg, Ms. 39180

Dear Scott:

Contained in this letter is toxicity information, safety precautions to avoid methomyl exposure, and methods for treatment of persons who are exposed. This information will be necessary to safely operate the Product 10 facility at Eagle River. Please call with any questions.

Sincerely,

Steve

S. I. Gleich
Area Engineer - Technical

Attachments
SIG:ps

# PRODUCT 10 TOXICITY INFORMATION

The information contained herein refers primarily to "Lannate"-L (Product 10) and the hazards associated with handling it. We remind you, however, that methomyl is present, in solution, in several other process streams.

These streams include the MCl extract from R101, the MCl solution from R102 after MeNCO reaction and the aqueous solution from R102 after solvent exchange. These process streams should be handled with the same precautions as the product.

Since methomyl is always in solution during the Product 10 process, workers will generally not contact the solid.

## A. Toxicity

In pure form, methomyl is a granular solid. It is the active ingredient in Product 10 where it is dissolved in methanol and water.

### 1. Oral-Pure Solid

Methomyl is highly toxic and may be fatal if it, or its solutions are swallowed or inhaled. The oral $LD_{50}$ (of pure methomyl) to fasted white rats is about 20 mg/kg. There was no clinical evidence of cumulative toxicity when 10 doses of the chemical were administered orally to male rats at 5.1 mg/kg per day over a 14 day period.

### 2. Oral-"Lannate" - L

"Lannate" - L is moderately toxic when taken orally. It has an $LD_{50}$ of 130 mg/kg when tested with male rats.

### 3. Inhalation

The acute inhalation toxicity of "Lannate" - L was determined by exposing male rats to an aerosol of the material for one hour. The ALC (approximate lethal concentration) was found to be 0.17 mg/L on a methomyl basis. Because of the very low vapor pressure of methomyl ($5 \times 10^{-5}$ mm Hg at 25°C) the toxicity hazard from methomyl vapors at room temperature is negligible. Vapors above "Lannate" - L will contain methanol, however. Methanol has a TLV of 200 ppm.

A. Toxicity (Continued)

4. Skin and Eye

The $LD_{50}$ of "Lannate"-L by skin absorption determined by test with rabbits (intact skin), is 5880 mg/kg. "Lannate"-L produced no skin irritation or sensitization when tested on intact quinea pig skin at concentrations up to 100% strength. Operating experience in our "Lannate"-L packaging facilities at Houston suggests that hot weather increases the possibility that contact with "Lannate"-L will cause development of exposure symptoms. This is probably because increased sweating opens the body pores more, and in turn increases exposure susceptibility.

Eye irritation tests with rabbits indicate "Lannate" -L is irritating to the eyes and causes toxic symptoms when 0.1 ml of the undiluted material is applied.

5. Methanol Hazards

The solvent methanol is a severe fire and health hazard by itself. It's properties, discussed in MCA Safety Data Sheet SD-22, should be reviewed with equal care to those shown in this letter for methomyl. Personnel should be protected equally from methanol and methomyl exposures.

B. Symptoms of Exposure

Methomyl poisoning produces effects associated with anti-chlorinesterase activity which may include weakness blurred vision, headache, nausea, abdominal cramps, discomfort in the chest, constriction of pupils, sweating, slow pulse and muscle tremors.

Operating experience has shown that the most prevalent symptoms of methomyl exposure are constricted pupils (known as "little eye") and/or nausea.

C. Treatment for Exposure

In case of accidental contact, wash skin with plenty of soap and water. Avoid hot water. For eyes, flush with water for 15 minutes and get medical attention. Remove and wash contaminated clothing before reuse. Action should be taken immediately after exposure. Minutes separate successful from unsuccessful decontamination.

C. Treatment for Exposure (Continued)

If the solution is swallowed, give a tablespoon of salt in a glass of warm water (warm soapy water may also be used) and repeat until vomit fluid is clear. Have the patient lie down and keep quiet. If he is not breathing, start artificial respiration immediately. Never give anything by mouth to an unconscious person. Call a physcian as soon as possible.

If warning symptoms appear (Section B this letter), before the physician arrives, immediately swallow two atropine tablets (each 1/100 gr); thereafter, every 10 to 15 minutes, take one atropine tablet (1/100 gr) until the throat becomes dry and the skin becomes dry and flushed. Take additional tablets as necessary to maintain a moderately dry throat and dry flushed skin until the physician arrives.

We have attached a copy of the pertinent section from the "Lannate"-L product label for further details of treatment (Exhibit A).

D. Operating Precautions

Care must be used so that personnel do not breathe or swallow solutions containing methomyl, and do not get material in their eyes, or on their skin or clothing. Equipment used for handling methomyl solutions should be free of leaks. Any leaks, no matter how small, should be fixed immediately. Where product must be handled in the open, adequate ventilation must be provided to protect workers against methanol vapors or inadvertent spraying of the product.

Housekeeping should be scrupulous. Any spill of product or other methomyl solution should be cleaned up immediately. Clothing worn while working with methomyl should be removed at the end of the workday and laundered before reuse. Personnel should wash hands and face thouroughly after handling the product and before eating or smoking. Eating or smoking areas should be isolated from the working area. Employees should be adequately warned about the dangers of using the product containers for their own personal use.

Protective equipment for workers packing product should include goggles, rubber gloves, and aprons. Workers who clean up a spill should wear rubber boots during the clean up operation.

Any process lines needing repair which may have contained methomyl should be adequately decontaminated before mechanics are permitted to work on them. Mechanics should wear goggles and rubber gloves when breaking a line and rubber gloves for the rest of the job.

Safety showers and eye wash stations should be easily accessible to all workers.

DU PONT

REG. U.S. PAT. OFF.

# Lannate® L

## METHOMYL INSECTICIDE

**Water Soluble Liquid** 1 GALLON CONTAINS 1.8 LBS. METHOMYL

**ACTIVE INGREDIENT:** Methomyl
S-methyl-N-[(methylcarbamoyl)oxy]thioacetimidate ..... 24%
**INERT INGREDIENTS** ..... 76%
U.S. Pat. 3,576,834 EPA Reg. No. 352-370-AA

Keep out of reach of children

## DANGER ☠ POISON

**FLAMMABLE. CONTAINS METHANOL.**
**MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED.**
**POISONOUS IF INHALED. CAUSES EYE DAMAGE.**

**Do not breathe vapors or spray mist.**
**Do not get in eyes, on skin, on clothing.**
**Use with adequate ventilation.**
**Keep away from heat, sparks, and open flame.**
**Keep container closed.**

In case of contact, wash skin with plenty of soap and water; for eyes, flush with water for 15 minutes and get medical attention; remove and wash contaminated clothing before re-use.

### ANTIDOTE AND FIRST AID

**ATROPINE IS AN ANTIDOTE—CONSULT PHYSICIAN FOR EMERGENCY SUPPLY OF 1/100 GRAIN ATROPINE TABLETS. CALL A PHYSICIAN AT ONCE IN ALL CASES OF SUSPECTED POISONING.**

**If swallowed,** give a tablespoonful of salt in a glass of warm water and repeat until vomit fluid is clear. **If inhaled,** remove from exposure. Have patient lie down and keep quiet. If patient is not breathing, start artificial respiration immediately. **Never give anything by mouth to an unconscious person.**

**If warning symptoms appear** (See **warning symptoms** below), before physician arrives, immediately swallow two atropine tablets (each 1/100 gr.), thereafter, every 10 to 15 minutes, take one atropine tablet (1/100 gr.) until throat becomes dry and skin becomes dry and flushed. Take additional tablets as necessary to maintain a moderately dry throat and dry, flushed skin until physician arrives.

### NOTE TO PHYSICIAN

**WARNING SYMPTOMS**—Methomyl poisoning produces effects associated with anticholinesterase activity which may include weakness, blurred vision, headache, nausea, abdominal cramps, discomfort in the chest, constriction of pupils, sweating, slow pulse, muscle tremors.

**TREATMENT**—Atropine sulfate should be used for treatment. Administer repeated doses, 1.2 to 2.0 mg. intravenously every 10 to 30 minutes until full atropinization is achieved. Maintain atropinization until the patient recovers. Artificial respiration or oxygen may be necessary. Allow no *further exposure to any cholinesterase inhibitor until recovery is assured*
Do not use morphine or 2-PAM.

---

**IMPORTANT**—When mixing spray, loading, applying or otherwise handling wear protective clothing, goggles, and a mask or respirator suitable for protection against methomyl vapors or spray mist such as: Willson Products "Agri-Tox" R-533 Felt 11-P Cartridge or Mine Safety Appliances type H "Comfo". Wear clean clothes daily. Wash thoroughly after handling and before eating or smoking. Do not contaminate or store near feed or foodstuffs.

Not for use or storage in or around the home. Keep animals and unprotected persons out of operational areas during treatment and while there is danger of drift. Do not re-use container; bury when empty. This product is toxic to fish, birds and other wildlife. Keep out of any body of water. Do not apply where runoff is likely to occur. Do not apply when weather conditions favor drift from areas treated. Do not contaminate water by cleaning of equipment, or disposal of wastes. This product is toxic to bees and should not be applied when bees are actively visiting the area.

Do not subject to temperatures below 32°F.

F. H. A. ADJUVANT .....

### DIRECTIONS

Du Pont "Lannate" L Methomyl Insecticide should be used only in accordance with recommendations on this label, or in separate published Du Pont recommendations available through local dealers.

"Lannate" L is a water soluble liquid to be diluted with water for application by conventional tractor-mounted spray equipment. Use only in commercial plantings, do not use in home plantings.

**SPRAY PREPARATION**—Fill spray tank ¼ to ½ full of water. Add "Lannate" L directly to spray tank and mix thoroughly, using mechanical or hydraulic means, do not use air agitation.

**APPLICATION**—Apply at the recommended rates when insects first appear. Unless otherwise noted, continue applications at 5- to 7-day intervals or as needed. Use sufficient water to obtain thorough, uniform coverage. Apply the low rates on small plants, small worms and light infestations of insects. Use intermediate rates on larger worms and heavier infestations of insects. Use 1 to 3 applications of the highest recommended rate for controlling severe infestations. Thereafter, use the lowest rate possible to maintain control.

**NOTICE TO BUYER**—Seller warrants that this product conforms to the chemical description on the label thereof and is reasonably fit for purposes stated on such label only when used in accordance with directions under normal use conditions. This warranty does not extend to use of this product contrary to label use directions, or under abnormal use conditions, or under conditions not reasonably foreseeable to seller; buyer assumes all risk of any such use. Seller makes no other warranties, express or implied.

| CROPS | INSECTS | QUARTS PER ACRE | LAST APPLICATION TO HARVEST—DAYS |
|---|---|---|---|
| Broccoli Cauliflower | Cabbage Looper, Imp. Cabbageworm, Diamondback Moth | ½-1* | 7 |
| | | 1-2* | 14 |
| Cabbage | Cabbage Looper, Imp. Cabbageworm, Diamondback Moth | ½-2* | 1 |
| Brussels Sprouts | Cabbage Looper, Imp. Cabbageworm | 1-2* | 14 |
| Celery | Cabbage Looper | 2 | 14 |
| Lettuce (Head) | Cabbage & Alfalfa Loopers, Beet Armyworm | ½-1 | 7 |
| | | 1-2 | 10 |
| Peanuts**—East of Miss. River | Corn Earworm (up to 3 applns. or as needed) | ½-2 | 21 |
| Pepper | Green Peach Aphids | 1 | 10 |
| Potato | Tuberworm, Cabbage Looper | 1 | 14 |
| | Aphids | 1-2 | |
| | Leafhoppers, Flea Beetles East of Miss. River | 1 | |
| Sweet Corn | Earworm—Whorl as needed | ½-1 | 0 (ears) 3 (forage) |
| | Earworm—Ears 1-3 days or as needed | ½-1 | |
| | Fall Armyworm, European Corn Borer—Ears 1-3 days or as needed | 1 | |
| Tomato | Tomato Fruitworm, Aphids, Cabbage Looper, Beet Armyworm | 1 | 1 |
| | | over 1-2 | 2 |
| Tobacco (Except Shade) | Flea Beetle, Hornworm | ½-1 | 7 (flue cured) 14 (air or fire cured) |
| | Budworm (2-3 applns. before flower buds open), Cabbage Looper, Aphids | 1 | |
| Chrysanthemums | Cabbage Looper, Corn Earworm, Beet Armyworm, Thrips (weekly) | ½-1 qt. per 100 gals | — |

*Add wetting agent. **Do not feed treated vines to livestock.

E. I. DU PONT DE NEMOURS & CO. (INC.)

ADEQ0022367/6

DON'T SAY IT—WRITE IT

DATE 6/2/75

TO Scott Parker

AT Vicksburg Chemical

FROM Steve Gleich

cc: PWW

## MENCO INFO

You may find the attached information useful. We would have given it to you sooner but just received it ourselves from a non-Vertac related person.

# METHYL ISOCYANATE $CH_3N=C=O$

## PHYSICAL PROPERTIES

Determined on purified samples

| | |
|---|---|
| Molecular Weight | 57.05 |
| Apparent Specific Gravity at 20/20°C. | 0.9599 |
| ΔSp. Gr./Δt. at 10 to 40°C. | 0.00147 per °C. |
| Boiling Point at 760 mm. Hg | 39.1°C. |
| at 300 mm. Hg | 16.7°C. |
| at 10 mm. Hg | −40°C. |
| Δb.p./Δp. at 750 to 770 mm. Hg | 0.035°C. per mm. Hg |
| Vapor Pressure at 20°C. | 348 mm. Hg |
| Solubility in Water at 20°C. | about 6.7% by wt.[a] |
| Solubility of Water In at 20°C. | about 1.2% by wt.[a] |
| Critical Pressure | 55 Atm. |
| Critical Temperature | 218°C. |
| Viscosity at 0°C. | 0.35 cps. |
| at 20°C. | 0.25 cps. |
| Freezing Point | <−80°C. |
| Heat of Vaporization at 1 atm. | 223 B.t.u. per lb. |
| Heat of Combustion at 25°C. | 8,041 B.t.u. per lb. |
| Flash Point, Tag open cup (ASTM Method D 1310) | <0°F.[b] |

(a) Reacts slowly
(b) Commercial material

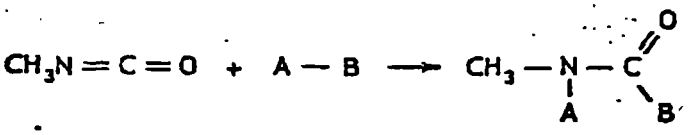
November, 1967
F-41443

SEVIN, SIRIATE, and UNION CARBIDE are trade marks of Union Carbide Corporation.

This information is not to be taken as a warranty or representation for which we assume legal responsibility nor as permission or recommendation to practice any patented invention without a license. It is offered solely for your consideration, investigation and verification.

Methyl isocyanate is an intermediate in the preparation of carbamate pesticides and should prove of interest in many other applications where special heterocyclic derivatives and polymers are needed.

In general, most reagents that attack methyl isocyanate will add to the N=C bond to form N-methylcarbamoyl derivatives:



## REACTIONS

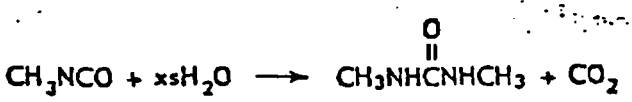
### ADDITION OF ACTIVE HYDROGEN COMPOUNDS

#### Hydroxy Compounds

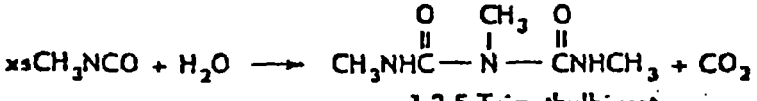
N-methyl carbamate

This reaction takes place smoothly with a variety of hydroxy compounds. Alcohols and phenols are often quantitatively converted to the carbamate, although a catalyst, such as a tertiary amine or a dialkyl tin dicarboxylate, is usually required to produce complete reaction within a reasonable period.[1,2,3] Other functional groups may be present, if they are unreactive towards methyl isocyanate. SEVIN Carbaryl Insecticide and SIRMATE Herbicide are among the useful products obtained by reaction with hydroxy compounds.

Water reacts with methyl isocyanate to form carbon dioxide and water-soluble ureas or biurets.



1,3-Dimethylurea

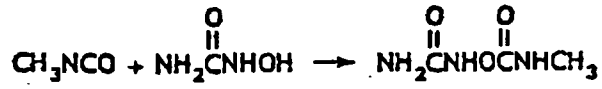


1,3,5-Trimethylbiuret

The reaction is slow at 20°C.; but, because of the heat produced, the reaction rate rapidly increases to the point of violent boiling. The presence of acids or bases greatly increases the rate of the reaction.[32]

The reaction of methyl isocyanate with carboxylic acids has not been described, but it can be expected to behave as other isocyanates. They form unstable, mixed anhydrides:

Other hydroxy compounds, such as enols, oximes and hydroxylamines, also produce N-methylcarbamates:

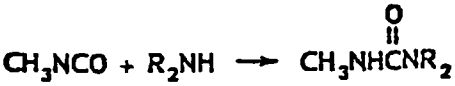


Ref. : 22

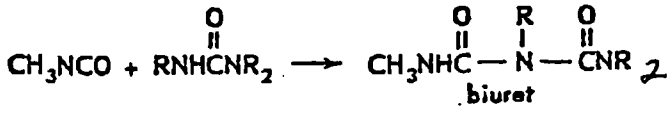
It would be expected that analogous thiocarbamates could be obtained from S-H compounds.[3]

N-H Compounds

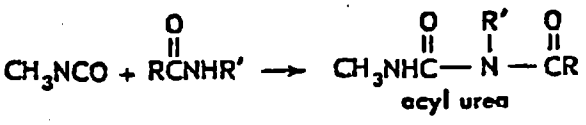
Ammonia and primary and secondary amines react rapidly at ambient temperatures without a catalyst:[1,2,3]



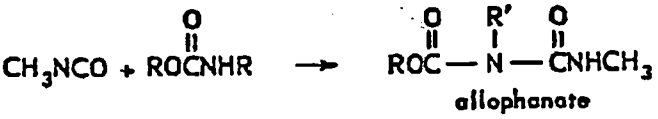
Methyl isocyanate will carbamoylate amides, ureas, or carbamates at higher temperatures:



biuret

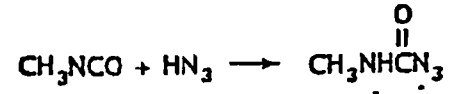


acyl urea

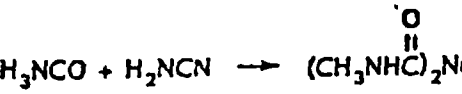


allophanate

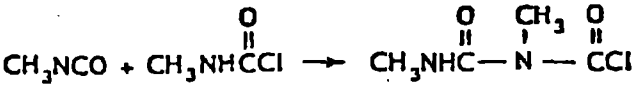
A number of other N-H compounds will react with methyl isocyanate:



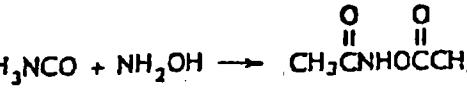
Ref. : 5



Ref. : 6



Ref. : 15 and 32



Ref. : 22

### Acids

Anhydrous acids add to methyl isocyanate to form N-methylcarbamoyl compounds:

$$CH_3NCO + HCl \rightleftharpoons CH_3NHC(=O)Cl$$ Ref. : 32

The methylcarbamoyl chloride dissociates into the reactants on heating and slowly changes to other products upon standing.[32]

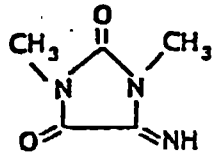
With concentrated sulfuric acid, the carbamoyl compound would be expected to decompose to form methylsulfamic acid:[7]

$$CH_3NCO + H_2SO_4 \longrightarrow CH_3NHSO_3H$$

Hydrogen cyanide is reported to react with methyl isocyanate:[5]

$$CH_3NCO + HCN \longrightarrow CH_3NHC(=O)CN$$

A second mole of methyl isocyanate will react if added;[5] later work[31] indicates that a cyclic product is obtained:



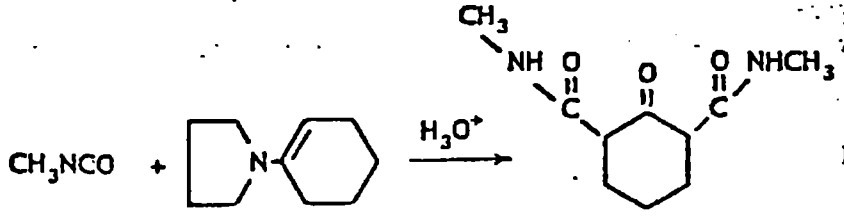
### C-H Compounds

Methyl isocyanate would be expected to react with active methylene compounds to form N-methylamides:[3]

$$CH_3NCO + Na^{\oplus}\,{}^{\ominus}CH(Y)_2 \longrightarrow (Y)_2CHC(=O)NHCH_3$$

$$Y = -COOR, -COR, \text{or} -CN$$

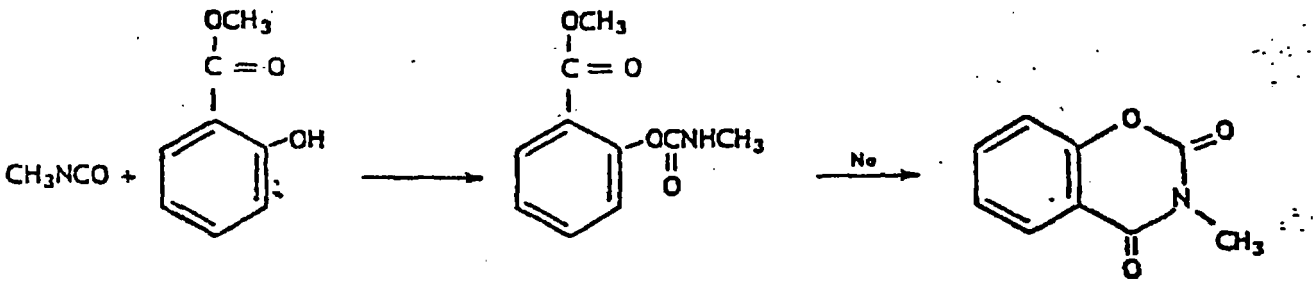
With enamines, the following would probably occur:



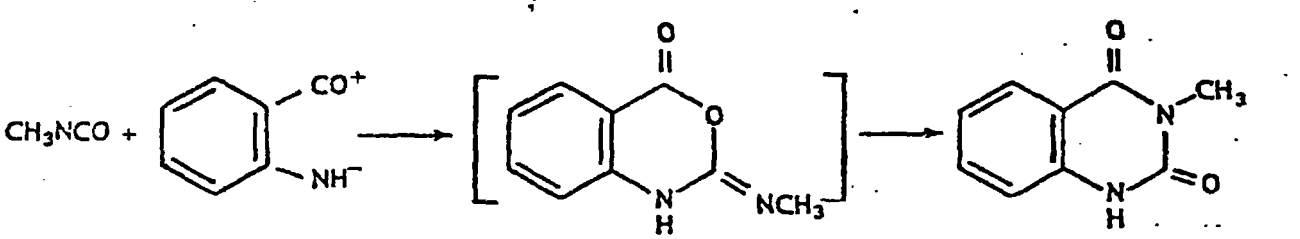
Ref. : 8,9,16

### Cyclizations

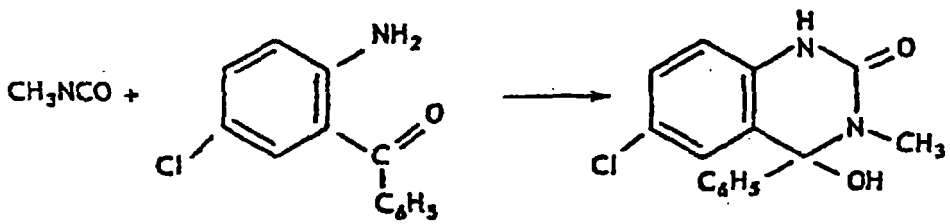
If methyl isocyanate is used to carbamoylate a difunctional molecule, the derivative may be made to cyclize:



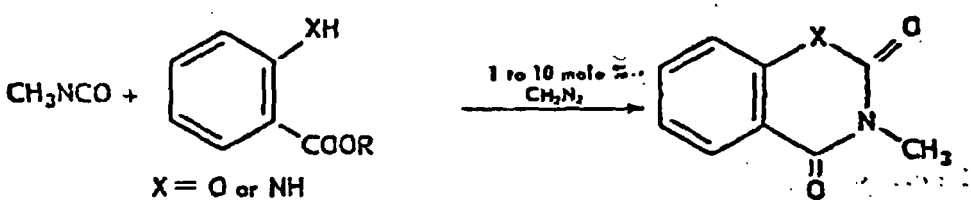

In other cases, cyclization occurs along with addition: Ref.: 14




Ref.: 13




Ref.: 28

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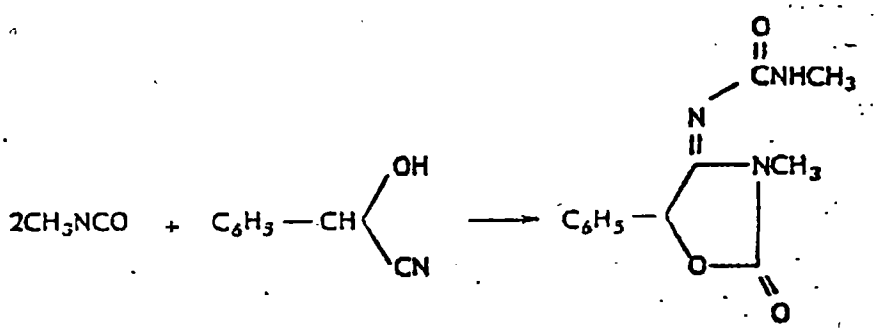
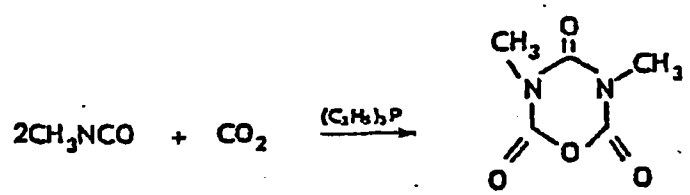


Ref.: 31

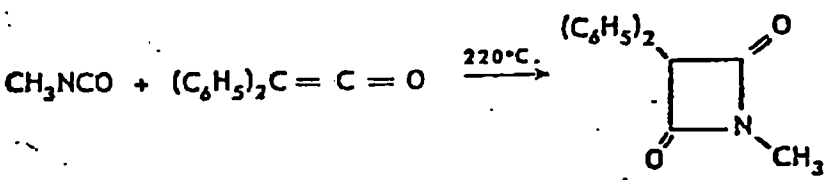
## REACTIONS WITH UNSATURATED COMPOUNDS

Alkyl isocyanates react with some unsaturated compounds to form cyclic addition products,[3] but only a few unsaturated compounds have been found to react with methyl isocyanate. In the presence of triethylphosphine (catalyst), and at room temperature, methyl isocyanate did not react with carbon oxysulfide, carbon disulfide, phenyl isothiocyanate, acetonitrile, nitromethane, quinone, ethylene, acetylene, dimethylketene, or diphenylketene; with aldehydes, carbon suboxide, aldoketenes or cyanic acid, gummy polymers resulted;[3] but with carbon dioxide a product resulted:[4]



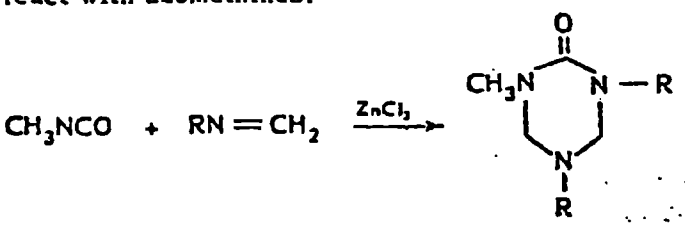
Diazomethane formed an amorphous solid with methyl isocyanate.[3]

At elevated temperatures, diphenylketene reacts as follows with methyl isocyanate:



Ref. : 24

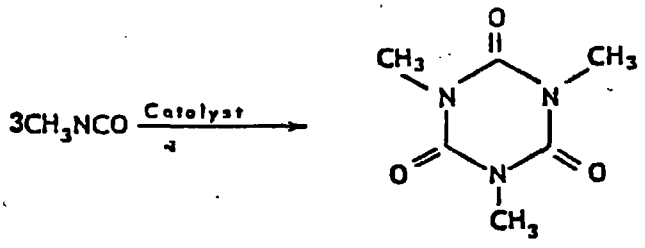
From analogous results obtained with other isocyanates, methyl isocyanate would be expected to react with azomethines:



Ref. : 8

## POLYMERIZATION

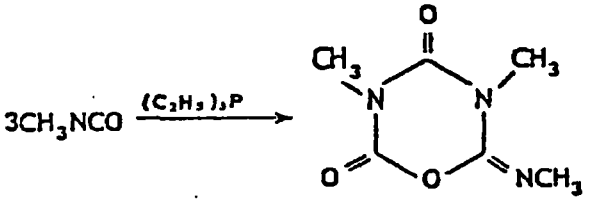
Purified methyl isocyanate will react with itself under the influence of a catalyst to form either a cyclic trimer (trimethyl isocyanurate) or a high molecular weight polymer. The type of polymer formed depends on the catalyst, the catalyst concentration, the temperature, and the methyl isocyanate concentration. Strong bases such as sodium hydroxide, sodium methoxide, and sodium acetate;[3,4] certain metal chlorides, such as ferric chloride and stannic chloride;[32] and some other compounds listed below catalyze trimerization:



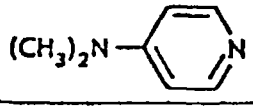

Methyl Isocyanate Trimer
(Trimethyl Isocyanurate)

Since the reaction is quite exothermic (51 Kcal/mole of trimer formed), contamination of methyl isocyanate with traces of these catalysts can cause violent reactions. ***Storage of commercial methyl isocyanate in carbon steel, tin, or copper containers must be avoided since such catalysts are formed from these metals upon standing.***

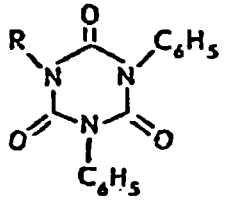
Triethylphosphine catalyzes the formation of an isomeric trimer, it is reported:[4]




### ACTIVITY OF TRIMERIZATION CATALYSTS

| Catalyst (1 to 3% in methyl isocyanate) | Time required for complete trimerization | References |
|---|---|---|
| $NaOCH_3$ | 10 minutes | 32 |
| $(C_6H_5)_3AsO$ | 15 minutes | 21 |
| $(C_2H_5)_3P$ | 1 hour | 4 |
| $FeCl_3$ | 1 hour | 32 |
| $SnCl_4$ | 1.5 hours | 32 |
| $(C_4H_9)_3SnOSn(C_4H_9)_3$ | 62 hours | 25 |
|  | 4 weeks | 25 |

The mode of action of the bis-tributyltin oxide has been studied.[25] By forming an isocyanate catalyst intermediate and reacting it with other isocyanates, mixed trimers could be formed:[25]





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A radiation-induced polymerization of methyl isocyanate has been reported.[19] Other polymers of alkyl monoisocyanates have been reported,[27] and a recent patent[30] reports that a tough, high-melting polymer can be produced specifically from methyl isocyanate.

## MISCELLANEOUS REACTIONS

**Chlorination:**

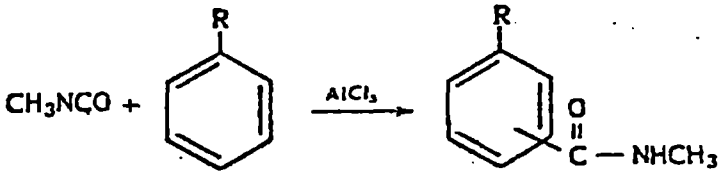
$$CH_3NCO + PCl_5 \xrightarrow{POCl_3} CH_3NCCl_2 + POCl_3$$ Ref. : 10

Addition of organometallic compounds to methyl isocyanate should produce N-methyl amides:

$$CH_3NCO + \begin{matrix} RMgX \\ or \\ RLi \end{matrix} \xrightarrow{H_2O} CH_3NHC(=O)R$$ Ref. : 3

$$CH_3NCO + (C_2H_5)_3Al \xrightarrow{H_2O} CH_3CH_2C(=O)NHCH_3$$ Ref. : 12,26

Isocyanates have been used in the Friedel-Crafts reaction.[11] Methyl isocyanate should produce N-methylbenzamides:



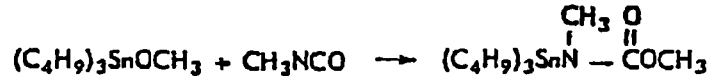

Silicon compounds add to methyl isocyanate; silylamine and silizane derivatives have been observed:

$$CH_3NCO + C_6H_5NHSi(CH_3)_3 \longrightarrow C_6H_5N(Si(CH_3)_3)C(=O)NHCH_3$$ Ref. : 17

$$CH_3NCO + C_6H_5N(CH_3)Si(CH_3)_3 \longrightarrow C_6H_5N(CH_3)C(=O)N(Si(CH_3)_3)CH_3$$

$$CH_3NCO + CH_3N(Si(CH_3)_3)_2 \longrightarrow CH_3N(Si(CH_3)_3)C(=O)N(Si(CH_3)_3)CH_3 \xrightarrow{CH_3NCO} CH_3NC(=O)N(CH_3)C(=O)N(Si(CH_3)_3)CH_3$$

Organotin derivatives:



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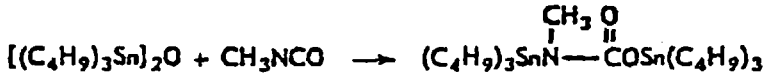
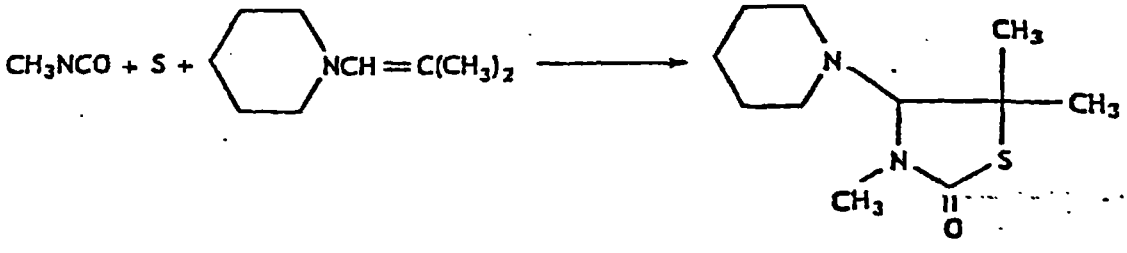
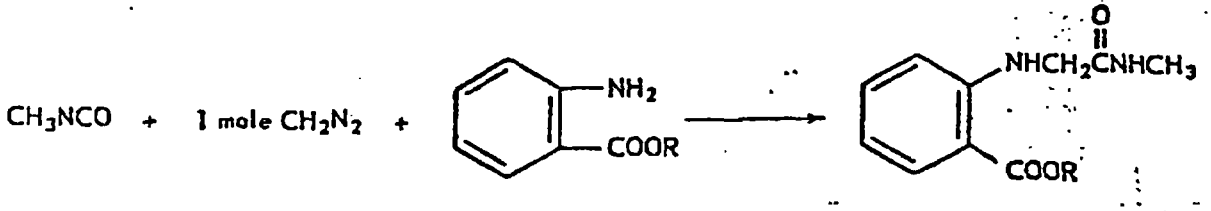


Ref.: 24

*Three component reactions:*



Ref.: 20



Ref.: 29

## STORAGE AND HANDLING

Methyl isocyanate is reactive, toxic, volatile, and flammable. Safe storage and handling require special precautions.

For purposes of transportation, methyl isocyanate is classified by the Bureau of Explosives as a flammable, poisonous liquid and requires both the Red flammable label and Poison B label.

Materials known to be safe for storage and handling are stainless steel, nickel, "Teflon," and glass-lined equipment. Any other material may be unsuitable, *and possibly dangerous* for methyl isocyanate service. Iron or steel, zinc or galvanized iron, copper and its alloys, and tin should not be used.

Because of the hazardous properties of both its liquid and vapor, methyl isocyanate must be kept confined within closed equipment. To exclude moisture and air, the vapor space of tanks and reactors should be blanketed with dry nitrogen having a maximum dew point of −40°F. or C.

Materials that might catalyze a reaction must be excluded. For further information on reactants and catalysts, see the discussion on reactions in this bulletin. Tanks and lines used for storage or transfer of methyl isocyanate should contain only methyl isocyanate or *dry* nitrogen; no common lines or pumps used for other products should be used for methyl isocyanate.

If liquid methyl isocyanate is spilled or must be disposed of, it should be treated to produce controlled decomposition. Vapors should not be vented to the atmosphere; they should also be decomposed. Men working in areas where methyl isocyanate is handled must be informed of its hazardous nature and must have and use protective clothing and equipment.

This information is purposely general in nature. Detailed information is available. In addition, our specialists should be consulted early in the design of any project concerning storage and handling of methyl isocyanate.

## PRECAUTIONARY LABELING

**DANGER!**

**EXTREMELY FLAMMABLE**
**BREATHING OF VAPOR HARMFUL OR FATAL**
**LIQUID CAUSES EYE INJURY AND SKIN BURNS**
**ABSORPTION THROUGH SKIN HARMFUL**

Do not breathe vapors.
Do not get in eyes, on skin or on clothing.
Keep away from heat, sparks and fire.
Do not leave container open.

**POISON!**

**CALL A PHYSICIAN**

IF INHALED — Remove patient to fresh air, give artificial respiration if not breathing. Give oxygen if breathing is difficult.

IN CASE OF CONTACT:
CLOTHING—Remove contaminated clothing and shoes at once. Wash thoroughly before re-use.
EYES AND SKIN—Immediately flush with plenty of water for at least 15 minutes. Get medical attention for eyes.

IMPORTANT — Immediately fill container with water and drain.
*Immediately reseal empty tank cars without cleaning.*

FOR INDUSTRY USE ONLY

## TOXICOLOGICAL PROPERTIES

Methyl isocyanate is a hazardous material by all means of contact. Since it has a high vapor pressure, inhalation of the material can easily occur if it is improperly handled. Although the "tear gas" effects of the vapor are extremely unpleasant, this property cannot be used as a means to alert personnel to exposure to chronically toxic concentrations of methyl isocyanate. Methyl isocyanate is a poison by inhalation[33,34] as defined in ICC regulations and is intensely irritating to breathe. It causes severe bronchospasm and asthma-like breathing. Sensitization may occur, after which traces of vapor cause true attacks of asthma. Although it does not quite meet the standards that define a poison by swallowing or skin contact, the difference is so small that methyl isocyanate should also be regarded as an oral and contact poison.[33,34] Skin contact can cause severe burns. The liquid will seriously injure the eyes, even when it is diluted with a non-toxic liquid to a one percent concentration. Like other isocyanates (TDI, for example), methyl isocyanate causes sensitization in animals.[34] Since exposure of a group of test animals to traces of methyl isocyanate sensitized the skin of all the animals, such sensitization could probably be expected to occur in humans. The same series of experiments[34] also demonstrated that a cross sensitization to other isocyanates will develop.

***Stringent precautions must be observed to eliminate any possibility of human contact with methyl isocyanate.***

## AVAILABILITY

Large quantities of methyl isocyanate are available on reasonable notice. Drums are available now. Sample shipments are made in special eight-ounce bottles packed in lug-locked sealed cans.



ADEQ0022367/18

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Lithographed in U.S.

ADEQ0022367/19

# REACTIVE CHEMICALS MANUAL DATA SHEET

UNION CARBIDE CORPORATION

CHEMICALS DIVISION

Chemical Name METHYL ISOCYANATE(MeNCO)
Random (IEM) Number 9142


Empirical Formula

$C_2 H_3 NO$

Synonyms

Methyl ester of isocyanic acid

## A. PHYSICAL PROPERTIES

1. Flammability Properties
   a. Flammability limits, in air, 760 mm.
      Upper--(Calc. by D. H. Way)---- 16 vol.%
      Lower--(Calc. by D. H. Way)---- 3.5 Vol.%
   b. Flammability limits, at operating conditions
      (_____ psig at _____ °C)
      Upper---- * Vol.%
      Lower---- * Vol.%
   c. Flash Point
      Open cup---- <0 °F
      Closed cup---- * °C
   d. Autoignition temperature---- * °C

2. Boiling Point and Vapor Pressure
   a. Boiling point, 760 mm.---- 39.1 °C
      300 mm.---- 16.7 °C
      50 mm.---- -17.0 °C
      10 mm.---- -40 °C
   b. Vapor pressure, 20°C---- 348 mm.
      °C---- mm.
   c. Critical pressure---- 55 atm
   d. Critical temperature---- 218 °C

3. Solubility
   a. Solubility in water, 20°C--Reacts slowly, but heat of reaction will increase rate of reaction-- % by wt.
   b. Solubility of water in, 20°C---- % by wt.

4. Thermal Properties
   a. Specific heat (liquid), 68 °F---- 0.443 Btu/lb./°F
   b. Heat of vaporization, 40 °C---- 222.6 Btu/lb.
   c. Heat of fusion, _____ °C---- * Btu/lb.

5. Specific Gravity
   a. Specific gravity, 20°C---- 0.9599
   b. Coefficient of expansion, 20°C---- 0.00148 per °C

6. Absolute viscosity, 0 °C---- 0.35 centipoises
   20 °C---- 0.25 centipoises

7. Freezing Point---- less than -80 °C

8. Molecular Weight---- 57.05

*Data not available.

## B. DESCRIPTION OF REACTIVITY

Type - Reacts with active hydrogen compounds with evolution of heat.

a. Chemical equations

acids (1) $HX + MeNCO \longrightarrow MeNHCO\text{-}X$

amines (2) $R_2NH + MeNCO \longrightarrow R_2NC(=O)NHMe$

water (3) $H_2O + MeNCO \longrightarrow MeNHC(=O)\text{-}NHMe$

alcohol & phenols (4) $ROH + MeNCO \longrightarrow MeNH\text{-}C(=O)\text{-}OR$

strong bases anhydrous (5) $MeNCO \xrightarrow{\text{Catalyst (B)}} (MeNCO)_3$ (Trimer)

b. Heat of reaction - All of the reactions above are exothermic. Reaction 5 produces 537 BTU/lb of MeNCO reacted; reaction 1 with the use of HCl produces approximately 280 BTU/lb of MeNCO reacted.

c. Rate of reaction - Reactions 1 and 2 are very fast. Reactions 3 and 4 are slow at ambient temperatures and in the absence of catalysts (amines or tin compounds). The rate of reaction 5 is strongly dependent on kind and amount of catalyst. Traces of NaOR produce very rapid reaction (minutes); $Ca(OH)_2$ produces measurable $(MeNCO)_3$ after months.

## C. CATALYTIC AGENTS

Specific catalysts

a. Trimerization reaction is catalyzed by $E+_3P$, Bases (e.g. NaOMe, NaOAc, (R+N) OH, etc.), Oxalic acid, Lewis acids (e.g. $FeCl_2$ or $FeCl_3$, $ZnCl_2$, $AlCl_3$, etc.). See "M."

b. Tertiary amines (including pyridine) cause an insoluble white polymer to form on surfaces in the vapor.

c. Per cent

(1) As little as 50 ppm with some catalysts.

(2) One tenth percent shows polymer formation.

d. Temperature

(1) Trimerization rate is strongly dependent on temperature (with $FeCl_3$ catalyst the rate was 200 times slower at 0°C than at 25°C).

(2) Unknown.

## D. MATERIALS OF CONSTRUCTION FOR STORAGE AND HANDLING

1. Safe - Stainless steel #304 and #316, MONEL metal, nickel, glass, Teflon,

D. MATERIALS OF CONSTRUCTION FOR STORAGE AND HANDLING (continued)

2. Unsafe - Carbon steel, copper, polyethylene, essentially all elastomers.

Reason - Steel and copper react slowly with traces of methylcarbamoyl chloride (produces HCl) to form an active trimerization catalyst. Methyl isocyanate diffuses through polyethylene. Elastomers are attacked.

E. PEROXIDE FORMATION

Does not form peroxides.

F. DETECTION OF HAZARDOUS CONDITIONS

1. Analyses (laboratory and unit methods) - Methods required are those required to detect trimerization potential of refined MeNCO.

a. Impurities - Methyl carbamoyl chloride - method is available.

b. Catalysts - Iron can probably be determined by a colorimetric method or by emmision spectroscope. A method is under development.

c. Decomposition products - An IR method for trimer detection is available (determines as little as 0.04% trimer).

2. Observation - In the presence of steel and methyl-carbamoyl chloride the MeNCO slowly turns light green. Deepening of the color indicates a greater potential for trimerization. Just as rapid trimerization begins, the MeNCO turns a tan color, and the mixture becomes rust colored as trimer is formed in quantity. No changes in the color of the MeNCO occur in the copper catalyzed trimerization.

G. METHOD OF PREVENTING REACTIVITY HAZARDS

1. MeNCO must not be allowed to contact active hydrogen compounds (see Sec. B-a). If contact inadvertently occurs the mixture should (1) be cooled, if possible, or (2) diluted with an inert solvent, such as MEK, acetone, chloroform, or toluene.

2. To prevent trimerization of MeNCO on contact with steel, MeNCO should be kept free of acids.

If the trimerization does begin, the reaction can be moderated by cooling the MeNCO. Addition of dimethyl acid pyrophosphate (0.1 per cent will saturate the MeNCO) will nearly stop the reaction. MeNCO that must contact steel should be inhibited with dimethyl acid pyrophosphate.

## H. METHODS OF REACTION CONTROL

1. Temperature - Cooling.

2. Pressure - None.

3. Precautions for shock, light, etc. - Not applicable.

4. Dumping - Reacting mixtures should be dumped into large volumes of ammonia solution (preferably in MeOH or acetone) or aqueous caustic.

5. Neutralization - See "G."

## I. HANDLING CONDITIONS

1. Unfavorable (i.e. shock, heat, light, overpressure) - Pure methyl isocyanate is stable to heat, light, and moderate pressures.

2. Waste disposal methods - Treat with caustic, sewer caustic layer, and burn remainder.

## J. HEALTH HAZARDS

1. Inhalation - Extremely irritating - Respiratory protection mandatory. If exposure results in apnea, needs mouth-to-mouth resuscitation after removal from contaminated atmosphere. Take to Medical Department. Medical treatment under direction of M.D. is $O_2$ under positive pressure and symptomatic and supportive therapy mandatory.

2. Ingestion - Extremely irritating - If swallowed, drink one pint $H_2O$ followed by emetic. After emesis, drink one pint water and bring victim to physician. Needs gastric lavage and symptomatic and supportive therapy mandatory.

3. Skin contact - Immediately remove contamination with copious amounts of soap and water. Exposures must be reported to Medical Department because MeNCO probably a strong sensitizing agent.

4. Eye hazard - After exposure, immediate use of eyebath for at least 10 minutes and then report to Medical Department.

5. Industrial hygiene practices

   a. Recognition - Methyl isocyanate is a strong lacrimator but this should not be relied upon for safe handling. The odor is detectable only for a short period of time (less than 30 seconds) in atmospheres of 5 parts per million.

5. Industrial hygiene practices (continued)

The compound boils at 38 to 39° C. which gives 100% pure MeNCO vapor. Moisture must be kept out, for water or acid in methyl isocyanate generates carbon dioxide - will rupture containers.

The vapor pressure is 348 at 20° C. so saturated vapor is about 450,000 ppm at this temperature. Instant death will occur if saturated vapors are breathed.

b. Evaluation - A rigorous air sampling program should be performed during start-up of new facilities. This program should be under the direction of the industrial hygienist who will evaluate the findings and make recommendations. A periodic sampling program should be conducted to assure that MeNCO vapors are maintained below the Threshold Limit Value of 0.02 ppm (tolylene diisocyanate) until an established limit is available.

c. Recommended control procedures:

(1) Enclosure of all processes should be practiced.

(2) Process ventilation should be available.

(3) This is an exceedingly hazardous chemical when breathed or contacted with the eyes.

(a) Approved air-supplied respiratory protection must be worn while handling methyl isocyanate.

(b) Skin and eye contact must be avoided. Approved protective clothing should be worn by operating personnel.

(c) Maintenance personnel should be protected from MeNCO while performing work on equipment in process units. Equipment should be thoroughly decontaminated before taking to maintenance shops for repair.

(4) All exposed personnel should be seen by a physician.

## K. FIRE FIGHTING CONSIDERATIONS

1. Type extinguisher - Dry chemicals, $CO_2$, water spray.

2. Unsafe methods - None known.

# METHYL ISOCYANATE

## TOXICOLOGICAL PROPERTIES

Methyl isocyanate is a hazardous material by all means of contact, and since it has a high vapor pressure, inhalation of the material can easily occur if it is improperly handled. Although the "tear gas" effects of the vapor are extremely unpleasant, this property cannot be used as a means to alert personnel to exposure to chronically toxic concentrations of methyl isocyanate. Methyl isocyanate is an ICC Class B poison by inhalation as defined in the regulations and is intensely irritating to breathe. It causes severe bronchospasm and asthma-like breathing. Sensitization may occur, after which traces of vapor cause true attacks of asthma. Although it does not quite meet the standards that define a poison by swallowing or skin contact, the difference is so small that methyl isocyanate should be also regarded as an oral and contact poison. Skin contact can cause severe burns, and the liquid will seriously injure the eyes even when it is diluted with a nontoxic liquid to a one percent concentration. Like other isocyanates (TDI, for example) methyl isocyanate causes sensitization in animals. Since exposure of a group of test animals to traces of methyl isocyanate sensitized the skin of all the animals, such sensitization could probably be expected to occur in humans.

Stringent precautions must be observed to eliminate any possibility of human contact with methyl isocyanate.

Single oral dose in Rats: $LD_{50}$ -- 71 mg/k

Single skin penetration in Rabbits: $LD_{50}$ -- 0.22 ml/k

Single inhalation by Rats: $LD_{50}$ -- 0.103 mg/L (44 ppm)
2 mg/L inhaled for 1 hour killed 6/6 Rats

Skin irritation in Rabbits: undiluted caused severe burns
10% solution caused irritation

Eye injury in Rabbits: severe corneal injury from the liquid and from a 1% solution in Deobase.

APPENDIX "B"

# IMPORTANCE OF PREVENTING CONTAMINATION OF MIC

## I. Trimerization

1. Trimerization of MIC to trimethyl isocyanurate is catalyzed by iron, steel, zinc, copper and tin.

2. MIC can be exposed to stainless steel, nickel and aluminum without trimerization occurring.

3. Trimerization is exothermic to the extent of 540 BTU per pound. ✓

4. There is an induction period which depends on temperature, surface to volume ratio, the metal, and the proportion of hydrolyzable chloride present in the MIC.

5. The induction period is characterized by slow formation of trimer and coloration of the MIC. Eventually, the reaction becomes violent because the high heat of trimerization increases the temperature of the MIC, thus increasing the reaction rate. The low boiling point of MIC makes the reaction particularly likely to rupture containers.

6. By maintaining MIC temperature below −10°C, trimerization can be prevented, even in the presence of large amounts of catalysts. (0.35% trimer at 6°C after 40 days. None at −40°C.)

7. Compounds of the metals which are catalytic will also catalyze trimerization.

8. Strong bases, including amines, also catalyze trimerization of MIC.

## II. Polymerization

1. Linear polymerization of MIC vapor is catalyzed by amines. $CO_2$ inhibits this.

2. Very pure liquid MIC, containing no chlorides, polymerizes spontaneously to a linear polymer.

3. This polymerization can be catalyzed by dimethylaniline, and presumably other amines.

4. Exothermic heat of polymerization is 345 BTU per pound.

b. Four 1 piece suits complete with integral head, face shield and fresh air masks for work of more hazardous nature. Offers complete liquid exposure protection and fresh air supply.

8. Toxic Gas Alarms.

a. Local
b. Plant.

# APPENDIX "D"

## PROCEDURE FOR HANDLING AN MIC SPILL OUTSIDE OF A PLANT

### GENERAL GUIDELINES

A. If there is a tank car rupture and a fire, let the MIC burn while protecting adjacent property.

B. If there is a tank car rupture and no fire, do the following:

1. Evacuate the area.
   Size of the area depends on prevailing wind, temperature, size of spill, surrounding terrain, etc.

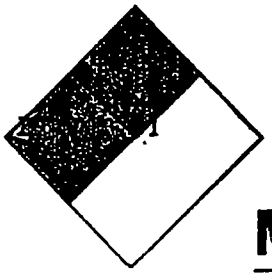
2. Ignite the MIC car if it can be safely done.

3. If the spill can't be ignited - do the following:

   a) Cover with activated carbon (available at a water treating facility).

   b) React with water using some basic material such as caustic, lime, or ammonia to accelerate the reaction.

4. If there is a small leak flood with water until the leak is stopped or its contents can be transferred.



No. BE-13.04

# MATERIAL HAZARDS CARD

**MATERIAL NAME(S):** METHANOL (METHYL ALCOHOL)

**DESCRIPTION:** CLEAR, COLORLESS LIQUID

**HANDLING, STORAGE:** SEE OPERATING INSTRUCTIONS. USE STEEL OR GLASS CONTAINERS.

## HAZARDS

**FIRE:** FLAMMABLE - MAY BE IGNITED BY HEAT, SPARKS OR OPEN FLAME.

**EXPOSURE:** VAPOR HARMFUL

**REACTIVITY:** NOT DANGEROUSLY REACTIVE

## IN CASE OF

| ACCIDENT | DO THIS |
|---|---|
| SPILL OR LEAK | SHUT OFF IGNITION. NO SMOKING OR FLARES. KEEP PEOPLE AWAY. SHUT OFF LEAK IF WITHOUT RISK. FLUSH AREA WITH WATER SPRAY. |
| FIRE | N SMALL FIRE USE DRY CHEMICAL OR CARBON MONOXIDE. N LARGE FIRE USE WATER SPRAY OR "ALCOHOL" FOAM. OOL TANK WITH WATER IF EXPOSED TO FIRE. |
| EXPOSURE | EMOVE TO FRESH AIR. |

**MATERIAL NAME(S):** METHANOL (MeOH)

**REFERENCES:**

MCA CHEM CARD CC-69
MCA SAFETY DATA SHEET SD-22
DU PONT METHANOL UNLOADING, HANDLING AND STORAGE SYSTEMS BULLETIN A-13385

**PHYSICAL PROPERTIES:**

BOILING POINT, 760 MM.....64.5°C (148°F)
FLASH POINT, T.C.C.....12°C (54°F)
T.O.C.....16°C (61°F)
SPECIFIC GRAVITY 20/40°C .....0.7910

**CHEMICAL PROPERTIES:**

CORROSIVITY.....NONCORRSIVE AT NORMAL ATMOSPHERIC TEMPERATURES
EXCEPTION - LEAD AND ALUMINUM
HYGROSCOPICITY .....NONE
LIGHT SENSITIVITY.....NONE
REACTIVITY.....NOT DANGEROUSLY REACTIVE.
SOLUBILITY.....MISCIBLE IN ALL PROPORTIONS WITH WATER

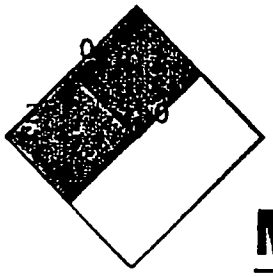
**FIRE & EXPLOSION DATA:**

FLAMMABLE LIMITS, PERCENT BY VOLUME IN AIR AT STP: 7.3 TO 36

AUTOIGNITION TEMPERATURE: 470° C (878°F)

**HEALTH DATA:**

THRESHOLD LIMIT IN AIR: 200 PPM BY VOLUME
262 MILLIGRAMS PER CUBIC METER



Hous-16
No._____

# MATERIAL HAZARDS CARD

**MATERIAL NAME(S):** Methylene Chloride, Dichloromethane, "MCl"

**DESCRIPTION:** Clear, colorless highly volatile liquid with pleasant, ethereal odor.

**HANDLING, STORAGE:** Stored in carbon steel tanks.

## HAZARDS

**FIRE:** Practically nonflammable and nonexplosive at ordinary temperatures, but at higher temperatures under favorable laboratory test conditions, it is capable of forming weakly combustible mixtures with air.

**EXPOSURE:** Vapor inhalation may produce nausea, dizziness, headaches. Skin contact will cause excessive dryness and skin cracking (defatting).

**REACTIVITY:** Reacts with aluminum, titanium, and strong basic salts.

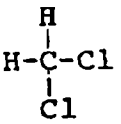
## IN CASE OF

| ACCIDENT | DO THIS |
|---|---|
| SPILL OR LEAK | Spills should be cleaned up immediately. In high vapor concentrations, wear breathing air mask Use mops, rags to soak up leaks, spills, then place them out of doors where they can be dried safely. Wear splash-proof goggles and gloves. |
| FIRE | Practically non flammable. Spray MCl tank with water if exposed to fire. If MCl fire occurs, wear air demand mask to fight fire and use any type fire fighting apparatus. Beware of toxic fumes (phosgene) see "HEALTH DATA" section. |
| EXPOSURE | Eye and skin exposure - flush with copious quantities of water.<br>Vapor inhalation - remove from fumes to fresh air If overcome, apply artificial respiration and call physican.<br>Ingestion - Induce vomiting, call physician. |

## MATERIAL NAME(S): Methylene Chloride, Dichloromethane, "MCl"

CHEMICAL FORMULA: $CH_2Cl_2$

CHEMICAL STRUCTURE:



## REFERENCES:


MCA Safety Data Sheet SD-86 (July, 1962)
Lange-Handbook of Chemistry (Tenth edition)
DuPont - Electrochemicals Dept., Chlorine Products Bulletins 524-1267 and 526-659
Underwriters Laboratories Report MH-2375, Nov., 1933


## PHYSICAL PROPERTIES:

STATE: Liquid

COLOR: Clear, water white

ODOR: Pleasant, aromatic, faintly ethereal

DENSITY: 1.326 g/cc @ 20/4°C

MELTING POINT: -96.7°C

BOILING POINT: +39.8°C

## CHEMICAL PROPERTIES:

MOLECULAR WEIGHT: 85.0

CORROSIVE: Noncorrosive at normal temperatures when moisture free. In contact with water especially at elavated temperatures, MCl will corrode iron, some stainless steels, copper, nickel and /other metals

SOLUBILITY IN $H_2O$: 2% at 20°C (immiscible)

SOLUBILITY IN ALCOHOLS: Infinite

## FIRE & EXPLOSION DATA:

FLASH POINT: Not found

AUTO IGN. TEMP.: 1224°F

AUTO DECOMP. TEMP.: Not found

LOWER EXPL. LIMIT: 15.5% volume)

UPPER EXPL. LIMIT: 66.0% volume)

MIN. IGNITION ENERGY: Not found

(dp/dt) max.: Not found

in oxygen only under pressure

## HEALTH DATA:

ALD: Not found

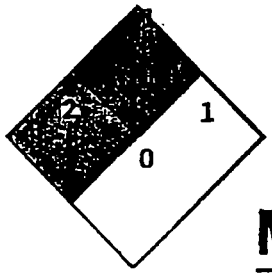
$LD_{50}$: Not found

TLV: 500 ppm

DETECTION THRESHOLD: 25 - 50 ppm

EXPOSURE SYMPTOMS: Not found

MAJOR SAFETY CONSIDERATION: MCl is an anesthetic, chief hazard is loss of consciousness following vapor inhalation at elevated temperatures,




No._____

# MATERIAL HAZARDS CARD

**MATERIAL NAME(S):** MTAAO, (S-methyl-N-hydroxy thioacetimidate)

**DESCRIPTION:** White crystals at room temperature but usually in a solution of water or methylene chlorides.

**HANDLING, STORAGE:** Handle as a corrosive, toxic liquid. For sampling, wear rubber gloves and goggles.

## HAZARDS

**FIRE:** MTAAO has a very low vapor pressure and is not a serious fire hazard. However if exposed to open flame, it will burn, forming obnoxious and potentially toxic fumes.

**EXPOSURE:** Vapors not strong but common solvent (methlene chloride) may cause respiratory irritation.

**REACTIVITY:** Not highly reactive with most common gases or metals.

## IN CASE OF

| ACCIDENT | DO THIS |
|---|---|
| SPILL OR LEAK | Isolate area. Keep upwind. If necessary to enter spill area, wear full protective clothing and a self-contained breathing apparatus. Wash spill with copious amounts of water. |
| FIRE | Avoid fumes which are obnoxious and potentially toxic. Extinguish fire with water or foam. |
| EXPOSURE | Immediately flush exposed area with water for at least 15 minutes. If not breathing, apply artificial respiration. Call a physician. Remove contaminated clothing. Keep patient at rest. |

## MATERIAL NAME(S):

MTAAO ( S-methyl-N-hydroxythioacetimidate )

## REFERENCES:

Product 10 Operating Instructions, 1975

## PHYSICAL PROPERTIES:

Melting Point: 91-92°C
Boiling Point: Not Available
Vapor Pressure @ 25°C: Not Available

## CHEMICAL PROPERTIES:

Chemical Formula: $C_3H^7SNO$

Molecular Weight: 105.2

Reacts with methyl isocyanate to form methomyl.

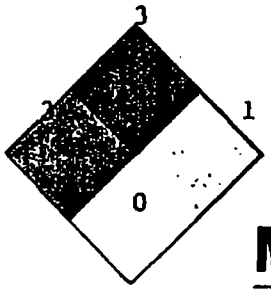
## FIRE & EXPLOSION DATA:

Fire: Burns in open flare to form obnoxious and potentially toxic fumes.

Explosion: Decomposes explosively when confined heating above 130°C is applied.

## HEALTH DATA:

Approximate Lethal Dose: 670 mg/Kg
Causes eye irritation, but effects are reversible.
MTAAO shows no cumulative oral toxicity.




No._____

# MATERIAL HAZARDS CARD

**MATERIAL NAME(S):** "Lannate" L Methomyl Insecticide

**DESCRIPTION:** "Lannate" L is a 25% solution of methomyl in 90% methanol - 10% water.

**HANDLING, STORAGE:** "Lannate" L is packed in 1 gal and 5 gal containers and is shipped in bulk. It is handled in 300 series stainless steels and in some plastics.

## HAZARDS

**FIRE:** "Lannate" L is flammable, producing toxic and obnoxious fumes on combustion.

**EXPOSURE:** Methomyl is a cholinesterase inhibitor. Most rapid and pronounced toxic effects are caused by oral ingestion.

**REACTIVITY:** Methomyl decomposes on strong heating. It is sensitive to confined heating and may explode at temperatures above 136°C (277°F).

## IN CASE OF

| ACCIDENT | DO THIS |
|---|---|
| SPILL OR LEAK | [illegible] spread where possible. Avoid all use of fires or flames and protect from other ignition sources.<br>Clean up spill in best practicable manner. If outside sp occurs try to avoid contaminating natural waters: methom is fatal to marine animals in concentrations as low as 10 ppm. |
| FIRE | Water is an effective fire-fighting agent; it is complete miscible with "Lannate" L. |
| EXPOSURE | Seek medical help immediately. Atropine sulfate is an effective antidote and may be administered orally or intravenously. |

## MATERIAL NAME(S):

"Lannate" L Methomyl Insecticide: a 25% solution of methomyl in 90% methanol - 10% water. (1.8 lb/gal)
Methomyl: S-methy-N-[(methylcarbamoyl)oxy]thioacetimidate.

## REFERENCES:

Product 10 Operating Instructions, 1975

## PHYSICAL PROPERTIES:

State: Liquid

Density: 7.4 lb/gal

Color: Dark Brown

Boiling Point: 70°C (159°F)

Incipient Crystallization Temperature: - 2°C (28°F)

## CHEMICAL PROPERTIES:

Molecular Weight: 162

Miscibility with Water: Total

## FIRE & EXPLOSION DATA:

Flash Point: 14°C (58°F)

Auto-decomposition Temperature: 136°C (277°F)

Methanol from "Lannate" L will form explosive mixtures with air; explosive limits are 6.7% to 36.5% methanol. These vapor compositions will be in equilibrium with "Lannate" L at temperatures of 11°C (52°F) and 44°C (111°F).

## HEALTH DATA:

Approximate Lethal Dose: 9 ml (0.3 oz) orally (in a 180 lb man)

Symptoms: headache, nausea, weakness, pupillary constriction, diarrhea. (More rapid and pronounced toxic effects are caused by oral ingestion.)

Antidote: atropine sulfate, administered orally or intravenously.

(Inhalation of methanol vapors can cause dizziness, intoxication, etc. Oral ingestion of methanol may cause blindness.)

## Information for Physicians Regarding Symptomatology and Treatment in "Lannate" Methomyl* Insecticide Poisoning Cases

Methomyl is a carbamate-type insecticide with a high degree of acute toxicity. Its toxic effects are related to the inhibition of blood and tissue cholinesterases and thus to an accumulation of excessive amounts of acetycholine in effector organs. Overexposure to methomyl would not be expected to result in a toxic effect to a specific organ in the usual sense of the word, such as a toxic hepatitis.

Methomyl intoxication would most likely occur from exposure to the dust or spray mist or it could occur if ingested. Methomyl is not readily absorbed through the intact skin.

### Signs and Symptoms

Signs and symptoms which may be expected to occur in the less severe poisoning cases are as follows:

1. Constriction of pupils (miosis)
2. Sweating, profuse
3. Weakness
4. Slow pulse
5. Nausea and vomiting
6. Muscle tremors
7. Blurred vision
8. Abdominal cramps and diarrhea

The exact order of onset of these signs and symptoms will vary but those given here are among the first to occur following over-exposure to this material. Clinical evidence of methomyl intoxication generally becomes apparent within a matter of minutes to within an hour following the exposure, the exact time depending on the severity and route of exposure.

* Methomyl is the common name for S-methyl-N-[(methylcarbamoyl)oxy] thioacetimidate

Since methomyl is a cholinesterase inhibitor, presumably any of the signs and symptoms associated with cholinesterase inhibition could occur and would depend on the severity and type of exposure. These are outlined in Table 1.

## Diagnosis

Diagnosis of methomyl intoxication can be made from a history of exposure followed by the onset of all or more likely some of the signs and symptoms listed in Table 1. The diagnosis can be confirmed by measuring the activity of the blood cholinesterases using an appropriate method such as the Ellman method.* However, the cholinesterase activity with this class of compounds may return to normal very rapidly after exposure; therefore a normal level does not disprove the diagnosis.

Some of the commonly used methods of determining acetycholinesterase activity in cases of organophosphorous intoxication are not desirable for this determination in cases involving carbamates. These methods involve measurements of change in pH and are patterned after the method originally described by Michel.**

## Medical Management

The treatment of methomyl intoxication may be summarized as follows:

1. Termination of exposure.

In the case of an inhalation exposure, remove person to an uncontaminated atmosphere. In case of contact, remove contaminated clothing and wash promptly contaminated skin or eyes with copious amounts of water. If ingestion has occurred, gastric lavage should be performed.

2. Atropine administration.

The appearance of any local or systemic signs or symptoms of anticholinesterase poisoning calls for the immediate use of atropine. This drug is antidotal because it inhibits the action of acetycholine at its many sites of action, with the exception of the voluntary muscles.

* G. L. Ellman, K. D. Courtney, V. Adrees and R. M. Featherstone, Biochem. Pharmacol., 7:88 (1961).

** H. O. Michel, J. Lab. Clin. Med., 34:1564 (1949).

In mild intoxication, 1.2 to 2 mg of atropine should be administered intramuscularly or intravenously initially and repeated at 10- to 30-minute intervals until symptoms are relieved and full atropinization (dry skin and dry mouth) is achieved. Maintain a mild degree of atropinization until patient recovers. In the mildest of cases, atropinization might be maintained by oral or sublingual administration of atropine tablets, 1/100 gr. (0.6 mg), as indicated by the recurrence of symptoms.

In severe intoxication, the initial atropine dosage should be 2 to 4 mg intravenously, with repeated intravenous administration of 2 mg every three to ten minutes until signs and symptoms disappear.

Note: 2-PAM (pyridine-2-aldoxime methiodide) should not be used in the treatment of methomyl poisoning since animal studies have shown it to be ineffective as an antidote not only for methomyl but other carbamate insecticides as well.

In addition, morphine and other respiratory depressants are contraindicated.

3. Removal of secretions and maintenance of open airway.

Whenever necessary, steps should be taken to remove excessive secretions from the respiratory tract and to maintain an open airway. These procedures include suction and the possible insertion of an endotracheal tube.

4. Artificial respiration when necessary.

In the severe intoxication cases, artificial respiration or oxygen administration may be necessary.

5. Alleviation of convulsions if these interfere with respiration and are not relieved by atropine.

Administer trimethadion (Tridione), 1 gram intravenously every 15 minutes up to a maximum of 5 grams, or sodium thiopental (2.5% solution) intravenously. Convulsions would not be expected except in the most severe intoxication.

Note to physician: Allow no further exposure to any cholinesterase inhibitors until full recovery is assured. Measurement of blood cholinesterase activity may be useful in this regard.

Detailed information concerning the treatment of intoxication by cholinesterase inhibitors is available in the following sources:

(1) B. Holmstedt, Pharmacol. Rev., 11:567 (1959).

(2) G. B. Koelle, Handbuch. Exp. Pharm., XV:1006 (1963).

First Aid

The following steps should be taken before the arrival of a physician:

(1) If swallowed, induce vomiting by giving warm salt water (a tablespoonful of salt in a glass of water) and repeat until vomit fluid is clear.

(2) If inhaled, remove person from exposure, have him lie down and keep quiet.

(3) In case of contact, remove contaminated clothing and wash contaminated skin or eyes with copious amounts of water.

(4) If patient has difficulty in breathing, start artificial respiration immediately.

(5) Give two tablets of atropine, each 1/100 gr. (0.6 mg), orally or by dissolving under the tongue if they are available at hand. Thereafter, every 10 to 15 minutes, give one atropine tablet repeatedly until throat and skin become dry. Give additional tablets as necessary to maintain dry throat and skin.

Haskell Laboratory
E. I. du Pont de Nemours & Company
Wilmington, Delaware

TABLE 1

SIGNS AND SYMPTOMS OF ANTICHOLINESTERASE POISONING*

| Site of action | Signs and symptoms |
|---|---|
| | **Following local exposure** |
| Pupils | Miosis, marked, usually maximal (pin-point), sometimes unequal |
| Ciliary body | Frontal headache, eye pain on focusing, slight dimness of vision, occasional nausea and vomiting |
| Conjunctivae | Hyperaemia |
| Nasal mucous membranes | Rhinorrhea, hyperaemia |
| Bronchial tree | Tightness in chest, sometimes with prolonged wheezi expiration suggestive of bronchoconstriction or increased secretion, cough |
| Sweat glands | Sweating at site of exposure to the liquid |
| Striated muscle | Fasciculations at site of exposure to the liquid |
| | **Following systemic absorption** |
| Bronchial tree | Tightness in chest, with prolonged wheezing expirat suggestive of bronchoconstriction or increased secretion, dyspnea, slight pain in chest, increa bronchial secretion, cough |
| Gastro-intestinal system | Anorexia, nausea, vomiting, abdominal cramps, epigastric and substernal tightness (? cardiospa with "heartburn" and eructation, diarrhea, tenesmus, involuntary defecation |
| Sweat glands | Increased sweating |
| Salivary glands | Increased salivation |
| Lachrymal glands | Increased lachrymation |
| Heart | Slight bradycardia |
| Pupils | Slight miosis (occasionally unequal), later more marked |
| Ciliary body | Blurring of vision |
| Bladder | Frequent or involuntary micturition |
| Striated muscle | Easy fatigue, mild weakness, muscular twitching, fasciculations, cramps, generalized weakness including muscles of respiration, with dyspnea and cyanosis |

TABLE 1 (Contd.)

SIGNS AND SYMPTOMS OF ANTICHOLINESTERASE POISONING*

| Site of action | Signs and symptoms |
|---|---|
| | Following systemic absorption |
| Sympathetic ganglia | Pallow, occasional elevation of blood pressure |
| Central nervous system | Giddiness; tension; anxiety; jitteriness; restlessness; emotional lability; excessive dreaming; insomnia; nightmares; headache, tremor; apathy; withdrawal and depression; bursts of slow waves of elevated voltage in EEG especially on overventilation; drowsiness, difficulty in concentrating; slowness of recall; confusion; slurred speech; ataxia; generalized weakness; coma with absence of reflexes; Cheyne-Stokes respiration; convulsion depression of respiratory and circulatory centr with dyspnea, cyanosis, and fall in blood press |

* From B. Holmstedt, Pharmacol. Rev., 11, 567 (1959) as cited in WHO Technical Report Series No. 227, Toxic Hazards of Pesticides to Man, p. 14 (1962).

B-11120

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
HOUSTON PLANT
P. O. BOX 347, LA PORTE, TEXAS 77571

BIOCHEMICALS DEPARTMENT

cc: J.W. Shackelford
~~L. Conaway~~
G. Mather

Houston Plant
July 22, 1976

John Miles
Production Superintendent
Eagle River Chemical Co.
West Helena, Arkansas

Product 10 Safety Information

To assist you in the safe manufacture of Product 10 the following information is attached.

1) Letter by S.I. Gleich to S. Parker describing Product 10 safety precautions.

2) A portion of the Union Carbide "Product Information" booklet concerning methyl isocyanate handling and safety measures.

3) Material Hazards Cards for methanol, methylene chloride, MTAAO, and "Lannate" L.

4) A paper entitled "Information for Physicians Regarding Symptomatology and Treatment in "Lannate" Methomyl Insecticide Poisoning Cases".

The first two items were previously transmitted to you. Both are thorough and require no further explanation.

The hazards cards provide a quick and concise safety guide for materials you use in making Product 10. I suggest you keep these cards handy for use by personnel involved with "Lannate" L.

Item 4 of the above list contains information for a physician when checking for or treating a methomyl exposure.

If you have questions about any of this material, please call.

Sincerely,

A.G. Rohrer
Engineer-Technical

AGR/pp
Attachments



ADEQ0022367/1

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
HOUSTON PLANT
P. O. BOX 347, LA PORTE, TEXAS 77571

BIOCHEMICALS DEPARTMENT

6/12

May 30, 1975

Mr. Scott Parker
Engineering Director
Vicksburg Chemical Co.
P. O. Box 3
Vicksburg, Ms. 39180

Dear Scott:

Contained in this letter is toxicity information, safety precautions to avoid methomyl exposure, and methods for treatment of persons who are exposed. This information will be necessary to safely operate the Product 10 facility at Eagle River. Please call with any questions.

Sincerely,

Steve

S. I. Gleich
Area Engineer - Technical

Attachments
SIG:ps

# PRODUCT 10 TOXICITY INFORMATION

The information contained herein refers primarily to "Lannate"-L (Product 10) and the hazards associated with handling it. We remind you, however, that methomyl is present, in solution, in several other process streams.

These streams include the MCl extract from R101, the MCl solution from R102 after MeNCO reaction and the aqueous solution from R102 after solvent exchange. These process streams should be handled with the same precautions as the product.

Since methomyl is always in solution during the Product 10 process, workers will generally not contact the solid.

## A. Toxicity

In pure form, methomyl is a granular solid. It is the active ingredient in Product 10 where it is dissolved in methanol and water.

### 1. Oral-Pure Solid

Methomyl is highly toxic and may be fatal if it, or its solutions are swallowed or inhaled. The oral $LD_{50}$ (of pure methomyl) to fasted white rats is about 20 mg/kg. There was no clinical evidence of cumulative toxicity when 10 doses of the chemical were administered orally to male rats at 5.1 mg/kg per day over a 14 day period.

### 2. Oral-"Lannate" - L

"Lannate" - L is moderately toxic when taken orally. It has an $LD_{50}$ of 130 mg/kg when tested with male rats.

### 3. Inhalation

The acute inhalation toxicity of "Lannate" - L was determined by exposing male rats to an aerosol of the material for one hour. The ALC (approximate lethal concentration) was found to be 0.17 mg/L on a methomyl basis. Because of the very low vapor pressure of methomyl ($5 \times 10^{-5}$ mm Hg at 25°C) the toxicity hazard from methomyl vapors at room temperature is negligible. Vapors above "Lannate" - L will contain methanol, however. Methanol has a TLV of 200 ppm.

A. Toxicity (Continued)

4. Skin and Eye

The $LD_{50}$ of "Lannate"-L by skin absorption determined by test with rabbits (intact skin), is 5880 mg/kg. "Lannate"-L produced no skin irritation or sensitization when tested on intact quinea pig skin at concentrations up to 100% strength. Operating experience in our "Lannate"-L packaging facilities at Houston suggests that hot weather increases the possibility that contact with "Lannate"-L will cause development of exposure symptoms. This is probably because increased sweating opens the body pores more, and in turn increases exposure susceptibility.

Eye irritation tests with rabbits indicate "Lannate" -L is irritating to the eyes and causes toxic symptoms when 0.1 ml of the undiluted material is applied.

5. Methanol Hazards

The solvent methanol is a severe fire and health hazard by itself. It's properties, discussed in MCA Safety Data Sheet SD-22, should be reviewed with equal care to those shown in this letter for methomyl. Personnel should be protected equally from methanol and methomyl exposures.

B. Symptoms of Exposure

Methomyl poisoning produces effects associated with anti-chlorinesterase activity which may include weakness blurred vision, headache, nausea, abdominal cramps, discomfort in the chest, constriction of pupils, sweating, slow pulse and muscle tremors.

Operating experience has shown that the most prevalent symptoms of methomyl exposure are constricted pupils (known as "little eye") and/or nausea.

C. Treatment for Exposure

In case of accidental contact, wash skin with plenty of soap and water. Avoid hot water. For eyes, flush with water for 15 minutes and get medical attention. Remove and wash contaminated clothing before reuse. Action should be taken immediately after exposure. Minutes separate successful from unsuccessful decontamination.

C. Treatment for Exposure (Continued)

If the solution is swallowed, give a tablespoon of salt in a glass of warm water (warm soapy water may also be used) and repeat until vomit fluid is clear. Have the patient lie down and keep quiet. If he is not breathing, start artificial respiration immediately. Never give anything by mouth to an unconscious person. Call a physcian as soon as possible.

If warning symptoms appear (Section B this letter), before the physician arrives, immediately swallow two atropine tablets (each 1/100 gr); thereafter, every 10 to 15 minutes, take one atropine tablet (1/100 gr) until the throat becomes dry and the skin becomes dry and flushed. Take additional tablets as necessary to maintain a moderately dry throat and dry flushed skin until the physician arrives.

We have attached a copy of the pertinent section from the "Lannate"-L product label for further details of treatment (Exhibit A).

D. Operating Precautions

Care must be used so that personnel do not breathe or swallow solutions containing methomyl, and do not get material in their eyes, or on their skin or clothing. Equipment used for handling methomyl solutions should be free of leaks. Any leaks, no matter how small, should be fixed immediately. Where product must be handled in the open, adequate ventilation must be provided to protect workers against methanol vapors or inadvertent spraying of the product.

Housekeeping should be scrupulous. Any spill of product or other methomyl solution should be cleaned up immediately. Clothing worn while working with methomyl should be removed at the end of the workday and laundered before reuse. Personnel should wash hands and face thouroughly after handling the product and before eating or smoking. Eating or smoking areas should be isolated from the working area. Employees should be adequately warned about the dangers of using the product containers for their own personal use.

Protective equipment for workers packing product should include goggles, rubber gloves, and aprons. Workers who clean up a spill should wear rubber boots during the clean up operation.

Any process lines needing repair which may have contained methomyl should be adequately decontaminated before mechanics are permitted to work on them. Mechanics should wear goggles and rubber gloves when breaking a line and rubber gloves for the rest of the job.

Safety showers and eye wash stations should be easily accessible to all workers.

DU PONT

REG. U. S PAT OFF

# Lannate® L

## METHOMYL INSECTICIDE

**Water Soluble Liquid** 1 GALLON CONTAINS 1 8 LBS METHOMYL

**ACTIVE INGREDIENT:** Methomyl
S-methyl-N-[(methylcarbamoyl)oxy]thioacetimidate . . . . . .24%
**INERT INGREDIENTS** . . . . . .76%
U S Pat 3,576,834 EPA Reg. No 352-370-AA

Keep out of reach of children

## DANGER ☠ POISON

**FLAMMABLE. CONTAINS METHANOL.**
**MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED.**
**POISONOUS IF INHALED. CAUSES EYE DAMAGE.**

**Do not breathe vapors or spray mist. Do not get in eyes, on skin, on clothing. Use with adequate ventilation.**
**Keep away from heat, sparks, and open flame. Keep container closed.**
In case of contact, wash skin with plenty of soap and water; for eyes, flush with water for 15 minutes and get medical attention; remove and wash contaminated clothing before re-use.

### ANTIDOTE AND FIRST AID

*ATROPINE IS AN ANTIDOTE—CONSULT PHYSICIAN FOR EMERGENCY SUPPLY OF 1/100 GRAIN ATROPINE TABLETS. CALL A PHYSICIAN AT ONCE IN ALL CASES OF SUSPECTED POISONING.*

**If swallowed,** give a tablespoonful of salt in a glass of warm water and repeat until vomit fluid is clear. **If inhaled,** remove from exposure. Have patient lie down and keep quiet. If patient is not breathing, start artificial respiration immediately. **Never give anything by mouth to an unconscious person.**

**If warning symptoms appear** (See **warning symptoms** below), before physician arrives, immediately swallow two atropine tablets (each 1/100 gr.), thereafter, every 10 to 15 minutes, take one atropine tablet (1/100 gr.) until throat becomes dry and skin becomes dry and flushed. Take additional tablets as necessary to maintain a moderately dry throat and dry, flushed skin until physician arrives.

### NOTE TO PHYSICIAN

**WARNING SYMPTOMS**—Methomyl poisoning produces effects associated with anticholinesterase activity which may include weakness, blurred vision, headache, nausea, abdominal cramps, discomfort in the chest, constriction of pupils, sweating, slow pulse, muscle tremors.

**TREATMENT**—Atropine sulfate should be used for treatment. Administer repeated doses. 1.2 to 2.0 mg. intravenously every 10 to 30 minutes until full atropinization is achieved Maintain atropinization until the patient recovers. Artificial respiration or oxygen may be necessary. Allow no further exposure to any cholinesterase inhibitor until recovery is assured Do not use morphine or 2-PAM.

---

**IMPORTANT**—When mixing spray, loading, applying or otherwise handling wear protective clothing, goggles, and a mask or respirator suitable for protection against methomyl vapors or spray mist such as Willson Products "Agri-Tox" R-533 Felt 11-P Cartridge or Mine Safety Appliances type H "Comfo" Wear clean clothes daily Wash thoroughly after handling and before eating or smoking. Do not contaminate or store near feed or foodstuffs

Not for use or storage in or around the home Keep animals and unprotected persons out of operational areas during treatment and while there is danger of drift Do not re-use container; bury when empty This product is toxic to fish, birds and other wildlife Keep out of any body of water Do not apply where runoff is likely to occur Do not apply when weather conditions favor drift from areas treated Do not contaminate water by cleaning of equipment, or disposal of wastes This product is toxic to bees and should not be applied when bees are actively visiting the area

Do not subject to temperatures below 32°F.

**E. I. DU PONT DE NEMOURS & CO. (INC.)**

### DIRECTIONS

Du Pont "Lannate" L Methomyl Insecticide should be used only in accordance with recommendations on this label, or in separate published Du Pont recommendations available through local dealers.

"Lannate" L is a water soluble liquid to be diluted with water for application by conventional tractor-mounted spray equipment. Use only in commercial plantings, do not use in home plantings.

**SPRAY PREPARATION**—Fill spray tank ¼ to ½ full of water. Add "Lannate" L directly to spray tank and mix thoroughly, using mechanical or hydraulic means. do not use air agitation.

**APPLICATION**—Apply at the recommended rates when insects first appear. Unless otherwise noted, continue applications at 5- to 7-day intervals or as needed. Use sufficient water to obtain thorough, uniform coverage Apply the low rates on small plants, small worms and light infestations of insects Use intermediate rates on larger worms and heavier infestations of insects. Use 1 to 3 applications of the highest recommended rate for controlling severe infestations. Thereafter, use the lowest rate possible to maintain control.

**NOTICE TO BUYER**—Seller warrants that this product conforms to the *chemical description on the label thereof and is reasonably fit for purposes* stated on such label only when used in accordance with directions under normal use conditions. This warranty does not extend to use of this product contrary to label use directions, or under abnormal use conditions, or under conditions not reasonably foreseeable to seller; buyer assumes all risk of any such use Seller makes no other warranties, express or implied

| CROPS | INSECTS | QUARTS PER ACRE | LAST APPLICATION TO HARVEST—DAYS |
|---|---|---|---|
| Broccoli Cauliflower | Cabbage Looper, Imp. Cabbageworm, Diamondback Moth | ½-1* | 7 |
| | | 1-2* | 14 |
| Cabbage | Cabbage Looper, Imp. Cabbageworm, Diamondback Moth | ½-2* | 1 |
| Brussels Sprouts | Cabbage Looper, Imp. Cabbageworm | 1-2* | 14 |
| Celery | Cabbage Looper | 2 | 14 |
| Lettuce (Head) | Cabbage & Alfalfa Loopers, Beet Armyworm | ½-1 | 7 |
| | | 1-2 | 10 |
| Peanuts**— East of Miss. River | Corn Earworm (up to 3 applns. or as needed) | ½-2 | 21 |
| Pepper | Green Peach Aphids | 1 | 10 |
| Potato | Tuberworm, Cabbage Looper | 1 | 14 |
| | Aphids | 1-2 | |
| | Leafhoppers, Flea Beetles East of Miss. River | 1 | |
| Sweet Corn | Earworm—Whorl as needed | ⅜-1 | 0 (ears) 3 (forage) |
| | Earworm—Ears 1-3 days or as needed | ½-1 | |
| | Fall Armyworm, European Corn Borer—Ears 1-3 days or as needed | 1 | |
| Tomato | Tomato Fruitworm, Aphids, Cabbage Looper, Beet Armyworm | 1 | 1 |
| | | over 1-2 | 2 |
| Tobacco (Except Shade) | Flea Beetle, Hornworm | ½-1 | 7 (flue cured) 14 (air or fire cured) |
| | Budworm (2-3 applns. before flower buds open), Cabbage Looper, Aphids | 1 | |
| Chrysanthemums | Cabbage Looper, Corn Earworm, Beet Armyworm, Thrips (weekly) | ½-1 qt. per 100 gals | — |

*Add wetting agent. **Do not feed treated vines to livestock.

ADEQ0022367/6

DON'T SAY IT–WRITE IT

DATE 6/2/75

TO Scott Parker

AT Vicksburg Chemical

FROM Steve Gleich

cc: PWW

## MENCO INFO

You may find the attached information useful. We would have given it to you sooner but just received it ourselves from a non-Vertac related person.

# METHYL ISOCYANATE $CH_3N=C=O$

## PHYSICAL PROPERTIES

Determined on purified samples

| | |
|---|---|
| Molecular Weight | 57.05 |
| Apparent Specific Gravity at 20/20°C. | 0.9599 |
| ΔSp. Gr./Δt. at 10 to 40°C. | 0.00147 per °C. |
| Boiling Point at 760 mm. Hg | 39.1°C. |
| at 300 mm. Hg | 16.7°C. |
| at 10 mm. Hg | −40°C. |
| Δb.p./Δp. at 750 to 770 mm. Hg | 0.035°C. per mm. Hg |
| Vapor Pressure at 20°C. | 348 mm. Hg |
| Solubility in Water at 20°C. | about 6.7% by wt.[a] |
| Solubility of Water In at 20°C. | about 1.2% by wt.[a] |
| Critical Pressure | 55 Atm. |
| Critical Temperature | 218°C. |
| Viscosity at 0°C. | 0.35 cps. |
| at 20°C. | 0.25 cps. |
| Freezing Point | <−80°C. |
| Heat of Vaporization at 1 atm. | 223 B.t.u. per lb. |
| Heat of Combustion at 25°C. | 8,041 B.t.u. per lb. |
| Flash Point, Tag open cup (ASTM Method D 1310) | <0°F.[b] |

(a) Reacts slowly

(b) Commercial material

November, 1967

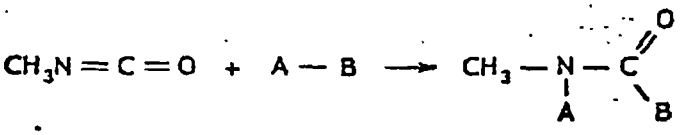
F-41443

SEVIN, SIRVATE, and UNION CARBIDE are trade marks of Union Carbide Corporation.

*This information is not to be taken as a warranty or representation for which we assume legal responsibility nor as permission or recommendation to practice any patented invention without a license. It is offered solely for your consideration, investigation and verification.*

Methyl isocyanate is an intermediate in the preparation of carbamate pesticides and should prove of interest in many other applications where special heterocyclic derivatives and polymers are needed.

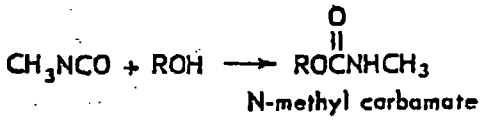
In general, most reagents that attack methyl isocyanate will add to the N=C bond to form N-methylcarbamoyl derivatives:



## REACTIONS

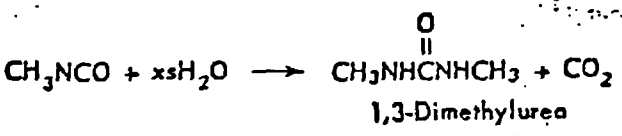
### ADDITION OF ACTIVE HYDROGEN COMPOUNDS

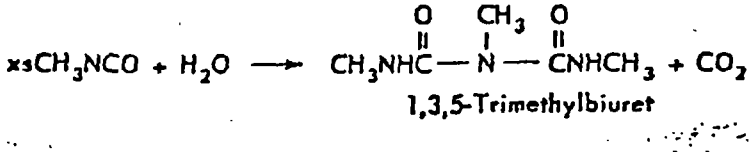
#### Hydroxy Compounds




This reaction takes place smoothly with a variety of hydroxy compounds. Alcohols and phenols are often quantitatively converted to the carbamate, although a catalyst, such as a tertiary amine or a dialkyl tin dicarboxylate, is usually required to produce complete reaction within a reasonable period.[1,2,3] Other functional groups may be present, if they are unreactive towards methyl isocyanate. SEVIN Carbaryl Insecticide and SIRMATE Herbicide are among the useful products obtained by reaction with hydroxy compounds.

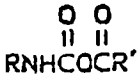
Water reacts with methyl isocyanate to form carbon dioxide and water-soluble ureas or biurets.



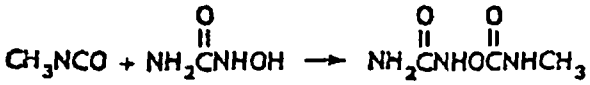



The reaction is slow at 20°C.; but, because of the heat produced, the reaction rate rapidly increases to the point of violent boiling. The presence of acids or bases greatly increases the rate of the reaction.[32]

The reaction of methyl isocyanate with carboxylic acids has not been described, but it can be expected to behave as other isocyanates. They form unstable, mixed anhydrides:



Other hydroxy compounds, such as enols, oximes and hydroxylamines, also produce N-methylcarbamates:

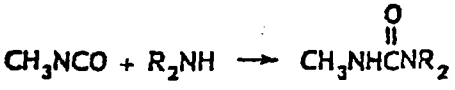


Ref. : 22

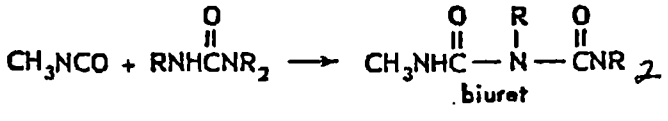
It would be expected that analogous thiocarbamates could be obtained from S-H compounds.[3]

N-H Compounds

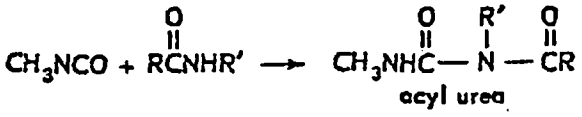
Ammonia and primary and secondary amines react rapidly at ambient temperatures without a catalyst:[1,2,3]



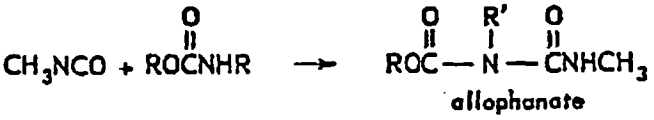
Methyl isocyanate will carbamoylate amides, ureas, or carbamates at higher temperatures:



biuret

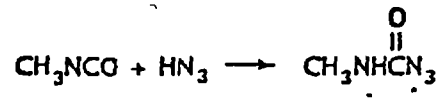


acyl urea

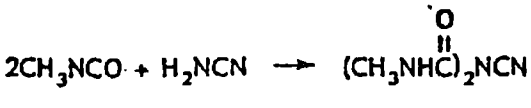


allophanate

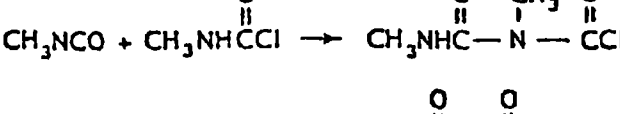
A number of other N-H compounds will react with methyl isocyanate:



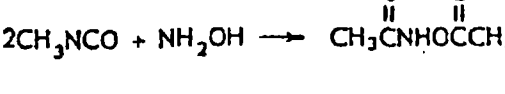
Ref. : 5



Ref. : 6



Ref. : 15 and 32



Ref. : 22

### Acids

Anhydrous acids add to methyl isocyanate to form N-methylcarbamoyl compounds:

$$CH_3NCO + HCl \rightleftharpoons CH_3NHC(=O)Cl \qquad \text{Ref. : 32}$$

The methylcarbamoyl chloride dissociates into the reactants on heating and slowly changes to other products upon standing.[32]

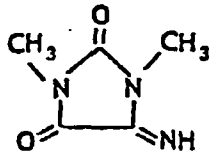
With concentrated sulfuric acid, the carbamoyl compound would be expected to decompose to form methylsulfamic acid:[7]

$$CH_3NCO + H_2SO_4 \longrightarrow CH_3NHSO_3H$$

Hydrogen cyanide is reported to react with methyl isocyanate:[5]

$$CH_3NCO + HCN \longrightarrow CH_3NHC(=O)CN$$

A second mole of methyl isocyanate will react if added;[5] later work[31] indicates that a cyclic product is obtained:



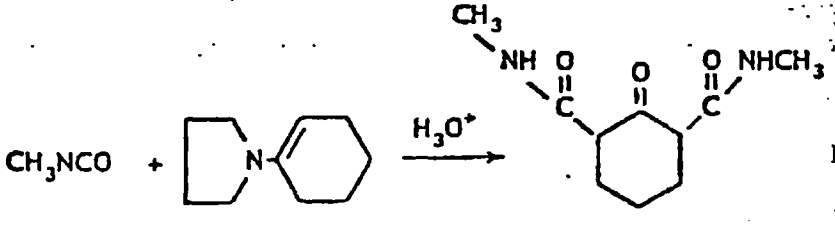
### C-H Compounds

Methyl isocyanate would be expected to react with active methylene compounds to form N-methylamides:[3]

$$CH_3NCO + Na^{\oplus}\,{}^{\ominus}CH(Y)_2 \longrightarrow (Y)_2CHC(=O)NHCH_3$$

$$Y = -COOR, -COR, \text{or} -CN$$

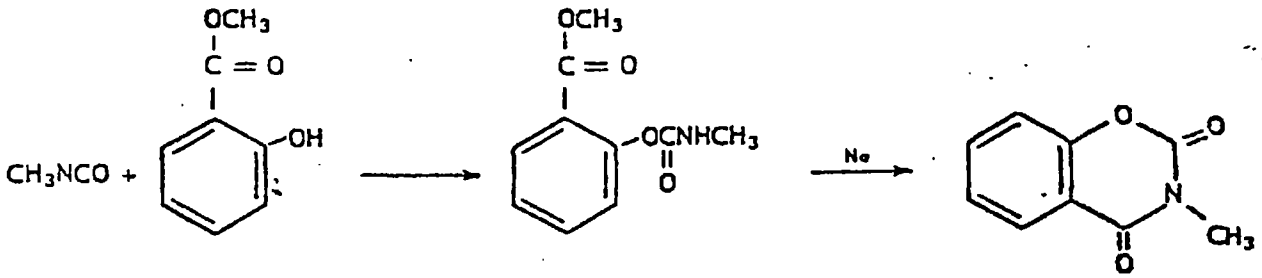
With enamines, the following would probably occur:



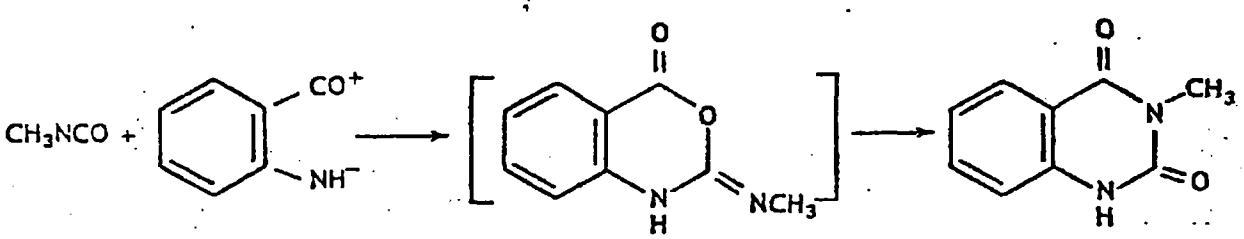
Ref. : 8,9,16

### Cyclizations

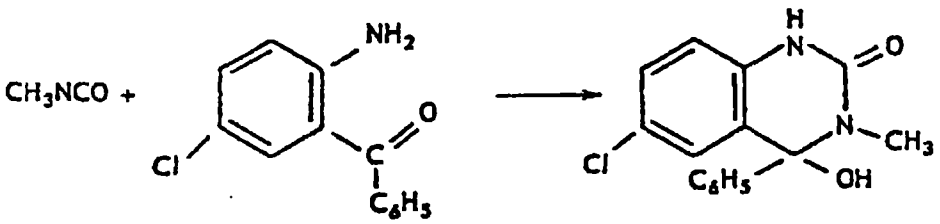
If methyl isocyanate is used to carbamoylate a difunctional molecule, the derivative may be made to cyclize:



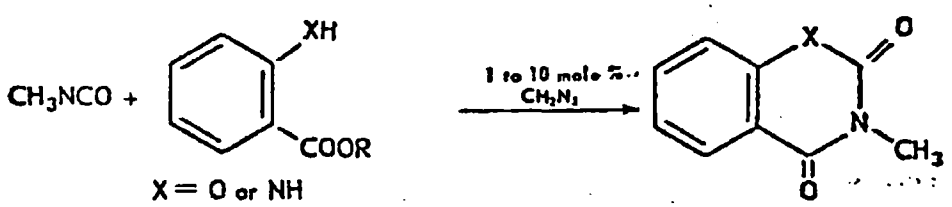

In other cases, cyclization occurs along with addition: Ref.: 14



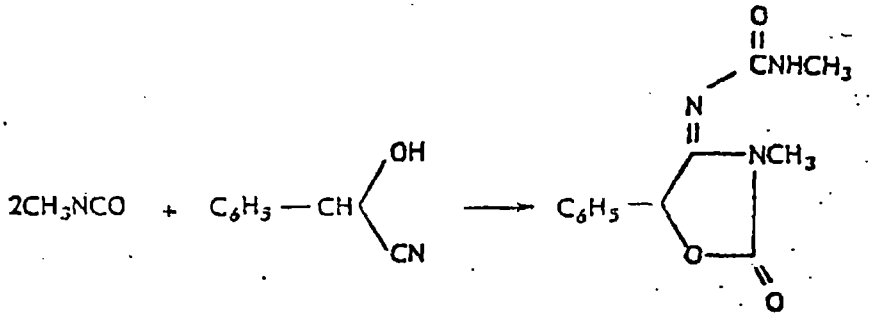

Ref.: 13




Ref.: 28



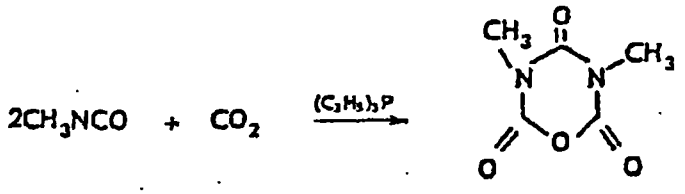

Ref.: 29



Ref.: 31

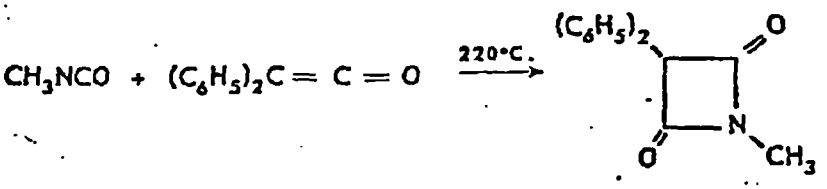
## REACTIONS WITH UNSATURATED COMPOUNDS

Alkyl isocyanates react with some unsaturated compounds to form cyclic addition products,[3] but only a few unsaturated compounds have been found to react with methyl isocyanate. In the presence of triethylphosphine (catalyst), and at room temperature, methyl isocyanate did not react with carbon oxysulfide, carbon disulfide, phenyl isothiocyanate, acetonitrile, nitromethane, quinone, ethylene, acetylene, dimethylketene, or diphenylketene; with aldehydes, carbon suboxide, aldoketenes or cyanic acid, gummy polymers resulted;[5] but with carbon dioxide a product resulted:[4]



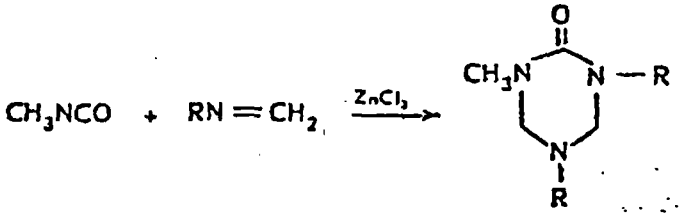
Diazomethane formed an amorphous solid with methyl isocyanate.[3]

At elevated temperatures, diphenylketene reacts as follows with methyl isocyanate:



Ref. : 24

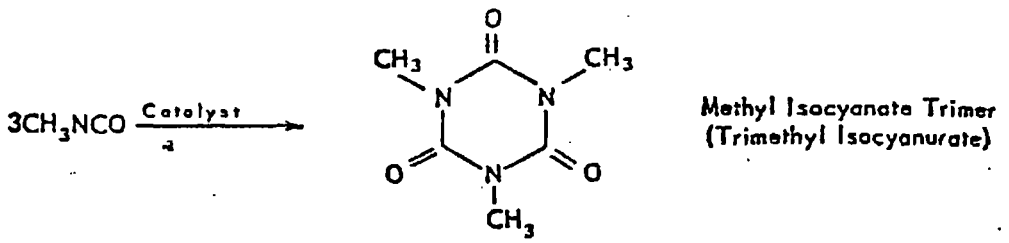
From analogous results obtained with other isocyanates, methyl isocyanate would be expected to react with azomethines:



Ref. : 8

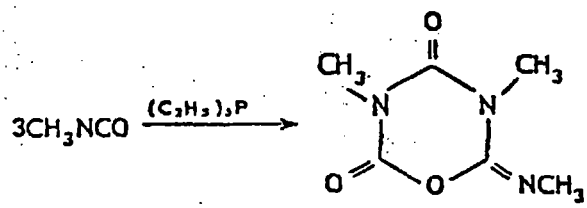
## POLYMERIZATION

Purified methyl isocyanate will react with itself under the influence of a catalyst to form either a cyclic trimer (trimethyl isocyanurate) or a high molecular weight polymer. The type of polymer formed depends on the catalyst, the catalyst concentration, the temperature, and the methyl isocyanate concentration. Strong bases such as sodium hydroxide, sodium methoxide, and sodium acetate;[3,4] certain metal chlorides, such as ferric chloride and stannic chloride;[32] and some other compounds listed below catalyze trimerization:

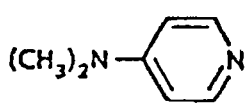



Since the reaction is quite exothermic (51 Kcal/mole of trimer formed), contamination of methyl isocyanate with traces of these catalysts can cause violent reactions. ***Storage of commercial methyl isocyanate in carbon steel, tin, or copper containers must be avoided since such catalysts are formed from these metals upon standing.***

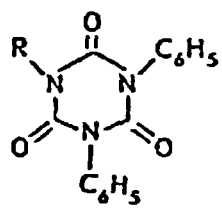
Triethylphosphine catalyzes the formation of an isomeric trimer, it is reported:[4]




ACTIVITY OF TRIMERIZATION CATALYSTS

| Catalyst (1 to 3% in methyl isocyanate) | Time required for complete trimerization | References |
|---|---|---|
| $NaOCH_3$ | 10 minutes | 32 |
| $(C_6H_5)_3AsO$ | 15 minutes | 21 |
| $(C_2H_5)_3P$ | 1 hour | 4 |
| $FeCl_3$ | 1 hour | 32 |
| $SnCl_4$ | 1.5 hours | 32 |
| $(C_4H_9)_3SnOSn(C_4H_9)_3$ | 62 hours | 25 |
|  | 4 weeks | 25 |

The mode of action of the bis-tributyltin oxide has been studied.[25] By forming an isocyanate catalyst intermediate and reacting it with other isocyanates, mixed trimers could be formed:[25]



A radiation-induced polymerization of methyl isocyanate has been reported.[19] Other polymers of alkyl monoisocyanates have been reported,[27] and a recent patent[30] reports that a tough, high-melting polymer can be produced specifically from methyl isocyanate.

## MISCELLANEOUS REACTIONS

**Chlorination:**

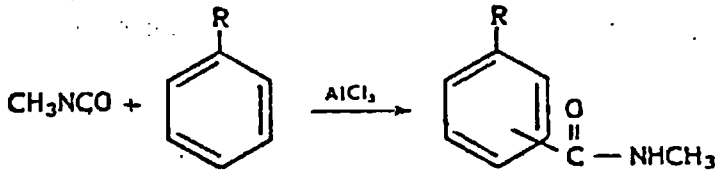
$$CH_3NCO + PCl_5 \xrightarrow{POCl_3} CH_3NCCl_2 + POCl_3$$ Ref. : 10

Addition of organometallic compounds to methyl isocyanate should produce N-methyl amides:

$$CH_3NCO + \begin{matrix} RMgX \\ or \\ RLi \end{matrix} \xrightarrow{H_2O} CH_3NHC(=O)R$$ Ref. : 3

$$CH_3NCO + (C_2H_5)_3Al \xrightarrow{H_2O} CH_3CH_2C(=O)NHCH_3$$ Ref. : 12,26

Isocyanates have been used in the Friedel-Crafts reaction.[11] Methyl isocyanate should produce N-methylbenzamides:



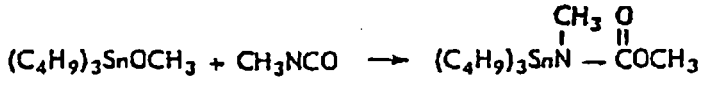

Silicon compounds add to methyl isocyanate; silylamine and silizane derivatives have been observed:

$$CH_3NCO + C_6H_5NHSi(CH_3)_3 \longrightarrow C_6H_5N(Si(CH_3)_3)C(=O)NHCH_3$$ Ref. : 17

$$CH_3NCO + C_6H_5N(CH_3)Si(CH_3)_3 \longrightarrow C_6H_5N(CH_3)C(=O)N(Si(CH_3)_3)CH_3$$

$$CH_3NCO + CH_3N(Si(CH_3)_3)_2 \longrightarrow CH_3N(Si(CH_3)_3)C(=O)N(Si(CH_3)_3)CH_3 \xrightarrow{CH_3NCO} CH_3NC(=O)N(CH_3)C(=O)N(Si(CH_3)_3)CH_3$$

Organotin derivatives:



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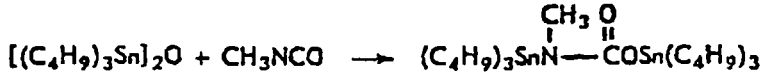

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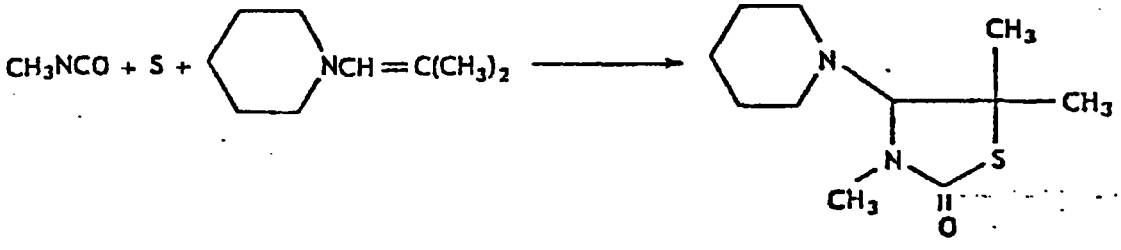
Three component reactions:



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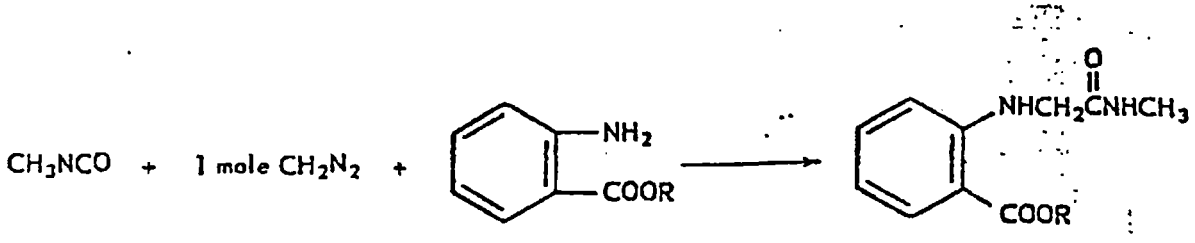

Ref.: 29

## STORAGE AND HANDLING

Methyl isocyanate is reactive, toxic, volatile, and flammable. Safe storage and handling require special precautions.

For purposes of transportation, methyl isocyanate is classified by the Bureau of Explosives as a flammable, poisonous liquid and requires both the Red flammable label and Poison B label.

Materials known to be safe for storage and handling are stainless steel, nickel, "Teflon," and glass-lined equipment. Any other material may be unsuitable, *and possibly dangerous* for methyl isocyanate service. Iron or steel, zinc or galvanized iron, copper and its alloys, and tin should not be used.

Because of the hazardous properties of both its liquid and vapor, methyl isocyanate must be kept confined within closed equipment. To exclude moisture and air, the vapor space of tanks and reactors should be blanketed with dry nitrogen having a maximum dew point of −40°F. or C.

Materials that might catalyze a reaction must be excluded. For further information on reactants and catalysts, see the discussion on reactions in this bulletin. Tanks and lines used for storage or transfer of methyl isocyanate should contain only methyl isocyanate or *dry* nitrogen; no common lines or pumps used for other products should be used for methyl isocyanate.

If liquid methyl isocyanate is spilled or must be disposed of, it should be treated to produce controlled decomposition. Vapors should not be vented to the atmosphere; they should also be decomposed. Men working in areas where methyl isocyanate is handled must be informed of its hazardous nature and must have and use protective clothing and equipment.

This information is purposely general in nature. Detailed information is available. In addition, our specialists should be consulted early in the design of any project concerning storage and handling of methyl isocyanate.

## PRECAUTIONARY LABELING

**DANGER!**

**EXTREMELY FLAMMABLE**
**BREATHING OF VAPOR HARMFUL OR FATAL**
**LIQUID CAUSES EYE INJURY AND SKIN BURNS**
**ABSORPTION THROUGH SKIN HARMFUL**

Do not breathe vapors.
Do not get in eyes, on skin or on clothing.
Keep away from heat, sparks and fire.
Do not leave container open.

**POISON!**

**CALL A PHYSICIAN**

IF INHALED — Remove patient to fresh air, give artificial respiration if not breathing. Give oxygen if breathing is difficult.

IN CASE OF CONTACT:

CLOTHING—Remove contaminated clothing and shoes at once. Wash thoroughly before re-use.

EYES AND SKIN—Immediately flush with plenty of water for at least 15 minutes. Get medical attention for eyes.

IMPORTANT — Immediately fill container with water and drain.
Immediately reseal empty tank cars without cleaning.

FOR INDUSTRY USE ONLY

## TOXICOLOGICAL PROPERTIES

Methyl isocyanate is a hazardous material by all means of contact. Since it has a high vapor pressure, inhalation of the material can easily occur if it is improperly handled. Although the "tear gas" effects of the vapor are extremely unpleasant, this property cannot be used as a means to alert personnel to exposure to chronically toxic concentrations of methyl isocyanate. Methyl isocyanate is a poison by inhalation[33,34] as defined in ICC regulations and is intensely irritating to breathe. It causes severe bronchospasm and asthma-like breathing. Sensitization may occur, after which traces of vapor cause true attacks of asthma. Although it does not quite meet the standards that define a poison by swallowing or skin contact, the difference is so small that methyl isocyanate should also be regarded as an oral and contact poison.[33,34] Skin contact can cause severe burns. The liquid will seriously injure the eyes, even when it is diluted with a non-toxic liquid to a one percent concentration. Like other isocyanates (TDI, for example), methyl isocyanate causes sensitization in animals.[34] Since exposure of a group of test animals to traces of methyl isocyanate sensitized the skin of all the animals, such sensitization could probably be expected to occur in humans. The same series of experiments[34] also demonstrated that a cross sensitization to other isocyanates will develop.

***Stringent precautions must be observed to eliminate any possibility of human contact with methyl isocyanate.***

## AVAILABILITY

Large quantities of methyl isocyanate are available on reasonable notice. Drums are available now. Sample shipments are made in special eight-ounce bottles packed in lug-locked sealed cans.



ADEQ0022367/18

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ADEQ0022367/19

# REACTIVE CHEMICALS MANUAL DATA SHEET

UNION CARBIDE CORPORATION

CHEMICALS DIVISION

Chemical Name METHYL ISOCYANATE(MeNCO)
Random (IBM) Number 9142


Empirical Formula

$C_2 H_3 NO$

Synonyms

Methyl ester of isocyanic acid

## A. PHYSICAL PROPERTIES

1. Flammability Properties
   a. Flammability limits, in air, 760 mm.
      Upper--(Calc. by D. H. Way)---- 16 vol.%
      Lower--(Calc. by D. H. Way)---- 3.5 Vol.%
   b. Flammability limits, at operating conditions
      (____ psig at ____ °C)
      Upper---- * Vol.%
      Lower---- * Vol.%
   c. Flash Point
      Open cup---- <0 °F
      Closed cup---- * °C
   d. Autoignition temperature---- * °C

2. Boiling Point and Vapor Pressure
   a. Boiling point, 760 mm.---- 39.1 °C
      300 mm.---- 16.7 °C
      50 mm.---- -17.0 °C
      10 mm.---- -40 °C
   b. Vapor pressure, 20°C---- 348 mm.
      °C---- mm.
   c. Critical pressure---- 55 atm
   d. Critical temperature---- 218 °C

3. Solubility
   a. Solubility in water, 20°C---- Reacts slowly, but heat of reaction will increase rate of reaction % by wt.
   b. Solubility of water in, 20°C---- % by wt.

4. Thermal Properties
   a. Specific heat (liquid), 68 °F---- 0.443 Btu/lb./°F
   b. Heat of vaporization, 40 °C---- 222.6 Btu/lb.
   c. Heat of fusion, ____ °C---- * Btu/lb.

5. Specific Gravity
   a. Specific gravity, 20°C---- 0.9599
   b. Coefficient of expansion, 20°C---- 0.00148 per °C

6. Absolute viscosity, 0 °C---- 0.35 centipoises
   20 °C---- 0.25 centipoises

7. Freezing Point---- less than -80 °C

8. Molecular Weight---- 57.05

*Data not available.

## B. DESCRIPTION OF REACTIVITY

Type - Reacts with active hydrogen compounds with evolution of heat.

a. Chemical equations

acids (1) $HX + MeNCO \longrightarrow MeNHCO\text{-}X$

amines (2) $R_2NH + MeNCO \longrightarrow R_2NCNHMe$ (O)

water (3) $H_2O + MeNCO \longrightarrow MeNHC\text{-}NHMe$ (O)

alcohol & phenols (4) $ROH + MeNCO \longrightarrow MeNH\text{-}C\text{-}OR$ (O)

strong bases anhydrous (5) $MeNCO \xrightarrow{\text{Catalyst (B)}} (MeNCO)_3$ (Trimer)

b. Heat of reaction - All of the reactions above are exothermic. Reaction 5 produces 537 BTU/lb of MeNCO reacted; reaction 1 with the use of HCl produces approximately 280 BTU/lb of MeNCO reacted.

c. Rate of reaction - Reactions 1 and 2 are very fast. Reactions 3 and 4 are slow at ambient temperatures and in the absence of catalysts (amines or tin compounds). The rate of reaction 5 is strongly dependent on kind and amount of catalyst. Traces of NaOR produce very rapid reaction (minutes); $Ca(OH)_2$ produces measurable $(MeNCO)_3$ after months.

## C. CATALYTIC AGENTS

Specific catalysts

a. Trimerization reaction is catalyzed by $E_3P$, Bases (e.g. NaOMe, NaOAc, (R+N) OH, etc.), Oxalic acid, Lewis acids (e.g. $FeCl_2$ or $FeCl_3$, $ZnCl_2$, $AlCl_3$, etc.). See "M."

b. Tertiary amines (including pyridine) cause an insoluble white polymer to form on surfaces in the vapor.

c. Per cent

(1) As little as 50 ppm with some catalysts.

(2) One tenth percent shows polymer formation.

d. Temperature

(1) Trimerization rate is strongly dependent on temperature (with $FeCl_3$ catalyst the rate was 200 times slower at 0°C than at 25°C).

(2) Unknown.

## D. MATERIALS OF CONSTRUCTION FOR STORAGE AND HANDLING

1. Safe - Stainless steel #304 and #316, MONEL metal, nickel, glass, Teflon,

D. MATERIALS OF CONSTRUCTION FOR STORAGE AND HANDLING (continued)

2. Unsafe - Carbon steel, copper, polyethylene, essentially all elastomers.

Reason - Steel and copper react slowly with traces of methylcarbamoyl chloride (produces HCl) to form an active trimerization catalyst. Methyl isocyanate diffuses through polyethylene. Elastomers are attacked.

E. PEROXIDE FORMATION

Does not form peroxides.

F. DETECTION OF HAZARDOUS CONDITIONS

1. Analyses (laboratory and unit methods) - Methods required are those required to detect trimerization potential of refined MeNCO.

a. Impurities - Methyl carbamoyl chloride - method is available.

b. Catalysts - Iron can probably be determined by a colorimetric method or by emmision spectroscope. A method is under development.

c. Decomposition products - An IR method for trimer detection is available (determines as little as 0.04% trimer).

2. Observation - In the presence of steel and methyl-carbamoyl chloride the MeNCO slowly turns light green. Deepening of the color indicates a greater potential for trimerization. Just as rapid trimerization begins, the MeNCO turns a tan color, and the mixture becomes rust colored as trimer is formed in quantity. No changes in the color of the MeNCO occur in the copper catalyzed trimerization.

G. METHOD OF PREVENTING REACTIVITY HAZARDS

1. MeNCO must not be allowed to contact active hydrogen compounds (see Sec. B-a). If contact inadvertently occurs the mixture should (1) be cooled, if possible, or (2) diluted with an inert solvent, such as MEK, acetone, chloroform, or toluene.

2. To prevent trimerization of MeNCO on contact with steel, MeNCO should be kept free of acids.

If the trimerization does begin, the reaction can be moderated by cooling the MeNCO. Addition of dimethyl acid pyrophosphate (0.1 per cent will saturate the MeNCO) will nearly stop the reaction. MeNCO that must contact steel should be inhibited with dimethyl acid pyrophosphate.

## H. METHODS OF REACTION CONTROL

1. Temperature - Cooling.

2. Pressure - None.

3. Precautions for shock, light, etc. - Not applicable.

4. Dumping - Reacting mixtures should be dumped into large volumes of ammonia solution (preferably in MeOH or acetone) or aqueous caustic.

5. Neutralization - See "G."

## I. HANDLING CONDITIONS

1. Unfavorable (i.e. shock, heat, light, overpressure) - Pure methyl isocyanate is stable to heat, light, and moderate pressures.

2. Waste disposal methods - Treat with caustic, sewer caustic layer, and burn remainder.

## J. HEALTH HAZARDS

1. Inhalation - Extremely irritating - Respiratory protection mandatory. If exposure results in apnea, needs mouth-to-mouth resuscitation after removal from contaminated atmosphere. Take to Medical Department. Medical treatment under direction of M.D. is $O_2$ under positive pressure and symptomatic and supportive therapy mandatory.

2. Ingestion - Extremely irritating - If swallowed, drink one pint $H_2O$ followed by emetic. After emesis, drink one pint water and bring victim to physician. Needs gastric lavage and symptomatic and supportive therapy mandatory.

3. Skin contact - Immediately remove contamination with copious amounts of soap and water. Exposures must be reported to Medical Department because MeNCO probably a strong sensitizing agent.

4. Eye hazard - After exposure, immediate use of eyebath for at least 10 minutes and then report to Medical Department.

5. Industrial hygiene practices

   a. Recognition - Methyl isocyanate is a strong lacrimator but this should not be relied upon for safe handling. The odor is detectable only for a short period of time (less than 30 seconds) in atmospheres of 5 parts per million.

5. Industrial hygiene practices (continued)

The compound boils at 38 to 39° C. which gives 100% pure MeNCO vapor. Moisture must be kept out, for water or acid in methyl isocyanate generates carbon dioxide - will rupture containers.

The vapor pressure is 348 at 20° C. so saturated vapor is about 450,000 ppm at this temperature. Instant death will occur if saturated vapors are breathed.

b. Evaluation - A rigorous air sampling program should be performed during start-up of new facilities. This program should be under the direction of the industrial hygienist who will evaluate the findings and make recommendations. A periodic sampling program should be conducted to assure that MeNCO vapors are maintained below the Threshold Limit Value of 0.02 ppm (tolylene di-isocyanate) until an established limit is available.

c. Recommended control procedures:

(1) Enclosure of all processes should be practiced.

(2) Process ventilation should be available.

(3) This is an exceedingly hazardous chemical when breathed or contacted with the eyes.

(a) Approved air-supplied respiratory protection must be worn while handling methyl isocyanate.

(b) Skin and eye contact must be avoided. Approved protective clothing should be worn by operating personnel.

(c) Maintenance personnel should be protected from MeNCO while performing work on equipment in process units. Equipment should be thoroughly decontaminated before taking to maintenance shops for repair.

(4) All exposed personnel should be seen by a physician.

## K. FIRE FIGHTING CONSIDERATIONS

1. Type extinguisher - Dry chemicals, $CO_2$, water spray.

2. Unsafe methods - None known.

# METHYL ISOCYANATE

## TOXICOLOGICAL PROPERTIES

Methyl isocyanate is a hazardous material by all means of contact, and since it has a high vapor pressure, inhalation of the material can easily occur if it is improperly handled. Although the "tear gas" effects of the vapor are extremely unpleasant, this property cannot be used as a means to alert personnel to exposure to chronically toxic concentrations of methyl isocyanate. Methyl isocyanate is an ICC Class B poison by inhalation as defined in the regulations and is intensely irritating to breathe. It causes severe bronchospasm and asthma-like breathing. Sensitization may occur, after which traces of vapor cause true attacks of asthma. Although it does not quite meet the standards that define a poison by swallowing or skin contact, the difference is so small that methyl isocyanate should be also regarded as an oral and contact poison. Skin contact can cause severe burns, and the liquid will seriously injure the eyes even when it is diluted with a nontoxic liquid to a one percent concentration. Like other isocyanates (TDI, for example) methyl isocyanate causes sensitization in animals. Since exposure of a group of test animals to traces of methyl isocyanate sensitized the skin of all the animals, such sensitization could probably be expected to occur in humans.

Stringent precautions must be observed to eliminate any possibility of human contact with methyl isocyanate.

Single oral dose in Rats: $LD_{50}$ -- 71 mg/k

Single skin penetration in Rabbits: $LD_{50}$ -- 0.22 ml/k

Single inhalation by Rats: $LD_{50}$ -- 0.103 mg/L (44 ppm)
2 mg/L inhaled for 1 hour killed 6/6 Rats

Skin irritation in Rabbits: undiluted caused severe burns
10% solution caused irritation

Eye injury in Rabbits: severe corneal injury from the liquid and from a 1% solution in Deobase.

APPENDIX "B"

# IMPORTANCE OF PREVENTING CONTAMINATION OF MIC

I. *Trimerization*

1. Trimerization of MIC to trimethyl isocyanurate is catalyzed by iron, steel, zinc, copper and tin.

2. MIC can be exposed to stainless steel, nickel and aluminum without trimerization occurring.

3. Trimerization is exothermic to the extent of 540 BTU per pound. ✓

4. There is an induction period which depends on temperature, surface to volume ratio, the metal, and the proportion of hydrolyzable chloride present in the MIC.

5. The induction period is characterized by slow formation of trimer and coloration of the MIC. Eventually, the reaction becomes violent because the high heat of trimerization increases the temperature of the MIC, thus increasing the reaction rate. The low boiling point of MIC makes the reaction particularly likely to rupture containers.

6. By maintaining MIC temperature below -10°C, trimerization can be prevented, even in the presence of large amounts of catalysts. (0.35% trimer at 6°C after 40 days. None at -40°C.)

7. Compounds of the metals which are catalytic will also catalyze trimerization.

8. Strong bases, including amines, also catalyze trimerization of MIC.

II. Polymerization

1. Linear polymerization of MIC vapor is catalyzed by amines. $CO_2$ inhibits this.

2. Very pure liquid MIC, containing no chlorides, polymerizes spontaneously to a linear polymer.

3. This polymerization can be catalyzed by dimethylaniline, and presumably other amines.

4. Exothermic heat of polymerization is 345 BTU per pound.

b. Four 1 piece suits complete with integral head, face shield and fresh air masks for work of more hazardous nature. Offers complete liquid exposure protection and fresh air supply.

8. Toxic Gas Alarms.

a. Local
b. Plant.

# APPENDIX "D"

## PROCEDURE FOR HANDLING AN MIC SPILL OUTSIDE OF A PLANT

### GENERAL GUIDELINES

A. If there is a tank car rupture and a fire, let the MIC burn while protecting adjacent property.

B. If there is a tank car rupture and no fire, do the following:

1. Evacuate the area.
   Size of the area depends on prevailing wind, temperature, size of spill, surrounding terrain, etc.

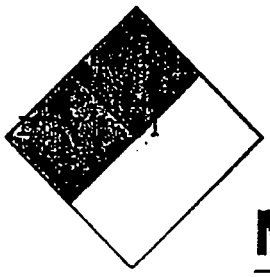
2. Ignite the MIC car if it can be safely done.

3. If the spill can't be ignited - do the following:

   a) Cover with activated carbon (available at a water treating facility).

   b) React with water using some basic material such as caustic, lime, or ammonia to accelerate the reaction.

4. If there is a small leak flood with water until the leak is stopped or its contents can be transferred.



No. BE-13.04

# MATERIAL HAZARDS CARD

**MATERIAL NAME(S):** METHANOL (METHYL ALCOHOL)

**DESCRIPTION:** CLEAR, COLORLESS LIQUID

**HANDLING, STORAGE:** SEE OPERATING INSTRUCTIONS. USE STEEL OR GLASS CONTAINERS.

## HAZARDS

**FIRE:** FLAMMABLE - MAY BE IGNITED BY HEAT, SPARKS OR OPEN FLAME.

**EXPOSURE:** VAPOR HARMFUL

**REACTIVITY:** NOT DANGEROUSLY REACTIVE

## IN CASE OF ACCIDENT DO THIS

| | |
|---|---|
| **SPILL OR LEAK** | SHUT OFF IGNITION. NO SMOKING OR FLARES. KEEP PEOPLE AWAY. SHUT OFF LEAK IF WITHOUT RISK. FLUSH AREA WITH WATER SPRAY. |
| **FIRE** | ON SMALL FIRE USE DRY CHEMICAL OR CARBON MONOXIDE. ON LARGE FIRE USE WATER SPRAY OR "ALCOHOL" FOAM. COOL TANK WITH WATER IF EXPOSED TO FIRE. |
| **EXPOSURE** | REMOVE TO FRESH AIR. |

**MATERIAL NAME(S):** METHANOL (MeOH)

**REFERENCES:**

MCA CHEM CARD CC-69
MCA SAFETY DATA SHEET SD-22
DU PONT METHANOL UNLOADING, HANDLING AND STORAGE SYSTEMS BULLETIN A-13385

**PHYSICAL PROPERTIES:**

BOILING POINT, 760 MM.....64.5°C (148°F)
FLASH POINT, T.C.C.....12°C (54°F)
T.O.C.....16°C (61°F)
SPECIFIC GRAVITY 20/40°C .....0.7910

**CHEMICAL PROPERTIES:**

CORROSIVITY.....NONCORRSIVE AT NORMAL ATMOSPHERIC TEMPERATURES
EXCEPTION - LEAD AND ALUMINUM
HYGROSCOPICITY .....NONE
LIGHT SENSITIVITY.....NONE
REACTIVITY.....NOT DANGEROUSLY REACTIVE.
SOLUBILITY.....MISCIBLE IN ALL PROPORTIONS WITH WATER

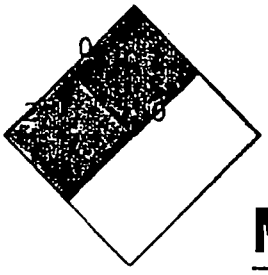
**FIRE & EXPLOSION DATA:**

FLAMMABLE LIMITS, PERCENT BY VOLUME IN AIR AT STP: 7.3 TO 36

AUTOIGNITION TEMPERATURE: 470° C (878°F)

**HEALTH DATA:**

THRESHOLD LIMIT IN AIR: 200 PPM BY VOLUME
262 MILLIGRAMS PER CUBIC METER



Hous-16
No._____

# MATERIAL HAZARDS CARD

**MATERIAL NAME(S):** Methylene Chloride, Dichloromethane, "MCl"

**DESCRIPTION:** Clear, colorless highly volatile liquid with pleasant, ethereal odor.

**HANDLING, STORAGE:** Stored in carbon steel tanks.

## HAZARDS

**FIRE:** Practically nonflammable and nonexplosive at ordinary temperatures, but at higher temperatures under favorable laboratory test conditions, it is capable of forming weakly combustible mixtures with air.

**EXPOSURE:** Vapor inhalation may produce nausea, dizziness, headaches. Skin contact will cause excessive dryness and skin cracking (defatting).

**REACTIVITY:** Reacts with aluminum, titanium, and strong basic salts.

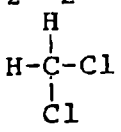
## IN CASE OF

| ACCIDENT | DO THIS |
|---|---|
| SPILL OR LEAK | Spills should be cleaned up immediately. In high vapor concentrations, wear breathing air mask Use mops, rags to soak up leaks, spills, then place them out of doors where they can be dried safely. Wear splash-proof goggles and gloves. |
| FIRE | Practically non flammable. Spray MCl tank with water if exposed to fire. If MCl fire occurs, wear air demand mask to fight fire and use any type fire fighting apparatus. Beware of toxic fumes (phosgene) see "HEALTH DATA" section. |
| EXPOSURE | Eye and skin exposure - flush with copious quantities of water.<br>Vapor inhalation - remove from fumes to fresh air If overcome, apply artificial respiration and call physican.<br>Ingestion - Induce vomiting, call physician. |

## MATERIAL NAME(S): Methylene Chloride, Dichloromethane, "MCl"

CHEMICAL FORMULA: $CH_2Cl_2$

CHEMICAL STRUCTURE:



## REFERENCES:


MCA Safety Data Sheet SD-86 (July, 1962)
Lange-Handbook of Chemistry (Tenth edition)
DuPont - Electrochemicals Dept., Chlorine Products Bulletins 524-1267 and 526-659
Underwriters Laboratories Report MH-2375, Nov., 1933


## PHYSICAL PROPERTIES:

STATE: Liquid

COLOR: Clear, water white

ODOR: Pleasant, aromatic, faintly ethereal

DENSITY: 1.326 g/cc @ 20/4°C

MELTING POINT: -96.7°C

BOILING POINT: +39.8°C

## CHEMICAL PROPERTIES:

MOLECULAR WEIGHT: 85.0

CORROSIVE: Noncorrosive at normal temperatures when moisture free. In contact with water especially at elavated temperatures, MCl will corrode iron, some stainless steels, copper, nickel and /other metals

SOLUBILITY IN $H_2O$: 2% at 20°C (immiscible)

SOLUBILITY IN ALCOHOLS: Infinite

## FIRE & EXPLOSION DATA:

FLASH POINT: Not found

AUTO IGN. TEMP.: 1224°F

AUTO DECOMP. TEMP.: Not found

LOWER EXPL. LIMIT: 15.5% volume)

UPPER EXPL. LIMIT: 66.0% volume)

MIN. IGNITION ENERGY: Not found

(dp/dt) max.: Not found

in oxygen only under pressure

## HEALTH DATA:

ALD: Not found

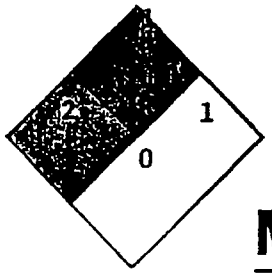
$LD_{50}$: Not found

TLV: 500 ppm

DETECTION THRESHOLD: 25 - 50 ppm

EXPOSURE SYMPTOMS: Not found

MAJOR SAFETY CONSIDERATION: MCl is an anesthetic, chief hazard is loss of consciousness following vapor inhalation at elevated temperatures,




No._____

# MATERIAL HAZARDS CARD

**MATERIAL NAME(S):** MTAAO, (S-methyl-N-hydroxy thioacetimidate)

**DESCRIPTION:** White crystals at room temperature but usually in a solution of water or methylene chloride.

**HANDLING, STORAGE:** Handle as a corrosive, toxic liquid. For sampling, wear rubber gloves and goggles.

## HAZARDS

**FIRE:** MTAAO has a very low vapor pressure and is not a serious fire hazard. However if exposed to open flame, it will burn, forming obnoxious and potentially toxic fumes.

**EXPOSURE:** Vapors not strong but common solvent (methlene chloride) may cause respiratory irritation.

**REACTIVITY:** Not highly reactive with most common gases or metals.

## IN CASE OF

| ACCIDENT | DO THIS |
|---|---|
| SPILL OR LEAK | Isolate area. Keep upwind. If necessary to enter spill area, wear full protective clothing and a self-contained breathing apparatus. Wash spill with copious amounts of water. |
| FIRE | Avoid fumes which are obnoxious and potentially toxic. Extinguish fire with water or foam. |
| EXPOSURE | Immediately flush exposed area with water for at least 15 minutes. If not breathing, apply artificial respiration. Call a physician. Remove contaminated clothing. Keep patient at rest. |

## MATERIAL NAME(S):

MTAAO ( S-methyl-N-hydroxythioacetimidate )

## REFERENCES:

Product 10 Operating Instructions, 1975

## PHYSICAL PROPERTIES:

Melting Point: 91-92°C
Boiling Point: Not Available
Vapor Pressure @ 25°C: Not Available

## CHEMICAL PROPERTIES:

Chemical Formula: $C_3H^7SNO$

Molecular Weight: 105.2

Reacts with methyl isocyanate to form methomyl.

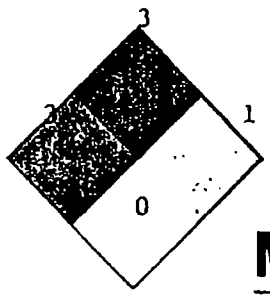
## FIRE & EXPLOSION DATA:

Fire: Burns in open flare to form obnoxious and potentially toxic fumes.

Explosion: Decomposes explosively when confined heating above 130°C is applied.

## HEALTH DATA:

Approximate Lethal Dose: 670 mg/Kg
Causes eye irritation, but effects are reversible.
MTAAO shows no cumulative oral toxicity.




No._____

# MATERIAL HAZARDS CARD

**MATERIAL NAME(S):** "Lannate" L Methomyl Insecticide

**DESCRIPTION:** "Lannate" L is a 25% solution of methomyl in 90% methanol - 10% water.

**HANDLING, STORAGE:** "Lannate" L is packed in 1 gal and 5 gal containers and is shipped in bulk. It is handled in 300 series stainless steels and in some plastics.

## HAZARDS

**FIRE:** "Lannate" L is flammable, producing toxic and obnoxious fumes on combustion.

**EXPOSURE:** Methomyl is a cholinesterase inhibitor. Most rapid and pronounced toxic effects are caused by oral ingestion.

**REACTIVITY:** Methomyl decomposes on strong heating. It is sensitive to confined heating and may explode at temperatures above 136°C (277°F).

## IN CASE OF

| ACCIDENT | DO THIS |
|---|---|
| SPILL OR LEAK | Avoid [illegible] spread where possible. Avoid all use of fires or flames and protect from other ignition sources.<br>Clean up spill in best practicable manner. If outside sp occurs try to avoid contaminating natural waters: methom is fatal to marine animals in concentrations as low as 10 ppm. |
| FIRE | Water is an effective fire-fighting agent; it is complete miscible with "Lannate" L. |
| EXPOSURE | Seek medical help immediately. Atropine sulfate is an effective antidote and may be administered orally or intravenously. |

IC-20843 [illegible] Houston [illegible] 11/20/

## MATERIAL NAME(S):

"Lannate" L Methomyl Insecticide: a 25% solution of methomyl in 90% methanol - 10% water. (1.8 lb/gal)
Methomyl: S-methy-N-[(methylcarbamoyl)oxy]thioacetimidate.

## REFERENCES:

Product 10 Operating Instructions, 1975

## PHYSICAL PROPERTIES:

State: Liquid

Density: 7.4 lb/gal

Color: Dark Brown

Boiling Point: 70°C (159°F)

Incipient Crystallization Temperature: - 2°C (28°F)

## CHEMICAL PROPERTIES:

Molecular Weight: 162

Miscibility with Water: Total

## FIRE & EXPLOSION DATA:

Flash Point: 14°C (58°F)

Auto-decomposition Temperature: 136°C (277°F)

Methanol from "Lannate" L will form explosive mixtures with air; explosive limits are 6.7% to 36.5% methanol. These vapor compositions will be in equilibrium with "Lannate" L at temperatures of 11°C (52°F) and 44°C (111°F).

## HEALTH DATA:

Approximate Lethal Dose: 9 ml (0.3 oz) orally (in a 180 lb man)

Symptoms: headache, nausea, weakness, pupillary constriction, diarrhea. (More rapid and pronounced toxic effects are caused by oral ingestion.)

Antidote: atropine sulfate, administered orally or intravenously.

(Inhalation of methanol vapors can cause dizziness, intoxication, etc. Oral ingestion of methanol may cause blindness.)

## Information for Physicians Regarding Symptomatology and Treatment in "Lannate" Methomyl* Insecticide Poisoning Cases

Methomyl is a carbamate-type insecticide with a high degree of acute toxicity. Its toxic effects are related to the inhibition of blood and tissue cholinesterases and thus to an accumulation of excessive amounts of acetycholine in effector organs. Overexposure to methomyl would not be expected to result in a toxic effect to a specific organ in the usual sense of the word, such as a toxic hepatitis.

Methomyl intoxication would most likely occur from exposure to the dust or spray mist or it could occur if ingested. Methomyl is not readily absorbed through the intact skin.

### Signs and Symptoms

Signs and symptoms which may be expected to occur in the less severe poisoning cases are as follows:

1. Constriction of pupils (miosis)
2. Sweating, profuse
3. Weakness
4. Slow pulse
5. Nausea and vomiting
6. Muscle tremors
7. Blurred vision
8. Abdominal cramps and diarrhea

The exact order of onset of these signs and symptoms will vary but those given here are among the first to occur following overexposure to this material. Clinical evidence of methomyl intoxication generally becomes apparent within a matter of minutes to within an hour following the exposure, the exact time depending on the severity and route of exposure.

* Methomyl is the common name for S-methyl-N-[(methylcarbamoyl)oxy] thioacetimidate

Since methomyl is a cholinesterase inhibitor, presumably any of the signs and symptoms associated with cholinesterase inhibition could occur and would depend on the severity and type of exposure. These are outlined in Table 1.

## Diagnosis

Diagnosis of methomyl intoxication can be made from a history of exposure followed by the onset of all or more likely some of the signs and symptoms listed in Table 1. The diagnosis can be confirmed by measuring the activity of the blood cholinesterases using an appropriate method such as the Ellman method.* However, the cholinesterase activity with this class of compounds may return to normal very rapidly after exposure; therefore a normal level does not disprove the diagnosis.

Some of the commonly used methods of determining acetycholinesterase activity in cases of organophosphorous intoxication are not desirable for this determination in cases involving carbamates. These methods involve measurements of change in pH and are patterned after the method originally described by Michel.**

## Medical Management

The treatment of methomyl intoxication may be summarized as follows:

1. Termination of exposure.

   In the case of an inhalation exposure, remove person to an uncontaminated atmosphere. In case of contact, remove contaminated clothing and wash promptly contaminated skin or eyes with copious amounts of water. If ingestion has occurred, gastric lavage should be performed.

2. Atropine administration.

   The appearance of any local or systemic signs or symptoms of anticholinesterase poisoning calls for the immediate use of atropine. This drug is antidotal because it inhibits the action of acetycholine at its many sites of action, with the exception of the voluntary muscles.

* G. L. Ellman, K. D. Courtney, V. Adrees and R. M. Featherstone, Biochem. Pharmacol., 7:88 (1961).

** H. O. Michel, J. Lab. Clin. Med., 34:1564 (1949).

In mild intoxication, 1.2 to 2 mg of atropine should be administered intramuscularly or intravenously initially and repeated at 10- to 30-minute intervals until symptoms are relieved and full atropinization (dry skin and dry mouth) is achieved. Maintain a mild degree of atropinization until patient recovers. In the mildest of cases, atropinization might be maintained by oral or sublingual administration of atropine tablets, 1/100 gr. (0.6 mg), as indicated by the recurrence of symptoms.

In severe intoxication, the initial atropine dosage should be 2 to 4 mg intravenously, with repeated intravenous administration of 2 mg every three to ten minutes until signs and symptoms disappear.

Note: 2-PAM (pyridine-2-aldoxime methiodide) should not be used in the treatment of methomyl poisoning since animal studies have shown it to be ineffective as an antidote not only for methomyl but other carbamate insecticides as well.

In addition, morphine and other respiratory depressants are contraindicated.

3. Removal of secretions and maintenance of open airway.

Whenever necessary, steps should be taken to remove excessive secretions from the respiratory tract and to maintain an open airway. These procedures include suction and the possible insertion of an endotracheal tube.

4. Artificial respiration when necessary.

In the severe intoxication cases, artificial respiration or oxygen administration may be necessary.

5. Alleviation of convulsions if these interfere with respiration and are not relieved by atropine.

Administer trimethadion (Tridione), 1 gram intravenously every 15 minutes up to a maximum of 5 grams, or sodium thiopental (2.5% solution) intravenously. Convulsions would not be expected except in the most severe intoxication.

Note to physician: Allow no further exposure to any cholinesterase inhibitors until full recovery is assured. Measurement of blood cholinesterase activity may be useful in this regard.

Detailed information concerning the treatment of intoxication by cholinesterase inhibitors is available in the following sources:

(1) B. Holmstedt, Pharmacol. Rev., 11:567 (1959).

(2) G. B. Koelle, Handbuch. Exp. Pharm., XV:1006 (1963).

First Aid

The following steps should be taken before the arrival of a physician:

(1) If swallowed, induce vomiting by giving warm salt water (a tablespoonful of salt in a glass of water) and repeat until vomit fluid is clear.

(2) If inhaled, remove person from exposure, have him lie down and keep quiet.

(3) In case of contact, remove contaminated clothing and wash contaminated skin or eyes with copious amounts of water.

(4) If patient has difficulty in breathing, start artificial respiration immediately.

(5) Give two tablets of atropine, each 1/100 gr. (0.6 mg), orally or by dissolving under the tongue if they are available at hand. Thereafter, every 10 to 15 minutes, give one atropine tablet repeatedly until throat and skin become dry. Give additional tablets as necessary to maintain dry throat and skin.

Haskell Laboratory
E. I. du Pont de Nemours & Company
Wilmington, Delaware

TABLE 1

SIGNS AND SYMPTOMS OF ANTICHOLINESTERASE POISONING*

| Site of action | Signs and symptoms |
|---|---|
| | **Following local exposure** |
| Pupils | Miosis, marked, usually maximal (pin-point), sometimes unequal |
| Ciliary body | Frontal headache, eye pain on focusing, slight dimness of vision, occasional nausea and vomiting |
| Conjunctivae | Hyperaemia |
| Nasal mucous membranes | Rhinorrhea, hyperaemia |
| Bronchial tree | Tightness in chest, sometimes with prolonged wheezi expiration suggestive of bronchoconstriction or increased secretion, cough |
| Sweat glands | Sweating at site of exposure to the liquid |
| Striated muscle | Fasciculations at site of exposure to the liquid |
| | **Following systemic absorption** |
| Bronchial tree | Tightness in chest, with prolonged wheezing expirat suggestive of bronchoconstriction or increased secretion, dyspnea, slight pain in chest, increa bronchial secretion, cough |
| Gastro-intestinal system | Anorexia, nausea, vomiting, abdominal cramps, epigastric and substernal tightness (? cardiospa with "heartburn" and eructation, diarrhea, tenesmus, involuntary defecation |
| Sweat glands | Increased sweating |
| Salivary glands | Increased salivation |
| Lachrymal glands | Increased lachrymation |
| Heart | Slight bradycardia |
| Pupils | Slight miosis (occasionally unequal), later more marked |
| Ciliary body | Blurring of vision |
| Bladder | Frequent or involuntary micturition |
| Striated muscle | Easy fatigue, mild weakness, muscular twitching, fasciculations, cramps, generalized weakness including muscles of respiration, with dyspnea and cyanosis |

TABLE 1 (Contd.)

SIGNS AND SYMPTOMS OF ANTICHOLINESTERASE POISONING*

| Site of action | Signs and symptoms |
|---|---|
| | Following systemic absorption |
| Sympathetic ganglia | Pallow, occasional elevation of blood pressure |
| Central nervous system | Giddiness; tension; anxiety; jitteriness; restlessness; emotional lability; excessive dreaming; insomnia; nightmares; headache, tremor; apathy; withdrawal and depression; bursts of slow waves of elevated voltage in EEG especially on overventilation; drowsiness, difficulty in concentrating; slowness of recall; confusion; slurred speech; ataxia; generalized weakness; coma with absence of reflexes; Cheyne-Stokes respiration; convulsion depression of respiratory and circulatory centr with dyspnea, cyanosis, and fall in blood press |

* From B. Holmstedt, Pharmacol. Rev., 11, 567 (1959) as cited in WHO Technical Report Series No. 227, Toxic Hazards of Pesticides to Man, p. 14 (1962).

B-14120

713 471 2771

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
HOUSTON PLANT
P. O. BOX 347, LA PORTE, TEXAS 77571

BIOCHEMICALS DEPARTMENT

October 17, 1975

Mr. Bill Shackelford, Plant Manager
Eagle River Chemical Company
P.O. Box 2648
West Helena, Arkansas 72390

Dear Bill:

Your Product 10 unit has demonstrated that it can safely produce a quality product. We appreciate the cooperation and performance of everyone in your organization.

There are still some changes that must be made and areas of concern that must be addressed before you will be able to operate at design capacity. Some of these are:

- Installation of a level device on the MIC hold tank so that MIC can be charged once/day and thereby reduce the R102 cycle by about 2 hours.
- Addition of two people to assist in unloading slurry trucks and MIC drums.
- Revisions to the agitation in the slurry hold tank and/or changes in operating procedure to obtain uniform batch sizes.
- Your plans for obtaining maximum benefit from the addition of a day supervisor.
- Procedures that have been or will be established to improve sampling techniques and communications between the lab and the operators.
- Preparation of a current set of operating instructions and a procedure to obtain DuPont approval of any deviation or changes.
- Reduction of odor problems associated with the slurry truck unloading.



AB0000114770/1

We would like to schedule a meeting to review your status and program sometime during the week of 10-27-75. Frank Maderich and several of us from Houston plan to attend. Since we are about out of the "start-up" phase, we suggest that you consider inviting Scott Parker, Ray Guidi and/or Niven Morgan to the meeting.

Please call me so that we can develop a firm schedule.

Very Truly Yours,

Steve

M. E. Stevens
Production Superintendent

MES:kl

DUPONT

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

ENERGY AND MATERIALS DEPARTMENT

November 18, 1975

Mr. William H. Brandon
First National Bank of Phillips County
P. O. Box 160
Helena, Arkansas 72342

Dear Mr. Brandon:

We understand that Eagle River Chemical Corporation has borrowed $1,250,000 from your bank for the purpose of purchasing equipment under Paragraph 3 of the Agreement of June 1, 1975 between E. I. Du Pont De Nemours and Company and Eagle River Chemical Corporation for the manufacture of Lannate® L methomyl for Du Pont. The identity of this equipment is specified in Exhibit "E" to the Agreement.

In connection with your loan for this equipment, you have asked Du Pont to agree to pay directly to your bank and not to Eagle River such amortization payments as Paragraph 3 of the Agreement requires us to pay Eagle River. Each payment shall be one-sixtieth (1/60) of $1,250,000 ($20,833.33) plus applicable interest at a rate equal to the lowest prime lending rate of lending institutions in the area of West Helena, Arkansas or ten percent (10%) per annum, whichever is lower. Eagle River has agreed to such an arrangement and has so indicated by signing below.

Should the Agreement be terminated by either Du Pont or Eagle River, Du Pont will pay to the First National Bank of Phillips County such amounts (if anything) as Paragraph 3 would require Du Pont to pay Eagle River.

Du Pont hereby agrees to make said amortization payment directly to your bank subject to the understanding that except as modified hereby, our Agreement with Eagle River remains in full force and effect in accordance with its terms.

Assuming this meets with your approval, will you kindly sign all three copies, retain the original, send the first copy to John C.

There's a world of things we're doing something about

AB0000065786/1

Bumpers, Eagle River Chemical Corporation and return the copy marked "WILM. E&M DEPT. COPY" to my attention as promptly as possible.

Very truly yours,

E. I. DU PONT DE NEMOURS AND COMPANY

BY H E Lang

TITLE DIRECTOR — PURCHASING

DATE Oct. 14, 1975

HJR

EAGLE RIVER CHEMICAL CORPORATION

BY John Bumgarner

TITLE Sec/Treas

DATE November 7, 1975

FIRST NATIONAL BANK OF PHILLIPS COUNTY

BY [illegible]

TITLE President

DATE November 4, 1975

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

BIOCHEMICALS DEPARTMENT

January 28, 1975

Mr. James A. Alexander
Project Manager
Vicksburg Chemical Company
Organic Chemicals
P. O. Box Three
Vicksburg, Mississippi 39180

Dear Mr. Alexander:

VERTAC -LANNATE® L MANUFACTURE

We are providing a process description for Lannate® L manufacture from crude MTAAO and methyl isocyanate. Confidentiality of the material is covered by the Du Pont-Vertac secrecy agreement of Dec. 19, 1974.

This information is consistent with our phone conversations of January 23 and 24 and should be considered to supersede our transmittals of June 6, 1974 and January 3, 1975.

Please feel free to call me if you have any questions.

Very truly yours,

E. L. Frailie
Technical Section

ELF:lrc
Attachments



AB0000117477/1

# VERTAC-LANNATE® L MANUFACTURE

The following describes a procedure to produce Lannate® methomyl insecticide from crude MTAAO and methyl isocyanate to be provided by Du Pont.

## GENERAL PROCESS DESCRIPTION

Du Pont will provide a slurry of crude MTAAO in water. Vertac should provide equipment to:

1. Batch vacuum distill.
2. Extract purified MTAAO into methylene chloride.
3. React purified MTAAO with methyl isocyanate.
4. Remove methylene chloride by distillation.
5. Dissolve methomyl in methanol to form Lannate® L.
6. Filter and package the Lannate® L in 1-gallon or 5-gallon polyethylene jugs.

Vertac should plan to dispose of three liquid waste streams:

1. Distillate - Odorous, non-flammable, but contains flammable components methyl mercaptan and dimethyl disulfide.
2. Raffinate - Potassium chloride brine containing small amount of organics - readily biotreatable.
3. Methomyl wash - A toxic aqueous stream containing dimethyl urea and methomyl. Under controlled operation, this stream is not generated. The clean up step which generates this stream will be required only if discrepancies in MTAAO or MI charge weights would result in poor Lannate® quality.

## EQUIPMENT REQUIREMENTS

The following equipment arrangement would permit MTAAO distillation and extraction into methylene chloride in one vessel with subsequent methomyl formation and solvent removal in a second vessel. An equipment list follows.

UNDER SECRECY AGREEMENT

A. MTAAO Still and Extractor

1. 2000 gallon, glass-lined, jacketed vessel rated for full vacuum.
2. 500 gallon steel distillate receiver.
3. 2000 gallon 316 stainless steel extract hold tank.
4. 125 ft.$^2$, 316 stainless steel, brine-cooled condenser.
5. 500 ft.$^2$, 316 stainless steel, water-cooled after condenser.
6. 100 GPM; 316 stainless steel pump.

B. Methomyl Reactor

1. 2000 gallon, glass-lined, jacketed vessel rated for full vacuum.
2. 2000 gallon, glass-lined condensate receiver.
3. 800 ft.$^2$, nickel, water-cooled condenser.
4. 200 ft.$^2$, Karbate tube, water-cooled condenser.
5. 100 ft.$^2$, 316 stainless steel, refrigerated inner condenser.
6. 100 GPM, 316 stainless steel pump.

C. Lannate® L Formulating Tank

1. 1000 gallon, stainless steel, agitated vessel.

D. Lannate® L Packaging

1. Filter prior to packaging.
2. Require facilities to package in 1-gallon or 5-gallon jugs.

E. PG&S Facilities

1. Fume incinerater.
2. 150 tons of refrigeration.
3. Waste disposal facilities for 3 liquid waste streams.
4. Cooling water.
5. Tankcar unloading facilities.
6. Tank truck unloading facilities.

UNDER SECRECY AGREEMENT

## LANNATE® L MANUFACTURE FROM CRUDE MTAAO

### BATCH DISTILLATION

Crude MTAAO will be delivered via tankcar as a 13% (by weight) slurry in a KCl brine. Twenty percent of the material is to be removed by vacuum distillation. The distillate, an odorous material containing dimethyl disulfide and methyl mercaptan, is to be discarded. The reaction mass is cooled to about 30°C prior to the next processing step.

#### OPERATING PARAMETERS

1. Reactor pressure, 100MM Hg. absolute.
2. Reactor temperature, 55°C, maximum.

#### MODE OF OPERATION

1. Charge crude MTAAO slurry to the reactor.
2. Reduce reactor pressure to 100MM Hg., absolute.
3. Heat reactor contents.
4. Remove 20% of the reactor charge overhead.
5. Break vacuum.
6. Cool reactor contents to about 30°C.

#### SAFETY CONSIDERATIONS

Dimethyl sulfide and methyl mercaptan are odorous, toxic materials. Contact and fume inhalation should be avoided.

### BATCH EXTRACTION

Extract the purified MTAAO into methylene chloride and transfer the methylene chloride layer to the methomyl reactor. The aqueous raffinate is extracted two more times and then discarded. The extracts from the two latter extractions are combined and used to make the first extraction in the following batch. Discard the raffinate, a readily biotreatable KCl brine containing a small amount of miscellaneous organics.

#### OPERATING PARAMETERS

1. Temperature, 25 to 30°C.
2. Pressure, atmospheric.

UNDER SECRECY AGREEMENT

BATCH EXTRACTION (Con't.)

MODE OF OPERATION

1. Add methylene chloride from extract hold tank to MTAAO slurry.
2. Agitate for 20 minutes.
3. Let reactor contents settle for 20 minutes.
4. Draw off lower methylene chloride layer and transfer to methomyl reactor.
5. Add 1/2 methylene chloride charge to water layer.
6. Agitate for 20 minutes.
7. Let reactor contents settle for 20 minutes.
8. Draw off lower methylene chloride layer to extract hold tank.
9. Repeat steps 5, 6, 7 and 8.
10. Discard raffinate.

METHOMYL FORMATION

Methyl isocyanate is added through a dip pipe to the methylene chloride solution of purified MTAAO. Accurate MTAAO analysis and charge weight control is required to assure acceptable finished product quality. (Excess methyl isocyanate will be converted to dimethylurea, whereas, deficient methyl isocyanate addition will result in MTAAO being left in the product.) After a hold period, water is added, methylene chloride is removed by distillation and the methomyl is transferred to liquid formulation.

OPERATING PARAMETERS

1. Reactor pressure - Atmospheric during methyl isocyanate reaction.
   - 100MM Hg during methylene chloride removal.
2. Reactor temperature - 46°C.
3. Methylene chloride removal temperature - 50°C.

Methomyl is extremely toxic. Avoid contact or fume inhalation.

UNDER SECRECY AGREEMENT

METHOMYL FORMATION (Con't.)

MODE OF OPERATION

1. Charge the methylene chloride solution of MTAAO to the reactor.
2. Concentrate the MTAAO by distilling off methylene chloride.
3. Add one pound of 50% caustic soda solution.
4. Add methyl isocyanate through a dip tube to the agitated reactor over a one hour period. Condense and reflux methylene chloride and methyl isocyanate to the reactor during the reaction period and subsequent hold period.
5. Hold and agitate for one hour.
6. Add a small amount of water (equivalent to the amount required for the Lannate® L formulation). This permits the methomyl to maintain its fluidity during the remainder of the solvent removal step.
7. Remove methylene chloride by distillation.
8. After all methylene chloride is removed, transfer the methomyl/water to the Lannate® L formulation tank.

LANNATE® L FORMULATION AND PACKAGING

The methomyl/water is dissolved in methanol, cooled and then filtered before being packaged in either 1-gallon or 5-gallon polyethylene jugs.

UNDER SECRECY AGREEMENT

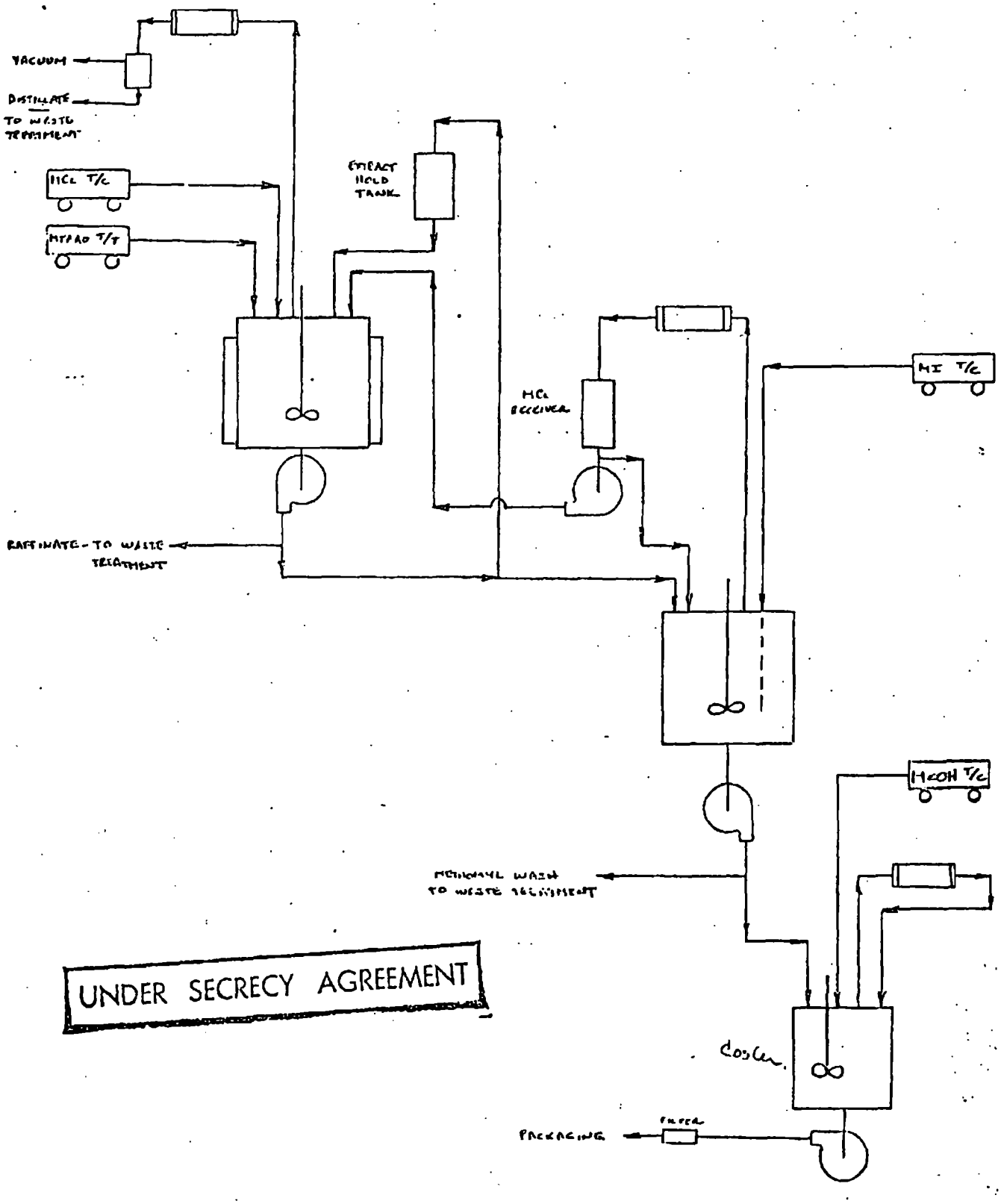
"LANNATE" METHOMYL INSECTICIDE

VERTAC MANUFACTURE FROM CRUDE MTAAO AND METHYL ISOCYANATE

WILMINGTON

FRAILIE

JANUARY 26 75




UNDER SECRECY AGREEMENT

6/6/73

Du Pont Dimethyl Esters
Continuous Process (II)

I Objectives - As covered in a previous report, continous dehydration of the crude DBA solution obtained as a raw material has been accomplished in both the laboratory and in the plant. The objectives of this study were (a) to determine the feasibility of a continuous esterification of anhydrous DBA in a column and (b) to develope a method of cleaning up the ester formed without using calcium hydroxide, and which could operate continuously. We feel that these objectives have been met, as indicated below.

II Esterification - In preparing an anhydrous DBA solution for this reaction, it was found that the precipitate which was previously considered to form during the esterification actually forms on addition of sulfuric acid to anhydrous DBA. In view of this, and due to the convenience of working with a lower melting solution than anhydrous DBA, we recommend the addition of sulfuric acid and methanol to the DBA and filtration to remove the precipitate before esterification. The amount of $H_2SO_4$ used was the same as in plant runs, 1.5 % based on the weight of anhydrous DBA using 93 % $H_2SO_4$. The methanol level is not critical, but a level of 30g of methanol/100g of DBA gives a solution which does not solidify at 30°C.

In the lab procedure, a solution was prepared as above, giving 76.1% DBA, 22.8 % methanol, and 1.14% $H_2SO_4$ (93%) (=1.06% $H_2SO_4$). This was filtered, and the acid number determined to be 304.

A column was prepared using 1" diameter glass tubing and packed for 27" with Berl saddles (ca. 1/4" diameter). This was heated using heating tape wrapped approximately one turn/inch at the bottom and one turn/three inches at the top. The temperature was measured in the center of the column. On top of this was a reflux condenser 10" long with the bulbs filled with Berl saddles and with steam in the jacket to maintain about 100°C on this part of the column. Methanol vapor was introduced into the bottom of the column from another flask filled with boiling methanol. Directly under the column was placed a collection flask maintained at or heated to 140°C. The DBA solution above was introduced into the top of the column from a separatory funnel at a constant rate. Methanol and water were removed from the top of the column, condensed and collected.

A standard run consisted of starting methanol through the column, equilibrating the temperatures, then starting the DBA flow and changing receivers for the distillate. Methanol used was determined as weight of distillate minus theoretical water plus theoretical methanol based on the amount of ester recovered. Results of three runs are shown below.

| Ref. | col temp | (min) time | AN | $CH_3OH$ / DBA | % yield (theo) | % yield (DBA) |
|---|---|---|---|---|---|---|
| 30-30 | 90°C | 45 | 27.8 | 1.75 | 87.3 | 105.8 |
| 30-32 | 110°C | 60 | 23.5 | 1.62 | 90.9 | 110.2 |
| 30-33 | 120°C | 100 | 17.9 | 1.40 | 97.0 | 117.5 |

THEORETICAL

III Clean-Up - Due to yield losses, distillation difficulties, and other problems an effort was made to eliminate the use of calcium hydroxide in the clean-up of the crude DME. Two approaches were tried, one of which was successful.

The unsuccessful approach involved distillation of the crude, untreated DME followed by clean-up using Dowex MSA-1 resin (highly alkaline) to remove the acid number (reduce it from about 6 to less than 1) and charcoal to remove the TBAH color. This worked, but the capacity of the resin was an order of magnitude less than advertised making this approach too expensive.

The successful approach involves using an ammonia wash on the curde DME, then distillation, and finally a column treatment with charcoal. The crude ester (AN = 25, TBAH = 15+) is heated to 55°C and washed with 28 g of 14% $NH_3$/100 g of ester. There is no soaping or precipitate, and the separation is clean and rapid. This gives DME with AN = 0.74, TBAH = 15 G. This material is distilled under vacuum (approximately 130 - 150 °C at 50 mm) with a 5 % forecut and a 1.4 % residue to give material with AN = 0.16, TBAH = 5-7. Recovered ester at this stage was 84.1 % of the crude ester used for input. "THEO" 100 − 5% − 1.4% = 93.6% VISUAL − PLANT LOSSES = 7.7% ANALYSIS

One thousand grams of DME obtained above was passed through 44 g of OL charcoal in a 1" column. The ~~acid number~~ * ranged from less than 1 to about 4 G, with a composite average of 2 G. Mixing this composite with starting distilled DME at 1:1 gave material with a color of 3 G. While not conclusive this indicates that a column treatment in which columns are exhausted is feasible. No attempt was made to regenerate the charcoal used.

* TBAH COLOR

2000+ grams ... DME
PER 44 g ...

J. E. Meier
6/16/73

Steve Stevens (Ext 661)

James O'Reilly - duPont - LaPorte
713-471-2771

Pat Bomar - Rosemary Calvert

Inv. 130, 10/31/79
EOM Fixed Cost $25,814.00

Inv 458, 11-29-79
Mid-Mo Fixed Cost $25,814.00
(dated 11-29-79 but for mid-mo ending 11-15-79)

Inv. 459 11-29-79
EOM Stand-by Cost $6,621.50

James says no Warmate was produced during Nov. making Inv 458 in error & should be for stand-by cost of $6621.50

Pat & Rosemary says they rec'd formal notice, which should be in their "contract" file, to go on stand-by 11-15-79. Rosemary to call me back tomorrow (4-15-80) & let me know who authorized us to go on S.B 11-15-79
SS

E.I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

ENERGY AND MATERIALS DEPARTMENT

November 13, 1979

C. P. Bomar, Jr., Vice President
Vertac, Inc.
Suite 2414
5100 Poplar Street
Memphis, TN 38137

Dear Mr. Bomar:

Confirming our earlier discussions we hereby notify you that your facility for producing our Lannate® insecticide should be placed on stand-by effective November 15, 1979.

We also wish to notify you that we intend to exercise our sole option to extend our agreement for an additional five-year period subject to renegotiation of mutually satisfactory terms and conditions of the extended agreement.

If you have any questions about this please contact me.

Very truly yours,

R. S. SEIDEL (SĪ-DEL')
SENIOR PURCHASING AGENT
CONTRACTING SECTION

RSS:jm



AB0000065763/2

To - David Stroud

Here's a copy of the letter we discussed

RE Colvin

VERTAC
INCORPORATED
Suite 3200 — Clark Tower
5100 Poplar Avenue
Memphis, Tennessee 38137

INTER-OFFICE CORRESPONDENCE

May 22, 1975

TO: Bill Shackelford

FROM: Larry Graybill

SUBJECT: Product 10 Contract

REPLY REQUESTED BY (DATE)

Enclosed are three (3) copies of the contract that we will be signing with DuPont shortly. Unless you and your staff are completely aware of our responsiblities under the contract, you cannot properly gear up for the manufacture and administration of the contract. For example, you need to examine your accounting function to determine if it will generate actual cost in such a manner that we can provide the quarterly revision as outlined in the contract. I would suggest that John Miles and Larry Conaway be included in the review of this contract.

Please advise them that this is not information for general discussion and ask them to treat the subject accordingly.

Sincerely,

Larry Graybill

LLG/bc
ENCLOSURES (3)

5/16/75

D R A F T

THIS AGREEMENT made and entered into this day of , 1975, by and between E. I. DU PONT DE NEMOURS AND COMPANY of Wilmington, Delaware (hereinafter referred to as "DU PONT") and EAGLE RIVER CHEMICAL CORPORATION of Helena, Arkansas, (hereinafter referred to as "EAGLE RIVER").

W I T N E S S E T H :

WHEREAS, EAGLE RIVER and DU PONT mutually agree that sufficient know-how exists to produce Lannate® L methomyl insecticide (hereinafter referred to as Product 10) from MTAAO slurry and methyl isocyanate provided by DU PONT and EAGLE RIVER has expressed an interest in installing necessary facilities to accomplish this manufacture and;

WHEREAS, DU PONT has expressed a need for Product 10 for the time, in the manner, and upon the terms and conditions set forth;

NOW, THEREFORE, in consideration of the premises and of the mutual covenants hereinafter set forth, the parties hereto mutually agree as follows:

1. MATERIAL AND FACILITIES

DU PONT will furnish, at no cost to EAGLE RIVER, the required quantity of MTAAO slurry, methyl isocyanate, methanol, coloring agent, filter aid and packaging materials necessary to produce, package, and label such quantities of Product 10 as DU PONT elects to have produced hereunder, subject to the limitations set forth below. Shipments of above raw materials will be f.o.b. EAGLE RIVER's plant near West Helena, Arkansas, at which point title to the said materials shall vest in EAGLE RIVER and EAGLE RIVER agrees that said materials will be used to

produce Product 10 exclusively for DU PONT. DU PONT will be responsible for all freight costs incurred, unless additional charges are incurred as a direct result of EAGLE RIVER's delay in unloading, in which case these additional costs will be the responsibility of EAGLE RIVER. The aforesaid materials will be shipped in tank cars, tank trucks, or other means as agreed between EAGLE RIVER and DU PONT. Specifications for the aforesaid materials are set forth in Exhibit "A" attached hereto and made a part hereof.

EAGLE RIVER guarantees that it will sell Product 10 to DU PONT in such quantities as DU PONT elects to purchase during the term of this Agreement, up to a maximum rate of the actual capacity of EAGLE RIVER's facility as defined below. The title to each shipment of Product 10 manufactured hereunder shall vest in DU PONT once said shipment is loaded for delivery per the written instructions of DU PONT which shall designate quantity, destination and method of transportation. The Product 10 shall meet DU PONT's specifications as shown on Exhibit "B" attached hereto and made a part hereof. All shipments of Product 10 will be f.o.b. either EAGLE RIVER's plant or Blackhawk Warehouse, West Helena, Arkansas and DU PONT will be responsible for all freight costs incurred.

DU PONT has furnished to EAGLE RIVER the basic process technology for Product 10 and hereafter, EAGLE RIVER will be responsible for converting same into a workable plant design for actual manufacture. EAGLE RIVER will install the necessary production facilities as defined in Exhibit "E".

EAGLE RIVER will complete the installation of its facility for manufacture of Product 10 on or about July 1, 1975. However, no

penalty will accrue to either party should the facility be completed later than this date; provided, however, should the facility not be completed prior to December 1, 1975, for any reason including contingencies cited in Article 8, then DU PONT shall have the right to terminate this Agreement by giving EAGLE RIVER thirty (30) days' prior written notice. Should DU PONT cancel for EAGLE RIVER's failure to complete the facilities by December 1, 1975, DU PONT shall not be required to make any amortization payments as provided in Article 3. COMPENSATION, nor shall DU PONT have any other obligation to EAGLE RIVER due to such a termination of this Agreement. EAGLE RIVER will submit monthly reports to DU PONT as to the progress of the construction of its facility for the manufacture of Product 10 and shall include in each such report a revised estimated date of completion. EAGLE RIVER will report any changes which will delay the completion date by more than thirty (30) days to DU PONT immediately upon learning of such delays. EAGLE RIVER will advise DU PONT in writing when the facility is complete and ready for the manufacture of Product 10 and such manufacture shall commence upon DU PONT's receipt of such notification (hereafter referred to as the "start-up date"). It is agreed and understood that the design capacity of EAGLE RIVER's facility will be 1MM gallons per year, and ninety (90) days after the start-up date, EAGLE RIVER will advise DU PONT of the actual capacity of its facility.

2. QUANTITY

It is estimated but not guaranteed that DU PONT will have EAGLE RIVER produce the following amounts of Product 10 during the initial two (2) years immediately after the start-up date.



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First year - 800,000 gallons

Second year - 800,000 gallons

DU PONT will furnish EAGLE RIVER each quarter a production forecast for the next three months and the following three quarters. Quantities for the remaining years under this contract shall be such quantities as DU PONT elects to purchase.

3. COMPENSATION

In consideration of EAGLE RIVER's services to be provided hereunder, DU PONT agrees to pay EAGLE RIVER as compensation its manufacturing costs described herein plus an add-on charge of $.50 per gallon for each gallon of Product 10 produced. The above add-on charge is firm for the first two (2) years following the start-up date. Thereafter, either party may request annually to renegotiate the above add-on charge upon thirty days prior notice to the other party. The manufacturing costs for Product 10 are summarized in Exhibit "C" attached hereto and made a part hereof. It is agreed that EAGLE RIVER may adjust costs each calendar quarter effective the first of January, March, June and September on thirty (30) days' prior written notice to reflect increases or decreases in costs, except for Item 6, miscellaneous operating cost and Item 7, administrative overhead, which may only be adjusted annually, effective January 1, provided thirty (30) days' prior written notice of the adjustment is given to DU PONT. Said adjustments cannot exceed maximum limits shown in Exhibit "C" without prior written approval of DU PONT. EAGLE RIVER will maintain adequate records to substantiate changes in manufacturing costs and will permit DU PONT's duly authorized representative to examine these records from time to time.

If EAGLE RIVER's facilities are shut down at DU PONT's direction, DU PONT agrees to pay EAGLE RIVER stand-by charges which are summarized in Exhibit "C" attached hereto and made a part hereof. It is understood that EAGLE RIVER will stand ready to operate the facilities 330 days per year with 35 days downtime for plant maintenance and repair. However, if EAGLE RIVER's facilities are unavailable for Product 10 production for less than 330 days per year for any cause not directly attributable to DU PONT, then DU PONT will not pay EAGLE RIVER any charges for any days less than 330 days per year that EAGLE RIVER is unable to produce Product 10.

It is anticipated but not guaranteed that DU PONT will require EAGLE RIVER's services to manufacture Product 10 under this Agreement for a period of approximately 24 to 36 months. During the term of this Agreement EAGLE RIVER agrees to manufacture other products for DU PONT for a mutually agreed upon compensation or maintain the facility on a stand-by basis until such time as DU PONT notifies EAGLE RIVER in writing that no further manufacturing will be required. DU PONT will continue to make amortization payments as defined under the following paragraph until sixty (60) such payments have been made or the Agreement is terminated as provided in Article 5. TERM OF AGREEMENT.

DU PONT agrees to amortize a portion of the cost of EAGLE RIVER's facility as shown on Exhibit "D" attached hereto and made a part hereof, including the cost of associated equipment and the installation thereof. The total amount to be amortized shall be $1,250,000. DU PONT will amortize said sum over a period of five (5) years, payable in 60 successive monthly installments, commencing on the first day of

the first month following the start-up date; which monthly payments shall be equal to an amount sufficient to amortize a note of $1,250,000, bearing interest at a rate equal to the prime lending rate of lending institutions in the area of West Helena, Arkansas, or ten percent per annum, whichever is lower. Each installment shall be applied first to interest and the balance of each installment shall be applied to the unamortized balance. DU PONT will have the option to pay the unamortized balance at any time. DU PONT acknowledges and agrees that EAGLE RIVER may assign its rights in said amortization payments to a lender as security for a loan to finance the construction herein contemplated.

DU PONT will have exclusive use of the facility during the term of this Agreement whether for manufacture of Product 10 or other materials which can be suitably manufactured by this facility, except that EAGLE RIVER may utilize the facility in producing materials for itself or third parties with DU PONT's prior written approval; however, DU PONT will retain preemptive rights so that EAGLE RIVER shall immediately interrupt any other production in order to manufacture products for DU PONT. During the period that EAGLE RIVER may utilize the facility, EAGLE RIVER will pay the amortization and interest payments on a pro rata basis and DU PONT shall be relieved of any such amortization or interest payments to the extent such payments are made by EAGLE RIVER.

4. TERMS OF PAYMENT

EAGLE RIVER shall invoice DU PONT twice each calendar month for the Product 10 shipped hereunder. Payment of each invoice shall be made by DU PONT on the basis of net thirty (30) days after receipt of the invoice. The invoice will be structured as shown on Exhibit "E".

5. TERM OF AGREEMENT

This Agreement shall become effective on June 1, 1975, and shall continue in full force and effect for a term of five years, subject to the right of DU PONT to terminate this Agreement for any reason and at any time by giving EAGLE RIVER six (6) months' prior written notice. Should DU PONT elect to exercise this right, then DU PONT will pay EAGLE RIVER within sixty (60) days the amount remaining to be amortized hereunder and a cancellation charge equal to one month's stand-by cost. DU PONT shall have the sole option to extend this Agreement for an additional five year period, provided DU PONT notifies EAGLE RIVER in writing on or before December 1, 1979, of its intentions to exercise said option at which time the parties agree to renegotiate the terms and conditions of the extended Agreement. In the event DU PONT exercises said option, no amortization payments will be made during the second five year term, provided the equipment has been fully amortized as provided in Paragraph 3. COMPENSATION. Title to all equipment listed in Exhibit "B" will remain in EAGLE RIVER at all times. Upon termination or expiration of this Agreement, all inventories of DU PONT-furnished raw materials will be returned to DU PONT at DU PONT's expense.

6. DEFAULT

Should either party be in default of this Agreement and the other party notify the defaulting party in writing of such default and the nature thereof, then the defaulting party will correct the condition causing it to be in default within 30 days of said notice or the non-defaulting party may terminate this Agreement by giving the defaulting party seven (7) days' written notice of termination. Notwithstanding

anything herein to the contrary, should either party terminate this Agreement by reason of default of the other, DU PONT shall continue to make amortization payments as provided in Article 3. COMPENSATION, but DU PONT shall have no other obligation to EAGLE RIVER.

If EAGLE RIVER should be adjudged bankrupt or make a general assignment for the benefit of its creditors, or if a receiver should be appointed on account of its insolvency, or it should fail to make prompt payment for materials or labor, or disregard laws, ordinances or other governmental regulations in such a manner that such action or condition limits EAGLE RIVER's ability to perform under this contract, then EAGLE RIVER will be considered in default of this Agreement and EAGLE RIVER will have thirty (30) days within which to correct this condition or DU PONT may terminate this Agreement by giving EAGLE RIVER seven (7) days' written notice of termination due to default by EAGLE RIVER.

7. FAIR LABOR STANDARDS ACT

EAGLE RIVER warrants that the Product 10 delivered hereunder will be produced in compliance with the Fair Labor Standards Act of 1938, as amended.

8. CONTINGENCY

Neither party shall be liable for delays and/or defaults in its performance under this Agreement due to causes beyond its reasonable control and without its fault or negligence, including, but without limiting the generality of the foregoing, acts of God, or the public enemy, fire or explosion, flood, actions of the elements, war, riots, embargoes, quarantine, strikes, lockouts, disputes with workmen or other

labor disturbances, total or partial failure of transportation, failures or delays in delivery of construction material, raw materials or supplies, acts or requests of any governmental authority or any cause beyond its reasonable control, whether or not similar to the foregoing.

9. ASSIGNMENT AND SUBCONTRACTING

The rights and obligations covered herein are personal to each party hereto and for this reason this Agreement shall not be assignable by either party in whole or in part nor shall either party subcontract any of its obligations hereunder without the prior written consent of the other party.

10. TECHNICAL INFORMATION

The "Non-Disclosure of Technical Information Agreement" dated December 19, 1974, signed by R. A. Guidi, binding EAGLE RIVER to the terms contained therein, is attached hereto as Exhibit "F" and made a part of this Agreement. EAGLE RIVER shall not disclose, without DU PONT's prior written consent, that it is processing Product 10 for DU PONT and the nature of this Agreement. DU PONT agrees to furnish reasonable technical assistance to EAGLE RIVER at no cost to EAGLE RIVER during the testing and initial production campaigns involved under this Agreement. The "Non-Disclosure of Technical Information Agreement" will survive any termination of this Agreement and will terminate or expire in accordance with its own terms and conditions.

11. TAXES

EAGLE RIVER shall be responsible for the payment of all taxes covering services to be performed, including but not limited to, the payment of all applicable taxes covering its employees. All taxes which may be levied upon the Product 10 after title thereto passes to

DU PONT, shall be either paid directly by DU PONT or, if paid for DU PONT by EAGLE RIVER, such payment shall be promptly reimbursed to EAGLE RIVER upon receipt of evidence of payment.

12. HAZARDS AND INDEMNIFICATION

EAGLE RIVER recognizes that hazards may be involved in performing the services described hereunder. Any information supplied by DU PONT concerning processing or handling of any materials is for guidance only. The methods employed by EAGLE RIVER in handling these materials shall be determined by EAGLE RIVER and responsibility for materials used and handled for the manufacture of products hereunder shall rest solely with EAGLE RIVER until said products are loaded for shipment in accordance with DU PONT's instructions. EAGLE RIVER agrees to take all known and industry-accepted precautions to prevent any injury to persons, including employees of EAGLE RIVER and DU PONT, or damage to property, including DU PONT's or EAGLE RIVER's property, during the manufacture of products hereunder and shall indemnify and hold DU PONT harmless against all loss and expense resulting from any act or omission on the part of EAGLE RIVER, its agents, employees or subcontractors, except to the extent any such loss is due to the negligence of DU PONT.

13. COMPLIANCE WITH LAWS

EAGLE RIVER agrees that in the performance of the manufacturing operations hereunder, as well as in the disposal of any waste material resulting from said operations, it will comply with all applicable laws, rules, and regulations of governmental authority concerned therewith. Should DU PONT be legally implicated on account of a violation of the foregoing provisions, it shall have the right to suspend operations



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hereunder until such time as the violation, either actual or alleged, is resolved; in the event of such a suspension, DU PONT will not incur any obligation or liability hereunder. Further, EAGLE RIVER agrees that it is solely responsible for the payment (not reimbursable under Article 3. COMPENSATION) of any fines, penalties, or other charges of a similar nature (including attorney's fees) arising from EAGLE RIVER's failure to comply with all applicable laws, rules, and regulation of governmental authority in connection with its performance under this Agreement. If EAGLE RIVER admits to the violation of any such law, rule or regulation, or if EAGLE RIVER is adjudicated by a court of competent jurisdiction to have violated any such law, rule or regulation, and a final judgment entered, and if any such violation is not thereafter corrected by EAGLE RIVER, then such violation shall be cause for DU PONT to terminate this Agreement under Article 6 hereof.

14. RAW MATERIAL AND CONSUMPTIONS AND LOSSES

EAGLE RIVER assumes full responsibility and liability for the safe handling and safekeeping of all materials which DU PONT shall have delivered to EAGLE RIVER, and EAGLE RIVER shall use due diligence in keeping operating losses at a minimum. Maximum consumption of raw materials are shown in Exhibit "C" and if the consumption for any one (1) quarter is in excess of these maximums, then, if requested in writing by DU PONT, EAGLE RIVER will, within 30 days of the end of that quarter, reimburse DU PONT for such losses at the current DU PONT costs for said raw materials.



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15. REPORTS

EAGLE RIVER agrees to maintain a complete set of records showing, in detail, as requested by DU PONT, quantities of materials received, processed, shipped and balance on hand, and shall submit written reports concerning the foregoing at such times as may be requested by DU PONT. EAGLE RIVER shall permit DU PONT's duly authorized representatives to examine these records and verify physical inventories from time to time.

16. CONTAMINATION AND RESPONSIBILITY

EAGLE RIVER shall take all steps necessary to prevent the contamination of DU PONT's Product 10 with foreign substances. EAGLE RIVER shall formulate and package material in accordance with DU PONT specifications, and shall bear the cost of handling, reworking, or replacing any material which cannot be marketed by reason of EAGLE RIVER's failure to meet specifications.

17. INSURANCE

EAGLE RIVER shall carry insurance with the following minimum limits:

A. Workmen's Compensation - Statutory; Employer's Liability $100,000;

B. Comprehensive General Liability, including Contractual Liability

- o Bodily Injury - $1,000,000
- o Property Damage - $500,000

Certificates indicating that this insurance is in effect shall be filed with Plant Buyer at DU PONT's Houston Plant prior to the furnishing of services by EAGLE RIVER under this Agreement. Such certificates shall



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provide that DU PONT is carried as an additional insured and the insurer will give DU PONT not less than ten (10) days' advance notice of any change in or cancellation of coverage. In case any subcontractor, with DU PONT's consent, is employed, EAGLE RIVER shall provide evidence of the same coverage in the same limits with respect to such subcontractor and provide DU PONT is named as a additional insured on such subcontractor's policies.

18. INDEPENDENT CONTRACTOR

The employees, methods, equipment and facilities used by EAGLE RIVER shall at all times be under its exclusive direction and control. EAGLE RIVER's relationship to DU PONT under this Agreement shall be that of an independent contractor and nothing in this Agreement shall be construed to constitute EAGLE RIVER, or any of its employees, and agent, associate, joint venturer or partner of DU PONT.

19. ENTIRETY

This Agreement embodies the entire understanding and agreement between DU PONT and EAGLE RIVER covering the sale of the materials hereunder, and there are no previous Agreements, understandings, conditions, warranties or representations, oral or written, expressed or implied, with reference to the subject matter hereof which are not merged herein or superseded hereby. No modification of this Agreement shall be of any force or effect unless reduced to writing and signed by the party claimed to be bound thereby.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed by their duly authorized representatives as of the day and year first hereinabove written.

| EAGLE RIVER CHEMICAL CORPORATION | E. I. DU PONT DE NEMOURS AND COMPANY |
|---|---|
| By_____ | By_____ |
| Title_____ | Title_____ |
| Date_____ | Date_____ |

EXHIBIT "A"

## SPECIFICATION OF RAW MATERIALS

### Raw Material Specifications

**MTAAO Slurry** - pH - 6.5-7.5
MTAAO - 7-13% by weight.
KCl - 17-21% by weight

**Methyl Isocyanate** - 98.0%, minimum
Hydrolyzable chlorides 0.1%, maximum
Color - NNDTS.

**Methanol** - 99.85%, minimum.

**"Marasperse" CB** - 7%, maximum $H_2O$
pH (3% solution) Min. 8.5-9.0 maximum
Dispersing efficiency 85 minimum

**Methylene Chloride** - (1) Boiling range at 760MM Hg.
IBP 39.5°C DP 40.3°C
(2) Moisture 0.008%, maximum
(3) Residue 7.5 ppm, maximum
(4) Acidity (as HCl) = 5.0 ppm, maximum
(5) Free Halogens - none.

Stabilized with "Amylene" - a mixture of 90% 2-methyl-2-butene and 10% miscellaneous pentenes.

EXHIBIT "B"

SPECIFICATIONS OF FINISHED PRODUCTS

.894 @ 24%

Finished Product Specifications

Methomyl - 24.0% minimum - 25.0% maximum.
Methomyl assay must be 95% on a solvent free/salt free basis.

Water - +2% to -10% (relative) of theoretical content

Color - 80% transmission, maximum.
60% transmission, minimum.

Clarity - Free of suspended or settled solids.

Solvent system should be 90% methanol and 10% water by weight.

"EXHIBIT C"

MANUFACTURING COST/PRODUCT 10

1,000,000 gals./year Capacity @ 330 days/year Operation

| | EST. USAGE PER GALLON | MAX. USAGE PER GALLON (1) | COST PER UNIT | EXPECTED COST VARIABLE COST/GAL | EXPECTED COST FIXED COST/GAL | MAXIMUM COST VARIABLE COST/GAL | MAXIMUM COST FIXED COST/GAL | STAND-BY COST/DAY |
|---|---|---|---|---|---|---|---|---|
| **1. RAW MATERIAL COST** | | | | | | | | |
| Slurry (as 100% MTAAO) | 1.27 Lb. | 1.30 Lb. | --- | --- | --- | --- | --- | --- |
| Raw Material #1 | .68 Lb. | .70 Lb. | --- | --- | --- | --- | --- | --- |
| Formulating Agent | 5.17 Lb. | 5.25 Lb. | --- | --- | --- | --- | --- | --- |
| Solvent | .68 Lb. | .70 Lb. | .22 | .1496 | --- | .1496 | --- | --- |
| | | | | .1496 | -0- | .1496 | -0- | -0- |
| **2. UTILITIES** | | | | | | | | |
| Electricity | 1.72 KWH | | .025 | .0322 | .0107 | .0322 | .0107 | Net Billing |
| Steam | 6.61 Lbs. | | | .0038 | .0038 | .0038 | .0038 | -0- |
| Water | | | | .0022 | .0007 | .0022 | .0007 | -0- |
| Nitrogen | | | | .0031 | .0002 | .0031 | .0002 | -0- |
| | | | | .0413 | .0154 | .0413 | .0154 | Net. Elec. |
| **3. OPERATING LABOR** - 4 Operators/Shift | | | | | .2760 | | .2760 | -0- |
| **4. NITROGEN SYSTEM RENTAL** | | | | | .0048 | | .0048 | 13.00 |
| **5. ROUTINE MAINTENANCE** | | | | | | | | |
| A. Repair Labor | | | | | .0374 | | .0374 | -0- |
| B. Materials | | | | | .0680 | | .0680 | -0- |
| C. Maintenance Overhead | | | | | .0150 | | .0150 | 41.00 |
| Sub-total Routine Maintenance | | | | | .1204 | | .1204 | 41.00 |
| **6. MISCELLANEOUS OPERATING** | | | | | | | | |
| A. Supervision & Clerical | | | | | .0110 | | .0110 | |
| B. Operating Materials | | | | | .0029 | | .0029 | |
| C. Laboratory | | | | | .0152 | | .0152 | |
| D. Shipping and Handling | | | | | .0355 | | .0355 | |
| E. Waste Incineration | | | | .0800 | --- | | --- | |
| Sub-total Miscellaneous Operating | | | | .0800 | .0646 | | .0646 | 50.00 |
| **7. ADMINISTRATION OVERHEAD** [General Plant Overhead (Taxes, Insurance, Plant Mgmt. Salaries, Eng. Salaries & Expense, etc.); Legal and Audit; Travel Expenses; Wage and Employee Benefit Adm. Expenses; and Miscellaneous Administrative Expenses.] | | | | | .0742 | | .0742 | 304.00 |
| TOTALS @ 1,000,000 | | | | .2709 | .5555 | | .5555 | 308.00 |

Total Cost Gallon - - .8264

NOTE: Maximum consumptions are best estimates at time of contract execution and will be mutually finalized within thirty (30) days following the first ninety (90) days operations.

AB0000117450/18

## EXHIBIT "D"
## INVOICE PROCEDURE

| | |
|---|---|
| Fixed Cost* ($/month) | 2 times per month |
| Conversion cost (variable) ($/gallon) | 2 times per month |
| Amortization ($/month) | 1 time per month |
| Stand-by cost ($/day) | 1 time per month |

*Regardless of production rate.

Revised

Send

# EXHIBIT E
## EQUIPMENT LIST - PRODUCT 10

R-1 System

1. 1 ea. 4000 gal G/L reactor, full vacuum rated with 25-30 HP gear box at 60 RPM, glass lined baffle & agitator;dip/leg & internal, steam sparger, made of alloy 20 or teflon lined steel motor to be TEFC or explosion proof.
2. 1 ea. 500 gallon distillate hold tank, C/S., full vacuum rated.
3. 1 ea. R-1 reactor discharge pump 100 GPM, 316 S/S.
4. Distillate hold tank pump, 304 or 316 S/S, 30 GPM.
5. R-1 o'head condenser, water cooled, full vacuum rated, 304 S/S, 316 S/S, or Karbate, 550 ft.$^2$
6. R-1 steam jet surface condenser 150# rating tube side, 316 S/S, 300 ft$^2$.
7. 2 stage steam jet C/S 335 lbs/hr non-condensibles at 90 mm HG, 350 lbs steam/hr 115-125 supply discharging against 1 psig back pressure.
8. 6000 gallon steam stripper, 304 or 316 S/S W/steam sparger coil, baffle & agitator W/30 GPM S/S Pump.
9. 6000 gallon bleach tank, bleach resistant brick lined.
10. 50 GPM bleach pump, hi silicone iron.
11. Fume burner, C/S.
12. Extract hold tank, 3000 gal. 316 S/S.
13. Extract hold tank pump 100 GPM, 316 S/S

R-2 System

1. 1 ea. 3000 gal glass lined reactor 25-30 HP TEFC or explosion proof motor w/gear box 60 RPM agitator. Glass lined baffle & agitator; dip/leg to be Alloy 20 or teflon lined steel; vessel to be full vacuum rated.

2. 1 ea. reflux condenser, 200 $ft^2$, full vacuum rated, single pass on tube side, water cooled, 75 psig rated on shell side; materials of construction: (a) 304 S/S (b) 316 S/S(c) nickle (d) karbate.

3. 1 each 300 gallon drop tank, 304 S/S, atmospheric pressure.

4. 1 ea. brine cooled tail condenser, 316 S/S full vacuum rated tube side, 75 pound rated shell side shell side, 100 $ft^2$.

5. 2 stage Havey or Karbate (acid resistant) steam jet, 220 pounds/hr non-condensibles at 90 mm HG, 1150 lbs steam/hr 115-125 lb. steam supply, against back pressure 1 psig.

6. 1 ea 200 $ft^2$ Karbate surface condenser 150 pounds pressure on tube side, 75 pound pressure on shell side, single pass on tube side. 450 $ft^2$.

7. 1 ea. vacuum receiver & decanter, 2000 gallon Materials: (1) chemical glass, (2) beer glass, (3) 304 S/S, (4) 316 S/S

8. 1 ea. atmospheric receiver-decanter, 2000 gallon materials construction: (1) Derakane plastic, (2) Atlac 382 plastic (3) beer glass (4) chemical glass

9. R-1 reactor discharge pump, 100 GPM, 304 or 316 S/S

10. Decanter pump, 316 S/S 100 GPM

Formulation & Packaging System

1. 1 ea. formulation tank 2000 gallon, baffled, 304 S/S.
2. 1 ea. formulation tank agitator 304 S/S or 316 S/S, 10 HP, 60 RPM explosion proof or TEFC motor.
3. Formulation tank recirculation cooler, 316 S/S, 300 $ft^2$.
4. Pressure leaf filter,75 psig, 316 S/S, paper filter medium , Sparkler 330-12 or equal.
5. Formulation tank pump, 304 or 316 S/S, 50 GPH 75 psig head.
6. Packaging hold tank, 304 S/S, 4500 gallon capacity, baffled.
7. Packaging hold tank agitator, 304 S/S, 10 HP, 60 RPM motor TEFC or explosion proof motor .

Waste System

1. Waste hold tank, 3000 gallon 316 S/S , baffled.
2. Waste hold tank agitator 315 S/S, 10 HP, 60 RPM, explosion proof or TEFC motor.
3. Waste hold tank pump, 316 S/S 50 GPH.

Refrigeration System

1. Brine storage tank C/S. 15,000 gal. atmospheric pressure.
2. 2 ea. brine recirculation pumps C/S. 700 GPH
3. Refrigeration unit, 150 tons for 0°F brine,$\Delta T$=
4. Refrigeration system feed pump, C/S. 700 GPH
5. Mixing eductor, C/S

VI. Raw Material Storage E

1. Slurry storage tank, 8,000 gallon capacity C/S W/lining of:
   (a) Stebbins filter acceptable for NaOCl
   (b) Gunnited Precreate

2. Mixing eductor, materials:
   (a) Hastalloy "C", (b) 316 S/S, (c) 317 S/S (d) titanium, (e) TEFC lined, (f)saran lined. NOT PVC.

3. 1 ea. Unloading Pump 100 GPM, materials:
   (a) Hastalloy "C"
   (b) Teflon Block pump
   (c) Alloy 20
   (d) Cast 316 S/S

VII. Offsites

1. Cooling tower 1000 GPM- 5.0 X $10^6$ BTU/hr capacity model 366-101 marley

2. Pond

$$\frac{200 \times 200 \times 5}{27} = 7,407 \text{ yd.}^3$$

3. 450' of Rail Track + one switch.

| | |
|---|---|
| Switch | 8,000 |
| 450' of track | 18,000 |
| | 26,000 |

4. Effluent Pumps at pond

NOTE: Pumps in areas I, II, III, IV, & VI to be equipped W/double internal mechanical seals W/ water flush. Water flush to be metered with small water Rotometer.

AB0000117450/23

EXHIBIT "F"

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

BIOCHEMICALS DEPARTMENT

December 19, 1974

Mr. Raymond A. Guidi
Vice President Manufacturing
& Engineering
Vertac, Incorporated
Clark Tower Building
Suite 2900
Memphis, Tennessee 38137

Dear Mr. Guidi:

Du Pont possesses technical information relating to processes, intermediates, and waste streams involved in the production of methomyl (Technical Information), and wishes to disclose this information to Vertac. We propose an Agreement on the following terms:

1. Technical Information disclosed by Du Pont to Vertac and designated in writing to be confidential, shall be maintained confidential by Vertac for ten (10) years from the date of this Agreement, except:

(a) information which is or becomes publicly known through no fault of Vertac,

(b) information which is learned by Vertac from a third party entitled to disclose it, and

(c) information already known to Vertac as shown by its prior written records.

2. Vertac shall not use for commercial purposes, without prior written permission of Du Pont, any Technical Information obtained under the Agreement so long as such information must be maintained confidential.



AB0000117450/24

EXHIBIT "F"



3. No license under any patent, express or implied, is granted by this Agreement.

If you accept the terms we propose, please sign and date a copy of this letter and return it to us.

Very truly yours,

E. I. DU PONT DE NEMOURS AND COMPANY

By R. E. Diebel

Title Vice President & General Manager
Biochemicals Department

Date December 19, 1974

ACCEPTED:

VERTAC, INCORPORATED

By _____

Raymond A. Guidi
Vice President Manu-
Title facturing & Engineering

Date _____

Yes. Send to Pat Bomar

INTER-OFFICE CORRESPONDENCE

VERTAC, INC.
SUITE 2414 • 5100 POPLAR
MEMPHIS, TN 38137 • 901-767-6851

DATE: February 16, 1977

TO: L. E. HARCROW, B. F. McAVOY, J. A. MITCHELL, J. W. SHACKELFORD

FROM: C.P. BOMAR

SUBJECT: DuPont Product 10 Agreement

REPLY REQUESTED BY (DATE)

Attached is a copy of the February 11, 1977 amendment to the Product 10 Agreement as signed by DuPont. If you approve of this amendment, please indicate your acceptance in the space provided below and return this memo to me.

The final signed Vertac copy will be circulated for your initials later.

C P Bomar
C. P. BOMAR

A C C E P T E D:

BY: J W Shackelford

DATE: Feb. 20, 1977

/em

CC: R. A. Guidi
J. J. O'Neill

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

ENERGY AND MATERIALS DEPARTMENT

Returned cover to Pat B. 2-21-77 indicating approval - S

February 11, 1977

MR. JOHN J. O'NEILL
EAGLE RIVER CHEMICAL CORPORATION
C/O VERTAC CONSOLIDATED
5100 POPLAR - SUITE 2414
MEMPHIS, TENNESSEE 38137

Dear Mr. O'Neill:

Reference is made to the Agreement between our two companies dated June 1, 1975 (hereinafter Agreement) relative to the manufacture of Lannate® L Methomyl. It is hereby mutually agreed to amend the aforesaid Agreement in the following manner effective July 1, 1976.

3. COMPENSATION - Delete this Article in its entirety and in lieu thereof insert the following:

3. COMPENSATION

A. Manufacturing Costs - The manufacturing costs for Product 10 are summarized in Exhibit "C", attached hereto and made a part hereof. All units of consumption (usage per gallon) including number of operators are fixed for the period of Agreement. It is agreed that EAGLE RIVER may adjust costs as follows:

1. Methylene Chloride - Invoiced monthly at actual cost to EAGLE RIVER based on agreed to consumption rates.

2. Utilities & Operating Labor - Costs may be adjusted each January 1 or July 1 on sixty (60) days' prior written notice to reflect actual increases or decreases in costs.

3. All Other Items - May be adjusted every twelve (12) months, effective July 1, based on actual increases or decreases in costs provided sixty (60) days' prior written notice of the adjustment is given to DU PONT.

If EAGLE RIVER's facilities are shut down at DU PONT's direction, DU PONT agrees to pay EAGLE RIVER as total compensation standby charges in accordance with Exhibit "C".

It is understood that EAGLE RIVER will stand ready to operate the facilities 330 days per year with 35 days downtime for plant maintenance and repair. However, if EAGLE RIVER's facilities are unavailable for Product 10 production for less than 330 days per year for any cause not directly attributable to DU PONT, then DU PONT will not pay EAGLE RIVER any charges for any days less than 330 days per year that EAGLE RIVER is unable to produce Product 10.

It is anticipated but not guaranteed that DU PONT will require EAGLE RIVER's services to manufacture Product 10 under this Agreement for a period of approximately 24 to 36 months. During the term of this Agreement, EAGLE RIVER agrees to manufacture other products for DU PONT for a mutually agreed upon compensation or maintain the facility on a stand-by basis until such time as DU PONT notifies EAGLE RIVER in writing that no further manufacturing will be required. DU PONT will continue to make amortization payments as defined herein until all such payments have been made or the Agreement is terminated as provided in Article 5. TERM OF AGREEMENT.

B. Amortization Payments - DU PONT agrees to amortize a portion of the cost of EAGLE RIVER's facility as defined in Exhibit "E", as amended, attached hereto and made a part hereof, including the cost of associated equipment and the installation thereof. The amounts to be amortized shall be:

1. $1,250,000 - DU PONT will amortize said sum over a period of five (5) years, payable in sixty (60) successive monthly installments with first payment made September 1975. Monthly payments shall be equal to an amount sufficient to amortize a note of $1,250,000 bearing interest at a rate equal to the prime interest rate charged by the First National Bank of Phillips County, Helena, Arkansas, or ten (10) percent per annum, whichever is lower. Each installment shall be one-sixtieth (1/60) of $1,250,000 plus applicable interest on the unamortized balance. DU PONT will have the option to pay the unamortized balance at any time without charge for accelerating payments. DU PONT acknowledges and has agreed to EAGLE RIVER assigning its rights to said amortization payments as security for a loan to finance the construction herein covered.

[redacted]

2. $72,000 - DU PONT agrees to pay directly to EAGLE RIVER an amount not to exceed seventy-two thousand dollars ($72,000) for additional equipment that will increase EAGLE RIVER's capacity to 1.2 million gallons of Product 10 per year. DU PONT will pay the $72,000 over a two (2) year period in twenty-four (24) equal monthly payments. First payment was made in June 1976.

C. Add-On Charge - In addition to all other costs, DU PONT agrees to pay EAGLE RIVER an add-on charge of $0.50 per gallon for the first one (1) million gallons of Product 10 produced in any contract year and $0.25 per gallon for every gallon of Product 10 produced over the initial one (1) million gallons in any contract year. The add-on charges are firm until July 1, 1977. Thereafter, either party may request annually to renegotiate the add-on charges with thirty (30) days' prior written notice.

All other terms and conditions remain the same.

Please signify your acceptance of the above by signing in the space provided below and returning the copy marked "WILM. E&M DEPT. COPY" to H. E. Burman.

Very truly yours,

E. I. DU PONT DE NEMOURS AND COMPANY

BY H. E. Burman

TITLE Vice President and General Manager ~~Engineering and Materials Department~~

DATE February 11, 1977

ACCEPTED:

VERTAC CONSOLIDATED

BY _____

TITLE _____

DATE _____

EFFECTIVE JULY 1, 1976

# EXHIBIT "C"

## For the Period: 7/1/76 - 12/31/76

Manufacturing Cost/Product 10

1,200,000 gallons/year capacity @ 330 day/year operation

| | USAGE PER GALLON | UNIT COST $ | VARIABLE COST/GALLON $ | FIXED COST PER MONTH $ | (1) STAND-BY COST/MONTH |
|---|---|---|---|---|---|
| 1. RAW MATERIAL USAGE | | | | | |
| Slurry (as 100% MTAAO) | 1.33 | - | | | |
| Methyl Isocyanate | 0.75 | - | | | |
| Methanol | 5.25 | - | | | |
| Methylene Chloride | 0.70(2) | 0.1975 | 0.13825 | | |
| 2. UTILITIES | | | | | |
| Electricity | 1.72 KWH | 0.02900 | 0.04988 | 1,500 | Net Billing |
| Steam | 13.10 lbs. | 0.00175 | 0.02293 | 740 | |
| Water | 4.15 gal. | 0.00053 | 0.00220 | 200 | |
| Nitrogen | 7.55 SCF | 0.00367 | 0.02771 | 450 | 450 |
| Natural Gas | 876 MSCF(3) | 0.81000 | - | 710 | |
| Sub Total | | | 0.10272 | 3,600 | 450 |
| 3. OPERATING LABOR | | | | | |
| Operating | | | - | 10,305 | |
| Packaging | | | 0.08000 | 4,800 | |
| Sub Total | | | 0.08000 | 15,105 | 2,555 |
| 4. MAINTENANCE | | | | | |
| Repair Labor | | | | 4,500 | |
| Maintenance Mat. | | | | 4,500 | |
| Maintenance O/H | | | | 2,000 | |
| Sub Total | | | - | 11,000 | 2,100 |
| 5. MISCELLANEOUS OPERATING EXPENSE | | | | | |
| Supervision & Clerical | | | | 3,150 | 2,100 |
| Operating Materials | | | 0.00550 | 1,050 | - |
| Laboratory | | | | 5,250 | 1,838 |
| Shipping & Handling | | | | 900 | |
| Sub Total | | | 0.00550 | 10,350 | 3,938 |
| 6. ADMINISTRATIVE O/H | | | | | |
| Sub Total | | | - | 7,140 | 4,200 |
| 7. WASTE DISPOSAL | | | | | |
| Sub Total | | | (4) | - | - |
| TOTAL | | | $0.32647 | $47,195 | $13,243 |

(1) For declared six months (min.) period; charge for shorter periods will be negotiated.

(2) Subject to retroactive adjustment to 7/1/76 upon establishing consumption by material balance.

(3) Monthly consumption.

(4) To be billed at cost from mutually acceptable disposal companies, but not to exceed $0.28 per gallon of Product 10.

[redacted]

EFFECTIVE JULY 1, 1976

EXHIBIT "C"

For the Period: 1/1/77 - 6/30/77

Manufacturing Cost/Product 10

1,200,000 gallons/year capacity @ 330 day/year operation

| | USAGE PER GALLON | UNIT COST $ | VARIABLE COST/GALLON $ | FIXED COST PER MONTH $ | STAND-B COST/MONT |
|---|---|---|---|---|---|
| 1. RAW MATERIAL USAGE | | | | | |
| Slurry (as 100% MTAAO) | 1.33 | - | | | |
| Methyl Isocyanate | 0.75 | - | | | |
| Methanol | 5.25 | - | | | |
| Methylene Chloride | 0.70(2) | 0.1975 | 0.13825 | | |
| 2. UTILITIES | | | | | |
| Electricity | 1.72 KWH | 0.03099 | 0.05330 | 1,500 | Net Billi |
| Steam | 13.10 lbs. | 0.00334 | 0.04375 | 740 | |
| Water | 4.15 gal. | 0.00056 | 0.00232 | 200 | |
| Nitrogen | 7.55 SCF | 0.00367 | 0.02771 | 450 | 450 |
| Natural Gas | 876 MSCF(3) | 1.13800 | - | 997 | |
| Sub Total | | | 0.12708 | 3,887 | 450 |
| 3. OPERATING LABOR | | | | | |
| Operating | | | - | 10,820 | |
| Packaging | | | 0.08000 | 5,280 | |
| Sub Total | | | 0.08000 | 16,100 | 2,555 |
| 4. MAINTENANCE | | | | | |
| Repair Labor | | | | 4,500 | |
| Maintenance Mat. | | | | 4,500 | |
| Maintenance O/H | | | | 2,000 | |
| Sub Total | | | - | 11,000 | 2,100 |
| 5. MISCELLANEOUS OPERATING EXPENSE | | | | | |
| Supervision & Clerical | | | | 3,150 | 2,100 |
| Operating Materials | | | 0.00550 | 1,050 | - |
| Laboratory | | | | 5,250 | 1,838 |
| Shipping & Handling | | | | 900 | |
| Sub Total | | | 0.00550 | 10,350 | 3,938 |
| 6. ADMINISTRATIVE O/H | | | | | |
| Sub Total | | | - | 7,140 | 4,200 |
| 7. WASTE DISPOSAL | | | | | |
| Sub Total | | | (4) | - | - |
| TOTAL | | | $0.35083 | $48,477 | $13,243 |

(1) For declared six months (min.) period; charge for shorter periods will be negotiated.

(2) Subject to retroactive adjustment to 7/1/76 upon establishing consumption by material balance.

(3) Monthly consumption.

(4) To be billed at cost from mutually acceptable disposal companies, but not to exceed $0.28 per gallon of Product 10.

[redacted]Y

CERTIFIED OFFICAL COPY Lannate (Product 10)

3-22-76

Exhibit D specifies "fixed cost" collection

THIS AGREEMENT made and entered into this day of , 1975, by and between E. I. DU PONT DE NEMOURS AND COMPANY of Wilmington, Delaware (hereinafter referred to as "DU PONT") and EAGLE RIVER CHEMICAL CORPORATION of Helena, Arkansas, (hereinafter referred to as "EAGLE RIVER").

W I T N E S S E T H :

WHEREAS, EAGLE RIVER and DU PONT mutually agree that sufficient know-how exists to produce Lannate® L methomyl insecticide (hereinafter referred to as Product 10) from MTAAO slurry and methyl isocyanate provided by DU PONT and EAGLE RIVER has expressed an interest in installing necessary facilities to accomplish this manufacture and;

WHEREAS, DU PONT has expressed a need for Product 10 for the time, in the manner, and upon the terms and conditions set forth;

NOW, THEREFORE, in consideration of the premises and of the mutual covenants hereinafter set forth, the parties hereto mutually agree as follows:

1. MATERIAL AND FACILITIES

DU PONT will furnish, at no cost to EAGLE RIVER, the required quantity of MTAAO slurry, methyl isocyanate, methanol, coloring agent, filter aid and packaging materials necessary to produce, package, and label such quantities of Product 10 as DU PONT elects to have produced hereunder, subject to the limitations set forth below. Shipments of above raw materials will be f.o.b. EAGLE RIVER's plant near West Helena, Arkansas, at which point title to the said materials shall vest in EAGLE RIVER and EAGLE RIVER agrees that said materials will be used to

Insurance Coverage

See also par. 14 on page 11

WILM. E. & M. DEPT. COPY

produce Product 10 exclusively for DU PONT. DU PONT will be responsible for all freight costs incurred, unless additional charges are incurred as a direct result of EAGLE RIVER's delay in unloading, in which case these additional costs will be the responsibility of EAGLE RIVER. The aforesaid materials will be shipped in tank cars, tank trucks, or other means as agreed between EAGLE RIVER and DU PONT. Specifications for the aforesaid materials are set forth in Exhibit "A" attached hereto and made a part hereof.

EAGLE RIVER guarantees that it will sell Product 10 to DU PONT in such quantities as DU PONT elects to purchase during the term of this Agreement, up to a maximum rate of the actual capacity of EAGLE RIVER's facility as defined below. The title to each shipment of Product 10 manufactured hereunder shall vest in DU PONT once said shipment is loaded for delivery per the written instructions of DU PONT which shall designate quantity, destination and method of transportation. The Product 10 shall meet DU PONT's specifications as shown on Exhibit "B" attached hereto and made a part hereof. All shipments of Product 10 will be f.o.b. either EAGLE RIVER's plant or Blackhawk Warehouse, West Helena, Arkansas and DU PONT will be responsible for all freight costs incurred.

DU PONT has furnished to EAGLE RIVER the basic process technology for Product 10 and hereafter, EAGLE RIVER will be responsible for converting same into a workable plant design for actual manufacture. EAGLE RIVER will install the necessary production facilities as defined in Exhibit "E".

EAGLE RIVER will complete the installation of its facility for manufacture of Product 10 on or about July 1, 1975. However, no

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penalty will accrue to either party should the facility be completed later than this date; provided, however, should the facility not be completed prior to December 1, 1975, for any reason including contingencies cited in Article 8, then DU PONT shall have the right to terminate this Agreement by giving EAGLE RIVER thirty (30) days' prior written notice. Should DU PONT cancel for EAGLE RIVER's failure to complete the facilities by December 1, 1975, DU PONT shall not be required to make any amortization payments as provided in Article 3. COMPENSATION, nor shall DU PONT have any other obligation to EAGLE RIVER due to such termination of this Agreement. EAGLE RIVER will submit monthly reports to DU PONT as to the progress of the construction of its facility for the manufacture of Product 10 and shall include in each such report a revised estimated date of completion. EAGLE RIVER will report any changes which will delay the completion date by more than thirty (30) days to DU PONT immediately upon learning of such delays. EAGLE RIVER will advise DU PONT in writing when the facility is complete and ready for the manufacture of Product 10 and such manufacture shall commence upon DU PONT's receipt of such notification (hereafter referred to as the "start-up date"). It is agreed and understood that the design capacity of EAGLE RIVER's facility will be 1MM gallons per year, and ninety (90) days after the start-up date, EAGLE RIVER will advise DU PONT of the actual capacity of its facility.

2. QUANTITY

It is estimated but not guaranteed that DU PONT will have EAGLE RIVER produce the following amounts of Product 10 during the initial two (2) years immediately after the start-up date.

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First year - 800,000 gallons

Second year - 800,000 gallons

DU PONT will furnish EAGLE RIVER each quarter a production forecast for the next three months and the following three quarters. Quantities for the remaining years under this contract shall be such quantities as DU PONT elects to purchase.

3. COMPENSATION

In consideration of EAGLE RIVER's services to be provided hereunder, DU PONT agrees to pay EAGLE RIVER as compensation its manufacturing costs described herein plus an add-on charge of $.50 per gallon for each gallon of Product 10 produced. The above add-on charge is firm for the first two (2) years following the start-up date. Thereafter, either party may request annually to renegotiate the above add-on charge upon thirty days prior notice to the other party. The manufacturing costs for Product 10 are summarized in Exhibit "C" attache hereto and made a part hereof. It is agreed that EAGLE RIVER may adjust costs each calendar quarter effective the first of January, April July, and October, on thirty (30) days' prior written notice, to reflect increases or decreases in costs, except for Item 6, miscellaneous operating cost and Item 7, administrative overhead, which may only be adjusted annually, effective January 1, provided thirty (30) days' prior written notice of the adjustment is given to DU PONT. Said adjustments cannot exceed maximum limits, which will be established by mutual agreement within 30 days following the first 90 days of operation, without prior written approval of DU PONT. EAGLE RIVER will maintain adequate records to substantiate manufacturing costs and will permit DU PONT's duly authorized representative to examine these records from time to time.

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If EAGLE RIVER's facilities are shut down at DU PONT's direction, DU PONT agrees to pay EAGLE RIVER as total compensation reasonable stand-by charges, which will be established by mutual agreement within 30 days following the first 90 days of operation. An estimate of such charges is summarized in Exhibit "C". It is understood that EAGLE RIVER will stand ready to operate the facilities 330 days per year with 35 days downtime for plant maintenance and repair. However, if EAGLE RIVER's facilities are unavailable for Product 10 production for less than 330 days per year for any cause not directly attributable to DU PONT, then DU PONT will not pay EAGLE RIVER any charges for any days less than 330 days per year that EAGLE RIVER is unable to produce Product 10.

It is anticipated but not guaranteed that DU PONT will require EAGLE RIVER's services to manufacture Product 10 under this Agreement for a period of approximately 24 to 36 months. During the term of this Agreement EAGLE RIVER agrees to manufacture other products for DU PONT for a mutually agreed upon compensation or maintain the facility on a stand-by basis until such time as DU PONT notifies EAGLE RIVER in writing that no further manufacturing will be required. DU PONT will continue to make amortization payments as defined under the following paragraph until sixty (60) such payments have been made or the Agreement is terminated as provided in Article 5. TERM OF AGREEMENT.

DU PONT agrees to amortize a portion of the cost of EAGLE RIVER's facility as defined in Exhibit "E" attached hereto and made a part hereof, including the cost of associated equipment and the installation thereof. The total amount to be amortized shall be $1,250,000. DU PONT will amortize said sum over a period of five (5) years, payable in 60 successive monthly installments, commencing on the first day of



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the first month following the start-up date, which monthly payments shall be equal to an amount sufficient to amortize a note of $1,250,000, bearing interest at a rate equal to the lowest prime lending rate of lending institutions in the area of West Helena, Arkansas, or ten percent per annum, whichever is lower. Each installment shall be one-sixtieth (1/60) of $1,250,000 plus applicable interest on the unamortized balance. DU PONT will have the option to pay the unamortized balance at any time without charge for accelerating payments. DU PONT acknowledges and agrees that EAGLE RIVER may assign its rights in said amortization payments to a lender as security for a loan to finance the construction herein contemplated.

DU PONT will have exclusive use of the facility during the term of this Agreement whether for manufacture of Product 10 or other materials which can be suitably manufactured by this facility, except that EAGLE RIVER may utilize the facility in producing materials for itself or third parties with DU PONT's prior written approval; however, DU PONT will retain preemptive rights so that EAGLE RIVER shall immediately interrupt any other production in order to manufacture products for DU PONT. During the period that EAGLE RIVER may utilize the facility, EAGLE RIVER will pay the amortization and interest payment on a pro rata basis and DU PONT shall be relieved of any such amortizati or interest payments to the extent such payments are made by EAGLE RIVER

4. TERMS OF PAYMENT

EAGLE RIVER shall invoice DU PONT twice each calendar month for the Product 10 shipped hereunder. Payment of each invoice shall be made by DU PONT on the basis of net thirty (30) days after receipt of the invoice. The invoice will be structured as shown on Exhibit "D" a copy of which is attached hereto and made a part hereof.

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5. TERM OF AGREEMENT

This Agreement shall become effective on June 1, 1975, and shall continue in full force and effect for a term of five years, subject to the right of DU PONT to terminate this Agreement for any reason and at any time by giving EAGLE RIVER six (6) months' prior written notice. Should DU PONT elect to exercise this right, then DU PONT will pay EAGLE RIVER within sixty (60) days from the date of termination the amount remaining to be amortized hereunder and a cancellation charge equal to one months' stand-by cost. DU PONT shall have the sole option to extend this Agreement for an additional five year period, provided DU PONT notifies EAGLE RIVER in writing on or before December 1, 1979, of its intentions to exercise said option at which time the parties agree to renegotiate the terms and conditions of the extended Agreement. In the event DU PONT exercises said option, no amortization payments will be made during the second five year term, provided the equipment has been fully amortized as provided in Paragraph 3. COMPENSATION. Title to all equipment defined in Exhibit "E" will remain in EAGLE RIVER at all times. Upon termination or expiration of this Agreement, all inventories of DU PONT-furnished raw materials will be returned to DU PONT at DU PONT's expense.

6. DEFAULT

Should either party be in default of this Agreement and the other party notify the defaulting party in writing of such default and the nature thereof, then the defaulting party will correct the condition causing it to be in default within 30 days of said notice or the non-defaulting party may terminate this Agreement by giving the defaulting party seven (7) days' written notice of termination. Notwithstanding

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anything herein to the contrary, should either party terminate this Agreement by reason of default of the other, DU PONT shall continue to make amortization payments as provided in Article 3. COMPENSATION, but DU PONT shall have no other obligation to EAGLE RIVER.

If EAGLE RIVER should be adjudged bankrupt or make a general assignment for the benefit of its creditors, or if a receiver should be appointed on account of its insolvency, or it should fail to make prompt payment for materials or labor, or disregard laws, ordinances or other governmental regulations in such a manner that such action or condition limits EAGLE RIVER's ability to perform under this contract, then EAGLE RIVER will be considered in default of this Agreement and EAGLE RIVER will have thirty (30) days within which to correct this condition or DU PONT may terminate this Agreement by giving EAGLE RIVER seven (7) days' written notice of termination due to default by EAGLE RIVER.

7. FAIR LABOR STANDARDS ACT

EAGLE RIVER warrants that the Product 10 delivered hereunder will be produced in compliance with the Fair Labor Standards Act of 1938, as amended.

8. CONTINGENCY

Neither party shall be liable for delays and/or defaults in its performance under this Agreement due to causes beyond its reasonable control and without its fault or negligence, including, but without limiting the generality of the foregoing, acts of God, or the public enemy, fire or explosion, flood, actions of the elements, war, riots, embargoes, quarantine, strikes, lockouts, disputes with workmen or other

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labor disturbances, total or partial failure of transportation, failures or delays in delivery of construction material, raw materials or supplies, acts or requests of any governmental authority or any cause beyond its reasonable control, whether or not similar to the foregoing.

9. ASSIGNMENT AND SUBCONTRACTING

The rights and obligations covered herein are personal to each party hereto and for this reason this Agreement shall not be assignable by either party in whole or in part nor shall either party subcontract any of its obligations hereunder without the prior written consent of the other party.

10. TECHNICAL INFORMATION

The "Non-Disclosure of Technical Information Agreement" dated December 19, 1974, signed by R. A. Guidi, binding EAGLE RIVER to the terms contained therein, is attached hereto as Exhibit "F" and made a part of this Agreement. EAGLE RIVER shall not disclose, without DU PONT's prior written consent, that it is processing Product 10 for DU PONT and the nature of this Agreement. DU PONT agrees to furnish reasonable technical assistance to EAGLE RIVER at no cost to EAGLE RIVER during the testing and initial production campaigns involved under this Agreement. The "Non-Disclosure of Technical Information Agreement" will survive any termination of this Agreement and will terminate or expire in accordance with its own terms and conditions.

11. TAXES

EAGLE RIVER shall be responsible for the payment of all taxes covering services to be performed, including but not limited to, the payment of all applicable taxes covering its employees. All taxes which may be levied upon the Product 10 after title thereto passes to

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DU PONT, shall be either paid directly by DU PONT or, if paid for DU PONT by EAGLE RIVER, such payment shall be promptly reimbursed to EAGLE RIVER upon receipt of evidence of payment.

12. HAZARDS AND INDEMNIFICATION

EAGLE RIVER recognizes that hazards may be involved in performing the services described hereunder. Any information supplied by DU PONT concerning processing or handling of any materials is for guidance only. The methods employed by EAGLE RIVER in handling these materials shall be determined by EAGLE RIVER and responsibility for materials used and handled for the manufacture of products hereunder shall rest solely with EAGLE RIVER until said products are loaded for shipment in accordance with DU PONT's instructions. EAGLE RIVER agrees to take all known and industry-accepted precautions to prevent any injury to persons, including employees of EAGLE RIVER and DU PONT, or damage to property, including DU PONT's or EAGLE RIVER's property, during the manufacture of products hereunder and shall indemnify and hold DU PONT harmless against all loss and expense resulting from any act or omission on the part of EAGLE RIVER, its agents, employees or subcontractors, except to the extent any such loss is due to the negligence of DU PONT.

13. COMPLIANCE WITH LAWS

EAGLE RIVER agrees that in the performance of the manufacturing operations hereunder, as well as in the disposal of any waste material resulting from said operations, it will comply with all applicable laws, rules, and regulations of governmental authority concerned therewith. Should DU PONT be legally implicated on account of a violation of the foregoing provisions, it shall have the right to suspend operations

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hereunder until such time as the violation, either actual or alleged, is resolved; in the event of such a suspension, DU PONT will not incu any obligation or liability hereunder. Further, EAGLE RIVER agrees that it is solely responsible for the payment (not reimbursable under Article 3. COMPENSATION of any fines, penalties, or other charges of a similar nature (including attorney's fees) arising from EAGLE RIVER's failure to comply with all applicable laws, rules, and regulat of governmental authority in connection with its performance under this Agreement. If EAGLE RIVER admits to the violation of any such law, rule or regulation, or if EAGLE RIVER is adjudicated by a court of competent jurisdiction to have violated any such law, rule or regulation, and a final judgment entered, and if any such violation is not thereafter corrected by EAGLE RIVER, then such violation shall be cause for DU PONT to terminate this Agreement under Article 6. DEFAULT hereof.

14. RAW MATERIAL AND CONSUMPTIONS AND LOSSES

EAGLE RIVER assumes full responsibility and liability for the safe handling and safekeeping of all materials which DU PONT shall have delivered to EAGLE RIVER and EAGLE RIVER shall use due diligence in keeping operating losses at a minimum. Maximum consumption of raw materials are shown in Exhibit "C" and if the consumption for any one (1) quarter is in excess of these maximums, then, if requested in writing by DU PONT, EAGLE RIVER will, within 30 days of the end of that quarter, reimburse DU PONT for such losses at the current DU PONT costs for said raw materials.

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15. REPORTS

EAGLE RIVER agrees to maintain a complete set of records showing, in detail, as requested by DU PONT, quantities of materials received, processed, shipped and balance on hand, and shall submit written reports concerning the foregoing at such times as may be requested by DU PONT. EAGLE RIVER shall permit DU PONT's duly authorized representatives to examine these records and verify physical inventories from time to time.

16. CONTAMINATION AND RESPONSIBILITY

EAGLE RIVER shall take all steps necessary to prevent the contamination of DU PONT's Product 10 with foreign substances. EAGLE RIVER shall formulate and package material in accordance with DU PONT specifications, and shall bear the cost of handling, reworking, or replacing any material which cannot be marketed by reason of EAGLE RIVER's failure to meet specifications.

17. INSURANCE

EAGLE RIVER shall carry insurance with the following minimum limits:

A. Workmen's Compensation - Statutory; Employer's Liability $100,000;

B. Comprehensive General Liability, including Contractual Liability

- o Bodily Injury - $1,000,000
- o Property Damage - $500,000

Certificates indicating that this insurance is in effect shall be filed with Plant Buyer at DU PONT's Houston Plant prior to the furnishing of services by EAGLE RIVER under this Agreement. Such certificates shall

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provide that DU PONT is carried as an additional insured and the insurer will give DU PONT not less than ten (10) days' advance notice of any change in or cancellation of coverage. In case any subcontractor, with DU PONT's consent, is employed, EAGLE RIVER shall provide evidence of the same coverage in the same limits with respect to such subcontractor and provide DU PONT is named as a additional insured on such subcontract policies.

18. INDEPENDENT CONTRACTOR

The employees, methods, equipment and facilities used by EAGLE RIVER shall at all times be under its exclusive direction and control. EAGLE RIVER's relationship to DU PONT under this Agreement shall be that of an independent contractor and nothing in this Agreement shall be construed to constitute EAGLE RIVER, or any of its employees, and agent, associate, joint venturer or partner of DU PONT.

19. ENTIRETY

This Agreement embodies the entire understanding and agreement between DU PONT and EAGLE RIVER covering the sale of the materials hereunder, and there are no previous Agreements, understandings, conditions, warranties or representations, oral or written, expressed or implied, with reference to the subject matter hereof which are not merged herein or superseded hereby. No modification of this Agreement shall be of any force or effect unless reduced to writing and signed by the party claimed to be bound thereby.

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IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed by their duly authorized representatives as of the day and year first hereinabove written.

| EAGLE RIVER CHEMICAL CORPORATION | E. I. DU PONT DE NEMOURS AND COMPANY |
|---|---|
| By_____ | By_____ |
| Title_____ | Title_____ |
| Date_____ | Date_____ |

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EXHIBIT "A"

SPECIFICATION OF RAW MATERIALS

Raw Material Specification

| | | |
|---|---|---|
| MTAAO Slurry | - | pH - 6.0 - 8.0<br>MTAAO - 7-13% by weight<br>KCl - 17-21% by weight |
| Methyl Isocyanate | - | 98.0%, minimum<br>Hydrolyzable chlorides 0.1%, maximum<br>Color - NNDTS |
| Methanol | - | 99.85%, minimum |
| "Marasperse" CB | - | 7%, maximum $H_2O$<br>pH (3% solution) Min. 8.5-9.0 maximum<br>Dispersing efficiency 85 minimum |
| Methylene Chloride | - | (1) Boiling range at 760MM Hg.<br>IBP 39.5°C DP 40.3°C<br>(2) Moisture 0.008%, maximum<br>(3) Residue 7.5 ppm, maximum<br>(4) Acidity (as HCl) = 5.0 ppm, maximum<br>(5) Free Halogens - none |

Stabilized with "Amylene" - a mixture of 90% 2-methyl-2-butene and 10% miscellaneous pentenes

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EXHIBIT "B"

SPECIFICATIONS OF FINISHED PRODUCTS

Finished Product Specifications

Methomyl - 24.0% minimum - 25.0% maximum
Methomyl assay must be 95% on a solvent free/salt free basis.

Water - +2% to -10% (relative) to theoretical content

Color - 80% transmission, maximum
60% transmission, minimum

Clarity - Free of suspended or settled solids

Solvent system should be 90% methanol and 10% water by weight

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MANUFACTURING COST/PRODUCT 10

1,000,000 gals./year Capacity @ 330 days/year Operation (3030 gal/day)

| | EST. USAGE PER GALLON | MAX. USAGE PER GALLON * | COST PER UNIT | EXPECTED COST VARIABLE COST/GAL | EXPECTED COST FIXED COST/GAL | MAXIMUM COST * VARIABLE COST/GAL | MAXIMUM COST * FIXED COST/GAL | STAND-BY * COST/DAY |
|---|---|---|---|---|---|---|---|---|
| **1. RAW MATERIAL COST** | | | | | | | | |
| Slurry (as 100% MTAAO) | 1.27 Lb. | 1.30 Lb. | --- | --- | --- | --- | --- | --- |
| Raw Material #1 | .68 Lb. | .70 Lb. | --- | --- | --- | --- | --- | --- |
| Formulating Agent | 5.17 Lb. | 5.25 Lb. | --- | --- | --- | --- | --- | --- |
| Solvent | .68 Lb. | .70 Lb. | .22 | .1496 | --- | .1496 | --- | --- |
| | | | | .1496 | -0- | .1496 | -0- | -0- |
| **2. UTILITIES** | | | | | | | | |
| Electricity | 1.72 KWH | | .025 | .0322 | .0107 | .0322 | .0107 | Net Billing |
| Steam | 6.61 Lbs. | | | .0038 | .0038 | .0038 | .0038 | -0- |
| Water | | | | .0022 | .0007 | .0022 | .0007 | -0- |
| Nitrogen | | | | .0031 | .0002 | .0031 | .0002 | -0- |
| | | | | .0413 | .0154 | .0413 | .0154 | Net. Elec. |
| **3. OPERATING LABOR** - 4 Operators/Shift | | | | .0567 | .2760 | | .2760 | -0- |
| **4. NITROGEN SYSTEM RENTAL** | | | | | .0048 | | .0048 | 13.00 |
| **5. ROUTINE MAINTENANCE** | | | | | | | | |
| A. Repair Labor | | | | | .0374 | | .0374 | -0- |
| B. Materials | | | | .0524 | .0680 | | .0680 | -0- |
| C. Maintenance Overhead | | | | | .0150 | | .0150 | 41.00 |
| Sub-total Routine Maintenance | | | | | .1204 | | .1204 | 41.00 |
| **6. MISCELLANEOUS OPERATING** | | | | | | | | |
| A. Supervision & Clerical | | | | | .0110 | | .0110 | |
| B. Operating Materials | | | | | .0029 | | .0029 | |
| C. Laboratory | | | | | .0152 | | .0152 | |
| D. Shipping and Handling | | | | | .0355 | | .0355 | |
| E. Waste Incineration | | | | .0800 | --- | | --- | |
| Sub-total Miscellaneous Operating | | | | .0800 | .0646 | | .0646 | 50.00 |
| **7. ADMINISTRATION OVERHEAD** [General Plant Overhead (Taxes, Insurance, Plant Mgmt. Salaries, Eng. Salaries & Expense, etc.); Legal and Audit; Travel Expenses; Wage and Employee Benefit Adm. Expenses; and Miscellaneous Adminstrative Expenses.] | | | | | .0742 | | .0742 | 204.00 |
| TOTALS | | | | .2709 | .5554 | | .5554 | 308.00 |

Cost/Gallon - - .8264

Don't correspond to 3030 gal/day mix cost!

#308/day

* Maximum consumptions, Maximum Cost and Stand-By Cost are best estimates at time of contract execution and will be mutually agreed upon based on actual experience within thirty (30) days following the first ninety (90) days operations.

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EXHIBIT "D"
INVOICE PROCEDURE

| | |
|---|---|
| Fixed Cost* ($/month) | 2 times per month |
| Conversion cost (variable) ($/gallon) | 2 times per month |
| Amortization ($/month) | 1 time per month |
| Stand-by cost ($/day) | 1 time per month |

*Regardless of production rate.

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EXHIBIT "E"
EQUIPMENT LIST - PRODUCT 10

R-1 System

1. 1 ea. 4000 gal G/L reactor, full vacuum rated with 25-30 HP gear box at 60 RPM, glass lined baffle & agitator;dip/leg & internal, steam sparger, made of alloy-20 or teflon lined steel motor to be TEFC or explosion proof.

2. 1 ea. 500 gallon distillate hold tank, C/S., full vacuum rated.

3. 1 ea. R-1 reactor discharge pump 100 GPM, 316 S/S.

4. Distillate hold tank pump, 304 or 316 S/S, 30 GPM.

5. R-1 o'head condenser, water cooled, full vacuum rated, 304 S/S, 316 S/S, or Karbate, 550 ft.$^2$

6. R-1 steam jet surface condenser 150# rating tube side, 316 S/S, 300 ft$^2$.

7. 2 stage steam jet C/S 335 lbs/hr non-condensibles at 90 mm HG, 350 lbs steam/hr 115-125 supply discharging against 1 psig back pressure.

8. 6000 gallon steam stripper, 304 or 316 S/S W/steam sparger coil, baffle & agitator W/30 GPM S/S Pump.

9. 6000 gallon bleach tank, bleach resistant brick lined.

10. 50 GPM bleach pump, hi silicone iron.

11. Fume burner, C/S.

12. Extract hold tank, 3000 gal. 316 S/S.

13. Extract hold tank pump 100 GPM, 316 S/S

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R-2 System

1. 1 ea. 3000 gal glass lined reactor 25-30 HP TEFC or explosion proof motor w/gear box 60 RPM agitator. Glass lined baffle & agitator; dip/leg to be Alloy 20 or teflon lined steel; vessel to be full vacuum rated.

2. 1 ea. reflux condenser, 800 $ft^2$, full vacuum rated, single pass on tube side, water cooled, 75 psig rated on shell side; materials of construction: (a) 304 S/S (b) 316 S/S(c) nickle (d) karbate.

3. 1 each 300 gallon drop tank, 304 S/S, atmospheric pressure.

4. 1 ea. brine cooled tail condenser, 316 S/S full vacuum rated tube side, 75 pound rated shell side shell side, 100 $ft^2$.

5. 2 stage Havey or Karbate (acid resistant) steam jet, 220 pounds/hr non-condensibles at 90 mm HG, 1150 lbs steam/hr 115-125 lb. steam supply, against back pressure 1 psig.

6. 1 ea 200 $ft^2$ Karbate surface condenser 150 pounds pressure on tube side, 75 pound pressure on shell side, single pass on tube side. 450 $ft^2$.

7. 1 ea. vacuum receiver & decanter, 2000 gallon Materials: (1) chemical glass, (2) beer glass, (3) 304 S/S, (4) 316 S/S

8. 1 ea. atmospheric receiver-decanter, 2000 gallon materials construction: (1) Derakane plastic, (2) Atlac 382 plastic (3) beer glass (4) chemical glass

9. R-1 reactor discharge pump, 100 GPM, 304 or 316 S/S

10. Decanter pump, 316 S/S 100 GPM

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Formulation & Packaging System

1. 1 ea. formulation tank 2000 gallon, baffled, 304 S/S.
2. 1 ea. formulation tank agitator 304 S/S or 316 S/S, 10 HP, 60 RPM explosion proof or TEFC motor.
3. Formulation tank recirculation cooler, 316 S/S, 300 $ft^2$.
4. Pressure leaf filter, 75 psig, 316 S/S, paper filter medium , Sparkler 330-12 or equal.
5. Formulation tank pump, 304 or 316 S/S, 50 GPM 75 psig head.
6. Packaging hold tank, 304 S/S, 4500 gallon capacity, baffled.
7. Packaging hold tank agitator, 304 S/S, 10 HP, 60 RPM motor TEFC or explosion proof motor .

Waste System

1. Waste hold tank, 3000 gallon 316 S/S , baffled.
2. Waste hold tank agitator 316 S/S, 10 HP, 60 RPM, explosion proof or TEFC motor.
3. Waste hold tank pump, 316 S/S 50 GPM.

Refrigeration System

1. Brine storage tank C/S. 15,000 gal. atmospheric pressure.
2. 2 ea. brine recirculation pumps C/S. 700 GPM
3. Refrigeration unit, 150 tons for $0^{o}F$ brine, $\Delta T=$
4. Refrigeration system feed pump, C/S. 700 GPM
5. Mixing eductor, C/S

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VI. Raw Material Storage

1. Slurry storage tank, 8,000 gallon capacity C/S W/lining of:
   (a) Stebbins filter acceptable for NaOCl
   (b) Gunnited Precreate

2. Mixing eductor, materials:
   (a) Hastalloy "C", (b) 316 S/S, (c) 317 S/S
   (d) titanium, (e) TEFC lined, (f)saran lined.
   NOT PVC.

3. 1 ea. Unloading Pump 100 GPM, materials:
   (a) HasTalloy "C"
   (b) Teflon Block pump
   (c) Alloy 20
   (d) Cast 316 S/S

VII. Offsites

1. Cooling tower 1000 GPM- $5.0 \times 10^5$ BTU/hr capacity model 366-101 marley

2. Pond

$$\frac{200 \times 200 \times 5}{27} = 7,407 \text{ yd.}^3$$

3. 450' of Rail Track + one switch.

| | |
|---|---|
| Switch | 8,000 |
| 450' of track | 18,000 |
| | 26,000 |

4. Effluent Pumps at pond

NOTE: Pumps in areas I, II, III, IV, & VI to be equipped W/double internal mechanical seals W/ water flush. Water flush to be metered with small water Rotometer.

VIII. Drawings

| DRAWING NUMBER | TITLE |
|---|---|
| 10-201 | Equip. Layout Plot Plan |
| 10-202 | Equip. Layout Process Bldg. |
| LN-02 | Process Flow Diagram |
| 10-001 | Engineer Flow Diagram |
| 10-002 | Engineer Flow Diagram |
| 10-003 | Engineer Flow Diagram |
| 10-004 | Engineer Flow Diagram |

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EXHIBIT "F"

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

BIOCHEMICALS DEPARTMENT

December 19, 1974

Mr. Raymond A. Guidi
Vice President Manufacturing
& Engineering
Vertac, Incorporated
Clark Tower Building
Suite 2900
Memphis, Tennessee 38137

Dear Mr. Guidi:

Sales

and/or its affiliates, Vicksburg Chemical Company and Eagle River Chemical Company (hereinafter "Vertac").

Du Pont possesses technical information relating to processes, intermediates, and waste streams involved in the production of methomyl (Technical Information), and wishes to disclose this information to Vertac. We propose an Agreement on the following terms:

1. Technical Information disclosed by Du Pont to Vertac and designated in writing to be confidential, shall be maintained confidential by Vertac for ten (10) years from the date of this Agreement, except:

(a) information which is or becomes publicly known through no fault of Vertac,

(b) information which is learned by Vertac from a third party entitled to disclose it, and

(c) information already known to Vertac as shown by its prior written records.

2. Vertac shall not use for commercial purposes, without prior written permission of Du Pont, any Technical Information obtained under the Agreement so long as such information must be maintained confidential.

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EXHIBIT "F"



*3. No license under any patent, express or implied, is granted by this Agreement.*

*If you accept the terms we propose, please sign and date a copy of this letter and return it to us.*

*Very truly yours,*

*E. I. DU PONT DE NEMOURS AND COMPANY*

DWK RJ

*By* R. E. Diebel

*Title* Vice President & General Manager
Biochemicals Department

*Date* December 19, 1974

*ACCEPTED:*

*VERTAC, INCORPORATED*

*By* [illegible]

*Raymond A. Guidi*
*Vice President Manu-*
*Title facturing & Engineering*

*Date* [illegible]

WILM. E. & M. DEPT. COPY

| | Date | Invoice | 1 Variable GAL. | 2 Variable DOLLARS | 3 Fixed | 4 Fixed DOLLARS |
|---|---|---|---|---|---|---|
| 1 | July 15 | 2387 | 45865 | 5003872 | | |
| 2 | 15 | 2389 | | | | 2264500 |
| 3 | 28 | 2393 | 26460 | 2886786 | | |
| 4 | 28 | 2397 | | | | 2264500 |
| 5 | Aug 13 | 2409 | 32184 | 3511274 | | |
| 6 | 13 | 2411 | | | | 2264500 |
| 7 | 27 | 2421 | 41556 | 4533760 | | |
| 8 | 27 | 2422 | | | | 2264500 |
| 9 | Sep 15 | 2438 | | | | 2264500 |
| 10 | 15 | 2439 | 49125 | 5359538 | | |
| 11 | 28 | 2445 | | | | 2264500 |
| 12 | 28 | 2446 | 46116 | 5031256 | | |
| 13 | Oct 15 | 2460 | | | | 2264500 |
| 14 | 15 | 2461 | 24732 | 2698261 | | |
| 15 | 28 | 2471 | | | | 2264500 |
| 16 | 28 | 2473 | 19764 | 2156252 | | |
| 17 | Nov 15 | 2495 | 44153 | 4817092 | | |
| 18 | 15 | 2496 | | | | 2264500 |
| 19 | 30 | 2513 | 39256 | 4282830 | | |
| 20 | 30 | 2514 | | | | 2264500 |
| 21 | | | 369211 | 40280921 | | 22645000 |
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AB0000065792/1

EM-6481

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

ENERGY AND MATERIALS DEPARTMENT

VERTAC CONSOLIDATED
NOV 29 [illegible]
RECEIVED

November 24, 1976

MR. JOHN O'NEILL
EAGLE RIVER CHEMICAL CORPORATION
C/O VERTAC CONSOLIDATED
5100 POPLAR - SUITE 2414
MEMPHIS, TENNESSEE 38137

Dear Mr. O'Neill:

Attached for your review is a draft of an amendment to our June 1, 1975 agreement that should cover the various changes we have discussed over the past several months.

Please let me know your comments.

Very truly yours,

Henry E. Burman

HENRY E. BURMAN
PURCHASING AGENT
CONTRACTING SECTION
EQUIPMENT AND SUPPLIES DIVISION

HEB/pjj
Attachment

There's a world of things we're doing something about

DRAFT
11/24/76

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

ENERGY AND MATERIALS DEPARTMENT

MR. JOHN J. O'NEILL
EAGLE RIVER CHEMICAL CORPORATION
C/O VERTAC CONSOLIDATED
5100 POPLAR - SUITE 2414
MEMPHIS, TENNESSEE 38137

Dear Mr. O'Neill:

Reference is made to the Agreement between our two companies dated June 1, 1975 (hereinafter Agreement) relative to the manufacture of Lannate® L Methomyl. It is hereby mutually agreed to amend the aforesaid Agreement in the following manner effective July 1, 1976.

3. COMPENSATION - Delete this Article in its entirety and in lieu thereof insert the following:

3. COMPENSATION

A. Manufacturing Costs - The manufacturing costs for Product 10 are summarized in Exhibit "C", attached hereto and made a part hereof. All units of consumption (usage per gallon) including number of operators are fixed for the period of Agreement. It is agreed that EAGLE RIVER may adjust costs as follows:

1. Methylene Chloride - Invoiced monthly at actual cost to EAGLE RIVER based on agreed to consumption rates.

2. Utilities & Operating Labor - Costs may be adjusted each January 1 or July 1 on sixty (60) days' prior written notice to reflect actual increases or decreases in costs.

3. All Other Items - May be adjusted every twelve (12) months, effective July 1, based on actual increases or decreases in costs provided sixty (60) days' prior written notice of the adjustment is given to DU PONT.

If EAGLE RIVER's facilities are shut down at DU PONT's direction, DU PONT agrees to pay EAGLE RIVER as total compensation reasonable stand-by charges, which will be established by mutual agreement within thirty (30) days following the

first ninety (90) days of operation. An estimate of such charges is summarized in Exhibit "C". It is understood that EAGLE RIVER will stand ready to operate the facilities 330 days per year with 35 days downtime for plant maintenance and repair. However, if EAGLE RIVER's facilities are unavailable for Product 10 production for less than 330 days per year for any cause not directly attributable to DU PONT, then DU PONT will not pay EAGLE RIVER any charges for any days less than 330 days per year that EAGLE RIVER is unable to produce Product 10.

It is anticipated but not guaranteed that DU PONT will require EAGLE RIVER's services to manufacture Product 10 under this Agreement for a period of approximately 24 to 36 months. During the term of this Agreement, EAGLE RIVER agrees to manufacture other products for DU PONT for a mutually agreed upon compensation or maintain the facility on a stand-by basis until such time as DU PONT notifies EAGLE RIVER in writing that no further manufacturing will be required. DU PONT will continue to make amortization payments as defined herein until all such payments have been made or the Agreement is terminated as provided in Article 5. TERM OF AGREEMENT.

B. Amortization Payments - DU PONT agrees to amortize a portion of the cost of EAGLE RIVER's facility as defined in Exhibit "E", as amended, attached hereto and made a part hereof, including the cost of associated equipment and the installation thereof. The amounts to be amortized shall be:

1. $1,250,000 - DU PONT will amortize said sum over a period of five (5) years, payable in sixty (60) successive monthly installments with first payment made September 1975. Monthly payments shall be equal to an amount sufficient to amortize a note of $1,250,000 bearing interest at a rate equal to the prime interest rate charged by the First National Bank of Phillips County, Helena, Arkansas, or ten (10) percent per annum, whichever is lower. Each installment shall be one-sixtieth (1/60) of $1,250,000 plus applicable interest on the unamortized balance. DU PONT will have the option to pay the unamortized balance at any time without charge for accelerating payments. DU PONT acknowledges and has agreed to EAGLE RIVER assigning its rights to said amortization payments as security for a loan to finance the construction herein covered.

effective 1-1-76

draft

DRAFT
11/24/76

2. $72,000 - DU PONT agrees to pay directly to EAGLE RIVER an amount not to exceed seventy-two thousand dollars ($72,000) for additional equipment that will increase EAGLE RIVER's capacity to 1.2 million gallons of Product 10 per year. DU PONT will pay the $72,000 over a two (2) year period in twenty-four (24) equal monthly payments. First payment was made in June 1976. $3000/mo. Right

C. Add-On Charge - In addition to all other costs, DU PONT agrees to pay EAGLE RIVER an add-on charge of $0.50 per gallon for the first one (1) million gallons of Product 10 produced in any contract year and $0.25 per gallon for every gallon of Product 10 produced over the initial one (1) million gallons in any contract year. The add-on charges are firm until July 1, 1977. Thereafter, either party may request annually to renegotiate the add-on charges with thirty (30) days' prior written notice.

All other terms and conditions remain the same.

Please signify your acceptance of the above by signing in the space provided below and returning the copy marked "WILM. E&M DEPT. COPY" to H. E. Burman.

Very truly yours,

E. I. DU PONT DE NEMOURS AND COMPANY

BY _____

TITLE _____

DATE _____

ACCEPTED:

VERTAC CONSOLIDATED

BY _____

TITLE _____

DATE _____

EFFECTIVE JULY 1, 1976

# EXHIBIT "C"

Manufacturing Cost/Product 10

1,200,000 gallons/year capacity @ 330 day/year operation

| | | USAGE PER GALLON | UNIT COST $ | VARIABLE COST/GALLON $ | FIXED COST PER MONTH $ | (1) STAND-BY COST/MONTH $ |
|---|---|---|---|---|---|---|
| 1. | RAW MATERIAL USAGE | | | | | |
| | Slurry (as 100% MTAAO) | 1.33 | - | | | |
| | Methyl Isocyanate | 0.75 | - | | | |
| | Methanol | 5.25 | - | | | |
| | Methylene Chloride | 0.70(2) | 0.1975 | 0.13825 | | |
| 2. | UTILITIES | | | | | |
| | Electricity | 1.72 KWH | 0.02900 | 0.04988 | 1,500 | Net Billing |
| | Steam | 13.10 lbs. | 0.00175 | 0.02293 | 740 | |
| | Water | 4.15 gal. | 0.00053 | 0.00220 | 200 | |
| | Nitrogen | 7.55 SCF | 0.00367 | 0.02771 | 450 | 450 |
| | Natural Gas | 876 MSCF(3) | 0.81000 | - | 710 | |
| | Sub Total | | | 0.10272 | 3,600 | 450 |
| 3. | OPERATING LABOR | | | | | |
| | Operating | | | - | 10,305 | |
| | Packaging | | | 0.08000 | 4,800 | |
| | Sub Total | | | 0.08000 | 15,105 | 2,555 |
| 4. | MAINTENANCE | | | | | |
| | Repair Labor | | | | 4,500 | |
| | Maintenance Mat. | | | | 4,500 | |
| | Maintenance O/H | | | | 2,000 | |
| | Sub Total | | | - | 11,000 | 2,100 |
| 5. | MISCELLANEOUS OPERATING EXPENSE | | | | | |
| | Supervision & Clerical | | | | 3,150 | 2,100 |
| | Operating Materials | | | 0.00550 | 1,050 | - |
| | Laboratory | | | | 5,250 | 1,838 |
| | Shipping & Handling | | | | 900 | |
| | Sub Total | | | 0.00550 | 11,731 | 3,938 |
| 6. | ADMINISTRATIVE O/H | | | | | |
| | Sub Total | | | - | 7,140 | 4,200 |
| 7. | WASTE DISPOSAL | | | | | |
| | Sub Total | | | (4) | - | - |
| | TOTAL | | | $0.32647 | $48,576 | $13,243 |

(1) For declared six months (min.) period; charge for shorter periods will be negotiated.

(2) Subject to retroactive adjustment to 7/1/76 upon establishing consumption by material balance.

(3) Monthly consumption.

(4) To be billed at cost from mutually acceptable disposal companies, but not to exceed $0.28 per gallon of Product 10.

# EAGLE RIVER CHEMICAL CORPORATION

P. O. BOX 2648
WEST HELENA, ARKANSAS 72390
Phone: (501) 572-3701

**INVOICE** No. 2513

INVOICE DATE November 30, 1971

FACTORY NO.

SALESMAN

TERMS

F. O. B.

SHIPPED TO

CUSTOMER'S ORDER NO.

SOLD TO
E. I. duPont de Nemours & Company
P. O. Box 347
La Porte, Texas 77571
ATTN: D. S. Baugh

| SHIPPED VIA | DATE SHIPPED |
|---|---|
| | |

| ✓ | QUANTITY | DESCRIPTION | | UNIT PRICE | AMOUNT |
|---|---|---|---|---|---|
| | | End of November variable cost billing for Product 10 shipped to blackhawk Warehouse. | | | |
| | | Methylene Chloride | 39,256 | $ .1313 | $ 5,154.31 |
| | | Utilities | 39,256 | .0942 | 3,697.92 |
| | | Operating Labor | 39,256 | .0800 | 3,140.48 |
| | | Expenses | 39,256 | .0055 | 215.91 |
| | | Waste Disposal | 39,256 | .2800 | 10,991.68 |
| | | Add on Charge | 39,256 | .5000 | 19,628.00 |
| | | | | $1.0910 | $42,828.30 |
| | | | | | $42,828.30 |

$1.0510
Cr. 5035

The goods specified herein were produced in compliance with the requirements of the Fair Labor Standards Act of 1938 as amended.

STANDARD FORM 4431-A
MATTICK BUSINESS FORMS
WHEELING, ILL.

TRIPLICATE COPY

[redacted]

**EAGLE RIVER CHEMICAL CORPORATION**
P. O. BOX 2648
WEST HELENA, ARKANSAS 72390
Phone: (501) 572-3701

**INVOICE** № 251

INVOICE DATE November 30, 19

FACTORY NO.

SALESMAN

TERMS

F. O. B.

SHIPPED TO

CUSTOMER'S ORDER NO.

SOLD TO
E. I. duPont de Nemours
P. O. Box 347
La Porte, Texas 77571
ATTN: Mr. D. S. Baugh

| SHIPPED VIA | DATE SHIPPED |
|---|---|
| | |

| ✓ | QUANTITY | DESCRIPTION | UNIT PRICE | AMOUNT |
|---|---|---|---|---|
| | | End of November fixed cost billing | | $22,645.0 |
| | | 24,28[illegible] | | |
| | | Dr. 0510<br>Cr. 5035 | | |
| | | TOTAL | | $22,[illegible] |

The goods specified herein were produced in compliance with the requirements of the Fair Labor Standards Act of 1938 as amended.

STANDARD FORM 4451-A
NATTICK BUSINESS FORMS
WHEELING, ILL.

TRIPLICATE COPY

AB0000065792/8

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

ENERGY AND MATERIALS DEPARTMENT

April 21, 1980

Vertac, Inc.
West Helena Plant
P. O. Box 2648
West Helena, AR 72390

OUR ORDER NO. GH-62379-S

Gentlemen:

Attached please find in duplicate the subject purchase order.

If this meets with your approval, please sign both copies, retain the original for your files and return the copy to me by May 2, 1980.

Very truly yours,

R. J. DE STEFANO
SENIOR PURCHASING AGENT
CONTRACTING SECTION

/jtm/deh/7715B
REV. 2/1/79
Attachment

There s a world of things we're doing something about

[redacted] INCORPORATED
WILMINGTON, DELAWARE 19898

| DATE | CONTRACT ORDER NO. | ALT. NO. | PAGE |
|---|---|---|---|
| April 10, 1980 | GII-62379-S | | 1 |

E. I. DU PONT DE NEMOURS & COMPANY

SHIP TO:

Strang, Texas

Vertac, Inc.
West Helena Plant
P. O. Box 2648
West Helena, Arkansas 72390

Wilmington, Delaware
ISSUING POINT

R. J. De Stefano
ISSUED BY

< To cover cost of producing and packaging approximately 300,000 gallons of Lannate® liquid at Vertac's West Helena, Arkansas plant in accordance with Du Pont's written instruction. Du Pont to supply all ingredients and packaging materials.

COMPENSATION: As full compensation Contractor shall be reimbursed as follows:

$ 0.80/gallon each 55-gallon drum
$ 0.90/gallon each 1 gallon jug

All terms and conditions of our Lannate® contract dated 6/1/75 as amended 4/1/76, 4/20/76, 7/1/76 and 5/10/78 apply except as they pertain to Quantity (2), Compensation (3), Terms of Payment (4), Term of Agreement ( and Raw Material, Consumption and Losses (14) sections.

YIELD LOSS: Contractor shall use its best efforts to maximize yields and shall ship in accordance with Du Pont's instructions all Lannate® which meets the specifications herein. To the extent possible, Contractor shall rework all off-specification material at its own expense. If during the Contractor's performance hereunder, any of Du Pont's material is actually lost, damaged or destroyed ("Yield Loss") for reasons other than the negligence of Contractor, then Contractor shall be afforded a Yield Loss allowance for up to a maximum of 1.5% based on the weight of the raw materials and a maximum of 3% on*materials furnished by Du Pont. Contractor shal reimburse Du Pont at Du Pont's replacement cost for any Yield Loss caused by the negligence of Contractor and any Yield Loss in excess of maximum Yield Loss. Replacement cost will be mutually agreed upon at the time the loss occurs. Yield Losses and reimbursement, if any, shall be determined quarterly and at the conclusion of this order.

Period of Agreement: Work to be completed by 7/1/80.

* packaging

[redacted] DUPONT

WILMINGTON, DELAWARE 19898

| DATE | CONTRACT ORDER NO. | ALT. NO. | PAGE NO |
|---|---|---|---|
| April 10, 1980 | GH-62379-S | | 2 |

E. I. DU PONT DE NEMOURS & COMPANY

SHIP TO:

Vertac, Inc.

ISSUING POINT

ISSUED BY

TERMS OF PAYMENT: Contractor shall invoice Du Pont monthly for the processing and packaging charge on such quantities of finished product as were produced during that month that meets Du Pont's specification & payment shall be made on the basis of Net Thirty (30) days from date of invoice. Mail (4) copies of your invoice to:

E. I. Du Pont De Nemours and Company
P. O. Box 347
La Porte, Texas 77571

Please signify your acceptance of the above by signing in the space provided below and returning the carbon copy to R. J. De Stefano, E. I. du Pont de Nemours and Company, Energy and Materials Department, Wilmington, DE 19898.

| VERTAC, INC. | E. I. DU PONT DE NEMOURS AND COMPANY |
|---|---|
| BY: _____ | BY: O Burkland |
| TITLE: _____ | TITLE: CONTRACTING MANAGER |
| DATE: _____ | DATE: April 15, 1980 |

AB0000065758/3

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
HOUSTON PLANT
P. O. BOX 347, LA PORTE, TEXAS 77571

BIOCHEMICALS DEPARTMENT

Copy to Byron
Dave
Homer
Larry
Richard
Jeff

June 1, 1979

Mr. Pat Bomar
Vertac Consolidated
5100 Poplar Street - Suite 2414
Memphis, Tennessee 38137

PRODUCT 10 PRODUCTION FORECAST

Dear Mr. Bomar:

In accordance with Article 2. QUANTITY of the agreement between Du Pont and Eagle River, it is estimated, but not guaranteed, that Du Pont will have Eagle River produce the following amounts of Product 10 during the indicated periods:

| PERIOD | GALLONS |
|---|---|
| July - 1979 | 100,000 |
| August - 1979 | 100,000 |
| September - 1979 | 100,000 |
| 4th Qtr. - 1979 | 260,000 |
| 1st Qtr. - 1980 | 240,000 |
| 2nd Qtr. - 1980 | 240,000 |
| TOTAL | 1,040,000 |

Congratulations on your record production in May!

We have told the plant that they will be down about two weeks this month due to our annual shutdown.

After our peak season ends in October, we will need to evaluate what production levels are needed for you during our low sales period.

Very truly yours,

M. E. Stevens
Production Superintendent

MES:mc



AB0000065800/1

B-14120

DEC 5 1977

Byron
Bob
George
Dave

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED

HOUSTON PLANT
P. O. BOX 347, LA PORTE, TEXAS 77571

BIOCHEMICALS DEPARTMENT

December 1, 1977

Mr. Pat Bomar
Vertac Consolidated
Suite 2414
5100 Poplar Street
Memphis, Tennessee 38137

PRODUCT 10 PRODUCTION FORECAST

Dear Mr. Bomar:

In accordance with Article 2. QUANTITY of the agreement between Du Pont and Eagle River, it is estimated, but not guaranteed, that Du Pont will have Eagle River produce the following amount of Product 10 during the indicated periods:

| PERIOD | | GALLONS |
|---|---|---|
| January | - 1978 | 80,000 |
| February | - 1978 | 80,000 |
| March | - 1978 | 80,000 |
| 2nd Qtr. | - 1978 | 240,000 |
| 3rd Qtr. | - 1978 | 180,000 |
| 4th Qtr. | - 1978 | 180,000 |
| Total | | 840,000 |

Very truly yours,

M. E. Stevens
Production Superintendent

MES:mc



AB0000065800/2

EM-6481

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

ENERGY AND MATERIALS DEPARTMENT

August 25, 1981

Vertac Chemical Corporation
5100 Poplar Street
Suite 2414
Memphis, TN 38137

Gentlemen:

OUR PURCHASE ORDER GH-75716-X

Attached please find in duplicate the subject Purchase Order.

If this meets with your approval, please sign both copies, retain the original for your files and return the copy to me by September 8, 1981.

Very truly yours,

R. J. DE STEFANO
SENIOR PURCHASING AGENT
CONTRACTING SECTION

RJD/kmb/0090c
Attachment

There's a world of things we're doing something about

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

CONTRACT ORDER
(FIELD LABOR)

| August 17, 1981 | GH-75716X | | 1 |
|---|---|---|---|
| DATE | CONTRACT ORDER NO. | ALT. NO. | PAGE NO. |

E. I. DU PONT DE NEMOURS & COMPANY

SHIP TO:

Vertac Chemical Corporation
5100 Poplar Street
Suite 2414
Memphis, TN 38137

Wilmington, Delaware
ISSUING POINT

R. J. De Stefano 079-103
ISSUED BY

This document when properly executed shall constitute a contract between E. I. DU PONT DE NEMOURS AND COMPANY (DU PONT) and VERTAC CHEMICAL CORPORATION (CONTRACTOR) for services described herein.

SERVICES - DU PONT agrees to supply to CONTRACTOR all raw materials including packaging, at no charge, to CONTRACTOR'S plant in West Helena, Arkansas. CONTRACTOR will receive DU PONT material, blend and produce Lannate® liquid (hereinafter referred to as PRODUCT) in accordance with DU PONT'S written instructions that are made a part hereof by reference.

CONTRACTOR agrees to segregate all DU PONT-owned materials supplied in accordance with this Contract in a separate inventory and identify said inventory indicating DU PONT ownership of the inventoried materials.

PRODUCT will not be shipped until quality is approved by DU PONT. Equipment used in the formulation, processing and packaging operations shall be thoroughly cleaned and free of possible contaminants. DU PONT shall have the right to inspect and approve the equipment prior to use.

Neither inspection nor approval by DU PONT shall constitute any representation or warranty by DU PONT with respect thereto, the assumption by DU PONT of any responsibility or liability with respect thereto, or the acceptance or waiver of any defect in the material or service supplied by CONTRACTOR, or be deemed to waive any of the CONTRACTOR'S obligation under this contract.

QUANTITIES - DU PONT agrees to purchase and CONTRACTOR agrees to blend up to one hundred thousand (100,000) gallons of PRODUCT.

TITLE - Notwithstanding the fact that DU PONT materials are located on CONTRACTOR'S premises, DU PONT shall retain title to such materials both before and after processing by CONTRACTOR. It is understood, however, that CONTRACTOR shall have title to all unuseable and waste materials, and all responsibility and liability in connection therewith shall vest in and be assumed by CONTRACTOR.

| ITEM | GEN LEDGER | SUB ACCOUNTS | REQUISITIONED BY | DELIVER TO | REQUISITION NO |
|---|---|---|---|---|---|
| | 7506 | 195032 | PLANT COPIES TO JUDY ESCOBEDO | 9764b/ddb | |
| | | | | | |
| | | | | | |

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

CONTRACT ORDER
(FIELD LABOR)

| August 17, 1981 | GH-75716X | | 2 |
|---|---|---|---|
| DATE | CONTRACT ORDER NO. | ALT NO. | PAGE NO |

E. I. DU PONT DE NEMOURS & COMPANY

SHIP TO:

Vertac Chemical Corporation
5100 Poplar Street
Suite 2414
Memphis, TN 38137

Wilmington, Delaware
ISSUING POINT

R. J. De Stefano 079-103
ISSUED BY

CONTRACTOR agrees that such waste will be disposed of in an environmentally safe manner and in compliance with all pertinent federal, state and local laws, rules and regulations.

COMPENSATION - As full compensation CONTRACTOR shall be reimbursed as follows:

$1.05/gallon each 1-gallon jug

YIELD LOSS - CONTRACTOR shall use its best efforts to maximize yields and shall ship in accordance with DU PONT'S instructions all Lannate® which meets the specifications herein. To the extent possible, CONTRACTOR shall rework all off-specification material at its own expense. If, during CONTRACTOR'S performance hereunder, any of DU PONT'S material is actually lost, damaged or destroyed ("Yield Loss") for reasons other than the negligence of CONTRACTOR, then CONTRACTOR shall be afforded a Yield Loss allowance for up to a maximum of 1.5% based on the weight of the raw materials and a maximum of 3% on materials furnished by DU PONT. CONTRACTOR shall reimburse DU PONT at DU PONT'S replacement cost for any Yield Loss caused by the negligence of CONTRACTOR and any Yield Loss in excess of maximum Yield Loss. Replacement cost will be mutually agreed upon at the time the loss occurs. Yield Losses and reimbursement, if any, shall be determined quarterly and at the conclusion of this order.

PERIOD OF AGREEMENT - Spot Order.

INSPECTION - DU PONT'S duly authorized representatives shall have the right to visit, observe and inspect CONTRACTOR'S processing facilities related to this Contract at any time during CONTRACTOR'S normal business hours.

SHIPMENTS - Freight charges for all materials shipped to CONTRACTOR by DU PONT and for all finished products shipped by CONTRACTOR in accordance with DU PONT'S instructions will be for DU PONT'S account.

| ITEM | GEN LEDGER | SUB ACCOUNTS | REQUISITIONED BY | DELIVER TO | REQUISITION NO |
|---|---|---|---|---|---|
| | 7506 | 195032 | | | |
| | | | | 9764b/ddb | |
| | | | | | |

AB0000065744/3

G-506-I-A-8PT.-6/78

E. I. DU PONT DE NEMOURS & COMPANY
(INCORPORATED)
WILMINGTON, DELAWARE 19898

CONTRACT ORDER
(FIELD LABOR)

| DATE | CONTRACT ORDER NO. | ALT. NO. | PAGE NO |
|---|---|---|---|
| August 17, 1981 | GH-75716X | | 3 |

E. I. DU PONT DE NEMOURS & COMPANY

SHIP TO:

Vertac Chemical Corporation
5100 Poplar Street
Suite 2414
Memphis, TN 38137

Wilmington, Delaware
ISSUING POINT

R. J. De Stefano 079-103
ISSUED BY

HAZARDS - CONTRACTOR recognizes that hazards may be involved in performing services as described hereunder. Product description and toxicological data for the material provided in the "Data Package" show operational safety hazards and environmental control for use. It is agreed and understood that this information is for CONTRACTOR'S information only, is provided without any representation or warranty as to its suitability for CONTRACTOR'S performing the services herein, and that the methods taken to process DU PONT'S materials hereunder as well as precautions taken by CONTRACTOR shall be determined by CONTRACTOR; and responsibility for methods used and safe handling until such materials are shipped to DU PONT shall rest solely with CONTRACTOR.

GENERAL CONDITIONS - DU PONT'S Standard Terms and Conditions, dated December 1979, are attached hereto and made a part hereof.

TERMS OF PAYMENT - CONTRACTOR shall invoice DU PONT monthly for the processing and packaging charge on such quantities of finished product as were produced during that month that meets DU PONT'S specifications and payment shall be made on the basis of Net Thirty (30) days from date of invoice. Mail (4) copies of your invoice to:

E. I. du Pont de Nemours and Company
P. O. Box 347
La Porte, Texas 77571

ENTIRETY - This document and the attachments specifically referred to herein embody the entire Contract, and there are no agreements, understandings, conditions, warranties or representations, oral or written, express or implied, with reference to the subject matter hereof which are not merged herein. No modification hereof shall be of any force or effect unless in writing signed by both parties.

| ITEM | GEN LEDGER | SUB ACCOUNTS | REQUISITIONED BY | DELIVER TO | REQUISITION NO |
|---|---|---|---|---|---|
| | 7506 | 195032 | | | |
| | | | | 9764b/ddb | |
| | | | | | |

AB0000065744/4

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

# CONTRACT ORDER
(FIELD LABOR)

| DATE | CONTRACT ORDER NO. | ALT. NO. | PAGE NO. |
|---|---|---|---|
| August 17, 1981 | GH-75716X | | 4 |

E. I. DU PONT DE NEMOURS & COMPANY

SHIP TO:

Vertac Chemical Corporation
5100 Poplar Street
Suite 2414
Memphis, TN 38137

Wilmington, Delaware
ISSUING POINT

R. J. De Stefano 079-103
ISSUED BY

Please signify your acceptance of the above by signing in the space provided below and returning the carbon copy to R. J. De Stefano, E. I. du Pont de Nemours and Company, Energy and Materials Department, Wilmington, DE 19898.

VERTAC, INC.

BY: [signature]

TITLE: V.P. Operations

DATE: Aug 31, 1981

E. I. DU PONT DE NEMOURS AND COMPANY

BY: [signature]

TITLE: SENIOR PURCHASING AGENT

DATE: CONTRACTING - AUGUST 27, 1981

REV. 2/14/79

| ITEM | GEN LEDGER | SUB ACCOUNTS | REQUISITIONED BY | DELIVER TO | REQUISITION NO |
|---|---|---|---|---|---|
| | 7506 | 195032 | | | |
| | | | | 9764b/ddb | |
| | | | | | |

AB0000065744/5

STANDARD TERMS AND CONDITIONS

(December 1979)

ASSIGNMENT AND SUBCONTRACTING - The rights and obligations covered herein are personal to each party hereto, and for this reason, this Agreement shall not be assignable by either party in whole or in part, nor shall either party subcontract any of its obligations hereunder without the prior written consent of the other party.

FAIR LABOR STANDARDS ACT - CONTRACTOR warrants that in the performance of the services hereunder, it will comply with applicable provisions of the Fair Labor Standards Act of 1938, as amended.

CONTINGENCY - Except to the extent otherwise provided herein in the provisions entitled LOSS AND DAMAGE and HOLD HARMLESS, no liability shall result to either party from delay in performance or nonperformance caused by circumstances beyond the control of the party affected, including, but not limited to, act of God, fire, flood, explosion, war, action or request of governmental authority, accident, labor trouble or shortage, inability to obtain material, equipment or transportation. It is agreed that each party when affected by contingencies beyond its control will notify the other party promptly and will use reasonable diligence for removal thereof. CONTRACTOR agrees if it invokes this provision, to allocate its remaining capacity on a fair and equitable basis.

LOSS AND DAMAGE - CONTRACTOR assumes full responsibility and liability for the safe handling and safekeeping of all material which DU PONT may deliver to CONTRACTOR while in its possession, and CONTRACTOR shall use due diligence in keeping operation losses at a minimum. CONTRACTOR shall obtain prior approval of DU PONT before moving any DU PONT-owned materials to a new location.

TERMINATION - If CONTRACTOR should be adjudged bankrupt or make a general assignment for the benefit of its creditors, or if a

receiver should be appointed on account of its insolvency, or it should fail to make prompt payment for materials or labor, or disregard laws, ordinances or other governmental regulations, or violate any provisions of this Agreement, DU PONT, without any liability to CONTRACTOR, may on seven (7) days' written notice to CONTRACTOR terminate CONTRACTOR'S services under this Agreement.

CONTAMINATION AND RESPONSIBILITY - CONTRACTOR shall take all steps necessary to prevent the contamination of DU PONT'S material with foreign substances. CONTRACTOR shall formulate and package material in accordance with DU PONT specifications, and shall bear the cost of handling, reworking or replacing any material which cannot be marketed by reason of CONTRACTOR'S failure to meet specifications.

HOLD HARMLESS - CONTRACTOR agrees to take all necessary precautions to prevent any injury to persons (including employees of CONTRACTOR and DU PONT) or damage to property (including DU PONT'S and CONTRACTOR'S property) during the progress of the work covered hereunder and shall indemnify DU PONT against all loss and expense which may result in any way from any act or omission, including failure by CONTRACTOR to meet DU PONT'S product specifications, on the part of CONTRACTOR, its agents, employees or subcontractors, except to the extent that any such loss is due solely and directly to the negligence of DU PONT.

TAXES - CONTRACTOR assumes full responsibility for the payment of all social security, unemployment compensation, and other taxes and charges for all employees engaged by CONTRACTOR in the performance of the services hereunder, and it will require each of its subcontractors, if any, to do the same.

INSURANCE - CONTRACTOR shall carry, at its expense, insurance of the following minimum limits as follows:

(A) Workmen's Compensation - Statutory; and Employer's Liability - $100,000 per accident

- This item requires a waiver of subrogation against DU PONT.

(B) Comprehensive General Liability, Bodily Injury and Property Damage in a combined single limit - $500,000 per occurrence.

- This item requires DU PONT to be named additional insured.

(C) Comprehensive Automotive Liability Bodily Injury and Property Damage in a combined single limit - $500,000 per occurrence.

(D) Contractual Liability in a combined single limit - $500,000 per occurrence.

Certificates of insurance evidencing the coverages required above shall be filed with DU PONT'S La Porte, Texas plant prior to the furnishing of services under this Agreement. Such certificates shall provide that the insurer will give DU PONT not less than ten (10) days' advance notice of any changes in or cancellation of coverage. In the event any subcontractor is employed, CONTRACTOR shall provide DU PONT with evidence of the same coverages in the same limits with respect to such subcontractor.

INDEPENDENT CONTRACTOR - The employees, methods, equipment and facilities used by CONTRACTOR shall at all times be under its exclusive direction and control. CONTRACTOR'S relationship to DU PONT under this agreement shall be that of an independent contractor; and nothing in this Agreement shall be construed to constitute CONTRACTOR, or any of its employees, an agent, associate, joint venturer or partner of DU PONT.

NONDISCLOSURE - The CONTRACTOR will not disclose to others (a) that DU PONT has purchased or plans to purchase services, articles or materials from CONTRACTOR or (b) the structure or composition of articles or materials to be processed for or purchased by DU PONT, when such structure or composition information is provided by DU PONT or (c) the structure or composition of the processed products produced hereunder when such structure or composition information is provided by DU PONT.

COMPLIANCE WITH LAWS - CONTRACTOR agrees that in the performance of the processing operations hereunder, as well as in the disposal of any waste material resulting from said operations, it will comply with all applicable laws, rules and regulations of governmental authority in connection therewith.

RECORDS - CONTRACTOR shall maintain, in accordance with generally accepted accounting principles and practices, such records as may be necessary adequately to reflect the accuracy of CONTRACTOR'S charges and invoices for reimbursement under this Agreement and to make and maintain such other and additional records as DU PONT may from time to time reasonably require in connection with this Agreement. DU PONT shall have the right from time to time to inspect and verify the records kept by CONTRACTOR in connection with this Agreement.

RJD/ddb/9823b



AB0000065744/9

Arkansas-Superfund-Cedar-Chemical

CEDAR CHEMICAL CORPORATION

**Facsimile Cover Sheet**

Neil

Info DVH

**To:** Gene McCutchen, Purchasing Agent
**Company:** Dupont
**Phone:**
**Fax:** 302-892-1531

**From:** Geoffrey L. Pratt
**Company:** Cedar Chemical Corporation
**Phone:** 901-685-5348
**Fax:** 901-684-5398

Dear Gene:

Based on a conversation with Tonya Pellegrin today, Cedar is proposing that we extend the contract order #LPMD1333 dated September 17, 1992 covering the cost of converting Dupont's sodium perborate into sodium metaborate by an additional one month period until July 31, 1994. This extension is based upon recent success in improving the reaction rate by the use of caustic soda.

Further, Cedar proposes to handle the cost of the caustic soda used by billing Dupont on a monthly basis for caustic consumed at Cedar's cost of purchase.

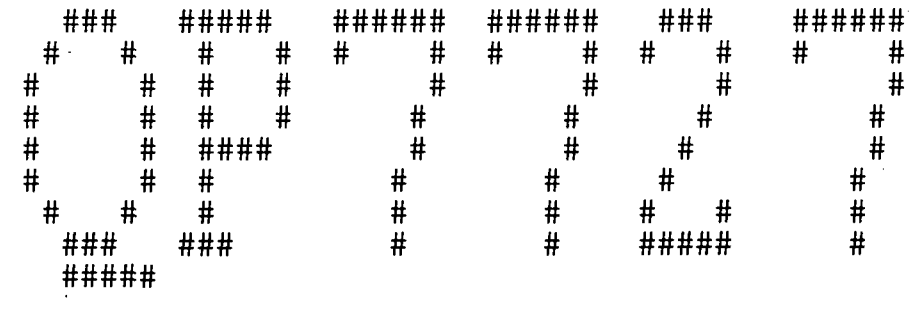
We hope that during the month of July we can use this new found reaction capability to work out a reasonable logistics program so that both Cedar and Dupont can achieve their goals on this project. Please contact me at 901-684-5373 if you have any comments on this proposal.

Sincerely,

Geoffrey L. Pratt, Vice President
*Custom Manufacturing & Specialty Chemicals*

GLP:lc

cc: Tonya Pellegrin, Dupont, Memphis, fax 901-353-7792
Dave Hoppel
Jim Krusling
Ed White



Job : 66
Date: 4/30/2008
Time: 11:06:19 AM

CC: Tom
Charlie
Neil

**CEDAR INTERNAL CORRESPONDENCE**

DATE: 8/9/90

TO: File

FROM: Geoffrey L. Pratt

CC: Randal Tomblin
Bill Eissler
John Miles✓
Niven Morgan, Jr.

SUBJECT: DuPont Meeting
July 25, 1990
Bob Blackhall

Bill Eissler and I met with Bob Blackhall, Elaine Donald and Paul Smith regarding the upcoming CNT Project. The following items were discussed:

1. DuPont was overly optimistic in forecasting CNT needs this year and will reduce the current projected run from three rail cars of PNT to two. They will also delay their projected October run into December. We indicated the reduction for the current run would pose no problems to us except the price would have to be adjusted and that we were currently committed through the end of the year to produce MBC. However, we did indicate that if their need became desperate, we may be able to negotiate a gap in the MBC production, otherwise, the next projected opening for CNT would be February, 1991.

2. We discussed product pricing and agreed that the simplest way to handle this next year's production would be to bill DuPont automatically for a $30,000 plant preparation and clean up fee, plus a fixed fee per pound of CNT based upon a $10,000 per day processing fee divided by the productivity target of 21,277 pounds per day presented in my letters of May 4, 1990 and July 9, 1990. This pricing formula would apply for all quantities down to a minimum of two cars of PNT (approximately 250,000 pounds).

3. Cedar should continue to supply chlorine to the project and bill DuPont for any caustic used in the scrubbing system.

4. DuPont would like copies of Certificates of Analyses on each lot in a product rail car, sent to them at the time the car is shipped. The COA should be faxed to Paul Smith at 609/540-3177 and the second copy should be faxed to 609/540-4498.

5. Cedar should continue to fax the records of car weights and receiving reports as they have in the past.

6. DuPont is interested in a long term contract on CNT and Bob Blackhall will develop a formula to adjust our fees due to inflation. They rejected the formula which we had proposed. The major issue is that our formula inflates our profit as our costs

rise. We indicated that we felt that this was very reasonable and would probably insist that a formula do that.

7. We asked if DuPont had additional projects for consideration and Elaine mentioned two:

A. Nitration of Ethyl Hexyl Alcohol - this nitrated product is a Cetane enhancer and the market for this product is expected to grow rapidly due to EPA pressure on the gasoline refiners. DuPont got out of this business on a make or buy decision and has since regretted this since their supplier, Ethyl, is very inflexible in pricing. They would be interested in a long term contract for us to produce the material and would provide us with their technology which they say removes much of the hazard associated with nitrating alcohols of this kind. There have been some serious accidents in the production of this material and we looked at the product several years ago under a development program with Mobil. Both Cedar and Mobil agreed to terminate the project, when Mobil's technology could not produce a process that both companies felt was safe. We will have to review DuPont's process very carefully to make sure that their claims on safety are justified. They did manufacture the product for many years with no accidents. DuPont expects this product to increase rapidly into the 10 to 12 million pounds plus demand per year.

B. Elaine also mentioned a project which again could have requirements in the millions of pounds perhaps beginning at approximatley three quarters of a million pounds for a poly isobutylene amine. DuPont does not have know how for this process and Elaine described it from literature sources as a reaction between poly isobutylene and chlorine in a solvent with subsequent amination using different amines which she described as DMAPA, or DEAT. DuPont has conducted a preliminary literature search on this process and will provide us with this information to determine our further interest. This would be a custom chemical project since the technology would belong to Cedar.

Geoffrey L. Pratt

mc

N. Robbins

RECEIVED
MAY 20 1993
Ans'd.....

DuPont Corporate Contracting
Chestnut Run Plaza
Wilmington, DE 19880-0721

DuPont Corporate Contracting

CONTRACT ORDER
E. I. DUPONT DE NEMOURS AND COMPANY

May 12, 1993

LPMD-1333 (Contract Order No.) 2 (Alt. No.) Page 1 of 2

Cedar Chemical Corporation
5100 Poplar Avenue - 24th Floor
Memphis, TN 38137
Attn: Mr. Geoffrey L. Pratt

Wilmington, Delaware
Issuing Point

R. A. Blackhall
Issued By

## ALTERATION #2

Reference is made to the Agreement entered into on September 17, 1992 between E. I. du Pont de Nemours & Company (DuPont) and Cedar Chemical Corporation (Cedar Chemical) to cover the cost to chemically convert DuPont-furnished sodium perborate tetrahydrate (SPBT) fines and sodium perborate monohydrate fines (SPBM) into sodium metaborate solution for DuPont's Memphis, Tennessee facility. It is hereby mutually agreed to amend the aforesaid Agreement in the following manner effective May 1, 1993.

SPECIFICATIONS: Add the following:

Per Exhibit A, "Technology Package - SPBM Addendum Rework SPBT Fines Into Sodium Metaborate Solution," dated December 3, 1992, which is attached hereto and made a part hereof.

All other terms and conditions of the current Agreement, except as modified in the above manner, shall continue in full force and effect.

Please have your authorized representative execute in the space provided below, indicating acceptance of this alteration. Cedar Chemical will keep one original and return one executed copy of this order to Robert A. Blackhall, E. I. du Pont de Nemours & Company, P. O. Box 80723, Materials and Logistics, Chestnut Run Plaza, Hickory Run Building, Room #1102, Wilmington, Delaware 19880. These copies must be returned, so payment can be made against this alteration.

Cedar Chemical Corporation

BY: Geoffrey L. Pratt

Geoffrey L. Pratt

Director of Custom Manufacturing
Title

E. I. du Pont de Nemours & Company

BY: R A Blackhall

Senior Purchasing Agent
Title

Page 2 of 2 for Du Pont internal use only.

E I du Pont de Nemours and Company

Printed on Recycled Paper

# TECHNOLOGY PACKAGE - SPBM ADDENDUM
# REWORK SPBT FINES INTO SODIUM METABORATE SOLUTION

## GENERAL

It is proposed to include Sodium Perborate Monohydrate (SPBM) Fines in the original 12,000,000 lbs. of material to be reworked over a twelve month period. SPBM Fines are defined as material which does not meet salable product specifications. This includes fines and rework. They undergo the same chemical decomposition as SPBT Fines discussed previously except for the presence of fewer waters of hydration. Differences from the Technology Package dated September 2, 1992 are highlighted below.

## CHEMISTRY

$NaBO_2.H_2O_2 \rightarrow NaBO_2 + 1\ H_2O + 0.5\ O_2$

## MATERIAL BALANCE

Basis: 1,000 lbs. SPBM Fines and 320 g/l final Meta solution

| | | |
|---|---|---|
| IN | 1,000 | lbs. SPBM Fines |
| | 1,635 | lbs. DI $H_2O$ |
| | 1.9 | lbs. Mg dry solids as $Mg(OH)_2$ |
| OUT | 161 | lbs. Oxygen |
| | 659 | lbs. Meta |
| | 1,815 | lbs. $H_2O$ |
| | 1.9 | lbs. Mg Solids |

Approximate meta solution volume = 228 gal.

## DETAILS

- MSDS is available for dry, granular SPBM.
- Higher active oxygen content may accelerate initial decomposition rates and increase foaming potential. However, SPBM's faster dissolution should reduce foaming potential. SPBM Fines addition rate may need to be adjusted.
- SPBM fines have a greater tendency to dust than SPBT fines. Du Pont may conduct additional air monitoring to determine appropriate personal protective equipment.

H. Hoppel

RECEIVED
MAY 20 1993
Ans'd.....

DuPont Corporate Contracting
Chestnut Run Plaza
Wilmington, DE 19880-0721

WNR

DUPONT

DuPont Corporate Contracting

CONTRACT ORDER
E. I. DUPONT DE NEMOURS AND COMPANY

May 12, 1993

LPMD-1333 (Contract Order No.) 2 (Alt. No.) Page 1 of 2

Cedar Chemical Corporation
5100 Poplar Avenue - 24th Floor
Memphis, TN 38137
Attn: Mr. Geoffrey L. Pratt

Wilmington, Delaware
Issuing Point

R. A. Blackhall
Issued By

---

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| Cedar Chemical Corporation | E. I. du Pont de Nemours & Company |
|---|---|
| BY: _____ | BY: _____ |
| Geoffrey L. Pratt | |
| Director of Custom Manufacturing | Senior Purchasing Agent |
| Title | Title |

Page 2 of 2 for Du Pont internal use only.

E. I. Du Pont de Nemours and Company

Printed on Recycled Paper

AB0000065454/1

# TECHNOLOGY PACKAGE - SPBM ADDENDUM
# REWORK SPBT FINES INTO SODIUM METABORATE SOLUTION

## GENERAL

It is proposed to include Sodium Perborate Monohydrate (SPBM) Fines in the original 12,000,000 lbs. of material to be reworked over a twelve month period. SPBM Fines are defined as material which does not meet salable product specifications. This includes fines and rework. They undergo the same chemical decomposition as SPBT Fines discussed previously except for the presence of fewer waters of hydration. Differences from the Technology Package dated September 2, 1992 are highlighted below.

## CHEMISTRY

$NaBO_2.H_2O_2 \rightarrow NaBO_2 + 1\ H_2O + 0.5\ O_2$

## MATERIAL BALANCE

Basis: 1,000 lbs. SPBM Fines and 320 g/l final Meta solution

| | | |
|---|---|---|
| IN | 1,000 | lbs. SPBM Fines |
| | 1,635 | lbs. DI $H_2O$ |
| | 1.9 | lbs. Mg dry solids as $Mg(OH)_2$ |
| OUT | 161 | lbs. Oxygen |
| | 659 | lbs. Meta |
| | 1,815 | lbs. $H_2O$ |
| | 1.9 | lbs. Mg Solids |

Approximate meta solution volume = 228 gal.

## DETAILS

- MSDS is available for dry, granular SPBM.
- Higher active oxygen content may accelerate initial decomposition rates and increase foaming potential. However, SPBM's faster dissolution should reduce foaming potential. SPBM Fines addition rate may need to be adjusted.
- SPBM fines have a greater tendency to dust than SPBT fines. Du Pont may conduct additional air monitoring to determine appropriate personal protective equipment.

EM-6670-C7 REV. 11/87

DUPONT

# E. I. DU PONT DE NEMOURS & CO., (INC.)

Materials and Logistics Department
Wilmington, Delaware 19898

LMD-956834-Y | 1
PURCHASE ORDER NO. | ALT. NO.

SITE NO. | TAX CODE | DIRECT ALL INQUIRIES

10/15/90
DATE OF ORDER

ISSUED BY: R.A. Blackhall

RELEASE NUMBER

PAGE OF

Net 30
TERMS OF PAYMENT

REQUIRED SHIP DATE | PROMISED SHIP DATE

FOB: ☐ DEST. (DEL'D) ☐ SHIP PT | ☐ PREPAID ☐ PREPAID ADDED ☐ OTHER (SEE BELOW) ☐ COLLECT | * IF COLLECT, Mail Freight Bill To:

FREIGHT TERMS | (If Ship Pt. Show City & State) | FREIGHT TERMS

VENDOR CODE

PAYEE CODE

Cedar Chemical Corporation
5100 Poplar Avenue
24th Floor
Memphis, TN 38137
Attn: Mr. G.L. Pratt

E. I. DU PONT DE NEMOURS & COMPANY

Include P.O. No. as part of address

PLEASE ENTER OUR ORDER AS SPECIFIED BELOW SUBJECT TO CONDITIONS AND INSTRUCTIONS LISTED ON BOTH THE FACE AND REVERSE SIDE OF THIS PURCHASE ORDER.

IF PRICE, TERMS, REQUIRED SHIPPING DATE OR OTHER CONDITIONS AND INSTRUCTIONS ARE NOT ACCEPTABLE IMMEDIATELY ADVISE INDIVIDUAL INDICATED BY RED ARROW ABOVE.

FURNISH COMPLETE SHIPPING INFORMATION AND INCLUDE 2 COPIES OF PACKING LIST WITH EACH SHIPMENT. SHOW PURCHASE ORDER NUMBER ON EACH PACKAGE, PACKING LIST, BILL OF LADING, INVOICE AND ALL CORRESPONDENCE.

.... MAIL YOUR INVOICE TO ADDRESS INDICATED BELOW:

☐ E.I. du Pont de Nemours & Co
☐ Mis. Stores/Chambers Works
Deepwater, NJ 08023
Attn: A/P Section

DO NOT INSURE UPS OR PARCEL POST. DO NOT DECLARE AIR EXPRESS AND AIR FREIGHT IN EXCESS OF $5000. IF LOWER CHARGES RESULT, DUPONT DECLARED VALUE SHALL NOT EXCEED LOWEST AMOUNT IN APPLICABLE TARIFF.

SHIP VIA:

| ITEM | QUANTITY | DESCRIPTION (INCLUDE ADJECTIVE, MANUF. NAME & NO.) | PRICE |
|---|---|---|---|

## ALTERATION #1

RECEIVED
DEC 4 1990
Ans'd.....

Alteration #1 issued to PO #LMD-956834-Y for chlorination of p-nitro toluene to change the following:

PERIOD OF AGREEMENT: From - 6/1/89 thru 5/31/90
To - 6/1/89 thru 12/31/91

CONTRACT ADMINISTRATOR: Change from K.F. Kamenski to Paul Smith (609) 299-5000 X 3593.

Compensation: Replace Exhibit "A" dated 5/12/89 with Exhibit "A" dated 8/14/90, attached hereto and made a part hereof.

NOT ATTACHED

NO OTHER CHANGES.

DO NOT WRITE BEYOND THIS LINE

BY. DATE

AB0000065594/1

N. Robbins

EM-6670-C7 REV. 11/87

DUPONT

# E. I. DU PONT DE NEMOURS & CO., (INC.)

Materials and Logistics Department
Wilmington, Delaware 19898

LMD-956834-Y | 1
PURCHASE ORDER NO. | ALT. NO.

SITE NO. | TAX CODE | DIRECT ALL INQUIRIES TO

ISSUED BY: R.A. Blackhall

RELEASE NUMBER

DATE OF ORDER: 10/15/90

REQUIRED SHIP DATE | PROMISED SHIP DATE

PAGE | OF

TERMS OF PAYMENT: Net 30

F.O.B. ☐ DEST. (DEL'D) ☐ SHIP PT

FREIGHT TERMS (If Ship Pt. Show City & State)

☐ PREPAID ☐ PREPAID ADDED ☐ OTHER (SEE BELOW) ☐ COLLECT

* IF COLLECT, Mail Freight Bill To:

FREIGHT TERMS

VENDOR CODE

PAYEE CODE

Cedar Chemical Corporation
5100 Poplar Avenue
24th Floor
Memphis, TN 38137
Attn: Mr. G.L. Pratt

E. I. DU PONT DE NEMOURS & COMPANY

Include P.O. No. as part of address

PLEASE ENTER OUR ORDER AS SPECIFIED BELOW SUBJECT TO CONDITIONS AND INSTRUCTIONS LISTED ON BOTH THE FACE AND REVERSE SIDE OF THIS PURCHASE ORDER.

IF PRICE, TERMS, REQUIRED SHIPPING DATE OR OTHER CONDITIONS AND INSTRUCTIONS ARE NOT ACCEPTABLE IMMEDIATELY ADVISE INDIVIDUAL INDICATED BY RED ARROW ABOVE

FURNISH COMPLETE SHIPPING INFORMATION AND INCLUDE 2 COPIES OF PACKING LIST WITH EACH SHIPMENT SHOW PURCHASE ORDER NUMBER ON EACH PACKAGE, PACKING LIST, BILL OF LADING, INVOICE AND ALL CORRESPONDENCE.

.... MAIL YOUR INVOICE TO ADDRESS INDICATED BELOW:

☐ E.I. du Pont de Nemours & Co.
Mis. Stores/Chambers Works
Deepwater, NJ 08023
Attn: A/P Section

DO NOT INSURE U.P.S. OR PARCEL POST DO NOT DECLARE AIR EXPRESS AND AIR FREIGHT IN EXCESS OF $50.00. IF LOWER CHARGES RESULT TO DUPONT, DECLARED VALUE SHALL NOT EXCEED LOWEST AMOUNT IN APPLICABLE TARIFF

SHIP VIA:

| ITEM | QUANTITY | DESCRIPTION (NOUN, ADJECTIVE, MANUF. NAME & NO.) | PRICE |
|---|---|---|---|

## ALTERATION #1

RECEIVED
DEC 4 1990
Ans'd.....

Alteration #1 issued to PO #LMD-956834-Y for chlorination of p-nitro toluene to change the following:

PERIOD OF AGREEMENT: From - 6/1/89 thru 5/31/90
To - 6/1/89 thru 12/31/91

CONTRACT ADMINISTRATOR: Change from K.F. Kamenski to Paul Smith (609) 299-5000 X 3593.

Compensation: Replace Exhibit "A" dated 5/12/89 with Exhibit "A" dated 8/14/90, attached hereto and made a part hereof.

DO NOT WRITE BEYOND THIS LINE

NO OTHER CHANGES.

CONFIRMING TO: BY: DATE:

AB0000065594/2

cc. Norm
Neil
Gene

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

MATERIALS AND LOGISTICS DEPARTMENT

November 15, 1990

Mr. Geoffrey L. Pratt
Cedar Chemical Corporation
5100 Poplar Avenue
24th Floor
Memphis, TN 38137

Dear Mr. Pratt:

REFERENCE is made to the Agreement entered into June 1, 1989 between E.I. DU PONT DE NEMOURS & COMPANY (DU PONT) and CEDAR CHEMICAL CORPORATION (CEDAR) relative to perform chlorination of p-nitro toluene for DU PONT'S Chambers Works, Deepwater, NJ, plant. It is hereby mutually agreed to amend the aforesaid Agreement in the following manner effective June 1, 1990:

PERIOD OF AGREEMENT

(Extend the term of this Agreement from ending May 31, 1990 to ending December 31, 1991.)

CONTRACT ADMINISTRATOR

(Change contract administrator from K.F. Kamenski to Paul Smith.)

COMPENSATION

(Replace Exhibit "A" dated 5/12/89 in its entirety with Exhibit "A" dated 8/14/90 with the exception of the paragraph relative to a formula for adjusting processing fees. It is agreed to meet for the purpose of adjusting processing fees at least two (2) months prior to the expiration of this Agreement or extensions thereof.)

ALL OTHER TERMS and conditions of the current Agreement, except as modified in the above manner, shall continue in full force and effect.

Please indicate your acceptance of this amendment by signing both copies in the space provided below and return the copy marked "WILM. ML&S COPY" to R.A. Blackhall, E.I. du Pont de Nemours & Company, Materials, Logistics & Services, PO Box 80015, BMP-15-1284, Wilmington, Delaware 19898.

| CEDAR CHEMICAL CORPORATION | E.I. DU PONT DE NEMOURS & COMPANY |
|---|---|
| BY: Geoffrey L Pratt | BY: [signature] |
| TITLE: Director Custom Mfg | TITLE: Mgr - Contracting |
| DATE: 11/20/90 | DATE: 11/16/90 |

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

August 14, 1990

AUG 21 1990

Mr. R. A. Blackhall
E. I. du Pont de Nemours & Co.
P. O. Box 80015, Barley Mill Plaza
Wilmington, DE 19898

Dear Bob:

As a follow up to our meeting of July 25, 1990, we are pleased to submit Cedar's proposal for the chlorination of PNT for the remainder of 1990:

1. A plant preparation and cleanup fee of $30,000 for each production campaign.

2. A processing fee per pound of CNT based upon a per diem processing fee of $10,000 divided by the productivity target of 21,277 pounds per day.

3. The above pricing formulas would apply for all quantities down to a minimum of two cars of PNT (approximately 250,000 pounds).

4. Stand by compensation of $9,000 per day for interruptions in Cedar's production due to items under du Pont's control such as the PNT supply. Du Pont would continue to have the option of declaring the campaign complete in which case the per diem would cease and the campaign would terminate.

5. Cedar will provide chlorine, if requested by du Pont for a price of 1.2 cents per pound of CNT during 1990.

You were to provide a formula for adjusting the above processing fees for inflation which would be triggered in 1991.

Cedar will provide du Pont with copies of Certificates of Analysis on each lot of CNT in a product rail car, such copies to be faxed to them at the time the car is shipped to the attention of Paul Smith at 609-540-3177 with a second copy to 609-540-4498.

Cedar will continue to fax the records of car weights and receiving reports as they have in the past.

Bob. I hope that this covers accurately the issues that we discussed and that we can develop a multi-year contract. Please let me know. if there is additional information that I can provide.

Sincerely,

Geoffrey L. Pratt
Director Operations
Custom Manufacturing

mc

cc: Paul H. Smith
Elaine A. Donald

DUPONT

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

CONTRACT ORDER

D. Hoppel

| DATE | CONTRACT ORDER NO. | ALT NO | PAGE NO |
|---|---|---|---|
| September 17, 1992 | LPMD-1333 | | 1/3 |

E. I. DU PONT DE NEMOURS & COMPANY

Cedar Chemical Corporation
5100 Poplar Avenue
24th Floor
Memphis, TN 38137
Attn: Mr. Geoffrey L. Pratt

Wilmington, DE
ISSUING POINT — LOCATION CODE

DIRECT ALL INQUIRIES ▶ R.A. Blackhall
ISSUED BY — BUYER CODE

This document, when properly executed, shall constitute an Agreement between E.I. DU PONT DE NEMOURS & COMPANY (DU PONT) and CEDAR CHEMICAL CORPORATION (CEDAR).

SERVICES: To cover the cost to chemically convert DU PONT-furnished sodium perborate tetrahydrate (SPBT) Fines ("Distressed" Rework Sodium Perborate) into sodium metaborate solution for DU PONT'S Memphis, TN plant.

PERIOD OF AGREEMENT: October 1, 1992 through April 1, 1994.

QUANTITIES: Approximately 12,000,000 lbs. (+/- 2%) of SPBT Fines. (This is conditional on CEDAR'S ability to chemically convert the SPBT Fines to specification.)

SPECIFICATIONS: Per DU PONT'S Technology Package, "Rework SPBT Fines Into Sodium Metaborate Solution", by Bess Hwang, dated October 1, 1992, which is attached hereto and made a part hereof.

COMPENSATION: $0.08/lb. of SPBT processed

If SPBT processed in the trial meets specification and is unacceptable to DU PONT (due to internal DU PONT problems with using the processed SPBT), this Agreement is terminated and DU PONT will reimburse CEDAR seventy thousand dollars ($70,000.00) to cover CEDAR'S startup costs.

Per CEDAR'S letter dated July 27, 1992 from G.L. Pratt to DU PONT'S R.A. Blackhall, which is included herein by reference.

If DU PONT elects, after 6.0MM lbs. of SPBT has been processed and accepted by DU PONT, additional quantities may be processed to a total of 12.0MM lbs. (+/- 2%) at the $0.08/lb. fee. If DU PONT elects to cease processing of any quantity exceeding 6.0MM lbs., but less than 12.0MM lbs. (+/- 2%), DU PONT agrees to pay CEDAR an amount of $0.02/lb. times the number of pounds not processed to the total of 12.0MM lbs.

G-506-LC

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

CONTRACT ORDER

| DATE | CONTRACT ORDER NO | ALT. NO | PAGE NO |
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| September 17, 1992 | LPMD-1333 | | 2/3 |

E. I. DU PONT DE NEMOURS & COMPANY

Cedar Chemical Corporation
5100 Poplar Avenue
24th Floor
Memphis, TN 38137
Attn: Mr. Geoffrey L. Pratt

Wilmington, DE
ISSUING POINT
DIRECT ALL INQUIRIES
R.A. Blackhall
ISSUED BY

TERMS & CONDITIONS: DU PONT'S General Conditions, EM-6685, Rev. 12/88, (as hand annotated) is attached hereto and made a part hereof.

YIELD: Per projection in "Specifications".

WASTE: The conversion process will not generate any aqueous waste. Fugitive emissions, with contaminants potentially harmful to DU PONT'S process, will be the responsibility of CEDAR to dispose.

Confirming CEDAR'S letter of September 9, 1991 from G.L. Pratt to DU PONT'S R.A. Blackhall, which is included herein by reference.

INVOICES: Invoices will be sent to the following address:

Original invoices to:

E.I. du Pont de Nemours & Company
Du Pont Chemicals
1007 Market Street
B-8209
Wilmington, DE 19898
Attn: Mr. Jim Pawloski

Copies of invoices to:

E.I. du Pont de Nemours & Company
2571 Fite Road
Memphis, TN 38127
Attn: Ms. Bess Hwang/Mr. Pete Garrison

G-506-LC

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

CONTRACT ORDER

| DATE | CONTRACT ORDER NO | ALT NO | PAGE NO |
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| September 17, 1992 | LPMD-1333 | | 3/3 |

E. I. DU PONT DE NEMOURS & COMPANY

Cedar Chemical Corporation
5100 Poplar Avenue
24th Floor
Memphis, TN 38137
Attn: Mr. Geoffrey L. Pratt

DIRECT ALL INQUIRIES

Wilmington, DE
ISSUING POINT — LOCATION CODE

R.A. Blackhall
ISSUED BY — BUYER CODE

CONTRACT ADMINISTRATOR: Business Contract Administrator - Jim Pawloski, Wilmington, DE (302) 773-4061. Technical Contract Administrator - Bess Hwang/Pete Garrison, Memphis, TN (901) 353-7100.

ENTIRETY: This document, and the documents specifically referred to herein, embody the entire Agreement, and there are no agreements, understandings, conditions, warranties or representations, oral or written, express or implied, with reference to the subject matter hereof which are not merged herein. No modifications hereof shall be of any force or effect unless in writing and signed by both parties.

Please signify your acceptance of the above by signing in the space provided below and returning the PINK COPY to Robert A. Blackhall, E.I. du Pont de Nemours & Company, PO Box 80723, CRP-HR-1102, Materials and Logistics, Wilmington, Delaware 19880.

CEDAR CHEMICAL CORPORATION

BY: [signature]

TITLE: Director Custom Mfg

DATE: October 1, 1992

E.I. DU PONT DE NEMOURS & COMPANY

BY: [signature]

TITLE: Sr. Purchasing Agent

DATE: September 24, 1992

CEDAR CHEMICAL

EM-6685 Rev. 12/88

# GENERAL CONDITIONS
# OFF-PLANT SERVICE
# E. I. DU PONT DE NEMOURS AND COMPANY
(INCORPORATED)

## 1. DEFINITIONS

When used in this Agreement:

MATERIAL means any unfinished matter, including packaging supplies, furnished by or on behalf of DU PONT to CONTRACTOR for processing, handling, storage, or for use in the production of finished goods.

PRODUCT means finished goods meeting DU PONT specifications that have been produced by CONTRACTOR from MATERIAL. PRODUCT also means finished goods that have been furnished by or on behalf of DU PONT for handling, storage or use by CONTRACTOR for DU PONT'S benefit.

REPLACEMENT COST shall be defined as follows:

1. When the MATERIAL or PRODUCT was bought by DU PONT, REPLACEMENT COST means the price paid by DU PONT, including all freight and handling charges.
2. When the MATERIAL or PRODUCT was manufactured by DU PONT for sale in its then existing form, REPLACEMENT COST means DU PONT'S list price for the MATERIAL or PRODUCT, less ten percent (10%).
3. When the MATERIAL or PRODUCT was manufactured by DU PONT, but not for sale by DU PONT in its then existing form, the REPLACEMENT COST means DU PONT'S manufacturing cost, including fixed and variable costs, plus all freight and handling charges.
4. In all cases REPLACEMENT COSTS shall include any fees paid by DU PONT for services for any processing of MATERIAL or PRODUCT.

The "price" as used in these definitions of REPLACEMENT COST will be the price of the MATERIAL or PRODUCT in effect at the time the loss, damage or destruction of the MATERIAL or PRODUCT occurred.

## 2. ASSIGNMENT AND SUBCONTRACTING

Neither party shall assign or transfer this Agreement, in whole or in part, or any interest arising under this Agreement or subcontract any work hereunder without the prior written consent of the other party. Subject to the provisions of this clause, this Agreement shall insure the benefit of and be binding upon the successors and assigns of the parties.

## 3. NONDISCRIMINATION

CONTRACTOR warrants that it has complied with all applicable laws, rules, orders and regulations of governmental authority covering the production, sale and delivery of the MATERIAL, PRODUCT or services specified herein, including, but not limited to, Executive Order 11246, and the rules and regulations promulgated thereunder, the Rehabilitation Act of 1973 and the Vietnam Era Veterans Readjustment Act of 1974. Further, CONTRACTOR warrants that in the performance of the services hereunder, it will comply with all applicable provisions of the Fair Labor Standards Act of 1938, as amended.

## 4. FORCE MAJEURE

No liability shall result to either party from delay in performance or from nonperformance caused by circumstances beyond the control of the party who has delayed performance or not performed. The nonperforming party shall be diligent in attempting to remove any such cause and shall promptly notify the other party of its extent and probable duration.

If a party, due to circumstances beyond its control, is unable to supply the total demands for the goods or services required by the Agreement, then that nonperforming party shall allocate its available supply among all purchasers in proportion to the amounts previously provided to those purchasers.

If the party who has delayed performance or not performed on account of circumstances beyond its control is unable to remove the causes within fifteen (15) days, the other party shall have the right to terminate, without penalty, this entire Agreement or any portion of it.

## 5. TERMINATION

If CONTRACTOR should refuse or fail to supply sufficient number of properly skilled personnel, or should it fail to make prompt payment to subcontractors for labor and MATERIAL used hereunder, or should it disregard or be in violation of any laws, ordinances or governmental regulations, or should it otherwise violate any of the clauses of this Agreement, or if DU PONT, hereunder in good faith, determines that personnel, MATERIAL, PRODUCT or equipment as required hereunder are being used in an unsafe manner or in any way such that DU PONT'S title thereto is in jeopardy, or that CONTRACTOR'S credit or financial position is impaired, then DU PONT may, without prejudice to any other right or remedy, terminate or suspend this Agreement without liability on written notice. Termination under this clause or under any other clause of this Agreement shall not relieve or release either party hereto from any rights, liabilities or obligations which it has accrued prior to the date of such termination.

## 6. DEFAULT

In the event that either party hereto shall default in the substantial performance of any material obligation specified herein, the nondefaulting party shall notify the other party hereof in writing and, if such default is not remedied within fifteen (15) days from date of such notice, then the nondefaulting party shall have the right to terminate this Agreement immediately. If, in the nondefaulting party's sole opinion, such default may result in substantial property damage, injury, accident or death, that party may, at any time, immediately suspend this Agreement without penalty or damages.

## 7. SAFEKEEPING/TITLE

CONTRACTOR assumes full responsibility and liability for the safekeeping and safe handling of all DU PONT MATERIAL or PRODUCT when such MATERIAL or PRODUCT is in CONTRACTOR'S care, custody and control. Unless otherwise specified in this Agreement, title to such MATERIAL or PRODUCT shall remain with DU PONT. CONTRACTOR shall reimburse DU PONT for the REPLACEMENT COST of any such MATERIAL or PRODUCT lost, damaged or destroyed while in CONTRACTOR'S care, custody or control. Reimbursement shall not affect DU PONT'S title to such MATERIAL or PRODUCT. CONTRACTOR shall segregate and placard such MATERIAL or PRODUCT indicating DU PONT'S ownership. CONTRACTOR shall obtain prior written approval of DU PONT before moving any such MATERIAL or PRODUCT to a new location.

## 8. CONTAMINATION

CONTRACTOR will take all steps necessary to prevent the contamination of DU PONT MATERIAL or PRODUCT when in CONTRACTOR'S care, custody and control. In the event of contamination, CONTRACTOR shall, at DU PONT'S option and at CONTRACTOR'S cost, rework, replace and/or dispose of all such contaminated MATERIAL or PRODUCT.

## 9. INDEMNIFICATION

RMB 8/25/92

CONTRACTOR will indemnify DU PONT for all liability, loss and expense incurred by DU PONT resulting from any act or omission, negligent or otherwise, by ~~DU PONT or~~ CONTRACTOR or CONTRACTOR'S agents, subcontractors or assigns in performance under this Agreement. This indemnity shall not apply ~~where the sole cause of~~ the liability, loss or expense is the willful misconduct or negligence of DU PONT. TO THE EXTENT THAT

The liability, loss or expense covered by this indemnity includes settlements, judgments, court costs, attorneys' fees and other litigation expenses incurred by DU PONT arising out of (1) injury to or death of any person, including employees of CONTRACTOR or DU PONT, or (2) loss of or damage to property, including property of CONTRACTOR or DU PONT, or (3) damage to the environment.

## 10. INSURANCE

CONTRACTOR, at its expense, shall carry and maintain in force at all times relevant hereto insurance of the type and minimum coverage limits as follows:

(a) Workers' Compensation—Statutory; and Employer's Liability—$100,000 per accident.

(b) Commercial General Liability (Occurrence Form), including Contractual Liability, in a combined single limit for Bodily Injury and Property Damage—$500,000 per occurrence.

(c) Comprehensive Automobile Liability, in a combined single limit for Bodily Injury and Property Damage—$500,000 per occurrence.

(d) Other insurance appropriate for CONTRACTOR'S business or required by law.

Upon DU PONT'S request, certificates of insurance evidencing the coverages required above of CONTRACTOR shall be filed with DU PONT'S designee. Such certificates shall provide that the insurer will give DU PONT thirty (30) days' advance notice of any changes in or cancellation of coverage. If in connection with the work being performed hereunder CONTRACTOR will not use motor vehicles on DU PONT property, other than parking areas, a letter so stating is acceptable in lieu of the automobile insurance certificate.

In the event any subcontractor is employed, with or without DU PONT'S consent, for the services covered in this Agreement, then CONTRACTOR assumes full responsibility to ensure that the subcontractor's services are covered by the same insurance limits as set forth herein.

Neither failure of CONTRACTOR to comply with any or all of the insurance provisions of this Agreement, nor the failure to secure endorsements on the policies as may be necessary to carry out the terms and provisions of this Agreement shall be construed to limit or relieve CONTRACTOR from any of its obligations under this Agreement, including the *INSURANCE* article.

## 11. INDEPENDENT CONTRACTOR

It is understood that the employees, methods, facilities and equipment of CONTRACTOR shall at all times be under its exclusive direction and control. CONTRACTOR'S relationship to DU PONT shall be that of an independent contractor and nothing in this Agreement shall be construed to constitute CONTRACTOR or any of its employees or officers, as an employee, agent, joint venturer or partner of DU PONT.

## 12. WASTE DISPOSAL

The parties agree to employ best efforts and work toward minimizing the waste generated. CONTRACTOR agrees to return any hazardous waste to DU PONT or its designate for disposal.

**WASTE DISPOSAL (Cont'd.)**

CONTRACTOR further agrees to furnish all required equipment and labor at no additional cost to DU PONT to remove and dispose of such quantities of nonhazardous waste as are produced hereunder and which DU PONT elects not to have returned to it. Prior to the start of actural processing hereunder, CONTRACTOR and DU PONT will agree in writing of the identity of any waste disposal subcontractor, methods used and the location of sites to be used for waste disposal hereunder. CONTRACTOR will notify DU PONT and get the written approval of DU PONT'S Contract Administrator prior to changing any waste disposal subcontractors, methods, or location of waste disposal under this Agreement. CONTRACTOR agrees that such waste will be transported and disposed of in a safe and environmentally sound manner so as to prevent any waste from entering the environment as a pollutant. CONTRACTOR will exercise controls necessary to prevent scattering of the waste or access to containers containing such wastes unless said access is authorized by DU PONT.

CONTRACTOR shall not use, reuse, sell or otherwise dispose of any DU PONT MATERIAL, processed MATERIAL not meeeting specification, or PRODUCT for its account, unless otherwise agreed to in writing by DU PONT'S Contract Administrator. CONTRACTOR agrees not to use, reuse, sell or otherwise dispose of any DU PONT packaging material without the prior written permission of DU PONT'S Contract Administrator, and then only if all DU PONT identification is completely removed.

**13. RECORDS AND INSPECTION**

CONTRACTOR agrees to maintain, in accordance with "Generally Accepted Accounting Principles and Practices", such records as may be necessary to adequately reflect the accuracy of CONTRACTOR'S charges and invoices for reimbursement under this Agreement and maintain such other additional records as DU PONT may from time to time reasonably require in connection with this Agreement. DU PONT shall have the right from time to time to inspect and verify the records kept by CONTRACTOR in connection with this Agreement. DU PONT'S duly authorized representatives shall have the right to visit, observe, audit, and inspect CONTRACTOR'S production and related facilities utilized to accomplish the objectives of this Agreement at any time during CONTRACTOR'S normal business hours. DU PONT'S duly authorized representatives shall also have the right to select and inspect samples of MATERIAL, MATERIAL-in-process and PRODUCT in CONTRACTOR'S facility received, obtained or produced under this Agreement and to reject PRODUCT or CONTRACTOR-supplied MATERIAL on the basis of the selected samples if DU PONT'S specifications are not met. DU PONT'S inspection or failure to exercise its right to test samples for compliance with DU PONT'S specifications shall not be deemed to establish that such MATERIAL or PRODUCT met DU PONT'S specifications.

**14. TAXES**

DU PONT agrees either to pay directly all property taxes, licenses, charges and assessments properly levied by any properly constituted governmental authority upon the DU PONT-owned MATERIAL, equipment (if any) and PRODUCT hereunder, or to reimburse CONTRACTOR therefore if paid by CONTRACTOR at DU PONT'S written direction. CONTRACTOR assumes full responsibility for the payment of all federal and state taxes of whatever sort, social security and unemployment compensation taxes, withholding taxes, and all other taxes or charges applicable to CONTRACTOR'S actions, employees, facilities and materials for performing services hereunder or applicable to CONTRACTOR'S income hereunder.

**15. AUTHORITY**

The parties hereby represent that they have full power and authority to enter into and perform this Agreement and the parties know of no contract, agreements, promises or undertakings which would prevent the full execution and performance of this Agreement.

**16. RESERVATION OF RIGHTS**

DU PONT'S waiver of any of its remedies afforded hereunder or by law is without prejudice and shall not operate to waive any other remedies which DU PONT shall have available to it, nor shall such waiver operate to waive DU PONT'S rights to any remedies due to a future breach, whether of a like or different character.

**17. HEADINGS**

All headings of the clauses of this Agreement are inserted for convenience only and shall not affect any construction or interpretations of this Agreement.

**18. NONDISCLOSURE**

CONTRACTOR agrees not to disclose to others (a) the fact that DU PONT has purchased or plans to purchase services, articles, MATERIALS or PRODUCT from CONTRACTOR or (b) any information or knowledge that may be gained or learned by CONTRACTOR about the business, PRODUCTS, employees or methods employed by DU PONT unless such disclosure is necessary to perform service required under this Agreement or as required by law.

**19. APPLICABLE LAW**

The laws of the State of Delaware shall govern the construction of this Agreement.

**20. SEVERABILITY**

In the event that any clause of this Agreement shall be found to be void or unenforceable, such findings shall not be construed to render any other clause of this Agreement either void or unenforceable, and all other clauses shall remain in full force and effect unless the clause(s) which is/are invalid or unenforceable shall substantially affect the rights or obligations granted to or undertaken by either party.

## 21. CORPORATE STATUS

In the event that CONTRACTOR'S invoice does not indicate that CONTRACTOR is an incorporated entity. by use of the words (or abbreviations) "Incorporated", "Corporation" or "P.C." as a part of CONTRACTOR'S company name, then CONTRACTOR shall display its tax identification number (TIN) on the invoice in lieu of such designations. Failure to furnish such information may result in withholding twenty percent (20%) of Agreement payments in accordance with IRS regulations.

## 22. SAFETY AND HEALTH

CONTRACTOR acknowledges that hazards may be involved in providing the services described hereunder. Accordingly, CONTRACTOR agrees to perform its services in a careful and workmanlike manner and to take all necessary precautions in the processing, handling, transportation and disposal of MATERIAL and PRODUCT involved in this Agreement to avoid an unhealthy or unsafe work environment, injuries to persons, damage to property or pollution. DU PONT may provide CONTRACTOR with certain information regarding the MATERIAL involved hereunder, including procedures for processing, handling, transporting and disposal, as well as toxicological data. Any information supplied by DU PONT shall be the latest information known to DU PONT and relevant to the work to be performed hereunder. Such information is provided without warranty or representation as to its completeness or suitability in providing the services herein. The methods employed and the precautions taken to handle DU PONT-owned equipment, if any, MATERIAL and PRODUCT shall be determined by and rest solely with CONTRACTOR. CONTRACTOR agrees to provide its employees with a safe and healthy workplace using, but not limited to, such information as is or may be provided by DU PONT.

DU PONT shall have the right to immediately suspend this Agreement, without liability to CONTRACTOR, if at anytime DU PONT in its sole judgment determines that CONTRACTOR has violated any of the provisions of this clause. Further, if CONTRACTOR fails to correct any such violation within seven (7) days immediately following DUPONT'S written notice to CONTRACTOR of the violation, DU PONT has the right to terminate this Agreement.

## 23. WARRANTY

CONTRACTOR warrants that the PRODUCT or services delivered hereunder will be free of defects in MATERIAL and workmanship and meet the specifications supplied by DU PONT. In the event that PRODUCT or services supplied by CONTRACTOR fails to meet any of the aforementioned warranties or are otherwise defective, CONTRACTOR shall, at DU PONT'S option, replace the defective PRODUCT or refund the purchase price including freight charges. CONTRACTOR further agrees to reimburse DU PONT for all costs incurred in the recall of defective PRODUCT and for all expenditures made in the settlement of any claim against DU PONT relating to defective PRODUCT or services supplied by CONTRACTOR. DU PONT shall notify CONTRACTOR promptly of any claim against DU PONT with respect to the PRODUCT or services supplied hereunder and shall provide CONTRACTOR and/or its insurance carrier with information needed for settlement or defense of such claims.

## 24. SHIPMENTS

Freight charges, excluding detention and demurrage charges, for all MATERIAL or other items supplied directly by DU PONT under this Agreement and for all PRODUCT produced hereunder by CONTRACTOR and shipped per DU PONT'S instructions shall be for DU PONT'S account. Detention and demurrage charges on incoming shipments shall be borne by CONTRACTOR unless caused by DU PONT'S early or excessive delivery of MATERIAL. Shipments of MATERIAL or PRODUCT hereunder to third parties are to be made by CONTRACTOR upon written direction from DU PONT.

## 25. CONFLICT OF INTEREST

CONTRACTOR shall not hire any employee or officer of DU PONT while that employee or officer is an employee or officer of DU PONT. CONTRACTOR shall not pay any salaries, commissions, fees, or make any payments or rebates, to any employee or officer of DU PONT, or to any designee of any such employee or officer, or favor any employee or officer of DU PONT, or any designee of any such employee or officer, with gifts or entertainment of significant cost or value or with service or goods sold at less than full market value. CONTRACTOR agrees that its obligation to DU PONT under this clause shall also be binding upon any subcontractors and sub-subcontractors of work hereunder. CONTRACTOR further agrees to insert the provisions of this clause in each such subcontract.

## ~~26. CLAIMS~~

In the event complaints are made against DU PONT relating to PRODUCT produced by ~~CONTRACTOR~~, a representative of DU PONT shall investigate the complaint and assign ~~responsibility therefor~~. Claims that result from a complaint attributable to MATERIAL provided by ~~DU PONT~~ or attributable to PRODUCT that meets all production specifications herein shall be ~~assumed by DU PONT. Claims attributable to services performed by CONTRACTOR shall be assumed by CONTRACTOR.~~

RAG 5/25/17

**CEDAR CHEMICAL CORPORATION SITE**

**TOLLING AGREEMENT**

This TOLLING AGREEMENT is entered into effective March 19, 2010 (the "EFFECTIVE DATE"), between Tyco Fire Products LP, formerly known as Ansul, Inc., formerly known as Wormald U.S., Inc. (collectively referred to as "Tyco Fire Products"); Helena Chemical Company; and ExxonMobil Chemical Co., a division of Exxon Mobil Corporation (collectively the "CAO RESPONDENTS") and E.I. DuPont de Nemours & Co. (the "TOLLING PARTY").

On March 22, 2007, the CAO RESPONDENTS entered into a Consent Administrative Order (the "CAO") with the Arkansas Department of Environmental Quality relating to the Cedar Chemical Corporation Site in Helena-West Helena, Arkansas (the "SITE"). *In the Matter of Cedar Chemical Corporation Site*, LIS No. 07-027 (Ark. Dept of Envt'l Quality, filed March 26, 2007). A true copy of the CAO is attached as Exhibit 1 to this AGREEMENT.

The TOLLING PARTY is a person or entity that may have responsibility with respect to the SITE. The TOLLING PARTY denies such responsibility for purposes of this TOLLING AGREEMENT.

The CAO RESPONDENTS contend that because of actions they have taken or may take and funds they have expended or may expend in connection with the SITE, the CAO, or both, they have certain claims,-including but not limited to contribution, response cost recovery, indemnity, set-off, apportionment, cross-claim, counterclaim, release, satisfaction, waiver, and estoppel, (the "TOLLED CLAIMS")-- against other parties that may have responsibility with respect to the SITE, including the TOLLING PARTY.

The CAO RESPONDENTS and the TOLLING PARTY agree that they do not wish to engage in litigation or other adjudication with one another at the present time regarding the TOLLED CLAIMS of the CAO RESPONDENTS.

In consideration of the mutual promises stated in this TOLLING AGREEMENT, the parties agree as follows:

1. Each CAO RESPONDENT agrees it will not initiate, file, or serve any lawsuit, civil action, or claim relating to the Tolled Claims against the TOLLING PARTY prior to the TERMINATION DATE as defined in Paragraph 4 below. The TOLLING PARTY agrees it will not initiate, file, or serve any lawsuit, civil action, or claim relating to the Tolled Claims against any of the CAO RESPONDENTS prior to the TERMINATION DATE as defined in Paragraph 4 below. TOLLED CLAIMS do not include, and nothing in this TOLLING AGREEMENT shall affect, any claims or defenses that the CAO RESPONDENTS or the TOLLING PARTY may have in the matter styled in the U.S. District Court, Eastern District of Arkansas, Helena Division as Harry Stephens Farms, Inc., et al. v. Wormald Americas, Inc., et al, Case No. 2-06CV-00166.

2. The period between the EFFECTIVE DATE of this TOLLING AGREEMENT and the TERMINATION DATE, as defined below in Paragraph 4, shall not be included in determining the applicability of any statute of limitations, laches, or any other defense based on the lapse of time in any action or proceeding brought by either party against the other involving the TOLLED CLAIMS of the CAO RESPONDENTS.

3. Nothing in this TOLLING AGREEMENT shall affect any defense available to any party as of the date of this TOLLING AGREEMENT. This TOLLING AGREEMENT shall not be deemed to revive any claim that is or was already barred on that date. Nothing in this TOLLING AGREEMENT, or in the circumstances which gave rise to this TOLLING AGREEMENT, shall be construed as an acknowledgment by any party that any claim has or has

not been barred, or is about to be barred, by the statute of limitations, laches, or other defense based on the lapse of time.

3. This TOLLING AGREEMENT shall not operate as an admission of liability by any party. This TOLLING AGREEMENT does not constitute an admission or acknowledgement on the part of the TOLLING PARTY that CAO RESPONDENTS possess a claim against it. The TOLLING PARTY reserves all rights or defenses that it may have to contest or defend any claim or action the CAO RESPONDENTS may assert or initiate against the TOLLING PARTY. Neither this TOLLING AGREEMENT nor any action taken pursuant to this TOLLING AGREEMENT shall be offered or received in evidence in any action or proceeding as an admission of liability or wrongdoing by any party.

4. Any party may terminate this TOLLING AGREEMENT on sixty (60) days written notice to the other(s) sent by electronic mail and registered mail, return receipt requested, to all other parties and their counsel at the following addresses:

To **Tyco Fire Products LP**:

Joseph L. Schohn
Counsel, Environment, Health and Safety
Tyco International
9 Roszel Road
Princeton, NJ 08540
(609) 806-2469
Fax: (609) 720-4335
jschohn@tyco.com

Ann P. Faitz
Faitz Law Firm PLLC
585 Silverwood
North Little Rock, AR 72116
(501) 831-5637
Fax: (501) 791-0966
ann.faitz@gmail.com

To **Helena Chemical Company**:

David W. Hawkins
General Counsel & Assistant Secretary
Helena Chemical Company
225 Schilling Blvd., Ste. 300
Collierville, TN 38017
(901) 537-7270
Fax: (901) 537-8677
HawkinsD@helenachemical.com

Kim Burke
Taft, Stettinius & Hollister LLP
425 Walnut Street, Ste. 1800
Cincinnati, OHIO 45202-3957
(513) 357-9369
Fax: (513) 381-0205
kburke@taftlaw.com

Allan Gates
Mitchell, Williams, Selig,
Gates & Woodyard, PLLC
425 West Capitol Ave., Ste. 1800
Little Rock, AR 722-1-3525
(501) 688-8816
Fax: (501) 688-8807
agates@mwlaw.com

To **Exxon Mobil Corporation**:

Dave Roberson
Project Manager
de maximis, inc.
2203 Timberloch Place, Suite 213
The Woodlands, TX 77380
(281) 363-8733
Fax: (281) 681-1781
dave@demaximis.com

Kevin J. Vaughan
Counsel, Environmental & Safety
Exxon Mobil Corporation
3225 Gallows Rd., Room 3D2109
Fairfax, VA 22037-0001
(703) 846-4416
kevin.j.vaughan@exxonmobil.com

Joseph W. Ghormley
Quattlebaum, Grooms, Tull & Burrow, PLLC
111 Center Street, Ste. 1900
Little Rock, AR 72201
(501) 379-1764
Fax: (501) 379-1701
jghormley@qgtb.com

To **Tolling Party:**

James B. Allen
DuPont Legal - B7084
1007 Market Street
Wilmington, DE 19898

302 774-8553
302 774-4812
james.b.allen@usa.dupont.com

Any party may change the addresses by which it should be given notice by giving written notice of the change of address to the other parties and their counsel at the above addresses by electronic mail and registered mail, return receipt requested. If not earlier terminated by notice, this TOLLING AGREEMENT shall terminate on March 22, 2012. Accordingly, the TERMINATION DATE shall be the earlier of March 22, 2012 or the first business day following sixty (60) days after the date of mailing of notice of termination pursuant to this paragraph.

5. If any CAO RESPONDENT terminates the TOLLING AGREEMENT, the termination shall affect only the rights between that particular CAO RESPONDENT and the

TOLLING PARTY. Such a termination shall not terminate or alter the rights between the other CAO RESPONDENTS and the TOLLING PARTY under this TOLLING AGREEMENT.

6. If the TOLLING PARTY terminates the TOLLING AGREEMENT, the termination shall affect only the rights between the TOLLING PARTY and the CAO RESPONDENT or CAO RESPONDENTS specifically identified in the termination notice. Such a termination shall not terminate or alter the rights between the TOLLING PARTY and any CAO RESPONDENT not specifically identified in the termination notice.

7. No CAO RESPONDENT shall have the right to terminate the rights that exist between the TOLLING PARTY and another CAO RESPONDENT under this TOLLING AGREEMENT.

8. This TOLLING AGREEMENT comprises the entire agreement of the parties with respect to the tolling of any statute of limitations and the doctrine of laches. This TOLLING AGREEMENT may be modified, amended, or supplemented only by a written instrument signed by all of the parties.

9. Each undersigned party represents, warrants, and states that all legal action necessary for the effectuation and execution of this TOLLING AGREEMENT has been validly taken and that the individuals whose signatures appear below on behalf of each party are duly authorized to execute this TOLLING AGREEMENT on behalf of their respective parties.

10. This TOLLING AGREEMENT shall be interpreted in accordance with the substantive law of the state of Arkansas without application of choice of law rules.

11. The parties agree that this TOLLING AGREEMENT may be executed in counterparts and shall be deemed fully executed and binding when a counterpart has been executed by each party. Copies of executed counterparts provided in electronic format will be considered equivalent to their originals.

**Tyco Fire Products LP**

By: _____

Position: _____

Date: _____, 2010

**Helena Chemical Company**

By: _____

Position: _____

Date: _____, 2010

**Exxon Mobil Corporation**

By: _____

Position: _____

Date: _____, 2010

Tolling Party: E.I. DuPont DeNemours & Company

By: James B. Allen
James B. Allen

Position: Corporate Counsel

Date: March 16, 2010

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
LA PORTE PLANT
P.O. BOX 347
LA PORTE, TEXAS 77572-0347

AGRICULTURAL PRODUCTS DEPARTMENT

# HOLIDAYS AND MONTH END DUE DATES

# FOR

# DU PONT LA PORTE PLANT

## 1991 HOLIDAYS

| | |
|---|---|
| NEW YEAR's DAY | January 1, 1991 (Tuesday) |
| GOOD FRIDAY | March 29 (Friday) |
| MONDAY AFTER EASTER | April 1 (Monday) |
| MEMORIAL DAY | May 27 (Monday) |
| FOURTH OF JULY | July 4 (Thursday) |
| FLOATER | July 5 (Friday) |
| LABOR DAY | September 2 (Monday) |
| THANKSGIVING DAY | November 28 (Thursday) |
| FRIDAY AFTER THANKSGIVING | November 29 (Friday) |
| CHRISTMAS HOLIDAYS | December 24 (Tuesday) |
| | December 25 (Wednesday) |

## 1991 Month End Due Dates

The Morning of:

| | |
|---|---|
| January 23 | July 23 |
| February 21 | August 21 |
| March 22 | September 20 |
| April 22 | October 21 |
| May 21 | November 19 |
| June 21 | December 20 |



AB0000065646/1

REVISED
mbq?
1991

AGRICULTURAL PRODUCTS DEPARTMENT
SCHEDULE OF MONTHLY CLOSING DATES AND
COMPUTER INVOICE RUNS FOR THE YEAR 1991

| MONTH | FIRST DAY OF SHIPMENTS IN MONTHS BUSINESS | LAST DAY OF SHIPMENTS IN MONTHS BUSINESS* | NO. OF ORDER DAYS (BUSINESS) IN FISCAL MONTH | NO. OF CALENDAR DAYS IN FISCAL MONTH | DATE OF FINAL INV. RUN |
|---|---|---|---|---|---|
| JANUARY | DEC 21 '90 | JAN 22 '90 | 20 | 33 | FRI 1/24 |
| FEBRUARY | JAN 23 '91 | FEB 20 | 21 | 29 | MON 2/22 |
| MARCH | FEB 21 | MAR 21 | 21 | 29 | TUES 3/25 |
| APRIL | MAR 22 | APR 21 | 20 | 31 | WED 4/23 |
| MAY | APR 22 | MAY 20 | 21 | 29 | THURS 5/22 |
| JUNE | MAY 21 | JUN 20 | 22 | 31 | TUES 6/24 |
| JULY | JUN 21 | JUL 22 | 20 | 32 | THURS 7/24 |
| AUGUST | JUL 23 | AUG 20 | 21 | 29 | FRI 8/22 |
| SEPTEMBER | AUG 21 | SEP 19 | 21 | 30 | TUES 9/23 |
| OCTOBER | SEP 20 | OCT 20 | 21 | 31 | WED 10/22 |
| NOVEMBER | OCT 21 | NOV 18 | 21 | 29 | THURS 11/20 |
| DECEMBER | NOV 19 | DEC 19 | 21 | 31 | THURS 12/23 |
| | | | 250 | 364 | |

*The actual hour of closing is 8:00 a.m. of the following work day.

Wilmington Holidays for 1991 listed below were used to arrive at above dates. They may not be observed at all locations on the specified dates.

| | |
|---|---|
| New Year's Day | Tuesday, January 1, 1991 |
| Good Friday | Friday, March 29, 1991 |
| Memorial Day | Monday, May 27, 1991 |
| Independence Day | Thursday, July 4, 1991 |
| 1st Floating Holiday | Friday, July 5, 1991 |
| Labor Day | Monday, September 2, 1991 |
| Thanksgiving Day | Thursday, November 28, 1991 |
| 2nd Floating Holiday | Friday, November 29, 1991 |
| Christmas Eve | Tuesday, December 24, 1991 |
| Christmas Day | Wednesday, December 25, 1991 |
| Personal Day | Any workday in 1991 |

NHS:aft/1
Rev. 12/03/90

DuPont LaPorte Holidays

Inventory & Month-end report as of 8:00 a.m.

# 1991

## JANUARY

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 | | |

## FEBRUARY

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | | |

## MARCH

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24/31 | 25 | 26 | 27 | 28 | [redacted] | 30 |

## APRIL

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 | 29 | 30 | | | | |

## MAY

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | [redacted] | 28 | 29 | 30 | 31 | |

## JUNE

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | | 1 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23/30 | 24 | 25 | 26 | 27 | 28 | 29 |

## JULY

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 | 29 | 30 | 31 | | | |

## AUGUST

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 |

## SEPTEMBER

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| 1 | [redacted] | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 | | | | | |

## OCTOBER

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 | | |

## NOVEMBER

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | [redacted] | | 30 |

## DECEMBER

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | [redacted] | | 26 | 27 | 28 |
| 29 | 30 | 31 | | | | |

**SAFETY IS THE REASON WE CAN ENJOY EVERY SEASON**

S-600

INTEROFFICE MEMORANDUM

Date: 05-Aug-1990 03:31pm
From: CHARLENE HUBACH
HUBACHCJ
Dept: A6-
Tel No: 470-3207

TO: CHARLIE PARKER/CEDAR CHEMICAL ( PAPER MAIL )

CC: ARTHUR J. SEPCIE ( SEPCIEAJ )
CC: WILLIAM GAAL ( GAALW )

Subject: MBC BULK PRODUCTION AT CEDAR CHEMICAL

CHARLIE -

I HAVE INCLUDED INFORMATION AND FORMS YOU WILL NEED WHEN YOU BEGIN THE MBC BULK PRODUCTION AT CEDAR CHEMICAL.

1) LIST OF RAW MATERIALS AND PACKAGING WITH YOUR CONTACT FOR RELEASES.

2) SEND COPY OF RECEIVERS AND SHIPPING PAPERS DAILY TO:

CHARLENE HUBACH
E. I. DUPONT
P. O. BOX 2020
LAPORTE, TEXA. 77572-2020

3) FOR SHIPPING MBC BULK TO DUPONT - BELLE PLANT USE SHIPPING IDENTIFICATION NUMBER:

STJB 95269 A01
STJB 95269 A02 ETC.

4) DAILY PRODUCTION REPORT - PLEASE FAX DAILY TO:

CHARLENE HUBACH - FAX 713/470-3195

5) DUPONT HOLIDAYS AND CALENDAR SHOWING OUR MONTH-END DATES. REPORT SHOULD BE AS OF 8:00 AM ON DATE INDICATED.

6) MONTHLY SUMMARY REPORT, DETAIL OF RECEIPTS AND DETAIL OF SHIPMENTS TO BE FAXED NOT MORE THAN 2 DAYS AFTER MONTH-END TO:

CHARLENE HUBACH - FAX 713/470-3195

7) ALL INVOICES SHOULD BE MAILED TO:

DEBRA KIRKPATRICK
E. I. DUPONT
P. O. BOX 2020
LAPORTE, TEXAS 77572-2020

IF YOU HAVE ANY QUESTIONS, PLEASE CALL ME AT 713/470-3207.

Copy to:
T. Lodice
K. Howard
J. Porter
B. Gustrock

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

RECEIVED
MAY 16 1991
Ans'd.....

May 13, 1991

Mr. Geoffrey L. Pratt
Director of Operations-Custom Manufacturing
Cedar Chemical Corporation
24th Floor
5100 Poplar Avenue
Memphis, TN 38137

Dear Geoff:

Attached is selected confidential information pertaining to the manufacture of ethylhexyl nitrate submitted under the terms of the secrecy agreement dated 9/24/90 and amended 10/22/90. This information is based on data that Du Pont believes are reliable. It is intended for use by persons having technical skill and at their own discretion and risk. Since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information.

Please acknowledge receipt of this information by signing and returning the attached acknowledgment.

I'd appreciate a proposal for making 2-10MM pounds of this material per year. Du Pont reserves the right to reject any bid based on their sole discretion.

If you should have any questions, contact me on (302) 774-2491.

Most sincerely,

Elaine Donald

Elaine A. Donald
Specialty Chemicals
Procurement Manager

EAD:cad
Attachment

cc: R. L. Thornton, Chemicals
C. F. Douty, Jackson Lab

Cedar Chemical Corporation acknowledges receipt of the technology package described below.

Name:_____; Title_____; Date_____

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| Hazards | | II - 11 - 13 | |
| Toxicity & Environmental Health | | II - 13, 16-17 | |
| Thermal Behavior | | II - 14 | |
| Safety References | | II - 15 | |
| Waste Streams | | II - 18 - 20 | |
| Process Stages | | II - 21 - 22 | |
| Patent Status | | II - 32 | |
| **Test Conclusion** | TA-C-84-121 | | 11/26/86 |
| **Test Authorization & Conclusion** | TA-C-85-137 | | 5/31/85 |
| **Test Authorization** | TA-C-86-143 | | 6/25/86 |
| **Test Authorization** | TA-C-86-144 | | 6/25/86 |
| **Test Authorization & Conclusion** | TA-C-87-232 | | 7/22/87 |
| **MSDS** | | | |
| Ethylhexyl alcohol | | | 1/15/90 |
| Ethylhexyl nitrate (DDA 1000) | | | 11/20/89 |
| Mixed Acids | | | 12/6/89 |
| Urea | | | 12/4/89 |
| **TSCA Registration** | #27247-96-7 | | |
| **Test Methods** | | | |
| Alchols - determination of acidity | | | |
| Method E5600.005.01 | | | |
| Color of Liquids - APHA | | | |
| Method E5600.065.01 | | | |
| Determination of Distillation Range | | | |
| Method E5600.120.01 | | | |
| 2EHA, gc assay | | | |
| Method E5600.165.01 | | | |
| 2EHA, ir identification | | | 11/13/90 |
| Method E5600.190.01 | | | |
| Refractive Index | | | |
| Method E5600.283.01 | | | |
| Specific Gravity by Hydrometer | | | |
| Method E5600.310.01 | | | |
| Determination of ASTM Color | | | |
| Method E6100.065.01 | | | |
| 2EHNitrate, gc analysis | | | |
| Method E6100.165.01 | | | |
| Acid or Base Number by Potentiometric Titration | | | |
| Method E6100.280.01 | | | |
| Mixed Acid | | | |
| Method N8900.005.01 | | | |
| Determination of Nitrous (Nitric Acid) | | | |
| Method N8900.220.01 | | | |
| Specified Gravity by Hydrometer | | | |
| Method N8900.310.01 | | | |
| Determination of Free Ammonia | | | |
| Method U3000.005.01 | | | |
| Determination of Total Nitrogen | | | |
| Method U3000.005.02 | | | |
| Determination of Ash Content | | | |
| Method U3000.015.01 | | | |

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| Determination of Total Nitrogen | | | |
| Method U3000.005.02 | | | |
| Determination of Ash Content | | | |
| Method U3000.015.01 | | | |

M. T. Gordon
July 24, 1984

Chambers Works Process
728-365 260
Aromatics East Area

REFERENCE

# 2-ETHYLHEXYL NITRATE (DDA-1000)
(Batch Process)

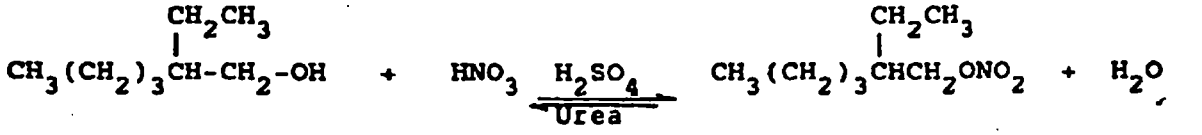
## Principle

2-Ethylhexyl nitrate (2-EHN) is made by the nitration of 2-ethylhexyl alcohol (2-EHA) with mixed acid in the presence of urea. In the process, urea is added to SP-15 mixed acid (24.7% $HNO_3$/57.6% $H_2SO_4$) to destroy nitrous acid present initially or formed during processing. 2-EHA is then added over 1 to 4 hours at 20-35°C, forming 2-EHN.

The product phase is separated from the spent acid and washed to a pH of 7.5 with soda ash/sodium sulfate solution. After decanting the aqueous layer, the product is dried with anhydrous sodium sulfate.

The final product contains 98.5% min. 2-EHN and is sold as a diesel fuel ignition improver by the Petrochemicals Division.

## Main Reaction

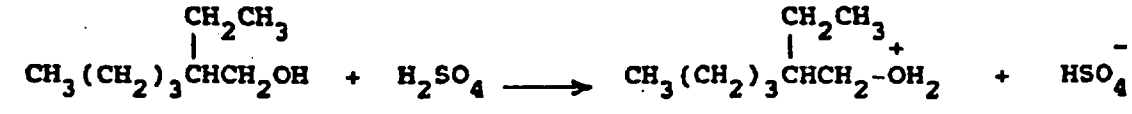


2-Ethylhexyl alcohol M.W. 130.22 | Nitric acid M.W. 63.02 | 2-Ethylhexyl nitrate M.W. 175.22

$\Delta H$ = -7 Kcal/mole

## Side Reactions

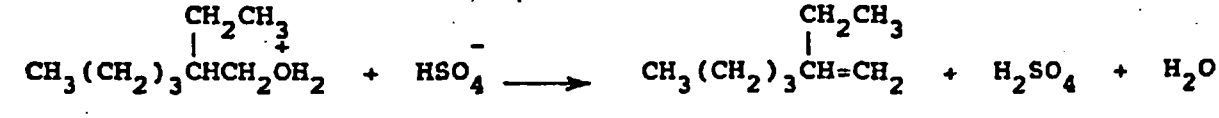
### Protonation



2-Ethylhexyl alcohol | Sulfuric acid M.W. 98.08 | Protonated 2-EHA M.W. 228.30

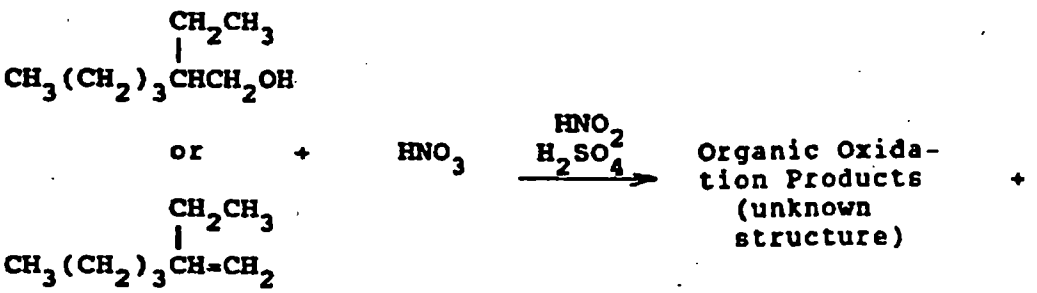
$\Delta H$ = -2.7 Kcal/mole

### Dehydration



Protonated 2-EHA | 2-Ethylhexene-1 M.W. 112.21

Oxidation



2-Ethylhexyl alcohol or 2-Ethylhexene-1 | Nitric acid M.W. 63.02

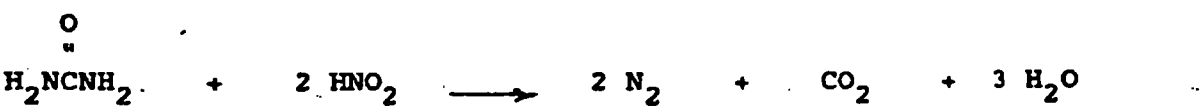
$$N_2O + NO_2 + CO_2 + CO$$

Nitrous oxide M.W. 44.02 | Nitrogen dioxide M.W. 46.01 | Carbon dioxide M.W. 44.01 | Carbon monoxide M.W. 28.01

$\Delta H$ = -128 Kcal/mole (for the C.W. process using SP-15 Mixed Acid; 30 mole percent $H_2SO_4$, equivalent to 70% W/W $H_2SO_4$ in spent acid).

(The $\Delta H$ varies from -75 to -500 Kcal/mole depending upon the $H_2SO_4$ strength. The high $\Delta H$ value was obtained with 35% $HNO_3$/ 60% $H_2SO_4$ which contains 42 mole-% $H_2SO_4$ and is equivalent to 80% W/W $H_2SO_4$ in the spent acid.)

Urea Reactions



Urea M.W. 60.06 | Nitrous acid M.W. 47.02 | Nitrogen M.W. 28.01 | Carbon dioxide

$\Delta H$ = -162 Kcal/mole of urea

(According to the literature, the volume ratio of $CO_2$ to $N_2$ (1:2) shown by the above reaction is never actually attained. The proportion of $CO_2$ is always much higher; the composition of the gas can vary considerably due to small changes in the concentration of the reactants. One mechanism indicates that ammonium salts can also be formed. Recent studies on the reaction of urea and nitrosylsulfuric acid in spent nitrating acid indicate the formation of ammonium salts, lending support to the probability that they are also formed in the urea-nitrous acid reaction.)

$$H_2NC(=O)NH_2 + HNO_3 + 0.5\ H_2SO_4 \longrightarrow N_2O + CO_2 + 0.5\ (NH_4)_2SO_4 + H_2O$$

| Urea | Nitric acid | Nitrous oxide | Carbon dioxide | Ammonium sulfate |
|---|---|---|---|---|
| M.W. 60.06 | M.W. 63.02 | | | $\Delta H$ = -65 Kcal/mole of urea |

The heat of reaction of urea with nitric acid cited above was calculated based upon heats of formation data. Laboratory experiments indicate a $\Delta H$ of -57 Kcal/mole of urea using SP-15 mixed acid (6282-21), supporting the second reaction equation. A larger value (-87 Kcal/mole) was obtained using a stronger mixed acid: 35% $HNO_3$/60% $H_2SO_4$. (6187-40).

Neutralization

$$H_2SO_4 + Na_2CO_3 \longrightarrow Na_2SO_4 + CO_2 + H_2O$$

| Sulfuric acid | Sodium carbonate M.W. 105.99 | Sodium sulfate M.W. 142.05 | Carbon dioxide | |
|---|---|---|---|---|

$$2\ HNO_3 + Na_2CO_3 \longrightarrow 2\ NaNO_3 + CO_2 + H_2O$$

| Nitric acid | Sodium carbonate | Sodium nitrate M.W. 85.00 | | |
|---|---|---|---|---|

CONFIDENTIAL

Basis

Trial Manufacture Request TMR-C-82-25 and the corresponding Test Conclusion dated 12/1/83 for demonstration of commercial manufacture of 2-ethylhexyl nitrate (2-EHN). Recommends adoption of process for continued commercial production as modified by:

- TA-C-82-375 and TC dated May 24, 1983, demonstrated product drying using anhydrous sodium sulfate and/or sodium carbonate.
- TA-C-83-24 and TC dated April 12, 1983, demonstrated use of one alkaline, 5% sodium sulfate wash and concurrent product and wash solution feed to the wash vessel.
- TA-C-83-70 Parts I and II and TC dated August 26, 1983, demonstrated a 20% increase charge size, and NT-1 alcohol feed and "cook" time decreases.

Test Authorizations issued subsequent to the TMR conclusion:

TA-C-82-374 Superceded by TA-C-83-24

TA-C-82-381 Parts I and II and TC dated April 30, 1984, for use of a 'Sparkler' filter to supplement the 'Cuno' Filter D-10 for removal of sodium sulfate drying agent. Not successful. See TA-C-83-305 for improved D-10 filter elements.

TA-C-82-385 and TC dated July 27, 1984, tried calcium oxide to scavenge dissolved acid from product. This test was not successful due to slow filtration of solids from the final neutralized and dried product.

TA-C-83-13 and TC dated May 24, 1983, successfully demonstrated the in-situ drying of "wet" 2-EHN in a tank car with anhydrous sodium sulfate. Not recommended as a routine procedure.

TA-C-83-17 and TC dated July 20, 1983, covered redrying drummed product.

TA-C-83-305 and TC dated July 27, 1984, successfully demonstrated use of 0.45 micron "Duo Fine" polypropylene filter cartridges for final product filtration.

TA-C-84-60 and TC dated February 20, 1984, documents a new provisional AEL of 2 ppm (8-hour TWA) for 2-EHN. (Note: in AEL meeting August 1, 1984 the provisional AEL was revised upward to 5 ppm.)

TA-C-84-118 and TC dated April 18, 1984, documents use of G. C. Method CW No. 11-66-30-1A, instead of 11-66-30-1 for 2-EHN final product purity and 2-EHN Product Specification 57-E.

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TA-C-84-121 dated April 23, 1984, proposes the use of $CaCl_2$ by dry 2-EHN and omitting sodium sulfate from the wash/ neutralization step.

TA-C-84-149 and TC dated May 18, 1984, updated yield and material balance data to reflect recent (circa 5/84) plant performance.

TA-C-84-158 and TC dated May 18, 1984, modifies process documentation to delete references to 2-EHN as a cyanogen (i.e. causing formation of methemoglobin).

Equipment

The NT-1 batch nitration set is located in Aromatics East Area Building No. 728. Existing utilities available in the building are: (1) 550v AC, (2) river water, (3) process water, (4) sanitary water, (5) 50 psig plant air, (6) 100 psig instrument air, (7) breathing air, (8) 165 psig steam. Project M-1107 has provided emergency cylinder nitrogen and electricity for the automatic dump system. Well water as an alternate nitrator cooling water source also has been provided. The equipment items listed below meet the general process requirements and are suitable for the manufacture of 2-EHN.

SP-15 Mixed Acid Storage Tank, TS-9:

Horizontal, steel, 8,000-gallon storage tank.

2-Ethylhexyl Alcohol Storage Tank, TS-8:

Horizontal, steel, 8,000-gallon storage tank.

2-Ethylhexyl Nitrate Storage Tank, TS-106:

Horizontal, steel, 10,000-gallon, 8' x 30', storage tank equipped with high-temperature-actuated water flooding system, external water deluge system, liquid overflow and gaseous vent nozzles.

Spent Acid Storage Tank, TS-107:

Horizontal, steel, 10,000-gallon storage tank.

SP-15 Mixed Acid Weigh Tank, TW-1-A:

Horizontal, 6' I.D. x 7' long, carbon steel, 1,866-gallon weigh tank. Tank is hydrostatically tested to 60 psig. Tank is mounted on a 3,000-pound balance beam scale with weight readout in the control room. Equipped with specific gravity and level indicator/recorder. High and low level signals are part of batch sequencing system.

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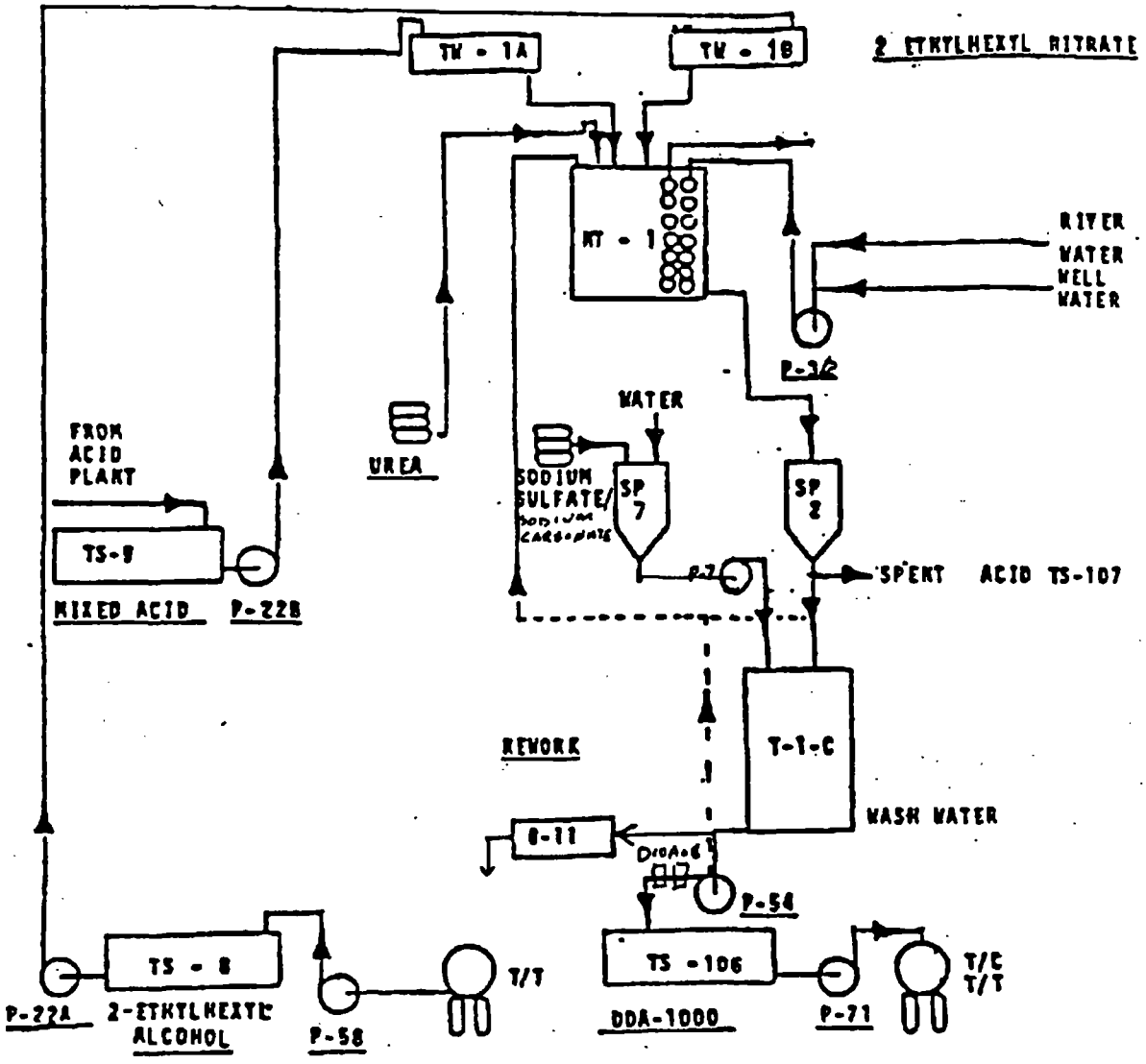
# SCHEMATIC DIAGRAM
# DDA-1000
# 2-ETHYLHEXYL NITRATE

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2-Ethylhexyl Alcohol Weigh Tank, TW-1-B:

Horizontal, 5' I.D. x 7' long, carbon steel, 1,142-gallon weigh tank. Tank is mounted on a 25,000-pound balance beam scale with weight readout in the control room. Equipped with level indicator recorder. High and low level signals are part of batch sequencing system.

Batch Nitrator, NT-1:

NT-1 is located in a cell which is barricaded from operating personnel but open at top and one side. Interlocks are provided to stop 2-EHA addition in event of failure of agitation, cooling water, instrument air, purge nitrogen or high temperature (control temperature sensing by dual RTD's, 2 thermocouples and an industrial thermometer located at different levels in NT-1). At preset temperatures (currently 32°, 35°, 40° and 45°C) interlocks cause the following events:

| | |
|---|---|
| 32° and 35°C: | 2-EHA feed line control valve and block valve close, respectively. Full cooling is applied at 35°C. |
| 40°C: | Agitation is turned off to reduce rate of reactions occurring between organic and acid phase. Full cooling is maintained. |
| 45°C: | Reaction mass is automatically dumped and drowned into a tub of water. |

NT-1 is atmospheric rated vertical tank, 8'10" I.D. x 6'5" high, constructed of 347 S/S. The normal capacity is 2,900 gallons. Working volume is approximately 2,000 gallons. The agitator consists of two impellers (bottom one 32" D. with four flat blades, top one 28" D. with four 45° pitched blades pumping down) turning at 100 rpm. The power/1,000 gallons ranges from four to seven hp/1,000 gallons depending on liquid level in the nitrator. Six banks of helical coils provide approximately 790 square feet of cooling surface. A nitrogen purge is provided. The vessel is vented via a 6" diameter stack and is fitted with an 18-inch soft head disc.

Acid/Product Separator, SP-2:

Vertical 304 S/S conical-bottom separator. Working pressure rating 50 psig. The separator is 6'6" O.D. x approximately 10' high.

Sodium Sulfate Solution Measuring Tank, SP-7:

This tank is a duplicate of SP-2 except is constructed of 347 S/S. This tank is agitated with an air sparge. Level and temperature indicators are provided.

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Product Wash Tub, T-1-C:

A vertical brick-lined, air- and/or nitrogen-agitated, 3,800-gallon carbon steel tank. Equipped with automatic temperature-activated water flush (@ 50°C).

Wash Water Hold Tank, B-11:

Horizontal 1,600-gallon steel tank. This tank provides hold-up to collect 2-EHN product in waste wash waters. Piping permits the heavy phase water wash solution to overflow to the organic trench while retaining the light phase organic layer.

SP-15 Mixed Acid Transfer Pump, P-22B:

This pump transfers SP-15 mixed acid from the storage tank, T-9 to weigh tank TW-1A. Pump is a La Bour Model DPL-25W, 3 x 3, S/S centrifugal pump rated at 100 gpm @ 116 feed, 1,770 rpm with a 25 hp motor.

2-EHA Transfer Pump, P-22A:

This pump transfers 2-EHA from storage tank, T-8 to weigh tank TW-1B and is identical to P-22B.

Wash Solution Transfer Pump, P-7:

This pump transfers wash solution from SP-7 to T-1-C. Pump is a Duriron S/S, 150 gpm pump.

Product Transfer Pump, P-54:

This pump transfers product 2-EHN from wash tub T-1-C to product storage tank TS-106. Pump is a La Bour, 2 x 2, Model DPL-15W carbon steel self-priming centrifugal pump rated at 40 gpm @ 35 feet, 1,800 rpm with a 5 hp motor. Equipped with high temperature shut off switch set at 50°C, and low flow interlock.

Product Transfer Pump, P-71:

This pump transfers product from storage tank, TS-106 to T/C's or T/T's. Pump is a Goulds ductile iron centrifugal pump rated at 100 gpm. Equipped with a high temperature shut-off switch set at 50°C and a low flow interlock.

2-EHA T/T Unloading Pump, P-58:

This pump transfers 2-EHA from T/T to storage tank T-8. Pump is a Goulds ductile iron centrifugal pump rated at 100 gpm. Equipped with a low flow shut-off interlock.

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Product Dryer, D-10 A&B:

These are 25-gallon steel tanks equipped with 0.45 micron "Duo Fine" polypropylene filter cartridges to remove dispersed, finely divided sodium sulfate wash solution droplets from the final product. "Duo Fine" polypropylene filter cartridges are also available in porosities up to 30μ but only the 0.45μ porosity cartridges have been tested.

Other suitable filter materials are cellulose and polyacrylate.

Product Filter, F-10:

This is a 25-gallon steel tank equipped with 0.45 micron "Duo Fine" polypropylene filter cartridges to remove residual solid contaminants such as rust from the final product before loading into T/C's or T/T's. "Duo Fine" polypropylene filter cartridges are also available in porosities up to 30μ but only the 0.45μ porosity cartridges have been tested.

Other suitable filter materials are cellulose and polyacrylate.

Drowning Tub, T-1:

Vertical wooden 8,300-gallon tank filled with water to quench the nitrator contents.

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Bill of Materials

| Materials and Product Code Numbers | Lb./ Charge | Wt. Ratio | Mol. Wt. | Moles | Molar Ratio | Lb./ cwt. | Specs. |
|---|---|---|---|---|---|---|---|
| Mixed acid, SP-15 015-290 | 16,175 | 2.303 | | | | 176.252 | 175-M Note 1 |
| (as 100% $HNO_3$) | 3,997 | 0.569 | 63.02 | 63.424 | 1.176 | 43.554 | |
| (as 100% $H_2SO_4$) | 9,323 | 1.327 | 98.02 | 95.113 | 1.763 | 101.589 | |
| (as 100% $H_2O$) | 2,855 | 0.406 | 18.02 | 158.435 | | | |
| Alcohol, 2-Ethylhexyl 023-275 | 7,024 | 1.000 | 130.22 | 53.939 | 1.000 | 76.538 | 330-A Note 3 |
| Urea, shotted 982-400 | 400 | 0.057 | 60.06 | 6.660 | 0.123 | 4.359 | 5-U-4 |
| Water (washes) | 2,595 | 0.369 | 18.02 | 144.167 | 2.673 | 28.277 | - |
| Sodium sulfate (wash) | 136.5 | 0.019 | 142.05 | 0.961 | 0.018 | 1.487 | 50-S-8 |
| anhydrous (dry) 884-000 | 50 | 0.007 | 142.05 | 0.352 | 0.007 | 0.545 | 50-S-8 |
| Sodium Carbonate 877-000 | 90 | 0.013 | 106.00 | 0.849 | 0.016 | 0.981 | 15-S-2 |
| Nitrogen 556-000 | 702 | 0.100 | 28.01 | 25.062 | 0.465 | 7.649 | 78-N-2 |
| Total | 27,172.5 | | | 548.963 | | | |

Product

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2-Ethylhexyl nitrate Tech. 365-260 | 9,177.19 | 1.307 | 175.22 | 52.375 | 0.971 | 100.000 | Note 2 |

Recovery (for future reference. Currently (6/84) spent acid is sent to WWTP)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Spent acid waste | 13,072 | 1.861 | | | | 142.440 | |
| (as 100% $H_2SO_4$) | 8,857 | 1.261 | 98.08 | 90.304 | 1.674 | 96.511 | Note 4 |
| (as 100% $H_2SO_4$ theory) | 9,323 | 1.327 | 98.02 | 95.113 | 1.763 | 101.589 | |

Note 1:

The specifications for SP-15 Mixed Acid are as follows:

Appearance: clear liquid, colorless to light green (visual)
Density: 1.661 ± 0.006 g/ml at 25°C (Method 6-36-3A)
Sulfuric acid: 57.6 ± 0.5% (Method 74-8-15-1A)
Nitric acid: 24.7 ± 0.5% (Method 74-8-15-1A)
$HNO_2$: 0.14% maximum (C&P Method CW-74-8-98-1A)

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Note 2:

The tentative specifications for 2-ethylhexyl nitrate are as follows:

Appearance: Clear, colorless to light amber liquid (visual)
Color: 1.0 max. ASTM (ASTM-D-1500-64 or Method 16-13-9A)
Purity: 98.5% min. (Method 11-66-30-1A; see TA/TC-C-84-118)
2-Ethylhexyl alcohol: 1.0% max. (Method 11-66-30-1A)
Total acid number: 0.2 mg KOH/g max. (ASTM-D-664-58 or Method 2-15-33)

Note 3:

The specifications for 2-Ethylhexanol are:

Identification: Comparison of its IR spectrum with that of a standard (Method 6-1-8), Refractive Index (Method 9-3-1), Gas Chromatography (Method 11-44-30-1)
Specific gravity: 0.8325 to 0.8345 at 20/20° (Method 6-36-3)
Distillation range: Initial to dry point, 182.00 to 186.00°C at 760 mm Hg (Method 6-2-1)
Color: APHA color maximum of 5 (Method 6-13-3)
Acidity: 0.01% w/w as acetic acid maximum (Method 2-15-30)
Aldehyde Content: 0.1% w/w maximum as 2-ethylhexanal (by UV spectroscopy, vendor Method 3804-9, on file at QCL)
Acid wash test: Not darker than 20 on platinum-cobalt color scale (no method number)

Note 4:

The tentative specifications for spent acid waste are:

$H_2SO_4$: 72% maximum (Method 74-8-15-1)
$HNO_3$: 7% maximum (Method 74-8-15-1)
TOC: 0.5% maximum (Method S 8210.190.01.CW)

Batch Size and Yield

The expected yield for this process is 130.7 lb. of 2-ethylhexyl nitrate per 100 lb. of 2-ethylhexyl alcohol which is 97.1% of theory. The goal yield is 131.8 lb./cwt or 98.0% of theory (TMR-C-82-25).

The capacity of the NT-1 set is limited by the nitration operation.

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## Material Balance

| In* | Lb./Chg. |
|---|---|
| SP-15 Mixed Acid | 16,175 |
| Urea | 400 |
| 2-EHA | 7,024 |
| Nitrogen | 702 |
| $Na_2SO_4$ Wash Solution and Drying Agent | 2,871.5 |
| Total | 27,172.5 |

| Out | |
|---|---|
| Waste Stream #1 to Atmosphere | 848.6 |
| Waste Stream #2 to WWTP (Aqueous) | 3,043.3 |
| Waste Stream #3 to WWTP (Spent Acid) | 14,103.4 |
| Product (assumes 97.1% of theory yield) | 9,177.2 |
| Total | 27,172.5 |

*$Na_2CO_3$ included in wash solution

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## Safety and Occupational Health Hazards

### Physical Properties

| Property | 2-Ethyl-hexyl Alcohol | SP-15 Mixed Acid | Urea | Sodium Sulfate | Sodium Carbonate | 2-Ethyl-hexyl Nitrate |
|---|---|---|---|---|---|---|
| Boiling Point (°C) | 184.3 | 120 | (3) | - | - | Dec. (3) |
| Vapor Pressure at 85°C (mm Hg) | 14 | 9-10 $HNO_3$ | - | - | - | 5.1 (1) |
| Vapor Density (air=1) | 4.7 | Not det'd | - | - | - | 6.0 |
| Solubility in Water at 20°C (%) | 0.07 | Mis-cible | 100 | 19.4 | 18 | 0.02 (2) |
| Sp.Gr. 20/4°C | 0.834 | 1.66 | 1.335 | 2.7 | 2.533 | 0.96 |
| Evap. Rate (BuAc = 1) | 0.02 | 1 | - | - | - | Not det'd |
| Viscosity (cps at 20°C) | 9.8 | 12.7 (7) | - | - | - | 1.5 @ 38°C (5) |
| Freezing Point | < -70 | -20 | 132.7 | - | - | < -40°C |
| Heat of Vapor-ization (cal/g) | 85 | - | - | - | - | 75 (1) |
| Heat of Combustion (Kcal/mole) | 1,260 | - | 151.6 | - | - | Not det'd |
| Flash Point TCC (°C) | 85 | - | - | - | - | 70 (4) |
| Autoignition Temp. (°C) | 296 | - | - | - | - | 130 (4) |
| EIT (°C) | - | - | - | - | - | 119.5 (6) |
| Autooxidation (°C) | - | - | - | - | - | 55 (4) |

(1) OCNB 6282-62,67
(2) OCNB 6187-45
(3) Decomposes before boiling
(4) Du Pont Engineering Test Center (reference Attachment No. 2)
(5) Petroleum Laboratory
(6) A.R.C. Run No. 736
(7) J Phys Chem. 27 701 (1923)

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## 2-EHN Process Hazards Reviews

| PHR No. | Date | Title | Subject |
|---|---|---|---|
| 82-37-WI | 05/17/82 | 2-Ethylhexyl Nitrate Design | Safety review of preliminary design for manufacturing facilities |
| 82-71-WI | 10/19/82<br>12/03/82<br>04/22/83 | Manufacture of 2-EHN | Safety review of proposed 2-EHN operation in Batch Nitrator |
| 82-72-FT | 11/17/82 | Fault Tree Analysis of 2-EHN | Fault Tree Process Hazards Review of the reactor system |
| 82-116-FM | 11/12/82 | Manufacture of 2-EHN | Failure Mode and Effect process hazards review |

In all of the above, the 2-EHN process was safe to run after implementation of the committee recommendations.

Additional PHR's are attached to the various TA's covering specific process modifications.

### Hazards

2-Ethylhexyl Alcohol (2-EHA) is a water white stable liquid which sets to glass below -70°C. The calculated LFL and UFL are 0.90 and 5.6% v/v, respectively.

SP-15 Mixed Acid is a clear, colorless to light green liquid and contains 24.7% $HNO_3$/57.6% $H_2SO_4$.

Mixed acid will not burn; however, it is a strong oxidizing agent and can cause a fire when mixed with combustible organics and oxidizable materials, metal powders, strong bases, turpentine, cyanides, sulfides, concentrated ammonia or amines, hydrogen sulfide.

On decomposition, it can release toxic $HNO_3$, $NO_x$ fumes, or flammable hydrogen gas (contact with metals).

Polymerization will not occur.

Urea is a white crystalline material which is soluble, part for part in water. Aqueous solutions decompose upon heating giving off some $NH_3$. Solid urea normally does not decompose to liberate ammonia until the temperature rises above the melting point, 132.7°C.

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Sodium Sulfate Anhydrous is a white, crystalline, non-volatile powder with a high M.P. (888°C). It is a stable, neutral, inorganic salt and is not considered hazardous.

Sodium Carbonate is a white, crystalline, non-volatile powder with a high M.P. (851°C with decomp.) and is not considered hazardous. It is alkaline and water soluble. In contact with acids, carbon dioxide gas is liberated and foaming takes place.

2-Ethylhexyl Nitrate (2-EHN) is a clear to light straw colored liquid with an ester odor. It is combustible and, if burned, would be expected to emit $NO_x$ fumes.

Thermal stability data have been obtained for 2-EHN and for the final reaction mass. The results are presented in Tables I and II.

Thermal stability tests are reported elsewhere and are listed in Table III.

The fact that 2-EHN, in a finely divided form, where a high surface to volume ratio exists (e.g. saturated lagging), will begin to self heat at 55°C and will spontaneously ignite at 130°C (in the presence of air), makes it mandatory that steam traced or hot surfaced equipment not be located nearby. When stored in bulk quantities, 2-EHN begins to decompose exothermally at 120°C, regardless of the presence or absence of air.

Spent Acid will contain less nitric than mixed acid but should be considered similar to mixed acid in hazardous reactivity and fire and explosion potential.

In addition, the spent acid could contain residual organic material which could oxidize. Based upon a heat of reaction of -128 Kcal/mole, an adiabatic temperature rise of 16°C would occur if there were 1% w/w 2-EHN present, the 2-EHN hydrolyzed to 2-EHA and the 2-EHA was oxidized by residual nitric acid.

Vent Gases from the process are $N_2$, $N_2O$ and $CO_2$.
$N_2O$,
laughing gas, is stable and chemically inert at process temperatures; however, it will support combustion. If oxidation of the alcohol occurs, $NO_x$ and carbon monoxide are generated. Carbon monoxide is very flammable (LFL = 12%; UFL = 75% by volume with air).

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An explosive mixture is unlikely. According to a literature reference* mixtures of $N_2O$ and CO are not explosive with less than either 20% $N_2O$ or 20% CO or greater than 50% inerts. With a nitrogen purge of 30 scfm, the inert gas concentration is normally > 50%. The $N_2$ purge also prevents other gases such as $H_2O$, $NO_x$, etc., from accumulating in the nitrator vapor space. Explosivity tests of 2-EHN reaction vent gases have been completed by the Engineering Test Center. Results of these tests confirmed that vapor phase ignition will not occur below 45°C, if 30 scfm $N_2$ purge of adequate agitation is maintained during the nitration.

Toxicity

2-Ethylhexyl Alcohol has an AEL of 20 ppm; breathing the vapors can cause coughing and irritation of the nose and throat. Contact of liquid with eyes will be irritating and can cause transient injury.

$LD_{50}$ orally in rats = 3.2 g/kg.

SP-15 Mixed Acid which contains 25% nitric acid and 57.5% sulfuric acid is extremely corrosive.

8-hour Time Weighted Average, ACGIH "TLV" - TWA:

| | |
|---|---|
| nitric acid | 2 ppm, 5 $mg/m^3$ |
| nitrogen dioxide | 5 ppm, 9 $mg/m^3$ (ceiling) |
| sulfuric acid | 1 $mg/m^3$ |

Note: Toxic oxides of nitrogen and other dangerous gases can be liberated when mixed acid is used or spilled.

Urea is a by-product of normal protein metabolism. It is considered moderately toxic by subcutaneous (SC), intravenous (IV) or oral administration.

| | | |
|---|---|---|
| SC $LD_{Lo}$ (dog) | = | 3,000 mg/kg |
| IV $LD_{Lo}$ (dog) | = | 3,000 mg/kg |
| oral $LD_{Lo}$ (domestic animals) | = | 511 mg/kg |

Sodium Sulfate Anhydrous is not considered hazardous. It has been used as a diuretic and has a slight dehydrating effect on the skin. Glaubers salt, $Na_2SO_4.10H_2O$, has an LD I.V. in rabbits of 4.47 g/kg.

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*Vander Wal, M. J., "Explosive and Nonexplosive Reactions Between Nitrogen Oxides and Flammable Gases", Rec. travaux chim. Pays Bas, 53, pp. 97-117 (1931).

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Table I

Thermal Behavior of 2-EHN (Neat)

| | | |
|---|---|---|
| A.R.C. Run Number | 579 | 736 (1) |
| Loading Density, g/cc | 0.2 | 0.6 |
| Initial Reaction Temperature, °C | 140.8 | 119.6 |
| Temperature at Maximum Self-Heat Rate, (TM), °C | | 208 |
| Maximum Self-Heat Rate, °C/minute | 282 | - |
| Pressure at TM, psia | 1,280 | - |
| Pressure Rate at TM, psia/minute | 47,000 | - |
| Heat of Reaction, Kcal/gm | -77.7 | - |

(1) Interrupted to prevent bomb rupture

Table II

Thermal Behavior of 2-EHN Reaction Mass
(40% w/w 2-EHN + 60% w/w - 70% $H_2SO_4$)

| | |
|---|---|
| A.R.C. Run Number | 587 |
| Loading Density, g/cc | 0.64 |
| Initial Reaction Temperature, °C | 90.3 |
| Temperature at Maximum Self-Heat Rate, (TM), °C | 193 |
| Maximum Self-Heat Rate, °C/minute | 76 |
| Pressure at TM, psia | 1,500 |
| Pressure Rate at TM, psia/minute | 16,000 |
| Heat of Reaction, Kcal/gm | -128 |

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Table III

2-EHN Safety References

| Item Title | Author | Date | Remarks |
|---|---|---|---|
| Explosion Hazards Stability of 2-EHN | L. C. Nixon | 03/01/82 | Flash point-CC, AIT, ADT, Impact, CVTS |
| Thermal Stability of 2-EHN RXN Mixes | K. Marcali | 04/21/82<br>02/04/83 | ARC: 2-EHN in MA; 2-EHA oxid. in MA;<br>2-EHN/Sp.Ac. Stab. |
| 2-EHN Reactor-pressure Relief/Damage | W. R. Tong | 11/29/82 | Press. Relief Calc. & Pot. Damage Estimate |
| Nitration of 2-EHA to 2-EHN ARC Study | K. Marcali | 12/06/82 | ARC: 2-EHN & 2-EHN+$H_2SO_4$ Thermal Behavior |
| 2-EHN Incident @ Fletcher Oil Co. | W. R. Tong | 12/21/82 | Analysis |
| 2-EHN Explosion at Plastifax | W. R. Tong | 12/29/82 | Analysis |
| 2-EHN: Dead-headed Pumps Hazard | T. P. Garrett | 12/30/82 | Calculations |
| Venting 2-EHN Reactor | B. J. Tilley | 01/07/83 | Calculations and Conclusion |
| 2-EHN Storage Tank Venting | B. J. Tilley | 01/28/83 | Calculations and Recommendations |
| 2-EHN/Methemoglobinemia | G. W. Lovett, M.D. | 02/04/83 | 2-EHN Does Not Cause Cyanosis |
| $N_2O/CO$ Explosivity | L. C. Nixon | 03/28/83 | Explosivity of mixes and $N_2/CO_2$ Effect |
| 2-EHN Reactor: Vapor Expl. Hazards | W. R. Tong | 04/06/83 | Low Probability |
| DOA-1000 Shipment via Barge | L. M. Goldstone | 01/03/84 | Hazard no worse than shipment of benzene or toluene |

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Sodium carbonate is considered to be moderately toxic by oral administration.

oral (rat) $LD_{50}$ - 4,220 mg/kg

The dust is strongly alkaline and will irritate the eyes and respiratory tract.

2-Ethylhexyl Nitrate (2-EHN) has not had a TLV established by ACGIH or OSHA. Du Pont has established a provisional AEL of 5 ppm (8 hour TWA P 8/1/84). It is considered to be slightly toxic (see MSDS rev. 6/1/84) based on the following animal tests:

Oral ALD (rat) = 7,500 mg/kg
Inhalation toxcity = low (rats ACL > 14 mg/l 4 hours)
Skin irritation = slight

Spent acid will contain less nitric acid than mixed acid but should be considered similar to mixed acid in toxicity. In addition, the spent acid could contain residual 2-ethylhexyl nitrate.

Vent gases from the process are $N_2$, $N_2O$ and $CO_2$. $N_2O$, laughing gas, is considered to be moderately toxic by inhalation:

Inhalation* $LC_{Lo}$ (mice) = 1,500 ppm

If product oxidation occurs, $NO_x$ and carbon monoxide are generated. The 8-hour Time Weighted Average, ACGIH "TLV" - TWA:

| | | |
|---|---|---|
| Nitric oxide | 25 ppm, | 30 $mg/m^3$ |
| Nitrogen dioxide | 5 ppm, | 9 $mg/m^3$ |
| Carbon monoxide | 50 ppm, | 55 $mg/m^3$ |

Environmental Health

The vapor pressure of 2-EHN is very low; the product has a distinctive odor and operating procedures, equipment ventilation and design are all intended to minimize worker exposure. Twenty air samples taken over a 10-day period during pilot plant runs in J-81 Bldg. showed 11 samples to have less than the detectable limit (0.01 $mg/m^3$), 5 samples in the range of 0.01 to 0.10 $mg/m^3$, and 4 samples from 0.11 to 0.17 $mg/m^3$. 2-EHN is considered to be slightly toxic.

An air monitoring program during production of 2-EHN in Building No. 728, utilizing personal monitors to assess worker exposure, is in operation.

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Results to date (3Q84) show atmospheric 2-EHN levels to be below 2 ppm (8-hour TWA-P 2/84).

Summary of 1983 air monitoring results are:

110 stationary samples ave. 0.15 $mg/m^3$
53 personal samples ave. 1.33 $mg/m^3$

1983 permissible limit was 7 $mg/m^3$

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M. T. Gordon
July 24, 1984

II-18

Chambers Works Process
728-365 260

## Characterization of Atmospheric Waste Streams

I. Source of Waste Stream:

Description: Vent to atmosphere
Waste Stream No. 1 (as listed in Material Balance, Page II-9)
Process Equipment Piece: NT-1

| | |
|---|---|
| Batch or Continuous | Batch |
| Batch Cycle Time (Hours/Batch) | 2.5 hrs./chg. |
| Batches per unit of time | 10/day max. |
| Flow from Source (ACFM) | 75.3 |

II. Composition and Quantity of Waste Stream:

A. Direct from Source

| Component | Lb./Chg. | Wt-% | Conc. |
|---|---|---|---|
| $N_2O$ | 73.3 | 8.6 | 5.9 |
| $CO_2$ | 73 3 | 8.6 | 5.9 |
| $N_2$ | 702.0 | 82.8 | 88.2 |

B. Leaving Control Apparatus N/A

III. Control Apparatus: Not applicable

IV. Stack(s):
Area: Aromatics East Bldg: 728
Stack or Fan No.: NT-1
Height above ground level (ft.): 110
Stack Diameter (inches): 6
Flow (Actual cfm): 75
No. of sources vented to this stack: 1

V. Hazards (Atmospheric Waste Stream)

Hazards (underline): Skin Irritant, Respiratory Irritant, Cyanotic, Carcinogenic, Poison, Flammable, Explosive, None

Threshold Limit Value: $CO_2$, TWA = 5,000 ppm
Toxic Limit: $N_2O$, $LC_{Lo}$ (mice) = 1,500 ppm

The above information has been reviewed with the Environmental Control Division and appropriate waste disposal group(s) on Chambers Works.

Author — Date 10/11/84

Area Environmental Coordinator — Date 10/18/84

CONFIDENTIAL

M. T. Gordon | II-19 | Chambers Works Process
July 24, 1984 | | 728-365 260

## Characterization of Aqueous Wastes to "A" Ditch

I. Source of Waste Stream:

Description: 2-EHN wash water
Waste Stream No. 2 (as listed in Material Balance, Page II-9)
Equipment Piece: T-1-C

II. Composition of Waste Stream:

| Component | Lb./Chg. | Wt-% |
|---|---|---|
| Sodium nitrate | 143.5 | 4.7 |
| 2-EHN | 102.0 | 3.4 |
| Urea | 15.0 | 0.5 |
| Sodium sulfate | 186.5 | 6.1 |
| Oxidation product | 1.3 | 0.04 |
| Water | 2595.0 | 85.26 |
| Total | 3043.3 | 100.00 |

III. Volume of Waste Stream:

| | |
|---|---|
| Flow | 362 gal./chg. |
| No. of charges/unit time | 10 max/day |
| Duration of flow per discharge | 1 hour |

IV. Characterization:

Acidity or Alkalinity as:
- Units $CaCO_3$/chg.
- Units $CaCO_3$/cwt product

Total Organic Carbon as:

| | |
|---|---|
| Lb. TOC/chg. | 59.9 |
| Lb. TOC/cwt. product | 0.65 |
| ppm | 19,673 |

V. Hazards and Toxicity: This waste stream contains dissolved and insoluble organic compounds which can cause irritation.

VI. Treatability at WWTP: All materials contained in this stream are treatable at the Waste Water Treatment Plant.

The above information reviewed with WWTP personnel on Chambers Works.

Mendel T. Gordon — Author — 10/11/84 — Date

Earl M. Potrelle — Area Environmental Coordinator — 10/18/84 — Date

CONFIDENTIAL

M. T. Gordon
July 24, 1984

II-20

Chambers Works Process
728-365 260

## Characterization of Aqueous Wastes to "A" Ditch

I. Source of Waste Stream:

Description: Spent acid
Waste Stream No. 3 (as listed in Material Balance, Page II-9)
Equipment Piece: SP-2 or NT-1

II. Composition of Waste Stream:

| Component | Lb./Chg. | Wt-% |
|---|---|---|
| 2-EHN | 153.0 | 1.1 |
| 2-EHA | .4 | .003 |
| Nitric acid | 465.9 | 3.3 |
| Sulfuric acid | 9,241.4 | 65.5 |
| Water | 3,849.4 | 27.3 |
| Urea | 285.0 | 2.0 |
| $(NH_4)_2SO_4$ | 108.2 | .8 |
| Total | 14,103.3 | 100.00 |

III. Volume of Waste Stream:

| | |
|---|---|
| Flow | 1,083 gal./chg. |
| No. of charges/unit time | 10 max/day |
| Duration of flow per discharge | 1 hour |

IV. Characterization:

| | |
|---|---|
| Acidity or Alkalinity as: | |
| Units $CaCO_3$/chg. | 9,807 |
| Units $CaCO_3$/cwt product | 106.9 |
| Total Organic Carbon as: | |
| Lb. TOC/chg. | 141.1 |
| Lb. TOC/cwt. product | 1.5 |
| ppm | 10,005 |

V. Hazards and Toxicity: This waste stream is strongly acidic (65% $H_2SO_4$) containing both soluble and insoluble organic compounds (~3%). This stream is corrosive to the skin.

VI. Treatability at WWTP: This stream is treatable at the Waste Water Treatment Plant after neutralization and dilution.

The above information reviewed with WWTP personnel on Chambers Works.

Mendel T. Gordon — 10/11/84
Author — Date

Earl M. Potrafke — 10/18/84
Area Environmental Coordinator — Date

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Process Steps and Limits

A. Equipment Cleanout Prior to Initial Start-Up or Following Major Repairs

It is important that all processing and storage vessels, process lines and pumps be clean and free of contaminants. After water flushing, draining and substantially drying the equipment, an appropriate flushing material should be used. For example: the 2-EHA T/T unloading system, storage tank and feed system should be flushed with 2-EHA. The nitrator, separator, wash tub, product lines and product tank also should be flushed with 2-EHA to remove organic contaminants. This equipment should be drained as well as possible to minimize initial product contamination. Finally the SP-15 storage and feed system should be flushed carefully with SP-15 mixed acid.

Caution: avoid accidental contact between 2-EHA and SP-15 during cleaning operations to avoid an uncontrolled reaction. Because 2-EHA has a low solubility in water, large amounts of water could be necessary to completely flush equipment of 2-EHA. Before flushing equipment with SP-15 or any strong acid, residual water should be removed to avoid excessive heat buildup due to high heat of dilution of strong acids.

B. Wash Solution Preparation

It is recommended that the following wash solutions be prepared before starting a charge of 2-ethylhexyl nitrate (2-EHN), in order to avoid processing delays in SP-2 or T-1-C in which the 2-EHN could be exposed to spent acid for periods longer than three hours (see Section D-10) (SP-2 and T-1-C have no cooling capability).

The weights of materials shown below to prepare the wash solutions are those given in the Bill of Materials per charge of 2-EHN. For economy, larger volumes can be prepared, depending upon equipment size, to wash several charges.

10% Sodium Sulfate Solution

1. Charge 2,595 ± 130 lb. of water to the wash makeup tank.

   The temperature of the water can be 15°C to 75°C, but the temperature of the final solution prior to use in Step E-14 must be 25 ± 10°C.

   Below 15°C the sodium sulfate could be difficult to dissolve completely or dissolve very slowly.

   Temperatures above 75°C do not represent any safety concern but unnecessarily waste energy.

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The specific gravity of a 10% sodium sulfate solution is 1.0535 $\frac{20°C}{4°C}$

2. Start the agitation.

   Use of an air or nitrogen sparge to agitate is satisfactory.

3. Charge 136.5 ± 68 lb. of anhydrous sodium sulfate and 90 ± 4.5 lb. of soda ash to the wash makeup tank.

   The rate of sodium sulfate and soda ash addition is not critical with respect to the safety of this operation.

   The final solution should contain 5 ± 0.5% sodium sulfate and 3.5 ± 0 4% soda ash.

   Higher concentrations waste $Na_2SO_4$, while at lower concentrations, the specific gravity of the wash solution will not be high enough to provide separation of the organic and aqueous layers within 15 minutes after the washing steps. Higher concentrations of soda ash are wasteful and lower concentrations could result in incomplete neutralization of the product.

4. Agitate until all of the sodium sulfate and sodium carbonate have dissolved.

   At 25°C, the sodium sulfate should be dissolved in the water after about one hour.

   If an air or nitrogen sparge is used for agitation, the sodium sulfate concentration will double in 24 hours due to evaporation of water. No hazard is expected, but the washing efficiency could be reduced.

5. Hold the wash in the makeup vessel until called for in the nitration procedure. (See Steps E-14, E-19, E-25.)

   Once the sodium sulfate has dissolved, the agitation can be stopped. The solution is stable.

C. Nitration

1. Make certain the nitrator is clean and empty.

   Residual water will evolve heat because of the heat of dilution when the mixed acid is added. Moreover, dilution of the acid could lead to a slow nitration. For each pound of water present, 196 Pcu will be produced. (The maximum adiabatic temperature rise for the full process amount of SP-15 acid in NT-1 would be approximately 30°C.)

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2. Feed nitrogen to the nitrator at 30 ± 1.5 scfm.

   $N_2$ is provided to prevent an accumulation of $NO_x$, $N_2O$ and CO in NT-1.

   A nitrogen purge is required prior to start-up if the nitrogen feed has been interrupted. In NT-1, a nitrogen purge of 30 scfm for 30 minutes (two nitrator volume changes) will be adequate to achieve greater than 90% V/V inerts.

3. Charge into the nitrator 16,175 lb. (+ 808 lb., - 324 lb.) of SP-15 Mixed Acid.

   SP-15 Mixed Acid is produced by mixing 93% sulfuric acid with 65% nitric acid to obtain a solution containing 24.7% $HNO_3$ and 57.6% $H_2SO_4$. Based upon laboratory measurements, SP-15 Mixed Acid has a density of 1.664 g/ml at 25°C. Mixtures of 93% $H_2SO_4$ and 65% $HNO_3$ within a density range of 1.661 ± 0.006 g/ml are expected to provide satisfactory $HNO_3$ concentrations for use in this process (25.1 ± 0.9% $HNO_3$). At higher densities, i.e., lower $HNO_3$ and higher $H_2SO_4$ concentrations, the nitration will be faster, but incomplete conversion of the alcohol will result. At lower densities, i.e., higher $HNO_3$ and lower $H_2SO_4$ concentrations, the nitration becomes slower. If the mixed acid density is 1.75 g/ml or greater (i.e., greater than 71.4% $H_2SO_4$), oxidation of the 2-EHA can occur even though the nitric acid concentration is less than 15% wt.

   The process is expected to operate satisfactorily with weighing errors of +5% to -2%. Overcharging by more than 5% will unnecessarily waste nitric acid. Undercharging by greater than 2% could result in an incomplete reaction.

4. Start the agitation and maintain through Step 9 for routine operation. If agitation stops after Step 6, but before Step 9, supervisory approval is required for restart.

5. Adjust the temperature of the mixed acid to 20 ± 5°C.

   A temperature greater than 25°C will slow the rate of urea addition in the next step. It is important to avoid hold periods once the addition of urea has been started because the urea reacts with nitric acid.

   Starting temperatures as low as 0°C have been successfully used in the laboratory using the heat of reaction of nitric acid with urea to bring the temperature of the mixed acid to 10°C.

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6. Charge 400 ± 8 lb. of urea allowing the temperature to rise to and controlling the temperature at 25 ± 5°C. (A temperature excursion during the addition of urea to 30° - 40°C is acceptable but the total time in this range must not exceed 30 minutes.) In NT-1 the time of addition has been 5-10 minutes and is expected to be < 30 minutes.

   If this time limit is exceeded or if the temperature should exceed 40°C, the mixed acid must be discharged to the WWTP. Above 40°C the reaction of urea and $HNO_3$ is too rapid to ensure an adequate urea concentration over the complete alcohol addition period.

   Urea is used in the process to react with any nitrous acid or $NO_x$ which is present in the mixed acid or formed by the oxidation of 2-ethylhexyl alcohol with nitric acid during processing. Nitrous acid and $NO_x$ catalyze the oxidation process. Oxidation leads to the formation of product impurities via highly exothermic reactions.

   Urea addition results in heat evolution due to several exothermic reactions. In NT-1, the heat of neutralization of urea with sulfuric acid provides an adiabatic temperature rise of 6°C (-5 Kcal/mole). The heat of reaction of urea with nitric acid generates an adiabatic temperature rise of 72°C (-57 Kcal/mole). The reaction of urea with nitrous acid is rapid, and the temperature rise from this source will depend upon the nitrous acid concentration in the mixed acid. The expected temperature rise assuming 0.1% $HNO_2$ in the mixed acid is calculated to be about 7°C ($\Delta H$ = -162 Kcal/mole of urea).

   In NT-1, if the urea addition starts at 20°C, it should be complete in approximately 30 minutes assuming a coolant temperature of 15°C and a final reaction mass temperature of 28°C.

   If greater than process amounts of urea are added, the nitration could be incomplete because of insufficient $HNO_3$ (urea reacts with the nitric acid). If less than process amounts are added, oxidation of the alcohol could occur toward the end of the nitration.

7. As soon as the urea has been added and the reaction mass temperature is between 20°C and 30°C (preferred temperature is 25°C), start the addition of 7,024 lb. (+ 140, -335 lb.) of 2-ethylhexyl alcohol at the rate of 117 lb./minute (+ 28 lb./minute, -40 lb./minute). Maintain the temperature between 20°C and 35°C during the addition.

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Temperatures above 35°C can lead to the loss of urea due to its rapid reaction with nitric acid at these temperatures. Temperatures below 20°C (0°C to 20°C) do not present any safety or product quality concerns. A minimum temperature of 20°C is specified to preclude the use of widely differing starting temperatures from one charge to the next.

Effective agitation is critical during the alcohol addition period. Poor agitation (<1 HP/1,000 gallons) result in a layer or pockets of 2-EHA collecting on the surface and must be avoided. A free layer of alcohol on the surface of the reaction mass will be exposed to oxidation due to the solubility of the acids (but not urea) in the organic layer. Normally, even with excellent agitation (>4 HP/1,000 gallons), there can be a free organic layer on the surface of the reaction mass. The alcohol content in this case, however, does not present a potential for oxidation due to the dilution effect of 2-EHN.

If the temperature rises above 35°C, stop the 2-EHA addition, apply full cooling and do not attempt to restart. The 2-EHA addition is stopped to stop the nitration reaction.

After the 2-EHA addition has been stopped and if the temperature can be controlled below 40°C, maintain agitation and isolate the product following the procedures in Section G.

If the temperature continues to rise above 40°C, stop the agitation in order to reduce the rate of reactions occurring between the organic and acid phases. If the temperature can be controlled below 45°C, isolate the product following the procedure in Section G but do not turn agitation on without supervisory approval. If the temperature continues to rise and reaches 45°C, dump the charge into the drowning tub to prevent a runaway reaction.

The rate of addition of 2-EHA is dependent upon the ability of the equipment ro remove the heat of nitration (-7 Kcal/mole). Rates slower than 25 pounds/minute, i.e., greater than a four hour addition time, could result in oxidation because the urea could be consumed after this time. Rates faster than 117 pounds/minutes, i.e, faster than a one hour addition time, risk accumulating a large concentration of 2-EHA which can lead to oxidation. Total elapsed time from the start of urea addition to end of 2-EHA addition should not exceed five hours.

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The first indication that oxidation is occurring is the appearance of $NO_x$ fumes above the surface of the reaction. The fumes become heavier as oxidation continues. As the rate of oxidation increases, the next indication will be an increase in the cooling requirements because of the high heat of oxidation (-128 Kcal/mole). As oxidation continues further, the organic layer will change in color from a straw yellow to green and then to blue if oxidation is extensive.

8. After the alcohol addition is complete, hold the charge between 20°C and 35°C for one half to one hour.

A hold time of one-half to one hour is generally sufficient to complete the nitration. If incomplete nitration is suspected, test for completeness of nitration and hold up to one hour longer and retest. Proceed with Step 9.

Nitration Completion Test: Wash two to three ounces of the unwashed organic layer twice with an equal volume of 10% sodium sulfate solution. Add a saturated aqueous Sodium carbonate solution dropwise to the second wash until the pH is = 7 (orange to Brilliant Yellow test paper). Separate the top organic layer, and submit one-half to one ounce to QCL for alcohol content by infrared (Method 11-66-1-1) or GC (Method 11-66-30-1A) analysis.

9. Sample the organic layer (unnecessary if done in Step 8) and send to QCL for purity (Method 11-66-30-1A). The charge can be processed further without waiting for results.

Charges found to be incompletely nitrated should be segregated and held for blending or rework (see Section F). Depending on the composition of the charge, it will be either blended or reworked. Reworking will only lower the 2-EHA content, it will not remove oxidation products. Product which is off-quality due to oxidation by-products must be blended or disposed to the WWTP.

D. Product Separation

10. Stop the agitation in the nitrator and allow the layers to separate.

The layers normally separate in < 15 minutes.

The top layer contains the product, 2-ethylhexyl nitrate.

If the nitrator is not be used as a separator, proceed to Step 12.

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11. Discharge the bottom spent acid layer directly to the WWTP or transfer to the spent acid storage tank before discharging to the WWTP.

    The maximum $HNO_3$ content of the spent acid which can be transferred to the storage tank is 7% weight (Method 74-8-15-1).

12. Transfer the contents of the nitrator to a separator and allow the layers to separate.

    The layers normally separate in < 15 minutes. Although laboratory experiments indicate that the aqueous and organic phases of a normal run are stable for 50 hours, hold times of over three hours should be avoided because of the decomposition potential of 2-EHN in content with spent acid (70% $H_2SO_4$).

13. Discharge the bottom spent acid layer directly to the WWTP or transfer to the spent acid storage tank before discharging to the WWTP.

    A careful cut should be made to remove as much of the spent acid as possible to facilitate washing the product acid-free in later steps. Do not cut any of the 2-EHN with the spent acid.

E. Washing

The weights of materials shown below are those needed to wash one charge of 2-EHN as described in the Bill of Materials. For economy and within the limits of the wash tub volume, two charges of 2-EHN can be combined.

When two charges are to be combined, twice the amount of $Na_2SO_4/Na_2CO_3$ solution should be used in Step 14, then the first charge should be processed through to Step 16 and held until the second is added per Step 15.

14. Charge 2,822 $\pm$ 203 lb. of sodium sulfate/$Na_2CO_3$ solution from the wash makeup tank to the wash vessel.

    In this step the residual acid is neutralized by the sodium carbonate. Carbon dioxide gas is evolved in this reaction and could cause some foaming. One to two feet of freeboard should be provided to avoid a foam out.

    Sodium sulfate is added to the wash solution to provide a sufficient density difference to achieve a rapid and complete separation.

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The wash is expected to remove all of the acid contained in the product.

The order of addition of the wash solution and the product layer (shown added in Step 15) is not critical. Good plant practice is to add the product layer to the wash solution to avoid potential local heating due to heat of dilution if a spent acid layer is present.

15. Drop the product layer from the separator to the wash tank containing the wash solution.

    No reaction or exotherm is expected in this step unless a free spent acid layer is present.

    The maximum adiabatic temperature rise in the wash tub would be 13°C if all of the spent acid from NT-1 were present.

16. Agitate the two layers 45 ± 15 minutes in the wash tank to achieve removal of the acid in the product layer.

    Air or nitrogen can be used to provide mixing. About 30 minutes mixing is expected to be adequate, but longer times (up to 24 hours) can be used.

    The product layer is stable under these conditions to at least 100°C.

17. Stop the agitation and allow the layers to separate. About 15 minutes should be satisfactory.

18. Transfer the bottom aqueous layer to the WWTP through B-11.

    B-11 is a decanter to collect any 2-EHN in the wash. B-11 may be bypassed if unavailable.

    The final aqueous layer should have a pH of 8.0 ± 1.0 (turns Brilliant Yellow paper a slight orange color).

19. Add 50 ± 25 lb. of anhydrous sodium sulfate per charge to the 2-EHN remaining in the wash tub and agitate for 15 to 60 minutes.

    Sodium sulfate which is 100% retained on a 400-mesh screen has been demonstrated to settle more rapidly than small particle materials and is therefore recommended.

20. Turn off agitation and let settle.

    A settling time of 15 minutes is usually adequate.

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21. Pump the product using a decant leg through a cartridge filter to storage.

    The decant leg is used to avoid entraining residual solids in the product and plugging the filter.

    A 0.45 "DuoFine" polypropylene filter cartridge which has been found to produce a clear product while retaining a high pumping rate is preferred.

    Sodium sulfate remaining in the wash tub is dissolved during the next wash cycle.

22. Product 2-EHN is shipped to users in tank trucks or rail tank cars.

    Shipping containers should be clean and dry before loading.

F. Rework

This rework procedure is written for a 9,177 lb. charge size of unwashed 2-EHN which contains up to 4% 2-EHA.

1. Make certain the nitrator is clean and empty.

    See coments under Section C, Step 1.

2. Feed nitrogen to the nitrator at 30 ± 1.5 scfm.

    See comments under Section C, Step 2.

3. Charge 2,300 ± 240 lb. of SP-15 mixed acid.

    Greater amounts will unnecessarily waste mixed acid.

    Lesser amounts could require a longer nitration time or not reduce the 2-EHA level to under 1% (by Method 11-66-30-1A).

4. Charge 5,000 ± 500 lb. of spent acid from the 2-EHN process to the nitrator.

    Spent acid is added to the nitrator to provide sufficient volume to reach the bottom agitator blade.

    Lesser amounts will result in inadequate agitation during the initial addition of the 2-EHN rework charge.

    Greater amounts of spent acid (up to 7,000 pounds) can be used without overflowing nitrator NT-1, but the use of amounts greater than 5,500 lb. will dilute the nitric acid concentrations unnecessarily and will result in a slower time for the rework nitration (1.5 hours versus 0.5 hour).

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5. Start the agitation.

6. Adjust the temperature of the acid solution to 25 ± 5°C.

   At temperatures under 20°C, the rate of nitration will be slow, unnecessarily extending the cycle time, but no safety hazard will result.

   At temperatures above 30°C, the time for urea addition could have to be extended to avoid exceeding the process temperature limits in Step P-7.

7. Charge 90 ± 10 lb. of urea, controlling the temperature at 25 ± 5°C.

   Lower temperatures do not create a safety hazard, but will unnecessarily extend cycle time.

   Higher temperatures could delay or extend the 2-EHN addition time in the next step. A temperature excursion during the addition of urea to between 30° and 40°C is acceptable, but the total time in this temperature range must not exceed 30 minutes. If this time limit is exceeded or if the temperature should exceed 40°C anytime during the urea addition, the charge must be aborted and the acid discharged to the WWTP.

   A temperature rise of 2.5°C is expected in NT-1, due primarily to the heat of neutralization between urea and nitric acid.

   Urea is used in the process to react with any nitrous acid or $NO_x$ which is present in the mixed acid or formed by the oxidation of 2-ethylhexyl alcohol with nitric acid during processing. Nitrous acid and $NO_x$ catalyze the oxidation process which leads to product impurities.

   If greater than process amounts of urea are added, the nitration could be incomplete because of insufficient $HNO_3$ (urea reacts with the nitric acid). If less than process amounts are added, oxidation of the alcohol could occur toward the end of the nitration.

8. As soon as the urea has been added, start the addition of 9,177 ± 230 lb. of the 2-EHN charge to be reworked at a rate of at least 130 lb./minute, while maintaining the temperature during the addition period between 20° and 35°C (preferred temperature is 30°C).

   An adiabatic temperature rise of 2° to 4°C is expected from the heat of nitration.

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If the temperature rises to 35-40°C once during the urea addition and the charge can be cooled to under 35°C within 30 minutes, resume the addition of the 2-EHN Rework.

Temperatures below 20°C (0 to 20°C) do not present any safety or product quality problems; however, the time to complete the nitration will be unnecessarily extended.

See comments under Section C, Step 7, for indications that oxidation is occurring.

If the temperature rises above 35°C, stop the addition of the 2-EHN rework charge and apply full cooling. Temperatures above 35°C can lead to the loss of urea due to its more rapid reaction with nitric acid at these temperatures.

If the temperature remains at 35-40°C for longer than one half hour or an excursion to 35-40°C occurs more than once, isolate as described in Sections C - E, Steps 9 to 30.

See the comments under Section C, Step 7, for the action to be taken if the temperature rises above 40°C.

Addition rates slower than 150 lb./minute unnecessarily extend the cycle time. Rates slower than 50 lb./minute risk extending the cycle time to a point that loss of urea, due to its reaction with nitric acid, becomes a problem.

9. After the 2-EHN addition is complete, hold the charge at 15° to 35°C for 30 $\pm$ 15 minutes and test for completeness of nitration by the test procedure given in Section E, Step 8.

   A hold time of 15 minutes should be sufficient to complete the nitration at 25-35°C, while up to 45 minutes could be required at 15-25°C.

   If the above test indicate excess 2-EHA content, hold the charge for up to three hours longer at 30 $\pm$ 5°C or up to six hours longer if the temperature is at 20 $\pm$ 5°C. When the nitration is complete or the time limit has been reached, proceed to Step 10.

10. Sample and isolate following the procedures in Step C-9 through Step E-30.

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G. Aborted Charge

1. Cool the reaction mass in the nitrator to 25 ± 5°C as rapidly as possible. While cooling, proceed as follows: (a) make certain the separator and wash tank are empty, (b) charge 2,822 ± 203 lb. of wash solution from the wash makeup tank to the wash tank, (c) sample the organic layer and send to QCL for purity (Method 11-66-30-1A). Processing may be continued without waiting for results.

2. When the temperature in the nitrator reaches 25 ± 5°C, stop the agitation if on (agitation shuts off on charges that exceed 40°C, Step C-7). Allow the layers to separate.

   The top layer contains the product, 2-ethylhexyl nitrate.

   The layers should separate in about 15 minutes.

   If the temperature of the reaction mass begins to rise after the agitation is stopped, dump the charge into the drowning tub.

3. Discharge the bottom spent acid layer directly to the WWTP.

   The spent acid is not stored because a possible reason for the temperature exotherm during Step 7 could have been contamination of the 2-EHA by a lower molecular weight alcohol. Lower molecular weight alcohols and nitrates can be soluble in the spent acid and decompose exothermally upon standing.

4. Transfer the product layer in the nitrator to the wash tank containing sodium sulfate/sodium carbonate solution.

5. Finish processing as described in Section E, Steps 16 to 22.

Patent Status

In the opinion of the Patents and Licensing Section, we are free to operate this process, based on domination search CPI No. L-82-8051-D dated 4/5/82.

Patent application CH 1250 Douty, filed November 8, 1983, claims the process.

/acs

Doc. No.: 1532D
Disc. No.: 0198D

12/10/84

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cc: C. Hopper

AG-6 REV. 4/86

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
BELLE, WEST VIRGINIA 25015

AGRICULTURAL PRODUCTS DEPARTMENT
BELLE PLANT, 901 W. DU PONT AVENUE

RECEIVED
MAR 05 1993
Ans'd.....

February 28, 1993

Geoffrey Pratt
Director of Custom Manufacturing
Cedar Chemical Corporation
5100 Poplar Ave.
Suite 2414
Memphis, TN 38137

xc: TJL
PS
We'll have to get a look at this one.
DJH
3/8

Dear Mr. Pratt,

As I mentioned in our earliar conversations, we would like to qualify a contract manufacturer to produce 200,000 pounds per campaign of purified Glycolic acid, using DuPont's 80% Glycolic acid as a feed material. We expect this work to last for one to two years with two campaigns per year at these rates. If sufficient market develops, we will evaluate long term contract manufacture versus insallation of facilities at our plant to produce this product.

We would like to know if you are interested in doing this work, and if you have the facilities available starting in June of this year. We would also like an estimate of your cost per pound to produce this product.

I have attached some information from the previous work we have done. Please call me at (304) 357-1227 if you have any questions. If you would like to submit a price estimate for this work, please fax it to me at (304) 357-1364.

Sincerely,

Donald W. Jeffery
DuPont

The following information is for the production of high purity glycolic acid through crystallization.

## SAFETY

Chemical goggles and gloves are required for handling glycolic acid.

## ENVIRONMENTAL

The diluted Glycolic acid, GA, will be returned to our plant in Belle, West Virginia. Any other dilute waste streams created as a result of this process are the responsiblity of the contractor to dispose of properly. Disposal means will be reviewed by DuPont for approval prior to contract acceptance.

## PROCESS

The Raw material Glycolic acid is supplied by DuPont in tank trucks. The material is unloaded into a reactor equipped with agitation and cooling capabilities. The solution is cooled to 30°F to facilitate crystallization. After two hours at this temperature, the cold slurry is then centrifuged to seperate the crystals from the filtrate.

The filtrate is returned to a tank truck for shipment back to DuPont. The crystals are then placed into a seperate tank and returned to solution at a concentration of 70% using DI water at 100°F to assist solubility. The solution is then drummed and shipped to DuPont.

About 5-10% of the crystalline product will be dried to 0.5% water and packaged into leverpaks for shipment to DuPont as solid product .

## EQUIPMENT

Tank Truck Unloading facilities
Reactor (1000 - 5000 gal) (316 SS or Glass)
Refrigeration Unit
Centrifuge (316 SS)
Mix tank (500 - 2000 gal) (316 SS, Glass or appr. liner)
Filtrate tank (2000 - 4000 gal) (316 SS, Glass or appr. liner)
Vacuum dryer

## RAW MATERIAL

The Raw material Glycolic acid is an 80-85% aqueous solution shipped via tank truck at 120°F.

## MISC INFORMATION

### Crystallization

The crystallization begins at ~60°F. The Crystallization yield is 25% at a final temperature of 30°F. Therefore, it will require handling 800,000 lbs of Raw material to produce 200,000 lbs of GA on a 100% basis. That will require handling 18 tank trucks of 85% GA raw material.

The final product is primarily shipped back as a 70% solution at 250 Kg (551 lbs) per drum. For a 200,000 lb campaign,

- 5% being shipped as crystalline would be 10,000 lbs or 100 leverpaks.
- the other 190,000 lbs would make 270,000 lbs of 70% solution.
- that would be 490 drums.

### Refrigeration Requirements

Our estimates show that you will need 0.1 MBTU/lb of Glycoilc acid to cool the solution and for the Heat of Crystallization. That will be 4.5 MM BTU/truck.

### Physical Property Data

Most physical property data is in the accompanying Product Specification sheet and technical info. Some additional is listed here. If any further is needed, please call.

- Heat Capacity of the Glycolic acid solution

| | |
|---|---|
| 5°C | 0.56 BTU/lb °F |
| 25°C | 0.58 BTU/lb °F |
| 40°C | 0.59 BTU/lb °F |

- Heat of Neutralization of GA with caustic is -52.02 Kcal/mol of H2O.

$$C2H4O3 + NaOH \Rightarrow NaC2H3O3 + H2O$$

DU PONT

# PRODUCT SPECIFICATION

## DU PONT GLYCOLIC ACID PRODUCT SPECIFICATIONS

| PRODUCT SPECIFICATIONS | GLYPURE (tm) HIGH PURITY GLYCOLIC ACID GLYPURE 99 | GLYPURE 70 | 70% TECHNICAL |
|---|---|---|---|
| Total Acid, % (as glycolic) | 99.0 min | 70.0 min; 72.0 max | 70.0 min; 72.0 max |
| Formic, % | N/A | N/A | 0.45 max. |
| Water, % | 0.5 max. | 30.0 max. | 30.0 max. |
| Sulfates, ppm | N/A | N/A | 800 max. |
| Total Heavy Metals, ppm | 4 max | 3 max | N/A |
| Color, Gardner | N/A | N/A | 3 max |
| Turbidity, NTU | N/A | N/A | 6 max |

Appearance -

- 70% Technical - A clear, light amber liquid with a mild odor resembling burnt sugar which is free of visible suspended matter.

- 70% Cosmetic Grade - A clear, water white liquid which is free of visible suspended matter.

- 99% Reaction Grade - Clear, colorless crystals.

N/A = not applicable, not a specification

7/27/92

The information set forth herein is furnished free of charge and is based on technical data that Du Pont believes to be reliable. It is intended for use by persons having technical skill and at their own discretion and risk. Since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information. Nothing herein is to be taken as a license to operate under or a recommendation to infringe any patents.

# Technical Information

## GLYCOLIC ACID
## TEMPERATURE VS. SOLUBILITY

| TEMP., C | g GLYCOLIC ACID/solution |
|---|---|
| 15.0 | 0.673 |
| 11.5 | 0.665 |
| 10.0 | 0.662 |
| 5.0 | 0.650 |
| 0.0 | 0.638 |
| -5.0 | 0.626 |
| -10.0 | 0.614 |
| -15.0 | 0.602 |
| -18.0 | 0.595 |
| -20.0 | 0.590 |

The information set forth herein is furnished free of charge is based on technical data believed to be reliable by Du Pont and is intended for use by persons having technical skill and know-how. It may not be all inclusive and suitability to local codes and practices should be confirmed by the user. The information is given and accepted at the user's risk and Du Pont makes no guarantees or warranties, express or implied, and assumes no responsibility for results obtained or damages incurred from use of the information in whole or in part. Nothing herein is to be taken as a license to operate or a recommendation to infringe any patents.

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Du Pont Chemicals

MSDS MATERIAL SAFETY DATA SHEET

6019CR | Revised 09-Jul-92 | Printed 24-Aug-92

# "GLYPURE" HIGH PURITY GLYCOLIC ACID - 70%

## MATERIAL IDENTIFICATION

| | |
|---|---|
| Corporate Number | DU005927 |
| "GLYPURE" is a non-registered trademark of Du Pont. | |
| Manufacturer/Distributor | Du Pont<br>1007 Market Street<br>Wilmington, DE 19898 |
| Phone Numbers | Product Information 1-800-441-9442<br>Transport Emergency CHEMTREC: 1-800-424-9300<br>Medical Emergency 1-800-441-3637 |
| Grade | HIGH PURITY - 70% SOLUTION |
| Chemical Family | ORGANIC ACID, AQUEOUS SOLUTION |
| Trade Names and Synonyms | HYDROXYACETIC ACID<br>HYDROXYETHANOIC ACID<br>HAA |
| CAS Name | ACETIC ACID, HYDROXY |
| CAS Number | 79-14-1 |
| Formula | HO-CH2-COOH |
| TSCA Inventory Status | Reported/Included |
| NPCA-HMIS Ratings | Health: 3<br>Flammability: 0<br>Reactivity: 0<br>Personal Protection rating to be supplied by user depending on use conditions. |

## COMPONENTS

| Material | CAS Number | Percent |
|---|---|---|
| GLYCOLIC ACID | 79-14-1 | 63.6- |
| | | 64.5 |
| WATER | 7732-18-5 | 30.0 |
| | NOTE FOR GLYCOLIC ACID COMPONENT:<br><br>Free glycolic acid exists in equilibrium with higher molecular weight oligomers. | |

(continued)

## HEALTH HAZARD INFORMATION

This compound may cause burns and ulceration of the eyes, and is a severe skin irritant. Prolonged exposure may cause skin burns and ulceration. Inhalation may cause nose, throat, and lung irritation. Ingestion may cause burns and/or perforation of the gastrointestinal tract.

Gross overexposure may result in death.

ANIMAL DATA:

Inhalation 4-hour LC50: 7.7 mg/L in rats
Oral LD50 : 4,240 mg/kg in rats

The compound is corrosive in the eye, is a severe skin irritant, but is not a skin sensitizer in animals.

Toxic effects described in animals from a single exposure by inhalation include body weight losses, ocular and nasal discharges, and other nonspecific effects. Repeated inhalation exposures produced liver, spleen, and thymus changes, and gastrointestinal tract alterations. By ingestion, the administration of single high oral doses produced severe gastrointestinal tract irritation, liver damage, increased kidney weights, and the formation of calcium oxalate crystals in the kidneys. Repeated ingestion dosing in cats produced weight loss, depression, vomiting, coma, convulsions, kidney failure due to calcium oxalate deposition, and death. Dogs given similar and higher doses exhibited no toxic effects. Long-term dosing in male and female rats resulted in high mortality in the male rats (60-70%) and kidney toxicity due to calcium oxalate deposition. The female rats exhibited no toxic effects.

No animal test reports are available to define carcinogenic or developmental hazards. At high dietary levels, a reduced number of offspring were observed in rats, but this effect occurred only at a maternally toxic dose. The compound does not produce genetic damage in bacterial cell cultures, but it has not been tested in animals.

HUMAN HEALTH EFFECTS:

Human health effects of overexposure by eye or skin contact include eye corrosion with corneal or conjunctival ulceration, or severe skin irritation with discomfort or rash. Higher or prolonged contact with skin may cause burns or ulceration. By inhalation, the effects may include irritation of the respiratory passages with cough and difficulty in breathing. By ingestion, irritation of the gastrointestinal tract may occur with abdominal pain, nausea, vomiting, diarrhea, and abnormal kidney function.

Individuals with preexisting diseases of the skin, kidneys, or reproductive system may have increased susceptibility to the toxicity of excessive exposures.

| | |
|---|---|
| Carcinogenicity | None of the components in this material is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen. |

(continued)

## DISPOSAL INFORMATION (continued)

| | |
|---|---|
| **Spill, Leak, or Release** | NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.<br><br>Neutralize spills with lime or soda ash. Flush spill area with plenty of water. This material may be a CERCLA hazardous substance due to its corrosive characteristic. Unless released material is immediately cleaned up for reprocessing, recycling, or reuse, a release of 100 lbs. may trigger the reporting requirements of CERCLA. |
| **Waste Disposal** | Comply with Federal, State, and local regulations. If approved, may be neutralized with lime or soda ash and flushed to wastewater treatment system. This material may may be a RCRA hazardous waste due to its corrosive characteristic (pH). |

## SHIPPING INFORMATION

| | |
|---|---|
| Shipping Containers | Drums<br>Sample Bottles<br>NOT REGULATED AS A HAZARDOUS MATERIAL BY DOT OR IMO. |

## STORAGE CONDITIONS

Keep in a well-ventilated area. Protect bulk storage area from sparks and flame. Keep packages tightly closed. Store above 10 deg C (50 deg F) melting point.

## TITLE III HAZARD CLASSIFICATIONS

| | |
|---|---|
| Acute | Yes |
| Chronic | No |
| Fire | No |
| Reactivity | No |
| Pressure | No |

```
LISTS:

  Extremely Hazardous Substance     -No
  CERCLA Hazardous Substance        -(Yes)*
  Toxic Chemical                    -No

  *Not specifically listed by CERCLA, but product meets the
   generic corrosive category definition.

CANADIAN WHMIS CLASSIFICATION:

  E
```

(continued)



AB0000118519/8

MATERIAL IDENTIFICATION

GLYCOLIC ACID - 85% SOLUTION

MSDS NUMBER : DU005979

Revision Date : 18-Nov-92
Date Printed : 15-Dec-92

MANUFACTURER/DISTRIBUTOR

Du Pont
1007 Market Street
Wilmington, DE 19898

PHONE NUMBERS

PRODUCT INFORMATION : 1-800-441-9442
TRANSPORT EMERGENCY : CHEMTREC: 1-800-424-9300
MEDICAL EMERGENCY : 1-800-441-3637

GRADE : TECHNICAL
CHEMICAL FAMILY : ORGANIC ACID, AQUEOUS SOLUTION

TRADE NAMES / SYNONYMS

HYDROXYACETIC ACID
HYDROXYETHANOIC ACID
HAA

CAS NAME : ACETIC ACID, HYDROXY
CAS NUMBER : 79-14-1
FORMULA : HO-CH2-COOH
TSCA INVENTORY STATUS : Reported/Included
NPCA-HMIS RATINGS : Health: 3 Flammability: 0 Reactivity: 0
Personal Protection rating to be supplied by user depending on use conditions.

COMPONENTS

| Material | CAS Number | % |
|---|---|---|
| GLYCOLIC ACID | 79-14-1 | 85 |
| METHOXYACETIC ACID | 625-45-6 | 1.4-3.0 |
| DIGLYCOLIC ACID | 110-99-6 | 0.7-1.5 |
| WATER | 7732-18-5 | ~15 |

NOTE FOR GLYCOLIC ACID COMPONENT:

Free glycolic acid exists in equilibrium with higher molecular weight oligamers.

## HEALTH HAZARD INFORMATION

This compound may cause burns and ulceration of the eyes, and is a severe skin irritant. Prolonged exposure may cause skin burns and ulceration. Inhalation may cause nose, throat, and lung irritation. Ingestion may cause burns and/or perforation of the gastrointestinal tract.

Gross overexposure may result in death.

ANIMAL DATA:

GLYCOLIC ACID

Inhalation 4-hour LC50: 7.7 mg/L in rats
Oral LD50 : 4,240 mg/kg in rats

The compound is corrosive in the eye, is a severe skin irritant, but is not a skin sensitizer in animals.

Toxic effects described in animals from a single exposure by inhalation include body weight losses, ocular and nasal discharges, and other nonspecific effects. Repeated inhalation exposures produced liver, spleen, and thymus changes, and gastrointestinal tract alterations. By ingestion, the administration of single high oral doses produced severe gastrointestinal tract irritation, liver damage, increased kidney weights, and the formation of calcium oxalate crystals in the kidneys. Repeated ingestion dosing in cats produced weight loss, depression, vomiting, coma, convulsions, kidney failure due to calcium oxalate deposition, and death. Dogs given similar and higher doses exhibited no toxic effects. Long-term dosing in male and female rats resulted in high mortality in the male rats (60-70%) and kidney toxicity due to calcium oxalate deposition. The female rats exhibited no toxic effects.

No animal test reports are available to define carcinogenic or developmental hazards. At high dietary levels, a reduced number of offspring were observed in rats, but this effect occurred only at a maternally toxic dose. The compound does not produce genetic damage in bacterial cell cultures, but it has not been tested in animals.

METHOXYACETIC ACID

Inhalation 7-hour ALC: >3,200 ppm in rats
Oral LD50 : Approximately 1,000 mg/kg in rats

The compound is a skin and eye corrosive in tests with laboratory animals. Toxic effects described in animals from short, high inhalation exposures include respiratory irritation. By ingestion, the effects of single, high exposures include reduced body and testicular weights,

(HEALTH HAZARD INFORMATION - Continued)

exposure should be similarly controlled. At the MAA concentrations present in the product, no increased risk of adverse human health effects is expected.

Individuals with preexisting diseases of the skin, kidneys, or reproductive system may have increased susceptibility to the toxicity of excessive exposures.

CARCINOGENICITY

None of the components in this material is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

EXPOSURE LIMITS

GLYCOLIC ACID - 85% SOLUTION

AEL * (Du Pont): 10 mg/m3 - 8 & 12 Hr. TWA
TLV (ACGIH) : None Established
PEL (OSHA) : None Established

* AEL is Du Pont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

SAFETY PRECAUTIONS

Avoid breathing mist. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling.

## FIRST AID

INHALATION

If inhaled, immediately remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing before reuse.

EYE CONTACT

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION

If swallowed, do not induce vomiting. Give large quantities of water. Call a physician. Never give anything by mouth to an unconscious person.

## STORAGE CONDITIONS

Keep in a well-ventilated area. Protect bulk storage area from sparks and flame. Keep packages tightly closed. Store above 10 deg C (50 deg F) melting point.

## TITLE III HAZARD CLASSIFICATIONS

Acute : Yes
Chronic : No
Fire : No
Reactivity : No
Pressure : No

LISTS:

| | |
|---|---|
| Extremely Hazardous Substance | -No |
| CERCLA Hazardous Material | -(*) |
| Toxic Chemical | -No |

*See Disposal Information.

CANADIAN WHMIS CLASSIFICATION:

E

## ADDITIONAL INFORMATION AND REFERENCES

For further information, see Du Pont Glycolic Acid Properties, Uses, Storage, and Handling Bulletin.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS : W. J. Brock
Du Pont Chemicals
P. O. Box 80709, Chestnut Run
Wilmington, DE 19880-0709
302-999-4946

End of MSDS

Phil Moss

DUPONT

(302) 695-3914

Bob

ROBERT A. SMILEY
Research Fellow
Applications Support Group
New Business Development

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petrochemicals Dept.
Experimental Station, Bldg. 336/140
Wilmington, DE 19898

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Senior Chemist - Technical

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DUPONT

W. J. (JOE) FAASSEN
Manufacturing Manager
New Business Development

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petrochemicals Department
1007 Market St.
Wilmington, DE 19898

(302) 774-1819

Oxford STOCK

MADE IN U.S.A.

PART I

E. I. DU PONT DE NEMOURS AND COMPANY

ORGANIC CHEMICALS DEPARTMENT

ANALYTICAL PROCEDURE

ORCHEM METHOD 25-20-30-3C

# 3,4-DICHLOROANILINE (3,4-DCA)

## Assay by Gas Chromatography

### I-A Principle

This method is based on the gas chromatographic separation achieved when a sample of 3,4-dichloroaniline is injected into a gas chromatograph containing a column which utilizes SE-30 on Gas Chrom Z as the stationary phase.

### I-B Scope

1. Application

This method (Note 1) replaces all previous gas chromatographic methods as the specification method for the following grades of 3,4-dichloroaniline: 93, H, RH, C, and D.

The method determines the following components:

| Component | Retention Time (Min.) |
|---|---|
| Methylene chloride (Solvent) | 0.30 |
| Morpholine | 0.65 |
| Aniline | 1.1 |
| o-Dichlorobenzene | 1.5 |
| o-Chloroaniline | 2.0 |
| p-Chloroaniline | 2.6 |
| 2,5-Dichloroaniline | 4.4 |
| 2,3-Dichloroaniline | 4.8 |
| 3,4-Dichloroaniline | 6.3 |
| 3-Chloro-4-morpholinoaniline (MA) | 12.2 |
| Hydrazo Tars | 18.1 |

2. Limitations

Results are reported in Area %.

I-C Precision and Accuracy

Two samples were analyzed on each of two days by four analysts. The resulting 95% C.L. are 0.16% at a level of 99% 3,4-DCA, 0.14% for combined 2,3 and 2,5 isomers at a level of 0.7% and 0.04% for p-chloroaniline at a level of 0.1%.

I-D Special Apparatus (Equivalent apparatus may be used)

1. Gas Chromatograph, Hewlett-Packard, Model 5750, equipped with a flame ionization detector.
2. Chromatographic column, 6 ft. x 1/4 in. o.d., glass, packed with 10% SE-30 on 60 to 80 mesh Gas Chrom Z.

I-E Reagents

1. Helium, Liquid Carbonic Corp., Specification L-114.
2. Hydrogen, Matheson, Extra Dry.
3. Air, breathing, Liquid Carbonic Corp., Specification L-117.
4. Methylene chloride, reagent grade.

I-F Notes

1. This method up-dates and replaces Reference 1 which specified the use of a stainless steel column (4 meters x 1/8 in. o.d.) packed with Burnell silicone grease and a Perkin-Elmer Model 820 instrument.

I-G. References

1. Orchem Method 25-20-30-3B.

Original: R. E. Patterson
Process Dept.
June 28, 1967
Revision: A. Varon
Quality Control
July 28, 1971



AB0000114714/2

Safety Sheet No.

# 3,4-Dichloroaniline

## II-A Unusual Safety Considerations

1. Product Hazards

The product and most of its possible contaminants are cyanogenic and dermatitic. Avoid all skin contact and inhalation of vapors. Wash spills immediately with soap and water.

2. Procedure Hazards

Handle the syringe carefully and sheathe it when not in use.

## II-B Procedure

1. Instrument Settings

| Instrument | | |
|---|---|---|
| Mfg. Hewlett-Packard | | |
| Model 5750 | | |
| Detector | | |
| Thermal Cond. [ ] | | |
| Flame Ioniz. [x] | | |
| Hyd. 20 psig<br>Air 40 psig | | |
| Electron capture [ ] | | |
| Other | | |
| Carrier gas | | |
| He [x] | $N_2$ [ ] | Other [ ] |
| Rotameter = 2.5<br>Flow**** (at 70 psig) | | |

| Column | |
|---|---|
| Mat'l of Const. Glass | |
| Length* 6 ft. | 1/4 in. o.d. Diam** |
| Packing Substrate 10% SE-30 | |
| Packing*** 60-80 mesh<br>Support Gas Chrom Z | |
| Column Temp. °C. Program | Inject Temp. °C. 300 |
| Detec. Temp. °C. 300 | Max. Safe Temp. °C. |
| Programming | |
| Initial Column Temp., °C. 150 | |
| Temp. Rise/min., °C. 10 | |
| Temp. Limit, °C. 280 | |
| Pre-program Hold, min. 3 | |

* Specify units (in., ft., meters, etc.)

** Specify o.d. or i.d. and units

*** Specify mesh size

**** Specify as ml./min. or psig

Retyped 4/16/72

I-C Precision and Accuracy

Two samples were analyzed on each of two days by four analysts. The resulting 95% C.L. are 0.16% at a level of 99% 3,4-DCA, 0.14% for combined 2,3 and 2,5 isomers at a level of 0.7% and 0.04% for p-chloroaniline at a level of 0.1%.

I-D Special Apparatus (Equivalent apparatus may be used)

1. Gas Chromatograph, Hewlett-Packard, Model 5750, equipped with a flame ionization detector.

2. Chromatographic column, 6 ft. x 1/4 in. o.d., glass, packed with 10% SE-30 on 60 to 80 mesh Gas Chrom Z.

I-E Reagents

1. Helium, Liquid Carbonic Corp., Specification L-114.
2. Hydrogen, Matheson, Extra Dry.
3. Air, breathing, Liquid Carbonic Corp., Specification L-117.
4. Methylene chloride, reagent grade.

I-F Notes

1. This method up-dates and replaces Reference 1 which specified the use of a stainless steel column (4 meters x 1/8 in. o.d.) packed with Burnell silicone grease and a Perkin-Elmer Model 820 instrument.

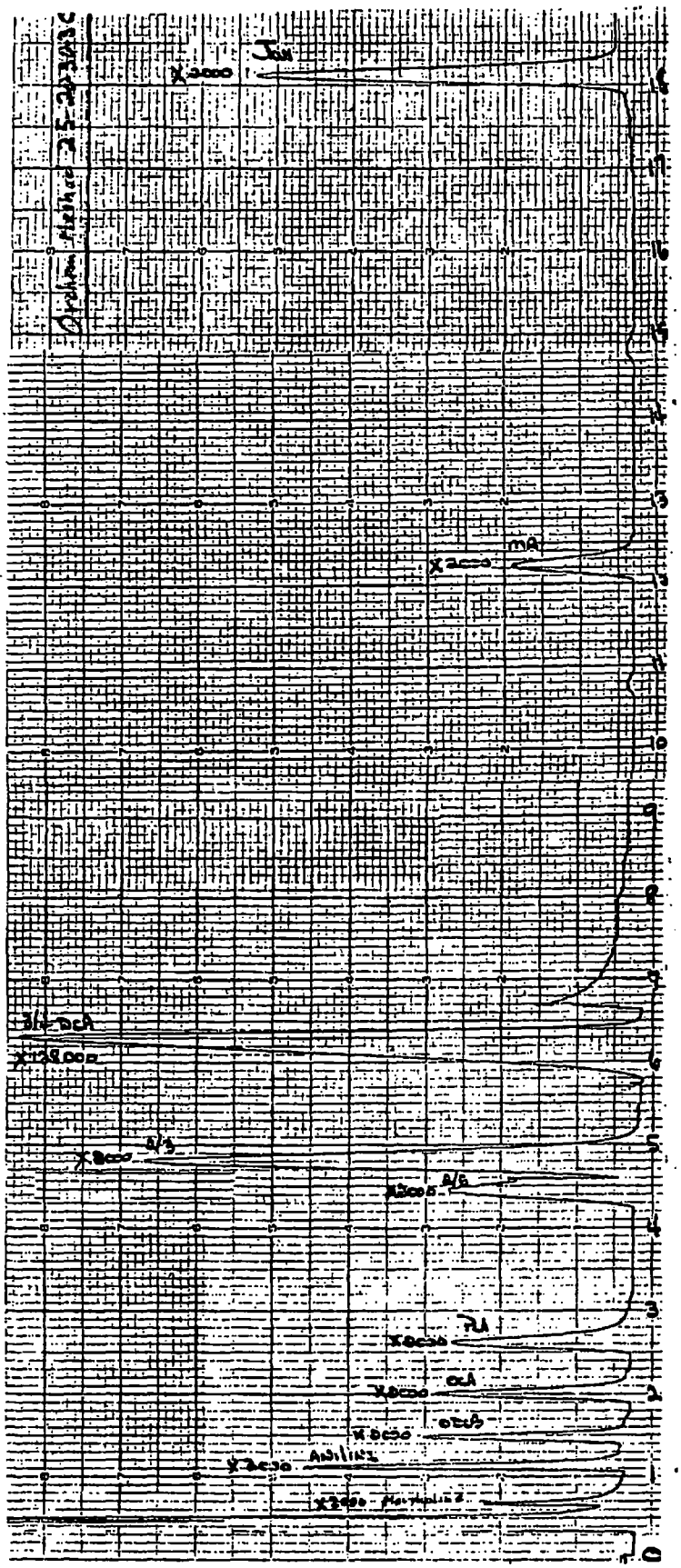
I-G. References

1. Orchem Method 25-20-30-3B.

Original: R. E. Patterson
Process Dept.
June 28, 1967
Revision: A. Varon
Quality Control
July 28, 1971



AB0000114714/4



CH-1003 REV. 2-83

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

CHEMICALS AND PIGMENTS DEPARTMENT
JACKSON LABORATORY
QUALITY CONTROL

November 26, 1990

To: Chuck Douty
Du Pont Chemicals
Jackson Laboratory

From: W. W. Kasper
Method Coordinator
Du Pont Chemicals
Jackson Laboratory, Quality Control

The attached analytical test methods are forwarded to you at your request, for transmittal to CEDAR under a secrecy agreement. These methods are used to determine the quality of Mixed Acid SP-15, 2-Etheylhexanol, 2-Ethylhexyl Nitrate, and Urea.

As part of our documentation upgrade, the methods followed by (P) are being or will be revised to our departmental format.

| Method No. | Test | Technique |
|---|---|---|
| E5600.005.01.CVP | Acidity | Titration |
| E5600.065.01.CVP | APHA Color | Comparison |
| E5600.120.01.CVP | Distillation Range | Distillation Range |
| E5600.165.01.CVP | Assay | Gas Chromatography |
| E5600.190.01.CV | Identification | Infrared Spectrophotometry |
| E5600.283.01.CVP | Refractive Index | Abbe Refractometer |
| E5600.310.01.CVP | Specific Gravity | Hydrometer |
| E6100.065.01.CVP | ASTM Color | Visual |
| E6100.165.01.CVP | Purity | Gas Chromatography |
| E6100.280.01.CVP | Acid Number | Potentiometric Titration |
| N8900.005.01.CVP | $H_2SO_4/HNO_3$ | Titration |
| N8900.220.01.CVP | $HNO_2$ | HPLC |
| N8900.310.01.CVP | Specific Gravity | Hydrometer |
| U3000.005.01.CVP | Free Ammonia | Titration |
| U3000.005.02.BEP | Total Nitrogen | Kjeldahl Method |
| U3000.015.01.CVP | Ash Content | Ash, Sulfated |

WWK/grm
W/Att.

cc: Bill Shackelford 11/11/85
cc: Miles
Jodie
Porter
Satterfield
Pace

DUPONT
ESTABLISHED 1802

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

AGRICULTURAL CHEMICALS DEPARTMENT

Agricultural Products Department

November 6, 1985

Mr. G. L. Pratt
Vertac Chemical Corporation
5100 Poplar
Memphis, TN 38137

Dear Geoffrey:

Enclosed is the equipment list you requested for the DCPI process currently used by our La Porte Plant. It includes size, material of construction, and other information on each equipment item. The information should be kept confidential per the secrecy agreement between Vertac and Du Pont.

You also requested my thoughts on which process Du Pont would use if we were to manufacture a high purity DCPI. I think our approach would be to look at what equipment is available and try to fit the process to that equipment. The present process using MBC solvent is known technology and in all probability could produce pure DCPI by adding a distillation step to remove the solvent. A second approach would be to change the solvent to allow DCPI to precipitate. Xylene or cumene are possibilities. This process change would require research work to develop the basic data needed for scale up. A filtration step would then replace the distillation step.

The no solvent process would definitely require considerable research effort but has certain benefits such as lower investment cost. This is a higher risk process since it has not been demonstrated.

Finally, the anisole process was developed to eliminate some of the problems caused by the trimethylamine (TMA) catalyst during refining of the DCPI. It did not eliminate the need for a solvent.

I am sure there are other approaches which have an equally good chance of success. Please feel free to contact me if you have any questions, or if I can be of further help.

Sincerely,

Donald W. Parman

Donald W. Parman

DWP:mlg
Enclosures

0529DWP/2

cc: Cover letter only

T N Kirchner
R J DeStefano-M&L



AB0000117561/1

## 1.0 DCPI Manufacture

| Fixed Asset No. | | | Ref. Drwg. P. O. No. |
|---|---|---|---|
| FAA- | East DCA Pump | | SKHO 3871 GH 22102 |
| | Location: | 1st Floor North | |
| | Manufacturer: | Milton-Roy | |
| | Serial #: | 108265 | |
| | Size: | Model AMR1-69-113 SMJ Simplex | |
| | Capacity: | 195 GPH | |
| | Construction: | 316 SS liquid ends, ball checks, ball seats, plunger, "Teflon"/ asbestos packing | |
| | MCN: | 11978 | |
| | Auxiliary: | 1. 1 hp 3, 60 cycle, 230/460 V., exp. proof NEMA C 1750 RPM motor.<br>2. Discharge surge dampening chamber. Pump aniline to Phosgenator. | |
| | West DCA Feed Pump | | |
| | Location: | 2st floor North | |
| | Manufacturer: | Duriron Co., Mach II | |
| | Serial #: | | |
| | Size: | 3" x 1-1/2" -13/11" | |
| | Capacity: | | |
| | Construction: | DCI cover, steam jacketed C/S stuffing box, type 9 seal | |
| | MCH: | 12749 | |
| | Auxiliary: | 7.5 HP, 1725 RPM motor | |
| FAA-316-342-1 EP 131-71 | Aniline Weigh Tank. | | BPF-116651 |
| | Location: | 1st floor Northwest | |
| | Manufacturer: | Pfaudler | |
| | Serial #: | | |
| | Size: | 60" x 33" high | |
| | Capacity: | 500 gal. | |
| | Construction: | Jacketed glass-lined steel | |
| | Project, MCN: | | |
| | Auxiliary: | 1. 5 HP, 1880 RPM motor, TEFC FAA 316-342-3<br>2. Agitator and Support FAA 316-342-2<br>3. Two 316 SS dip pipes<br>4. Glass covered thermowell<br>5. 3" 316 SS flush bottom valve | |



AB0000117561/2

1.0 DCPI Manufacture (continued)

| Fixed Asset No. | | Ref. Drwg. P.O. No. |
|---|---|---|
| | Aniline Weigh Tank (continued) | |
| | Auxiliary (cont) 6. Toledo tank scale, Model 2151, FAA 316-342-7<br>7. Vent condenser FAA 316-342-11 | |
| FAA-316-7021-01 | Phosgene Weigh Tank | BPF-167689<br>GHC 2477 |
| | Location: 4th floor South<br>Manufacturer: Newarc Welding & Fabr. Corp.<br>Size: 60" ID x 8' straight side<br>Capacity: 1410 gal.<br>Construction: Steel, horizontal, with dished heads<br>Project #: P9309<br>Serial #: 5921<br>Auxiliary: 1. Toledo tank scale<br>2. Double series 2" 3/16 SS D.B.P. 240 psig @ 112°C Holds phosgene from cylinders to feed Phosgenator<br>Design Pressure: 250 psig @ 150°F | |
| FAA-316-345-1 | TMA Addition Facilities | |
| | Location: 3rd floor Northwest<br>Manufacturer:<br>Serial #:<br>Size:<br>Capacity:<br>Construction:<br>MCN: 1188<br>Auxiliary: 1. Model IBIG Cuno filter w/Poroklean steel filters, passing particles less than 60-70 microns. GH3765<br>2. Flowmeter FAA 316-345-6, GH 38922, MCN 1188, Foxboro Integral Orifice Transmitter Type 13A, Serial #1120104, 0-53" $H_2O$, 0-0.488 SCFM air equivalent.<br>3. Weigh Scale FAA 316-345-1<br>4. Feed Valve FAA 316-345-2<br>5. Vaporizer FAA 316-345-5 | |



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1.0 DCPI Manufacture (continued)

| Fixed Asset No. | | | Ref. Drwg. P.O. No. |
|---|---|---|---|
| FAA 316-346-1<br>EP 131-125 | Phosgenator<br>Location:<br>Manufacturer:<br>Size:<br>Capacity:<br>Construction:<br>Auxiliary: | <br>3rd floor, Northwest<br>Pfaudler<br>66" x 70" high<br>1000 gal.<br>Jacketed glass-lined steel | SKHO-1245 |

1. 7-1/2 HP, 1750 RPM motor, TEFC FAA 316-346-3 to drive agitator.
2. Agitator drive and supports, RLBH high duty FAA 316-346-2
3. Glass covered 3 bladed agitator
4. Glass covered thermowell. Length from flange to tip is 86". Tip is oval, 9-1/2" long, 3-1/2" x 2" axis.
5. Two glass covered dip pipes.
6. Two Hastelloy C dip pipes 1-1/2" Sch 40 pipe clad inside and outside w/0.013" thick Ta. Dip pipe is 70" long w/3" tapered Ta section. Bottom outlet is 3/8" ID. MCN 1232, P.O. #GH42250.
7. One glass-covered paddle baffle. Baffle has 4 parts-nozzle, mid, paddle, & tip. Nozzle is 4" OD x 32 1/2" long. Mid changes from cylinder to flat, is 5" long. Paddle is 59 3/16" long, 2-1/8" thick, 7 3/4" wide. Tip is semi-circular, 3-5/16" radius.
8. Two Dore dip pipes, one a double pipe w/concentric separator & other a single tube. Double dip pipe is a #E930-235-84 w/a #E930-235-108 inside (Distillate Return/Nickel Condenser Return). Single dip pipe is a #E930-235-84 (MCB Absorber Reflux).
9. Double rupture disc 25 psig @ 220°F. Hast B - Au - Hast B.
10. Steam service facilities to jacket 15 lb. pressure controlled.
11. Water service facilities to jacket.



AB00000117561/4

1.0 DCPI Manufacture (continued)

| Fixed Asset No. | | | Ref. Drwg. P.O. No. |
|---|---|---|---|
| | Phosgenator (continued) | | |
| | Auxiliary (cont): | 12. Instrument systems<br>12.1 Temperature<br>12.2 Level<br>12.3 Phosgene feed<br>12.4 Off-gas rate measurement<br>12.5 Solvent feed<br>12.6 Aniline (DCA) feed<br>12.7 TMA feed<br>12.8 Off-gas temperature & pressure profile. | |
| | | 13. Reflux vapor separator 6" x 24" Hast B on return from MCB absorber. | |
| | | 14. Rupture disc vent separator w/a type DRR Hast B R/D B.S.P. is 50 psig @ 100°C. | |
| | Design Pressures: | Tank - 50psig to 29" Hg vacuum, jacket-65psig or 50 psig w/full vacuum in tank. | |
| FAA-316-346-41 | Phosgenator Transfer Pump | | |
| | Location: | 2nd floor Northwest | |
| | Manufacturer: | Duriron Co, Mark II | |
| | Serial #: | 67450 | |
| | Size: | 3" x 1-1/2", 10 1/2" Impeller | GH-39846 |
| | Capacity: | 100 GPM @ 110 TDH | |
| | Construction: | Chlorimet 3 (Hast C) on wetted surfaces | |
| | Project #: | 8729-2 | |
| | Auxiliary: | 15 HP, 1770 RPM motor | |
| FAA-316-363-1 | A Reboiler Preheater | | SKHO-1534 |
| | Location: | 4th floor South | |
| | Manufacturer: | Pfaudler | |
| | Size: | 2" pipe 12 sections 10' long | |
| | Capacity: | 60 $ft^2$ | GH-38139 |
| | Construction: | Jacketed glass-lined pipe | GH-38146 |
| | Auxiliary: | 1. Steam controlled by process exit temp. | |
| | | 2. Local exit temperature guage | |



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1.0 DCPI Manufacture (continued)

| Fixed Asset No. | | | Ref. Drwg. P.O. No. |
|---|---|---|---|
| FAA-316-365-01 | A Reboiler | | BPF-91864 |
| | Location: | 4th Mezzanine South | |
| | Manufacturer: | Pfaudler | |
| | Size: | 60" dia. x ~~33" high~~ see BPF-91864 | |
| | Capacity: | 500 gal. | |
| | Construction: | Jacketed glass-lined steel | |
| | Auxiliary: | 1. Glass coated level dip pipe | |
| | | 2. Glass coated thermowell | |
| | | 3. 5 HP TEFC motor FAA 316-365-3 | |
| | | 4. Glass coated agitator FAA 316-365-2 | |
| | | 5. Instrument systems | |
| | | 5.1 Temperature | |
| | | 5.2 Off-gas flow for A & B reboilers | |
| | | 5.3 Steam flow to jacket | |
| | | 5.4 Level | |
| | Design Pressures: | Tank - 50 psig or 29" Hg vacuum | |
| | | Jacket - 90 psig or 75 psig w/full vacuum in tank. | |
| FAA-316-365-18 | A Reboiler Transfer Pump | | SKHO-3360-3A |
| | Location: | 4th floor center North | |
| | Manufacturer: | Mission Valve & Pump Co. | |
| | Serial #: | 4696 | —— |
| | Size: | 1 x 1 1/2 Model PAT size 1 x 1 1/2, 7" impeller | 13753 |
| | Capacity: | 20 gpm at 44' TDH | |
| | Construction: | Solid "Teflon" | |
| | Project #: | P6704 | |
| | Auxiliary: | 1. 3/4 HP, 1750 motor | |
| FAA-316-365-30 | A Reboiler Transfer Pump | | |
| | Location: | 4th floor center South | |
| | Manufacturer: | Durco Mark II | |
| | Auxiliary: | 1. 10 HP, 1725 RPM motor. | |
| FAA-316-363-1 | B Reboiler Preheater | | SKHO-3360-3A |
| | Location: | 4th floor center | SKHO-3360-7 |
| | Manufacturer: | Pfaudler | |
| | Size: | 2" pipe, 12 sections 10' long | —— |
| | Capacity: | 60 ft$^2$ | |
| | Construction: | Jacketed glass-lined steel | GH-12756 |
| | Auxiliary: | 1. 150# steam service to jacket, pressure controller | |
| | | 2. Local steam pressure guage | |



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1.0 DCPI Manufacture (continued)

| Fixed Asset No. | | | Ref. Drug. P.O. No. |
|---|---|---|---|
| FAA-316-365-11 | B Reboiler | | BPF-91864 |
| | Location: | 4th Mezzanine center | |
| | Manufacturer: | Pfaudler | |
| | Size: | 60"dia. x ~~33" high~~ see BPF 91864 | |
| | Capacity: | 500 gal. | |
| | Construction: | Jacketed glass-lined steel | |
| | Auxiliary: | 1. Glass coated level dip pipe<br>2. Glass coated thermowell<br>3. Instrument systems<br>3.1 Temperature<br>3.2 Off-gas flow (A & B reboiler flow is combined)<br>3.3 Steam flow to jacket<br>3.4 Level | |
| | Design Pressures: | Same as A Reboiler | |
| FAA-316-365-27 (Idle) | B Reboiler Transfer Pump | | |
| | Location: | 4th floor West | |
| | Manufacturer: | Mission Valve & Pump Co. | |
| | Serial #: | 5755 | |
| | Size: | 1 x 1 1/2 Model PAT style B | GH 18492 |
| | Capacity: | 30 gpm at 50' head | |
| | Construction: | Solid "Teflon" | |
| | MCN: | 11855 | |
| | Auxiliary: | 1. 1 1/2 HP, 1750 RPM, TEFC motor<br>2. Crane #20 R Mechanical Seal. | |
| FAA-316-348-12 | Water Booster Pump. | | |
| | Location: | 1st floor outside SW corner | |
| | Manufacturer: | Duriron Company | |
| | Size: | Durco 4 x 3-10 centrifugal pump. 8" impeller. | |
| | Capacity: | 250 gpm at 50' TDH | 14166 |
| | Construction: | Ductile iron casing, bronze fittings, DC-8 shaft. | |
| | MCN: | 11776 | |
| | Auxiliary: | 10HP 3 phase 60 cycle 1750 RPM TEFC motor | |

Eliminated



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1.0 DCPI Manufacture (continued)

| Fixed Asset No. | | | Ref. Drwg. P.O. No. |
|---|---|---|---|
| FAA-316-369-2 | Nickel Condenser | | BPF-154894 |
| | Location: | 4th floor East central | |
| | Manufacturer: | Yuba Industries | ——— |
| | Size: | 15" ID, shell x10' (approx) | |
| | Capacity: | 168 ft$^2$ surface area | |
| | Construction: | 80-8' long 1" OD, 14 BWG nickel tubes, C/S tube sheets w/3/8" nickel liners, nickel bonnets & channel, 3/16" nickel lined steel covers, 304 SS tie rods & spacers, C/S shell 50 psig tubes, 150 psig shell 8" top inlet, 6" bottom outlet, 4" bottom side outlet, 2" water nozzles. | |
| | Auxiliary: | 1. Water flow measured by orifice. Full rate = 250 gpm. Water can be valved to bypass the condensor<br>2. Dial thermometer reading process exit temperature.<br>3. Sample points inlet vapor and outlet liquid lines.<br>4. Sight glass in outlet liquid line<br>5. Off-gas can be bypassed to MCB brine condenser. | |
| FAA-316-348-01 | MCB Brine Condenser | | SKHO-1081<br>SKHO-1083 |
| | Location: | 4th Mezzanine, NE | |
| | Manufacturer: | Engineers & Fabricators, Inc. | ——— |
| | Size: | 14" dia x 13'10", 195 ft$^2$ surface area | GH-34789 |
| | Capacity: | 81 tubes 1" OD 14 BWG x 10' long | |
| | Construction: | SS shell, Hastelloy C tubes, single pass, shell & tube. | |
| | Project #: | 4859 | |
| | Auxiliary: | Brine flow controlled by condensate temp. | |



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1.0 DCPI Manufacture (continued)

| Fixed Asset No. | | | Ref. Drwg. P.O. No. |
|---|---|---|---|
| FAA-316-348-06 | Phosgene Scrubber | | |
| L-131-44 | Location: | 4th Mezzanine East | |
| | Manufacturer: | Pfaudler | |
| | Size: | 16" dia x 12' overall length, 8' packing | GH-33457 |
| | Design pressure: | 50 psi @ 350°F | |
| | Capacity: | | |
| | Construction: | Glass lined steel, type 59 | |
| | MCN: | 888 | |
| | Auxiliary: | 1. 1.5" Kygar flexirings 11.2 ft³<br>2. Distributor plate<br>3. Pressure drop transmitter across column<br>4. Local inlet gas temp guage<br>5. Gas outlet temp recorded in Control Room. | |
| FAA-316-348-10 | Solvent Chiller | | |
| | Location: | 3rd level to Scrubber- new steel bay to roof of 4th floor | |
| | Manufacturer: | Constructed in field | |
| | Size: | 3/4" Sch. 10 pipe 66' long in four sections jacketed w/2" Sch. 40 pipe | |
| | Capacity: | 182 ft² area | |
| | Construction: | 316 S/C pipe w/ C/S jacket | |
| | W #: | 205191C | |
| | Auxiliary: | 1. Brine service to jacket flow controlled to maintain preset stream exit tamp.<br>2. Flow rate of process stream controlled from & indicated in Control Room.<br>3. Temp. of brine discharge locally indicated.<br>4. Orifice plate & caps provided for measurement of brine flow rate. | |



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1.0 DCPI Manufacture (continued)

| Fixed Asset No. | | | Ref. Drwg. P.O. No. |
|---|---|---|---|
| FAA-316-348-84 | MCB Absorber | | SKHO-1560 |
| L-131-29 | Location: | 4th Mezzanine East | SKHO-1418 |
| | Manufacturer: | Glascote Products, Inc. | |
| | Size: | 15 7/8 ID x 12' long | ——— |
| | Capacity: | 57" packed section, 6.6 $ft^3$ | |
| | Construction: | Hast C Heads and shell. | GH-38303 |
| | MCN: | 1133, 12859 | |
| | Auxiliary: | 1. 1.5" Kynar Flexirings | |
| | | 2. Hold down plate-Hast C | |
| | Internal Working Pressure: | 50 psig or full vacuum | |
| FAA-316-348-03 | -40°F Condenser | | SKHO-1119 |
| | Location: | 4th Mezzanine, NE | |
| | Manufacturer: | Engineers & Fabricators, Inc. | |
| | Size: | 48 - 1" OD tubes | ——— |
| | Capacity: | 150 $ft^2$ area | GH-33739 |
| | Construction | 316 SS shell & heads, Hastelloy C tubes, one pass | |
| | Auxiliary: | 1. Freon supply to shell | |
| | | 2. Automatic level control of freon in shell | |
| FAA-316-348-09 | -100°F Condenser | | BPF-151363 |
| | Location: | 4th Mezzanine, East | BPF-7887 |
| | Manufacturer: | Adsco Div., Yuba Consolidated Ind., Inc. | ——— |
| | Size: | 16" ID x 13' 1 3/4" overall length, 12' tube length | |
| | Capacity: | 150 $ft^2$ | |
| | Construction: | Hastelloy C tubes, 304 SS shell, 316L SS tube sheets and heads, two pass horizontal | |
| | Auxiliary: | 1. Freon supply to shell | |
| | | 2. Automatic level control on Freon in shell. | |
| | | 3. Temp. of inlet gas recorded in instrument control room. | |
| | | 4. Temp of exit gas recorded in instrument control room | |
| | | 5. Electrical tracing on drain | |

1.0 DCPI Manufacture (continued)

| Fixed Asset No. | | | Ref. Drwg. P.O. No. |
|---|---|---|---|
| FAA-316-348-11 | -100°F Separator | | BPF-152044 |
| | Location: | 4th Mezzanine | |
| | Manufacturer: | Allied Steel | |
| | Size: | 16" x 18" vert. | ——— |
| | Capacity: | 15 gal. | 2175-1/2 |
| | Construction: | 316L SS, vert. | |
| | Project #: | 1214 | |
| | Auxiliary: | Sample valves in off-gas line. | |
| FAA-316-351-01 | -40° Compressor | | SKHO-839 |
| | Location: | Low roof | |
| | Manufacturer: | York Refrigeration Co. | |
| | Size: | 8 cylinder Model ~~F-3089-90E~~ | ——— |
| | Capacity: | 12 tons at -40°F | |
| | Auxiliary: | 1. 50 HP 1750 RPM ~~motor~~ FAA-316-351-2 ~~Allis-~~ Chalmers ~~#1-5125-31171-1-1~~ | |
| | | 2. Four-stage capacity reduction control. | |
| FAA-316-351-04 EP-131-810 | -100°F Compressor | | |
| | Location: | Low roof | |
| | Manufacturer: | York Refrigeration Co. | |
| | Size: | 16 cylinder Model ~~F-3169-90E~~ | |
| | Capacity: | 5 tons at -100°F | |
| | Auxiliary: | 1. 40 HP 1750 RPM ~~motor~~ FAA-316-351-5 ~~Allis-~~ Chalmers ~~#1-6126-80248-1-1~~ | |
| | | 2. Four-stage capacity reduction control. | |
| FAA-316-351-09 | Expansion Valves and Intercooler | | |
| | Location: | 4th Mezzanine E of Nickel Cond. | |
| | Manufacturer: | Alco | |
| | Size: | TCLE3HW - South<br>TCLE5HW - North<br>TB1019HW48 | |
| | Capacity: | South - 3 tons<br>North - 5 tons | |



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1.0 DCPI Manufacture (continued)

| Fixed Asset No. | | | Ref. Drwg. P.O. No. |
|---|---|---|---|
| FAA-316-351-10<br>EP 131-810 | Freon Condenser - York | | BPF-131155 |
| | Location: | Low roof | |
| | Manufacturer: | York Refrigeration Co. | |
| | Serial #: | 07-1812 | |
| | Size: | Model MC1606-4F shell and tube | |
| | Capacity: | 168 5/8" copper finned tubes 72 7/32" Long | |
| | Construction: | Steel shell, copper tubes - four-pass gas side, two-pass brine. | |
| | Auxiliary: | 1. Brine service<br>2. Dehydrator | |
| FAA-316-351-11 | Freon Receiver - York | | |
| | Location: | Low roof | |
| | Manufacturer: | York Refrigeration Co. | |
| | Size: | Model 3010 | |
| | Capacity: | 3000 lbs liquid "Freon" 22 (75%) & "Freon" 12 (25%) | |
| | Construction: | Steel | |
| | Auxiliary: | Level instrument | |
| FAA-316-369-01 | Vacuum Flash Tank | | BPF-158518<br>SKHO-3360-6 |
| | Location: | 4th & 5th level, new steel bay | |
| | Manufacturer: | Nooter | |
| | Size: | 2'6" OD x 3/16" thick x 18' high | |
| | Capacity: | 635 gal. | |
| | Construction: | Nickel | |
| | Project #: | 6704 | |
| | Auxiliary: | 1. Level control in Control Room<br>2. Pressure in tank controlled by split range system on $N_2$ feed to jets.<br>3. Feed nozzle is 8" dia pipe w/45° elbow to direct flashing fluid along the wall & downward at a 45° angle. Nozzle is in 10° Van-Stone flange to permit continuous rotation of elbow to change direction of inlet stream.<br>4. 8" top nozzle<br>5. Temp. recorded in Control room | |

1.0 DCPI Manufacture (continued)

| Fixed Asset No. | | | Ref. Drwg. P.O. No. |
|---|---|---|---|
| FAA- | Vacuum Flash Transfer Pump | | |
| | Location: | 3rd level new steel bay | — |
| | Manufacturer: | Duriron Co., Inc. | |
| | Size: | 3 x 2-7, Durco Mark II, 6" impeller | GH 16558 |
| | Capacity: | 80 gpm at 31' head | |
| | Construction: | Durimet 20 | |
| | Auxiliary: | 1. 1750 RPM 5 HP TEFC motor<br>2. Crane 9 seal | |
| | Serial #: | 111298 | |
| FAA-316-369-03 | Vacuum Flash Condenser | | BPF-154894 |
| | Location: | 6th level new steel bay | |
| | Manufacturer: | Adsco Div., Yuba Consolidated Ind. | — |
| | Serial No: | S-56847-2 | GHC 2117 1/2 |
| | Size: | 12 3/4" shell OD, 14' | |
| | Capacity: | 150 $ft^2$ | |
| | Construction: | 48 1" OD x 12' 14 BWG nickel tubes, C/S shell, type OPFH | |
| | Project #: | 6704 | |
| | Auxiliary: | 1. Process water service to shell<br>2. Water flow manually adjusted by local valve. Condensate temp. locally indicated<br>3. Pressure drop indicated in control room. | |
| FAA-316-369-5 | Vacuum Flash Jet System | | |
| | Location: | 6th level, new steel bay | |
| | Manufacturer: | Graham | — |
| | Serial #: | Primary Condenser: 3907<br>Secondary condenser: 3908<br>Secondary jet: 6829-69-3 | GH-12950 |
| | Graham Job #: | 6829-JC-69 | |
| | Size: | Two-stage Model 98-6 x 9.4C - 6 x 9 | |
| | Capacity: | 50mm Hg 50 pph $N_2$, 8 pph $COCl_2$, 8 pph HCl, 1.5 MCB | |
| | Construction: | Inter & after vertical surface condensers. Ejectors-plastic armored impervious graphite Hastelloy C lined steam chest, Hastelloy C nozzle. Condensers - Impervious graphite tube C/S shell | |



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1.0 DCPI Manufacture (continued)

| Fixed Asset No. | | Ref. Drwg. P.O. No. |
|---|---|---|
| FAA-316-369-5 | Vacuum Flash Jet System (continued) | |
| | Project #: 6704 | |
| | Auxiliary: 1. Local pressure gage in vapor feed line. | |
| | 2. Steam pressure gages. | |
| | Vacuum Flash Jets Condenser Seal Pot | |
| | Location: Pump House roof | |
| | Manufacturer: Flourodynamics | — |
| | Size: 2' dia - 3' high 59 gal full - 30 gal to overflow | GH 12567 |
| | Construction: FRP shell - "Teflon" lining | |
| | Auxiliary: 1. 3" top nozzle blanked | |
| | 2. 2" top nozzle - overflow to ditch | |
| | 3. 3" side nozzle overflow to LSPD | |
| | 4. 3" bottom inlet from V/F jets condensers | |
| FAA-316-368-17 | Vacuum Flash Distillate Hold Tank | BPF 154856 |
| | Location: Ground level, steel bay | |
| | Manufacturer: Matthew Corcoran Co. | — |
| | Size: 4' OD x 5" high vert. tank w/dished heads | |
| | Capacity: 535 gal. | |
| | Construction: Nickel throughout. 1/4" walls, 5/16" heads | |
| | Project #: 6704 | |
| | Auxiliary: 1. LT 688, LG 688 remote | |
| | 2. 22" side manhole, 6" flush bottom 2-2" bottom nozzles, 2" side nozzle, 10" center nozzle on top, 3-2", 2-4", 1-6" nozzles. | |
| | 3. Distillate return measured by orifice in 1" pipe, 1.1 gpm at 30" $H_2O$. | |
| FAA-316-368-21 | Vacuum Flash Distillate Pump | |
| | Location: Ground level, steel bay | |
| | Manufacturer: Duriron Co. | — |
| | Size: HD2X-084 | |
| | Capacity: 15 gpm, 130' TDH | GH 2104-142 |
| | Project #: 6704 | |
| | Auxiliary: 1. 7 1/2 HP, 3530 RPM motor | |

1.0 DCPI Manufacture (continued)

| Fixed Asset No. | | | Ref. Drwg. P.O. No. |
|---|---|---|---|
| | Vacuum Flash Distillate Preheater | | |
| | Location: | 3rd level steel bay (stairs to door) | |
| | Size: | 9' of 2" steam jacketed pipe | |
| | Auxiliary: | Inlet & outlet temp. gauges | |
| FAA-312-339-1(S) FAA-312-339-40 (N) | Stripped Phosgenate Hold Tanks | | |
| | Location: | Tank Farm | |
| | Manufacturer: | Pfaudler | |
| | Size: | S - 11' dia-18'4" long | |
| | | N - 11' dia-20' long | GH 41857 (S) GH 26186 (N) |
| | Capacity: | 15,000 gal. | |
| | Construction: | Glass-lined steel | |
| | Project #: | 1478 (S) 2501 (N) | |
| | Auxiliary: | 1. Thermowell | |
| | | 2. 20" dia manhole w/hinged cover | |
| | | 3. Rupture disc assembly - 12 psig @ 72°F, FAA-312-339-3, GH 43272, GH 43494, 316-TEF-Hast | |
| | | 4. 3" Durco plug valve-Hastelloy C for discharge | |
| | | 5. Glass lined, tantalum tipped feed dip pipe | |
| | | 6. Temp - local & transmitted to Control Room. | |
| | | 7. Pressure - local and transmitted to Control Room. | |
| | | 8. Level - local & recorded in Control Room | |
| | | 9. Steam traced and fully insulated | |
| FAA-312-339-5 | Stripped Phosgenate Transfer Pump (North) | | |
| | Location: | Tank Farm | |
| | Manufacturer: | Duriron Co. | |
| | Size: | Type Mark II - 3 x 1 1/2-13, A20 | |
| | Capacity: | 150 gpm at 120' TDH | GH 41587 |
| | Construction: | "Chlorimet 3" (Durco equiv. of Hast. C) | |



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## 2.0 HCl Recovery

| Fixed Asset No. | | | Ref. Drwg. P.O. No. |
|---|---|---|---|
| FAA-316-352-01<br>EP 131-152 | **HCl Absorber Cooler** | | BPF 130757, Sh. 1 |
| | Location: | 3 & 4 levels, steel bay | |
| | Manufacturer: | Falls Industries, Inc. | |
| | Size: | 139" overall, shell 20" dia.<br>55 7/8" ID x 1 1/4" OD tubes<br>102 3/4" long | |
| | Capacity: | 108 $ft^2$ surface area | |
| | Construction: | Impervite tubes, SS shell | |
| | Auxiliary: | 1. Hastelloy B pipe<br>2. Process water service facilities<br>3. Instrument systems<br>3.1 Specific gravity<br>3.2 Temperature<br>3.3 Measurement of vapor feed by 2.024" orifice in 4" pipe, 1075 pph at 10" $H_2O$ P. | |
| FAA-316-352-08<br>EP 131-153 | **Tails Tower** | | BPF 130757, Sh. 2 |
| | Location: | 5th level, steel bay | |
| | Manufacturer: | Falls Industries, Inc. | |
| | Size: | 110 5/8" overall length<br>66" length x 15 1/2" ~~dia.~~<br>of packing | |
| | Capacity: | | |
| | Construction: | Impervite | |
| | Auxiliary: | 1. 1" carbon Raschig rings packing 7.2 $ft^3$<br>2. Process water service facilities - water controlled by HCl Sp. Gr.<br>3. Instrument systems<br>3.1 Temperature | |
| FAA-316-352-19<br>EP 131-154<br>L 131-40 | **HCl Recirculation Tank** | | D 74865 |
| | Location: | 2nd level, steel bay | |
| | Manufacturer: | Pfaudler | |
| | Size: | 66" OD x 66" | |
| | Capacity: | 1000 gal. | |
| | Construction: | PCW glass-lined | |
| | Auxiliary: | 18" manhole - 2-3" type<br>DV graphite R/D 20 psig @ 360°F., Saran lined specific gravity chamber | |



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2.0 HCl Recovery (continued)

| Fixed Asset No. | | | Ref. Drwg. P.O. No. |
|---|---|---|---|
| FAA-316-352-12 | HCl Recirculation Pumps | | |
| FAA-316-352-14 | Location: | Pump House | |
| EP 131-155 | Manufacturer: | Duriron Model 5PBUR | — |
| | Serial #: | 59717, 59718 | |
| | Size: | 6" impeller | GH 36013 |
| | Capacity: | 65 gpm @ 40' TDG @ 1750 TPM | |
| | Construction: | Durcon 5 carbon filled epoxy | |
| | MCN: | 993 | |
| | Auxiliary: | 3 HP, 1740 RPM motor<br>FAA 316-352-13<br>FAA 316-352-15 | |
| FAA-316-352-22 | HCl-MCB Absorbers (2) | | |
| FAA-316-352-23 | Location: | 2nd & 3rd level steel bay | |
| | Manufacturer | HAVEG | |
| | Size: | 2' x 12' | — |
| | Construstion: | H-41 | |
| | Project #: | ?1527 | 1856403041 |
| | Auxiliary: | Activated carbon packing | |
| FAA-311-336-02 | HCl Storage Tank | | BPF 130755 |
| | Location: | Tank Farm | |
| | Manufacturer: | B.F. Goodrich | |
| | Size: | 9' dia., 36' long horizontal | — |
| | Capacity: | 17,500 gal. | |
| | Construction: | Rubber lining | |
| | Auxiliary: | 1. 22" OD manhole cover rubber lined<br>2. 1-2" Sch. 80 "Kynar" inlet pipe, 3'10" into tank.<br>3. 1-2" Sch. 80 "Kynar" pump suction pipe 11'0" into tank<br>4. 1-2" Sch. 80 "Kynar" level dip pipe, 9' 4 1/2" into tank.<br>5. 5/8" polypropylene intalox saddles in vent scrubber | |



AB0000117561/17

| Fixed Asset No. | | | Ref. Drwg. P.O. No. |
|---|---|---|---|
| FAA-311-336-05 | HCl Loading Pump | | |
| | Location: | Tank Farm | |
| | Manufacturer: | Durco | — |
| | Size: | | |
| | Capacity: | | |
| | Construction: | Durichlor | |
| | Auxiliary: | 10 HP 3500 RPM motor | |

E. I. Du Pont De Nemours & Company, Inc.
Agricultural Products Department
Wilmington, Delaware

# CONTRACTOR'S MANUAL

## METHOMYL INSECTICIDE

### SYNTHESIS

DU PONT CONFIDENTIAL INFORMATION
SPECIAL CONTROL

MANUAL NUMBER 10

WHEN NO LONGER NEEDED, PLEASE RETURN TO:

E. I. Du Pont De Nemours & Co., Inc.
Agricultural Products Department
Contract Manager, Manufacturing Division
Walker's Mill, Barley Mill Plaza
Wilmington, Delaware 19898

Prepared by:
A.J.Sepcie
January 1986

CONTRACTOR MANUAL

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## INTRODUCTION

The purpose of this manual for Methomyl Insecticide is to document the product formula, process and packaging.

For general guidelines concerning Safety and Environment, Quality, Production or Accounting Procedures, refer to your "Guidelines and Instructions for Contractors" manual. If you do not have a copy of this manual, contact your Du Pont Contract Administrator.

THE FOLLOWING INFORMATION IS BASED ON TECHNICAL DATA THAT DU PONT BELIEVES ARE RELIABLE. IT IS INTENDED FOR USE BY PERSONS HAVING TECHNICAL SKILL AND AT THEIR OWN DISCRETION AND RISK. SINCE CONDITIONS OF USE ARE OUTSIDE OUR CONTROL, WE MAKE NO WARRANTIES, EXPRESS OR IMPLIED, AND ASSUME NO LIABILITY IN CONNECTION WITH ANY USE OF THIS INFORMATION. THE INFORMATION AND DATA IN THIS MANUAL MAY NOT BE SUFFICIENT FOR EQUIPMENT DESIGN OR SIZING.

The information in this manual is to be considered CONFIDENTIAL. The Contractor shall not furnish it to any third party without prior written permission of Du Pont.

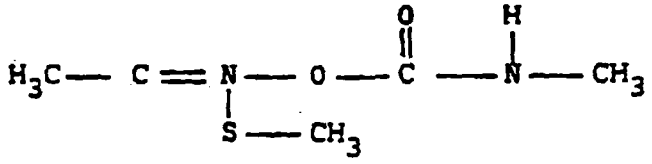
## I. DESCRIPTION OF PRODUCT MANUFACTURE & FLOWSHEET

### A. Product Description

Methomyl is a fast acting, broad spectrum, contact, carbamate insecticide. It is applied in relatively low doses and degrades rapidly and totally. The insecticide provides short-term residues on plants which usually last for 1 to 2 days depending on rates applied, size of larvae, external conditions, etc. The contact kill on insects is supplemented by additional kill as insects feed on treated plants. Maximum insect kill is reached in about 2 days.

#### PHYSICAL PROPERTIES

1. COMMON NAME: METHOMYL INSECTICIDE
2. CHEMICAL NAME: S-METHYL-N-[(METHYLCARBAMOYL)OXY] THIOACETIMIDATE
3. PRODUCT APPLICATION: INSECTICIDE
4. DOT HAZARD CLASSIFICATION: POISON, B
5. EMPIRICAL FORMULA: (METHOMYL) $C_5H_{10}N_2O_2S$
6. MOLECULAR WEIGHT: (METHOMYL) 162.2 GM/MOLE
7. STRUCTURAL FORMULA: (METHOMYL)



8. PHYSICAL FORM (25°C): (METHOMYL) CRYSTALLINE SOLID
9. DENSITY: (METHOMYL IN MCL) APPROX. 11 LB./GAL.
10. ODOR: MILD CABBAGE-LIKE ODOR
11. COLOR: (METHOMYL) WHITE CRYSTALLINE SOLID



AB0000118615/4

1. DESCRIPTION OF PRODUCT MANUFACTURE & FLOWSHEET (cont'd)

A. Product Description (cont'd)

PHYSICAL PROPERTIES (cont'd)

12. STABILITY: STABLE UNDER NORMAL CONDITIONS

13. MELTING POINT: (METHOMYL) APPROX. 78°C

14.

| MATERIALS | FORM @ 25°C | PURPOSE |
|---|---|---|
| METHOMYL | SOLID | ACTIVE INGREDIENT |
| MTAAO | SOLID | INTERMEDIATE |
| MONOMETHYL AMINE | LIQUID | REACTANT |
| PHOSGENE (IN CYLINDERS) | LIQUID | REACTANT |
| HCL | LIQUID | pH CONTROL |
| CAUSTIC | LIQUID | pH CONTROL |
| METHYLENE CHLORIDE | LIQUID | SOLVENT |
| WATER | LIQUID | SOLVENT |

15. DUST EXPLOSIBILITY

| ITEM | METHOMYL TECH |
|---|---|
| MIN. IGNITION ENERGY (M-JOULE) | 150 |
| LOWER EXPLOSIVE LIMIT (MG/L) | 70 |
| MAXIMUM PRESSURE (PSI) | 95 |
| RATE OF PRESSURE RISE (PSI/SEC) | |
| AVERAGE | 1760 |
| MAXIMUM | 6060 |

I. DESCRIPTION OF PRODUCT MANUFACTURE AND FLOWSHEET (cont'd)

B. Process Description

1.0 Process Description, General

Phosgene and a base solution of monomethyl amine and caustic are added simultaneously to a water/MCl mixture of MTAAO at a pH of 10.5 and temperature less than 25°C. At completion, the pH is reduced to 7.0 with phosgene or HCl. The active ingredient is then extracted 2 or 3 times with methylene chloride and sent to solvent exchange. The brine material is sent to waste disposal. The product is then stored or loaded into tank trucks for further processing.

2.0 Raw Materials Preparation

MTAAO Intermediate
The intermediate MTAAO, is received in 50 lb. or 25 kg bags. The MTAAO is dumped from bags and slurried with methylene chloride and water in an agitated vessel. The slurry pH will vary from 3 to 10. The mixture is to be made with 15 wt. % MTAAO and equal wt % of water and MCl. Do not cool the slurry in this feed tank because it will become thick and plug up transfer lines. However, product cooling time in the reactor may be reduced by pumping through the reactor cooler when charging the reactor. Flush the transfer line with approximately 20 gallons of water after the slurry is in the reactor.

Base Mix
The base mix is prepared in the base mix feed tank by adding 40% MMA to 25% caustic. Approximately two moles MMA and three moles of caustic are needed per mole of MTAAO. The caustic must be cooler than 25°C before adding the MMA to avoid flashing of the MMA and building pressure or losing material through a vent. Use of 50% caustic is not recommended because the heat of dilation would cause the MMA to boil when added. The MMA should be mixed at a 100% molar excess to MTAAO, which provides sufficient MMA for conversion. Isolating the base mix tank from the amine scrubber during preparation is necessary to avoid losses of MMA.

Amine Scrubber
Amines are easily scrubbed from a vent stream by feeding the vent to a packed column with a continuous stream of water circulating from a reservoir over the column. Except for the phosgenator, vessels containing amines should be vented to the amine scrubber.



AB0000118615/6

I. DESCRIPTION OF PRODUCT MANUFACTURE AND FLOWSHEET (Cont'd)

B. Process Description (cont'd)

2.0 Raw Materials Preparation (cont'd)

Caustic Scrubber
The caustic scrubber should be designed to circulate a 7.5 to 15% caustic solution over a packed column capable of absorbing a minimum of 2000 lbs. of phosgene (one full cylinder). The pH will normally be above 13 and should be checked routinely to determine if the solution needs to be changed.

3.0 Batch Reaction Phosgenation

Once a full batch size of MTAAO is prepared, it is pumped to a glass lined agitated reactor and cooled to 10 to 15°C. A prepared base mixture of mono-methyl Amine and caustic are readied in a separate feed tank. When the reaction mass is cooled, a small amount of the base feed is added to the MTAAO slurry to bring the reactor material pH to 10.5. The reaction generates a considerable amount of heat (approximately 2M BTU/lb. of methomyl) and normally requires an external cooler with brine cooling. The feed rate will be determined on the heat removal capacity of the contractors system. Base feed mix and phosgene must be added below the surface of the liquid to avoid losses through the vent system. Phosgene may be a vapor or liquid feed to the reactor. If vapor is chosen, a vaporizer will most likely be necessary.

Once the pH is set, phosgene and base feed are added simultaneously to the reaction mixture. The pH must be maintained at 10.5 +0.5 units, and the temperature kept below 25°C. Low and high pH alarms should be set at 9 and 11 respectively. Reaction completion is when all the base feed is added to the reaction mixture.

Control of pH is important. If the pH is too high, the product is destroyed. If the pH is too low, the reaction will not take place. An internal or external pH measurement device is acceptable. Although caustic is used to keep the pH high, the control variable may be either the base mix or phosgene. What this means is that the base mix or phosgene would be added at a constant rate and the other material would vary to control pH.

The reactor is vented to a condenser which is brine cooled. The condensed liquid is returned to the reactor and vapors go to the caustic scrubber.



AB00001186157/7

I. DESCRIPTION OF PRODUCT MANUFACTURE AND FLOWSHEET (Cont'd)

B. Process Description (cont'd)

4.0 Reactor Neutralization

After all the base mix is added, phosgene may continue to be added to stop the reaction and stabilize the product by bringing the pH down to 6.5 to 7.5. HCl may be used as an alternate for neutralization. Foaming may occur as the pH is lowered and carbonates are neutralized. A sample of the reaction mixture should be taken and checked for the amount of unreacted MTAAO in the batch. Results should be less than 2.0%, with normal less than 1.0.

Once reaction and neutralization are complete, the mixture is pumped to a storage tank or another agitated glass lined vessel for extraction of the active methomyl. The reactor cooler is taken off-line and allowed to drain the product back to the reactor. Brine cooling is valved off to the reactor jacket and cooler. The reactor and cooler are flushed with a minimal amount of water (15 to 20 gallons or until the liquid is clear) and added to the reaction mixture. Failure to flush could cause the cooler to plug. Flush the cooler a second time before transferring in a new batch of MTAAO. Leave this in the reactor with the incoming batch.

5.0 Product Extraction

The extraction vessel should be large enough to hold the reaction batch. Extraction of the reaction batch is done two or three times with MCl, which may be fresh or recovered material. If the reactor is not the limiting piece of equipment, the reaction mix may be first separated in the reactor. The bottom phase will be the product/MCl phase, and after each extraction/settling step, this phase is cut and pumped to a solvent exchange vessel. The upper phase is a brine solution, and after the final extraction it is sent for waste treatment. The extractor should be vented to the amine scrubber only during the addition of MCl in the event a vapor release occurs and causes an increase of pressure. Normally MCl is added to the reaction mix, the mixture is agitated for 20 to 30 minutes, and then allowed to settle for 15 to 20 minutes before being separated.

I. DESCRIPTION OF PRODUCT MANUFACTURE AND FLOWSHEET (cont'd)

B. Process Description (cont'd)

5.0 Product Extraction (cont'd)

The interface between the brine and product/MCl phase has a dark colored "rag" layer which must not be transferred with the product, it is to be sent with the brine layer for waste treatment. After the final extraction and transfer, flush the brine line with 15 gallons of water to clean any residual "rag" material. The contractor must determine an extraction process that works best with his equipment. Below is one extraction process that has been used successfully.

| Extraction Step | Amt of MCl (% of RX.MIX) | Mix Time (MIN.) | Settle Time (MIN.) |
|---|---|---|---|
| 1st Extraction | 35 | 30 | 20 |
| 2nd Extraction | 14 | 20 | 15 |
| 3rd Extraction | 14 | 20 | 15 |

Methomyl losses with the brine water must be kept to a minimum.

Methomyl concentration in the final product/MCl solution should be 25-35%.

6.0 Product/Solvent Storage

The product/MCl extract may be held in an intermediate storage tank or loaded into MC 307 stainless steel tank trucks. The storage tank may be 316L stainless steel or glass lined.

7.0 Unit Consumption

Since this is a batch process, the consumption of raw materials should not vary greatly under normal conditions. Below are the expected material consumptions per pound of methomyl:

| Raw Material | Methomyl U/C |
|---|---|
| MTAAO | .69 |
| Phosgene | .99 |
| MMA | 2.36 |

Caustic, HCl and Methylene Chloride consumptions will vary. Process control and waste treatment are the primary areas for these materials losses.

8.0 Bulk Product Loading/Unloading

Methomyl/MCl solution should be loaded into MC 307 stainless steel tank trucks through the bottom outlet nozzle. Grounding is necessary to minimize static charge build-up.



AB0000118615/9

## METHOMYL IN METHYLENE CHLORIDE SPECIFICATIONS FOR PRODUCTION AT GREAT LAKES CHEMICAL

| ITEM | SPECIFICATION | METHOD |
|---|---|---|
| Yield from MHTA, % | 95% Min. | * |
| Methomyl, % | 30.0 - 35.0 | * |
| MHTA, % | 0.5 Max. | * |
| pH, % | 6.0 - 8.0 | * |
| DMU, % | | * |
| Water, % | | * |

*Methods to be defined by Great Lakes and agreed to by Du Pont Research and La Porte Control Laboratory.

0390JHL/2

E. I. DU PONT DE NEMOURS & COMPANY
AGRICULTURAL PRODUCTS DEPARTMENT

May 26, 1987
ISSUE NO. 2
SUPERSEDES: 4/18/86

XC: BE
Info
DVH
2/10

QUALITY MANUFACTURING SPECIFICATION

L-18

LINURON TECHNICAL

| ITEM | SPECIFICATION | AVERAGE ANALYSIS 1986 | STD METHOD OF ANALYSIS |
|---|---|---|---|
| Linuron, % | 92.0 Min.* | 93.4 | L588.4384-3 |
| Other Impurities, % | 8.0 Max. total | 4.53 | L330.328-3 |
| Diuron, wt % | 3.0 Max. | Non-Detectable | L566.129-1 |
| Bis Urea, wt % | 2.5 Max.* | 1.58 | L330.328-3 |
| T-855, wt % | 2.0 Max. | 0.49 | L332.067-1 |

* For linuron to be formulated into "Lorox" L.

ADDITIONAL INFORMATION

Color: Tan
Approximate pounds per cubic foot: 37
I.C.C. Label Requirement: None

AUTHORIZATION

SAR No. 69-5, Authorized 10/15/69
SAR H-81-2
SAR No. H-81-5
SAR LP-85-12 (Bis Urea Specification)

POINT OF MANUFACTURE

La Porte

LA PORTE

** TOTAL PAGE.002 **

# CEDAR INTERNAL CORRESPONDENCE

| | | | |
|---|---|---|---|
| **TO:** | Craig Keese | cc: | Tomblin<br>Gastrock<br>Satterfield<br>Hopple |
| **FROM:** | Stanley Bernard | | |
| **DATE:** | November 4, 1994 | | |
| **SUBJECT:** | Linuron technical production | | |

Several years ago Dupont ceased production of Linuron Technical in Texas and began purchasing the material needed for their Linuron product from 5 different sources. The impurity spectrum of the technical Linuron from these different sources varied widely. Like Propanil, Linuron is a low melting compound (92-94°) and impurities can greatly influence handling, grinding, and formulation characteristics.

Approximately 3 years ago, Dupont began using Linuron technical produced by Rashim (spelling may not be correct) of Israel. Due to this technical's impurities, it was particularly hard to process as it was tacky and prone to "smear". Product that was produced from this technical also did not meet specifications and required reworking. Contract formulators under the direct daily supervision of Dupont soon accumulated 800,000 pounds of re-work. Dupont, in their infinite wisdom and arrogance, moved the formulation "in-house" to their facility in El Paso, TX where another 1,000,000 pounds of product requiring re-working was produced. Contract formulators are still re-working the 1,800,000 pounds of material produced.

I should soon have an impurity profile of acceptable Linuron technical and of the material prone to process and formulation problems.

Considering the above, our Linuron technical R&D process must include formulation evaluation in both DF and SC forms.

# GUIDELINES & INSTRUCTIONS

# FOR

# CONTRACTORS

## DU PONT

### AGRICULTURAL PRODUCTS DEPARTMENT

WHEN NO LONGER NEEDED
PLEASE RETURN TO:

AGRICULTURAL PRODUCTS DEPT.
CONTRACT MANAGER, MFG.DIV.
WALKER'S MILL, BMP
WILMINGTON, DE 19898

REV. 1/88

# AGRICULTURAL PRODUCTS DEPARTMENT
## GUIDELINES & INSTRUCTIONS FOR CONTRACTORS

### INTRODUCTION

This write-up is specifically for Du Pont Agricultural Products Department U.S. Contractors. It is intended to clearly communicate what is expected by Du Pont of its Contractors and what Contractors can expect from Du Pont.

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## I. DU PONT ORGANIZATION

Several Du Pont job titles used throughout these guidelines are defined below:

### A. Plant Personnel

(Usually the Belle, La Porte or Mobile plants)

- **Contract Superintendent or Supervisor**

  Supervises the Outside Contracts Group for a particular plant.

- **Contract Administrator**

  Person responsible for day to day liaison and operational functions with contractor. Monitors for Du Pont all aspects of Contractor's performance. Once production starts, all communications between Du Pont and the Contractor relative to the production should normally channel through the Contract Administrator or his office.

- **Contract Coordinator**

  Oversees supply of crudes, packaging materials, etc. to Contractor. Works with counterpart at Contractor to maintain records of production, consumption, inventories, etc.

### B. Wilmington Personnel

- **Contract Manager**

  Along with Du Pont M&L Department, negotiates contract, commits for line time and coordinates production startup date and scheduling. Handles all business arrangements between DuPont and Contractor.

## II. SAFETY AND ENVIRONMENTAL

### A. Du Pont Philosophy

Our philosophy is that we will not make, handle, use, sell, transport or dispose of a product unless we can do so safely and in an environmentally sound manner. Our ten safety principles follow for your information and use.

1. All injuries and occupational illnesses can be prevented. At Du Pont, we believe that this is a realistic goal and not just a theoretical objective. Our safety performance proves this goal is achievable, as we have plants with over 1,000 employees that have operated for over ten years without a lost-time injury.

2. Management is directly responsible for preventing injuries and illnesses, with each level accountable to the one above and responsible for the level below. This includes all levels, from the chairman, who is also the chief safety officer, through to the first line supervisor.

3. Safety is a condition of employment; each employee must assume responsibility for working safely. In Du Pont, safety is as important as production, quality, and cost control.

4. Training is an essential element for safe workplaces. Safety awareness does not come naturally--management must teach, motivate and sustain employee safety knowledge to eliminate injuries. This includes establishing procedures and safety performance standards for each job or function.

5. Safety audits must be conducted. Management must audit performance in the workplace to assess the effectiveness of facilities and programs, and to detect areas for improvement. Employees must take time to recognize hazards and then take adequate precautions to prevent injury.

6. Any deficiencies that create an imminent hazard must be corrected immediately and corrective action initiated promptly on all deficiencies, either through modifying facilities, changing procedures, bettering employee training or disciplining constructively and consistently. Follow-up audits are used to verify effectiveness.

7. It is essential to investigate all unsafe practices and incidents with injury potential, as well as all injuries.

8. Safety off the job is just as important as safety on the job. Du Pont was a pioneer in tracking the off-the-job safety of employees beginning in 1953. As a result, the Company initiated programs to dramatically improve off-the-job performance.

9. It's good business to prevent illnesses and injuries. Serious illnesses and injuries involve tremendous costs--direct and indirect. The highest cost is human suffering.

10. People are the most critical element in the success of a safety and health program. Management responsibility must be complemented by employees' suggestions and their active involvement in keeping workplaces safe.

B. Off-Site Contractor Personnel Safety Corporate Guidelines

A copy of these follow for your information.

# OFF-SITE CONTRACTOR PERSONNEL SAFETY

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## 1. INTRODUCTION

Du Pont believes that all injuries can and should be prevented. Our concern extends to the safety of the employees of all off-site contractors utilized by the Company.

In addition to the direct benefits of fewer injuries and lower accident-related costs, experience shows that improved contractor safety performance will result in improved overall effectiveness.

## 2. SCOPE

This guideline sets forth safety and occupational health considerations for dealing with off-site contractors providing products or services to the Company with either their own or Du Pont owned equipment or facilities.

## 3. POLICY

Du Pont should select and conduct business only with contractors that have demonstrated a high degree of concern for the safety of their employees.

3.1 Safety performance should be a prime consideration in the selection of all contractors.

3.2 Contractors are not to be used for jobs Du Pont employees would not be assigned, unless these jobs can be done safely with contractors' special expertise and training.

3.3 The contractor shall be informed of all environmental, safety and health hazards associated with Du Pont materials and processes being used. These communications should be documented.

3.4 Safety and health-related communications should be with contractor supervision and not directly with its employees. However, where the nature of the hazard is unique or other unusual circumstances dictate, information concerning hazards resulting from Du Pont activities or facilities may be communicated directly to contractor employees. Such communications should be documented.

3.5 Each contractor shall follow occupational health and safety practices which meet all applicable local, state and federal laws and regulations.

3.6 In addition, dedicated contractors (contractor operations which under terms of the contract or agreement are operated solely for Du Pont) should have the goal of achieving the same safety priority as we have in our operations. They are to follow safety practices that provide protection equivalent to that provided Du Pont employees doing similar work. Audits of dedicated contractors activities should be conducted to determine compliance with the contract.

## 4. INJURY/ILLNESS REPORTING

All occupational injuries/illnesses (See S&OH Guideline 3.5) to personnel of dedicated contractors shall be reported by the site. A sample report form is included on Page 3. Do not submit Form ER-8784, Safety Incident Information Control Report. Injury/illness reports should be sent within one month to Safety and Occupational Health Division.

4.1 All fatalities and extraordinarily severe lost workday injuries shall be reported within 24 hours to the Safety and Occupational Health Division.

## 5. CONTRACT TERMINATION

5.1 Contracts shall be written in a manner to permit termination for contractor's failure to comply with safety requirements.

5.2 Contractor's supervision should be advised that their failure to correct unsatisfactory conditions can lead to work stoppage or termination of the contract. If contractual deficiencies persist, consideration should be given to termination of the contractor.

ER-6785 Rev 9/86

# INJURY/ILLNESS REPORT A

SAFETY CONTROL REPORT MUST ACCOMPANY THIS REPORT

DUPONT

INCIDENT I D

INCIDENT DATE

DEPT CODE | SITE CODE | YEAR | MONTH | DAY | 24 HR CLOCK

NAME OF INJURED (LAST FIRST MIDDLE INITIAL)

D O E J O H N H

SSN/EMPLOYEE NO. 0

AGE

BIRTH DATE YEAR MONTH DAY

MAIL ADDRESS (STREET NO AND NAME)

A B C C O N S T R U C T I O N C O

CITY | STATE/COUNTRY | ZIP CODE

OCCUPATION

EMPLOYMENT STATUS: N D

SEX (M OR F)

ADJ SERVICE DATE YEAR MONTH DAY

MARITAL STATUS

SALARY/WAGE (S OR W)

FILL IN EMPLOYER'S NAME ON THIS LINE (IN PLACE OF ADDRESS) FOR CONTRACTOR INJURIES

FILL IN "ND" FOR INJURIES TO NON-DUPONT WORKERS

CLASSIFICATION/ACCOUNTABILITY (Check One)

| | INJURY | | | ILLNESS | | | |
|---|---|---|---|---|---|---|---|
| | TAB | NON-TAB | | NON-TAB | | | |
| | ACCEPTED A | ALLEGED B | OTHER C | ACCEPTED EXPOS D | POSSIBLE EXPOS E | ALLEGED EXPOS F | # DAYS LOST OR RESTR G |
| 1 FTL | | | | | | | |
| 2 LWC | | | | | | | |
| 3 RWC | | | | | | | |
| 4 MTC | | | | | | | |
| 5 FAC | | | | | | | |

A TAB-ACCEPTED
Any occupational injury counted in corporate safety statistics. All (and only) those injuries are entered on OSHA Log 200 (US only)

B NT-ALLEGED
Any injury alleged by an employee or former employee as being work-related but denied by the company

C NT-OTHER
Any injury accepted by the company as being work-related but for which the company does not accept causality (not within the OSHA definition of an occupational injury)

D NT-ACCEPTED EXPOSURE
Any illness that the company accepts causality for where
— There was significant Du Pont exposure that could have been the determining factor in the illness, and
— The latency period since last Du Pont exposure is satisfied
All (and only) these illnesses are entered on OSHA Log 200 (US only)

E NT-POSSIBLE EXPOSURE
Any illness where there has been possible Du Pont exposure but is judged not causal to the illness

F NT-ALLEGED EXPOSURE
Any illness alleged by an employee or former employee as being work-related but causality is denied by the company or is unknown

G ESTIMATED NUMBER OF DAYS LOST OR RESTRICTED
Any injury or illness requiring in days lost or restricted should be indicated on the appropriate line regardless of classification

*Report submitted to cover workers' compensation claim or award

DATE OF DEATH (IF APPLICABLE) YEAR MONTH DAY

IF ILLNESS, WHAT WAS EXPOSURE PERIOD?

FROM YEAR MONTH DAY YEAR MONTH DAY

WHAT TREATMENT WAS ADMINISTERED?

NAME & ADDRESS OF PHYSICIAN

WHERE WAS TREATMENT ADMINISTERED (STREET NO. AND NAME)

CITY STATE/COUNTRY ZIP CODE

*COMPLETE DATA USING CODES ON REVERSE

REPORT DATE YEAR MONTH DAY

PREPARED BY (Please Print) PHONE # TITLE

INJURY/ILLNESS INFOR... CODES ON REVERSE)

Primary

OF INJURY

E OF INJURY

T OF BODY AFFECTED

CCIDENT TYPE

PERSONAL PROTECTIVE EQUIP DEFICIENCY

(Y/N)

WAS EMPLOYEE WORKING A ROTATING SHIFT SCHEDULE AT TIME OF INJURY? —

NUMBER OF REGULAR SHIFT HOURS ON DATE OF INJURY —

HOURS ON SHIFT AT TIME OF INJURY —

HOW MANY MONTHS INJURED FAMILIAR WITH WORK HE WAS DOING? —

WHAT CHANGES ARE RECOMMENDED TO PREVENT RECURRENCE?

DO NOT FILL IN THIS SECTION

SR-879d

# SAFETY INCIDENT INFORMATION

CONTROL REPORT

THIS SAFETY INCIDENT INFORMATION REPORT IS A MULTI-SECTION DOCUMENT USED TO REPORT COMPANY SAFETY INCIDENTS

INCIDENT I D

DEPT CODE | SITE CODE | INCIDENT DATE (YEAR MONTH DAY) | 24 HR CLOCK

TYPE OF INCIDENT 10 | DAY OF WEEK

DEPARTMENT/SUBSIDIARY NAME

SITE NAME

MAIL ADDRESS (STREET NO AND NAME)

CITY

LOCATION IF DIFFERENT

CITY | STATE | ZIP CODE

AREA/BLDG WHERE INCIDENT

SECTION OF EMPLOYING UNIT

USE "10" FOR ALL NON DU-PONT RECORDABLE INJURIES

ADDITIONAL DOCUMENTS

INDICATE NUMBER OF OTHER REPORTS ENCLOSED

- ☐ PART A INJURY/ILLNESS
- ☐ PART B PROPERTY LOSS/PUBLIC LIABILITY
- ☐ PART C MOTOR VEHICLE ACCIDENT REPORT
- ☐ PART D TRANSPORTATION EQUIPMENT REPORT
- ☐ OTHER _____

DID INCIDENT OCCUR ON COMPANY OWNED/LEASED PROPERTY? _____ Yes ☐ No ☐

COMPLETE USING CODES ON REVERSE SIDE

CAUSE OF INCIDENT — PRIMARY ☐☐☐ CONTRIBUTING (IF APPLICABLE) ☐☐☐ ☐☐☐ LOCATION ☐☐☐ ACTIVITY STATUS AT TIME OF INCIDENT ☐☐☐

## ABSTRACT OF INCIDENT

COMPLETE ABSTRACT OF INCIDENT IN SPACE PROVIDED INCLUDE ANY EQUIPMENT OR SUBSTANCES INVOLVED, AND ANY ACTIONS MOVEMENTS, OR CONDITIONS WHICH MAY HAVE LEAD TO THE INCIDENT, OR MAY HAVE INCREASED ITS SEVERITY.

DO NOT USE

# CODES

## EMPLOYMENT STATUS

| | |
|---|---|
| A | Active Employee |
| TR | Former Employee |
| TP | Pensioner |
| ND | Non Du Pont |

## SOURCE OF INJURY/ILLNESS

| | |
|---|---|
| 801 | Process Equipment (Reactors, Mixers, Exchangers, Filters, Day Tanks) |
| 802 | Process Pipelines and Fittings |
| 803 | Pumps, Compressors, Refrigeration Equipment |
| 804 | Boilers, Furnaces, Heaters |
| 805 | Utility Pipelines and Fittings |
| 806 | Conveying Equipment |
| 807 | Water, Waste, Air Treatment, Conditioning, Purifying Equipment |
| 808 | Transportation Equipment (Lift Trucks, Rail Cars, Dollies, Barges, or Ships) |
| 809 | Mechanical Equipment (Presses, Windups) |
| 810 | Tools (Power, Hand, Special Purpose) |
| 811 | Laboratory (Glassware) |
| 812 | Office (Computation, Cleaning, Coffee Pots) |
| 813 | Electrical (Motors, Switch Gear, Wiring, Insulation) |
| 814 | Instrument |
| 815 | Motor Vehicle (Car or Truck) |
| 850 | Other |
| 899 | Not Applicable |

## NATURE OF INJURY/ILLNESS

### INJURY

| | |
|---|---|
| 101 | Amputation |
| 102 | Bite, Sting |
| 103 | Bruise, Contusion |
| 104 | Burn—Hot, Cold, Chemical, Scald |
| 105 | Concussion, Unconscious |
| 106 | Cut, Laceration, Puncture |
| 107 | Exhaustion, Heat Stroke |
| 108 | Electric Shock |
| 110 | Foreign Body, Sliver, Chip, Dust |
| 111 | Fracture, Crush, Dislocate |
| 112 | Internal Injury, Hernia, Heart |
| 113 | Loss of Senses, Faculties |
| 114 | Scrape, Scratch, Abrasion |
| 115 | Sprain, Strain, Torn |
| 116 | Suffocation, Drowning |
| 199 | Other Injuries |

### ILLNESS

| | |
|---|---|
| 201 | Skin Disease, Disorder |
| 202 | Lung Problem, Dust-Related |
| 203 | Lung Problem, Toxic-Agent Related |
| 204 | Poisoning |
| 205 | Disorders Due to Physical Agents Other Than Toxic Agents |
| 206 | Disorders Associated with Repeated Trauma |
| 207 | Asbestos, Benign Asymptomatic |
| 208 | Asbestos, Benign Symptomatic |
| 209 | Asbestos, Malignant |
| 210 | Bladder Tumor |
| 299 | Other Occupational Illnesses |

## PART OF BODY (For injuries to more than one part of body select most serious)

### HEAD/NECK

| | |
|---|---|
| 301 | Scalp |
| 302 | Skull |
| 303 | Ears |
| 304 | Eyes |
| 305 | Face |
| 306 | Nose |
| 307 | Mouth/Teeth |
| 308 | Neck |
| 310 | Whole Head |

### ARM/SHOULDER

| | |
|---|---|
| 401 | Shoulder |
| 402 | Upper Arm |
| 403 | Elbow |
| 404 | Forearm |
| 405 | Wrist |
| 406 | Hand |
| 407 | Finger |
| 408 | Whole Arm |

### TORSO

| | |
|---|---|
| 501 | Chest/Ribs |
| 502 | Back Muscles |
| 503 | Back Skeletal/Nervous |
| 504 | Abdomen |
| 505 | Groin |
| 506 | Hip |
| 507 | Buttocks |
| 510 | Whole Torso |

### LEG

| | |
|---|---|
| 601 | Thigh |
| 602 | Knee |
| 603 | Shin, Calf |
| 604 | Ankle |
| 605 | Foot |
| 606 | Toe |
| 610 | Whole Leg |

### FACULTY/SYSTEM

| | |
|---|---|
| 701 | Hearing |
| 702 | Vision |
| 703 | Smell |
| 704 | Taste |
| 705 | Touch |
| 706 | Respiratory |
| 707 | Circulatory |
| 708 | Digestive |
| 709 | Urinary |
| 710 | Nervous |

## ACCIDENT TYPE

### FALLS, SLIPS, TRIPS

| | |
|---|---|
| 101 | Off Chair, Furniture |
| 102 | Off Dock, Open Excavation |
| 103 | Off Ladder, Scaffold |
| 104 | Off Machinery, Equipment |
| 105 | Off Vehicle |
| 109 | Off Other High Place |
| 141 | On Stairs, Steps—Indoors |
| 142 | On Paved Surface—Indoors |
| 149 | On Other Flat Surface—Indoors |
| 151 | On Stairs, Steps—Outdoors |
| 152 | On Paved Surface—Outdoors |
| 153 | On Loose Ground Covers—Outdoors |
| 159 | On Other Flat Surfaces—Outdoors |
| 171 | Over Object on Ground Floor |
| 179 | Over Other Objects (Trips) |
| 199 | Falls—Other |

### STRUCK, CAUGHT BY/AGAINST OBJECT

| | |
|---|---|
| 201 | By Airborne Dust, Particles |
| 202 | By Another Person, Object Being Held |
| 203 | By Chips/Particles from Use of Powered Hand Tools, Machinery or Equipment |
| 204 | By Chips/Particles from Use of Non-Powered Hand Tools |
| 210 | By Object—Blown Off Pressurized System |
| 211 | By Object—Broken Off, Vibrated Loose, Mobilized |
| 212 | By Object—Collapse, Cave-In |
| 213 | By Object—Dropped, Released by Self During Handling |
| 214 | By Object—from Expulsion, Overpressure |
| 215 | By Object—Dropped, Released or Thrown by Another Person |
| 219 | By—Other |
| 240 | By/Against Powered Hand Tool |
| 241 | By/Against Non-Powered Hand Tool |
| 242 | By/Against Moving Equipment/Machinery |
| 250 | Against Stationary, Sharp Object |
| 251 | Against Other |
| 260 | Caught in Moving Machinery, Equipment |
| 281 | Caught, Pinched between Objects |
| 299 | Caught by Other |

## ACCIDENT TYPE (CONTINUED)

### CONTACT WITH MATERIAL, CONDITION

| | |
|---|---|
| 301 | Chemicals—Corrosive, Irritating Substances In, Around or From Process Equipment |
| 302 | Chemicals—Corrosive, Irritating Substances While Handling or Transferring Bulk Quantities |
| 303 | Chemicals—Corrosive, Irritating Substances in Small Laboratory Quantity |
| 304 | Commercial Cleaning Materials |
| 329 | Chemicals—Other |
| 330 | Electricity—Power Hand Tools |
| 339 | Electricity—Other |
| 340 | Exposure to Natural Elements |
| 351 | Fire Flame, Intense Heat |
| 352 | Hot, Cold Surface |
| 353 | Non-Pressurized Hot Liquid, Hot Material |
| 354 | Pressurized Hot Liquid, Gas |
| 355 | Pressurized Cold Liquid, Gas |
| 360 | Noise |
| 370 | Radiation |
| 380 | Smoke, Gas |
| 390 | Welding Flash |
| 399 | Other Material or Condition |

### OVER-EXERTION STRAIN

| | |
|---|---|
| 401 | Load-Carrying, Holding, Twisting, Reaching |
| 402 | Load-Lifting |
| 403 | Load-Pulling, Pushing, Turning |
| 449 | Load—Other |
| 450 | No Load—Bending |
| 451 | No Load—Reaching, Twisting |
| 499 | No Load—Other |

### MISCELLANEOUS

| | |
|---|---|
| 501 | Animal, Insect, Plant |
| 521 | Public Transportation |
| 541 | Sports Activity |
| 561 | Vehicle Passenger, Driver |
| 599 | Other |

## PERSONAL PROTECTIVE EQUIPMENT DEFICIENCY

| | |
|---|---|
| 01 | Safety Belt/Harness |
| 02 | Corrosive Resistant Clothing |
| 03 | Safety Glasses |
| 04 | Safety Glasses with Side Shields |
| 05 | Goggles |
| 06 | Safety Shoes/Toe Protection |
| 07 | Work Gloves (e.g., Cotton, Leather) |
| 08 | Corrosive Resistant Gloves |
| 09 | Burn Resistant Gloves |
| 10 | Head Protection |
| 11 | Face Shield/Nitrometer Mask |
| 12 | Respirator/Supplied Air/SCBA |
| 99 | Other |

## C. Contractor Responsibility

### 1. General

A contractor has the responsibility for using the safety information, such as Material Safety Data Sheets, hazards information, explosibility data and sharing it with the employees so that they understand the hazards and rules, procedures, protective clothing or other measures that you expect to be followed to prevent injury. If you have questions, or are not sure about something, ask the Contract Administrator for assistance.

In addition to the product specific safety data provided by Du Pont, the Contractor should provide a safe and healthful workplace and train employees in safe industrial practices.

### 2. Injury/Incident Reporting

Any serious injuries or incidents occurring on a contractor's premises which are directly or indirectly related to production for Du Pont should be promptly reported to the Du Pont Contract Administrator as follows:

Serious Injuries

Report within 24 hours or on the next working day any fatality or serious injury (i.e. where an employee is hospitalized or misses at least one day of work) directly or indirectly related to handling or processing materials for Du Pont. A report form shown on Page 3.B should be completed and given to the Contract Administator.

Incidents

Report significant fire, explosions, spills, etc., with potential for personal injury or property damage as well as environmental incidents which may lead to adverse publicity for either your company or DuPont.

Examples of environmental incidents are:

- Gas or vapor releases to atmosphere or solid or liquid spills eventually going off-site into sewers, ditches or waterways and with the potential to affect people, animals, or vegetation.

- Repeated and important community complaints (e.g. noise, odors).

- A communication from the authorities alleging failure to meet environmental or occupational health regulations.

- Advice from a physician that changes in physical condition of employee(s) may be related to exposure in the work place.

- An incident likely to be reported in the media with one or both of our companies names being mentioned.

Serious incidents should be reported to the Contract Administrator within 24 hours using Form 3.C. In some cases it may be appropriate to call the Contract Administrator or other Du Ponter at home.

3. Waste Disposal

The Contractor must comply with all applicable government laws and regulations and, unless agreed to otherwise, the Contractor agrees to furnish all equipment and labor to remove and dispose of waste which Du Pont elects not to have returned to it. The following guidelines further define how to handle waste.

a. Internal recycle of wastes should have high priority. Saving filter bags and washdowns and sweepdowns for the next campaign may be possible for a particular product. Recycle must be done with care so as not to cause cross contamination or cause product degradation. Work with your Contract Administrator on specific proposals.

b. Du Pont will dispose of all RCRA wastes under its contracts with its approved waste disposal Contractors or disposed of internally within Du Pont. Under no circumstance should RCRA waste be handled by the Contractor or its contract with a waste disposal Contractor. RCRA wastes include, but are not limited to wastes containing

Methomyl ("Lannate")
Azodrin
Ethylene
Dithiocarbanic Acid ("Manzate")

The RCRA waste includes the technical, formulated product, off specification product and contaminated containers. Empty containers are considered non hazardous if triple rinsed. RCRA wastes are additionally defined as ignitable liquid pesticides and their containers, liquids with a flash point (CC) less than 140°F are RCRA by their characteristic of ignitability. These containers may be single rinsed to render them non hazardous. Other RCRA characteristic wastes are corrosives, reactive and "EP Toxic" materials as identified in RCRA regulation.

c. RCRA rules dictate that each generator must have ongoing minimization studies and submit periodic status reports. Both Du Pont and the Contractor need to jointly work on this.

d. Du Pont may choose to have solid wastes that are non recycleable returned to it or a location designated by Du Pont. These wastes include floor sweepings, equipment cleanout, un-recycleable technical material, worn out dust collector bags, and lab samples (dry).

e. The Contractor is responsible for safely disposing of empty containers that were contaminated with non RCRA wastes or have been rendered non RCRA by being rinsed. There are exceptions to this, one of which is Azodrin drums, which, after being rendered non hazardous, are disposed of by Du Pont. Bags that contained non RCRA technicals, and at time of disposal only contain traces of the technical, may be disposed of by the Contractor.

f. Non-RCRA liquid waste will be the Contractor's responsibility. When quoting, the Contractor should state the disposal plan and if by waste disposal Contractor, note the Contractor's name and location. If Du Pont approval is not secured this way, the Du Pont Contract Administrator must give express, written approval.

g. Often times, label language changes so frequently that unused bags or containers are left over. Before using any printed packaging materials or labels from a previous campaign, obtain approval from the Contract Administrator or Labels Section in Wilmington. If these materials need to be disposed of, consult the Contract Administration on how to deface or witness the destruction. Future use of such bags for any reason is a concern.

# *DU PONT AGRICULTURAL PRODUCTS DEPARTMENT*

# *QUALITY PRINCIPLES FOR CONTRACTED PRODUCTS*

## *Preamble*

*Quality is a hallmark honored by our company since it was founded nearly two centuries ago and for our Department since production and sale of crop protection chemicals started in the 1940's. Today, worldwide competition has highlighted the need to emphasize anew the total quality effort of the Du Pont Company. We define quality as meeting customer needs by doing the right job, the right way, the first time. The efforts of all Du Pont employees must be matched by equally high standards from our contractors and suppliers. Contractors include those doing synthesis, formulation and repackaging tasks.*

*Du Pont organizations are being directed by quality principles which translate philosophy into action. Similar principles have been developed for our contractors and suppliers so that they understand the values Du Pont wants implemented. Successful contractors and suppliers will be those who participate in our Quality Process. The ultimate objective of this process is excellence and leadership in the market place which promotes prosperity for both Du Pont and its contractors and suppliers. These principles will foster greater teamwork and a closer relationship.*

## *Du Pont Philosophy*

*Quality products from our contractors are vital to the competitiveness of Du Pont's crop protection chemicals business. We seek to continually improve quality and long term, mutually-beneficial relationships with contractors who are able to commit appropriate technical, managerial and financial resources to develop cost effective solutions responsive to our needs.*

## *QUALITY PRINCIPLES*

*Du Pont and contractors will contribute to the continued improvement of our competitive positions, ensuring the success of our respective businesses. A Quality Contractor will excel in many areas such as safety, responsiveness, cost control, productivity, product quality, environmental protection, and the contractor-Du Pont relationship.*

- *We expect our contractors to share our goals of zero customer complaints and continued quality improvement.*
- *Du Pont will communicate our expectations around product quality.*
- *We expect a contractor to have quality management systems that will result in*
  - *-- product meeting all specifications.*
  - *-- uniform and pleasing appearance of the package, carton and pallet.*
  - *-- fill weights that meet standards outlined in the Guidelines & Instructions for Contractors and the Product Contractor Manual.*
  - *-- availability of line time and product on schedule.*
  - *-- confirmation that raw materials and packages meet specifications.*
  - *-- acceptable trace level control.*
  - *-- use of the sample and retain plan.*
- *The contractor is a partner with Du Pont and should advise us of deviations from norm in all areas affecting quality.*
- *The contractor should look for and advise of ways to continually improve product quality, increase productivity, reduce costs, improve safety, and lessen environmental impact.*
- *We will participate in timely and periodic constructive communications about our joint performance in all areas, even including market feed back.*
- *We need mutual communications to ensure that Du Pont provides resources to work on quality improvement and problems, and the contractor provides adequate resources and facilities to meet quality commitments.*

B. Contamination of Du Pont Products

Of utmost concern to Du Pont (and by implication, the Contractor) is the possibility of contamination of one product with another. This has happened, and the consequences can be very expensive in terms of both money and reputation.

The most damaging combinations are contamination of an insecticide or fungicide with an herbicide. For that reason, Du Pont rarely approves the production of these pesticides in equipment which has been used for herbicides. Accordingly, these instructions are aimed primarily at conditions where herbicide follows herbicide; although they apply to any combination of products. Extreme care must be exercised to prevent contamination of one herbicide with another. Crop herbicides are selective in their action, i.e. one herbicide will be safe for a particular crop and quite injurious to another.

There are many ways in which one product can become contaminated with another. Several of the most likely are

- Failure to adequately clean, flush and inspect equipment when changing products.
- Mistakenly charging a quantity of the wrong active ingredient. Many packages look alike.
- Reusing empty containers of one technical material for sweepings, shakedown, etc. of another.
- Misuse of a prelabeled finished product container.
- Dust sifting or blowing from an adjoining area.
- Laboratory sample recycled to the wrong process.
- Using unlabeled or incorrectly labeled containers.

The following procedures will be used to minimize the possibility of cross contamination and to monitor this characteristic. This is in addition to analyses required for normal specification quality.

I. Cleanout

- As soon as verbal agreement is reached that a production run is to be made, the Contractor will advise the Du Pont Contract Administrator in writing the name of and type of product which will have been run in the equipment immediately prior to the Du Pont product and provide samples as requested. If the preceding campaign was short, then the names of products run in the last two or three campaigns are needed. If there is an intervening change in this product, the Contract Administrator will be verbally notified immediately and confirmed in writing. Development of analytical methods takes time, therefore, early knowledge is a must.

- Du Pont will then set maximum limits for Trace Level Components (TLC) in its product and will provide an analytical method for determination. This information will be conveyed to the Contractor in advance of startup.

- The Contractor and Contract Administrator will consult and agree on procedures to be used for cleanout of the facilities. If flushes of clay or other inert materials are used, they must be analyzed for contaminant and pass the maximum limits specification before production starts.
  Where liquid systems are involved, the last flush material, water or other solvents, must also pass the maximum specification limits.

- All materials and containers which will not be used in the campaign are to be removed from the operating area to reduce the possibility of inadvertent mixing of products.

- Following cleanout, the Contract Administrator will inspect the unit and approve for startup. Production will not commence until this approval is given. The Contract Administrator's inspection does not relieve the Contractor of any responsibility.

- A minimum finished product sampling and analysis schedule for TLC will be established by the Contract Administrator. Following is a recommended schedule:

  --Take four samples at random from the first batch (defined as that quantity of finished product which may be readily identified by a given lot and batch number. It bears no relationship to quantities charged or blended at the front end of the system.) and analyze for TLC. If any sample is greater than two-thirds of the specification maximum, then adjacent samples should be run. Repeat this procedure for each successive batch until all samples are less than two-thirds of the specification max.

  --After the above conditions have been met, take four samples at random from the next batch and run a composite sample. If the analysis of the composite is greater than one-fourth of the specification, then analyze all four samples individually.

  --On subsequent batches, run a four sample composite until TLC analysis is less than 10% of the specification. Then run a four sample composite on every four to five batches for the first 100M lbs of production.

  --If TLC exceeds the maximum after 10M lbs have been produced, then cleanout procedures must be repeated.

  --Spot checks for TLC should be made at appropriate intervals throughout a campaign.

- The first batches of Finished Product should be retained in properly marked drums or other bulk containers until analysis shows that contaminant levels are satisfactory. Product may then be packed in small packages, if called for by the contract. All product failing the contamination test will be conspicuously identified and set aside and held until advised of disposition by the Contract Administrator.

- When a sample is taken to the lab for any purpose, it must NOT be returned to the line for rework but must be disposed of properly as waste when no longer needed. If for some special product there is a compelling reason to return material to the production line, then there should be an explicit written procedure, with controls, signed by the Contract Administrator that allows this.

2. Mistaken Charge

- Once the equipment is clean, contamination from outside sources must be avoided. All Du Pont contracts specify that the contractor will segregate, identify and maintain a separate inventory of Du Pont owned materials. This must be done for several reasons, one of which is to help avoid the mistake of moving the wrong material to the charging area.

- The Contractor should provide a means of double checking that the labels of materials brought to the charging area are correct and that the components intended for a specific batch agree with the batching logs.

3. Reuse of Shipping Containers

In some instances, technical product (or finished product for repackaging) may be furnished in drums. After such drums are emptied, operators often find them convenient for trash and waste of all kinds and even move them from one area to another for such purposes -- WITH LABELS INTACT. Therefore, the following rules must be followed.

- Movement of a Du Pont supplied drum from its own area for any use in another area or production line is prohibited. Likewise, drums from other areas must not be moved into the area being used for Du Pont product. There is no circumstance under which such a practice is permissible.

- A Du Pont supplied drum may be used within its own area for like-kind refuse, provided that the label is completely obliterated and the drum clearly marked for TRASH or WASTE.

- Disposal of all containers will be made in accordance with the Contract terms.

4. Misuse of Labeled Finished Product Containers

We have often found prelabeled finished product containers used for the same purposes as discussed above; this is an even more serious offense. In the case of liquids, we have noted instances where a foreman has grabbed an empty, but fully labeled Du Pont container and used it to collect a sample of another product.

The use of a labeled finished product container for any purpose other than to contain the intended product is forbidden. It should be made clear to all employees that there is no circumstance under which labeled containers may be misused.

5. Dust Contamination from Adjoining Areas

With most Du Pont products the maximum permissible level of a contaminant is very small, usually under 50 ppm, although in some cases it may be higher. With levels this low, it is not difficult for dust from an adjoining unit to infiltrate a Du Pont production area and create a problem. Many things can be done to reduce this risk. (Continued next page.)

Movement of a Du Pont supplied drum from its own area for any use in another area or production line is prohibited. Likewise, drums from other areas must not be moved into the area being used for Du Pont product. <u>There is no circumstance under which such a practice is permissible.</u>

A Du Pont supplied drum may be used within its own area for like-kind refuse, provided that the label is completely obliterated and the drum clearly marked for TRASH or WASTE.

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## III. QUALITY, SECTION 2: PRODUCT

### A. General

Specifications as stated in the Contractor's Manual and/or Contract must be strictly adhered to. Product outside the specifications will normally be reworked, but in no case can it be released without prior written approval from Du Pont. At the end of each campaign, or once per month, whichever is most frequent, the Contractor must supply a quality summary to Du Pont. This should specifically include all analytical data and following statistics for each specification test.

- Specification goal to be shown.
- Number and frequency of analyses carried out.
- Quantity of production covered and period.
- Range, mean, and sigma for each month or for the campaign.
- Quantity of product reworked and reasons why.

### B. Analytical Frequency

This must be jointly agreed between the Contractor and the Du Pont Contract Administrator considering the type of process e.g. batch or continuous and the importance of certain quality parameters. The objective is to assure that all product is within specification. Once established, the Contractor may not deviate from the agreed analytical frequency without approval of Du Pont. In general, with batch processes, analyses should be made on each batch of product.

Before initial quality approval, a cross-check sample must be sent to Du Pont (the Contract Administrator will specify the location) with all analytical results. Any disagreements with Du Pont will require further laboratory checking until agreement is achieved.

C. Retention of Laboratory Samples

Laboratory samples of each batch large enough to repeat all specification tests are to be retained by the Contractor until a written release is given by the Contract Administrator to destroy the samples. In any case, the storage period will not be more than 2 years.

D. Quality Approval Request (QAR) Procedure

The quality approval procedure will be used in the following situations:

- To approve the quality of the first production of a new product.
- To approve the quality of an established product manufactured by a different process or in new or significantly modified equipment.
- To approve the quality of an established product in which intentional changes in raw materials or operating procedures are made which could affect the characteristics of the finished product, the biological or other end-use properties. The same applies to formulation changes in an established product, wherein the change is made for the purpose of modifying (improving) the characteristics of the product.

  Normally the Du Pont Contract Administrator will handle all aspects of sample preparation, correspondence, and instructions for sample shipment. However, the Contractor must understand that no product can be shipped until QAR has been approved and product released by the Du Pont Contract Administrator.

E. Warehouse Storage Tests

Du Pont requires continuous storage tests on packed finished products to monitor effect of storage on product and package quality at each manufacturing location. Normally a contractor will have no responsibility in this program except to remove a standard case or drum of the finished product and ship it to the location designated by the Contract Administrator.

F. Raw Material Acceptance Testing

Although generally Du Pont supplies raw materials, the Contractor has the responsibility of verifying the analysis of raw materials upon receipt to insure the proper raw materials are used. The exception to this would be cases where the Contractor is furnishing a raw material such as denatured ethanol, then it is the sole responsibility of the Contractor to assure that the material meets specs and to handle problems with the vendor.

Incoming raw materials should be inspected immediately upon arrival for damage, shortage or other discrepancy and the Du Pont Contract Coordinator notified promptly if such problems are found. The Contractor alone must not try to correct a vendor's problem. (See V.B).

G. Experimental Work

In no case should equipment or the process be changed without approval of the Du Pont Contract Administrator.

H. Package Weight Control

The present Du Pont policy is to assure that every package has a 95% probability of meeting the stated minimum label net weight. Contractors must establish a system of routine check of a certain number of filled packages per hour and recording the results, plus

periodic checking of package tare weights. These random checks are in addition to those in Appendix #1. The most reliable system to ensure weight control is an automatic check weigher which rejects unsatisfactory packages. A report on weight control performance must be submitted to the Du Pont Contract Administrator together with analytical data each month and at the end of a campaign.

## IV. PRODUCTION

### A. Production Schedule

A production schedule covering an entire campaign or a fixed interval of time, whichever is appropriate, will be agreed to by the Contractor and the Wilmington Contract Manager before a contract is awarded. Such schedules may be altered from time to time by mutual agreement as provided for by conditions in the contract.

### B. Production & Raw Materials Inventory Reporting

A monthly production report is to be sent to the Du Pont plant Contract Coordinator which includes the quantity of finished product produced and shipped, raw materials received and consumed and packaging materials received and consumed. See Accounting V.A for details and Appendix #3 for format to be used.

The importance of this report for Du Pont accounting purposes cannot be overemphasized. It is an integral part of the information used for determination of total mill cost and working capital. Because of this, we will require that the Plant Manager or Production Manager of the contract site sign the Production-Inventory report attesting to its accuracy.

Daily and weekly reports to the Contract Administrator may also be requested but these may be oral. It should be emphasized that verbal reports must be reliable numbers so that both parties can keep supplies of raw materials available to avoid costly shutdowns as a result of unexpected shortage.

C. Physical Inventory

The Contractor will make a physical inventory and reconciliation at the end of each month and at the end of a campaign. A physical inventory is defined as an actual count. The date of the check will be specified by Du Pont. (See V.A)

D. Lot Numbering

The Du Pont log numbering system is described in Appendix #2 attached. All packages and cartons are to be numbered legibly, in a permanent weather resistant manner, and in the place on the package and cartons specified by the Contractor Manual for the product or the Contract Administrator. It will sometimes be necessary to add EPA establishment numbers to packages and cartons.

E. Warehousing

Herbicides are to be segregated in such a way that no cross contamination of other agrichemical products such as fungicides and insecticides can occur. A separate room in a warehouse is desirable or if this is impossible, then segregation in a partitioned and clearly identified area must be provided. Absolutely, in no case shall unsealed packages of herbicides be stored adjacent to sealed or unsealed packages of other Agricultural chemicals. The critical part of any partition is the base which should be constructed to prevent flow of liquid herbicides or wash water into adjacent storage areas.

If in the handling of other Agricultural chemicals, the possibility arises that contamination by herbicides has occurred, the suspected material should be segregated without delay and tests undertaken to establish the extent of contamination. Notify the Du Pont Contract Administrator immediately.

F. Packaging & Palletizing

Will be performed in accordance with instructions issued in the Contractor Manual for the product or by the Contract Administrator for each product.

## V. ACCOUNTING

The accounting procedures for any contract are very important and must be followed in order to facilitate payment of invoices and maintain adequate accounting for all materials supplied by Du Pont. Accurate inventories by weight and/or number are essential. Du Pont normally will furnish most accounting forms such as bills of lading, material receipt forms, and production and consumption records. All contracts must be reviewed monthly and reports of stock received, consumed and on hand, as well as finished product produced, filed with contract clerk. Listed below are the various accounting instruments followed by instructions for use. Examples of these instruments are in the Appendix.

## APPENDICES

#3 Plant Inventory Summary

#4 Detail of Receipts

#5 Detail of Shipments

#6 Materials & Supplies Received

#7 Shipping Orders / Bills of Lading

#8 Calculation for Raw Material Allowances

All contracts with Du Pont contain the following clause:

"CONTRACTOR AGREES TO SEGREGATE ALL DU PONT -- OWNED MATERIALS SUPPLIED IN ACCORDANCE WITH THIS AGREEMENT IN A SEPARATE INVENTORY AND IDENTIFY AS DU PONT'S."

In order to accomplish the accounting objectives contained in this guide, contractors must comply with this provision.

A. Month End Report (Appendix #3)

Month-end Inventory Report:Production, Raw Materials & Packages. This form should be used to calculate consumptions. A physical inventory must be taken at the end of an accounting period to insure the accuracy of the consumptions. An accounting period extends from the closing date of one month to the closing date of the next month. A calendar of monthly closing dates will be furnished by the Contract Administrator. A Detail of Receipts and Detail of Shipments used in accounting for the month should accompany this report to verify that Du Pont and Contractor are using the same Receiving and Shipping Reports. (Appendices #4 & #5) This report must be returned to Du Pont within two days of the closing date, which might require use of overnight delivery service.

A physical inventory of finished product must be taken at the end of an accounting period. Production should be calculated and verified; no production adjustments should be made except in "explainable" cases.

B. Receiving Report (Appendix #6)

This report should be submitted to the Contract Coordinator immediately upon receipt of materials and should contain the following information:

- Date of receipt
- Vendor

B. Receiving Report Continued

- Name of carrier and truck/tractor number
- Bill of lading identification number
- Description (including vendor's name of material)
- Number of pieces (bags, boxes, etc.)
- Weight, total weight if a crude or raw material used in production
- Condition of material
- Discrepancies from bill of lading noted on receiving report (should also be noted on the carrier's copy)
- When possible, a copy of the bill of lading should be attached to the receiving report
- Report should be signed by a Contractor representative
- Receiving reports should be forwarded promptly to the Du Pont Coordinator.

C. Bills of Lading (Appendix #7)

Contractors will normally receive instructions or orders for the shipment of goods from two sources within Du Pont:

- All quality approved FINISHED PRODUCT will be ordered out by the Du Pont Marketing Division. Most orders will be placed by one or more of our Regional Sales Offices but on occasion an order will originate from Wilmington

C. Bill of Ladings Continue

- Raw materials, formulation components and packaging materials will arrive and be shipped out when necessary by direction of the Du Pont Contract Coordinator at a plant location.

Appendix #7 contains typical instructions prepared by the Du Pont Marketing Division for the preparation and handling of bills of lading for finished product. A copy of these or similar instructions will be sent by the Marketing Division to the Contractor's Shipping Supervisor.

In addition to the instructions in Appendix #7, the following rules must also be observed:

- Bills of lading are legal documents and must be prepared accurately.

- No hand written changes on a bill of lading will be accepted and the bill of lading must be carrier signed.

- The proper freight description, Du Pont product name and shippers identification number are to be shown on the bill of lading. This information will be provided by the Marketing Division for finished product and by the Contract Clerk for raw materials, etc. No material will be moved without a proper shipper's ID number.

D. Invoices (Each Contractor will supply his own)

- Contractor invoices need to be prepared accurately to facilitate prompt payment.

- Invoices MUST be identified with the correct purchase order number covering the services rendered.

- The invoice should be based on shipment of finished product, requiring a carrier signed copy of the bill of lading to be attached.

- The invoice must reflect exact contract coverage or delayed payment will result. If something extra is added (e.g. overtime) which is not in the contract, payment will be delayed. Any service which is not specified in the contract but which has been mutually agreed to with the Contract Coordinator must be invoiced separately and some type of documentation should accompany the invoice. The contract will then have to be altered to agree with the new terms or conditions.

E. Transportation

Du Pont will specify carriers for the movement of finished product and at some locations, any shipment. This service can be beneficial to the contractor and to Du Pont if utilized properly.

A Du Pont Materials & Logistics (M&L) representative will familiarize the contractor with the system and procedures where DuPont contract carriers are involved. Du Pont has specified carriers and in most cases, will tell the contractor which one to use.

The Contractor's obligation is to give enough information to M&L and the Du Pont Contract Coordinator so that the scheduling of trucks in and out does not conflict with daily operation to cause delay of shipment. If a Du Pont contract carrier does not arrive as scheduled or causes delays or other problems with respect to a shipment, the Contract Administrator or Coordinator should be advised promptly.

F. Freight Bills

Du Pont is responsible for all freight bills. All Du Pont Shipments go prepaid. Information printed on the DuPont bill of lading is to be followed. (See V.C)

Freight bills that are received by the Contractor covering inbound raw materials or packaging supplies should be forwarded immediately to the Du Pont Contract Coordinator at the plant responsible. The Contractor should not return such freight bills to the carrier, nor should the contractor pay them. The Du Pont Contract Coordinator will take care of payment.

G. Scheduling of Crudes

When a campaign is scheduled for startup, the Contractor should provide the Du Pont Contract Coordinator, at the plant responsible, with the name of one person and one backup for the scheduling of material.

The Contractor should give the Du Pont Contract Coordinator an accurate schedule, at least one week at a time, and early enough to allow delivery. The Contractor should advise the Du Pont Contract Coordinator of any restrictions on the acceptance of delivery, e.g. day of week or time of day. The person scheduling crudes for the Contractor needs to recognize that last minute ordering of materials for next day delivery is impossible. All precautions should be taken to avoid shutdown situations because of lack of crudes or packaging. The Du Pont Contract Coordinator will accommodate the Contractor's request if at all feasible.

In come cases such as packaging materials or large volume diluents (clays), Du Pont will place a blanket order with the supplier and the Contractor will enter release notices for quantities as required for production.

## APPENDICES

1. Weight Control Plan for Finished Product

2. Du Pont Lot Numbering System

3. Plant Inventory Summary

4. Detail of Receipts

5. Detail of Shipments

6. Material & Supplies Received

7. Shipping Orders / Bills of Lading

| | | |
|---|---|---|
| Exhibit | I | Instructions by Facsimile |
| Exhibit | II | Instruction by TWX |
| Exhibit | III | Regional Office Identification by Order Number Prefix |
| Exhibit | IV | Important Specifics for Bill of Lading Preparation |

8. Calculation for Raw Material Allowances

## APPENDIX #1

### WEIGHT CONTROL PLAN FOR FINISHED PRODUCT

An established weight control plan must be maintained by the Contractor. Du Pont weight control requirements are:

- Digital scales are to be used for filling and check weighing and must have minimum resolution as follows:
  - -- for liquid containers of 2-1/2 gallon or less and powder containers of 25 lb or less: 0.01 lb.
  - -- for liquid containers greater than 2-1/2 gallon and powder containers greater than 25 lb: 0.1 lb.

  Scales calibrated in grams or kilograms are acceptable if they provide equivalent resolution.

- A system of check weighing must be maintained. A minimum of 1% of the packages or 5 packages / 8 hour shift (whichever is greater) are to be checked weighed each 8 hour shift. The check weighing is to be independent of the filling process and sealed packages are to be used.

- All check weight data is to be forwarded to the Du Pont Contract Administrator along with an indication of gross or net weight, the tare weight assumed.

- Filling and check weighing scales must be checked with a test weight at least once per 8 hour shift. The test weight should be 80% to 120% of net package weight.

- Du Pont will occasionally request that the Contractor collect some data on package tare weight.

- The target fill weight should be set 1.64 standard deviations above the label weight (or weight required to meet label volume) which gives a 95% probability of meeting the label weight/volume without excessive giveaway. Set the target weight initially based on prior experience standard deviation for the package size being filled, then adjust the target weight if needed based on the current run standard deviation. When packaging liquids, the density of the liquid must be routinely checked and taken into consideration when setting the target fill weight.

## APPENDIX #2

## DU PONT LOT NUMBERING SYSTEM

Du Pont products produced by a contractor must have both a "formulation date" and batch number as shown below:

Formulation Date: mm/yy

```
|  |
|  |---> year
|---> month of year produced
```

Batch Number: T -- mmddyy -- xxx

```
|       |       |
|       |       |---> batch number by contractor
|       |---> month, day, year of production
|---> Contractor site code specified by Du Pont
```

PLANT INVENTORY SUMMARY

DAYS OPER. _____ DATE _____

PRODUCT: PLANT: APPROVED: PLT. MGR.

| COST SHEET # | UNIT | STOCK LAST REPORT | RECEIPTS | SHIPMENTS | THEORETICAL CONSUMPTION | ACTUAL CONSUMPTION | VAR ± % | PRODUCTION | STOCK THIS REPORT |
|---|---|---|---|---|---|---|---|---|---|
| FINISHED PRODUCT | | | | | | | | | |
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| RAW MATERIALS | | | | | | | | | |
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| PACKAGING MATERIALS | STOCK LAST REPORT | RECEIPTS | SHIPMENTS | ACTUAL CONSUMPTION | THEORETICAL CONSUMPTION | VARIANCE ± % | STOCK THIS REPORT | |
|---|---|---|---|---|---|---|---|---|
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APPENDIX 4



## DETAIL OF RECEIPTS

Campaign
STOCK LOCATION MONTH

| Date | Receiver Number | Product | Pkg. Size | Number of Packages | Quantity Received | |
|---|---|---|---|---|---|---|
| | | | | | Good | Damaged |
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## DETAIL OF SHIPMENTS

Campaign _____

STOCK LOCATION _____ MONTH _____

| Ship Date | Du Pont Order Number | Product | Pkg. Size | No. Cases and/or Drums | Customer & Destination |
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# APPENDIX 6

## MATERIAL AND SUPPLIES RECEIVED

DATE OF RECEIPT: _____

VENDOR: _____

CARRIER: _____ TRUCK/TRAILER NO. _____

BILL OF LADING NO.: _____

| PACKAGES NUMBER AND KIND | QUANTITY | DESCRITPION OF ARTICLES RECEIVED | WEIGHTS | CONDITIONS |
|---|---|---|---|---|
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CHECKED BY: _____

COMMENTS:

APPENDIX 7

Exhibit I
Instructions by Facsimile

34. A,B,C,D,E,F

cc: T. N. Kirchner
F. W. Voss
(Plant Contract Administrator)
(Marketing-Product Coordinator)

Date_____

SHIPPING ORDER/BILL OF LADING INSTRUCTIONS

Dear

The Sales Service Center of the Agricultural Products Department will fax or phone shipping orders to you in advance of a shipment. If fax'd, you will receive the order in a prescribed format. Attached Exhibit A defines each item on the order; Exhibit B illustrates the format of the order.

For all shipments, please prepare the 6-part Bill of Lading Form AG-363 as outlined in Exhibit C attached. The portions of the B/L dealing with quantity and the various weights must not be filled in until the trailer is actually loaded and the quantities verified by the shipping supervisor. Due to the varying sizes of trailers, it may not be possible to load the precise quantity specified on the order. In such cases, the shipping order should have the quantity adjusted and the Wilmington Product Coordinator in the Sales Service Center, Wilmington (who placed the order) must be notified by fax or phone.

Please distribute the Bills of Lading copies as follows:

Original #1 - To the production clerk at our plant Belle, WV, La Porte, TX or Mobile, AL responsible for the production and/or packing campaign.

#2 - Carrier's copy

#3 - (Packing List) Affix to last packed unit put on the trailer.

#4 - Financial Services Division (FSD)* To same address (envelope) as #6, along with original monthly stock report.

#5 - Warehouse - Retain for your files.

#6 - E. I. du Pont de Nemours & Co., Inc.*
Agricultural Products Department
Sales Service Center
Barley Mill Plaza, Bldg. 38 2-122
Wilmington, DE 19898
Attn: Stock Records Clerk

Attached Exhibit D provides important specific information for Bill of Lading preparation.

Please call if you have any questions.

Product Coordinator

(302) 992-60

* Use preaddressed envelope AG-764 available from above named Product Coordinator.

OFF-LINE WAREHOUSES WITHOUT TWX EQUIPMENT

EXHIBIT A - SHIPPING INSTRUCTIONS

1. PRINT DATE: Date Order was transmitted

2. DOC CTRL NR: Assigned by the "System." Use this number along with MOS Order Number for reference (will be sequential for your location)

3. PAGE: Page Number

4. DU PONT ORD NR: Du Pont Order Number assigned by the "System." (Will not always be sequential)

5. ORD TYPE: Type of order, i.e., regular, intradepartmental, sample, customer return goods order, etc.

6. ORD DATE: Date order was placed

7. REQST SHIP DATE: Requested ship date

8. CSR: Customer Service Specialist in Wilmington responsible for order

9. DOC STATUS: Is document an Original Order, Alteration, Cancellation, or Retransmission?

10. SIG: Significance of schedule ship date, i.e., Ship on requested date, ship week of the date, customer pick up, etc.

11. CPO: Customer purchase order number

Exhibit A
PAGE 2

12. SHIP TO: Ship to name and address

13. CARR: Carrier name for shipment when specified by customer Otherwise, will be blank, and shipping point must fill in carrier.

14. FRT TERMS: Prepaid or Collect

15. SPECIAL INSTRUCTIONS: Instructions to be followed by ship point, freight forwarder and general comments.

IMPORTANT: All Special Instructions should be read and followed.

16. NET LBS OR GALLONS:

17. CTNR TYPE: Carton, drums, etc

18. CTNR DSC: Carton 8-3 lb each

19. PROD: and NAME: Mnemonic code and registered name of product.

20. INVTRY CAT: Inventory category code, i.e., standard material, off-quality material, etc.

21. TOTAL PAGES PRINTED IS: Total number of pages to the order and bill of lading.

22. ORDER QUANTITY: Per case or drum

MEMO INSTRUCT-DO NOT SHIP EI DUPONT DE NEMOURS-FOR DUPONT USE ONLY PG 1

10/07/86 A006 ORIGINAL H

10/01/86 SHIP ON SCHEDULED DATE AV1 11:44 34.I

SBRICK XXXX N NJBI99176

604116900 BLYTHEVILLE,AR

E I DU PONT DE NEMOURS & CO INC NFL EXTRA90DF
AG PRODUCTS DEPARTMENT
C/O A & I WAREHOUSE INC PREPAID
3183 TRANQUILITY DRIVE FMIS
MEMPHIS , TN 38116 P.O. BOX 8964
WILMINGTON DE 19899

CUST NR: 00144237

E I DU PONT DE NEMOURS & CO INC NFL
AG PRODUCTS DEPARTMENT
C/O A & I WAREHOUSE INC
3183 TRANQUILITY DRIVE
MEMPHIS , TN 38116

439900000

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1600 | BAG | WEED KILLING COMPOUND,N.O.I.B.N. | 40480.0 | 40000.0 | 025P | 01 | |
| 25 LB | BAG | EXTRA90DF 5113 CAT: F00 | | | LB | | |
| 25 | | "EXTRAZINE" 90DF HERBICIDE | | | | | |
| LB NET | | | | | | | |

1600 40480

SPECIAL INSTRUCTIONS
LN:00 PALLETIZE AND STRETCH WRAP

Exhibit B
FAX

END END END END END TOTAL PAGES PRINTED IS 1 END END END END END

STRAIGHT BILL OF LADING
SHORT FORM—ORIGINAL—NOT NEGOTIABLE

CARRIER'S NO.

EXHIBIT C 34.E

RECEIVED, subject to the classifications and tariffs in effect on the date of this Bill of Lading:

| DATE | CARRIER'S FULL NAME | |
|---|---|---|
| MO/DAY/YR OF SHIP. | | |
| CUSTOMER ORDER NO. IF FURNISHED ON ORDER | AT SHIP POINT CITY & STATE | S.P. CODE |
| SHIPPER'S ID NO | DU PONT ORDER NUMBER (9 DIGITS) | |

From E. I. DU PONT DE NEMOURS & COMPANY (INC.)
90 AGRICULTURAL PRODUCTS DEPARTMENT

CONSIGNED TO

SHIP TO NAME & ADDRESS

(PLACE "X" IN APPROPRIATE BOX)

If Prepaid Mail Freight Bills To
FMIS FREIGHT
BOX 8964
WILMINGTON, DE 19899

VEHICLE OR CAR INITIAL & NO

IF LOSS OR DAMAGE RESULTS IN THE RELEASED VALUE OF THE SHIPMENT IS HEREBY STATED BY THE SHIPPER TO BE NOT EXCEEDING [illegible] PER POUND (FOR EACH ARTICLE IN THE PACKAGE) OR ANY HIGHER VALUE STATED BY SHIPPER, THE CARRIER'S LIABILITY SHALL NOT EXCEED 50 CENTS PER POUND PER ARTICLE. WHICHEVER VALUE RESULTS IN THE LOWER TRANSPORTATION CHARGES ON THE DATE OF SHIPMENT.

| CHECK ONE PRD ☒ | COLLECT ☐ | BUYERS P/U ☐ | SHIPPER LOAD ▶ | CONSIGNEE UNLOAD ▶ |
|---|---|---|---|---|

[redacted]

Subject to Section 7 of conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

E. I. DU PONT DE NEMOURS & CO

Per _____
(Signature of Consignor)

| NUMBER BY TYPE OF PACKAGE BAG | DRUM | CARTON | HM | DESCRIPTION AND CLASSIFICATION (PROPER SHIPPING NAME AND CLASS PER 49 CFR 172.101) | TOTAL QUANTITY (WEIGHT, VOLUME, GALLONS, ETC.) | WEIGHT (SUBJECT TO CORRECTION) | DU PONT COMM CODE |
|---|---|---|---|---|---|---|---|
| | | | | [illegible] INSECTICIDE, LIQUID, N.O.S. (MONOCROTOPHOS IN ACETONE), FLAMMABLE LIQUID, UN 2784, POISON | | | 7 |
| (SEE REVERSE SIDE FOR SHIPPING NAME) | | | | INSECTICIDE LIQUID, N.O.S., COMBUSTIBLE LIQUID, NA 1993 (XYLENE) | | | 8 |
| | | | | MEVINPHOS, POISON B, NA 2783 | | | 9 |
| | | | | [illegible] INSECTICIDE, LIQUID, N.O.S. (MEVINPHOS IN XYLENE), FLAMMABLE LIQUID, UN 2784, POISON | | | 10 |
| | | | | DICHLOROACETYL CHLORIDE, CORROSIVE MATERIAL, UN 1765 | (NET PLUS | | 11 |
| | | | | [illegible] INSECTICIDE, LIQUID, N.O.S. (MEVINPHOS IN ISOPROPANOL), FLAMMABLE LIQUID, UN 2784, POISON | TARE WEIGHT) | | 12 |
| | | | | CARBAMATE PESTICIDE, SOLID, N.O.S. (METHOMYL), POISON B, UN 2757 | | | 6 |
| | | | | CARBAMATE PESTICIDE, LIQUID, N.O.S. (METHOMYL IN METHANOL), FLAMMABLE LIQUID, POISON B, UN 2758 | | | 16 |
| | | | | FLAMMABLE LIQUID, POISONOUS, N.O.S. (DIAZINON IN METHANOL), FLAMMABLE LIQUID, POISON B, UN 3065 | | | 17 |
| | | | | ETHANOL SOLUTION, FLAMMABLE LIQUID, UN 1170 | | | 20 |
| | | | | ORGANIC PHOSPHATE COMPOUND, LIQUID, POISON B, NA 2783 | | | 30 |
| | | | | PESTICIDE, WATER REACTIVE, ORM-C, NA 2210 | | | 173 |
| | | | | ETHANOL SOLUTION, COMBUSTABLE LIQUID, UN 1170 | | | 185 |
| | | | | INSECTICIDE, LIQUID, N.O.S. (CONTAINS DIAZINON), POISON B, NA 2902 | | | 18 |
| | | | | CARBAMATE PESTICIDE, LIQUID, N.O.S. (METHOMYL IN CYCLOHEXANONE), POISON B, UN 2757 | | | 19 |
| | | | | XYLENE SOLUTION, FLAMMABLE LIQUID, UN 1307 | | | 2* |
| | | | | | | | |
| | | | | AGRICULTURAL INSECTICIDE, N.O.I.B.N., LIQUID | | | 19C |
| (SEE REVERSE SIDE FOR DESCRIPTION OF ARTICLES) | | | | AGRICULTURAL FUNGICIDES, N.O.I.B.N., OTHER THAN LIQUID | | | 10C |
| | | | | AGRICULTURAL FUNGICIDES, N.O.I.B.N., LIQUID | | | 10S |
| | | | | CHEMICALS, N.O.I.B.N. | | | 120 |
| | | | | WEED KILLING COMPOUND, N.O.I.B.N. | | | 18C |
| | | | | CLEANING COMPOUND, LIQUID, N.O.I.B.N. | | | 18C |
| | | | | AGRICULTURAL INSECTICIDE, N.O.I.B.N., OTHER THAN LIQUID | | | 18S |

PLACARDS OFFERED _____ T.E.G. ATTACHED _____

DO NOT SHIP OR STORE WITH FOODSTUFFS

FOR CONSIGNEE AND SHIPPER'S USE ONLY
THIS SHIPMENT CONSISTS OF THE FOLLOWING NAMED PRODUCTS AND PACKAGES:

NO. OF PACKAGES (PACKAGE SIZE) (PRODUCT NAME)

EXAMPLE: 875 12 x 4 LB CASES "KARMEX" WEED KILLER

THE DESCRIPTION AND WEIGHT INDICATED ON THIS BILL OF LADING ARE CORRECT SUBJECT TO VERIFICATION BY THE EASTERN, WESTERN OR SOUTHERN WEIGHING AND INSPECTION BUREAU ACCORDING TO AGREEMENT.

For CHEMICAL EMERGENCY Spill, Leak, Fire, Exposure or Accident Call CHEMTREC Day or Night (800) 424-9300 (Toll Free) • Washington, DC 483-7616 • Outside Continental USA (202) 483-7616

GROSS PRODUCT WEIGHT TOTAL WT. FROM ABO
PALLET WEIGHT FILL IN
GROSS SHIPPING WEIGHT FILL IN
(GROSS PROD WGT + PALLET WGT)

This is to certify the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

E. I. du Pont de Nemours & Company, Shipper
Per SHOW SIGNATURE
Permanent post-office address of shipper. PLATTE CHEMICAL CO.
P. O. BOX 5156 GREENVILLE, MISSISSIPPI

DATE SHIPMENT PICKED UP: FILL IN

DRIVER'S FULL NAME: OBTAIN DRIVER'S SIGNATURE
BY:

1

Per CARRIER'S FULL NAME
(CARRIER)

AB0000118625/47

THE FOLLOWING IS AN ALPHABETICAL LISTING OF THE MOST COMMONLY SHIPPED COMMODITIES AND THEIR CORRESPONDING DU PONT COMMODITY CODES WHICH REFERENCE THE PROPER BILL OF LADING DESCRIPTIONS SHOWN ON THE FACE OF THIS BILL OF LADING FOR COMMODITIES NOT LISTED HERE REFER TO THE PUBLIC WAREHOUSE MANUAL OR CONTACT THE ORDERING OFFICE FOR THE PROPER DESCRIPTION.

| DU PONT COMMODITY CODE | COMMODITY NAME |
|---|---|
| 160 | Ally® Herbicide |
| 160 | Amitrole® X-N Weed & Brush Killer |
| 190 | Asana Insecticide 1.9 EC |
| 185 | Asana Technical |
| 190 | Asana XL Insecticide 0.66 EC |
| 6 | Asana HP Insecticide 1.9 EC (Bulk) |
| 150 | Assure® Herbicide |
| 150 | Atrazine Technical |
| 160 | Atrazine 4L Herbicide |
| 160 | Atrazine 80W Herbicide |
| 160 | Atrazine 90 DF Herbicide |
| 30 | Azodrin Insecticide 78% Technical |
| 7 | Azodrin 5 Insecticide 72% Technical |
| 100 | Benlate® Fungicide |
| 100 | Benlate® PNW Fungicide |
| 100 | Benlate® 75C Fungicide |
| 100 | Benomyl 50 W |
| 100 | Benomyl Technical |
| 30 | Bidrin 8 Insecticide |
| 30 | Bidrin Insecticide Technical |
| 160 | Bladex Technical |
| 160 | Bladex 80W Herbicide |
| 160 | Bladex 90DF Herbicide |
| 160 | Bladex 4L Herbicide |
| 160 | Bladex 4L Herbicide, Bulk |
| 160 | Blazine 4L Herbicide |
| 160 | Blazine 80W Herbicide |
| 160 | Bromacil Technical |
| 120 | Butyl Urea, Secondary |
| 160 | Canopy® Herbicide |
| 100 | Carbendazim Composition |
| 100 | Carbendazim Technical |
| 160 | Cinch Technical |
| 160 | Cinch Tec Herbicide |
| 160 | Classic® Herbicide |
| 160 | Conquest 4L Herbicide |
| 160 | Conquest 90DF Herbicide |
| 100 | Curzate® M-8 Fungicide |
| 100 | Delsene® 75 Fungicide |
| 11 | Dichloroacetyl Chloride |
| 160 | Diuron Technical |
| 30 | EPN Technical |
| 160 | Escort® Herbicide |
| 160 | Extrazine 4L Herbicide |
| 160 | Extrazine 90DF Herbicide |
| 160 | Finesse™ Herbicide |
| 185 | Gardona Insecticide Technical |
| 160 | Gemini™ Herbicide |
| 160 | Glean® Herbicide |
| 160 | Harmony™ Herbicide |
| 20 | 25% Hexazinone Liquid |
| 160 | Hexazinone Technical |
| 160 | Hyvar® L Citrus Herbicide |
| 160 | Hyvar® X Herbicide |
| 160 | Hyvar® X-L Herbicide |
| 165 | Hyvar® X-L Herbicide Bulk |
| 160 | Karmex® Herbicide |
| 160 | Krenite® Brush Control Agent |
| 160 | Krenite® S Brush Control Agent |
| 160 | Krenite® Technical |
| 160 | Krovar® I Herbicide |
| 160 | Krovar® II Herbicide |
| 160 | Krovar® DF™ Herbicide |
| 160 | Krovar® Technical |
| 6 | * Lannate Insecticide (RQ-50 Kilo DM) |
| 16 | * Lannate L Insecticide (RQ-55 Gal DM) |
| 19 | * Lannate LV Insecticide (RQ-55 Gal DM) |
| 160 | Lexone® DF™ Herbicide |
| 160 | Lexone 4L Herbicide |
| 160 | 50% Linuron Composition |
| 160 | Linuron Technical |
| 160 | 50% Linuron Herbicide |
| 160 | Lorox Herbicide |
| 160 | Lorox DF™ Herbicide |
| 160 | Lorox L Herbicide |
| 105 | Manzate® Flowable Fungicide With Zinc |
| 100 | Manzate Fungicide |
| 170 | Manzate Fungicide (Water Shipments Only) |
| 100 | Manzate D Fungicide |
| 170 | Manzate D Fungicide (Water Shipments Only) |
| 100 | Manzate 200 Fungicide |
| 170 | Manzate 200 Fungicide (Water Shipments Only) |
| 105 | Manzate 200 Flowable Fungicide |
| 6 | Methomyl Composition |
| 6 | * Methomyl Technical (RQ-50 Kilo DM) |
| 120 | Neburon Technical |
| 6 | Nudrin Technical |
| 16 | Nudrin 1.8 Insecticide Solution |
| 6 | * Nudrin 90 Insecticide Solution (RQ-50 Kilo DM) |
| 21 | Nustar Fungicide |
| 160 | Oust Herbicide |
| 18 | Oxamyl Technical 42 |
| 190 | Pay-Off Insecticide 2.5 EC |
| 9 | Phosdrin Insecticide |
| 9 | * Phosdrin 10 3.VS Insecticide (RQ-All Pkgs 10 lbs. or More) |
| 10 | * Phosdrin 4EC Insecticide (RQ-All Pkgs 10 lbs. Or More) |
| 12 | * Phosdrin IPAA Insecticide (RQ-All Pkgs 10 lbs. or More) |
| 21 | Punch™ Fungicide |
| 190 | Pyrdrin Technical |
| 190 | Pyrdrin 5 ULV Insecticide |
| 190 | Pyrdrin 2.4 EC Insecticide |
| 8 | Pyrdrin 2.4 EC Insecticide (Bulk) |
| 185 | Racon Insecticide Technical |
| 185 | Savey™ Miticide |
| 160 | Sinbar® Herbicide |
| 180 | Surfactant WK |
| 160 | Telar™ Herbicide |
| 100 | Tersan® 1991 Turf Fungicide |
| 100 | Tersan® LSR Turf Fungicide |
| 170 | Tersan® LSR Turf Fungicide (Water Shipments Only) |
| 160 | Tupersan® Herbicide |
| 160 | Tupersan® 70 Herbicide |
| 160 | Velpar® Herbicide |
| 160 | Velpar® K2 Herbicide |
| 20 | Velpar L Herbicide |
| 20 | Velpar RP Herbicide |
| 185 | Vendex 50 WP Miticide |
| 185 | Vendex 4L Miticide |
| 185 | Vendex Technical |
| 17 | Vydate® L Insecticide Nematicide |

* COMMODITIES HAVING "REPORTABLE QUANTITIES" MUST BE SO INDICATED BY PLACING THE LETTERS "RQ" IN THE HM COLUMN PRECEDING THE COMMODITY DESCRIPTION IF INDIVIDUAL PACKAGES ARE LESS THAN INDICATED QUANTITY, DO NOT ENTER "RQ" IN THE HM COLUMN

AG 303 REV 2 86

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WALKER'S MILL, BARLEY MILL PLAZA
WILMINGTON, DELAWARE 19898

AGRICULTURAL PRODUCTS DEPARTMENT

35. A,B,C,D,E,F

cc: T. N. Kirchner
F. W. Voss
Product Coordinator
Plant Contract Administrator

Date _____

APPENDIX 7

Exhibit II
Instructions by TWX

**SHIPPING ORDER/BILL OF LADING INSTRUCTIONS**
**(PRODUCT NAME)**

Dear

The Customer Service Center of Agricultural Products Department will TWX or phone shipping orders to you in advance of a shipment. If TWXd, you will receive the order in a prescribed format. Attached Exhibit A defines each item on the order; Exhibit B illustrates the format of the order.

For all shipments, please prepare the 6-part Bill of Lading Form AG-363 as outlined in Exhibit C attached. The portions of the B/L dealing with quantity and the various weights must not be filled in until the trailer is actually loaded and the quantities verified by the shipping supervisor. Due to the varying sizes of trailers, it may not be possible to load the precise quantity specified on the order. In such cases the shipping order should have the quantity adjusted and the Wilmington Product Coordinator (who placed the order) in the Customer Service Center, Wilmington must be notified by TWX or phone.

-246c

Please distribute the Bills of Lading copies as follows:

Original #1 - To the production clerk at our plant Belle, WV, La Porte, TX or Mobile, AL responsible for the production and/or packing campaign.

#2 - Carrier's copy

#3 - (Packing List) Affix to last packed unit put on the trailer.

#4 - Financial Services Division (FSD)* To same address (envelope) as #6, along with original monthly stock report.

#5 - Warehouse - Retain for your files.

#6 - E. I. du Pont de Nemours & Co., Inc.*
Agricultural Products Department
Sales Service Center
Barley Mill Plaza, Bldg. 38 2-122
Wilmington, DE 19898
Attn: Stock Records Clerk

Attached Exhibit D provides important specific information for Bill of Lading preparation.

Please call if you have any questions.

Product Coordinator

(302) 992-60

* Use preaddressed envelope AG-764 available from above named Product Coordinator.

"OFF-LINE - TWX WAREHOUSES"

EXHIBIT A -- SHIPPING INSTRUCTIONS

1. PRINT DATE: Date order was transmitted

2. DOC CTRL NR: Assigned by the "System". Use this number along with MOS Order Number for reference (will be sequential for your location)

3. PAGE: Page Number

4. DU PONT ORD NR: Du Pont Order Number assigned by the "System". (Will not always be sequential)

5. ORD TYPE: Type of order, i.e. regular, intradepartmental, sample, customer return goods order, etc.

6. ORD DATE: Date order was placed

7. EXP PACK DATE: (On Export Orders Only)

8. REQST SHIP DATE: Requested ship date

9. SCHED SHIP DATE: Defaults to requested ship date unless changed by Customer Service Specialist.

10. CSR: Customer Service Specialist in Wilmington responsible for order.

11. DOC STATUS: Is document an Original Order, Alteration, Cancellation, or Retransmission?

12. SIG: Significance of schedule ship date, i.e. Ship on requested date, ship week of the date, customer pick up, etc.

13. CPO: Customer purchase order number.

14. SHIP TO: Ship to name and address.

15. CARR: Carrier name for shipment when specified by customer. Otherwise, will be blank, and shipping point must fill in carrier.

16. DLVRY INST: Delivery instructions as specified by the customer, i.e. deliver before 3:00 P.M., call before delivery, etc.

17. FRT TERMS: Prepaid or collect

18. ROUT: Routing instructions for carrier.

19. SPECIAL INSTRUCTIONS: Instructions to be followed by ship point, freight forwarder and general comments.

35.C

IMPORTANT: All Special Instructions should be read and followed.

20. Line Item Number (s)

21. NET LBS. OR GALLONS

22. CTNR TYP: Carton, drums, etc.

23. CTNR DSC: Carton 8-3 LB each

24. PROD: and NAME: Mnemonic code and registered name of product.

25. INVTRY CAT: Inventory category code i.e. standard material, off quality material, etc.

26. TOTAL PAGES PRINTED IS: Total number of pages to the order and bill of lading.

35.I

TIME: 11:09 PRINT DATE: 09/10/84 (1) DOC CTRL NR: A401 (2)

DU PONT DE NEMOURS & CO FOR DU PONT USE ONLY PAGE: 1 (3)

SHIPPING INSTRUCTIONS DUPONT ORD NR: CSMB00388 (4) ORD TYPE: A (5)

ORD DATE: 09/10/84 (6) EXP PACK DATE: (7) REQST SHIP DATE: 09/11/84 (8)

CUST SHIP DATE: 09/11/84 (9) CSR: AW1 (10) DOC STATUS: ORIGINAL (11)

ILL SHIP ON REQUESTED DATE (12) CPO: 30721 (13)

SHIP TO:

ISE CO INC * ROBERT S (14)

515 E 29TH ST NORTH

ICHITA , KS 67219

* DU PONT TRADEMARK

DUNTY: SEDGWICK

ARR: . (15) FRT TERMS: PREPAID (17)

LVRY INST: (16) ROUT: (18)

**********

SPECIAL INSTRUCTIONS *

IIS TEST COMPLETED BY R.ORLANDO (19)

**********

QTY: 24.00 LB (20) NO. CTNRS: 1 (22) CTNR TYP: CTN CTNR CD: 003R

PROD: DUST CTNR DSC: CS 8-3LB (23)

NAME: *DUST* HERBICIDE (24)

INVTRY CAT INVTRY RES

F00

(25)

QTY: 96.00 LB (21) NO. CTNRS: 8 (22) CTNR TYP: CTN CTNR CD: 002P

PROD: BENL CTNR DSC: CS 6-2 LB (23)

NAME: *BENLATE* FUNGICIDE (24)

INVTRY CAT INVTRY RES

F00

(23)

END END END END TOTAL PAGES PRINTED IS 1 (26) END END END END END

# STRAIGHT BILL OF LADING
## SHORT FORM—ORIGINAL—NOT NEGOTIABLE

CARRIER'S NO.

AG-363 Rev 5-8

EXHIBIT C 35.E

RECEIVED subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading

| DATE | CARRIER |
|---|---|
| MO/DAY/YR OF SHIP. | CARRIER'S FULL NAME |

| CUSTOMER ORDER NO | | SHIP POINT CITY & STATE | S/P CODE | SHIPPER'S I.D. NO |
|---|---|---|---|---|
| IF FURNISHED ON ORDER | AT | | | DU PONT ORDER NUMBER (9 DIGITS) |

From E. I. DU PONT DE NEMOURS & COMPANY (INC.)
50 AGRICULTURAL PRODUCTS DEPARTMENT

CONSIGNED TO

SHIP TO NAME & ADDRESS

(PLACE "X" IN APPROPRIATE BOX)

If Prepaid Mail Freight Bills To
FMIS FREIGHT
BOX 8964
WILMINGTON, DE 19899

VEHICLE OR CAR INITIAL & NO

IF LOWER CHARGES RESULT THE RELEASED VALUE OF THE PROPERTY IS HEREBY STATED BY THE SHIPPER TO BE NOT EXCEEDING 10¢ CENTS PER POUND FOR EACH CAR BUTTER RATED OR ANY HIGHER VALUE PERMITTED BY RAILROAD 50 CENTS PER POUND PER ARTICLE WHICHEVER VALUE RESULTS IN THE LOWEST TRANSPORTATION CHARGES ON THE DATE OF SHIPMENT

| CHECK ONE PPD | COLLECT | BUYERS P.U | SHIPPER LOAD | CONSIGNEE UNLOAD |
|---|---|---|---|---|
| ☒ | ☐ | ☐ | | |

[redacted]

Subject to Section 7 of conditions of applicable bill of lading if this shipment is to be delivered to the consignee without recourse on the consignor the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges

E. I. DU PONT DE NEMOURS & CO

Per _____
(Signature of Consignor)

| NUMBER BY TYPE OF PACKAGE BAG | DRUM | CARTON | HM | DESCRIPTION AND CLASSIFICATION (PROPER SHIPPING NAME AND CLASS PER 49 CFR 172.101) | TOTAL QUANTITY (WEIGHT, VOLUME, GALLONS, ETC.) | WEIGHT (SUBJECT TO CORRECTION) | DU PONT COMM. CODE |
|---|---|---|---|---|---|---|---|
| | | | | ORGANOPHOSPHORUS PESTICIDE LIQUID N.O.S. (MONOCROTOPHOS IN ACETONE), FLAMMABLE LIQUID UN 2784 POISON | | | 7 |
| (SEE REVERSE SIDE FOR SHIPPING NAME) | | | | INSECTICIDE LIQUID, N.O.S., COMBUSTIBLE LIQUID, NA 1993 (XYLENE) | | | 8 |
| | | | | MEVINPHOS POISON B NA 2783 | | | 9 |
| | | | | ORGANOPHOSPHORUS PESTICIDE, LIQUID, N.O.S. (MEVINPHOS IN XYLENE), FLAMMABLE LIQUID, UN 2784 POISON | | | 10 |
| | | | | DICHLORACETYL CHLORIDE, CORROSIVE MATERIAL UN 1765 | (NET PLUS | | 11 |
| | | | | ORGANOPHOSPHORUS PESTICIDE, LIQUID, N.O.S. (MEVINPHOS IN ISOPROPANOL, FLAMMABLE LIQUID UN 2784 POISON | TARE WEIGHT) | | 12 |
| | | | | CARBAMATE PESTICIDE SOLID N.O.S. (METHOMYL) POISON B, UN 2757 | | | 6 |
| | | | | CARBAMATE PESTICIDE LIQUID N.O.S. (METHOMYL IN METHANOL), FLAMMABLE LIQUID POISON B UN 2758 | | | 16 |
| | | | | FLAMMABLE LIQUID POISONOUS N.O.S. (DRAMYL IN METHANOL), FLAMMABLE LIQUID POISON B UN 1992 | | | 17 |
| | | | | ETHANOL SOLUTION FLAMMABLE LIQUID UN 1170 | | | 20 |
| | | | | ORGANIC PHOSPHATE COMPOUND LIQUID POISON B NA 2783 | | | 30 |
| | | | | PESTICIDE WATER REACTIVE ORM-C NA 2210 | | | 170 |
| | | | | ETHANOL SOLUTION COMBUSTABLE LIQUID UN 1170 | | | 165 |
| | | | | INSECTICIDE LIQUID N.O.S. (CONTAINS DRAMYL) POISON B NA 2902 | | | 18 |
| | | | | CARBAMATE PESTICIDE LIQUID N.O.S. (METHOMYL IN CYCLOHEXANONE), POISON B UN 2757 | | | 19 |
| | | | | XYLENE SOLUTION FLAMMABLE LIQUID UN 1307 | | | 21 |
| | | | | | | | |
| | | | | AGRICULTURAL INSECTICIDE NOIBN LIQUID | | | 190 |
| (SEE REVERSE SIDE FOR DESCRIPTION OF ARTICLES) | | | | AGRICULTURAL FUNGICIDES, N.O.I.B.N., OTHER THAN LIQUID | | | 100 |
| | | | | AGRICULTURAL FUNGICIDES N.O.I.B.N. LIQUID | | | 105 |
| | | | | CHEMICALS N.O.I.B.N. | | | 120 |
| | | | | WEED KILLING COMPOUND N.O.I.B.N. | | | 160 |
| | | | | CLEANING COMPOUND LIQUID N.O.I.B.N. | | | 180 |
| | | | | AGRICULTURAL INSECTICIDE N.O.I.B.N. OTHER THAN LIQUID | | | 185 |

PLACARDS OFFERED _____ T.E.G. ATTACHED _____

**DO NOT SHIP OR STORE WITH FOODSTUFFS**

**FOR CONSIGNEE AND SHIPPER'S USE ONLY**
**THIS SHIPMENT CONSISTS OF THE FOLLOWING NAMED PRODUCTS AND PACKAGES:**

NO. OF PACKAGES (PACKAGE SIZE) (PRODUCT NAME)

EXAMPLE: 875 12 x 4 LB CASES "KARMEX" WEED KILLER

DESCRIPTION AND WEIGHT INDICATED ON S BILL OF LADING ARE CORRECT SUBJECT VERIFICATION BY THE EASTERN WESTERN SOUTHERN WEIGHING AND INSPECTION BUREAU ACCORDING TO AGREEMENT

For CHEMICAL EMERGENCY Spill, Leak, Fire, Exposure or Accident Call CHEMTREC-Day or Night (800) 424-9300 (Toll Free) • Washington, DC 483-7616 • Outside Continental USA (202) 483-7616

GROSS PRODUCT WEIGHT TOTAL WT. FROM ABOVE
PALLET WEIGHT FILL IN
GROSS SHIPPING WEIGHT FILL IN
(GROSS PROD WGT + PALLET WGT)

This is to certify the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation

E. I. du Pont de Nemours & Company, Shipper
Per SHOW SIGNATURE

Permanent post-office address of shipper. PLATTE CHEMICAL CO.
P. O. BOX 5156 GREENVILLE, MISSISSIPPI

DATE SHIPMENT PICKED UP: FILL IN

DRIVER'S FULL NAME: OBTAIN DRIVER'S SIGNATURE
By:

Per CARRIER'S FULL NAME
(CARRIER)

AB000011862S/54

THE FOLLOWING IS AN ALPHABETICAL LISTING OF THE MOST COMMONLY SHIPPED COMMODITIES AND THEIR CORRESPONDING DU PONT COMMODITY CODES WHICH REFERENCE THE PROPER BILL OF LADING DESCRIPTIONS SHOWN ON THE FACE OF THIS BILL OF LADING. FOR COMMODITIES NOT LISTED HERE REFER TO THE PUBLIC WAREHOUSE MANUAL OR CONTACT THE ORDERING OFFICE FOR THE PROPER DESCRIPTION.

| DU PONT COMMODITY CODE | COMMODITY NAME |
|---|---|
| 160 | Ally® Herbicide |
| 160 | Ammate® X-NI Weed & Brush Killer |
| 190 | Asana Insecticide 1.9 EC |
| 185 | Asana Technical |
| 190 | Asana XL Insecticide 0.66 EC |
| 8 | Asana HP Insecticide 1.9 EC (Bulk) |
| 160 | Assure® Herbicide |
| 160 | Atrazine Technical |
| 160 | Atrazine 4L Herbicide |
| 160 | Atrazine 80W Herbicide |
| 160 | Atrazine 90 DF Herbicide |
| 30 | Azodrin Insecticide 78% Technical |
| 7 | Azodrin 5 Insecticide 78% Technical |
| 100 | Benlate® Fungicide |
| 100 | Benlate® PNW Fungicide |
| 100 | Benlate® 75C Fungicide |
| 100 | Benomyl 50 W |
| 100 | Benomyl Technical |
| 30 | Bidrin 8 Insecticide |
| 30 | Bidrin Insecticide Technical |
| 160 | Bladex Technical |
| 160 | Bladex 80W Herbicide |
| 160 | Bladex 90DF Herbicide |
| 160 | Bladex 4L Herbicide |
| 160 | Bladex 4L Herbicide, Bulk |
| 160 | Blazine 4L Herbicide |
| 160 | Blazine 80W Herbicide |
| 160 | Bromacil Technical |
| 120 | Butyl Urea, Secondary |
| 160 | Canopy® Herbicide |
| 100 | Carbendazim Composition |
| 100 | Carbendazim Technical |
| 160 | Cinch Technical |
| 160 | Cinch Tec Herbicide |
| 160 | Classic® Herbicide |
| 160 | Conquest 4L Herbicide |
| 160 | Conquest 90DF Herbicide |
| 100 | Curzate® M-8 Fungicide |
| 100 | Delsene® 75 Fungicide |
| 11 | Dichloroacetyl Chloride |
| 160 | Diuron Technical |
| 30 | EPN Technical |
| 160 | Escort® Herbicide |
| 160 | Extrazine 4L Herbicide |
| 160 | Extrazine 90DF Herbicide |
| 160 | Finesse™ Herbicide |
| 185 | Gardona Insecticide Technical |
| 160 | Gemini™ Herbicide |
| 160 | Glean® Herbicide |
| 160 | Harmony™ Herbicide |
| 20 | 25% Hexazinone Liquid |
| 160 | Hexazinone Technical |
| 160 | Hyvar® L Citrus Herbicide |
| 160 | Hyvar® X Herbicide |
| 160 | Hyvar® X-L Herbicide |
| 165 | Hyvar® X-L Herbicide Bulk |
| 160 | Karmex® Herbicide |
| 160 | Krenite® Brush Control Agent |
| 160 | Krenite® S Brush Control Agent |
| 160 | Krenite® Technical |
| 160 | Krovar® I Herbicide |
| 160 | Krovar® II Herbicide |
| 160 | Krovar® DF™ Herbicide |
| 160 | Krovar® Technical |
| 6 | * Lannate® Insecticide (RQ-50 Kilo DM) |
| 16 | * Lannate® L Insecticide (RQ-55 Gal. DM) |
| 19 | * Lannate® LV Insecticide (RQ-55 Gal. DM) |
| 160 | Lexone® DF™ Herbicide |
| 160 | Lexone® 4L Herbicide |
| 160 | 50% Linuron Composition |
| 160 | Linuron Technical |
| 160 | 50% Linuron Herbicide |
| 160 | Lorox® Herbicide |
| 160 | Lorox® DF™ Herbicide |
| 160 | Lorox® L Herbicide |
| 105 | Manzate® Flowable Fungicide With Zinc |
| 100 | Manzate® Fungicide |
| 170 | Manzate® Fungicide (Water Shipments Only) |
| 100 | Manzate® D Fungicide |
| 170 | Manzate® D Fungicide (Water Shipments Only) |
| 100 | Manzate® 200 Fungicide |
| 170 | Manzate® 200 Fungicide (Water Shipments Only) |
| 105 | Manzate® 200 Flowable Fungicide |
| 6 | Methomyl Composition |
| 6 | * Methomyl Technical (RQ-50 Kilo DM) |
| 120 | Neburon Technical |
| 6 | Nudrin Technical |
| 16 | Nudrin 1.8 Insecticide Solution |
| 6 | * Nudrin 90 Insecticide Solution (RQ-50 Kilo DM) |
| 21 | Nustar® Fungicide |
| 160 | Oust® Herbicide |
| 18 | Oxamyl Technical 42 |
| 190 | Pay-Off® Insecticide 2.5 EC |
| 9 | Phosdrin Insecticide |
| 9 | * Phosdrin 10 3WS Insecticide (RQ-All Pkgs 10 lbs. or More) |
| 10 | * Phosdrin 4EC Insecticide (RQ-All Pkgs 10 lbs. Or More) |
| 12 | * Phosdrin IPA4 Insecticide (RQ-All Pkgs 10 lbs. or More) |
| 21 | Punch™ Fungicide |
| 190 | Pyrdrin Technical |
| 190 | Pyrdrin 4 ULV Insecticide |
| 190 | Pyrdrin 2 4 EC Insecticide |
| 8 | Pyrdrin 2.4 EC Insecticide (Bulk) |
| 185 | Rabon Insecticide Technical |
| 185 | Savey™ Miticide |
| 160 | Sinbar® Herbicide |
| 180 | Surfactant WK |
| 160 | Telar™ Herbicide |
| 100 | Tersan® 1991 Turf Fungicide |
| 100 | Tersan® LSR Turf Fungicide |
| 170 | Tersan® LSR Turf Fungicide (Water Shipments Only) |
| 160 | Tupersan® Herbicide |
| 160 | Tupersan® 70 Herbicide |
| 160 | Velpar® Herbicide |
| 160 | Velpar® K3 Herbicide |
| 20 | Velpar® L Herbicide |
| 20 | Velpar® RP Herbicide |
| 185 | Vendex 50 WP Miticide |
| 185 | Vendex 4L Miticide |
| 185 | Vendex Technical |
| 17 | Vydate® L Insecticide/Nematicide |

* COMMODITIES HAVING "REPORTABLE QUANTITIES" MUST BE SO INDICATED BY PLACING THE LETTERS "RQ" IN THE HM COLUMN PRECEDING THE COMMODITY DESCRIPTION. IF INDIVIDUAL PACKAGES ARE LESS THAN INDICATED QUANTITY, DO NOT ENTER "RQ" IN THE HM COLUMN.

EXHIBIT III

REGIONAL OFFICE IDENTIFICATION BY ORDER NUMBER PREFIX

ORDER NUMBER PREFIX 25B

E. I. Du Pont De Nemours & Co., Inc.
Agricultural Products
Attn: Office Manager
Chaddsford Business Campus
Brandywine 2 Suite 202
U.S. Rt. #1 and #202 19317
215-358-5322

ORDER NUMBER PREFIX 17B

E. I. Du Pont De Nemours & Co., Inc.
Agricultural Products
Attn: Office Manager
223 Perimeter Center Parkway
Atlanta, GA 30346
404-393-8100

ORDER NUMBER PREFIX 15B

E. I. Du Pont De Nemours & Co., Inc.
Agricultural Products
Attn: Office Manager
5725 East River Road
Chicago, IL 60631
312-399-7600

ORDER NUMBER PREFIX 36B

E. I. Du Pont De Nemours & Co., Inc.
Agricultural Products
Attn: Office Manager
7401 Mansfield Avenue, Suite 300
Lakewood, CO 80235
303-987-2510

ORDER NUMBER PREFIX 48B

E. I. Du Pont De Nemours & Co., Inc.
Agricultural Products
Attn: Office Manager
2180 Sandmill Road
Menlo Park, CA 94025
415-854-1030

ORDER NUMBER PREFIX 40B

E. I. Du Pont De Nemours & Co., Inc.
Agricultural Products
Product Coordinator
Walker's Mill 2-166, Barley Mill Plaza
Wilmington, DE 19898

EXHIBIT IV

IMPORTANT SPECIFICS FOR OUR BILL OF LADING PREPARATION

- Proper bill of lading description for product: By example: For "Lorox" L. Weed Killing Compound, N.O.I.B.N.

- Freight Payment Terms: Prepaid Ship Point Freight Allowed

- Bill of lading number will be the Shipper's I.D. number. This number consists of nine characters---the first four being the alpha prefix _____ and the remaining five indicate the numerical order number. When more than one shipment is made against an order, indicate the partial by adding A01 (for the first shipment), A02 (for the second shipment) immediately after the nine character number. (No hyphen or dash.)

  By Example: If the alpha prefix is XRUP, then Order Number 15B40111 with two partials would be

  Shipment ID number partial one, XRUB40111A01
  Shipment ID number partial two, XRUB40111A02

- Carriers should send freight bill as indicated below and on Bill of Lading to:

  FMIS Freight
  P.O. Box 8964
  Wilmington, DE 19899

  Do not show the Du Pont name in above address.

- Shipping Packages: Carton containing 2 2-1/2 gallon jugs
  Gross weight per carton 53 lbs
  36 cartons per pallet

- TWX or phone Wilmington, phone (302) 992-6___ on day of shipment and provide the order number, quantity by package size, ship date and carrier.

- Add to Bill of Lading "Protect from Freezing" as appropriate.

## APPENDIX 8

## METHOD OF CALCULATION FOR RAW MATERIAL ALLOWANCES

Maximum
Raw Material Use = (1 + Allowance % / 100) x Production x FMS Specified Charge

Where:

Production = Number of Unit Packages Filled x Label Weight (Volume)

Allowance % = Allowance % specified on Raw Materials in the Contract

FMS Specified Charge = The Unit Consumption shown on the Formulation Manufacturing Specifications (FMS) Sheet in the Contractor Manual.

For all Raw Material Consumption beyond the maximum calculated above, the Contractor must reimburse Du Pont for Over-Consumption.

Example:

Production = 100,000 lbs Hyvar X
Allowance % = 1.5%
FMS Specified Charge -- 0.838 lbs Bromacil Tech/lb Product

Maximum Bromacil Tech Use = (1 + 1.5/100) x 100,000 x 0.838 = 85,057

Actual consumption by the Contractor was 86,000 lbs Bromacil Tech thus the Contractor must reimburse Du Pont for 86,000 - 85,057 = 943 lbs that were Over-Consumed.

AG-303 REV. 2-86

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WALKER'S MILL, BARLEY MILL PLAZA
WILMINGTON, DELAWARE 19898

AGRICULTURAL PRODUCTS DEPARTMENT

December 19, 1988

Mr. Geoff Pratt
Cedar Chemical Company
5100 Poplar Avenue
Memphis, TN 38137

Dear Geoff:

We look forward to meeting with you, tentatively, on ~~January 17~~ 1/24 at 8 a.m. to further discuss the possibility of manufacture of diisocyanates starting early in the second quarter.

Since we last discussed this, the technology has changed slightly. A revised technology package (P. O. Moss' October 14, 1988 report) is enclosed and issued per the terms of our November 10, 1987 Confidential Information and Invention Agreement. If there are questions, you are welcome to call Phil Moss directly at 302-695-3491. This way when we meet on the 17th, you will possibly be in a position to tell us what process changes are required for the two scopes of work (Cedar does reaction and purification, and scope two - Cedar does purification only). Once we agree on the process equipment required for each scope, we are interested in a quote for facilities modifications and ongoing costs.

Sincerely,

T. N. Kirchner

TNK009:akd
Encl.

Reviewed 1-18-89 JPeter



AB0000117768/1

DUPONT CONFIDENTIAL

E. I. duPont de Nemours & Co., Inc
Agricultural Products Department
Experimental Station
Wilmington, Delaware 19898

# INFORMATION PACKAGE

# MANUFACTURE OF TRANS CYCLOHEXYL DIISOCYANATE

Prepared by: P. O. Moss
P. O. Moss
Research Engineer
October 14, 1988
Revised:

WHEN NO LONGER NEEDED RETURN TO:

P. O. Moss
E. I. du Pont de Nemours & Co., Inc.
Agricultural Products Department
Experimental Station
P.O. Box 80402
Wilmington DE 19880-0402

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## INTRODUCTION

This information manual summarizes our current knowledge about the production of trans cyclohexyl diisocyanate (t-CHDI) Further development work is underway, and improvements to the process will probably result from this research.

## PRE MANUFACTURING NOTICE STATUS

The PMN for t-CHDI is being prepared and will be submitted in the near future.

## RAW MATERIALS AND PRODUCT

A. Trans Cyclohexyl Diamine (t-CHDA) — short term molten in truck melts 65°

The key raw material, trans cyclohexyl diamine (t-CHDA), is to be produced by Dupont and will be provided mid to late March 1989. Supplies will be limited.

T-CHDI is moderately toxic and a severe skin and eye irritant. It is combustible and will produce hazardous gases such as ammonia, carbon monoxide, and hydrogen cyanide when burning. The MSDS can be found in the appendix.

Current plans call for the shipment of this material as a melt in iso tanks. Shipment in drums is also being considered.

B. Trans Cyclohexyl Diisocyanate (t-CHDI)

Only limited data exist for the properties of t-CHDI. It is extremely toxic by inhalation, moderately toxic by skin exposure and slightly toxic by ingestion. T-CHDI presents only a slight fire hazard. It also reacts with moisture in the air to degrade the product. The MSDS and an information sheet can be found in the appendix.

Manufacturing specifications:

- o Assay . . . . . >99%
- o Orthodichlorobenzene . . . . . <.5%
- o Monoisocyanates (mixed) . . . . . <1.0%

C. Other Raw Materials

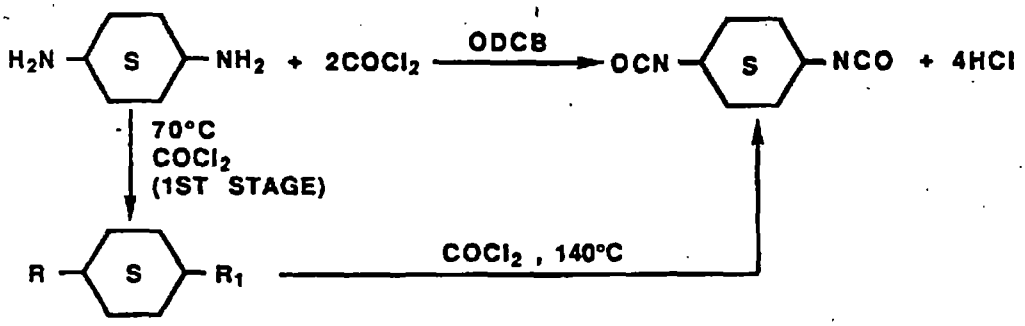
o Phosgene: Phosgene is a colorless, extremely toxic gas with an odor of musty hay at low concentrations. With inhalation, it can cause delayed pulmonary edema. Exposure to the skin and cause severe burns. It is available in 1 ton and 150 lb cylinders.

o Orthodichlorobenzene: Orthodichlorobenzene (ODCB) is a clear, irritating, combustible liquid. Prolonged exposure can cause narcosis and liver and kidney damage. It is available in a variety of packages including 55 gal drums, and tank trucks.

MSDS's for the above compounds can found in the appendix. Technical grades of these raw materials have been used successfully for all laboratory work. The effects of rust, scale and other impurities likely to found in a manufacturing situation have not been investigated.

## CHEMISTRY

### REACTION:

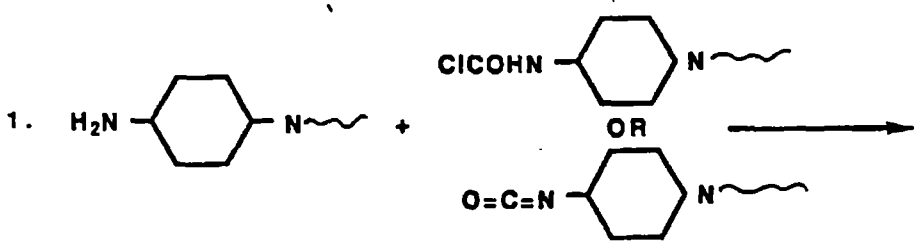


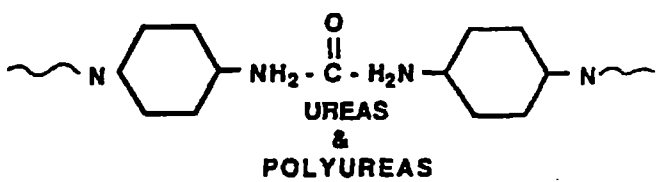

R OR $R^1$ = $NH_2$ · HCl OR NHCOCl

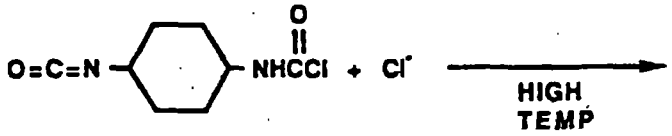
AMINE HYDRO-CHLORIDE

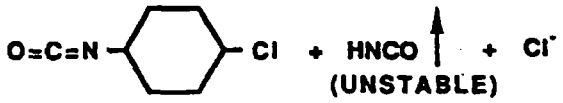
CARBAMOYL CHLORIDE

### BY-PRODUCT REACTIONS:

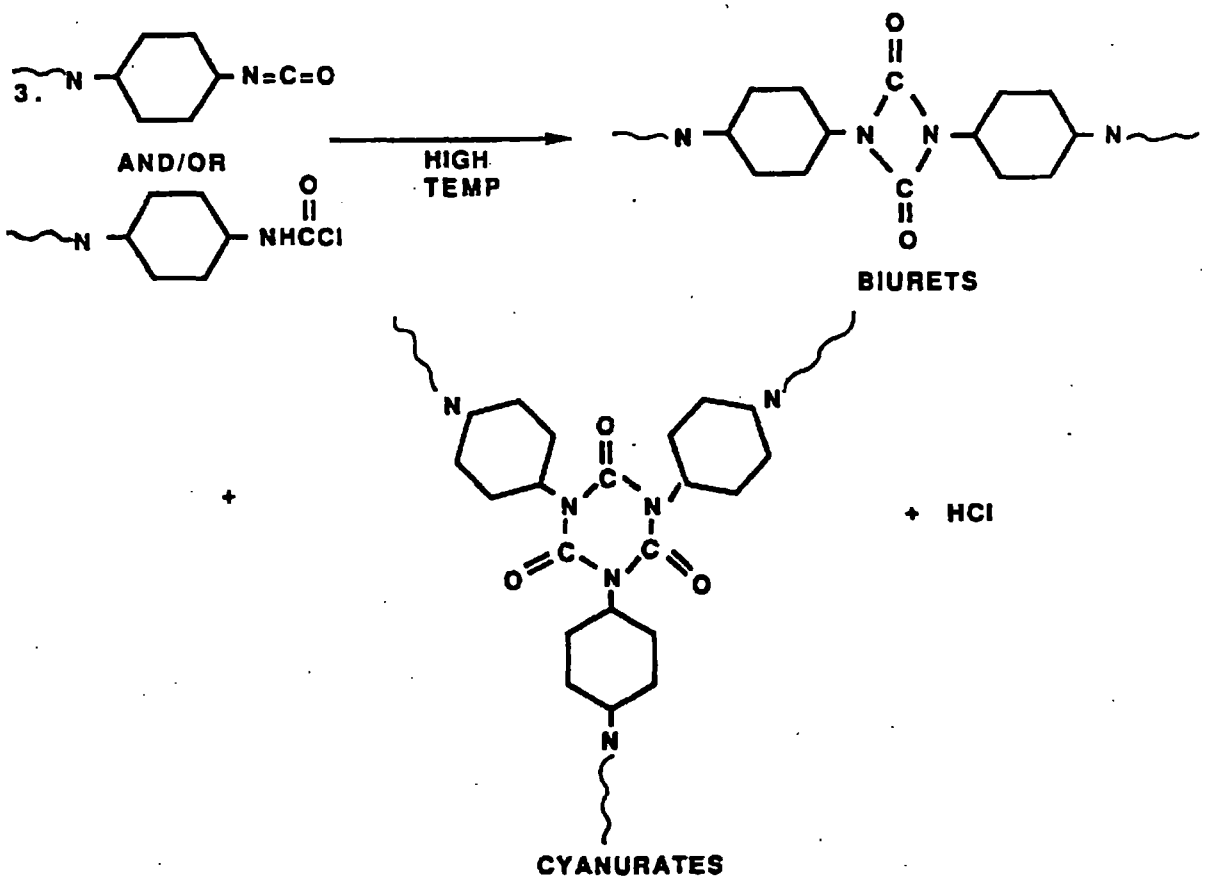


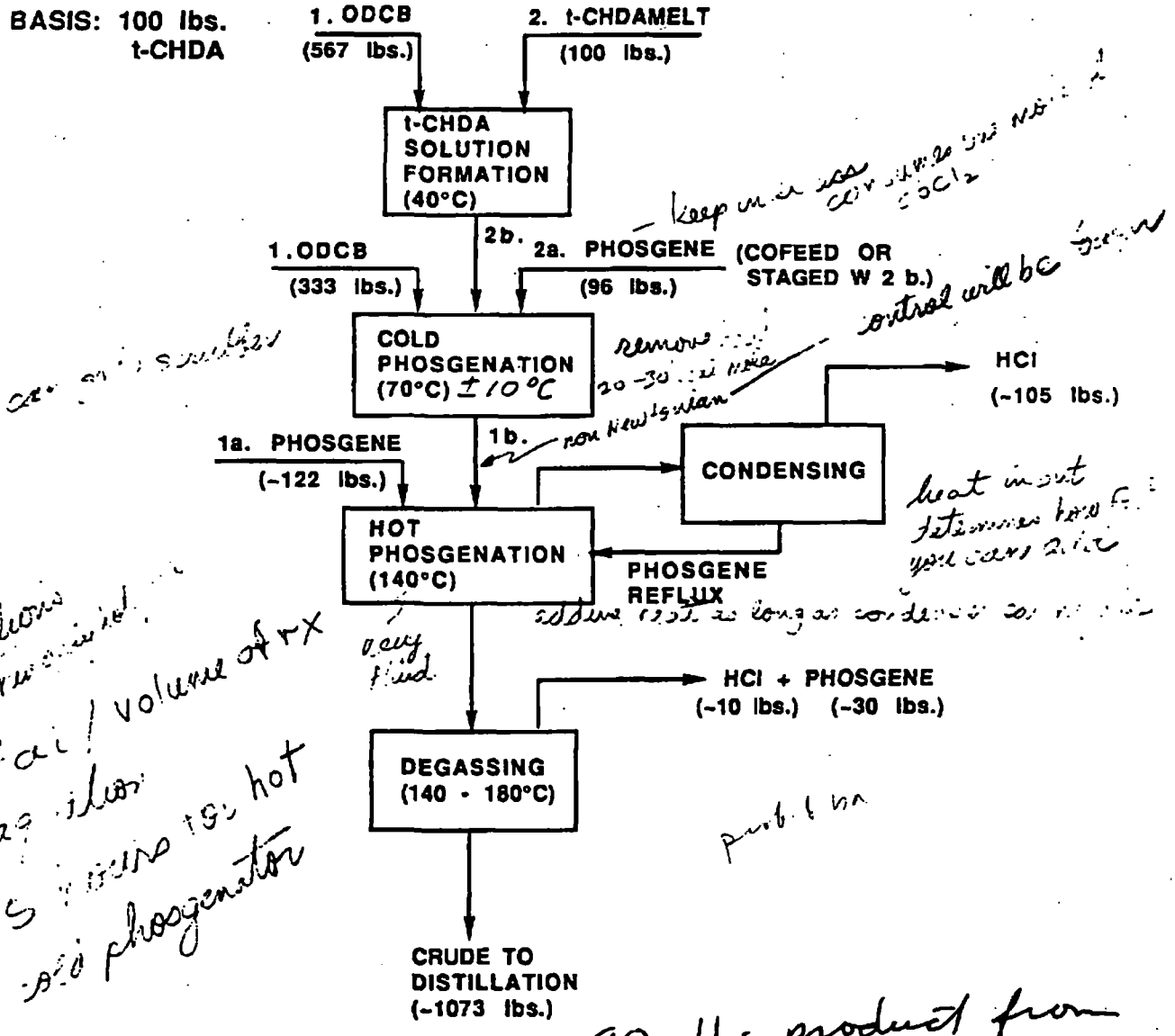
2. 


BY-PRODUCT REACTION - CONT'D

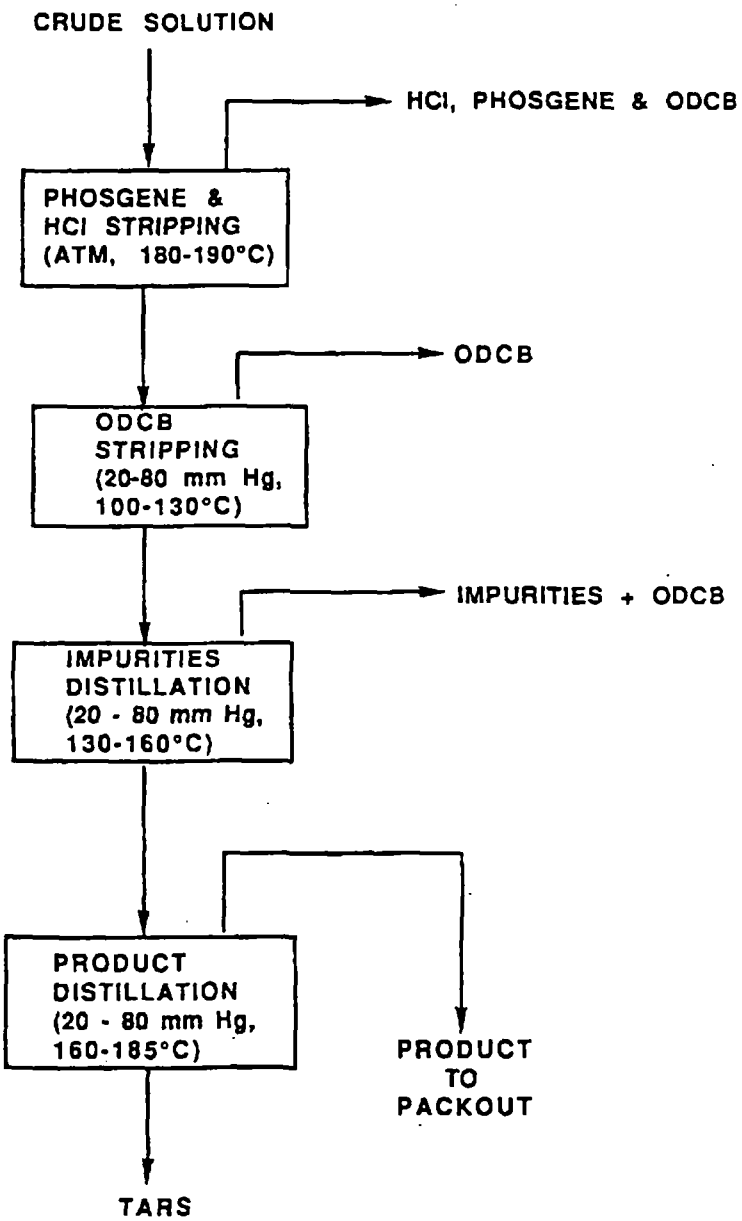
3. 

# t-CHDI CRUDE PRODUCT FLOWSHEET




90 lbs product from distillation

# t-CHDI DISTILLATION



PROCESS DESCRIPTION AND ENGINEERING

The trans CHDI process can be divided into five basic steps: diamine solution formation, cold phosgenation, hot phosgenation degassing and distillations. A solution of the diamine in orthodichorobenzene (ODCB) is first formed. In the cold phosgenation, the diamine solution is phosgenated at 50 - 70 deg C with phosgene in excess to form a complex mixture of molecules. Some of the amine groups are in the form of hydrochloride salts and some are converted to carbamoyl chloride. In the third step, the mixture formed in the cold phosgenation is cofed with phosgene to a heel of material from the previous batch at 140 deg C. Here, the remaining hydrochloride salt groups are converted to carbamoyl chloride. The carbamoyl chloride groups then undergo dehydrohalogenation to form the diisocyanate. Phosgene is kept in reflux during this entire operation and HCl gas evolves from the reaction mass. The crude product is then heated to 155 deg C. to remove most of the excess phosgene and HCl.

The resulting crude is approximately 12% diisocyanate in ODCB, trace amounts of phosgene and HCl, a small but important percentage of monoisocyante by-products and some high boiling ureas, polyureas, and biurets. Four distillations are necessary. In the first distillation, all the phosgene and HCl is stripped off at atmospheric pressure. Then about 90% of the ODCB is stripped out at atmospheric pressure with the end point being temperature of the pot at 190 deg C. The material is then vacuum distilled (20 mm Hg abs) to remove the remainder of the ODCB and the monoisocyanates. The monoisocyanates removal is the most difficult distillation as their boiling points are close to that of the diisocyanate. The product is then separated from the high boiling by-products by taking it overhead at the high vacuum.

A. DIAMINE SOLUTION PREPARATION

1.0 Description and Objective

The purpose of this step is to make a solution/slurry of the trans cyclohexyldiamine (t CHDA) in ODCB. The diamine is solid at room temperature and is soluble in ODCB up to 13 wt% at ambient temperature. To date, solutions have been made from flaked solid diamine by charging it to a tank of stirring ODCB at ambient temperature. The solids float and dissolve to form an amber colored solution of light viscosity.

Plans for interim operation call for using the diamine in the form of a melt in iso tanks. To date, a process that uses melt to form the solution has not been investigated.

2.0 Laboratory and Semiworks Experience

Solutions/sloes of t CHDA and ODCB have been made up to XX wt% in stirred round bottom flasks, resin kettles, and in the semiworks an unagitated XX liter glass cylindrical kettle with a

recirculation loop. The dissolution of the tCHDA is quite slow at ambient temperature, taking about 2 hrs to reach an apparent equilibrium point. Warming of the solution to between 40 and 45 deg C helped the dissolution rate and solubility markedly.

3.0 Equipment

Making the solution from the flaked diamine requires a stirred tank reactor equipped with a solids charge hopper with rotary valve or equivalent. Nitrogen padding is a must because of the reactivity of the diamine with air and moisture and the combustibility of ODCB. The solutions exposed to the air formed a "scum" of probable decomposed material. Experience indicates that there are no special agitation requirements.

Although there is no experience with making the solution from melt diamine, one can speculate that a stirred tank reactor may be used for this service as well. Handling of the melt will require traced or jacketed piping (mp =60 deg C.) The diamine sublimes and some provisions for it in the handling system should be included in the design. Cooling will probably not be required because the next step operates at 50 to 70 deg C.

Stainless steel should be an adequate material of construction for this entire system. Glass lined equipment can be used if available.

4.0 Thermodynamics, Kinetics and Energy Requirements

Dissolution of tCHDA in ODCB has no notice heat of solution.

5.0 Process Control

The variables to control in this step are the diamine additionrate. It is recommended that the diamine be added to the ODCB at a slow but practical rate to prevent any possibility of lumping.

6.0 Hazards

The hazards of this step are only those hazards associated with the raw materials.

B. COLD PHOSGENATION

1.0 Objective and Description

The objective of this step is to partially react the tCHDI in the solution produced in the previous step with phosgene at a temperature of between 50 and 70 deg C. By doing this prior to the high temperature phosgenation, The amine groups are "capped" thus protecting them from the amine - isocyanate urea formation reaction.

Phosgene should be kept in excess during the entire reaction. This may be accomplished in a batch reaction mode by dissolving it in a charge of ODCB plus a heel of material remaining from the last batch, then slowly feeding in the diamine solution

controlling the temperature with the feed rate. It can also be done by starting with a heel of ODCB or reacted material and cofeeding or alternating the charges of phosgene and diamine, being careful to keep the phosgene in at least 10% excess at all times.

The resulting reaction mass from the combination of diamine and phosgene is a very thick yellowish white slurry containing some gelatinous solids and viscous liquid.

This first phosgenation will consume only one mole of phosgene per mole diamine. The reaction produces a mixture of compounds: an amine hydrochloride salt of the carbamoyl chloride, a double amine hydrochloride salt, and a double carbamoyl chloride. The actual proportions of these reaction products have not been measured.

## 2.0 Laboratory and Semiworks Experience

Cold phosgenations have been run in 500 ml round bottom flasks, 1 liter resin kettles and a 50 liter glass reactor. T-CHDI solutions of strengths ranging from 15 to 30 wt % have been used. The effect of diamine feed strength on conversion to the desired products has not been measured due to the complex mixture of desired compounds. Yields for this step also not been measured.

In almost all the runs thus far have been done using a surface feed of the diamine solution. This was done more for convenience and reliability than optimization of yields (see discussion below on diamine solution addition point). Cycle times in the semiworks for this step were 5-6 hrs mostly due to the heavy exotherm and the thick material limiting heat transfer.

## 3.0 Equipment

The equipment used for the cold phosgenation should be a stirred tank reactor constructed of corrosion resistant materials such as glass lined steel or Hastalloy. Facilities for cooling are required as the reaction is highly exothermic. Since the operating temperature is 50-70 deg C ambient water can be used for cooling.

Diamine solution feed point design is critical to trouble-free operation and possibly yields. A dip tube addition close to the tip of the agitator is recommended. However, the reaction is fast and will plug the feed dip tube if the reaction mass or phosgene is allowed to back up into it. An automatic ODCB rinse out system of the dip tube every time diamine solution flow is interrupted could be used to remedy this problem. At the feed point itself (tip of a dip tube) the agitation should be as turbulent as possible for adequate mixing to prevent lumps of material forming in the reactor. Rapid dispersal of the diamine is thought to be beneficial to yield. By lowering the concentration of the unprotected amine groups at a local level (good mixing), the side reaction between them and the carbamoyl chloride to form ureas and polyureas is slowed.

Because of the viscosity of the formed slurry, mechanical adequacy of the reactor agitator and drive should be evaluated. With such a thick slurry, good agitation is necessary for adequate heat transfer. No measurements are currently available.

Little or no off gas comes off this reaction since the HCl generated from the amine to carbamoyl chloride reaction reacts with any free amines groups to form the hydrochloride salts. However, since phosgene is present and in excess, venting to some type of phosgene neutralizing scrubber is recommended.

4.0 Thermodynamics and Energy Requirements

The dissolution of phosgene in ODCB is exothermic and is estimated to be XX kcal per mole phosgene by experimentation The overall heat of reaction is for the conversion of the diamine to the carbamoyl chloride - hydrochloride salt mixture is estimated to be XX kcal per mole diamine by calculation.

5.0 Process Control

Variables to be controlled in this step are: The phosgene feed rate and amount, the temperature of the reaction, the feed rate of the diamine solution/slurry, and the ratio of the diamine feed and the phosgene feed.

The phosgene feed rate should be controlled in such a manner that mass transfer/reaction rate is adequate enough to to keep up with the diamine feed rate and minimize venting losses. In other words, amounts of phosgene in the reaction mass should be controlled to maintain an excess when compared to the diamine fed. However, excess must be controlled to make sure that the phosgene solubility in the reaction mass is not exceeded.

It is critical to maintain the reactor temperature between 50 and 70 deg C. Too low a temperature will slow the reaction to such an extent that a build-up of unreacted material is possible and could result in uncontrollable exotherming of the reaction mass. Also, the slurries tend to get thicker as they get cooler.

Too high a temperature will result in low yields and possible phosgene starvation of the reaction mass. This could be due to some of the amine hydrochloride salt groups reacting with phosgene and therefore consuming unanticipated amounts beyond one equivalent. Another consequence of too high a temperature could be the the loss of phosgene by venting and could thus remove phosgene from the system. If phosgene starvation becomes severe enough at the higher temperatures, and the exothermic urea/polyurea formation reactions become dominant, temperature "spiking" (sudden rise of the reactor temperature 30 deg or more) can result.

The recommended control scheme is to place full cooling on the vessel and control the temperature of the reactor with the diamine solution feed, keeping the phosgene in excess.

6.0 Hazards

The hazards associated with this step are those for the raw materials and the possibility of temperature "spiking" if the reaction is not conducted properly (see process control section above). The product of this reaction contains dissolved phosgene.

C. HOT PHOSGENATION

1.0 Objective and Description

In this step, the reactions are completed to form the trans cyclohexyl diisocyanate in the form of crude product solution in ODCB.

The cold phosgenated reaction mass is slowly fed into a agitated reactor at 140 deg C. containing either a heel from a previous batch or ODCB. Phosgene is kept in excess and in reflux during the entire procedure. Hydrogen chloride gas is given off in a steady and controlled manner. The reactor is heated and phosgene is fed to control the temperature.

Once the cold phosgenated material feed is complete, the reaction is continued with refluxing phosgene until the HCl venting tapers off.

2.0 Laboratory and Semiworks Experience

Hot phosgenations have been run in 500 ml round bottom flasks, 1 liter resin kettles, and a glass 50 liter round bottom reactor. To date, batch reactions (non cofeed) have been done almost exclusively because of the difficulty of transferring the thick cold phosgenated material in a controlled manner on a lab scale. Also, in the semiworks situation, only one reactor was available for both hot an cold phosgenation. The reactors used were equipped with agitators and very low temperature condensers (dry ice/acetone which is -70 deg c.).

In the batch mode, the cold phosgenated material is slowly heated up from the cold phosgenation temperature of 70 to a final temperature of 140 deg C while maintaining phosgene in reflux. This method of operation results in lower yields, and is difficult to control. For this reason, and the results of work on other isocyanates, the cofeed method is recommended.

3.0 Equipment

The equipment used for the hot phosgenation should be a agitated tank reactor constructed of corrosion resistant materials such as glass lined steel of Hastalloy. Heating facilities must not only be able to heat the material to 140 deg C but also provide significant heat input (say at least 170 deg C on a reactor jacket). Heat input during the hot phosgenation is important as it provides burlap of phosgene and therefore strips HCl from the reaction mass forcing the carbamoyl chloride to release HCl and form the isocyanate groups.

The off gas system for the hot phosgenator must have very cold (-70) phosgene condensing facilities because the HCl acts as an inert. Since phosgene freewheels rapidly around the condensing and reactor system, operating the condenser at a temperature higher than this will result in lower phosgene yields. Some intermediate temperature condensers can be used to lower the heat load on this final very cold condenser. However, the entire condensing system must be sized to handle all the heat load provided from the reactor heating system. Instrumentation to measure the gas flow from the final condenser will also be required to determine reaction endpoint when the HCl flow tapers off.

4.0 Thermodynamics and Energy Requirements

The reactions in the hot phosgenation are somewhat endothermic. The higher the heat input to the reactor, the shorter the batch times. Heat is required to thermally crack the carbamoyl chloride groups to isocyanate and also provides driving force to boil phosgene from the reaction mass. Boiling phosgene strips HCl out of the reaction mass and therefore shifts the carbamoyl chloride/isocyanate equilibrium toward isocyanate.

5.0 Process Control

Measure and control of the phosgene, and cold phosgenated material flow rates, and heat input to the reactor are required. Flow measurement of the HCl off gas from the final condenser to determine end point is also recommended.

The recommended control strategy is to set the flow of the cold phosgenate, and heat input, then control the temperature of the reactor by adding phosgene.

6.0 Hazards

The hazards associated with the hot phosgenation step are the same as those with the cold phosgenation.

D. DEGASSING

1.0 Description and Objective

The objective of this step is to heat the completed hot phosgenate without phosgene condensing to about 182 deg C. thus stripping out all the phosgene and HCl.

This is a simple heating operation to the phosgene free boiling point of the hot phosgenate.

2.0 Equipment

The equipment used for the degassing step should be a tank reactor constructed of corrosion resistant material such as glass lined steel or Hastalloy. While agitation is not necessary, it is desirable to promote heat transfer. Heating facilities must also be provided to heat the material up to 182-183 deg C. Some kind of condensing should also be provided for ODCB vapors (water cooled) but not so cool as to condense or promote the absorption

of phosgene in the condensed ODCB. The best way to avoid the reintroduction of absorbed phosgene to the degassing material is to divert any ODCB condensate to the cold phosgenator for recycle.

This system must be vented to a phosgene neutralizing scrubber of sufficient capacity to handle all the phosgene and HCl contained in the hot phosgenate.

3.0 Thermodynamics and Energy Requirements

The only heat effects of this step are the heat capacity of the hot phosgenate, and the heats of solution of phosgene and HCl in the hot phosgenate.

4.0 Process Control

The only parameter to control on this step is the rate of heatup of the material. The upper limit on this rate will be the capacity of the ODCB condenser and neutralizing scrubber to adequately handle the vented gasses.

5.0 Hazards

There are no hazards associated with this step other than those of the contained materials

E. DISTILLATION

1.0 Objective and Description

The objective of these steps is to remove the lower boiling ODCB and monoisocyanates, and the higher boiling ureas, polyureas, biurets and cyanurates from the product to meet the product specifications.

If complete degassing has not been achieved in the degassing step, the material is first run through a stripping column with the reboiler temperature at about 185 deg C. The ODCB/phosgene/HCl removed from the overheads can be recycled to the cold phosgenator. This distillation is run at atmospheric pressure.

The ODCB and impurities (monoisocyanates) distillations are conducted at 20 to 80 mm Hg absolute pressure. Both of these distillations are stripping operations with the waste streams coming off overhead and the product from the reboiler.

The product distillation separates the product overhead and the high boiling tars (polyureas, biurets and cyanurates) and is conducted at 20 to 80 mm Hg. The product is then packed out in drums as a cast melt.

All the distillations except the impurities distillation require a minimal number of theoretical plates (about 5) with reasonable reflux ratios of 2:1 and 1:1. The impurities distillation is by far the most demanding, requiring a minimum of 10 theoretical plates as the boiling points of the product and the monoisocyanates appear to be very close. Even with this high number of theoretical plates, reflux ratios may be 3:1 or higher.

The exposure of the product to high temperatures can cause degradation and polymerization to thermosetting cyanurate and biuret type polymers that do not dissolve in any common solvents. This is a time/temperature relationship that has yet to be determined. This seems to be an especially acute problem when the material contains the high boilers. If reboilers are allowed to run at temperatures much above 185 deg C, the equipment could be ruined.

3.0 Equipment

The set-up for distilling this material can be configured in a number of ways. Ideally four distillation columns would be used for a once through process. For interim operation though, one column could be used for all the distillations. However configured, the whole process must be constructed of corrosion resistant materials such as glass lined steel or Hastalloy.

Given that the material is temperature sensitive, and the material can polymerize, minimization of heat exposure should be a high priority in the design. For this reason, continuous operation of the columns is recommended, especially for the last two distillations. Also, the equipment used for the impurities distillation should have enough theoretical stages to keep the reflux ratio to a minimum.

Trans CHDI is a subliming material with a melting point of about 60 deg C. The bottom half of the ODCB distillation equipment and he entire distillation trains for the impurities distillation and final distillation therefore be heat traced and insulated. Condenser temperatures also must controlled in a way that will condense the product yet keep it above its melting point. T-CHDI vapors will solidify on any cool surface. At some point between the still condenser and the vacuum source, there must be some facilities to knock down any t-CHDI vapors. A brine cooled condenser with a small ODCB spray to rinse it down is a very good way to accomplish this. This ODCB can then be redistilled to recover product.

Du Pont Material Safety Data Sheet

MATERIAL IDENTIFICATION

NUMBER : 00000452
NAME : 1,4-DIAMINOCYCLOHEXANE

TRADE NAMES AND SYNONYMS :
Hydrogenated para-Phenylenediamine
HPPD
1,4-Cyclohexanediamine

CAS NAME : 1,4-DIAMINOCYCLOHEXANE
CAS NUMBER : 3114-70-3
FORMULA : C6H14N2
MOLECULAR WEIGHT : 114.19
MANUFACTURER/DISTRIBUTOR: E.I. du Pont de Nemours & Co., Inc.
1007 Market Street
Wilmington, DE 19898
PRODUCT INFORMATION PHONE : 1-(800)441-7515
TRANSPORTATION EMERGENCY PHONE : 1-(800)424-9300
MEDICAL EMERGENCY PHONE : 1-(800)441-3637

**********

COMPONENTS

| Material | CAS Number | % |
|---|---|---|
| SOLID: | | |
| trans-1,4-Diaminocyclohexane | 2615-25-0 | 9 |
| cis-1,4-Diaminocyclohexane | 15827-56-2 | |
| LIQUID: | | |
| cis-1,4-Diaminocyclohexane | 15827-56-2 | 78-[illegible] |
| trans-1,4-Diaminocyclohexane | 2615-25-0 | 18-[illegible] |

**********

PHYSICAL DATA

Boiling Point : 97 deg C at 760 mm Hg.
Vapor Pressure : 18 mm Hg at 87-88 deg C
Melting Point : 72 to 73 deg C
% Volatiles : 100 WT %
Evaporation Rate : 1 (Butyl Acetate = 1.0)
Solubility in Water : 58.2 WT % at 25 deg C
Odor : Amine-like
Form : Crystalline Solid
Color : White
Specific Gravity : 0.96
Data is based on pure trans-1,4-Diaminocyclohexane.

HAZARDOUS REACTIVITY

Instability : Stable.
Incompatibility : Incompatible with acids, acid chlorides, CO2, strc oxidizers.
Decomposition : Decomposes with heat. Hazardous gases/vapors produced are CO, CO2, and NOx.
Polymerization : Polymerization will not occur.

**********

FIRE AND EXPLOSION DATA

Flash Point : 71 deg C
Method : CC

FIRE AND EXPLOSION HAZARDS

Combustible. Hazardous gases/vapors produced in fire are CO, CO2 anc NOx.

EXTINGUISHING MEDIA

Water Spray. Chemical Foam. Dry Chemical. CO2.

SPECIAL FIRE FIGHTING INSTRUCTIONS

Keep personnel removed & upwind of fire. Hose with water from a distance to prevent splashing on personnel.

**********

HEALTH HAZARD INFORMATION

1,4-Diaminocyclohexane:

Inhalation 4hr ALC: 1.9 mg/l in rats.
Skin Absorption: No Information Found.
Oral LD50: 1,300 mg/kg in rats.
Oral ALD: 1,000 mg/kg in rats.

The compound was found to be corrosive to rabbit skin. It was a severe eye irritant in rabbits. It did not produce sensitization in guinea pigs, and it was not mutagenic in the Ames assay.

Based on animal tests, human health effects of overexposure by inhalation, ingestion, or skin or eye contact may include: skin burns or ulcerations; eye corrosion, tearing, or blurring of vision; or irritation of the upper respiratory passages.

Carcinogenicity

None of the components in this chemical is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

(HEALTH HAZARD INFORMATION - CONTINUED)

Exposure Limits for 1,4-DIAMINOCYCLOHEXANE

TLV * (ACGIH) : None Established
PEL (OSHA) : None Established

* TLV is a registered trademark.

Safety Precautions

Avoid breathing vapors or mist. Do not get in eyes, on skin, or c clothing. Wash thoroughly after handling. Wash clothing after use Discard shoes if contaminated.

**********

FIRST AID

INHALATION
If inhaled, remove to fresh air. If not breathing, give artificia respiration. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT
Call a physician. In case of contact, immediately flush skin wit plenty of water for at least 15 minutes while removing contamina clothing and shoes.

EYE CONTACT
In case of contact, immediately flush eyes with plenty of water at least 15 minutes. Call a physician.

INGESTION
If swallowed, do not induce vomiting. Give large quantities of water. Never give anything by mouth to an unconscious person. Ca a physician.

**********

PROTECTION INFORMATION

Generally Applicable Control Measures and Procedures

Use only with adequate ventilation. Keep away from heat, sparks flames. Keep container tightly closed. Do not mix with strong ac oxidants. Do not consume food, drink or tobacco in the areas whe they may become contaminated with this material.

Personal Protective Equipment

Eye/Face : Face shield. Coverall chemical splash goggle Use when splash is likely.
Respirator : Air supplied respirator.
Chemical Cartridge Respirator : Half-mask organic vapor cartridg Full-face organic vapor cartridge if eye protection needed.

(PROTECTION INFORMATION - CONTINUED)

Additional : Impervious clothing as needed to prevent skin contact.
Protective Gloves : Impervious gloves such as Neoprene.

**********

DISPOSAL INFORMATION

Spill, Leak, or Release

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.
Dike spill. Prevent liquid from entering sewers, waterways or low areas. Recover free liquid for reuse or reclamation. Soak up with sawdust, sand, oil dry or other absorbent material.

Waste Disposal

Treatment, storage, transportation and disposal must be in accordance with applicable Federal, State/Provincial, and Local regulations. Recover nonusable free liquid and dispose of in an approved and permitted incinerator. Recover nonusable free liquid and/or contaminated water, and dispose of in an approved and permitted biological treatment system or an approved and permitted deepwell. Remove nonusable solid material and/or contaminated soil for disposal in an approved and permitted landfill. Do not flush surface water or sanitary sewer system.

**********

SHIPPING INFORMATION

DOT
Proper Shipping Name :
Liquid: Corrosive Liquid, NOS (Diaminocyclohexane)
Solid: Corrosive Solid, NOS (Diaminocyclohexane)
Hazard Class : Corrosive Material
UN/NA No. : Liquid: UN 1760 Solid: UN 1759
DOT Label(s) : Corrosive
DOT Placard : Corrosive
Freight Class : Chemicals, NOI

DOT/IMO
Proper Shipping Name :
Liquid: Corrosive Liquid, NOS (Diaminocyclohexane)
Solid: Corrosive Solid, NOS (Diaminocyclohexane)
Hazard Class : 8, Corrosive Material
UN No. : Liquid: UN 1760 Solid: UN 1759
DOT/IMO Label : Corrosive
Packaging Group : I

STORAGE CONDITIONS

Store in well ventilated area. Keep container tightly closed. Do nc store or consume food, drink or tobacco in areas where they may bec contaminated with this material.

**********

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Date of latest Revision : 88/08/10
Responsibility for MSDS : Petrochemicals - Env. Affairs
E.I. du Pont de Nemours & Co.
Wilmington, DE 19898
302/999-5049

Du Pont Material Safety Data Sheet

MATERIAL IDENTIFICATION

NUMBER : 471
NAME : TRANS-1,4-CYCLOHEXANE DIISOCYANATE

CHEMICAL FAMILY : Isocyanate
TRADE NAMES AND SYNONYMS :
CHDI

CAS NAME : TRANS-1,4-CYCLOHEXANE DIISOCYANATE
CAS NUMBER : 7517-76-2
FORMULA : C6H10(NCO)2
MOLECULAR WEIGHT : 166.18
MANUFACTURER/DISTRIBUTOR: E.I. du Pont de Nemours & Co., Inc.
1007 Market Street
Wilmington, De 19898
PRODUCT INFORMATION PHONE : 1-(800)441-7515
TRANSPORTATION EMERGENCY PHONE : 1-(800)424-9300
MEDICAL EMERGENCY PHONE : 1-(800)441-3637

**********

COMPONENTS

| Material | CAS Number | % |
|---|---|---|
| TRANS-1,4-CYCLOHEXANE DIISOCYANATE | 7517-76-2 | ~9 |

**********

PHYSICAL DATA

Boiling Point : 260 deg C (500 deg F) at 760 mm Hg.
Vapor Pressure : <0.02 mm Hg at 20 deg C
Melting Point : ~60 deg C (~140 deg F)
Solubility in Water : Negligible
Odor : Pungent
Form : Cast Solid
Color : White
Specific Gravity : 1.116 at 70 deg C

**********

HAZARDOUS REACTIVITY

Instability : Stable.
Incompatibility : Incompatible with water. Incompatible with strong acids, strong alkalis, strong oxidizers, alcohol, amines and other hydrogen.
Decomposition : Decomposes with heat. Hazardous gases/vapors produced are NOx, CO, HCN (possible combustion products).
Polymerization : Self-polymerization will not occur.

Avoid ignition sources and temperatures above 60 deg C (140 deg F) to minimize isocyanate vaporization.

FIRE AND EXPLOSION DATA

Flash Point : >99 deg C (>210 deg F)
Method : PMCC

FIRE AND EXPLOSION HAZARDS

Hazardous gases/vapors produced in fire are Nitrogen Dioxide, Carb: Monoxide and Hydrogen Cyanide.

EXTINGUISHING MEDIA

Water Spray. Water Fog. Chemical Foam. Dry Chemical. CO2. Earth or mud.

SPECIAL FIRE FIGHTING INSTRUCTIONS

Wear self-contained breathing equipment or air-line respirators. Normal protective clothing should be worn by fire-fighting personnel.

**********

HEALTH HAZARD INFORMATION

Inhalation 4 hr LC50: <0.1 mg/l in rats.*
Skin absorption LD50: >4,640 mg/kg in rabbits.
Oral LD50: 760 mg/kg in rats.

TRANS-1,4-CYCLOHEXANE DIISOCYANATE has been tested extensively to determine toxicity and potential hazards in shipping, storage and handling. Examination of this data indicates that trans-1,4-cyclohexane diisocyanate is toxic by ingestion and very toxic by inhalation. Trans-1,4-cyclohexane diisocyanate is a severe eye irritant and lachrymator, a moderate skin irritant and may cause skin and lung sensitization. Trans-1,4-cyclohexane diisocyanate was found to be nonmutagenic in the Ames test.

* Material aerosoled at 60 deg C.

Carcinogenicity

None of the components in this chemical is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

Exposure Limits for TRANS-1,4-CYCLOHEXANE DIISOCYANATE

TLV * (ACGIH) : None Established
PEL (OSHA) : None Established

(HEALTH HAZARD INFORMATION - CONTINUED)

* TLV is a registered trademark.

Safety Precautions

Do not breathe vapor or mist. Do not breathe dust. Do not breathe gas. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling.
SPILLAGE ON CLOTHES: Remove contaminated clothing immediately and examine skin for contamination. Soak clothing in decontaminant liquid [a solution of ammonia (8%) and detergent (2%) in water] for 24 hours followed by normal laundry.

**********

FIRST AID

INHALATION
If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT
In case of contact, immediately wash skin with soap and plenty of water.

EYE CONTACT
In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician. Immediate first aid is needed to prevent eye damage.

INGESTION
If swallowed, do not induce vomiting. Give large quantities of water. Never give anything by mouth to an unconscious person. Call a physician.

**********

PROTECTION INFORMATION

Generally Applicable Control Measures and Procedures

Use only with adequate ventilation. Keep away from heat, sparks, flames. Keep container tightly closed.
Empty container may contain hazardous residues.

Personal Protective Equipment

Eye/Face : Coverall chemical splash goggles.
Chemical Cartridge Respirator : Self-contained breathing apparat
Additional : Chemical-resistant apron or suit in high-exposure situations.
Protective Gloves : Natural rubber, butyl rubber, polyvinyl alcc Viton.

DISPOSAL INFORMATION

Spill, Leak, or Release

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.
Prevent liquid from entering sewers, waterways or low areas.
Neutralize with 2% ammonia.
Mix with an absorbent such as Neutracit-2 (J. T. Baker Chemical Co.). Decontaminate absorbent and spill area with solution of 2% ammonia and 2% detergent in water. Slowly stir isocyanate into the decontamination solution. Allow to react for 48 hours.

Waste Disposal

Treatment, storage, transportation and disposal must be in accordance with applicable Federal, State/Provincial, and Local regulations. Do not flush to surface water or sanitary sewer syst
Neutralize by 2% ammonia as above.

**********

SHIPPING INFORMATION

DOT

Proper Shipping Name :
Poison B, Solid, N.O.S.
Hazard Class : Poison B
UN/NA No. : UN 2811
DOT Label(s) : Poison

**********

STORAGE CONDITIONS

Keep container tightly closed.
Store this material away from extremes of heat and cold.
Protect from moisture; store in a dry area. Do not reuse container. Since emptied containers retain residues, all labeled hazard precautions must be observed. Dispose of container in accordance with applicable regulations.

**********

ADDITIONAL INFORMATION AND REFERENCES

The information contained in this MSDS is based on Akzo Chemie America's MSDS for "Elate" CHDI dated 10/1/87 with Du Pont requirements added.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Date of latest Revision : 88/07/14
Responsibility for MSDS : Petrochemicals - Env. Affairs
E. I du Pont de Nemours & Co.
Wilmington, DE 19898
302-774-5810

Du Pont Material Safety Data Sheet

MATERIAL IDENTIFICATION

NUMBER : L0000303
NAME : Ortho-Dichlorobenzene

CHEMICAL FAMILY : Aromatic Chlorohydrocarbon
TRADE NAMES AND SYNONYMS :
Dichlorobenzene, ODCB, 1, 2-/, O-Dichlorobenzene

CAS NUMBER : 95-50-1
FORMULA : C6H4CL2
MANUFACTURER/DISTRIBUTOR: Standard Chlorine of Delaware, Inc.
Governor Lea Road
Delaware City, DE 19706
TRANSPORTATION EMERGENCY PHONE : CHEMTREC: 1-800-424-930C
MEDICAL EMERGENCY PHONE : 1-302-834-4536

**********

COMPONENTS

| Material | | CAS Number | |
|---|---|---|---|
| Ortho-dichlorobenzene | (98.5% Min.) | 95-50-1 | |
| Para-dichlorobenzene | | 106-46-7 | is < |
| Meta-dichlorobenzene | | 541-73-1 | is < |

**********

PHYSICAL DATA

Boiling Point : 180.5 deg C
Vapor Pressure : 1 mm Hg at 20 deg C
Vapor Density : 5.05 (Air = 1.0)
Melting Point : -17 deg C
Odor : Mild aromatic
Form : Liquid
Color : Colorless
Specific Gravity : 1.310 at 15 deg C
Solubility in H2O: 0.0145% WT @ 20 deg. C.

Ortho-Dichlorobenzene has a distinct odor at concentrations well below airborne exposure limits. It has been reported to lie perceptible to most people at 2-4 ppm. At 10-15 ppm the odor becomes strong enough to become objectionable to most individuals.

**********

HAZARDOUS REACTIVITY

Instability : Stable.
Incompatibility : Incompatible with strong oxidizers, oxidizing age
hot aluminum and aluminum alloys.
Polymerization : Polymerization will not occur.
Hazardous gases produced are carbon monoxide (CO), carbon dioxide (CO2), smoke, soot, hydrogen chloride and chlorine and chlorine derivatives.

(HAZARDOUS REACTIVITY - CONTINUED)

**********

FIRE AND EXPLOSION DATA

Flash Point : 66 deg C
Method : COC
Flammable Limits in Air, % by Vol.
LEL : 2.2%
UEL : 9.2%

FIRE AND EXPLOSION HAZARDS

Combustible. Hazardous gases/vapors produced in fire are chlorides a chlorine.

EXTINGUISHING MEDIA

Water Spray. Chemical Foam. Dry Chemical. CO2.
Any class B extinguishing agent.

SPECIAL FIRE FIGHTING INSTRUCTIONS

Wear self-contained breathing apparatus. Wear full protective equipment. Use water spray.
Thoroughly decontaminate firefighting equipment after use.

**********

HEALTH HAZARD INFORMATION

Exposure Effects - ACUTE

Inhalation: Vapors can cause irritation of eyes and respiratory system. Excessive vapor inhalation can result in narcosis, liver and kidney damage, unconsciousness and even death in confined or poorly ventilated areas.

Eye/Skin: Ortho-dichlorobenzene is absorbed through the skin and causes irritation when applied for 15-60 minutes. Eye contact with liquid can cause severe irritation, pain and discomfort, although permanent damage is not likely. Vapor concentrations greater than 100 ppm cause eye irritation. Prolonged or repeated skin contact with liquid can result in cracking of skin and dermatitis. Blistering of the skin (i.e., second degree burns) is possible with sensitive individuals.

Ingestion: Although swallowing is not a likely route of exposure in industrial applications, accidental ingestion of large quantities of orthodichlorobenzene can cause effects similar to those described above for inhalation.

Exposure Effects-CHRONIC

(HEALTH HAZARD INFORMATION - CONTINUED)

Chronic inhalation tests of orthodichlorobenzene in animals (rats, guinea pigs and rabbits-93 ppm for seven months) showed no adverse effects; however, tests on animals a higher concentrations have shown liver and kidney injury.

Animal Data

Inhalation (Rat): 707 ppm/7-hour, Moderately Toxic

Oral LD50 (Rats): 1,516 mg/kg, Slightly Toxic

Dermal LD50 (Rabit): › 10,000 mg/kg, Practically Nonirritating

Eye Irritation (Rabbit): (24-hr Score) 12.3 on a scale of 110.0, Slightly Irritating

Skin Irritation (Rabbit): (24-hr Score) 0.0 on a scale of 8.0, Practically Nonirritating

Microbial mutagenicity assays using five Salmonella strains and one yeast strain with and without mammalian microsomal activation did not reveal any mutagenic effect.

Carcinogenicity

The following components are listed by IARC, NTP, OSHA, or ACGIH as carcinogens. A 'P' indicates a Proposed Carcinogen.

| Chemical | IAR | NTP | OSH |
|---|---|---|---|
| Para-dichlorobenzene | | X | P |

Exposure Limits for Ortho-Dichlorobenzene

AEL * (DuPont): 50 ppm - 15 Min. TWA
TLV ** (ACGIH) : 50 ppm, 300 mg/m3 (Ceiling)
PEL (OSHA) : 50 ppm, 300 mg/m3 (Ceiling)

Other Applicable Exposure Limits:

Exposure Limits for Para-dichlorobenzene

AEL * (DuPont): None Established
TLV ** (ACGIH) : 75 ppm, 450 mg/m3
STEL 110 ppm, 675 mg/m3
PEL (OSHA) : 75 ppm, 450 mg/m3

(HEALTH HAZARD INFORMATION - CONTINUED)

* AEL is DuPont's Acceptable Exposure Limit.
** TLV is a registered trademark.

Safety Precautions

Avoid breathing vapors or mist. Avoid contact with eyes. Avoid contact with skin. Avoid contact with clothing. Wash thoroughly after handling.
Do not wear contact lenses.

**********

FIRST AID

SKIN CONTACT
Immediately wash with soap and plenty of water. Remove contamina clothing. Wash clothing before reuse.

EYE CONTACT
Immediately flush with plenty of water for at least 15 min. Call physician.

Inhalation
Remove to fresh air. If not breathing, give artificial respiration. Preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

Ingestion
Give 3 glasses of milk or water. DO NOT induce vomiting and get medical help immediately. Never give anything by mouth to an unconscious person.

Note to Physiscian: DO NOT administer adrenalin for overexposure.

**********

PROTECTION INFORMATION

Generally Applicable Control Measures and Procedures

Use only with adequate ventilation. Keep away from heat, sparks flames. Keep container tightly closed. Do not consume food, drin or tobacco in the areas where they may become contaminated with this material.

Personal Protective Equipment

Eye/Face : Face shield. Coverall chemical splash goggle
Respirator : Wear suitable respirator with insufficient ventilation.
Protective Gloves : Rubber.
Additional: Protective clothing to prevent skin contact.
Apron for splashing.

## DISPOSAL INFORMATION

### Spill, Leak, or Release

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.
Evacuate personnel, thoroughly ventilate area, use self-contained breathing apparatus. Dike spill. Prevent liquid from entering sewers, waterways or low areas. Soak up with sawdust, sand, oil c or other absorbent material.
Only personnel equipped with NIOSH/MSHA-approved, self-contained breathing apparatus or full face piece air-line respirators with auxilary SCBA operated in the pressure-demand mode and eye and skin protection permitted in area.

### Waste Disposal

Cleaned-up material is a RCRA Hazardous Waste. Treatment, storage transportation and disposal must be in accordance with applicable Federal, State/Provincial, and Local regulations. Recover nonusa free liquid and dispose of in an approved and permitted incinera Remove nonusable solid material and/or contaminated soil, for disposal in an approved and permitted landfill.
Thoroughly wet vacuum area of spill. Place all contaminated material in metal containers.

**********

## SHIPPING INFORMATION

DOT

Proper Shipping Name :
Combustible Liquid, N.O.S. (Orthodichlorobenzene)
Dichlorobenzene, Ortho, Liquid

| | |
|---|---|
| Hazard Class | : Combustible Liquid |
| UN/NA No. | : NA 1993 ORM-A/UN 1591 |
| DOT Label(s) | : Product label |
| Special Information | : Reportable Quantity: 100 lbs (45.4 k |
| Freight Class | : Ortho-Dichlorobenzene |

Reportable Quantity : 100 lbs.
Shipping Containers
Less than 110 gallons.

**********

## STORAGE CONDITIONS

Store in well ventilated area. Keep container tightly closed. Stor accordance with Federal Regulations. Do not store or consume food, drink or tobacco in areas where they may become contaminated with material.
Do not cut or weld on or near this container.

(STORAGE CONDITIONS - CONTINUED)

Avoid contamination of water supplies.

**********

ADDITIONAL INFORMATION AND REFERENCES

**This product can become a hazardous waste RCRA # -**
ODCB:U-070 emptied container retains vapor and product residue. Observe all labeled safeguards until container is cleaned, reconditioned or destroyed. Do not cut or weld on or near this container. Avoid contamination of water supplies: Handling, storage, and use procedures must be carefully monitored to avoid spills or leaks. Any spill or leak has the potential to cause underground water contamination which may, if sufficiently severe, render a drinking water source unfit for human consumption. Contamination that does occur cannot be easily corrected.

**********

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Date of latest Revision : 88/03/04
Responsibility for MSDS : Thomas E. Pierson
Governor Lea Road
Delaware City, DE 19706
302-834-4536

Du Pont Material Safety Data Sheet

MATERIAL IDENTIFICATION

NUMBER : L0000166
NAME : Phosgene

CHEMICAL FAMILY : Acid Chloride
TRADE NAMES AND SYNONYMS :
Carbonyl Chloride

CAS NAME : Carbonyl Chloride
CAS NUMBER : 75-44-5
FORMULA : COCL2
MANUFACTURER/DISTRIBUTOR: PPG Industries
One PPG Place
Pittsburgh, PA 15272
PRODUCT INFORMATION PHONE : 1-304-843-1300
TRANSPORTATION EMERGENCY PHONE : 1-800-424-9300

**********

COMPONENTS

| Material | CAS Number | % |
|---|---|---|
| Phosgene (min) | 75-44-5 | 9 |
| Hydrogen Chloride (max) | | 0. |
| Chlorine (max) | | 0. |

**********

PHYSICAL DATA

Boiling Point : 7.5 deg C at 760 mm Hg.
Vapor Density : 3.4 (Air = 1.0)
% Volatiles : 100 WT %
Odor : Mild sweet odor
Color : Clear, colorless
Specific Gravity : 1.388 at 20 deg C
Solubility: slowly decomposes. Vapor Pressure: 23.44 PSIA @ 20 deg. C.
Form: Liquid and gas under pressure.

**********

HAZARDOUS REACTIVITY

Instability : Stable. Reacts with excess heat, moisture.
Incompatibility : Incompatible with azides, reactive metals (such a powdered aluminum potassiumor sodium) and alcohols
Decomposition : Decomposes by reaction with azides, all alcohols a certain diols, moisture. Hazardous gases/vapors produced are carbon dioxide, hydrogen chloride.
Polymerization : Polymerization will not occur.

FIRE AND EXPLOSION DATA

Not applicable.

FIRE AND EXPLOSION HAZARDS

Keep water away from phosgene leaks and liquid pools; could increase phosgene vaporization and release.

EXTINGUISHING MEDIA

Not applicable.

SPECIAL FIRE FIGHTING INSTRUCTIONS

Evacuate personnel to a safe area. Wear self-contained breathing apparatus. Wear full protective equipment. Cool tank/container with water spray.

**********

OTHER PHYSICAL HAZARDS

In the event of fire and in the absence of leaks, phosgene-containing vessels should be removed from the fire area and/or cooled with water spray. This is imperative because boiling of the phosgene and subsequent ruture of vessel could create an extremely hazardous situation.

**********

HEALTH HAZARD INFORMATION

ACUTE:

Inhalation: **Phosgene** is a highly toxic gas and is classified by the U. S. Department of Transportation as a Class "A" poison. The principal action of inhalation overexposure is **delayed pulmonary edema**. However, this effect is not immediately apparent in a relatively mild exposure. An exposed person may accidentally breathe the gas deeply into the lungs without being aware of the hazard. Inhalation of small amounts may cause coughing, respiratory tract irritation and delayed pulmonary edema. The onset of pulmonary edema. The onset of pulmonary edema may be delayed for as long as 24 hours after exposure, but depending upon the extent of exposure, it usually occurs within 8 hours.

EYE/SKIN CONTACT: Liquid phosgene may cause severe chemical burns. If there has been liquid exposure with respect to the skin, inhalation of vapors must also be suspected (2).

INGESTION: Should be considered toxic if ingested. However,

(HEALTH HAZARD INFORMATION - CONTINUED)

this route of exposure is not the primary occupational concern.

CHRONIC:

Chronic at low concentrations.

According to NIOSH (2), there are no pertinent data in the scientific literature concerned with long-term effects on humans exposed to phosgene at low concentrations.

TOXICITY DATA:

LC50 Inhalation: LCLO Rate 50 ppm/30 min.

LD50 Dermal: Not available.

LD50 Ingestion: Not available.

NIOSH LC50 (Lethal Concentration): Unknown.

EMERGENCY AND FIRST AID PROCEDURES

NOTE: Prior to attempting a rescue of persons exposed to phosgene, all rescue/first aid personnel must be equipped with NIOSH/MSHA-Approved, self-contained breathing apparatus until rescue/first aid operations are complete, phosgene vapors have been eliminated, and all contaminated clothing has been removed and disposed.

NOTES TO PHYSICIAN INCLUDING ANTIDOTES:

IMPORTANT! The attached letter dated May 3, 1982, entitled, "To: Emergency Room and Treating Physicians" should be given to any physician attending anyone suspected of overexposure to phosgene.

TO: EMERGENCY ROOM AND TREATING PHYSICIANS MAY 3, 1982
This patient has possibly been exposed to phosgene. Phosgene may cause pulmonary edema which can be a delayed response to this incident. The delayed response can be as short as 4-6 hours or as long as 12-24 hours after the incident.

IT IS IMPORTANT THAT THE FOLLOWING STEPS ARE TAKEN:

1. The actual time of the incident should be determined.

2. The degree or amount of exposure should be ascertained based on:
   - Subjective Symptoms - tightness in chest, shortness of breath, nausea (include the subjective symptoms experienced at the time of the intitial incident).

(HEALTH HAZARD INFORMATION - CONTINUED)

- Objective Findings - irritation of mucous membranes (eye, nose, mouth, and throat), cough, wheezing or rales by auscultation, chest x-ray.

Chest x-rays should be compared with baseline x-ray to evaluate the development of pulmonary edema.

3. The subjective symptoms cannot be verified by objective findings and the significance of the exposure should be determined.

   A. If the subjective symptoms cannot be verified by objective findings and the exposure is not significant.

      - Make arrangements to follow the patient until the pulmonary latency period has lapsed (24 hours).

      - Close observation is recommended for the first 4 to 6 hrs. after the incident before allowing the patient to leave your direct supervision.

      - Patients released after initial observation (4 to 6 hours recommended) should be advised to avoid strenuous physical exertion for 24 hours.

   B. If subjective symptoms are verified by objective findings and/or the exposure is significant:

      - Place the patient at complete rest in a medical facility for close observation.

      - Monitor the vital signs regularly (at least hourly). Gradual increases in vital signs may indicate developing pulmonary edema.

      - Institute vigorous measures to prevent pulmonary edema.

4. Routine arterial blood gas analyses should be made. This diagnostic procedure should be reserved for patients who are hospitalized for treatment (not just observation), or who have had a significant exposure verified by objective findings.

5. A routine pulmonary function test is requested before discharging a patient from observation of before final discharge from hospitalization.

The following physicians are available for consultations:

| | |
|---|---|
| Carl B. Meyers, M.D. | Office Phone 412-434-3846 |
| PPG Corp. Medical Director | Home Phone 412-831-2147 |
| Pittsburgh, PA. | |

(HEALTH HAZARD INFORMATION - CONTINUED)

Keith Wilson, M.D.
Pulmonary Section
Methodist Hospital
Houston, Texas

Office Phone 713-790-2070
Page Phone 713-790-2201

Carcinogenicity

None of the components in this chemical is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

Exposure Limits for Phosgene

TLV * (ACGIH) : None Established
PEL (OSHA) : 0.1 ppm, 8 hr TWA

* TLV is a registered trademark.

Other Applicable Exposure Limits:

Chlorine - 1.0 ppm, Ceiling;

Hydrogen Chloride - 5.0 ppm, Ceiling.

Note: NIOSH recommends for phosgene 0.1 ppm time-weighted Avg. and 0.2 ppm as Ceiling Conc. for any 15 min. period (2).

Safety Precautions

Avoid breathing vapors or mist. Avoid contact with eyes. Avoid contact with skin. Avoid contact with clothing. Wash clothing af use.
For additional product information, contact PPG Ind. Inc.

**********

FIRST AID

INHALATION
If inhaled, remove to fresh air. If not breathing, give artific respiration. If breathing is difficult, give oxygen. Call a physician. Do not allow person to walk. Take immediately to loca medical facility or hospital.

INGESTION
If swallowed, induce vomiting immediately by giving two glasses water and sticking finger down throat. Never give anything by mc to an unconscious person. Call a physician. Take immediately to hospital if vomiting cannot be induced or if unconscious or in convulsions.

(FIRST AID - CONTINUED)

EYE OR SKIN CONTACT:

Immediately provide exposed person with approved respiratory protection. Remove from area of exposure to fresh air. Thoroughly flush eyes and skin with plenty of water (soap and water for skin) for at least 15 min. while removing contaminated clothing and shoes. (DO NOT REMOVE RESPIRATORY PROTECTION DURING THIS PROCEDURE). Transport person to a hospital or local medical facility. Observe for possible inhalation overexposure. Place contaminated clothing into an airtight container until it can be decontaminated. Decontaminate clothing by placing in a 20% soda ash solution overnight. Then discard contaminated clothing.

See Health Hazards Information.

**********

PROTECTION INFORMATION

Generally Applicable Control Measures and Procedures

Use only with adequate ventilation. Keep away from heat, sparks flames. Keep container in a cool place. Do not mix with moisture
Do not apply heat to cylinder or ton tank.
Do not use tank or cylinder as a vaporizer.
Phosgene should be unloaded as a liquid using nitrogen pad.
Use only appropriate wrench as provided by manufacturer for opening and closing container valves. Failure to do so may result in valve stem damage and possible phosgene release.

Personal Protective Equipment

Eye/Face : Coverall chemical splash goggles. Safety shc & eye wash fountain in immediate area.
Respirator : Air supplied respirator.
Chemical Cartridge Respirator : Self-contained.
Additional : Chemical suit. Protective footwear. Chemical impervious suit tight at wrist and ankles w/hood.
Protective Gloves : Neoprene or other impervious rubber gloves.

**********

DISPOSAL INFORMATION

Aquatic Toxicity :
Unknown.

Spill, Leak, or Release

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.
See Additional Information for spill or leak procedures.

(DISPOSAL INFORMATION - CONTINUED)

Waste Disposal

Phosgene can be absorbed in alkaline solutions. The most common solution is caustic soda.

CAUSTIC SODA SOLUTIONS FOR NEUTRALIZING PHOSGENE

| Phosgene Container Size | Caustic soda (100%) Pounds | Water Gallons |
|---|---|---|
| 150 Pounds | 486 (100% Excess) | 720 |
| 1 Ton | 6,540 (100% Excess) | 9,660 |

Place neutralized material in a closed container. Contact local hazardous waste disposal facility for disposal. Clothing that has been placed in airtight containers should be neutralized with 20% soda ash solution, then discarded.

NOTE: Care must be taken when using or disposing of chemical materials to prevent environmental contamination. It is your duty to dispose of the chemical materials in accordance with the Clean Water Act, the Clean Air Act, the Resource Conservation and Recover Act and any regulations as provided thereunder, as well as other relevant Federal, State or local laws/regulations regarding disposal.

**********

SHIPPING INFORMATION

DOT

Proper Shipping Name : Phosgene
Hazard Class : Poison A
UN/NA No. : UN 1076

Reportable Quantity : 5,000 lbs.

**********

STORAGE CONDITIONS

Store in well ventilated area. Store in cool place. Keep container tightly closed.
Fireproof area away from other containers. Keep away from heat & moisture-excessive heat can cause a pressure buildup & may result in container rupture. Moisture can cause decomposition to carbon dioxide & hydrogen chloride. Avoid contamination with other chemicals. Phosgene is a reactive chemical; contamination may result in violent decomposition, fire, or explosion. Never place a leaking container in water.
Make sure piping is dry and free of contamination of any type before admitting phosgene. Use only dry air (-40F Dew

(STORAGE CONDITIONS - CONTINUED)

Point Min.) or oil-free Nitrogen for purging, testing for leaks, or padding.

**********

ADDITIONAL INFORMATION AND REFERENCES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Evacuate all personnel immediately. Only trained personnel wearing NIOSH/MSHA-Approved, self-contained breathing apparatus should be permitted to reenter area. Treat all exposed personnel as outlined in emergency and first aid procedures. Never put water on a phosgene leak. To locate leak use commercial ammonia (26 deg.) in a squeeze bottle or a cloth tied to a stick and dipped in ammonia water. When ammonia water is held near (but not on) a phosgene leak, or is sprayed into the air near a phosgene leak, the ammonia forms a white cloud in the presence of phosgene. Care should be taken to avoid spraying ammonia water on copper fittings. Personnel wearing full face, self-contained breathing apparatus, should position themselves upwind so escaping phosgene moves away from them. For leaks in cylinders and ton containers, rotate so gas escapes instead of liquid. If possible, remove to an isolated spot. Emergency capping kits for cylinders and ton containers should be on hand and used for stopping phosgene leaks. Such kits include step-by-step instructions and tools and can be obtained commercially from Indian Springs Manufacturing Company, P.O. Box 112, Baldwinsville, New York, 13027.

**********

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Date of latest Revision : 85/08/01
Responsibility for MSDS : Carl B Myers M.D. (Med. Dir.)
One PPG Place
Pittsburgh, PA 15272
412-434-3846

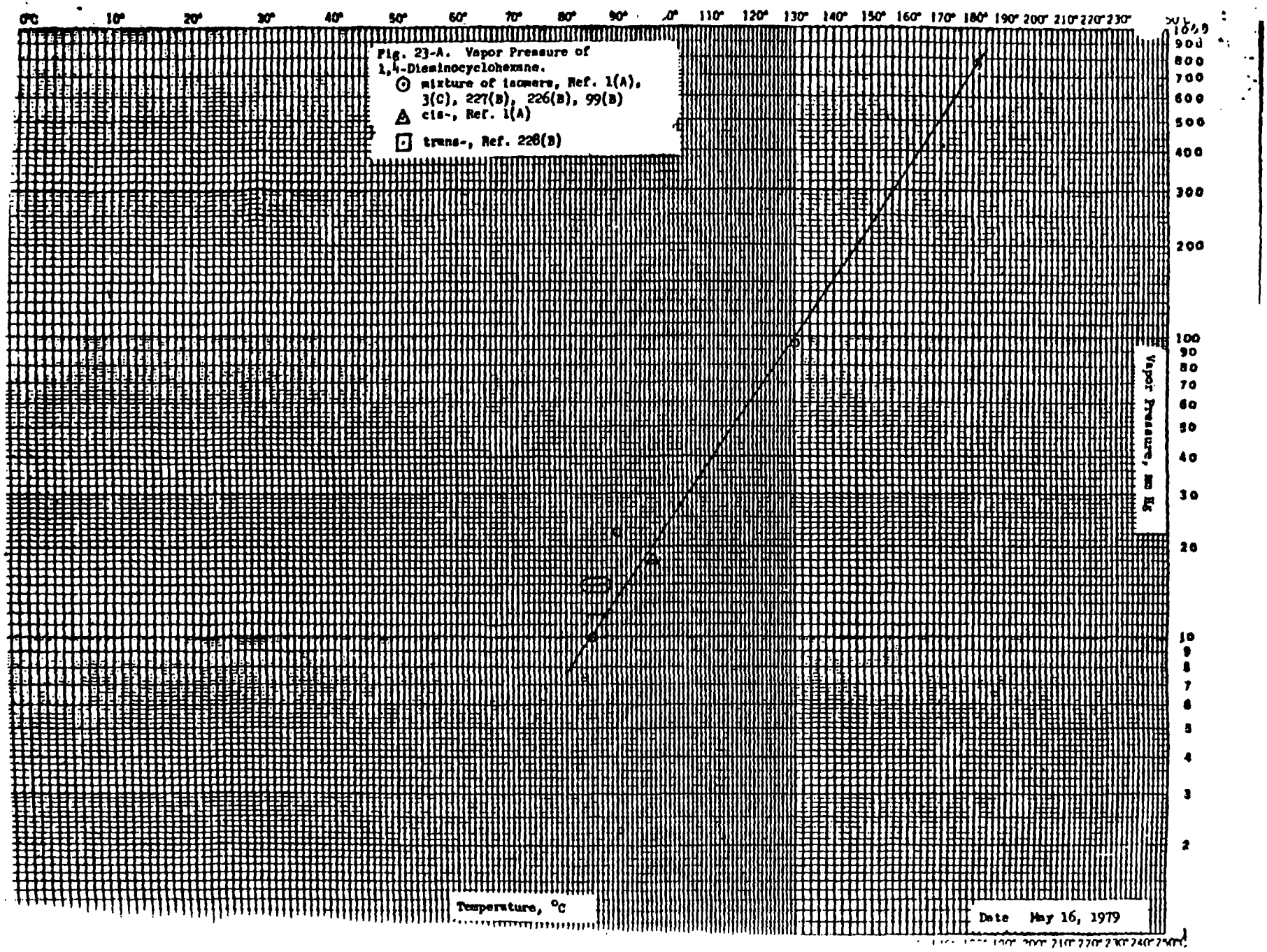
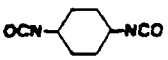


Fig. 23-A. Vapor Pressure of 1,4-Diaminocyclohexane.
⊙ mixture of isomers, Ref. 1(A), 3(C), 227(B), 226(B), 99(B)
△ cis-, Ref. 1(A)
⊡ trans-, Ref. 226(B)
Vapor Pressure, mm Hg
Temperature, °C
Date May 16, 1979

Bull

# PROPERTIES OF ELATE® CHDI DIISOCYANATE

**Chemical Name:** trans-1,4-cyclohexane diisocyanate

**Structural Formula:** 

**CAS Registry Number:** 7517-76-2

| Properties | Value | Notes |
|---|---|---|
| Form | White, flaked solid | |
| Purity | 98% min | Modified ASTM D-1638 |
| Insolubles | 0.5% max | |
| Molecular Weight | 166.2 | |
| NCO Content | 50.6% | |
| Isocyanate Equiv. | 83.1 | |
| Specific gravity | 1.12 @ 70°C | |
| Melting point | 58-62°C | |
| Boiling point | 143°C @ 25 mm Hg<br>260°C @ 760 mm Hg | |
| Viscosity | 13.0 cps @ 85°C<br>1.1 cps @ 70°C | Brookfield Viscometer<br>No. 2 spindle @ 20 rpm |
| Flash point | >200°F | Pensky-Martens |
| Vapor pressure | <0.02 mm Hg @ 20°C | |

## Solubility of ELATE CHDI

| Solvent | Solubility gms/100 gms solvent | |
|---|---|---|
| | 23°C | 40°C |
| Toluene | 76 | 123 |
| Acetone | 24 | 31 |
| Ethyl Acetate | 55 | 98 |
| Cellosolve[1] Acetate | 37 | 86 |
| Tetrahydrofuran | 23 | 31 |
| Perchloroethylene | 14 | 39 |
| Chloroform | 48 | 68 |

[1]Trademark of Union Carbide Corp.

## Reactivity of ELATE CHDI

Based on the reactivity of MDI as 1, the relative reactivities of several diisocyanates in three catalyzed reactions were as follows:

1. Urethane formation (with n-butanol in toluene @ 50°C catalyzed with dibutyl tin dilaurate)
   PPDI:MDI:CHDI:IPDI:$H_{12}$MDI=
   1.50: 1.00: 0.40: 0.16: 0.14

2. Urea formation (with water in cellosolve acetate @ 50°C catalyzed with diazabicyclo(2.2.2)octane)
   PPDI:MDI:CHDI:IPDI:$H_{12}$MDI=
   2.20: 1.00: 0.01: 0.005: 0.005

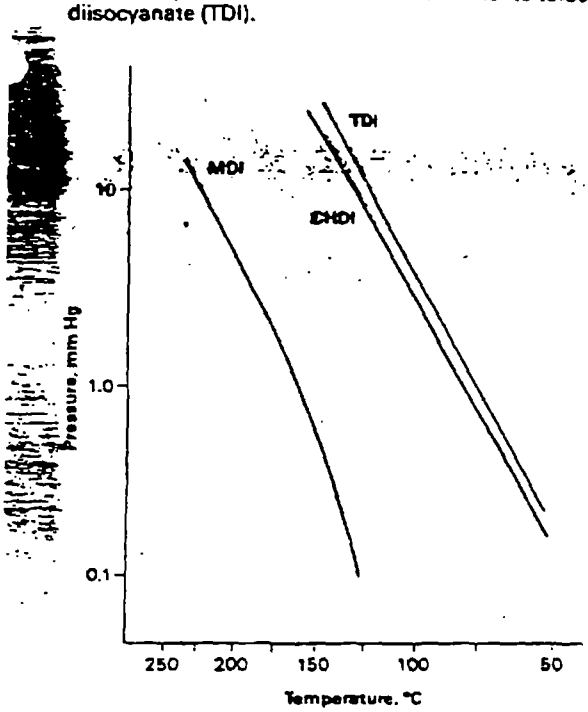
3. Isocyanurate formation (cyclotrimerization catalyze N,N',N''-tris(dimethyl aminopropyl) hexahydrotriazine
   PPDI:MDI:CHDI:IPDI:$H_{12}$MDI=
   1.50: 1.00: 0.02: 0.01: 0.01

PPDI—p-Phenylene diisocyanate
IPDI—Isophorone diisocyanate
CHDI—trans-1, 4-Cyclohexane-diisocyanate
MDI—4,4'-Diphenylmethane diisocyanate
NDI—1,5-Naphthalene diisocyanate
$H_{12}$MDI—4,4'-Methylenebis(cyclohexyl)diisocyanate

300 S Wacker Drive, Chicago, Illinois 60606 312/786-0400

### Vapor Pressure of ELATE CHDI

The vapor pressure of ELATE CHDI is similar to toluene diisocyanate (TDI).




### ELATE CHDI Toxicity data

ELATE CHDI has been tested extensively to determine toxicity and potential hazards in shipping, storage and handling. Examination of this data indicates that ELATE CHDI is toxic by ingestion and very toxic by inhalation. ELATE CHDI is a severe eye irritant and lachrymator, a moderate skin irritant and may cause skin and lung sensitization. Both ELATE CHDI and 1,4-cyclohexyl diamine were found to be nonmutagenic in the Ames test.

| Toxicity test | Value |
|---|---|
| Acute Oral Toxicity ($LD_{50}$) in rats | 760 mg/kg |
| Acute Inhalation Toxicity ($LC_{50}$) in rats | <0.1 mg/l (4hrs)[1] |
| Acute Dermal Toxicity ($LD_{50}$) in rabbits | >4640 mg/kg |
| Primary Irritation Index (skin) on rabbits | 2.80 |
| Skin Sensitization Test in guinea pigs | Mild sensitizer |
| Eye Irritation Score in rabbits | 55[2] |
| Ames (Salmonella) | Negative |

[1]Material aerosoled at 60°C. Because CHDI has a vapor pressure of <0.02 mm hg @ 20°C, it may be assumed to have a TLV of 0.02 ppm, which is the OSHA standard for TDI.
[2]Average score for 6 rabbits. Total possible score is 110; scores >30 indicate potential to cause irreversible damage.

### Health Hazard Data

ELATE CHDI is a SEVERE LACHRYMATOR. It is harmful if swallowed or inhaled, causes skin irritation and severe eye irritation. It may cause allergic pulmonary and/or skin reaction. Wash thoroughly after handling. Avoid prolonged or repeated skin contact. Avoid contact with eyes and clothing. Do not breathe dust or vapor.

PROTECTIVE CLOTHING: Full face respiratory protection, goggles, and rubber gloves must be worn when handling this material.

VENTILATION: The working area must be well ventilated and containers kept closed when not in use.

FIRST AID: IN CASE OF OVEREXPOSURE CALL A PHYSICIAN IMMEDIATELY.

EYE CONTACT: Wash out with plenty of water for at least 15 minutes immediately. Seek medical attention!

SKIN CONTACT: Wash with soap and water.

INHALATION: Remove patient to uncontaminated area, administer oxygen if needed. Keep patient at rest. Seek medical attention immediately!

INGESTION: Drink large quantities of water to reduce concentration. If vomiting occurs, drink more water. Keep patient at rest. Seek medical attention immediately!

SPILLAGE ON CLOTHES: Remove contaminated clothing immediately and examine skin for contamination. Soak clothing in decontaminant liquid [a solution of ammonia (8%) and detergent (2%) in water] for 24 hours followed by normal laundry.

CLEANUP: Clean up immediately using NU-2 Neutralizer compound. Decontaminate spill area with mixture of 96% water, 2% ammonia, and 2% liquid detergent.

WASTE DISPOSAL: Discarded ELATE CHDI should not be discharged or flushed into a sewer or any water streams. The discarded material should first be converted to a non reactive compound by neutralization with 2% ammonia.

### Storage and Handling

Store this material away from extremes of heat and cold. Protect from moisture; store in a dry area and re-close opened containers tightly. Do not reuse container. Since emptied containers retain residues, all labeled hazard precautions must be observed. Dispose of container in accordance with applicable regulations.

IN CASE OF FIRE: Use water fog, carbon dioxide, sand or dry chemical.

### Shipping

ELATE CHDI is classified as Poison B by U.S. DOT and IATA. Regulation UN 2811 defines shipping conditions for this product.

### Availability

ELATE CHDI is available in 10 kg drums. Samples (0.5 to 1.0 kg) are available for evaluation upon request. For additional data sheets on formulating ELATE CHDI in high performance polyurethanes and on typical properties of formulations or to place orders or obtain samples contact:

Akzo Chemie bv
Diversification Unit
Plastics and Elastomers
Stationstraat 48
3818 LW Amersfoort
The Netherlands
Phone: 033-643911
Telex: 79276

Akzo Chemie America
Business Development Dept.
300 South Wacker Drive
Chicago, Illinois 60606
Phone: (312) 786-0400
Telex: 25-3233

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CC: Tom
Ken
Joe
Greg

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

MATERIALS AND LOGISTICS DEPARTMENT

March 21, 1989

Mr. Geoffrey L. Pratt
Director of Operations
Custom Manufacturing
Cedar Chemical Corp.
24th Floor
5100 Poplar Ave.
Memphis, TN 38137

Dear Mr. Pratt,

Further to my conversation with you last week, I am forwarding a flow sheet for the custom synthesis project. Our requirements are expected to be around one million pounds per year beginning in the third quarter of 1989.

For this production rate we estimate the following reactor volumes:

- Dehydration - 1 x 2,000 gal.
- Reaction 1 - 1 x 2,000 gal.
- Reaction 2 - 1 x 4,000 gal.
- Precipitation - 2 x 4,000 gal.

It is preferable that all vessels be glass-lined but essential that equipment for Reactions 1 and 2 be glass. The process requires significant volumes of solvents so it will be necessary to have solvent storage capacity and a distillation recovery system.

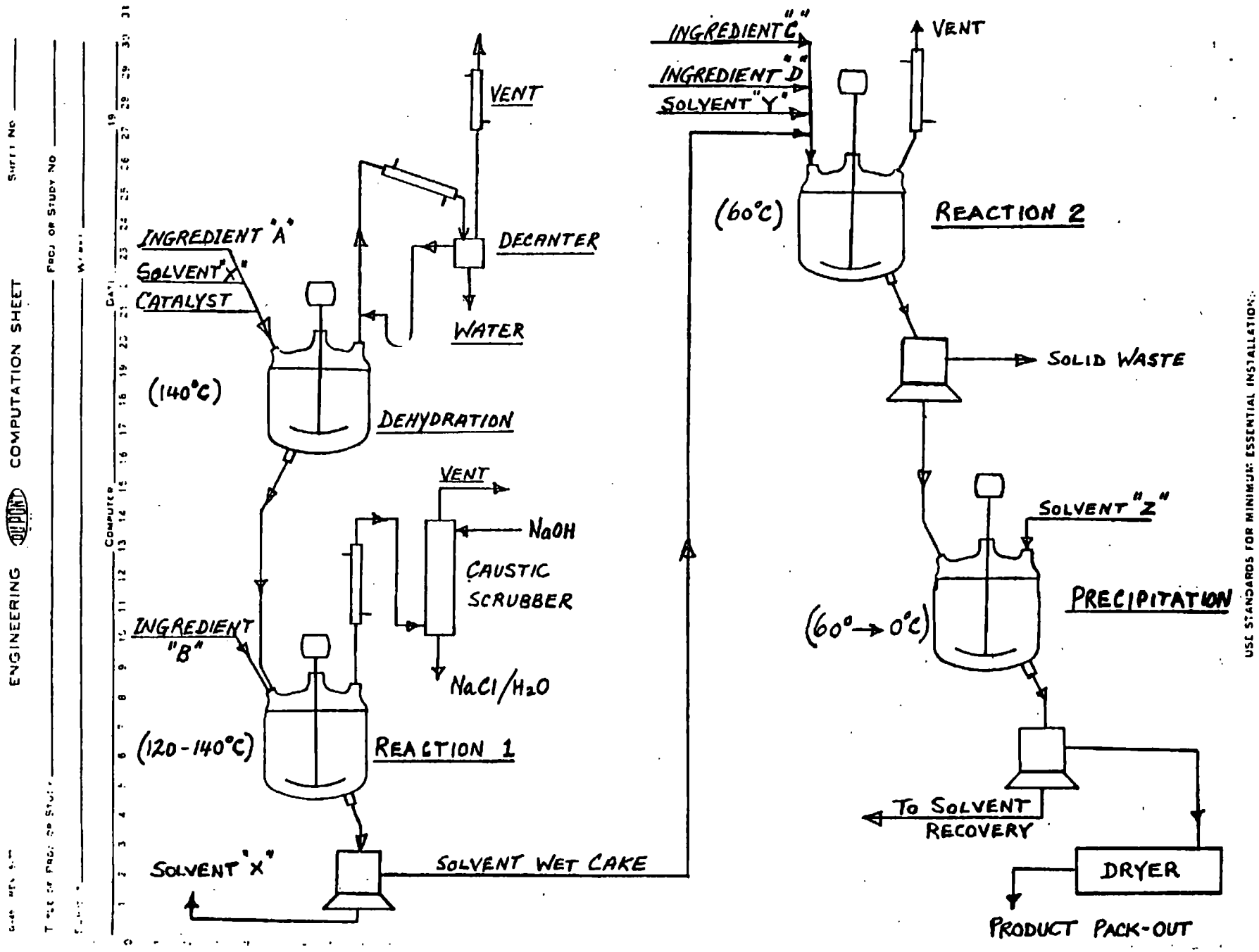
Please look over this information and let me know by the end of this month if there is an interest in pursuing further. We can supply a Technical Information package under secrecy agreement. A draft of such agreement is also enclosed.

I look forward to hearing from you.

Yours truly,

D. M. H. Waring
M&L Planning
Business Services

a:DMHW18.doc:bls
Attachments


ENGINEERING
DUPONT
COMPUTATION SHEET
VENT
DECANTER
WATER
INGREDIENT "A"
SOLVENT "X"
CATALYST
(140°C)
DEHYDRATION
VENT
NaOH
CAUSTIC SCRUBBER
NaCl/H2O
INGREDIENT "B"
(120-140°C)
REACTION 1
SOLVENT "X"
SOLVENT WET CAKE
INGREDIENT "C"
INGREDIENT "D"
SOLVENT "Y"
VENT
(60°C)
REACTION 2
SOLID WASTE
SOLVENT "Z"
PRECIPITATION
(60° → 0°C)
To SOLVENT RECOVERY
DRYER
PRODUCT PACK-OUT
USE STANDARDS FOR MINIMUM ESSENTIAL INSTALLATION

E.I. 4481 REV. 9-82

cc: Tom
Ken
Joe
Greg

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

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Yours truly,

D. M. H. Waring
M&L Planning
Business Services

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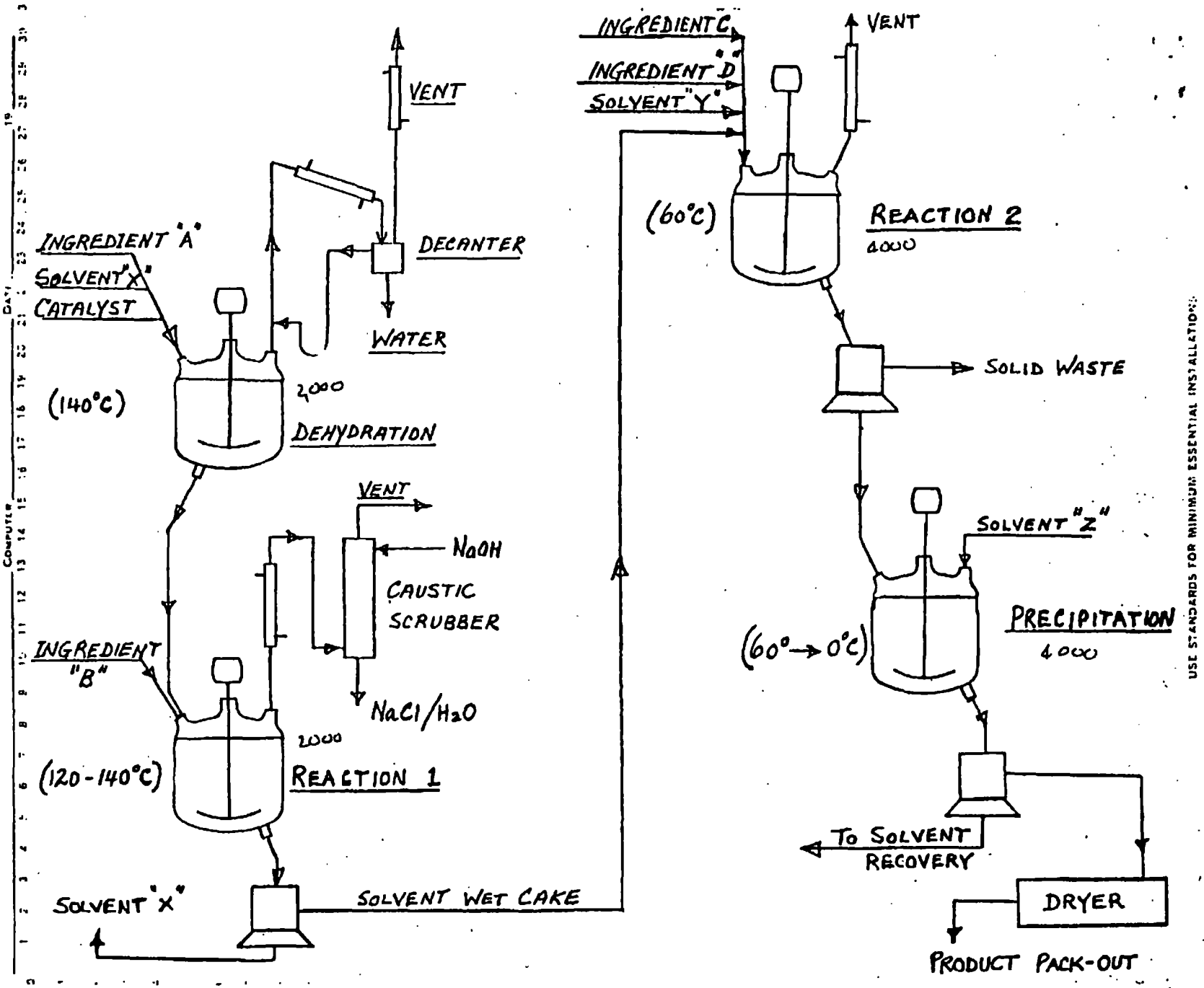


AB0000118292/2

DuPont Chlorinations

AG-327 REV. 1-88

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
LA PORTE PLANT
P.O. BOX 347
LA PORTE, TEXAS 77572-0347

AGRICULTURAL PRODUCTS DEPARTMENT

November 20, 1989

Mr. John Miles
Cedar Chemical Corp.
P. O. Box 2749
West Helena, AR 72390

Dear John:

Enclosed is a recently upgraded section of our "Guidelines & Instructions for Contractors" regarding cross contamination prevention. This is a subject critical to our mutual success. Please be sure to read carefully and review with all your employees who deal with Du Pont products. Key items from this upgraded section are:

- Under no circumstances should containers be re-used for Du Pont product, rework or recycle storage.

- Insecticide or fungicide samples must be disposed of and not recycled. Herbicides samples can be reworked if written sample rework procedures have been agreed to by the Du Pont contract administrator. It is preferred that lab samples be reworked immediately rather than storing and recycling in bulk.

- All Du Pont materials must be properly labeled using the labels which are ordered from Blackhawk Warehouse. Details of labeling requirements are given on pages 21-22 of the attached.

- New sampling requirements for cross contamination prevention from a preceeding product are given on pages 11-12 of the attached.

Sincerely,

AGR/dk
Attachment

cc: A. J. Sepcie
T. N. Kirchner, AG, Wilm.



ARB00001173O8/2

B. Contamination of Du Pont Products

Of utmost concern to Du Pont (and by implication, the Contractor) is the possibility of contamination of one product with another. This has happened, and the consequences can be very expensive in terms of both money and reputation.

The most damaging combinations are contamination of an insecticide or fungicide with an herbicide. For that reason, Du Pont rarely approves the production of these pesticides in equipment which has been used for herbicides. Accordingly, these instructions are aimed primarily at conditions where herbicide follows herbicide; although they apply to any combination of products. Extreme care must be exercised to prevent contamination of one herbicide with another. Crop herbicides are selective in their action, i.e. one herbicide will be safe for a particular crop and quite injurious to another.

There are many ways in which one product can become contaminated with another. Several of the most likely are

- Failure to adequately clean, flush and inspect equipment when changing products.
- Mistakenly charging a quantity of the wrong active ingredient. Many packages look alike.
- Reusing empty containers of one technical material for sweepings, shakedown, etc. of another.
- Misuse of a prelabeled finished product container.
- Dust sifting or blowing from an adjoining area.
- Laboratory sample recycled to the wrong process.
- Using unlabeled or incorrectly labeled containers.

The following procedures will be used to minimize the possibility of cross contamination and to monitor this characteristic. This is in addition to analyses required for normal specification quality.

1. Cleanout

- As soon as verbal agreement is reached that a production run is to be made, the Contractor will advise the Du Pont Contract Administrator in writing the name of and type of product which will have been run in the equipment immediately prior to the Du Pont product and provide samples as requested. If the preceding campaign was short, then the names of products run in the last two or three campaigns are needed. If there is an intervening change in this product, the Contract Administrator will be verbally notified immediately and confirmed in writing. Development of a trace level component (TLC) detection procedure takes time; therefore, early knowledge on what the preceding product is, is a must.

- Du Pont will then set maximum limits for Trace Level Components (TLC) in its product and will provide a detection procedure for determination. This information will be conveyed to the Contractor in advance of startup.

- The Contractor and Contract Administrator will consult and agree on procedures to be used for cleanout of the facilities. If flushes of clay or other inert materials are used, they must be analyzed for contaminant and pass the maximum limits specification before production starts.
  Where liquid systems are involved, the last flush material, water or other solvents, must also pass the maximum specification limits.

- Clay flushes with a minor concentration of a technical different than the Du Pont technical currently being formulated SHALL NOT be used.

- All materials and containers which will not be used in the campaign are to be removed from the operating area to reduce the possibility of inadvertent mixing of products.

- Following cleanout, the Contract Administrator will inspect the unit and approve for startup. Production will not commence until this approval is given. The Contract Administrator's inspection does not relieve the Contractor of any responsibility.

- The following is the minimum required start-up TLC sampling and analytical schedule. Any deviation from this schedule must be agreed to by the Contract Administrator prior to start-up.

  --Sample the first material through the filling equipment.

  For liquids:

  a)Take a grab sample and analyze for TLC, stop pack out until this is completed.

  b)Finished product container weight/volume may be adjusted while (a) is being completed.

  c)If TLC result of (a) is greater than 2/3 of the maximum TCL specification, stop formulation and contact the Contract Administrator. If TLC is less than 2/3 of the maximum specification, begin finished product pack out and continue formulation.

  For solids:

  a)Take a grab sample and analyze for TLC, then pack out 3,000 pounds in bulk containers while analysis is being run.

  b)Then take another grab sample of product made after the 3,000 pound quantity and analyze for the TLC and finished product analysis and begin finished product pack out.

  c)Review TLC results of (a) and (b), if either of them is greater than 2/3 of the maximum TLC specification or if (b) is greater than (a), contact the Contract Administrator at once.

--After the above conditions have been met, take a composite sample made up of a sample from each pallet of the next batch and analyze for TLC. If the TLC result of this sample is greater than the previous sample, stop formulation and contact the Contract Administrator at once.
--Analyze a composite sample of the next four finished product batches for TLC. If each of these batch TLC results is less than the preceding batch, discontinue start-up TLC analyses. If any batch TLC result is greater than the preceding result, stop formulation and contact the Contract Administrator at once.
--Continue to run TLC analysis on each 5th finished product batch, beginning with batch 10, until 100,000 pounds or gallons have been produced. Record these results on the lab analytical sheet for this product and report the results promptly to the Contract Administrator.

- The first batches of Finished Product should be retained until analysis shows that contaminant levels are satisfactory. All product failing the contamination test will be conspicuously identified and set aside and held until advised of disposition by the Contract Administrator.

- When a sample is taken to the lab for any purpose, it must NOT be returned to the line for rework but must be disposed of properly as waste when no longer needed. If for some herbicide product there is a compelling reason to return material to the production line, then there should be an explicit written procedure, with controls, signed by the Contract Administrator that allows this. Under no circumstance shall fungicide or insecticide lab samples be returned to the production line.

2. Mistaken Charge

- Once the equipment is clean, contamination from outside sources must be avoided. All Du Pont contracts specify that the contractor will segregate, identify and maintain a separate inventory of Du Pont owned materials. The Contractor shall do this. This must be done for several reasons, one of which is to help avoid the mistake of moving the wrong material to the charging area.

- The Contractor should provide a means of double checking that the labels of materials brought to the charging area are correct and that the components intended for a specific batch agree with the batching logs.

- The first check is when the raw materials are initially staged in the formulating area, the person doing this will check that the visible labels on the pallet indicate the correct material.

- The second check is when the person charging the raw material to the batch will check EACH raw material package label before charging and recording the lot number on the batch sheet. If there is no lot number, then the Contractor Supervision must approve charging and initial the batch sheet. Rework and recycle charges dumped via drums or bags should be recorded on the batch sheet with each label checked prior to charging.

3. Reuse of Shipping Containers

In some instances, technical product (or finished product for repackaging) may be furnished in drums. After such drums are emptied, operators often find them convenient for trash and waste of all kinds and even move them from one area to another for such purposes -- WITH LABELS INTACT. Therefore, the following rules must be followed:

- A Du Pont supplied raw material or finished product container must not be reused for any purpose. Likewise, drums from other areas must not be moved into the area being used for Du Pont product. <u>There is no circumstance under which such a practice is permissible.</u>

- Disposal of all containers will be made in accordance with the Contract terms.

4. <u>Misuse of Labeled Finished Product Containers</u>

We have often found prelabeled finished product containers used for the same purposes as discussed above; <u>this is an equally serious offense.</u> In the case of liquids, we have noted instances where a foreman has grabbed an empty, but fully labeled Du Pont container and used it to collect a sample of another product.

The use of a labeled finished product container for any purpose other than to contain the intended product is forbidden. <u>It should be made clear to all employees that there is no circumstance under which labeled containers may be misused.</u>

5. <u>Dust Contamination from Adjoining Areas</u>

With most Du Pont products the maximum permissible level of a contaminant is very small, usually under 50 ppm, although in some cases it may be higher. With levels this low, it is not difficult for dust from an adjoining unit to infiltrate a Du Pont production area and create a problem. Many things can be done to reduce this risk. (Continued next page.)

- Fixed partitions reaching from floor to roof should separate adjoining areas

- There should be no opening between adjoining areas but if an opening exists it should be capable of being sealed by a good fitting door.

- No direct vehicular traffic between areas should be permitted.

- Fans used for cooling should be positioned such that any dust generated cannot be blown toward an adjoining area.

- Spillages should be cleaned up promptly.

The above comments address only some of the most obvious ways cross contamination may occur. All employees must be aware of the risks inherent in these operations and continually reminded of the proper procedures. Du Pont expects that the Contractor's management will establish programs to minimize such risks. Our contracts make the Contractor financially liable for loss of product or damages from the use of contaminated product. THE GOAL IS ZERO CONTAMINATION.

F. Packaging & Palletizing

Will be performed in accordance with instructions issued in the Contractor Manual for the product or by the Contract Administrator for each product.

G. Proper Labeling of Du Pont Materials

The importance of proper labeling during the storage, handling, manufacture, transportation and inventory of Du Pont materials cannot be overemphasized. Proper labeling helps assure correct operation by reducing the potential for such problems as:

- Unsafe handling practices
- Inaccurate accounting
- Misplaced materials
- Poor inventory control
- Cross contamination
- Bill of lading and shipping errors
- Improper warehousing practices

All of these problems can result in serious consequences such as:

- Reduced employee safety
- Loss of revenue
- Damage to Du Pont's reputation
- Customer dissatisfaction and complaints
- Increased work load
- Over ordering materials
- Increased warehousing needs and expenses

Proper labeling alone will not eliminate all these problems, but it is a positive step in bringing them under stricter control. In order to improve our effectiveness in this area, the correct use of labels is required. The labels covered in this section are:

| LABEL TYPE | LABEL NUMBER |
|---|---|
| ■ Caution label (static) | AG-3456 8019 |
| ■ Property of Du Pont | LAPORTE 072189 |
| ■ Du Pont sample | LP 081089 |
| ■ This drum contains | B-21129 5-73 |
| ■ Rework | AG-2339 8017 |
| ■ Trash only | B-22081 9-80 |
| ■ For disposal | LP 082389 |

These labels are stocked at Blackhawk Warehouse and may be obtained from there by any of the following methods:
THE METHODS ARE LISTED IN ORDER OF PREFERENCE--

(1) Contact Blackhawk Warehouse via All-in-One and copy in your Contract Coordinator. Blackhawk's All-in-One address is BLACKNM@A1WMVX08.

(2) Telephone Nancy Moneymaker at Blackhawk Warehouse and request shipment of the desired labels. Their phone number is (501)572-6764. Notify your Contract Coordinator.

(3) Place your order with Blackhawk Warehouse via fax. Blackhawk's fax numbers are (501)572-7749 and (501)572-4230. You may also notify your Contract Coordinator via fax. The number is (713)470-3195.

(4) Should you have a problem securing labels using any of the above methods, contact your Contract Coordinator immediately by phone.

Please remember IT IS YOUR RESPONSIBILITY TO MAINTAIN AN ADEQUATE SUPPLY OF THESE LABELS AND USE THEM TO KEEP ALL APPROPRIATE DU PONT PRODUCTS OR MATERIALS IN YOUR POSSESSION OR CONTROL OR SENT OUT FOR STORAGE PROPERLY LABELED AT ALL TIMES. Proper labeling includes not only applying the correct label but filling it out properly as well. These labels, with the exception of the "TRASH ONLY" labels may only be used on Du Pont products or materials. The "TRASH ONLY" labels may be used only on trash containers in the plant. Please make sure all your employees are aware of this procedure and that it is being followed at all times. An example of each of the above labels and an explanation of its use follows.

CAUTION LABEL (STATIC) AG-3456 8019

PURPOSE: TO WARN AGAINST POSSIBLE STATIC CHARGES FROM STRETCH WRAP FILM.

USE: APPLIED, AFTER WRAPPING, TO THE CENTER OF ALL FOUR SIDES OF STRETCH WRAPPED PALLETS OF DU PONT MATERIALS, EITHER IN PROCESS, IN STORAGE OR FINISHED PRODUCT.
NOTE - THESE LABELS SHOULD ALSO BE APPLIED TO ANY VENDOR SUPPLIED STRETCH WRAPPED PALLETS OF MATERIALS SHIPPED TO YOU FOR DU PONT USE AS SOON AS RECIEVED.

"PROPERTY OF DU PONT" LABEL LAPORTE 072189

DU PONT

REG. U.S. PAT. & TM OFF.

# PROPERTY OF

# E.I. DUPONT de NEMOURS CO.

LAPORTE 072189

PURPOSE: TO IDENTIFY ALL DU PONT MATERIALS IN USE, STORAGE OR TRANSIT.

USE: APPLY TO ALL SHIPMENTS OF GOODS RECIEVED AS WELL AS ALL MATERIALS PRODUCED OR ACCUMULATED IN THE PLANT. THIS INCLUDES ALL MATERIALS SUCH AS CRUDES, PACKAGING SUPPLIES, TECHNICALS, REWORK AND MISCELLANEOUS ITEMS BUT DOES NOT INCLUDE FINISHED PRODUCT UNLESS SPECIFICALLY INSTRUCTED.

DU PONT SAMPLE LABEL LP 08/089

E. I. DU PONT DE NEMOURS & COMPANY

SAMPLE OF _____

DATE _____ TIME _____

LOT NO _____ BATCH NO _____

SAMPLED BY _____

SAMPLE INFORMATION _____

FOR DU PONT PRODUCTS ONLY

PURPOSE: TO IDENTIFY AND DIFFERENTIATE ALL DU PONT SAMPLES TAKEN DURING A CAMPAIGN OR AT OTHER TIMES FOR ANALYTICAL, RETAIN, SAMPLE SHIPMENT OR ANY OTHER REASON REQUIRING A SAMPLE.

USE: APPLIED DIRECTLY TO THE SAMPLE CONTAINER, ONE SAMPLE PER LABEL AND ONE LABEL PER SAMPLE. ALL INFORMATION REQUIRED ON THE LABEL MUST BE FILLED IN.

NOTE - THIS LABEL IS ONLY INTENDED FOR INTERNAL USE. WHEN TRANSPORTING FROM THE PLANT, THE APPROPRIATE PRODUCT LABELING MUST ALSO BE APPLIED.

"THIS DRUM CONTAINS" LABEL B-21129 5-73

PURPOSE: TO CORRECTLY IDENTIFY CONTENTS OF CONTAINERS AS WELL AS RECORD DATE OF PRODUCTION, DRUM NUMBER AND NET WEIGHT.

USE: APPLIED TO DRUMS OR OTHER PACKAGES CONTAINING SUCH DU PONT MATERIALS AS IN PROCESS MATERIAL BEING HELD FOR USE, IN SPECIFICATION MATERIALS FOR LATER USE, DRUMS CONTAINING PARTIAL OR DAMAGED PACKAGES OF CRUDES FOR USE IN THE UNIT OR ITEMS IN PLANT STORAGE (EX. DUST COLLECTOR BAGS STORED BETWEEN CAMPAIGNS)

NOTE - (1) THIS LABEL IS NOT TO BE USED IN PLACE OF A "REWORK" OR "TRASH ONLY" LABEL. (2) THIS LABEL IS NOT SUFFICIENT FOR TRANSPORTATION OR OFF PLANT STORAGE. WHEN REMOVED FROM THE PLANT, THE APPROPRIATE PRODUCT LABELING MUST ALSO BE APPLIED.

"REWORK" LABEL AG-2339 8017

**When Removed From Plant, The Appropriate Product Labeling Must Also Be Applied.**

# REWORK

Product Name _____

Date _____ Lot No. _____

Quality Problem _____

Reason For Rework _____

Name _____

Net Weight _____

AG-2339 8017

PURPOSE: TO CORRECTLY IDENTIFY AND RECORD NECESSARY INFORMATION REGARDING DU PONT REWORK MATERIAL HELD ON PLANT OR STORED OFF PLANT FOR LATER REUSE.

USE: APPLIED TO EACH INDIVIDUAL DRUM OF REWORK OR TO ALL FOUR SIDES OF STRETCH WRAPPED PALLETS OF FINISHED PRODUCT CONTAINERS WHICH HAVE BEEN DECLARED OFF SPECIFICATION. ALL INFORMATION REQUIRED ON THE LABEL MUST BE FILLED IN. NOTE - AS THE LABEL STATES, "WHEN REMOVED FROM THE PLANT, THE APPROPRIATE PRODUCT LABELING MUST ALSO BE APPLIED".

"TRASH ONLY" LABEL B-22081 9-80

PURPOSE: TO CORRECTLY IDENTIFY ALL TRASH CONTAINERS ON THE SITE.

USE: THIS LABEL SHOULD BE APPLIED TO AT LEAST TWO SIDES OF ALL TRASH CONTAINERS. IF POSSIBLE, ALL TRASH CONTAINERS SHOULD BE THE SAME SIZE, TYPE AND COLOR. UNDER NO CIRCUMSTANCES MAY DU PONT PRODUCT OR CRUDES DELIVERY DRUMS BE USED AS TRASH DRUMS. NO TRASH DRUM MAY CONTAIN ANY TYPE LABEL IN ADDITION TO THE "TRASH ONLY" LABEL.

NOTE - SHOULD THE PLANT SITE DECIDE NOT TO USE THIS LABEL ON ALL TRASH DRUMS, SOME MUTUALLY ACCEPTED ALTERNATIVE MUST BE REACHED. THE GOAL IS THAT ALL TRASH DRUMS ARE THE SAME AND EASILY IDENTIFYABLE AS SUCH.

"FOR DISPOSAL" LABEL LP 082389

PURPOSE: TO IDENTIFY CONTAINERS OF MATERIAL FOR DISPOSAL.

USE: THIS LABEL IS TO BE APPLIED TO AT LEAST TWO SIDES OF ALL CONTAINERS OF DU PONT MATERIAL BEING HELD FOR DISPOSAL. STRETCH WRAPPED PALLET LOADS OF MATERIALS FOR DISPOSAL MUST HAVE ONE OF THESE STICKERS ON EACH SIDE. PROPER PRODUCT LABELS AND/OR DESCRIPTION LABELS SUCH AS "THIS DRUM CONTAINS" LABELS ARE TO BE USED ALONG WITH THIS LABEL. IN ADDITION, SPECIAL STENCILING MAY BE REQUIRED FOR MATERIALS BEING SHIPPED TO ANOTHER SITE FOR DISPOSAL. NOTE - DIFFERENT MATERIALS FOR DISPOSAL MAY NOT BE MIXED IN THE SAME CONTAINER NOR MAY CONTAINERS OF DIFFERENT MATERIALS FOR DISPOSAL BE MIXED ON THE SAME PALLET.

DU PONT

# TEST METHOD

ALCOHOLS

DETERMINATION OF ACIDITY AS ACETIC ACID

METHOD E5600.005.01.CWP

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DU PONT CHEMICALS

GENERAL PROCEDURE

METHOD E5600.005.01.CWP

# ALCOHOLS

## Determination of Acidity as Acetic Acid

### I-A. Principle

The sample is titrated with 0.05 N alcoholic potassium hydroxide to a phenolphthalein end point.

### I-B. Scope

#### 1. Application

This is a specification method for the determination of small amounts (up to 0.02%) of acidity as acetic acid, in alphatic ($C_1$ to $C_{10}$) alcohols.

#### 2. Limitations

No study has been made.

### I-C. Precision and Accuracy

No study has been made.

### I-D. Special Apparatus

None.

### I-E. Reagents (Reagent Grade)

1. Alcoholic potassium hydroxide, 0.05 N.

   Prepare by careful dilution of 0.1 N solution (Ref. 1) 1 to 2 with methyl alcohol. Use half of the posted normality of the 0.1 N solution as the normality.

2. Phenolphthalein 0.05% in 2B alcohol, Orchem Method 1-8-1.

## I-F. Notes

None.

## I-G. References

None.

PART II

METHOD E5600.005.01.CWP

# ALCOHOLS

## Determination of Acidity as Acetic Acid

### II-A. Unusual Safety Considerations

#### 1. Product Hazards

2-Ethylhexyl alcohol is an eye and skin irritant. It may be absorbed through the skin, and may cause an allergic skin reaction. Avoid contact with skin, eyes, and clothing. Wash thoroughly after use. In case of contact, wash affected area with large amounts of water and report to Medical. 2-Ethylhexyl alcohol is a combustible liquid. Keep away from heat, sparks, and flames. For more information, refer to MSDS No. 04210341.

#### 2. Procedure Hazards

There are no unusual procedure hazards.

### II-B. Procedure

1. Weigh 100 ± 10 ml of sample to the nearest 0.1 g and transfer to a 250-ml Erlenmeyer flask.
2. Add a few drops of phenolphthalein.
3. Titrate with 0.05 N alcoholic potassium hydroxide solution to a pink end point permanent for at least 15 seconds.

#### Calculations

$$\frac{V \times N \times 6.0}{W} = \text{\% acidity as acetic acid}$$

Where V = ml of titrant, Step 3

W = g of sample, Step 1

N = normality of 0.05 N alcohol KOH solution

$$6.0 = \frac{\text{M.W. of acetic acid} \times 100}{1000}$$

Report results to the nearest 0.001%.

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DU PONT

# TEST METHOD

GENERAL METHOD

COLOR OF LIQUIDS
DETERMINATION OF APHA STANDARDS

METHOD E5600.065.01.CWP

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DU PONT CHEMICALS

ANALYTICAL PROCEDURE

METHOD E5600.065.01.CWP

GENERAL METHOD

# Color of Liquids
# Determination by APHA Standards

## I. Principle:

The sample is compared with platinum-cobalt color standards in Nessler tubes.

## II. Scope:

### A. Application:

These standards are also known as the Hazen Platinum-Cobalt Color Standards. They were developed initially for determining the color of water.

### B. Limitations:

These standards are used mostly for the determination of the color of so-called water white liquids.

## III. Precision & Accuracy:

Not determined.

The results of color determinations shall be expressed in whole numbers and recorded as follows:

| Color Units | Record to Nearest Units |
|---|---|
| 1 - 50 | 1 |
| 51 - 100 | 5 |
| 101 - 250 | 10 |
| 251 - 500 | 20 |

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## IV. Apparatus:

1. Nessler tubes, 100-ml. matched.

2. Tube rack with a white or mirrored surface placed at such an angle that the light is reflected upward through the column of liquid.

## V. Reagents:

1. Preparation of color standards.

Dissolve 1.245 g. of potassium chloroplatinate ($K_2PtCl_6$) and one gram of cobaltous chloride ($CoCl_2 \cdot 6H_2O$) in water with 100 ml. of concentrated HCl and dilute to one-liter with distilled water. This solution has a color of 500. To prepare standards having colors of 5, 10, 15, 20, etc., dilute 1, 2, 3, 4 ml., etc., of the above solution with distilled water to 100 ml. in standard Nessler tubes. Protect the tubes from evaporation and from dust when not in use.

## VI. Hazards:

2-Ethylhexyl alcohol is an eye and skin irritant. It may be absorbed through the skin, and may cause an allergic skin reaction. Avoid contact with skin, eyes, and clothing. Wash thoroughly after use. In case of contact, wash affected area with large amounts of water and report to Medical. 2-Ethylhexyl alcohol is a combustible liquid. Keep away from heat, sparks, and flames. For more information, refer to MSDS #04210341.

## VII. Procedure:

1. Fill a 100-ml. Nessler tube with the sample and compare with the standards.

2. Make the observations by looking vertically downward through the tubes.

## VII. References:

1. American Public Health Association: "Standard Methods for the Examination of Water and Sewage", 10th Edition, p. 87 (1955).

DU PONT

# TEST METHOD

GENERAL PROCEDURE

DETERMINATION OF DISTILLATION RANGE

METHOD E5600.120.01.CWP

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DU PONT CHEMICALS

ANALYTICAL PROCEDURE

METHOD E5600.120.01.CWP

# GENERAL PROCEDURE

## Determination of Distillation Range

### I. Principle

The method depends on the measurement of the temperature at which a liquid distills under carefully standardized conditions.

### II. Scope

This method, which corresponds to the Barrett procedure, has been used extensively and has been found satisfactory. and has been found satisfactory.

### III. Precision and Accuracy

No statistical study of the precision and accuracy has been made. Repeatability of results by the same operator using the same apparatus is ± 0.1°C. for the initial boiling point. For the intermediate points, the differences in temperature readings should not exceed the amounts equivalent to 1 ml. of distillate at each point in question.

### IV. Special Apparatus

1. Distillation flask, 200-ml. capacity

With standard side outlet, corresponding to the following dimensions:

| | | |
|---|---|---|
| Diameter of bulb | 73 mm. | (2.9 in.) |
| Outside diameter of neck | 24 mm. | (0.9 in.) |
| Inside diameter of neck | 21 mm. | (0.8 in.) |
| Length of neck | 105 mm. | (4.1 in.) |
| Inside diameter of side outlet tube | 5 mm. | (0.2 in.) |
| Length of side outlet tube | 127 mm. | (5.0 in.) |
| Side outlet joined to neck above base of neck | 52 mm. | (2.1 in.) |

The side outlet is set on an angle of 75 ± 5° with the neck. A tolerance of 5% is allowed on the other dimensions of the flask.

2. Thermometer

Selected from the following list on the basis of the expected distillation range:

| J.L. No. | Range, 0°C. | Graduation, 0°C. |
|---|---|---|
| 1 | -36 to +30 | 0.2 |
| 2 | -5 to +30 | 0.1 |
| 3 | +25 to +60 | 0.1 |
| 4 | +55 to +90 | 0.1 |
| 5 | +85 to +120 | 0.1 |
| 6 | +115 to +185 | 0.2 |
| 7 | +180 to +250 | 0.2 |
| 8 | +245 to +420 | 0.5 |

No correction for emergent stem is necessary since these thermometers are calibrated at 3-inch immersion.

3. Condensing apparatus

This apparatus consists of a copper trough, listed in A. H. Thomas catalog as No. 1272, and a condenser tube and is assembled as shown in Figure 1 of the Appendix.

The condenser tube is made of Pyrex glass, "sharp-cut" at the ends and not "fire-smoothed." It may be "cold-polished" to overcome the hazard presented by a sharp edge of glass. This tube must be straight and have a length of 24 inches and an inside diameter of 0.5 inch. For liquids boiling below 60°C., use a tube with a length of 22 inches and an inside diameter of 0.5 inch, the lower end of which is cut off at an acute angle, is curved for a length of 3 inches and projects into the 100-ml. receiver for a distance of 0.5 inch. This tube is connected in the trough by means of suitable perforated corks, adjusted so that exactly 15 inches of the tube are cooled in the trough. When set up, the distance from the center line of the flask to the end of the condenser is 700 mm. (27.56 in.).

Use the following table to determine the proper method of cooling the condenser:

| Product Characteristic | Method |
|---|---|
| (1) Boiling above 150°C. | Use tap water. |
| (2) Boiling below 150°C. | Use ice in the water. |
| (3) Solid at room temperature | Use water, heated above the melting point of the product. |



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4. Heating apparatus

Assembled as shown in Figure 1 of the Appendix. This apparatus consists of a gas burner or an electric heater, covered with an asbestos board and contained in an asbestos shield.

For substances boiling below 150°C., rest the distillation flask in a 1-inch hole cut in 1/4-inch asbestos board; for substances boiling above 150°C., rest the flask in a 1.5-inch hole in the asbestos board. In either case the edge of the hole should not be beveled.

The heat source must be capable of distilling the sample at a uniform rate. If a gas burner is used, a section of asbestos board is fitted in the base of the burner chamber and a circular opening is cut in the center of the board to fit the burner base and to center the burner accurately under the flask. If an electric heater is used, this lower asbestos board may be omitted.

## V. Reagents

No reagents are required.

## VI. Hazards

Analyze all samples in a well-ventilated hood since a large percentage of samples analyzed are toxic. Handle and transfer samples while wearing rubber or impervious gloves, if practical. In case of spills, clean up immediately. Notify your foreman of any unusual conditions.

2-Ethylhexyl alcohol is an eye and skin irritant. It may be absorbed through the skin, and may cause an allergic skin reaction. Avoid contact with skin, eyes, and clothing. Wash thoroughly after use. In case of contact, wash affected area with large amounts of water and report to Medical. 2-Ethylhexyl alcohol is a combustible liquid. Keep away from heat, sparks, and flames. For more information, refer to MSDS No. 04210341.

## VII. Procedure

1. Rinse the flask with the sample to be analyzed and allow it to drain for 30 seconds. Rinse the condenser tube and allow it to drain, finally removing the last drop from the end of the tube with a piece of filter paper.

2. Measure 100 ml. of sample into the flask from a graduated cylinder, allowing the cylinder to drain for 30 seconds.

3. Place the cylinder under the delivery end of the condenser tube. Connect the side tube of the flask to the condenser by means of a well-rolled, perforated cork.

4. Insert the stopper carrying the thermometer into the flask, placing the thermometer so that the top of the small, upper mercury bulb is level with the bottom of the exit tube.

5. Center the heat source under the flask and heat rapidly at first, especially with high-boiling liquids.

6. When vapors are seen to condense on the sides of the flask, cut down the heat so as to allow the mercury thread to climb within 0.5 to 1.0°C. of the boiling point at the first drop.

7. Adjust the heat, as shown by experience, so that the distillate will drop from the condenser into the receiving graduate at a rate of about three drops every two seconds. In no case should the rate be slower than one drop per second or faster than two drops per second, except with certain impure materials which tend to froth during distillation. For pure substances having a narrow distillation range the heat will not have to be changed once it is correctly regulated, but with liquids having a wide range, more heat must be applied from time to time to keep up the desired rate.

8. Note the temperature when the first drop falls into the receiver and then when 5 ml., 15 ml., 85 ml. and 95 ml. have been collected. Consult the specification analysis manual for distillation data required. Also note the temperature at the dry point. (See Note 1 for various techniques to use in determining dry point.)

Correction for Barometric Pressure

If necessary, correct the temperature reading to 760 mm. barometric pressure using the following formula:

$$0.00012 \times (760 - P) \times (273 + t) = C$$

Where: C = correction to the observed temperature "t" in °C.
P = actual barometric pressure in mm. of Hg.
t = observed temperature in °C.

## VIII. Notes

1. In taking readings of the dry point, the procedure will differ with each of three classes of substances as follows:

Class I - Liquids with a small range and a true dry point (e.g., benzene, alcohol, pure amino compounds). The dry point is the temperature at the instant the bottom of the flask goes dry.

Class II - Liquids with a small distillation range but which crack instead of going dry (e.g., nitro- and chloro-substituted compounds). The dry point is taken as the temperature at which the residue in the flask begins to crack, i.e., at the sudden appearance of smoke or heavy vapor in the flask.

With substances of this class it is often desirable to measure the residue in the flask. Where there is not more than 3.5 ml. of residue present, the following method is used.

Allow the flask to cool to room temperature and fit it into one of seven holes that have been cut in a plate of 1/32-inch brass, 8-1/2 by 5-3/4 inches. Fit the flask into the hole in the plate where the level of the liquid can just be seen when sighting along the top of the plate. Calculate the volume from the following table:

| Diameter of Hole (in mm.) | Volume (in ml.) |
|---|---|
| 47 | 3.5 |
| 46 | 3.0 |
| 44.5 | 2.5 |
| 42 | 2.0 |
| 38 | 1.5 |
| 34 | 1.0 |
| 30 | 0.5 |

Class III - Substances with a wide distillation range but which do not crack or go dry (e.g., solvent naphtha). With this class of compounds the dry point and the whole range is greatly affected by the rate of heating.

Regulate the distillation rate to 1.5 drops per second for every 10 ml. up to 85 ml. At the 85-ml. point be sure that the rate is exactly 1.5 drops per second and do not change the rate of heating thereafter. The temperature reading will reach a maximum after which it will drop. The maximum temperature is taken as the dry point.

For all types of compounds, the dry point is best determined by looking through the flask into the illuminated heat chamber.

## IX. References

None.



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## X. Appendix

Figure 1, the distillation apparatus sketch, is appended.

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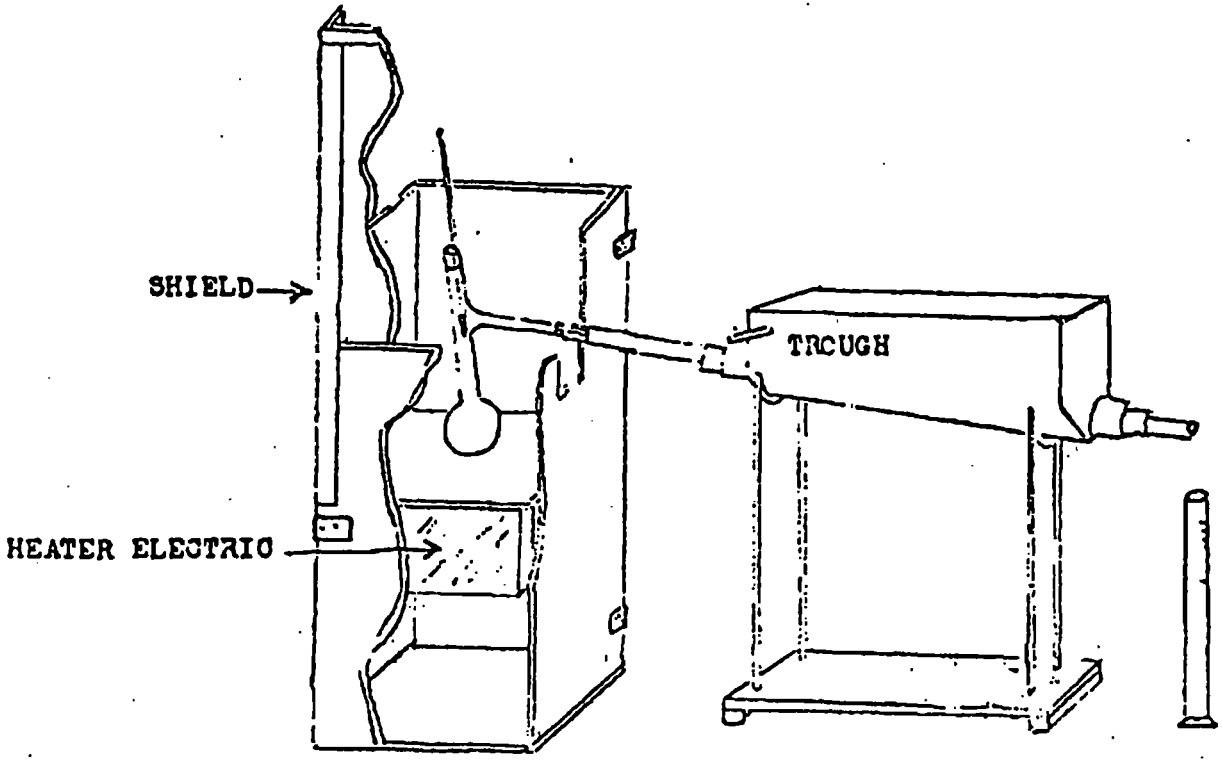
FIG. No. 1

APPARATUS FOR THE DETERMINATION OF DISTILLATION RANGE



DU PONT

# TEST METHOD

2-ETHYLHEXYL ALCOHOL (2-EHA)

ASSAY BY GAS CHROMATOGRAPHY

METHOD E5600.165.01.CWP

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PART I

E. I. DU PONT DE NEMOURS & COMPANY

DU PONT CHEMICALS

ANALYTICAL PROCEDURE

METHOD E5600.165.01.CWP

# 2-ETHYLHEXYL ALCOHOL (2-EHA)

## Assay by Gas Chromatography

### I-A. Principle

This method is based on the gas chromatographic separation achieved when a sample of 2-ethylhexyl alcohol is passed through a glass column packed with 5% Carbowax 20 M on 80/100 mesh Chromosorb W-HP. Results are quantitated by the area percent procedure, using a flame ionization detector.

### I-B. Scope

#### 1. Application

This method is designed to determine the quality of 2-ethylhexyl alcohol.

#### 2. Limitations

The purity is reported as area percent. None of the unknown components present (less than 0.4%) have been identified.

### I-C. Precision and Accuracy

#### 1. Development Precision

A sample of 2-ethylhexyl alcohol (T/T 4472) was analyzed three times by one technician. Results are shown as follows:

| Average, Area % | Standard Deviation | 95% C.L. for Single Determination |
|---|---|---|
| 99.687 | ± 0.001 | ± 0.003 |

#### 2. Routine Precision

A sample of 2-ethylhexyl alcohol (T/T 4472) has been analyzed across the shifts (5 technicians; 10 determinations) in the Quality Control Laboratory. Results are shown as follows:

| Average, Area % | Standard Deviation | 95% C. L. for Single Determination |
|---|---|---|
| 99.680 | ± 0.009 | ± 0.021 |

3. Accuracy

No accuracy studies were conducted.

I-D. Special Apparatus (Equivalent apparatus may be substituted)

1. Gas chromatograph, Hewlett-Packard, Model 5880A, equipped with a flame ionization detector.
2. Syringe, 10 µL capacity.
3. Gas chromatographic column, glass, 6-ft. length, 1/4" o.d., available from Jackson Laboratory storeroom.
4. Septum vial, 10-mL.

I-E. Reagents

1. Column packing, 5% Carbowax 20 M on 80/100 mesh Chromosorb W-HP.
2. Methylene chloride, reagent grade.

I-F. Notes

None

I-G. References

None

Data Sheet METHOD E5600.165.01.CWP PART II

# 2-ETHYLHEXYL ALCOHOL (2-EHA)

## Assay by Gas Chromatography

## II-A. Unusual Safety Considerations

### 1. Product Hazards

2-Ethylhexyl alcohol is an eye and skin irritant. It may be absorbed through the skin, and may cause an allergic skin reaction. Avoid contact with skin, eyes, and clothing. Wash thoroughly after use. In case of contact, wash affected area with large amounts of water and report to Medical. 2-Ethylhexyl alcohol is a combustible liquid. Keep away from heat, sparks, and flames. For more information, refer to MSDS No. 04210341.

### 2. Procedure Hazards

Methylene chloride is narcotic. Avoid breathing its fumes.

Handle the syringe with care to avoid skin puncture.

## II-B. Procedure

### 1. Instrument Settings

| Instrument |
|---|
| Mfg. Hewlett-Packard |
| Model 5880A |
| **Detector** |
| Thermal Cond. ( ) |
| Flame Ioniz. (x)<br>Hyd. 40 psig<br>Air 40 psig |
| Electron capture ( ) |
| Other |
| **Carrier gas** |
| He (X) N ( ) Other ( ) |
| Flow**** 20 mL/min. |

| Column |
|---|
| Mat'l of Const. Glass |
| Length* 6-ft. Diam.**1/4"o.d. |
| Packing<br>Substrate 5% Carbowax 20 M |
| Packing*** Chromosrob W-HP<br>Support 80/100 mesh |
| Isotherm oven Inject Port<br>Temp.°C 85 Temp.°C 200 |
| Detec. Max. Safe Oven<br>Temp.°C 300 Temp.°C 225 |
| **Programming** |
| Initial Col. Temp.,°C |
| Temp. Rise/min.,°C |
| Temp. Limit,°C |
| Pre-program Hold, min. |

*Specify units (in., ft., meters, etc.)
**Specify o.d. or i.d. and units
***Specify mesh size
****Specify as mL/min or psig

2. Order of Elution Method E5600.165.01.CWP Part II

| Component | Retention Time (Min.) | Range Investigated |
|---|---|---|
| Methylene chloride (Solvent | 0.44 | - |
| 2-Ethylhexyl alcohol (2-EHA) | 12.32 | 99.4-99.7% |
| | | |

3. Sample Analysis

a. Pipet 1 mL of sample into a septum vial.

b. Add to the vial 10 mL (graduate cylinder) of methylene chloride.

c. Seal the vial and thoroughly shake.

d. Inject 4 µL of sample solution.

e. Scan for a minimum of 15 minutes.

f. Calculate results as follows:

$$\frac{A_i}{\Sigma A} \times 100 = \text{area \% of component } i$$

Where: $A_i$ = area for component i

$\Sigma A$ = sum of all component areas

g. Report results to the nearest 0.01%.

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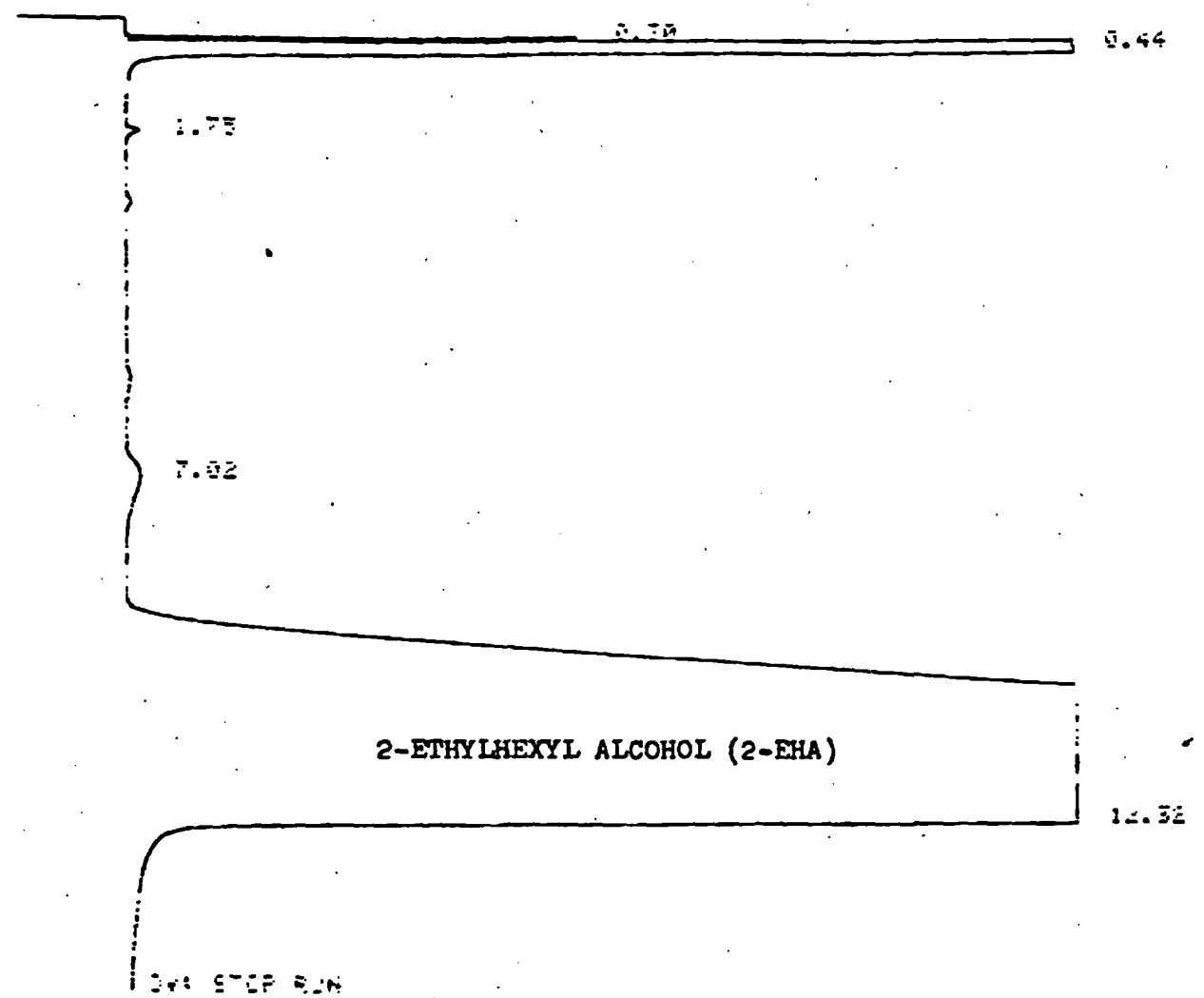
Method E5600.165.01.CWP Part II




[MP] 58305 MANUAL INJECTION @ 14:13 JAN 25, 1984

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305 SIGNAL A DEVICE# 5
310 ATTN 205 DEVICE# 5
315 ATTN 2^10
320 INJ 1 TEMP 200
325 DET 1 TEMP 300
330 %OFFSET 10
335 CHART SPEED .
340 DELETE OVEN TEMP
345 OVEN TEMP 85
350 OVEN TEMP EQUIB TIME 1
355 OVEN TEMP INITIAL TIME 1
360 OVEN TEMP POST VALUE 210
365 OVEN TEMP POST TIME 5
370 START
375 PAGE

DU PONT

# TEST METHOD

E. I. du Pont de Nemours & Company (Inc.)
Chemicals & Pigments Department

Method No. E5600.190.01.CW
Original: November 13, 1990


## 2-ETHYLHEXYL ALCOHOL

## Product Identification by Infrared Spectrophotometry

### I. Principle

An infrared spectrum of the product obtained by attenuated total reflectance (ATR, see Comment 1) is compared to a spectrum of reference material in order to determine the nature of the sample. The degree to which the spectrum of the sample matches the spectrum of the reference material gives an indication of identity, composition, and purity of the sample.

### II. Applicability

This method is generally applicable to any sample which is liquid at room temperature and may be handled without extraordinary precautions under normal laboratory conditions. This method is intended for the qualitative identification of 2-ethylhexyl alcohol.

### III. Limitations

Samples which are strong acids or bases should not be run by this procedure since they may damage the cell materials. Samples containing suspended particles may exhibit unusual or inconsistent spectra which could lead to difficulties in matching reference to sample spectra. This method is not intended to measure small changes in sample composition or to detect trace impurities.

### IV. Sensitivity, Precision and Accuracy

#### A. Sensitivity

Generally, changes in sample composition down to approximately 5% are easily observable. However, the extent to which an impurity or change in sample composition effects the spectrum can vary greatly. This method is not intended to measure small changes in sample composition or to detect trace impurities.

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B. Precision

1. Single Operator

Not applicable.

2. Multiple Operator

Not applicable.

C. Accuracy

Not applicable. See Part IV-A.

V. Special Apparatus (Equivalent apparatus may be substituted)

1. Nicolet 510 Fourier Transform Infrared Spectrophotometer.

2. External horizontal ATR accessory. Spectra-Tech part 0062-005 (see Comment X-1).

3. ZnSe trough plates, 60° and 45°. Spectra-Tech parts 0050-605 and 0050-603.

4. Volatile liquids cover. Spectra-Tech part 0050-901.

VI. Reagents (Reagent grade except as noted)

1. Cleaning solvents (e.g. acetone, toluene, methanol, etc.)

VII. Special Safety Considerations

A. Product Hazards

2-Ethylhexyl alcohol is an eye and skin irritant. It may be absorbed through the skin, and may cause an allergic skin reaction. Avoid contact with skin, eyes, and clothing. Wash thoroughly after use. In case of contact, wash affected area with large amounts of water and report to Medical. 2-Ethylhexyl alcohol is a combustible liquid. Keep away from heat, sparks, and flames. For more information, refer to MSDS No. 04210341.

B. Procedure Hazards

Fill and empty the boat cell in a good hood. Keep the volatile sample cover on the boat cell whenever the cell is full and is not in a hood.

Selenium compounds are toxic. Use great care in handling the zinc selenide trough plate (boat cell) to avoid creation of dust or fragments of the material which might be ingested. Wash hands thoroughly after handling this material.

B. Procedure Hazards (Cont.)

The beam from the low-power alignment HeNe laser in the FTIR emanates vertically out of the horizontal ATR when the sample boat is not in place. Do not bend over the instrument and look down into the instrument so as to look directly into this beam. Always keep a sample boat in place on the instrument when not in use.

## VIII. Procedure

### A. Operating Conditions

This method requires that the technician running the method be trained in the operation of the FTIR, including data acquisition and storage functions.

The instrument parameters should be set to the following values:

| | |
|---|---|
| NSS:(Sample Scans) | 50 (for calibration)<br>10 (for sample) |
| NSB:(Background Scans) | 50 (for calibration)<br>10 (for sample) |
| NDP:(Data Points, Res.=8 cm-1) | 4096 |
| NTP:(Transform Points) | 8192 |
| VEL:(Mirror Velocity) | 30 |
| GAN:(Gain) | 1 |

Purge: The monochromator case must be provided with a dry nitrogen purge.

### B. Calibration

NOTE: Calibration (obtaining a reference scan) only needs to be done when using a new instrument or after major instrument maintenance. A reference scan may be taken at any time if the validity of the current reference scan is under question.

1. Using the 45° boat cell, obtain a scan of the reference material utilizing Steps XIII-D-1-6.

2. Plot the reference spectrum in percent transmittance over the range of 4000 $cm^{-1}$ to 650 $cm^{-1}$.

NOTE: If a computerized matching program is to be used, save the spectrum to disk as indicated by the computer program instructions.

3. Inspect the reference spectrum. If the sample is too absorbing (more than one peak "pegged" at 0% T), repeat the scan in a 60° boat cell. Note which cell was used on the reference scan.

C. Sampling

The sample should be well-mixed to insure a representative sample of the product. The sample should be homogeneous and should not contain any observable suspended particles.

D. Sample Analysis

1. Using the same trough type as the reference (60° or 45°), place the clean, dry sample trough in position on the instrument.

2. Using the conditions specified in Step VIII-A, obtain a background scan of the empty sample trough.

3. Using a dropper, fill the sample trough with enough sample to completely cover the bottom of the trough. Typically, 2-3 mL of sample will be required. Do not fill the trough over 2/3 full.

4. Place the solvent cover on the trough and place the trough onto the sample position of the instrument.

5. Using the conditions specified in Step VIII-A, obtain a scan of the sample.

6. Ratio the sample scan to the background scan collected in Step VIII-D-2.

7. Plot the transmission spectrum over the range of 4000-650 $cm^{-1}$.

   NOTE: If a computerized matching program is used, view the spectrum as instructed by the program instructions.

8. Compare the sample spectrum to the spectrum of the reference material.

9. Report whether or not the sample scan matches the reference scan. Ignore small differences in the spectra, particularly sloping baselines, different noise levels, and differences in the $CO_2$ region (around 2360 $cm^{-1}$) of the spectrum.

10. Clean the trough thoroughly with acetone, and dry with a soft cloth if necessary. Never subject the cell to anything but room-temperature conditions. Even rinsing with warm water may crack the cell crystal.

E. Calculations

Not applicable.

## IX. Quality Control

It is suggested that a standard pure sample, such as acetone or toluene, be run on a periodic schedule, as set by supervision, and compared to a reference of that material to check the performance of the instrument. If large differences in peak intensity (>5% T) or position (>0.5 $cm^{-1}$) are noticed, supervision should be notified. Possible sources of error would be boat cell damage or contamination, or poor instrument alignment.

## X. Comments

1. This method is designed to use attenuated total reflectance (ATR) to obtain the sample spectrum. It is not recommended to compare the ATR spectrum to a spectrum obtained by transmission techniques since the ATR spectrum will exhibit distinct differences in relative peak intensities as compared to the transmission spectrum.

2. Either an external or in-compartment (Spectra-Tech part 0012-401T) ATR accessory may be used. The external accessory is recommended since it does not utilize the main sample compartment of the spectrophotometer.

## XI. References

1. DX Advanced Operations Manual, Nicolet Analytical Instruments, Madison, WI.

2. MSDS #04210341 (2-ethyl-1-hexanol).

## XII. Appendix

None.

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# TEST METHOD

GENERAL PROCEDURE

DETERMINATION OF REFRACTIVE INDEX

METHOD E5600.283.01.CWP

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## GENERAL PROCEDURE

### Determination of Refractive Index with an Abbe Refractometer

I - Reference:

Bausch & Lomb Optical Company - Abbe Refractometer - Directions for Use - Series 512.

II - Status:

The following method is a copy of the instructions given in the above reference.

By closely following these directions and control of the temperature within a fraction of a degree, it is possible to obtain an accuracy of one or two units in the fourth decimal place.

III - Description of the Instrument:

The Abbe Refractometer, as made by the Bausch & Lomb Optical Company, is designed and constructed so as to combine accuracy with strength and durability. The instrument consists essentially of four parts.

1. The Telescope
2. The Abbe Prisms
3. The Sector
4. The Compensator Prisms

The telescope consists of an Objective (Figure 1), Eyepiece, and a cross line engraved on the plano side of the collective lens of the Eyepiece. The function of the telescope is to form an image of the border line of the total reflection in the plane of the cross hairs, whose intersection provides a point with which the border line may be brought into coincidence under conditions assuring the greatest possible accuracy of setting.

The Abbe prisms, two flint glass prisms of high refractive index, are cemented in hollow water jacketed mounts so designed that when temperature control is desired, water can be circulated around the prisms. The exposed surfaces of the Upper Abbe Prism are highly polished, while the hypotenuse surface of the Lower Abbe Prism is finely ground. This surface serves solely for the purpose of illumination. The upper prism mount is rigidly attached to the alidade or index arm. When the lower mount is clamped into position against the upper, the hypotenuse surfaces are separated by a space of 0.10 mm. to 0.15 mm. thick. It is in this space that the liquid to be measured is held.



AB0000117986/2

The Scale Sector is a metal arm to which the telescope is rigidly attached. One end is connected to the upright in the base in such a manner that the whole sector may be rotated about an axis, which coincides with the axis of rotation of the Abbe prisms. This may be considered as the main axis of the instrument. The sector may be rotated between fixed limits to suit the various conditions of illumination at various points on the index scale. On the upper end of the sector is mounted a German silver scale graduated directly in terms of refractive index of the D line (Sodium) at a temperature of 20°C. In the case of instruments carrying the additional percentage total solids scale, both scales (index and percentage) are engraved on the same alidade and are read by the same indicator line in the Magnifier Unit. The data on which the direct reading percentage scales are based are those given in the above reference.

An alidade or movable arm, which may be rotated as a unit with the Abbe prisms around the main axis of the instrument but independently with respect to the sector (Figure 1), rests against the sector. The upper end of the alidade bears a reference line, which when the arm is rotated moves along the index scale. The Fine Adjustment provides a slow motion and facilitates bringing the border line in exact coincidence with the cross hairs.

The two Compensator Prisms are two direct vision Amici prisms that rotate in opposite directions about the optical axis of the telescope. The pinion head rotates the prisms, the amount of rotation being read on the Compensator Prism Scale. The lower prism can be rotated with reference to the scale for purposes of adjustment by means of the milled ring which is clamped by a small screw at the base of the lower Amici prism mount.

IV - Manipulation of the Instrument:

Experience shows that a short time spent in systematic manipulation of the refractometer is sufficient to establish deftness in its use. This is a great asset and it is recommended that the beginner carry out the following instructions carefully before any readings are taken, repeating the whole series of actions until they can be performed without thought.

Place the instrument in front of a well-lighted window or other source of white light. To the right of this space, place a bottle of distilled water and one of alcohol. Obtain a glass rod, a test tube in which to keep it and a piece of clean soft cloth (a piece of linen washed in distilled water is the best).

Remove the refractometer from the case by sliding the instrument from the case. Remove the cloth covering the instrument and the paper covering the prisms and eyepiece. Place the instrument in the space reserved for it with the Scale Sector at the left and the Mirror at the rear.

Unclamp the index arm (by loosening the Fine Adjustment) and move to the rear end of the scale. Hold the refractometer base firmly with the right hand and with the left hand, rotate the telescope and sector until the telescope is horizontal and pointing away from the operator.

Open the prisms by loosening the prism clamp and swing the hinged Lower Abbe Prism out until its surface is horizontal. The surface of this prism is finely ground, while the surface of the fixed Upper Abbe Prism is highly polished.

Place some distilled water on the polished surface of the fixed Upper Abbe Prism, using the glass rod and only enough distilled water to insure filling the spaces between the prisms when they are clamped together. Again, hold the base in the right hand and rotate the telescope and Scale Sector about the axis until the instrument is in position.

Unclamp the index arm and move to the other end of the scale. Focus the telescope Eyepiece sharply on the cross hairs and bring the divided field into view by moving the index arm. The field will have a colored border, which may be achromatized by use of the compensators rotated by the pinion.

The line will be sharpest when the edge is just turning blue. Then bring the line almost into coincidence by moving the index arm. Clamp this arm and obtain exact coincidence with the cross hairs by means of the slow motion screw.

Read the refractive index through the Magnifier. This is sharply focused on the cross line and also turned until the scale is well-illuminated. The index scale is divided so as to read to three decimals directly, while the fourth is estimated. The lines on the scale are of three different lengths. The line of intermediate length reads one unit in the second decimal place, the longest line reads five in the third decimal place, while the shortest line is one unit in the third decimal place. The index of distilled water will be about 1.3330, depending on the temperature of the liquid.

After reading the index, open the prisms and clean with the soft cloth.



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To use transmitted light through the Abbe, swing the prism box shutter into the upright position in order to close the rear ground glass window.

To use reflected light, swing the prism box shutter under the auxiliary prism so that the opening is closed.

V - Care of Prisms:

In order to obtain the best results with the refractometer, great care should be taken of the prisms since they are made of dense glass which tarnishes and scratches easily.

Immediately after use, clean both prisms with a cloth and remove traces of substances used with a suitable solvent. Either alcohol or xylol is suitable, but avoid solvents of the type of acetone since they attack the litharge—glycerine cement which holds the prism in place. This not only loosens the prism but renders the cemented surface porous and more apt to retain contaminating residues from previous measurements. This cement is the best obtainable for refractometers and has been selected because of its almost universal resistance to attack by chemicals. Compounds likely to attack the cement should be avoided, but damage can be minimized, if not entirely avoided, by thoroughly cleaning the prism to prevent such materials remaining in contact with the cement for any length of time. Wash the prism faces frequently and flush thoroughly with a suitable solvent at the end of the day and before putting the instrument in storage for any length of time. Follow these instructions closely, particularly in the food preserving laboratory where acetic acid solutions, such as vinegar and compounds of acetic acid, are involved.

Great care should be taken with the upper polished prism. When cleaning, rub it very carefully to prevent scratching. Liquids introduced for examination should be free from solid particles. Solid specimens should be cleaned carefully and the surface of specimen and prism should be free from dust before they are placed together. In removing a solid specimen from the surface of the prism, lift the specimen directly upward from the prism surface; do not allow the specimen to slide over it.

VI - Adjustment of the Instrument:

Each instrument is given a thorough inspection and is placed in proper adjustment before leaving the factory. In order, however, that the adjustment may be checked as the occasion demands, a test piece of special glass, whose refractive index is carefully measured and engraved upon it, is supplied.

Apply the test piece to the Upper Abbe Prism (Figure 1) as directed under Section VIII - Refractive Index—Solids. If the mean of several readings does not agree with the index engraved on the test piece, correct the instrument by setting the index arm so that it reads correctly and then bring the dividing line to the cross hairs by moving the objective of the telescope. This is accomplished by turning the small screw in the telescope tube close to the drum index. The screw driver provided with each instrument is for this purpose. The screw itself is at the bottom of a small opening on the lower portion of the telescope tube.

VII - Effect of Temperature:

As the index and dispersion of a substance vary with the temperature, it is important to know the temperature and to control it. This is particularly true in the case of liquids, where as a rule the temperature coefficients are large and negative. The temperature coefficients for a few liquids are as follows:

| | | |
|---|---|---|
| Water | - | 0.0001 |
| Benzine | - | 0.0006 |
| Linseed Oil | - | 0.0004 |
| Carbon Disulfide | - | 0.0008 |

Thus it is seen that in order to obtain an accuracy of one or two units in the fourth decimal place, it is necessary to know the temperature and control it to a fraction of a degree.

On the other hand in the case of solids, the temperature has very little effect and can generally be neglected. A few examples are as follows:

| | | |
|---|---|---|
| Light Crown Glass | - | 0.000,002 |
| Heavy Crown Glass | - | 0.000,014 |
| Light Flint Glass | - | 0.000,001 |
| Fluorite | - | 0.000,012 |

VIII - Refractive Index - Solids:

Solid specimens to be measured should have two polished surfaces at right angles to each other and intersecting in a sharp line. Where an accurate result is not required, it is possible to obtain a suitable image by simply breaking the specimen approximately at right angles to one polished surface.

Practice in the manipulation of the Abbe for solid specimens can be obtained by the use of the glass test piece provided with the instrument.



AB0000117986/6

The important part in measuring solid pieces is to see that the two surfaces which will come in contact are perfectly clean. A surface can be most readily examined for the presence of dirt if it is viewed along an axis almost parallel to itself and so held that a strong diffused illumination, as skylight, is reflected from the surface into the eye.

Handle the instrument in the same way as in the measurements of liquids except that the telescope is at the right when the prisms are opened. Place a drop of monobromonaphthalene on the polished surface of the test piece which is then placed on the polished surface of the prism. Firmly press the two together without sliding one on the other. The liquid forms a thin film between the prism and the test piece, holding the latter firmly in position. Care should be taken that as little liquid as is possible is used. A single small drop is quite sufficient.

Rotate the instrument into reading position as in the case of liquids except that the Scale Sector is on the right. Reflect light, from a window, from the lower prism case onto the polished end of the test piece. In order to reflect the light evenly, the settings can be made quite easily by placing a piece of white paper on the surface of the Lower Abbe Prism.

Monobromonaphthalene can be used for solids whose indices are lower than 1.64; methylene-di-iodide is used for indices higher than 1.64. The latter liquid should be kept corked as exposure to air causes it to crystallize and turn black.

Product Hazards

2-Ethylhexyl alcohol is an eye and skin irritant. It may be absorbed through the skin, and may cause an allergic skin reaction. Avoid contact with skin, eyes, and clothing. Wash thoroughly after use. In case of contact, wash affected area with large amounts of water and report to Medical. 2-Ethylhexyl alcohol is a combustible liquid. Keep away from heat, sparks, and flames. For more information, refer to MSDS No. 04210341.

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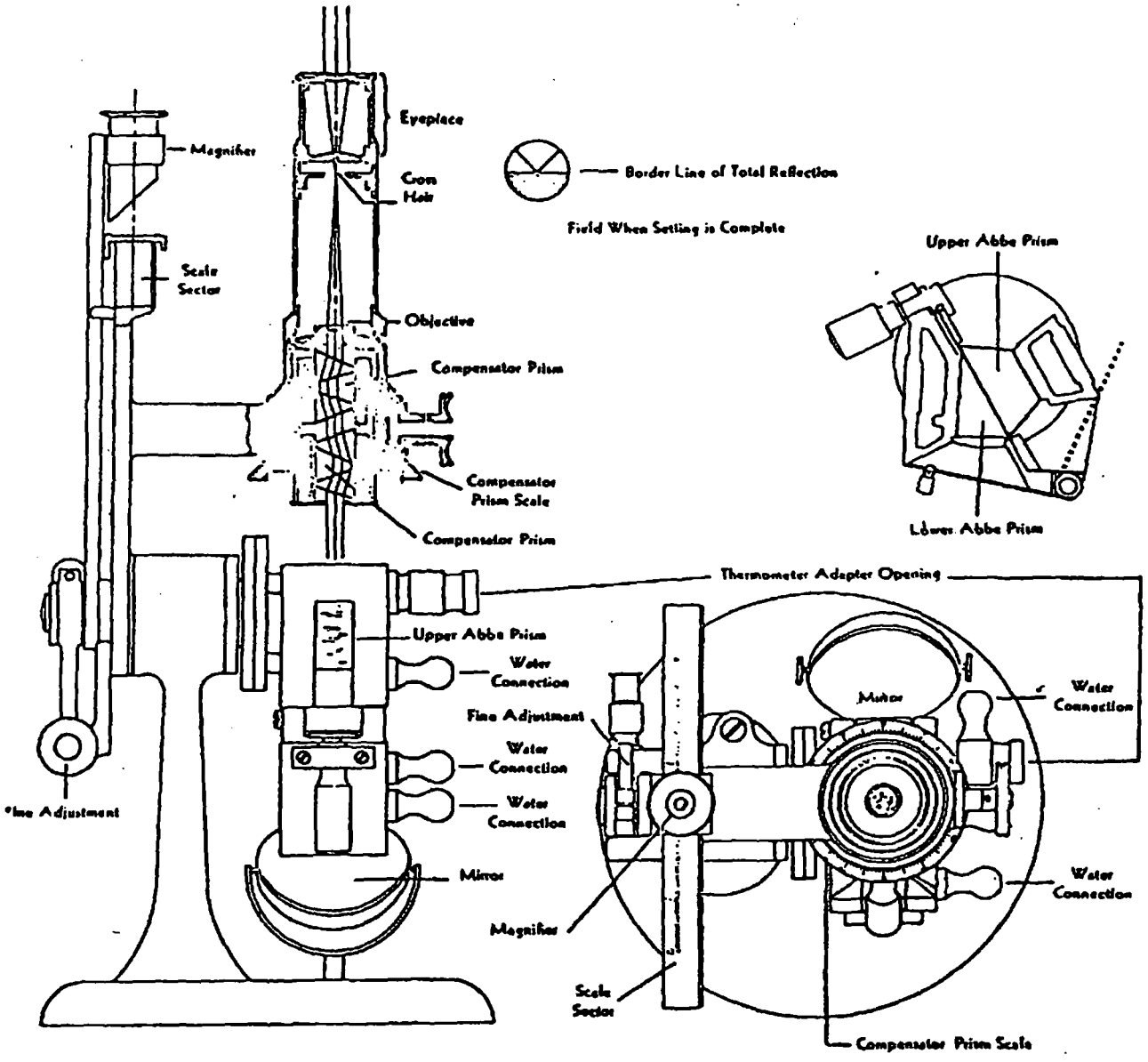
E-mmm




*Path of Light Rays through the Bausch & Lomb Abbe Refractometer*

Figure 1

DU PONT

# TEST METHOD

GENERAL PROCEDURE

SPECIFIC GRAVITY BY HYDROMETER

METHOD E5600.310.01.CWP

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DU PONT CHEMICALS

ANALYTICAL PROCEDURE

METHOD E5600.310.01.CWP

GENERAL PROCEDURE

# Specific Gravity by Hydrometer

## I-A. Principle

This method describes a procedure for determining the specific gravity of a liquid at a specified temperature by means of a glass hydrometer. Values are usually determined at 15.56/15.56°C, 20/20°C or 25/25°C.

## I-B. Scope

### 1. Application

This method which is simple and rapid is suitable for process control and specification testing.

### 2. Limitations

The hydrometer method gives a comparatively rough estimate of the specific gravity, the inherent error being about ± 1 in the third decimal place.

## I-C. Precision and Accuracy

Duplicate results by the same operator should agree within 0.002 specific gravity.

The average of two results reported by one laboratory should not differ from the average of two results by another laboratory by more than 0.004 specific gravity.

Four technicians analyzed the same sample of "Alkanol" 1009-C one technicians analyzed the same sample of "Alkanol" 1009-C one time each within a 12-hour period. Hydrometers were chosen at random from a supply containing several hydrometers of each range required in the laboratory. The values obtained had a precision of 1.050 ± 0.001 at 25/25°C.

## I-D. Apparatus

1. Hydrometers, of glass, conforming to Specifications for ASTM Hydrometers (ASTM Designation: E 100).

2. Thermometer of suitable range as prescribed in ASTM Specification E1 or in the J.L. Series of Thermometers.

3. Hydrometer cylinders, made of clear glass or plastic. For convenience in pouring, the cylinder may have a lip on the rim. The inside diameter of the cylinder shall be at least one inch greater than the outside diameter of the hydrometer used in it. The height of the cylinder shall be such that the length of the column of sample it contains is greater by at least one inch than the portion of the hydrometer which is immersed beneath the surface of the sample, after a state of equilibrium has been reached.

4. Water bath capable of maintaining a temperature, during the test, within $\pm$ 0.1°C. (Note 1)

## I-E. Reagents

No reagents are required.

## I-F. Notes

1. For this application a temperature range of 0.5°C is satisfactory. The $\pm$ 0.1°C range is specified since this is the standard range used in the laboratory for other applications.

## I-G. References

1. ASTM Method D-891

METHOD E5600.310.01.CWP

## GENERAL PROCEDURE

## Specific Gravity by Hydrometer

### II-A. Unusual Safety Considerations

Hazards will vary with the product being analyzed. Consult the hazard section of an analytical method which covers the product being tested.

2-Ethylhexyl alcohol is an eye and skin irritant. It may be absorbed through the skin, and may cause an allergic skin reaction. Avoid contact with skin, eyes, and clothing. Wash thoroughly after use. In case of contact, wash affected area with large amounts of water and report to Medical. 2-Ethylhexyl alcohol is a combustible liquid. Keep away from heat, sparks, and flames. For more information, refer to MSDS No. 04210341.

### II-B. Procedure

No special preparation of the sample is necessary except the adjustment of its temperature in a constant temperature bath, to within ± 0.1°C of the temperature specified for the test.

1. Adjust the temperature of the sample in the original container to within two degrees of the temperature specified for the test.

2. Pour the sample into the dry hydrometer cylinder without splashing, so as to avoid formation of air bubbles and to reduce to a minimum the evaporation of the lower boiling constituents of the more volatile samples. Remove any air bubbles formed, after they have collected on the surface of the sample, by touching them with a piece of clean filter paper.

3. Place the cylinder vertically in the water bath and stir the contents of the cylinder with the thermometer, being careful to avoid the formation of air bubbles.

4. When the temperature is about 0.3°C from the specified temperature, slowly and carefully lower the hydrometer into the sample to a level near which it is expected to float and then release the hydrometer. Keep the rest of the stem dry, as unnecessary liquid on the stem changes the effective weight of the hydrometer, and so affects the reading obtained.

5. Allow the hydrometer to come to rest, floating freely and not touching the walls of the cylinder.

II-B. Procedure (Cont'd.)

6. When the temperature of the sample comes within ± 0.1°C of the temperature specified for the test, remove the thermometer and read the gravity as follows:

   Place the eye slightly below the level of the liquid and slowly raise the eye until the surface of the sample first seen as a distorted ellipse seems to become a straight line cutting the hydrometer scale. Read and report the gravity to the nearest scale division.

   The temperature of the bath and the temperature shown on the thermometer in the sample should agree within 0.10°C.

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# TEST METHOD

GENERAL PROCEDURE

DETERMINATION OF ASTM COLOR

METHOD E6100.065.01.CVP

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PART I

E. I. DU PONT DE NEMOURS AND COMPANY

DU PONT CHEMICALS

GENERAL PROCEDURE

METHOD E6100.065.01.CWP

PETROLEUM PRODUCTS

# Determination of ASTM Color

## I-A. Principle

Liquid samples are visually matched to any one of sixteen ASTM color standards. A direct readout enables the operator to make a quick, accurate reading. No calculation is required.

## I-B. Scope

### 1. Application

This is a specification method applicable to liquid petroleum products, including Fuel Oil Additives (FOA).

### 2. Limitations

The product must be of such color density that it may easily be compared to the ASTM standards ranging from 0.5 to 8.0. If the color observed is darker than a rating of 8.0, a dilution technique will be necessary.

## I-C. Precision and Accuracy

No formal study at this laboratory has been made. ASTM D 1500-IP 196, paragraph 7, states: "The results obtained by different operators in the same laboratory should not vary by more than 0.5 number, and the same variation should apply for determinations between different laboratories at the 95 percent Confidence Level".

## I-D. Special Apparatus (Equivalent apparatus may be substituted)

1. Petroleum Colorimeter, ASTM D 1500, Fisher Scientific Company, Cat #13-449.

2. Test jars, 2, Fisher Scientific Cat. # 13-450A

3. Mazda #A-19, lamp, 60 watt

## I-E. Reagents

1. Kerosine having a color lighter than +21 Saybolt Color by ASTM Method D 156 . This material is used only for diluting dark samples.

## I-F. Notes

1. This method is an adaptation of ASTM Method D 1500-IP 196.

## I-G. References

ASTM D 1500-IP 196 adopted 1966.

PART II

METHOD E6100.065.01.CWP

PETROLEUM PRODUCTS

Determination of ASTM Color

## II-A. Unusual Safety Considerations

### 1. Product Hazards

This is a general procedure and product hazards must be determined on an individual basis.
For 2-Ethylhexyl Nitrate refer to MSDS 1796PC.

### 2. Procedure Hazards

Kerosine is flammable. Keep away from flames and other ignition sources. Kerosine is also irritating to the eyes and skin.

## II-B. Procedure

1. Place a test jar, half-filled with distilled water, in the right hand compartment of the colorimeter.

2. Place the sample jar, half-filled with the sample to be analyzed, in the left compartment and close the lid.

3. Switch on the light source and compare the color of the sample with that of the standard glasses by rotating the large dial on the front of the colorimeter.

   The itensity of the light source may be increased or decreased by moving the source light, using the knurled, sliding knob under the main chassis.

4. If an exact match is not possible, then use that standard glass reference which possesses the next darker color.

5. Read the ASTM number directly from the small port below the large dial.

6. Report the ASTM number as follows:

   a. Exact match; report the ASTM number
      Example: 7.5 ASTM Color
   b. If sample color appears to be between two glasses, record the designation of the darker glass preceded by the letter "L".
      Example: L 7.5 ASTM Color
   C. If the color is darker than 8.0, report as: Example: D8 ASTM Color.

7. If a dilution is requested, dilute 15 volumes of sample with 85 volumes of solvent kerosine, and read as above but indicate dilution. Example: L 7.5 Dil ASTM Color.

8. If sample is cloudy as received, heat to 6°C above its cloud point and analyze as above.

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# TEST METHOD

2-ETHYLHEXYL NITRATE (2-EHN)

ANALYSIS BY GAS CHROMATOGRAPHY

METHOD E6100.165.01.CWP

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E. I. DU PONT DE NEMOURS & COMPANY

DU PONT CHEMICALS

ANALYTICAL PROCEDURE

*METHOD E6100.165.01.CWP*

# 2-ETHYLHEXYL NITRATE (2-EHN)

## Analysis by Gas Chromatography

## I-A Principle

This method is based on the gas chromatographic separation achieved on a column packed with 5% Carbowax 20M on Chromosorb W-HP. The separated components are detected by a flame ionization detector. Results are reported as area %.

## I-B. Scope

### 1. Application

This method is applicable to the product analysis and process control of 2-ethylhexyl nitrate (2-EHN). The method determines residual 2-ethylhexyl alcohol (2-EHA) in the product at the 0-2% level. The following retention times were obtained from a spiked sample of 2-ethylhexyl nitrate:

| Component | Retention Time (Min.) |
|---|---|
| Methylene chloride | 0.40 |
| Oxidation product | 5.30 |
| 2-Ethylhexyl nitrate | 9.48 |
| 2-Ethylhexyl alcohol | 11.64 |

### 2. Limitations

This method suffers from the usual limitations associated with an area percent quantitative method. It assumes:

1) All components are detected and respond equally.

2) The mixture is completely separated into all its components.

3) The detector responds linearly at all quantity levels and retains consistent sensitivity.

4) Any overlapping peaks are quantitated in a consistent and accurate manner.

5) That the column and detector are not overloaded by the injected amount.

These assumptions were found to be valid for the samples studied during method development.

## I-C. Precision and Accuracy

### 1. Development Precision

Charge 72 (Acidic 2 EHN) and Lot 107 (DDA-1000) were analyzed by one technician, four determinations on each sample.

Results are shown below:

| Component | Avg. Concentration, % | | Standard Deviation | | 95% C.L. for Single Det. | |
|---|---|---|---|---|---|---|
| | Chg. 72 | Lot 107 | Chg. 72 | Lot 107 | Chg. 72 | Lot 107 |
| Oxidation Product | 0.23 | 0.32 | ± 0.02 | ± 0.02 | ± 0.08 | ± 0.07 |
| 2-Ethylhexyl nitrate | 99.22 | 99.26 | ± 0.03 | ± 0.04 | ± 0.11 | ± 0.12 |
| 2-Ethylhexyl alcohol | 0.44 | 0.31 | ± 0.02 | ± 0.01 | ± 0.05 | ± 0.03 |

### 2. Routine Precision

Charge 72 (Acidic 2 EHN) and Lot 107 (DDA-1000) were analyzed across the shifts (5 technicians; 10 determinations on each sample) in the Quality Control Laboratory. Results are shown as follows:

| Component | Avg. Concentration, % | | Standard Dev. | | 95% C.L. for Single Det. | |
|---|---|---|---|---|---|---|
| | Chg. 72 | Lot 107 | Chg. 72 | Lot 107 | Chg. 72 | Lot 107 |
| Oxidation Product | 0.21 | 0.30 | ± 0.02 | ± 0.01 | ± 0.04 | ± 0.02 |
| 2-Ethylhexyl nitrate | 99.23 | 99.27 | ± 0.04 | ± 0.02 | ± 0.08 | ± 0.04 |
| 2-Ethylhexyl alcohol | 0.46 | 0.31 | ± 0.01 | ± 0.01 | ± 0.02 | ± 0.02 |

### 3. Accuracy

No formal accuracy study was conducted.

I-D. Special Apparatus (Equivalent apparatus may be substituted)

1. Gas chromatograph, Hewlett-Packard Model 5880A, equipped with a flame ionization detector.
2. Syringe, Hamilton, 10-µL capacity.
3. Gas chromatographic column, glass, 6 ft. x 1/4 inch o.d., available from Jackson Laboratory storeroom.
4. Reaction vial, 10-mL, available from Jackson Laboratory storeroom.
5. Septa, "Teflon"/rubber, available from Jackson Laboratory storeroom.
6. Standard seals, available from Jackson Laboratory storeroom.
7. Graduated cylinder, 50-mL, available from Jackson Laboratory storeroom.
8. Pipet, 10-mL and 1-mL, available from Jackson Laboratory storeroom.
9. Separatory funnel, 60-mL capacity, available from Jackson Laboratory storeroom.

I-E. Reagents

1. Column packing, 5% Carbowax 20M on Chromosorb W-HP, 80/100 mesh, available from American Scientific Products, McGraw Park, IL.
2. Methylene chloride, Fisher, ACS reagent grade.
3. Sodium hydroxide, 1% solution.
4. Helium, Liquid Carbonic Corporation, L-114.
5. Hydrogen, Union Carbide Corporation, Extra Dry.
6. Air, breathing, Liquid Carbonic Corporation, Specification L-117.

I-F. Notes

1. The injection port temperature is of primary importance in this analysis. The product is thermally labile, yielding additional 2-ethylhexyl alcohol and other peaks at high injection port temperatures.

2. Retention times will have to be reestablished from time to time. Prepare standards at the expected composition levels and chromatograph according to this method.

# 2-ETHYLHEXYL NITRATE (2-EHN)
# Analysis by Gas Chromatography

## II-A. Unusual Safety Considerations

### 1. Product Hazards

The product is slightly irritating to the skin and inhalation of vapors can cause cyanosis, headaches, nausea, dizziness, and decreased blood pressure. Work in a hood when handling this material. In case of eye contact flush eyes with copious amounts of water and report to the Medical Division. In case of skin contact wash exposed area with soap and water and report to Medical Division. For more information see MSDS 1796PC.

### 2. Procedure Hazards

Methylene chloride is narcotic. Avoid breathing its vapors. Sodium hydroxide is corrosive. Avoid skin contact. Handle the syringe with care to avoid skin puncture.

## II-B. Procedure

### 1. Instrument Settings

| Instrument |
|---|
| Mfg. Hewlett-Packard |
| Model 5880A |
| **Detector** |
| Thermal Cond. ( ) |
| Flame Ioniz. (X)<br>Hyd. 40 psig<br>Air 40 psig |
| Electron capture ( ) |
| Other |
| **Carrier gas** |
| He (X) N ( ) Other ( ) |
| Flow**** 20 mL/min. |

| Column |
|---|
| Mat'l of Const. Glass |
| Length* 6-ft. Diam.** 1/4" o.d. |
| Packing Substrate 5% carbowax 20M |
| Packing*** Support Chromasorb W-HP |
| Column Temp.°C 85 Inject Temp.°C 200 |
| Detec. Temp.°C 300 Max. Safe Oven Temp.°C 225 |
| Programming None |
| Initial Col. Temp.,°C |
| Temp. Rise/min.,°C |
| Temp. Limit,°C |
| Pre-program Hold, min. |

*Specify units (in., ft., meters, etc.)
**Specify o.d. or i.d. and units
***Specify mesh size
****Specify as mL/min or psig

| Component | Retention Time (Min.) | Range Investigated |
|---|---|---|
| Methylene chloride (Solvent) | - | - |
| Oxidation Product | 5.30 | 3-10% |
| 2-Ethylhexyl Nitrate (2-EHN) | 9.48 | 98-100% |
| 2-Ethylhexyl Alcohol (2-EHA) | 11.64 | 0-2% |

3. Sample Preparation

a. Add 40 mL (graduate cylinder) of 1% sodium hydroxide solution to a separatory funnel.

b. Add 10 mL (graduate cylinder) of sample into the separatory funnel.

c. Stopper the funnel and thoroughly shake

Use caution when venting the separatory funnel.

d. Discard the bottom layer.

4. Sample Analysis

a. Pipet 1 mL of the sample into a serum vial.

b. Add to the vial 10 mL (graduate cylinder) of methylene chloride.

c. Seal and shake.

d. Inject 4 µL of sample solution.

e. Scan for a minimum of 15 minutes.

Calculations

$$\frac{A_i}{\Sigma A} \times 100 = \text{area \% of component i}$$

Where: $A_i$ = area of component i

$\Sigma A$ = Sum of all component areas

Report results to the nearest 0.01%.

5. Quality Control

a. Obtain from the manufacturing area a well-mixed sample, approximately 8 ounces, of a representative production lot of 2-ethylhexyl nitrate for use as a Quality Control Standard.

Store in a properly labeled brown bottle and protect from sunlight.

b. Once each day, analyze a subsample of the Quality Control Standard by this method and record results on a "Shewhart" Control Chart and/or enter results into a CUSUM loop.

Specific instructions, including control limits, will be supplied by laboratory supervision.

c. If results from analysis of the Standard fall outside limits established according to current laboratory guidelines, investigate the cause of the deficiency and report promptly to Supervision.

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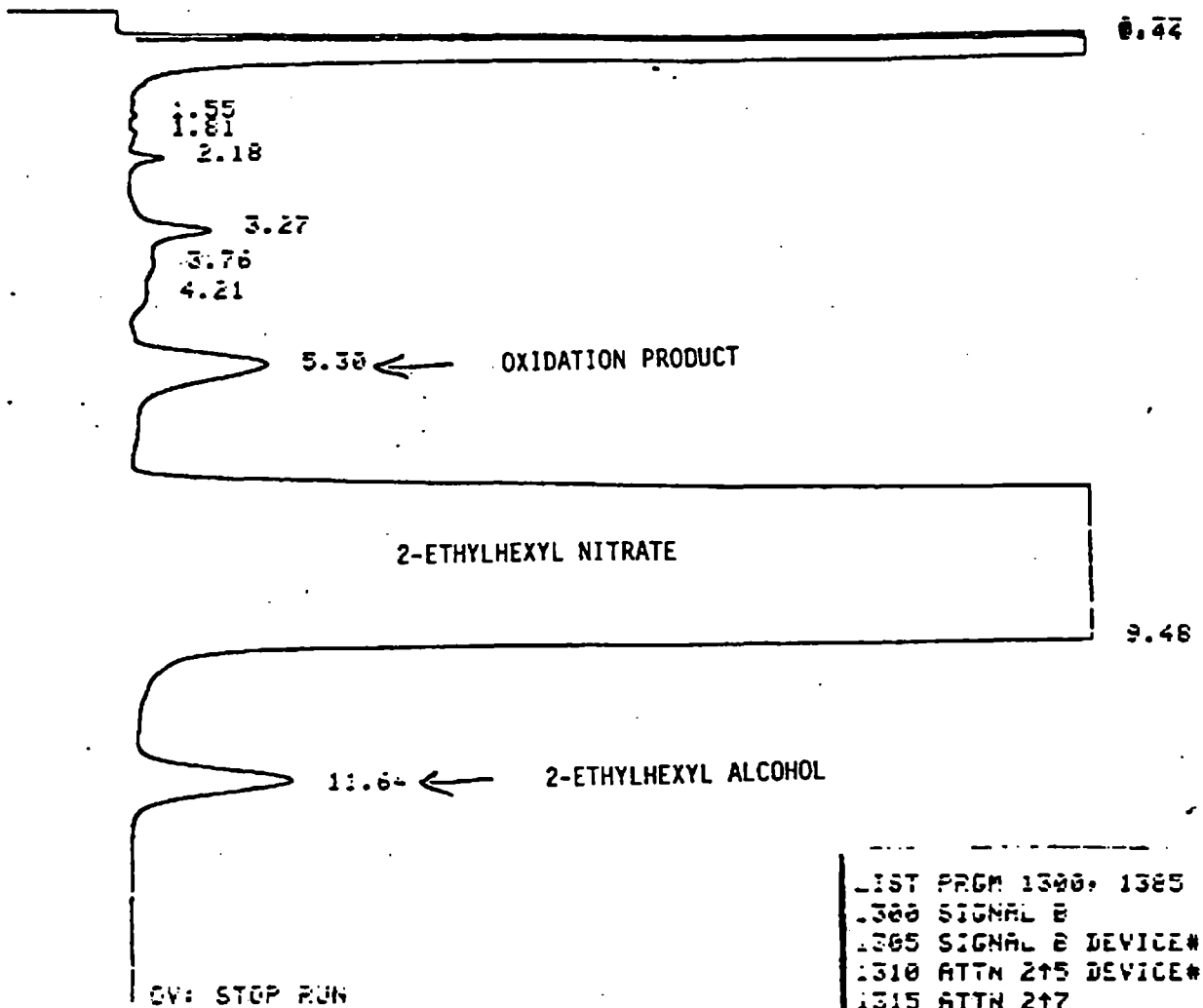
OVEN TEMP NOT READY

READY FOR INJECTION

Method E6100.165.01.CWP Part II




[HP] 5880A MANUAL INJECTION @ 13:47 DEC 13, 1983

```
LIST PRGM 1300, 1385
1300 SIGNAL 8
1305 SIGNAL 8 DEVICE# 5
1310 ATTN 215 DEVICE# 5
1315 ATTN 217
1320 INJ 1 TEMP 200
1325 DET 1 TEMP 300
1330 %OFFSET 10
1335 CHART SPEED 1
1340 DELETE OVEN TEMP
1345 OVEN TEMP 65
1350 OVEN TEMP EQUIB TIME 3
1355 OVEN TEMP INITIAL TIME 1
1360 OVEN TEMP POST VALUE 200
1365 OVEN TEMP POST TIME 5
1370 START
1375 PAGE
1380 START PRGM 1300
```

DU PONT

# TEST METHOD

GENERAL PROCEDURE

TOTAL ACID OR TOTAL BASE NUMBER
DETERMINATION BY NONAQUEOUS POTENTIOMETRIC TITRATION

METHOD E6100.280.01.CWP

CONFIDENTIAL

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PART I

E. I. DUPONT DE NEMOURS AND COMPANY

DU PONT CHEMICALS

GENERAL PROCEDURE

METHOD E6100.280.01.CWP

# TOTAL ACID or TOTAL BASE NUMBER
(Neutralization Number)

## Determination by Nonaqueous Potentiometric Titration

### I-A. Principle

This procedure is based on the potentiometric titration of all acidic or basic constituents with potassium hydroxide or perchloric acid, respectively.

### I-B. Scope

#### 1. Application

This method, which is an adaptation of ASTM Method D664, is applicable to a wide variety of products that require the determination of total acid and base numbers. The total acid number is the quantity of base, expressed in milligrams of potassium hydroxide, that is required to neutralize all acidic constituents present in 1 gram of sample. The total base number is the quantity of acid, expressed in terms of the equivalent number of milligrams of potassium hydroxide, that is required to neutralize all basic constituents present in 1 gram of sample.

#### 2. Limitations

The method is limited to petroleum and other products which require a nonaqueous titration medium.

### I-C. Precision and Accuracy

Precision and accuracy studies have not been conducted. It is quoted in ASTM Method D664 that results should not differ from the mean by more than the following amounts:

| Total Acid or Base Number | Reproducibility |
|---|---|
| 0.05 to 1.0 | 0.04 |
| 20 to 100 | 4 |
| 100 to 250 | 10 |



AB0000118013/2

I-D. Special Apparatus (Equivalent apparatus may be substituted)

1. Automatic titrator, Metrohm, Model E-436, Brinkman, Inc.

2. Titrator stand equipped with 20-ml buret, Metrohm, Model E-436D, Brinkamn, Inc.

3. Indicating Glass Electrode, Beckman, Model 39301.

4. Reference Calomel Electrode, saturated aqueous KCl (fiber plug), Fisher, Model 13-639-52 or (dual glass junction), Leeds and Northrup Co., Model 117208.

I-E. Reagents (Reagent Grade except as noted)

1. Titration solvent

   Add 500 ml of toluene and 5 ml of water to 495 ml of anhydrous isopropyl alcohol.

2. 0.1 N Alcoholic Potassium Hydroxide

   Add 6 grams of KOH to 1 liter of anhydrous isopropyl alcohol or anhydrous denatured ethyl alcohol (2T alcohol). Boil gently for 10 minutes to effect solution. Allow the solution to stand for 2 days and then filter through a fine sintered-glass funnel. Protect the solution from atmospheric $CO_2$ by means of a guard tube containing soda lime and from coming in contact with cork, rubber or stopcock grease.

3. 0.1 N Perchloric Acid in Glacial Acetic Acid

   Pipet 12 ml of 60% perchloric acid into a 1-liter volumetric flask containing approximately 800 ml of glacial acetic acid. Mix well and then slowly add 40 ml of acetic anhydride. Again, mix, cool to ambient temperature and dilute to volume with glacial acetic acid.

4. 0.1N Perchloric Acid in Acetonitrile

   Pipet 12 ml of 60% perchloric acid into a 1-liter volumetric flask containing approximately 800 ml of acetonitrile. Mix well and dilute to volume with acetonitrile.

5. Potassium hydrogen phthalate, Certified ACS, acidimetric standard, Fisher Scientific Co.

I-F. Notes

Tables I & II are attached, indicating the products currently analyzed by this method.

## I-G. References

1. ASTM Method D 664

## I-H. Appendix

### 1. Standardization of 0.1N Alcoholic Potassium Hydroxide

1. Weigh 0.25-0.30g (to the nearest 0.0001g) of primary standard potassium hydrogen phthalate (previously dried at 110°C for 1 hour) into three 150 ml beakers.
2. Add 75 ml of distilled water and dissolve by stirring.
3. Titrate potentiometrically with 0.1N alcoholic potassium hydroxide solution using the Metrohm titrator and glass/calomel electrodes.
4. Titrate a blank of just 75 ml distilled water.
5. Calculate the normality of the titrant from the potential break obtained on the recorder trace.

Calculations:

$$\frac{W}{(V_S - V_B) \times 0.20422} = \text{Normality}$$

Where: $W$ = grams of potassium hydrogen phthlate
$V_S$ = volume in milliliters of potassium hydroxide solution required to titrate the standard
$V_B$ = volume, in milliliters, of potassium hydroxide solution required to titrate the blank

$$0.20422 = \frac{\text{molecular weight of potassium hydrogen phthalate}}{1000}$$

The three results should agree within 0.0005. If not, prepare new standards and rerun the titrations. Obtain the normality by averaging the three results.

### 2. Standardization of 0.1N Perchloric Acid

1. Weigh 0.25-0.30g (to the nearest 0.0001g) of primary standard potassium hydrogen phthalate (previously dried at 110°C for 1 hour) into three 150-ml beakers.
2. Add 75 ml of glacial acetic acid and dissolve by stirring.
3. Titrate potentiometrically with 0.1N perchloric acid solution using the Metrohm titrator and glass/calomel electrodes.

4. Titrate a blank of just 75 ml glacial acetic acid.

5. Calculate the normality of the titrant from the potential break obtained on the recorder trace.

Calculations:

$$\frac{W}{(V_S - V_B) \times 0.20422} = \text{Normality}$$

Where: $W$ = grams of potassium hydrogen phthlate
$V_S$ = volume in milliliters of perchloric acid solution required to titrate the standard
$V_B$ = volume, in milliliters, of perchloric acid solution required to titrate the blank.

$$0.20422 = \frac{\text{molecular weight of potassium hydrogen phthalate}}{1000}$$

The three results should agree within 0.0005. If not, prepare new standards and rerun the titrations. Obtain the normality by averaging the three results.

PART II

Method E6100.280.01.CWP

TOTAL ACID or TOTAL BASE NUMBER
(Neutralization Number)

Determination by Nonaqueous Potentiometric Titration

## II-A. Unusual Safety Considerations

### 1. Product Hazards

Many of the compounds are of unknown toxicity. Appropriate precautions should be observed to avoid skin contact. Wash exposed areas with copious amounts of water. For more information see MSDS #1796PC.

### 2. Procedure Hazards

The solvents employed are toxic, irritating to the skin and eyes and flammable. Avoid skin contact, do not breathe vapors and work in a well ventilated area. If skin contact occurs, wash exposed areas with copious amounts of water.

Perchloric acid (60%) readily oxidizes organic materials, can cause violent explosions and is extremely corrosive. The reagent must be clearly labeled, stored by itself in a lead tray and kept in a cool place. All measuring devices must be washed thoroughly with water. In case of skin contact, wash exposed areas with copious amounts of water and report to Medical.

## II-B. Procedure

1. Use the attached Table I or II to select the proper sample size and in the case of base number the proper titrant.

2. Weigh the sample to the nearest 0.1 mg into a 250-ml beaker.

3. Add 125 ml of titration solvent

   Prepare Titration Solvent as follows: Add 500 ml of toluene and 5 ml of distilled water to 495 ml of anhydrous isopropyl alcohol.

4. Mix well using a magnetic stirring bar.

5.(a) To determine acid number titrate potentiometrically with N/10 alcoholic potassium hydroxide using the Metrohm Titrator and glass/calomel electrodes.

   (b) To determine base number titrate potentiometrically with N/10 perchloric acid in the proper solvent (Table II) using the Metrohm Titrator and glass/calomel electrodes.

6. Titrate, similarly, 125 ml of titration solvent (blank).

7. Calculate the total acid number or total base number from the potential break obtained on the recorder trace.

Calculations

$$\frac{(V_S - V_B) \times N \times 56.1}{W} = \text{Total Acid Number } \underline{\text{or}} \text{ Total Base Number (mg KOH/g)}$$

Where: $V_S$ = volume in milliliters of 0.1N KOH or 0.1N perchloric Acid for sample

$V_B$ = Volume in milliliters of 0.1N KOH or 0.1N perchloric acid for blank

N = normality of KOH or perchloric acid

W = weight of sample in grams

$$56.1 = \frac{\text{molecular weight of KOH} \times 1000}{1000}$$

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AB0000118013/7

Method E6100.280.01.CWP Part II

TABLE I

TOTAL ACID NUMBER

| Product | Sample Size, g | Expected Range, mg KOH/g |
|---|---|---|
| Antioxidant PL-1278 | 30 | 0.51-0.57 |
| DCI 4A/DCI 4AW | 0.5 | 97-117 |
| DCI 6 (PL 1178) | 0.5 | 130-160 |
| DCI 6A | 0.5 | 110-140 |
| DCI 86 | 0.5 | 115-170 |
| DMA-50/DMA-50RS | 2 | <30 |
| DMA-52 | 2 | <30 |
| DMA-53 | 2 | <30 |
| DMA-54 | 2 | <30 |
| DMA-55 | 2 | <30 |
| DMA-56 | 2 | <30 |
| DMA-58 | 2 | 34-42 |
| DMA-60 | 2 | <30 |
| DMA-60 HF | 2 | <30 |
| DMA-61 | 2 | <30 |
| DMA-62 | 2 | 36-44 |
| DMA-64 | 2 | <30 |
| DMA-1408 | 2 | <30 |
| DuPont Aviation Fuel Additive | 0.5 | 121-155 |
| FOA #401 | 2 | 42-52 |
| FOA #402 | 2 | 44-54 |
| FOA #403 | 2 | 20-50 |
| FOA #404 | 2 | 52-72 |
| FOA #405 | 2 | 38-58 |
| FOA #407 | 10 | 4.2-7.9 |
| FOA #408 | 0.5 | 83-117 |
| FOA #409 | 2 | 64-80 |
| PL-1126A | 1 | 65-75 |
| PL-1279 | 1 | 57-77 |

TABLE II

TOTAL BASE NUMBER

| Product | Sample Size, g | Expected Range, mg KOH/g | Solvent in 0.1N Perchloric Acid |
|---|---|---|---|
| Antioxidant PL-1278 | 2 | 20-22 | Acetonitrile |
| Butylamines 707 (Mixed 80/20) | 0.2 | 365-435 | Glacial Acetic Acid |
| FOA #23 | 0.5 | 124-164 | Glacial Acetic Acid |
| FOA #310 | 0.2 | 225-275 | Acetonitrile |
| FOA #401 | 1 | 53-65 | Acetonitrile |
| FOA #403 | 0.2 | 170-210 | Acetonitrile |
| FOA #405 | 0.2 | 235-265 | Acetonitrile |
| FOA #407 | 0.2 | 270-300 | Glacial Acetic Acid |
| FOA #408 | 0.5 | 95-115 | Glacial Acetic Acid |
| FOA #1228 | 0.2 | 295-335 | Glacial Acetic Acid |
| PL-1126A | 1 | 40-50 | Glacial Acetic Acid |
| PL-1279 | 0.5 | 160-190 | Acetonitrile |

DU PONT

# TEST METHOD

MIXED ACID

DETERMINATION OF TOTAL SULFURIC ACID AND NITRIC ACID

METHOD N8900.005.01.CWP

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PART I

E. I. DU PONT DE NEMOURS AND COMPANY

DU PONT CHEMICALS

ANALYTICAL PROCEDURE

METHOD N8900.005.01.CWP

# MIXED ACID

## Determination of Total Sulfuric Acid and Nitric Acid

### I-A. Principle

Total acidity (as sulfuric acid) is determined by neutralization with sodium hydroxide solution. Total sulfuric acid is determined by evaporation (to remove nitric acid) followed by neutralization with sodium hydroxide solution. Nitric acid is determined by difference.

### I-B. Scope

#### 1. Application

This procedure is applicable to the determination of total sulfuric acid in the range of 40 to 99% and nitric acid in the range of 25 to 45%. Outside these ranges, the method is applicable provided that the sample size is increased or decreased proportionally.

#### 2. Limitations

If nitrosylsulfuric acid is present, the results would not represent the actual content of $H_2SO_4$ and $HNO_3$. In this case, the reported results will be on the high side.

### I-C. Precision and Accuracy

A plant sample of mixed acid, averaging 50.18% $H_2SO_4$ and 32.16% $HNO_3$, was analyzed across the four shifts in duplicate determinations for a total of eight analyses. The 95% confidence limit was found to be $\pm$ 0.52% for $H_2SO_4$ and $\pm$ 0.43% for $HNO_3$.

### I-D. Special Apparatus

1. Steam bath.

2. Evaporating dish, porcelain or glass, flat-bottom, 6 inch.



AB0000118022/2

## I-E. Reagents

1. Sodium hydroxide, 0.3N standard solution.

   Prepare and standardize according to Methods 1-5-1 or 1-5-2.

2. Methyl red indicator solution.

   Dissolve 0.2 g of indicator in 600 ml of 2T alcohol and dilute to 1 liter with distilled water.

PART II

METHOD N8900.005.01.CWP

# MIXED ACID

## Determination of Total Sulfuric Acid and Nitric Acid

### II-A. Unusual Safety Considerations

#### 1. Product Hazards

The acids are very corrosive liquids. Avoid skin contact. Wash any affected area with copious amounts of water. In case of skin burns, report to Medical. For more information refer to refer to MSDS 04213647 for Mixed Acid SP-15.

#### 2. Procedure Hazards

Same as for product hazards above.

### II-B. Procedure

SHAKE SAMPLE WELL PRIOR TO TRANSFERRING TO THE VIAL. RUN DUPLICATE DETERMINATIONS.

1. Transfer some of the sample to a vial and close it with a plastic cap fitted with a medicine dropper.

2. Tare weigh the vial with the medicine dropper and sample to the nearest 0.0001 g.

3. Transfer 0.5 to 0.6 g of sample, using the medicine dropper, to a 500-ml Erlenmeyer flask that contains approximately 150 ml of distilled water and 3-5 drops of methyl red indicator.

4. Replace the medicine dropper in the vial and reweigh to the nearest 0.0001 g.

5. Obtain the weight of sample by difference.

6. Titrate with 0.3N sodium hydroxide standard solution to a yellow end point.

7. Apply a temperature correction to the buret readings.

8. Calculate the total acidity as follows:

$$\frac{V \times N \times 4.904}{W} = \% \text{ Total acidity (as sulfuric acid)}$$



AB0000118022/4

where V = volume in ml of 0.3N NaOH titer, after temperature correction.
N = normality of NaOH solution
W = weight of sample in grams

$$4.904 = \frac{(M.W.\ H_2SO_4) \times 100}{2 \times 1000}$$

9. Follow Steps 1 through 5 above, with the exception of Step 3 which becomes Step 10 below.

10. Transfer 0.5 to 0.6 grams of sample, using the medicine dropper, to a 6" flat-bottomed glass or porcelain dish that contains 10-20 ml of distilled water.

11. Place the dish on a steam bath and with the aid of a current of nitrogen, evaporate for at least 30 minutes but not more than 1 hour.

12. Add to the dish 100 to 150 ml of distilled water, 3-5 drops of methyl red indicator and titrate with 0.3N NaOH solution to a yellow end point.

13. Apply a temperature correction to the buret readings.

14. Calculate results as follows:

a. $\frac{V_1 \times N \times 4.904}{W_1}$ = Total sulfuric acid

b. (% Total acidity - % Total sulfuric acid) x 1.285 = % total nitric acid

where $V_1$ = ml of 0.3N NaOH titer after temperature correction
N = normality of NaOH solution
$W_1$ = weight of sample in grams

$$4.904 = \frac{(M.W.\ H_2SO_4) \times 100}{2 \times 1000}$$

$$1.285 = \frac{(M.W.\ HNO_3) \times 2}{M.W.\ H_2SO_4}$$

15 Report results to the nearest 0.1%.

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DU PONT

# TEST METHOD

## NITRATOR SPENT ACIDS AND MIXED ACIDS

## DETERMINATION OF NITROUS ACID AND/OR % NITRIC ACID IN SPENT NITRATOR ACID OR MIXED ACID

## METHOD N8900.220.01.CWP

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PART I

E. I. DU PONT DE NEMOURS & COMPANY

DU PONT CHEMICALS

ANALYTICAL PROCEDURE

METHOD N8900.220.01.CWP

# NITRATOR SPENT ACIDS AND MIXED ACIDS

## Determination of Nitrous Acid and/or % Nitric Acid in Spent Nitrator Acid or Mixed Acid by High Pressure Liquid Chromatography (HPLC)

### I-A. Principle

Nitric acid is converted to sodium nitrate and nitrous acid to sodium nitrite via hydrolysis with 0.5 M NaOH solution. (See Note 1 of Section I-F).

Nitrate and nitrite ions are separated from spent nitrator acid or mixed acid by reverse-phase/ion exchange high pressure liquid chromatography and detected at 205 nm wavelength. Results are calculated and reported as weight % $HNO_3$ and/or weight % $HNO_2$. With spent acids weight % $HNOSO_4$ is often requested in place of weight % $HNO_2$.

### I-B. Scope

#### 1. Application

This procedure was designed to determine the amount of nitrate and nitrite in spent nitrator acid where typical levels are 250-30,000 ppm nitrate and 250-20,000 ppm nitrite. The detection limit for both anions is 0.2 ppm. Impurities such as iron, lead, chloride, sulfate, copper and nickel do not interfere in the determination of nitrate or nitrite using this method. The method can also be used to determine the amount of nitrous acid in mixed acids used in the nitrators where typical levels are generally less than 1400 ppm.

#### 2. Limitations

Samples must be diluted so that $NO_3$- and $NO_2$- are both less than 200 ppm.



AB0000118027/2

Interference with the $NO_2$- peak could result from the presence of bromide, bromate, acetate, permanganate or cyanate ions. Interference with the $NO_3$- peak could result from the presence of persulfate ion.

$NO_3$- and $NO_2$- must be greater than 100 ppm in the original sample to detect them at the 0.2 ppm level after the required dilution.

## I-C. Precision and Accuracy

### 1. Development Precision

After multiple dilutions, a sample of spent acid originally containing 2.81% $NO_2$- and 0.11% $NO_3$- was analyzed nine times. The relative standard deviation was 0.46% for $NO_2$- and 6.1% for $NO_3$-. (See Note 2 of Section I-F).

### 2. Routine Precision

Samples of mixed acid and spent acid were analyzed across the shifts in the Quality Control Laboratory. The results are shown below:

| Sample | Number of Technicians | Number of Analyses | Average, % | 95% C. L. (Single Det.) |
|---|---|---|---|---|
| Mixed Acid | 5 | 10 | 0.11% $HNO_2$ | ± 0.02 |
| Spent Acid | 5 | 10 | 1.16 $HNO_2$/1.73% $HNO_3$ | ± 0.11/± 0.38 |

### 3. Accuracy

Spiking experiments were conducted on spent acid samples containing 20.3 ppm $NO_2$- and 10.5 ppm $NO_3$- using spikes of 76.3 ppm $NO_2$- and 35.0 ppm $NO_3$-. The results indicated a recovery of 99+%.

## I-D. Special Apparatus (Equivalent apparatus may be substituted)

1. Constametric HPLC pump Model II G.
2. Variable wavelength UV detector, Schoeffel Model SF-770, set at 205 nm.
3. Liquid chromatographic column, Whatman Co., Partisil ODS-3 (25 cm). Catalog No. 4228-104.
4. Sampling valve, 7,000 psi with a 20-µL sample loop. The valve is available from Dupont Instrument Products Catalog #834084-901.
5. 0.45-µm Millipore filter, Millipore Catalog #HAWP 04700.

I-D Special Apparatus (Cont'd)

6. Millipore 47 mm filter holder, Catalog #XX1004704, XX1004702, XX1004703.

7. Hewlett-Packard 3354 computer for determining the peak areas at specified retention times.

8. Autosampler - Micromeritics Model 725.

9. Guard column - Whatman Co.: Pell ODS kit # 4390-403, 7 cm x 2.1 mm x 1/4".

10. Acrodisc filters, Fisher Scientific Catalog #09-730-218.

I-E. Reagents

1. Octylamine, practical Eastman Kodak, P7588.

2. Phosphoric Acid, 85% Fisher Sci., A-242.

3. Water, deionized Millipore, Milli Q.

4. Sodium nitrite, $NaNO_2$ Certified ACS, Fisher Sci., S-347.

5. Sodium nitrate, $NaNO_3$ Certified ACS, Fisher Sci., S-343.

6. Sodium hydroxide, NaOH Certified ACS, Fisher Sci., S-318.

7. Methanol, HPLC Grade, Fisher Sci., A-452.

I-F. Notes

1. $HNO_3 + NaOH \longrightarrow H_2O + Na^+ + NO_3^-$

   $HNO_2 + NaOH \longrightarrow H_2O + Na^+ + NO_2^-$

2. The areas for typical $NO_2^-$ and $NO_3^-$ peaks were linear with concentration throughout the entire level (0-200 ppm) examined.

I-G. References

1. Skelly, N. E., Analytical Chemistry, 1982, 54 712-715. Separation of Inorganic and Organic Anions on Reversed-Phase Liquid Chromatography Columns.

PART II

METHOD N8900.220.01.CWP

# NITRATOR SPENT ACIDS AND MIXED ACIDS

## Determination of Nitrous Acid and/or % Nitric Acid in Spent Nitrator Acid or Mixed Acid by High Pressure Liquid Chromatography (HPLC)

### II-A. Unusual Safety Considerations

#### 1. Product Hazards

Spent nitrator acids are considered corrosive (up to 70% sulfuric acid)and could also be cyanogenic (could contain traces of nitrated organics). Skin contact and breathing of the vapors should be avoided. If skin contact occurs, wash the exposed area with water then soap and water and report to Supervision. For more information refer to refer to MSDS 04213647 for Mixed Acid SP-15.

#### 2. Procedure Hazards

Octylamine is flammable and harmful if absorbed through the skin; it causes irritation if the vapors are inhaled. Avoid contact with the skin and breathing of the vapors. Handle only in a well-ventilated hood. If skin contact occurs, wash the exposed area with water, then soap and water and report to Supervision.

Sodium nitrite and sodium nitrate are strong oxidants and toxic. Avoid contact with skin, eyes and combustible material. If swallowed report to Medical.

Phosphoric acid is corrosive and a strong skin irritant. Avoid skin contact. If skin contact occurs wash the exposed area with water, then soap and water and report to Supervision.

Sodium hydroxide is corrosive and a strong skin irritant. Avoid skin contact. If skin contact occurs, wash the exposed area with water and report to Supervision.

Methanol is toxic and flammable. Avoid skin contact and breathing of vapors. If skin contact occurs wash the exposed area with water and report to supervision. Clean up spills, if they occur.

## II-B. Procedure

### 1. Instrument Settings

| | |
|---|---|
| Detector: | Schoeffel SF-770 |
| Detector (UV): | 205 nm |
| Pump: | Constametric II G |
| Flow rate: | 2.0 mL/minute |
| Injection procedure: | Valco via Micromeritics autosampler |
| Sample size | 20 µL |
| Sample concentration: | 200 ppm |
| Solvent: | Water |
| Pressure: | 1700 psi |
| Separation mechanism: | Ion exchange |
| Column trade name: | Partisil ODS-3 |
| Source: | Whatman |
| Length: | 25 cm |
| OD: | 1/4 inch. |
| ID: | 4.6 mm |
| Guard column | 7 cm x 2.1 mm x 1/4" Whatman Co.: Pell ODS |
| Particle size: | 5 µ |
| Other column parameters: | operated at room temperature |
| Mobile phase: | 0.01 M octylamine in water with pH adjusted to 6.25 with $H_3PO_4$ |

### 2. Order of Elution

| Component | Retention Time (min.) | Concentration or Range Investigated |
|---|---|---|
| $NO_2$- | 5-7 | 0-200 ppm |
| $NO_3$- | 7-9 | 0-200 ppm |

3. Preparation of Standard Solution

(1) Weigh 0.069 g ± 0.002 g to an accuracy of 0.0001 g of sodium nitrite into a 100-mL volumetric flask 1.

(2) Weigh 0.034 g ± 0.002 g to an accuracy of 0.0001 g of sodium nitrate into a second 100-mL volumetric flask 2.

(3) Fill flasks 1 and 2 to the mark with deionized water.

(4) Calculate the concentration of $NO_2$- in ppm using the expression in II-B-12 and label flask 1 with this concentration..

(5) Calculate the concentration of $NO_3$- in ppm using the expression in II-B-12 and label flask 2 with this concentration .

(6) Pipet 5.0 mL from flask 1 and place into a clean, empty 100-mL flask 3.

(7) Pipet 5.0 mL from flask 2 and add to flask 3.

(8) Fill flask 3 to the mark with deionized water.

(9) Calculate the concentration of $NO_2$- in ppm by dividing the concentration calculated in Step (4) by 20 and put this on the label for flask 3.

(10) Calculate the concentration of $NO_3$- in ppm by dividing the concentration calculated in Step (5) by 20 and put this on the label for flask 3.

4. Preparation of Sample Solution (Spent Acid)

(1) Weigh out 1 g ± 0.05 g of spent acid into a preweighed 100-mL volumetric flask. Record both the weight of the volumetric flask and the flask plus sample to 0.1 mg. (Report the difference as weight, $W_s$, and use in Section II-B-14). Add enough 0.5 M NaOH to fill the volumetric to the mark. Mix well by shaking. With some spent acid samples caustic may cause solids to precipitate. It is not necessary to dissolve these solids, just allow them to settle out.

NOTE: The acid sample may be solid when received. If it is, melt the sample using hot water (~80°C) and stir with a glass rod. Any heating should be done in a hood.

(2) Take 5.0 mL (pipet) of the sample just prepared in Step 1 and add to a 50-mL beaker.

(3) Add 3-5 mL deionized water to the beaker.

(4) Using a pH meter, adjust the pH to 7-7.5 with 1:4 $H_3PO_4$ ($\sim$20% $H_3PO_4$).

(5) Wash beaker contents into a 25-mL volumetric and fill to the mark with deionized water.

5. Preparation of Sample Solution (Mixed Acid)

(1) Take 1.0 mL (pipet) of mixed acid and add it to a 100-mL volumetric flask containing approximately 90 mL of 0.5 M NaOH. The pipet tip should be below the level of the NaOH solution. Fill to the mark with 0.5 M NaOH.

(2) *Weigh a duplicate 1.0 mL sample of mixed acid to the* nearest 0.1 mg. (Report as weight, $W_s$, and use in Section II-B-14).

(3) Take 5.0 mL (pipet) of the sample just prepared in Step 1 and add to a 50-mL beaker.

(4) Add 3-5 mL deionized water to the beaker.

(5) Using a pH meter, adjust the pH to 7-7.5 with 1:4 $H_3PO_4$ ($\sim$20% $H_3PO_4$).

(6) Wash beaker contents into a 25-mL volumetric and fill to the mark with deionized water.

6. Preparation of Mobile Phase

(1) Add 1.6 mL of octylamine to 1000 mL of "Millipore" Q water slowly with stirring.

(2) Adjust pH slowly to 6.25 $\pm$ 0.01 using 1:4 $H_3PO_4$ ($\sim$20% $H_3PO_4$).

(3) Octylamine dissolves slowly and the pH rises as it does.

(4) Continue stirring for 15 minutes while periodically checking the pH.

(5) Filter through a 0.45-um "Millipore" filter #HAWP 04700 using a vacuum filtration apparatus.

7. Preparation of 0.5 M NaOH

(1) Place 20.0 g of NaOH into a 1-L volumetric flask.

(2) Add "Millipore" Q water to the solid NaOH slowly with good stirring. Bring the final volume up to 1 L.

8. Conditioning of the Column

Pump mobile phase through the column until the detector base line is stable. This may require several hours.

9. Standard Analysis

(1) Charge the sampling valve by flushing with the standard solution. The sample should be injected through a disposable filter (Gelman Acrodisc)..

(2) Inject the standard solution onto the column using the sample valve (20-µL loop) again using a disposable filter (Gelman Acrodisc).

10. Sample Analysis

Repeat Step 9 with the sample as prepared in Step II-B-4 or II-B-5. A typical analysis time by this method is 45 minutes.

11. Correcting Erratic Column Behavior

The baseline may drift badly and rise after several samples (perhaps 10-50) have been run. When this happens replace the mobile phase with methanol and flush the column for 30 minutes. Return to the mobile phase, recondition the column and prepare to restart your analyses.

12. Calculation for ppm $NO_2^-$ and ppm $NO_3^-$

$$\text{ppm } NO_2^- = \text{Wt. } NaNO_2 \times 10^4 \times 0.667$$

$$\text{ppm } NO_3^- = \text{Wt. } NaNO_3 \times 10^4 \times 0.730$$

Where:

Wt. $NaNO_2$ = wt. of sodium nitrite weighed in II-B-3-1

Wt. $NaNO_3$ = wt. of sodium nitrate weighed in II-B-3-2

0.667 = molecular weight ratio for $\frac{[NO_2^-]}{[NaNO_2]}$

0.730 = molecular weight ration for $\frac{[NO_3^-]}{[NaNO_3]}$

13. Response Factor Calculation

Calculate the response factor F,

$$F = C/R$$



AB0000118027/9

where:

F = factor for nitrite or nitrate

C = concentration of nitrite (II-B-3-9) or of nitrate (II-B-3-10)

R = area response for nitrite or nitrate

14. Calculations (for sample)

$$\text{Wt. \% of } HNO_2 = \frac{F_{NO2^-} \times R_{NO2^-} \times 500 \times 1.022}{W_s \times 10^{+4}}$$

$$\text{Wt. \% of } HNO_3 = \frac{F_{NO3^-} \times R_{NO3^-} \times 500 \times 1.016}{W_s \times 10^{+4}}$$

For spent acid samples Wt. % $HNOSO_4$ is usually asked for instead of Wt. % $HNO_2$. Use the following expression for wt. % $HNOSO_4$.

$$\text{Wt. \% of } HNOSO_4 = \frac{F_{NO2^-} \times R_{NO2^-} \times 500 \times 2.762}{W_s \times 10^{+4}}$$

where:

$F_{NO2^-}$ = factor for nitrite from Step II-B-13

$F_{NO3^-}$ = factor for nitrate from Step II-B-13

$R_{NO2^-}$ = area response of nitrite in the sample

$R_{NO3^-}$ = area response of nitrate in the sample

500 = dilution factor for the sample = 100/1 x 25/5

1.022 = molecular weight ratio for $[HNO_2]/[NO_2^-]$

1.016 = molecular weight ratio for $[HNO_3]/[NO_3^-]$

2.762 = molecular weight ratio for $[HNOSO_4]/[NO_2^-]$

$W_s$ = weight in grams of spent or mixed acid from Section II-B-4-1 or II-B-5-2

NOTE: When dealing with the spent or mixed acid samples certain levels of $HNO_3$, $HNO_2$ or $HNOSO_4$ may be too great for the method (i.e. 200 ppm). The following wt. % of each acid should indicate to you that the level of acid is too great for the method.

| | SPENT ACID | MIXED ACID |
|---|---|---|
| Wt. % $HNO_3$ | > 10 | - |
| Wt. % $HNO_2$ | > 10 | > 6 |
| Wt. % $HNOSO_4$ | > 27 | - |

If these levels are encountered a 10:1 dilution with water will bring the level into the correct range. Pipet 1 mL of the solution prepared in II-B-4-5 or II-B-5-6 into a 10-mL volumetric flask. Add water to the mark, mix well and inject this as your sample (II-B-10). When calculating wt. % $HNO_2$, $HNO_3$ or $HNOSO_4$ replace the dilution factor of 500, from the expressions in II-B-14, with 5000.

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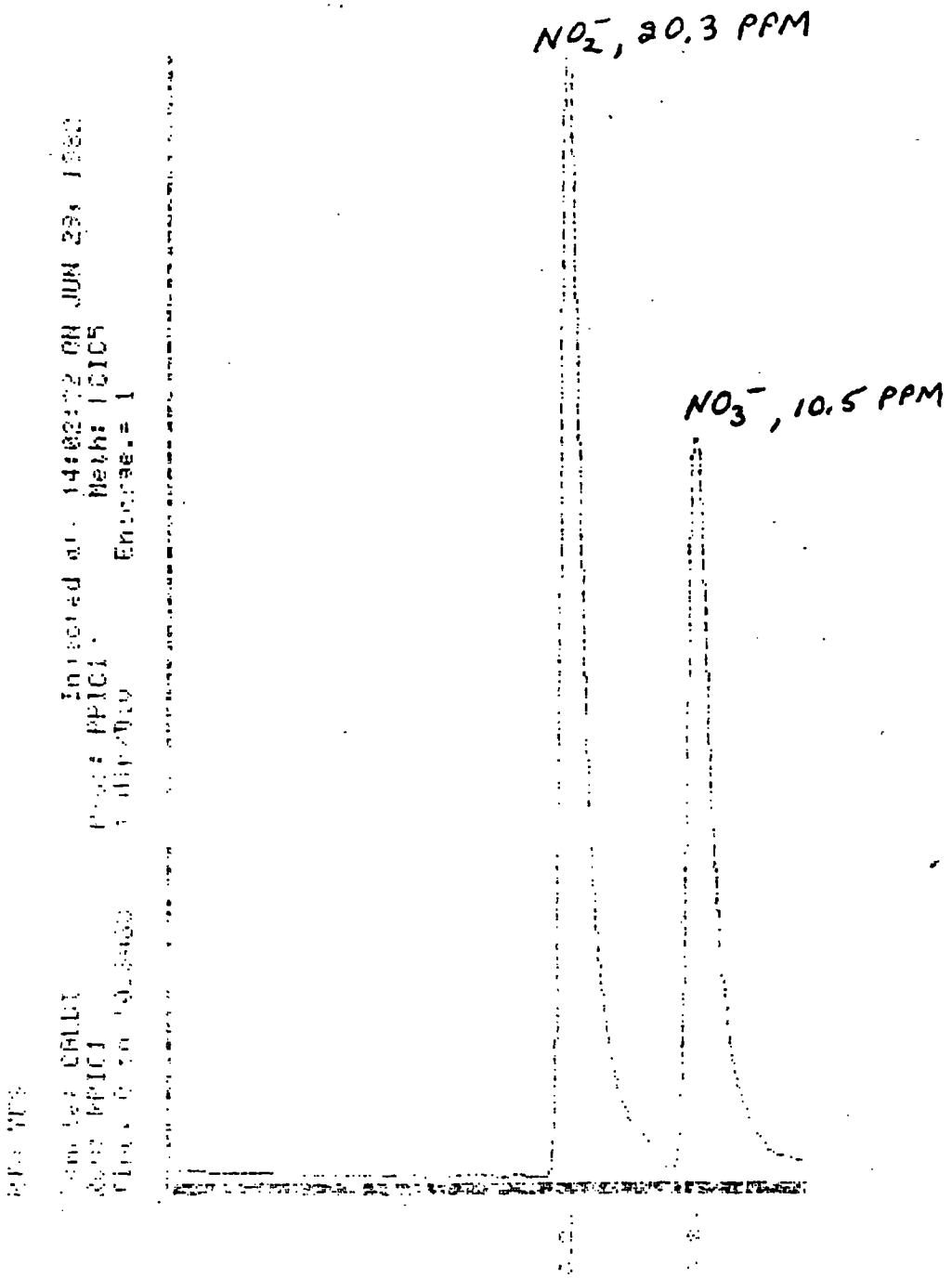
$NO_2^-$, 20.3 PPM
$NO_3^-$, 10.5 PPM

DU PONT

# TEST METHOD

GENERAL PROCEDURE

SPECIFIC GRAVITY BY HYDROMETER

METHOD N8900.310.01.CWP

CONFIDENTIAL

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## I-D. Apparatus

1. Hydrometers, of glass, conforming to Specifications for ASTM Hydrometers (ASTM Designation: E 100).

2. Thermometer of suitable range as prescribed in ASTM Specification E1 or in the J.L. Series of Thermometers.

3. Hydrometer cylinders, made of clear glass or plastic. For convenience in pouring, the cylinder may have a lip on the rim. The inside diameter of the cylinder shall be at least one inch greater than the outside diameter of the hydrometer used in it. The height of the cylinder shall be such that the length of the column of sample it contains is greater by at least one inch than the portion of the hydrometer which is immersed beneath the surface of the sample, after a state of equilibrium has been reached.

4. Water bath capable of maintaining a temperature, during the test, within $\pm$ 0.1°C. (Note 1)

## I-E. Reagents

No reagents are required.

## I-F. Notes

1. For this application a temperature range of 0.5°C is satisfactory. The + 0.1°C range is specified since this is the standard range used in the laboratory for other applications.

## I-G. References

1. ASTM Method D-891

PART II

METHOD N8900.310.01.CWP

## GENERAL PROCEDURE

## Specific Gravity by Hydrometer

### II-A. Unusual Safety Considerations

Hazards will vary with the product being analyzed. Consult the hazard section of an analytical method which covers the product being tested. For more information refer to refer to MSDS 04213647 for Mixed Acid SP-15.

### II-B. Procedure

No special preparation of the sample is necessary except the adjustment of its temperature in a constant temperature bath, to within ± 0.1°C of the temperature specified for the test.

1. Adjust the temperature of the sample in the original container to within two degrees of the temperature specified for the test.

2. Pour the sample into the dry hydrometer cylinder without splashing, so as to avoid formation of air bubbles and to reduce to a minimum the evaporation of the lower boiling constituents of the more volatile samples. Remove any air bubbles formed, after they have collected on the surface of the sample, by touching them with a piece of clean filter paper.

3. Place the cylinder vertically in the water bath and stir the contents of the cylinder with the thermometer, being careful to avoid the formation of air bubbles.

4. When the temperature is about 0.3°C from the specified temperature, slowly and carefully lower the hydrometer into the sample to a level near which it is expected to float and then release the hydrometer. Keep the rest of the stem dry, as unnecessary liquid on the stem changes the effective weight of the hydrometer, and so affects the reading obtained.

5. Allow the hydrometer to come to rest, floating freely and not touching the walls of the cylinder.

II-B. Procedure (Cont'd.)

6. When the temperature of the sample comes within ± 0.1°C of the temperature specified for the test, remove the thermometer and read the gravity as follows:

   Place the eye slightly below the level of the liquid and slowly raise the eye until the surface of the sample first seen as a distorted ellipse seems to become a straight line cutting the hydrometer scale. Read and report the gravity to the nearest scale division.

   The temperature of the bath and the temperature shown on the thermometer in the sample should agree within 0.10°C.

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DU PONT

# TEST METHOD

UREA

DETERMINATION OF FREE AMMONIA

METHOD U3000.005.01.CVP

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DU PONT CHEMICALS

ANALYTICAL PROCEDURE

METHOD U3000.005.01.CWP

# UREA

## Determination of Free Ammonia

### I-A. Principle

This method is based on the direct titration of small amounts of ammonia in urea with standard acid after dissolution of a suitable size sample.

### I-B. Scope

#### 1. Application

This method was developed as a specification test for purchased urea.

#### 2. Limitations

Any other basic impurities will interfere. In our studies it was assumed no such impurities were present.

### I-C. Precision and Accuracy

#### 1. Accuracy

No study of the accuracy was made. It is assumed to be as accurate as any other aqueous acid-base titration.

#### 2. Development Precision

The standard deviation was determined as $\pm$ 0.8 ppm with a 95% confidence interval of $\pm$ 1.5 ppm at the 15-ppm level. The precision was determined from 2 samples run in duplicate by two technicians on each of 2 days.

I-D. Special Apparatus

1. Micro buret, 5-ml.

I-E. Reagents (Reagent Grade)

1. Hydrochloric acid, 0.01N standard.

   Dilute 0.1N standard acid exactly 1 to 10 with water.

2. Phenolphthalein indicator solution.

I-F. Notes

None.

METHOD U3000.005.01.CWP

# UREA

## Determination of Free Ammonia

### II-A. Unusual Safety Considerations

#### 1. Product Hazards

No unusual hazards. Refer to MSDS 34411007 for Urea.

#### 2. Procedure Hazards

No unusual hazards.

### II-B. Procedure

1. Weigh 17 ± 2 g. to nearest mg. of urea into a 400-ml. beaker.

2. Dissolve in 250-ml. (graduate) of water.

3. Add a few drops of phenolphthalein indicator.

4. Titrate with 0.01N standard HCl to disappearance of the pink color.

#### Calculations

$$\frac{\text{ml. acid x normality x 17030}}{\text{g. sample}} = \text{ppm free } NH_3$$

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DU PONT

# TEST METHOD

**UREA**

**DETERMINATION OF TOTAL NITROGEN**

**METHOD U3000.005.02.BEP**

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# UREA

## Determination of Total Nitrogen

## Kjeldahl Method

### I. Applicability

This method is applicable to all types of urea.

### II. Principle

A portion of the sample is digested with concentrated sulfuric acid. This decomposes the organic matter and converts the combined nitrogen to ammonium bisulfate. The solution is diluted and a nonvolatile alkali is added in excess to displace the ammonia. The ammonia is distilled into a saturated boric acid solution forming ammonium borate. The ammonium borate is titrated with standard hydrochloric acid. The result is calculated as nitrogen.

Fundamental Equations

1. $CO(NH_2)_2 + H_2O + 2\ H_2SO_4 \rightarrow CO_2 + 2\ NH_4HSO_4$
   Urea

2. $NH_4HSO_4 + 2\ NaOH \rightarrow NH_3 + Na_2SO_4 + 2\ H_2O$

3. $B(OH)_3 + H_2O + NH_3 \rightarrow NH_4^+ + [B(OH)_4]^-$
   Boric acid

4. $NH_4^+ + [B(OH)_4]^- + HCl \rightarrow NH_4Cl + B(OH)_3 + H_2O$

### III. Unusual Safety Considerations

The concentrated sulfuric acid and the concentrated sodium hydroxide solution (450 g/liter) are corrosive and can cause serious burns. If either material is spilled on the skin, wash the affected area thoroughly with water.

The fumes occurring in the digestion are extremely corrosive and must be avoided. Conduct the digestion in an adequate hood.

Kjeldahl flasks have been known to explode during both digestion and distillation. It is advisable to conduct these operations behind a shield.

Upon the addition of zinc to the acid solution, hydrogen is liberated. After the addition of sodium hydroxide, a small amount of hydrogen continues to be liberated. This contributes to the effectiveness of zinc as an antibump. When the distillation is complete and while the flasks are cooling on the still, hydrogen accumulates in the

Kjeldahl flasks. (Steam keeps the hydrogen swept out up to this point.) As soon as the flasks are cool, carry them to a flame-free sink and clean them to eliminate the generation of hydrogen. Do not smoke while disconnecting these flasks from the stills nor immediately afterward while carrying or cleaning them.

The addition of water to the solution remaining after digestion and the subsequent addition of sodium hydroxide liberates considerable heat. Special precautions must be taken to prevent spewing. The precautions are included in the procedure.

Since Kjeldahl flasks erode rapidly in this service, they should be examined for flaws before each use.
For more information refer to MSDS 34411007 for Urea.

IV. Sensitivity, Precision, and Accuracy

The standard deviation ($\sigma$) of the method is ca. 0.20% absolute.

V. Apparatus and Reagents

(Equivalent apparatus may be substituted. Reagents are reagent grade.)

1. Flask, Kjeldahl, long neck, 800 ml

2. Kjeldahl digestion and distillation apparatus, complete with heat source, traps, and block-tin or equivalent noncorrosive tubing condensers, e.g., Fisher Scientific No. 13-158 and 13-157

3. Boiling stones, Norton Alundum Supports, 1/8 in. diameter x 1/8 in. long, mixture SA-103 or equivalent

4. Boric acid with bromcresol green-methyl red indicator

   a. Weigh 50 $\pm$ 1 g of boric acid into 1 liter (grad cyl) of distilled water contained in a bottle. Mix by any convenient means until a saturated solution is obtained.

   b. Add 3.4 ml (Mohr pipet) of a methanol solution of methyl red, 1 g/liter, and 17.0 ml (Mohr pipet) of a methanol solution of bromcresol green, 1 g/liter. Mix thoroughly.

   c. Adjust the pH of the solution to 3.33 $\pm$ 0.03 at 25 $\pm$ 1°C, using 0.34 N hydrochloric acid (ca. 2.6 ml).

5. Bromcresol green in methanol, 1 g/liter

6. Hydrochloric acid, 0.34 N, standard

7. Mercuric oxide, HgO

8. Methyl red in methanol, 1 g/liter

9. Oil, mineral or SAE 30 lubricating

10. Paraffin

11. Potassium sulfate or anhydrous sodium sulfate

12. Sodium hydroxide, 450 g/liter

    (Other concentrations of sodium hydroxide are permitted provided the equivalent amount of sodium hydroxide used equals or exceeds that specified in the procedure.)

13. Sodium thiosulfate, 80 g $Na_2S_2O_3 \cdot 5\ H_2O$/liter

14. Sulfuric acid, concentrated

15. Zinc metal, granular, 20 mesh

16. Zinc metal, mossy

VI. Procedure

1. Divide and reduce the sample as received in the laboratory by standard quartering or riffling methods. Grind a representative portion of not less than 50 g to 40 mesh (U.S. Standard Sieve) or finer and mix thoroughly.

   (Grind as rapidly as possible to avoid loss or gain of moisture during the operation. Preserve the ground sample in a tightly stoppered bottle.)

2. Weigh ($\pm$ 0.0001 g) 0.90 $\pm$ 0.05 g of the ground sample on a piece of filter paper or in a Mallinckrodt "Wa-Cup". Carefully wrap the sample in the paper and drop it into an 800 ml Kjeldahl flask.

   (Examine the flasks before using to see that they contain no pin holes or other flaws. Flasks in this service are eroded very rapidly.)

3. Place a similar piece of paper in an empty flask which serves as a blank. Add 2 or 3 boiling stones to each flask and treat blank and sample identically from this step on.

4. Add ca. 15 $\pm$ 2 g of potassium sulfate or anhydrous sodium sulfate and 0.7 $\pm$ 0.05 g of mercuric oxide to the flask.

5. Place 10 ml (grad cyl) of distilled water, 25 ml (grad cyl) of concentrated sulfuric acid and a piece of paraffin about the size of a pea in the flask.

   (If the Mallinckrodt "Wa-Cup" is placed in the flask, omit the paraffin.)

6. Heat the flask in a hood until dense $SO_3$ fumes are evolved and for at least 30 minutes thereafter.

   (The liquid should be essentially colorless. Traces of brown or black residue on the sides of the flask indicate incomplete digestion.)

7. Cool the flask in a stream of air (never use water) until crystals start to form (ca. 60°C) and then carefully add ca. 300 ml of distilled water using the technique described in the parenthetical note below. Continue swirling the contents of the flask as necessary to dissolve all crystalline matter. Any crystals left from this step will react violently when the solution is made alkaline in a subsequent step. Now place the flask in a water bath at 25°C or cooler for a minimum of 15 minutes so that the solution will be cooled to 30°C or lower.

   (Considerable heat will be evolved as the water is added. Keep the mouth of the flask pointed away from personnel and add the water in small increments. Swirl and cool the flask between additions of water.)

8. Place ca. 150 ml of saturated boric acid solution with indicator in a 500 ml Erlenmeyer flask. Support the flask under the draw-off of a Kjeldahl still with the tip of the draw-off beneath the surface of the boric acid. Do not allow the draw-off to touch the bottom of the flask.

   (The still should be inspected prior to each use to see that there are no leaks or obstructions.)

9. Add 25 ml (grad cyl) of 80 g/liter sodium thiosulfate solution to the cool Kjeldahl flask. Mix to precipitate the mercury and cool the flask again to 30°C or lower.

10. Add ca. 6 drops of mineral oil or SAE 30 lubricating oil. Then add 0.4 $\pm$ 0.1 g of 20 mesh zinc and one piece of mossy zinc.

11. Swirl the flask to suspend the precipitate, then add 75 ml (grad cyl) of 450 g/liter sodium hydroxide so that it flows slowly down the neck of the flask and forms a layer on the bottom.

    (Keep the mouth of the flask pointed away from personnel.)

12. Quickly attach the flask to the trap of the Kjeldahl still and swirl to mix.

    (If the contents of the flask are not mixed thoroughly at this point they may spew out upon heating in the next step.)

13. Apply heat to the flask and distill the liquid until at least 150 ml of distillate is obtained. Lower the receiving flask until the tip of the draw-off is above the distillate. Remove the heat from the Kjeldahl flask and purge the draw-off until distillation stops.

14. Rinse the tip of the draw-off with distilled water and remove the receiving flask from the draw-off.

15. Titrate the contents of the blank receiving flask with standard 0.34 N hydrochloric acid to the rose colored end point. Record the titer to 0.01 ml and apply buret and temperature corrections.

16. Titrate the contents of the sample receiving flask with 0.34 N hydrochloric acid to the same end point. Record the titer to 0.01 ml and apply buret and temperature corrections.

17. Calculations

Net titer = ml sample titer, step 16 - ml blank titer, step 15

$$\% \text{ Nitrogen} = \frac{\text{net titer} \times \text{N HCl} \times 1.401}{\text{g of sample, step 2}}$$

Report results to 0.01%.

## VII. Comments

1. A measured volume of standard HCl or $H_2SO_4$ may be used instead of boric acid to absorb the ammonia. In this case the excess acid in blank and sample is titrated with standard NaOH to a methyl red end point. In calculating, the sample titer is subtracted from the blank titer to obtain net titer and the normality of the NaOH is used instead of normality of HCl.

2. The condition of the rubber stoppers and connections on the distillation apparatus must be such that no ammonia is lost.

3. Incomplete digestion of the sample will result in low recovery.

## VIII. References

1. "Official Methods of Analysis", AOAC, 10th Ed., Washington, D. C., 1965, Section 2.044, p 16

The information set forth herein is furnished free of charge and is based on technical data that Du pont believes to be reliable. It is intended for use by persons having technical skill at their own discretion and risk. since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information. Nothing herein is to be taken as a license to operate under or a recommendation to infringe any patents.

DU PONT

# TEST METHOD

**UREA**

**DETERMINATION OF ASH CONTENT**

**METHOD U3000.015.01.CWP**

CONFIDENTIAL

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DU PONT CHEMICALS

ANALYTICAL PROCEDURE

METHOD U3000.015.01.CWP

# UREA

## Determination of Ash Content

### I-A. Principle

A relatively large sample (100g) is decomposed in a crucible by heating with a Bunsen burner. The decomposition is completed by heating in a muffle furnace. The residue is cooled, weighed and calculated as ash content in ppm.

### I-B. Scope

#### 1. Application

This is a specification method to determine up to 100 ppm ash in purchased urea.

#### 2. Limitations

No study has been made. Any loss of nonvolatiles will negate results.

### I-C. Precision and Accuracy

No formal study of precision has been made.

Two samples were analyzed in duplicate, one at 15 ppm showed a range of 12-18 ppm and the other at 75 ppm showed a range of 60-90 ppm.

### I-D. Special Apparatus (Equivalent apparatus may be used)

1. Muffle furnace, 800°C.

2. Crucible, platinum, 100-ml capacity.

### I-E. Reagents

None

### I-F. Notes

None

METHOD U3000.015.01.CWP

# UREA

## Determination of Ash Content

### II-A. Unusual Safety Considerations

#### 1. Product Hazards

There are no unusual product hazards. Refer to MSDS 34411007 for Urea.

#### 2. Procedure Hazards

There are no unusual procedure hazards. Handle the hot crucible with care, using tongs.

### II-B. Procedure

1. Tare a 100-ml platinum crucible to the nearest 0.0002g.

   Place the crucible in a muffle furnace at 800°C for 1 hour and then cool to room temperature in a desiccator prior to taring.

2. Place the tared crucible in a tripod containing a quartz triangle.

3. Add approximately (weighed to the nearest mg) 20g of the sample to the crucible and heat slowly with a Bunsen burner until the sample is completely decomposed.

4. Repeat Step 3 four more times until approximately 100g of sample has been decomposed.

5. Place the crucible in an 800°C muffle furnace for about 1 hour.

   Handle the hot crucible carefully, using long-handled tongs.

6. Remove the crucible from the oven, cool to room temperature in a desiccator and weigh the residue plus crucible to the nearest 0.0002g.

## Calculations

$$\frac{(W_R - W_T)}{W_S} \times 10{,}000 = \text{ppm ash}$$

Where $W_R$ = weight of residue + crucible, in g, Step 6

$W_T$ = tare weight of crucible, in g, Step 1

$W_S$ = total sample weight = sum of each of the approximately 20g added

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AB0000118054/4

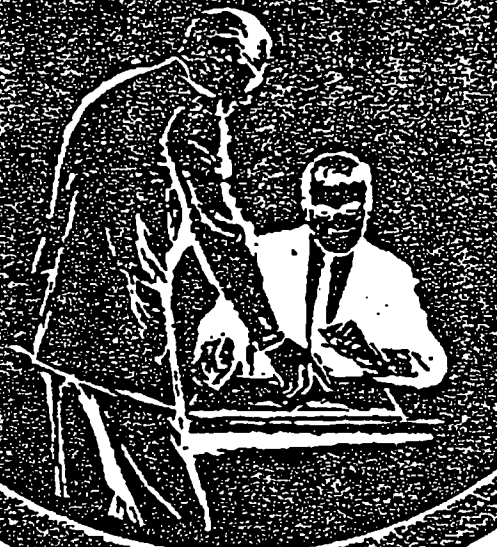
Bob,

For your information. Gives specifications and prices on several products in this line.

Dennis

AGS

# Du Pont DIBASIC ESTERS



DU PONT Polymer Intermediates

AB0000108072/1

# DU PONT DIBASIC ESTERS

## DESCRIPTION AND USES

Du Pont DBE's are refined dimethyl esters of adipic, glutaric and succinic acids. The product family with typical compositions is shown below:

| | |
|---|---|
| DBE-Dimethyl Adipate, | 27 ± 3% |
| -Dimethyl Glutarate, | 50 ± 5% |
| -Dimethyl Succinate, | 23 ± 2% |
| DBE-2-Dimethyl Adipate, | 32 ± 4% |
| -Dimethyl Glutarate, | 68 ± 4% |
| DBE-3-Dimethyl Adipate, | 90 ± 2% |
| -Dimethyl Glutarate, | 10 ± 2% |

DBE-4-Dimethyl Succinate

DBE-5-Dimethyl Glutarate

The DBE and DBE-2 mixtures are strong, active solvents having general utility in the coatings and printing industries. These esters are solvents for many important polymers and resin systems and are photochemically nonreactive under Rule 66 of the Los Angeles County Pollution Regulations.

All members of the family offer economical sources of straight chain difunctional building blocks for polymers, resins, and high value organic compounds such as odorants, pigments, pharmaceuticals and insecticides. For example, they can be transesterified to give plasticizers and polyesters for use in coatings or polyurethane elastomers. They are also intermediates for polyamide resins.

## AVAILABILITY

Du Pont DBE's offer a unique raw material position favorable for extensive product growth. They are readily available for purchase in multimillion pound quantities.

To order call toll free:
800-441-9475 and ask for extension 4138 or 4139

## SHIPPING INFORMATION

Standard Shipments:
Tank Trucks
Tank Cars
Drums—
485 Lbs. Net
525 Lbs. Gross

Shipping Point:
Tank Truck and Tank Cars—
Bayport, TX
Drums—Houston, TX
—Philadelphia, PA

Freight Classification—
Paint & Lacquer Solvents

DOT Classification—
These products are not classified as hazardous materials.

## STORAGE AND HANDLING

Dibasic Esters can be stored in mild steel tanks.

The presence of excess water, however, can cause hydrolization to the free dibasic acids which are corrosive to mild steel. Hydrolyzed product can be handled in stainless steel containers.

## SAFE HANDLING PRACTICES

The products may cause irritation to the eyes and good hygienic practice dictates copious flushing immediately with water in the event of contact with eyes. Contact a physician.

**Polymer Intermediates Department**

**DBE** **Dimethyl Adipate**
**Dimethyl Glutarate**
**Dimethyl Succinate**

**DBE-2** **Dimethyl Adipate**
**Dimethyl Glutarate**

Du Pont DBE and DBE-2 are refined mixtures of the dimethyl esters of succinic, glutaric and adipic acids.

## USES

SOLVENTS - DBE and DBE-2 are strong, active solvents. They have general utility owing to their low cost and exemption from Rule 66. Typical current uses are:

- Retarder solvent in acrylic lacquer and enamel thinner formulations for automotive and industrial coatings.
- Retarder solvent for other industrial coatings systems; for example, automotive primers and container, coil and appliance coatings.
- Solvent for printing inks.
- Chemical reaction media, reactor cleaning solvent, insecticide solvent, and general household cleaning solvent formulations.

INTERMEDIATES - DBE and DBE-2 are unique sources of mixed aliphatic dibasic acids for polymer synthesis. Their low cost and availability allow them to replace existing acids and to be the intermediates of choice in the manufacture of products such as:

- Coatings resins
- Polyester polyols for urethane products
- Plasticizers
- Unsaturated polyester resins
- Other polyester and polyamide applications

(Over)

The facts stated and the recommendations made herein are based on our research and the research of others, and are believed to be accurate. No guarantee of their accuracy is made however, and the product discussed is distributed without warranty on our part, express or implied and upon conditions that recipients shall make their own tests to determine its suitability for their particular purposes. Likewise, statements concerning the possible uses of our product are not intended as recommendations to use it in the infringement of any patent.

DUPONT

E-05506

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## SPECIFICATIONS

| | DBE | DBE-2 |
|---|---|---|
| Diester Content, Wt. %, Min. | 99 | 99 |
| Water, Wt. %, Max. | 0.5 | 0.5 |
| Color, Gardner Scale, Max. | 1 | 1 |
| Acid Number, Max. | 1 | 1 |
| Major Components, Conc. Range | | |
| Dimethyl Adipate, Wt. % | 20-30 | 28-45 |
| Dimethyl Glutarate, | 40-60 | 55-72 |
| Dimethyl Succinate, | 20-30 | 0-3 |

## GENERAL INFORMATION

| | DBE | DBE-2 |
|---|---|---|
| Appearance | Clear Liquid | Clear Liquid |
| Solubility Parameters (Hansen System) | | |
| Polar Bonding | 3.4 | 3.3 |
| Hydrogen Bonding | 4.1 | 4.0 |
| Non-Polar Bonding | 8.5 | 7.0 |
| Solubility Parameter | 10.1 | 8.7 |
| Evaporation Rate (BuAc=100) | <1 | <1 |
| Viscosity at 25°C., Centipoise | 2.39 | 2.38 |
| Specific Gravity, 25°C | 1.086 | 1.086 |
| Distillation Range, °C | 196-225 | 210-225 |
| Freezing Point, °C (Approx.) | -20 | -13 |
| Flash Point, °F Tag Closed | 212 | 219 |
| Average Molecular Weight (Approx.) | 160 | 165 |
| Odor | Mild, Pleasant | Mild, Pleasant |

## FOR FURTHER INFORMATION:

Du Pont Company
Polymer Intermediates Department
Intermediates Division
6514 Nemours Building
Wilmington, DE 19898
(302) 774-7591 or 774-9200

77-4
E-15964

**Polymer Intermediates Department**

# DBE-3 Dimethyl Adipate (Major Component)
# DBE-5 Dimethyl Glutarate

Du Pont DBE-3 and DBE-5 are refined dimethyl esters of adipic and glutaric acids, respectively.

## USES

DBE-3 and DBE-5 are unique building blocks for the synthesis of a wide variety of resins, plasticizers, lubricants, specialty chemicals, fibers, adhesives and elastomers. Their low cost and ample availability make them an attractive source of 5 and 6 carbon, linear dibasic acid groupings in such applications as:

- Polymeric and aliphatic ester plasticizers
- Polyester polyol based urethane elastomers and foams
- Textile lubricants
- Low temperature synthetic lubricants
- Unsaturated polyester resins
- Co-monomers for fibers
- Polyamide resins

## SPECIFICATIONS

| | DBE-3 | DBE-5 |
|---|---|---|
| Diester Content, Wt. %, Min. | 99 | 99 |
| Water, Wt. %, Max. | 0.5 | 0.5 |
| Color, Gardner Scale, Max. | 1 | 1 |
| Acid Number, Max. | 1 | 1 |
| Major Components, Concentration, Wt. % | | 97.5 |
| Dimethyl Glutarate | 10 ± 5 | 97 (Min.) |
| Dimethyl Adipate | 90 ± 5 | 1 (Typical) |

(Over)

The facts stated and the recommendations made herein are based on our research and the research of others, and are believed to be accurate. No guarantee of their accuracy is made, however, and the product discussed is distributed without warranty on our part, express or implied, and upon conditions that recipients shall make their own tests to determine its suitability for their particular purposes. Likewise, statements concerning the possible uses of our product are not intended as recommendations to use it in the infringement of any patent.

DUPONT

E-09906

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AB0000108072/5

## GENERAL INFORMATION

| | DBE-3 | DBE-5 |
|---|---|---|
| Appearance | Clear Liquid | Clear Liquid |
| Viscosity at 25°C, Centipoise | 4 (Approx.) | 2.76 |
| Specific Gravity, 25°C | 1.06 | 1.09 |
| Distillation Range, °C | 215-225 | 210-215 |
| Freezing Point, °C (Approx.) | 8 | -37 |
| Flash Point, °F Tag Closed | 215 | 224 |
| Molecular Weight | 173 (Avg.) | 160 |
| Odor | Mild, Pleasant | Mild, Pleasant |

## FOR FURTHER INFORMATION:

Du Pont Company
Polymer Intermediates Department
Intermediates Division
6514 Nemours Building
Wilmington, DE 19898
(302) 774-7591 or 774-9200

77-4
E-15965

Polymer Intermediates Department

# D[illegible]-4 Dimethyl Succinate

Du Pont DBE-4 is the pure dimethyl ester of succinic acid.

## USES

DBE-4 is a versatile starting material for the synthesis of many industrially important organic compounds. Its purity and availability for growth make it an attractive source for the linear four carbon dibasic acid group in such uses as:

- Organic pigments
- Insecticides
- Pharmaceuticals
- Specialty chemicals
- Succinic Anhydride
- Succinic Acid

## SPECIFICATIONS

| | |
|---|---|
| Dimethyl Succinate, Wt. %, Min. | 99.0 |
| Water, Wt. %, Max. | 0.5 |
| Color, APHA Max. | 30 |
| Acid Number, Max. | 1 |

## GENERAL INFORMATION

| | |
|---|---|
| Formula | $CH_3-O-CO-CH_2-CH_2-CO-O-CH_3$ |
| Molecular Weight | 146.4 |
| Appearance | Clear Liquid |
| Odor | Mild, Pleasant |
| Melting Point, °C | 19 |
| Boiling Point, °C | 196 |
| Density, $G/CM^3$ at 20°C | 1.12 |
| Viscosity at 20°C, Centipoise | 2.87 |
| Flash Point, °F Tag Closed | 202 |

## FOR FURTHER INFORMATION

Du Pont Company
Polymer Intermediates Department
Intermediates Division
6514 Nemours Building
Wilmington, DE 19898
(302) 774-7591 or 774-9200

The facts stated and the recommendations made herein are based on our research and the research of others, and are believed to be accurate. No guarantee of their accuracy is made, however, and the product discussed is distributed without warranty on our part, express or implied, and upon conditions that recipients shall make their own tests to determine its suitability for their particular purposes. Likewise, statements concerning the possible uses of our product are not intended as recommendations to use it in the infringement of any patent.

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AB0000108072/7

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

POLYMER INTERMEDIATES DEPARTMENT

THANK YOU FOR YOUR CARD . . .

We have enclosed the information you requested on Du Pont Dibasic Esters (DBE's). As you review the literature, you can see that this family of Du Pont chemicals offers many varied applications. The prices of DBE's are:

| | Price Schedule (Lb.) | | | |
|---|---|---|---|---|
| | Bulk | 1-3 Drums | 4-11 Drums | Over 12 Drums |
| DBE and DBE-2 | $ .27 | $ .34 | $ .33 | $ .32 |
| DBE-3 | .26 | .33 | .32 | .31 |
| DBE-4 | .95 | 1.02 | 1.01 | 1.00 |
| DBE-5 | .36 | .43 | .42 | .41 |

Du Pont DBE's are readily available to meet your needs. If you'd like samples to get you started, please specify the product that interests you and contact me at:

Du Pont Company
Polymer Intermediates Dept.
1007 Market Street
Wilmington, Delaware 19898
Phone: (302) 774-7591

We thank you for your interest in DBE's and hope we can be of service to you in developing new and better products.

Sincerely,

Gerald P. Griffith

Gerald P. Griffith
Marketing Representative

GPG:pcr
Encs.



AB0000108072/8

Polymer Intermediates Department

Your Du Pont Polymer Intermediates Sales Representatives stand ready to handle your requirements. They will be glad to assist you on specific problems or questions which may arise in connection with your use of this product. Requests for technical assistance, experimental samples, prices, or shipping information can be obtained from our Wilmington sales office listed below.

*The facts stated and the recommendations made herein are based on our research and the research of others, and are believed to be accurate. No guarantee of their accuracy is made, however, and the product discussed is distributed without warranty on our part, express or implied, and upon conditions that recipients shall make their own tests to determine its suitability for their particular purposes. Likewise, statements concerning the possible uses of our product are not intended as recommendations to use it in the infringement of any patent.*

**Du Pont Company**
**Polymer Intermediates Dept.**
**Intermediates Division**
**1007 Market Street**
**Wilmington, DE 19898**

DU PONT

DuPont Specialty Chemicals
1007 Market Street
Wilmington, DE 19898

DuPont Specialty Chemicals

Dear Customer:

Thank you for your interest in DuPont Chemicals' products. The literature you requested is enclosed.

If you should require additional literature, technical information, or sample, please call me on 800-441-9408.

Sincerely,

Vonda L. McNair

Vonda L. McNair
Sr. Customer Specialist

Enclosure(s)

DU PONT

# PRODUCT SPECIFICATION

PRODUCT NAME: DIMETHYLAMINE ANHYDROUS

Number: 4130

DATE ISSUED: 03/22/93
DATE SUPERSEDED: 01/05/93

SIMILAR NAMES: DMA

| Property | Units | Minimum | Maximum | Typical Analysis | Test Method |
|---|---|---|---|---|---|
| SALES SPECIFICATIONS: | | | | | |
| Dimethylamine | (%) | 99.3 | | 99.8 | D3100.165.01.BE |
| Trimethylamine | (ppm) | | 3000 | 200 | D3100.165.01.BE |
| Monomethylamine | (ppm) | | 1000 | 500 | D3100.160.01.BE |
| Ammonia as NH3 | (ppm) | | 500 | 0 | D3100.165.01.BE |
| Water | (ppm) | | 3000 | 1000 | D3100.210.01.BE |
| Formaldehyde | (ppm) | | 50 | 0 | D3100.065.01.BE |

APPEARANCE: Clear, colorless liquid (under pressure) with an ammoniacal odor.

OTHER INFORMATION: DOT Hazard Classification: Flammable Gas.

PRODUCT NAME: DIMETHYLAMINE ANHYDROUS

Number: 4130

The information set forth herein is furnished free of charge and is based on technical data that Du Pont believes to be reliable. It is intended for use by persons having technical skill and at their own discretion and risk. Since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information. Nothing herein is to be taken as a license to operate under or a recommendation to infringe any patents.

PHYSICAL DATA:

| Property | Typical Value |
|---|---|
| Chemical Formula | (CH3)2NH |
| Molecular Weight | 45.08 |
| Boiling Point @760mm Hg, C (F) | 6.9 (44.4) |
| Freezing Point (in air @ 1 atm), C (F) | -92.2 (-133.9) |
| Vapor Density (air =1) | 1.55 |
| Liquid Density @ Sat'n Pressure | |
| @ 25C (77F), g/mL (Mg/m3) | 0/6496 |
| lb/gal | 5.42 |

For Further Information, Contact:

DuPont Company
Du Pont Chemicals
Wilmington DE. 19898
800 441-9442

For Further Information, Contact:

DuPont Company
Du Pont Chemicals
Wilmington DE. 19898
800 441-9442

[redacted]

SECTION 4

[redacted]

DU PONT

Du Pont Chemicals

MSDS MATERIAL SAFETY DATA SHEET

3220CR | Revised 12-Feb-91 | Printed 28-Apr-92

# SODIUM PERBORATE MONOHYDRATE

## MATERIAL IDENTIFICATION

| | | |
|---|---|---|
| Corporate Number | DU004647 | |
| Manufacturer/Distributor | DuPont<br>1007 Market Street<br>Wilmington, DE 19898 | |
| Phone Numbers | Product Information<br>Transport Emergency<br>Medical Emergency | 1-800-441-9442<br>CHEMTREC: 1-800-424-9300<br>1-800-441-3637 |
| Grade | TECHNICAL | |
| Chemical Family | PEROXYGEN SALT | |
| Trade Names and Synonyms | SODIUM METABORATE PEROXYHYDRATE | |
| CAS Name | PERBORIC ACID, SODIUM SALT, MONOHYDRATE | |
| CAS Number | 10332-33-9 | |
| Formula | $NaBO_2.H_2O_2$ | |
| TSCA Inventory Status | Reported/Included | |
| NPCA-HMIS Ratings | Health: 2<br>Flammability: 0<br>Reactivity: 0<br>Personal Protection rating to be supplied by user depending on use conditions. | |

## COMPONENTS

| Material | CAS Number | Percent |
|---|---|---|
| SODIUM PERBORATE MONOHYDRATE | 10332-33-9 | 97 |
| SODIUM METABORATE | 7775-19-2 | 3 |

(continued)

Printed on Recycled Paper

## PHYSICAL DATA

| | |
|---|---|
| Vapor Pressure | 10 mm Hg at 25°C (77°F) |
| Melting Point | 63°C (145°F) |
| Water Solubility | 1.5 WT % at 15°C (59°F) |
| pH | 10.0 to 10.4 (in water) |
| Odor | None |
| Form | Crystalline powder |
| Color | White |

Bulk Density : 550 to 750 kg/m3

## # HAZARDOUS REACTIVITY

| | |
|---|---|
| Instability | Stable at normal temperatures and storage conditions. |
| Incompatibility | Incompatible with mixtures containing heavy metal salts, combustible organic matter or moisture. |
| Polymerization | Polymerization will not occur. |

Decomposition : Can occur gradually, releasing controlled amounts of oxygen; not considered hazardous under foreseeable circumstances.

## FIRE AND EXPLOSION DATA

| | |
|---|---|
| | Will not burn. |
| **Fire and Explosion Hazards** | Releases oxygen at high temperatures. |
| **Extinguishing Media** | Water for fires in which sodium perborate monohydrate is involved. |
| **Special Fire Fighting Instructions** | Wear self-contained breathing apparatus. Wear full protective equipment. |

## # HEALTH HAZARD INFORMATION

Causes eye irritation or burns. Causes skin, nose, and throat irritation.

ANIMAL DATA:

Sodium Perborate Monohydrate

Oral LD50: 1500 mg/kg in rats

Sodium Metaborate

(continued)

## # HEALTH HAZARD INFORMATION (continued)

Skin Absorption LD50: >10,000 mg/kg in rabbits
Oral LD50 : 2330 mg/kg in rats

Sodium metaborate is a skin irritant, but is untested for eye irritancy. Sodium perborate monohydrate is untested for skin and eye irritancy, and for animal sensitization. However, a related material is a severe eye irritant and a mild skin irritant, but is not a skin sensitizer in animals. The effects in animals from single, high, oral doses to sodium perborate monohydrate include lung effects.

No animal test reports are available to define carcinogenic, mutagenic, developmental, or reproductive effects for the product, or for the individual components.

HUMAN HEALTH EFFECTS:

Based on animal studies with a related material, the human health effects of overexposure to the compound by skin or eye contact may be expected to include skin irritation with discomfort or rash; or eye irritation with discomfort, tearing, or blurring of vision. Prolonged eye exposure to the product may cause eye corrosion with corneal or conjunctival ulceration. High ingestion and skin exposure to similar boron compounds have led to nausea, vomiting, diarrhea, anuria, and twitching of facial muscles. Kidney damage may also occur.

| | |
|---|---|
| **Carcinogenicity** | None of the components in this material is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen. |
| **Exposure Limits** | |
| SODIUM PERBORATE MONOHYDRATE | |
| TLV (ACGIH) | None Established |
| PEL (OSHA) | Particulates Not Otherwise Regulated<br>15 mg/m3 - 8 Hr TWA - Total Dust<br>5 mg/m3 - 8 Hr TWA - Respirable Dust |
| Other | TLV (ACGIH) :<br>Particulates Not Otherwise Classified<br>10 mg/m3 - 8 Hr. TWA - Total Dust |
| **Safety Precautions** | Avoid breathing dust. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling. |

## FIRST AID

INHALATION: If inhaled, remove to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

IN CASE OF CONTACT: Immediately flush eyes with plenty of water for at least 15 minutes. Call a physician. Flush skin with water.

IF SWALLOWED: Immediately give two glasses of water and induce vomiting. Never give anything by mouth to an unconscious person. Call a physician.

| | |
|---|---|
| **Notes to Physician** | Activated charcoal or gastric lavage may be advisable for significant ingestions. To prepare activated charcoal slurry, suspend 50 gm of activated charcoal in 400 mL of water in a bottle and shake well. Administer 5 mL/kg of body weight, or 350 mL for an average adult. |

(continued)



AB0000042344/4

## PROTECTION INFORMATION

| | |
|---|---|
| **Generally Applicable Control Measures and Precautions** | Good general ventilation should be provided to keep dust concentrations below the exposure limit. |
| **Personal Protective Equipment** | |
| Eye/Face | Coverall chemical splash goggles. |
| Respirator | Use NIOSH/MSHA approved respiratory protection. |
| Protective Gloves | Impervious. |

## DISPOSAL INFORMATION

| | |
|---|---|
| **Spill, Leak, or Release** | NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.<br><br>Sweep up spillage. Flush spill area with water. |
| **Waste Disposal** | Comply with Federal, State, and local regulations. If approved, may be removed to land disposal area or flushed to sewer to waste treatment plant. Large spills may be neutralized with sulfuric acid or sodium bisulfate. |

## # SHIPPING INFORMATION

| | |
|---|---|
| **DOT** | |
| Proper Shipping Name | NOT REGULATED AS A HAZARDOUS MATERIAL BY DOT OR IMO |
| Hazard Class | NOT REGULATED |
| Shipping Containers | Railroad Hopper Car<br>Hopper Truck<br>1500-pound Super Sacks<br>50-pound Bags; Drums |

## STORAGE CONDITIONS

| | |
|---|---|
| | Store in cool place.<br><br>Keep containers dry. Avoid contamination. Do not store with heavy metal salts or combustible organic matter. |

## TITLE III HAZARD CLASSIFICATIONS

| | |
|---|---|
| Acute | Yes |
| Chronic | Yes |
| Fire | No |
| Reactivity | No |

(continued)

## TITLE III HAZARD CLASSIFICATIONS (continued)

| | |
|---|---|
| Pressure | No |

LISTS:

| | |
|---|---|
| Extremely Hazardous Substance | -No |
| CERCLA Hazardous Substance | -No |
| Toxic Chemicals | -No |

## ADDITIONAL INFORMATION AND REFERENCES

TSCA Inventory Status: Reported/Included as the anhydrous salt, CAS # 7632-04-4

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS:

W. J. Brock
Du Pont Chemicals
P. O. Box 80709, Chestnut Run
Wilmington, DE 19880-0709
302-999-4946

# Indicates updated section.

**End of MSDS**

DU PONT

Du Pont Chemicals

MSDS MATERIAL SAFETY DATA SHEET

3219CR | Revised 11-Mar-91 | Printed 28-Apr-92

# SODIUM PERBORATE TETRAHYDRATE

## MATERIAL IDENTIFICATION

| | | |
|---|---|---|
| Corporate Number | DU004666 | |
| Manufacturer/Distributor | Du Pont<br>1007 Market Street<br>Wilmington, DE 19898 | |
| Phone Numbers | Product Information<br>Transport Emergency<br>Medical Emergency | 1-800-441-9442<br>CHEMTREC: 1-800-424-9300<br>1-800-441-3637 |
| Grade | TECHNICAL | |
| Chemical Family | PEROXYGEN SALT | |
| Trade Names and Synonyms | SODIUM METABORATE PEROXYHYDRATE | |
| CAS Name | PERBORIC ACID, SODIUM SALT, TETRAHYDRATE | |
| CAS Number | 10486-00-7 | |
| Formula | $NaBO_2 \times H_2O_2 \times 3H_2O$ | |
| TSCA Inventory Status | Reported/Included | |
| NPCA-HMIS Ratings | Health: 3<br>Flammability: 0<br>Reactivity: 0<br>Personal Protection rating to be supplied by user depending on use conditions. | |

## COMPONENTS

| Material | CAS Number | Percent |
|---|---|---|
| SODIUM PERBORATE TETRAHYDRATE | 10486-00-7 | 98.6 |
| SODIUM METABORATE | 7775-19-2 | 1.4 |

(continued)

Printed on Recycled Paper

## MATERIAL IDENTIFICATION

UREA

MSDS NUMBER : 34411007
CORPORATE NUMBER : DU000651

Revision Date : 04-Dec-89
Date Printed : 02-Nov-90

MANUFACTURER/DISTRIBUTOR
PURCHASED MATERIAL

PHONE NUMBERS
TRANSPORT EMERGENCY : CHEMTREC: 1-800-429-9300
MEDICAL EMERGENCY : 1-800-441-3637

CHEMICAL FAMILY : AMIDES

TRADE NAMES / SYNONYMS
CARBAMIDE
CARBONYLDIAMINE
CARBAMIMIDIC ACID
CARBAMIDE RESIN
ISOUREA
B-I-K
PSEUDOUREA
SUPERCEL 3000

CAS NAME : UREA
CAS NUMBER : 57-13-6
FORMULA : NH2 CONH2
MOLECULAR WEIGHT : 60.06
NPCA-HMIS RATINGS : Health: 1 Flammability: 1 Reactivity: 1
Personal Protection rating to be supplied by user depending on use conditions.

## COMPONENTS

| Material | CAS Number | % |
|---|---|---|
| UREA | 57-13-6 | 100 |

## PHYSICAL DATA

Boiling Point : Decomposes before boiling
Vapor Pressure : 0.08 mm Hg at 0 deg C
Melting Point : 135 deg C (275 deg F)
Water Solubility : 1 Gram dissolves in 1 ml of water
pH : 7.2 For a 10% aqueous solution
Odor : Develops ammonia odor
Form : Prisms, pellets or powder
Color : Colorless to white

CONFIDENTIAL

(PHYSICAL DATA - Continued)

Specific Gravity : 1.34 at 20 deg C

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## HAZARDOUS REACTIVITY

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Instability : Stable at normal temperatures and storage conditions. Reacts with sodium or calcium hypochlorite and other reactive chlorine-containing material to form spontaneously explosive nitrogen trichloride. With nitric acid urea forms urea nitrate which decomposes explosively when heated.
Incompatibility : Incompatible with strong oxidizing agents.
Decomposition : Decomposes with heat. Hazardous gases/vapors produced are ammonia; decomposition in a flame or hot surface may give off toxic oxides of nitrogen.
Polymerization : Polymerization will not occur.

Nitrite fusion with urea to form cyanate must be done per standard instructions to avoid risk of explosion.

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## FIRE AND EXPLOSION DATA

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No Information Available.

**FIRE AND EXPLOSION HAZARDS**

Like most organic powders or crystals, under severe dusting conditions, this material may form explosive mixtures in air. Hazardous gases/vapors produced in fire are ammonia or oxides of nitrogen.

**EXTINGUISHING MEDIA**

Water. Water Spray. Foam. Dry Chemical. CO2.

**SPECIAL FIRE FIGHTING INSTRUCTIONS**

Keep personnel removed & upwind of fire. Wear self-contained breathing apparatus. Wear full protective equipment. Cool tank/container with water spray.

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## HEALTH HAZARD INFORMATION

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ANIMAL DATA

Skin Absorption LD50: > 21,400 mg/kg in rabbits
Oral ALD: 15,000 mg/kg in rats

The compound is a mild skin irritant, and is an eye irritant. Toxic effects described in animals from short exposures by inhalation, ingestion, or skin contact include

(HEALTH HAZARD INFORMATION - Continued)

central nervous system and nonspecific effects. Tests in bacterial or mammalian cell cultures demonstrate no mutagenic activity. Tests for embryotoxic activity and reproductive toxicity in animal species have been inconclusive, with positive results in some studies, and negative results in others.

HUMAN HEALTH EFFECTS

Overexposure by inhalation, ingestion, or skin or eye contact may initially include nonspecific discomfort, such as nausea, headache, or weakness; skin irritation or rash; or eye irritation, tearing, or blurring of vision. Significant skin permeation after contact appears unlikely. There are no reports of human sensitization.

Urea is a product of protein metabolism and occurs in urine and other body fluids. Adult human excretion rate is about 30g/day of urea.

**CARCINOGENICITY**

None of the components in this material is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

**EXPOSURE LIMITS**

UREA

| | | |
|---|---|---|
| AEL * | (Du Pont): | None Established |
| TLV | (ACGIH) : | None Established |
| PEL | (OSHA) : | Particulates Not Otherwise Regulated<br>15 mg/m3 - 8 Hr TWA - Total Dust<br>5 mg/m3 - 8 Hr TWA - Respirable Dust |
| WEEL | (AIHA) : | 10 mg/m3 (8 hr TWA) |

* AEL is Du Pont's Acceptable Exposure Limit.

**SAFETY PRECAUTIONS**

Avoid breathing dust. Avoid contact with eyes, skin, or clothing. Wash thoroughly after handling.

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**FIRST AID**

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**INHALATION**

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

**SKIN CONTACT**

Flush skin with water after contact. Wash contaminated clothing before reuse.

(FIRST AID - Continued)

EYE CONTACT

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION

No specific intervention is indicated as compound is not likely to be hazardous by ingestion. Consult physician if necessary.

## PROTECTION INFORMATION

GENERALLY APPLICABLE CONTROL MEASURES AND PROCEDURES

Keep away from heat, sparks and flames. Keep container tightly closed. Avoid dust generation.

Use ventilation that is adequate to keep airborne concentrations below exposure limits.

PERSONAL PROTECTIVE EQUIPMENT

EYE/FACE PROTECTION

Wear safety glasses. Wear coverall chemical splash goggles, and face shield when the possibility exists for eye or face contact from airborne material.

RESPIRATORS

A NIOSH/MSHA approved air purifying respirator with a dust cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air purifying respirators is limited. Use a positive pressure air supplied respirator if there is any potential for an uncontrolled release, exposure levels are not known, or any other circumstances where air purifying respirators may not provide adequate protection.

PROTECTIVE CLOTHING

Wear impervious clothing, such as gloves, apron, boots, or whole bodysuit made from Neoprene, as appropriate.

## DISPOSAL INFORMATION

AQUATIC TOXICITY

24 hour LC50, creek chub: > 16,000 mg/L

(DISPOSAL INFORMATION - Continued)

SPILL, LEAK, OR RELEASE

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.
Remove source of heat, sparks, flame, impact, friction or electricity. Dike spill. Recover undamaged and minimally contaminated material for reuse or reclamation. Shovel or sweep up.

WASTE DISPOSAL

Treatment, storage, transportation and disposal must be in accordance with applicable Federal, State/Provincial, and Local regulations. Do not flush to surface water or sanitary sewer system.

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## STORAGE CONDITIONS

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Store in well ventilated area. Store in cool place. Keep container tightly closed.

Keep dry. Avoid exposure to high temperatures.

---

## TITLE III HAZARD CLASSIFICATIONS

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| | |
|---|---|
| Acute | : Yes |
| Chronic | : No |
| Fire | : No |
| Reactivity | : No |
| Pressure | : No |

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The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS : E. I. du Pont de Nemours & Co.
Corporate MSDS Office - ERD
Barley Mill Plaza, P14-2150
Wilmington, DE 19880-0014
302-992-6704

End of MSDS

## MATERIAL IDENTIFICATION

**MIXED ACID SP-15**

MSDS NUMBER : 04213647

Revision Date : 06-Dec-89
Date Printed : 02-Nov-90

MANUFACTURER/DISTRIBUTOR
Du Pont
1007 Market Street
Wilmington, DE 19898

PHONE NUMBERS
PRODUCT INFORMATION : 1-(800)441-7515
TRANSPORT EMERGENCY : 1-(800)424-9300
MEDICAL EMERGENCY : 1-(800)441-3637

GRADE : PLANT INTERMEDIATE
CHEMICAL FAMILY : INORGANIC ACID

TRADE NAMES / SYNONYMS
EHN MIXED NITRATING ACID
ACID MIXED SP-15 - BLDG 4558

## COMPONENTS

| Material | CAS Number | % |
|---|---|---|
| *SULFURIC ACID | 7664-93-9 | 57.6 |
| *NITRIC ACID | 7697-37-2 | 24.7 |
| WATER | 7732-18-5 | 17.7 |

* Regulated as a toxic chemical under section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372.

## PHYSICAL DATA

Boiling Point : 82 to 118 deg C
Vapor Density : 2.8 (Air = 1.0)
Melting Point : -40 to 21 deg C
Evaporation Rate : > 1 (Butyl Acetate = 1.0)
Water Solubility : 100 WT % at 25 deg C *
Odor : ACIDIC
Form : LIQUID
Color : CLEAR TO TAN
Specific Gravity : 1.8 at 25 deg C

* Generates large amount of heat.

CONFIDENTIAL

## HAZARDOUS REACTIVITY

| | |
|---|---|
| **Instability** | : Unstable with heat. |
| **Incompatibility** | : Incompatible with water, organic compounds, metals and alkalis. |
| **Decomposition** | : Decomposes with heat. Hazardous gases/vapors produced are NOx, SO3 or H2. |
| **Polymerization** | : Polymerization will not occur. |

## FIRE AND EXPLOSION DATA

Non-flammable but may ignite some combustibles like wood on contact.

**FIRE AND EXPLOSION HAZARDS**

Strong Oxidizer. Hazardous gases/vapors produced in fire are NOx, SO3. Reacts with most metals to produce hydrogen.

**EXTINGUISHING MEDIA**

Small Fires: Dry Chemical or CO2.

Large Fires: Water Spray, Fog, or Foam.

**SPECIAL FIRE FIGHTING INSTRUCTIONS**

Evacuate personnel to a safe area. Keep personnel removed & upwind of fire. Wear self-contained breathing apparatus. Wear full protective equipment. Shut off source of fuel, if possible and without risk. Cool tank/container with water spray. Isolate area. Guard against intruders.

## HEALTH HAZARD INFORMATION

Principal Health Hazard: Liquid and vapor cause severe burns to eyes, skin and all body tissue. Harmful if inhaled, may cause delayed lung injury. Spillage may liberate dangerous gas.

Sulfuric acid:

INHALATION 1 hr LC50, rats; 347 ppm
ORAL LD50, rats; 2140 mg/kg

Nitric acid:

INHALATION 1 hr LC50, rats; 115 ppm
ORAL LD50: 50-500 mg/kg (species unspecified)

Components of this mixture are corrosive to skin and eye and are untested for animal sensitization. Toxic effects in animals include respiratory irritation, and corrosion of

(HEALTH HAZARD INFORMATION - Continued)

mucosal surfaces. Animal test reports are not available to define mutagenic, embryotoxic, or reproductive hazards for all components. Tests in animals demonstrate no carcinogenic activity.

Human health effects of overexposure to this mixture may include eye irritation with discomfort, tearing, blurring of vision; skin irritation with discomfort or rash; irritation of the upper respiratory passages; or erosion of dental surfaces. Higher exposures may lead to eye corrosion with corneal or conjunctival ulceration; skin burns or ulceration; temporary lung irritation effects with cough, discomfort, difficulty breathing, or shortness of breath; or possibly modest initial symptoms, followed in hours by severe shortness of breath requiring prompt medical attention. Ingestion may cause severe corrosion of mucosal surfaces. Significant skin permeation, and systemic toxicity after contact appears unlikely. There are no reports of human sensitization.

Individuals with preexisting diseases of the lungs may have increased susceptibility to toxicity of excessive exposures.

Although one limited study of refinery workers did suggest a possible link between sulfuric acid exposure and laryngeal cancer, the study was limited because of the small number of workers involved and the mixed exposures to several other materials, including diethyl sulfate, an IARC and NTP carcinogen. Based on the overall weight of evidence from all animal toxicity and human epidemiological studies, no cause-and-effect relationship between cancer and sulfuric acid exposure has been shown.

AQUATIC TOXICITY:

Sulfuric acid is slightly toxic to aquatic life. The 48 hour TLm in flounder is 100-300 ppm.

Nitric acid is moderately toxic to aquatic life.

**CARCINOGENICITY**

None of the components in this material is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

**APPLICABLE EXPOSURE LIMITS**

SULFURIC ACID

AEL * (Du Pont): 1 mg/m3 - 8 & 12 Hr. TWA
TLV (ACGIH) : 1 mg/m3
STEL: 3 mg/m3
PEL (OSHA) : 1 mg/m3

(HEALTH HAZARD INFORMATION - Continued)

NITRIC ACID

| | | |
|---|---|---|
| AEL * | (Du Pont) | : 5 mg/m3 - 8 & 12 Hr. TWA |
| TLV | (ACGIH) | : 2 ppm, 5.2 mg/m3<br>STEL 4 ppm, 10 mg/m3 |
| PEL | (OSHA) | : 2 ppm, 5 mg/m3<br>STEL 4 ppm, 10 mg/m3 |

* AEL is Du Pont's Acceptable Exposure Limit.

SAFETY PRECAUTIONS

Do not breathe vapor or mist. Do not get in eyes. Do not get on skin. Do not get on clothing. Wash thoroughly after handling. Wash clothing after use. Discard shoes if contaminated.

---

FIRST AID

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INHALATION: If inhaled, remove to fresh air immediately. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. (Wash clothing before reuse.)

EYE CONTACT: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION: If swallowed do NOT induce vomiting. Immediately give two glasses of water, or activated charcoal slurry. Never give anything by mouth to an unconscious person. Call a physician.

NOTES TO PHYSICIANS:

To prepare activated charcoal slurry suspend 50 g activated charcoal in 400 ml water in plastic bottle and shake well. Administer 5 ml/kg, or 350 ml for an average adult.

Sulfuric acid acts as a corrosive on mucous membranes, producing strong irritation, erythema, or blistering.

## PROTECTION INFORMATION

GENERALLY APPLICABLE CONTROL MEASURES AND PROCEDURES

Use only with adequate ventilation. Keep away from heat, sparks and flames. Do not mix with organic compounds, metals, or water. Do not consume food, drink or tobacco in the areas where they may become contaminated with this material.

PERSONAL PROTECTIVE EQUIPMENT

| | |
|---|---|
| Eye/Face | : Coverall chemical splash goggles. |
| Respirator | : Air supplied respirator. |
| Additional | : Chemical suit. |
| Protective Gloves | : Acid proof gauntlet gloves |

## DISPOSAL INFORMATION

SPILL, LEAK, OR RELEASE

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.
Evacuate personnel, thoroughly ventilate area, use self-contained breathing apparatus. Keep upwind of leak - evacuate until gas has dispersed. Dissipate vapor with water spray. Dike spill. Neutralize with lime or soda ash.

WASTE DISPOSAL

Treatment, storage, transportation and disposal must be in accordance with applicable Federal, State/Provincial, and Local regulations. Do not flush to surface water or sanitary sewer system.

## STORAGE CONDITIONS

Store in well ventilated area. Store in cool place. Store in accordance with National Fire Protection Assn regulations. Store in accordance with Federal Regulations. Do not store or consume food, drink or tobacco in areas where they may become contaminated with this material.

Provide pressure relief on containers.

## ADDITIONAL INFORMATION AND REFERENCES

Follow Building Operating Instructions.
THIS MSDS CLONED FROM MIXED ACID MSDS#04212969

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The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS : Mendel T. Gordon
E. I. du Pont Co.
Chambers Work
Jackson Lab
609-540-3772

**End of MSDS**

Du Pont Material Safety Data Sheet

MATERIAL IDENTIFICATION

NUMBER : 04210580
NAME : FERRIC CHLORIDE

CHEMICAL FAMILY : IRON SALT
TRADE NAMES AND SYNONYMS :
FERRIC CHLORIDE ANHYDROUS SUBLIMED
IRON TRICHLORIDE
FLORES MARTIS
IRON (III) CHLORIDE
IRON SESQUICHLORIDE

CAS NUMBER : 7705-08-0
FORMULA : Fe Cl3
MOLECULAR WEIGHT : 162.20
MANUFACTURER/DISTRIBUTOR: PVS CHEMICALS, INC.
11001 Harper
Detroit
Michigan
48213
PRODUCT INFORMATION PHONE : 313-921-1200
TRANSPORTATION EMERGENCY PHONE : CHEMTREC: 1-800-424-9300
MEDICAL EMERGENCY PHONE : 313-921-1200

**********

COMPONENTS

| Material | CAS Number | % |
|---|---|---|
| FERRIC CHLORIDE | 7705-08-0 | 95 |
| FERROUS CHLORIDE | 7758-94-3 | 2 |

**********

PHYSICAL DATA

Boiling Point : 305 to 317 deg C at 760 mm Hg.
Vapor Pressure : 1.0 mm Hg at 194 deg C
Melting Point : -306 deg C
Solubility in Water : 100 WT %
Odor : Slightly acidic
Form : Granular solid16
Color : Greenish black
Specific Gravity : 2.9 at 25 deg C

**********

HAZARDOUS REACTIVITY

Instability : Stable. Reacts with water to produce hydrochloric fumes.
Incompatibility : Incompatible with water.
Decomposition : Decomposes with heat. Decomposition temperature 290 deg C. Hazardous gases/vapors produced are Chlorine
Polymerization : Polymerization will not occur.

FIRE AND EXPLOSION DATA

Non-flammable.

FIRE AND EXPLOSION HAZARDS

Hazardous gases/vapors produced in fire are Chlorine.

EXTINGUISHING MEDIA

Use media suitable for surrounding fire.

SPECIAL FIRE FIGHTING INSTRUCTIONS

Wear full protective equipment. Cool tank/container with water spray.

**********

HEALTH HAZARD INFORMATION

Toxicity:
Oral LD50 (rat): 1932 mg/kg.
Dermal (rabbit): caused erythema to skin.

Effects of overexposure:
Contact can cause irritation or corrosive burns to human tissue. Contact with eyes may cause irritation and may be corrosive and result in permanent visual loss unless removed quickly by through irrigation with water. Moderate skin irritant. Ingestion may cause severe liver and/or kidney damage. High heat of solution (353 BTU/LB) can cause severe burns if in contact with moist skin or mucous tissue.

Carcinogenicity

None of the components in this chemical is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

Exposure Limits for FERRIC CHLORIDE

| | | |
|---|---|---|
| TLV * | (ACGIH) | : None Established |
| PEL | (OSHA) | : None Established |
| Other | | : Iron Salts, as Fe: TLV: 1 mg/m3 |

* TLV is a registered trademark.

Safety Precautions

Do not get in eyes. Avoid breathing vapors or mist. Avoid contact

(HEALTH HAZARD INFORMATION - CONTINUED)

with skin. Avoid contact with clothing. Wash thoroughly after handling. Wash clothing after use. Discard shoes if contaminated.

**********

FIRST AID

INHALATION:
If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician. Corrosive to respiratory tract.

SKIN CONTACT:
Call a physician. In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.

EYE CONTACT:
In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION:
If swallowed, induce vomiting immediately by giving two glasses of water and sticking finger down throat. Never give anything by mouth to an unconscious person. Call a physician.

**********

PROTECTION INFORMATION

Generally Applicable Control Measures and Procedures

Use only with adequate ventilation. Keep container in a cool place. Keep container tightly closed. Do not mix with water. Do not consume food, drink or tobacco in the areas where they may become contaminated with this material.

Personal Protective Equipment

| | |
|---|---|
| Eye/Face | : Coverall chemical splash goggles. Eye wash and safety showers. Do not wear contact lens |
| Filter Respirator | : full face with dust filter. |
| Additional | : as needed to prevent contact with skin clothing and shoes. |
| Protective Gloves | : rubber, neoprene. |

**********

DISPOSAL INFORMATION

Spill, Leak, or Release

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.
Shovel or sweep up.

(DISPOSAL INFORMATION - CONTINUED)

Superfund reportable discharge = 1000 lbs.
Flush residue with large amounts of water.

Waste Disposal

Cleaned-up material is a RCRA Hazardous Waste. Treatment, storage, transportation and disposal must be in accordance with applicable Federal, State/Provincial, and Local regulations.

**********

SHIPPING INFORMATION

DOT

Proper Shipping Name :
FERRIC CHLORIDE, SOLID
Hazard Class : ORM-B
UN/NA No. : UN 1773

Reportable Quantity : 1000 lbs.

**********

STORAGE CONDITIONS

Store in well ventilated area. Store in cool place. Keep container tightly closed. Do not store or consume food, drink or tobacco in areas where they may become contaminated with this material. Store container in a dry place.

**********

ADDITIONAL INFORMATION AND REFERENCES

The above information is based on a MSDS issued by:
PVS Chemicals, Inc. - January 1, 1986

Follow standard plant procedures and safety rules for first aid and personnel protective equipment when handling this material.

**********

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Date of latest Revision : 88/04/12
Responsibility for MSDS : MSDS Coordinator.
E. I. Du Pont Co.
Chambers Works
C & P
609-540-3039

Du Pont Material Safety Data Sheet

MATERIAL IDENTIFICATION

| | |
|---|---|
| NUMBER | : 7410CR |
| CORPORATE NUMBER | : DU000003 |
| NAME | : Chlorine |
| CHEMICAL FAMILY | : HALOGEN |
| CAS NAME | : CHLORINE |
| CAS NUMBER | : 7782-50-5 |
| FORMULA | : Cl2 |
| TSCA INVENTORY STATUS | : Reported/Included |
| NFPA RATING | : Health: 3 Flammability: 0 Reactivity: 0 |
| NPCA-HMIS RATING | : Health: 3 Flammability: 0 Reactivity: 1 Personal Protection rating to be supplied by user depending on use conditions. |
| MANUFACTURER/DISTRIBUTOR | : E.I. du Pont de Nemours & Co., Inc. 1007 Market Street Wilmington, DE 19898 |
| PRODUCT INFORMATION PHONE | : 1-(800)441-7515 |
| TRANSPORTATION EMERGENCY PHONE | : 1-(800)424-9300 |
| MEDICAL EMERGENCY PHONE | : 1-(800)441-3637 |

**********

COMPONENTS

| Material | CAS Number | % |
|---|---|---|
| *CHLORINE | 7782-50-5 | 100 |

* Regulated as a toxic chemical under section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372.

**********

PHYSICAL DATA

| | |
|---|---|
| Boiling Point | : -34.6 deg C (-30.1 deg F) at 760 mm Hg. |
| Vapor Pressure | : 4800 mm Hg at 20 deg C |
| Vapor Density | : 2.5 (Air = 1.0) |
| Melting Point | : -101 deg C (-149.8 deg F) |
| Evaporation Rate | : > 1 (Butyl Acetate = 1.0) |
| Solubility in Water | : 0.57 WT % at 30 deg C |
| Odor | : Acrid, Threshold : 0.2-0.4ppm |
| Form | : Gas @STP/Liquid |
| Color | : Gas: Greenish yellow; Liquid: Amber |
| Specific Gravity | : 1.56 at -35 deg C Liquid |

**********

HAZARDOUS REACTIVITY

| | |
|---|---|
| Instability | : Dry chlorine is stable in steel containers at room temperature. |
| Decomposition | : Toxic and corrosive hydrochloric and hypochlorous acids are formed with water or steam. |
| Polymerization | : Polymerization will not occur. |
| Incompatibility | : Reacts explosively or forms explosive compounds with acetylene, turpentine, |

(HAZARDOUS REACTIVITY - CONTINUED)

fuel gas, hydrogen, ether, ammonia gas, and finely divided metals. May also form explosive mixtures with combustible organic vapors and cause runaway reactions with certain polymers if contacted in confined areas. Combines with carbon monoxide and sulfur dioxide to form toxic and corrosive phosgene and sufuryl chloride.

**********

FIRE AND EXPLOSION DATA

Will not burn in air.

FIRE AND EXPLOSION HAZARDS

Strong Oxidizer.
Contact with combustible materials may cause fire. Dangerous when heated, emits highly toxic fumes.

EXTINGUISHING MEDIA

As appropriate for combustibles in area.

SPECIAL FIRE FIGHTING INSTRUCTIONS

Keep personnel removed & upwind of fire. Wear self-contained breathing apparatus. Wear full protective equipment. Shut off source of fuel, if possible and without risk. Cool tank/container with water spray.

**********

HEALTH HAZARD INFORMATION

Liquid Chlorine is corrosive to the skin and eyes. Chlorine gas is extremely irritating to the nose, throat and lungs.

ANIMAL DATA:

Inhalation 1 hour LC50: 293 ppm in rats

Toxic effects demonstrated in animals from short exposures by inhalation include upper and lower respiratory tract effects. Longer term exposures by inhalation include respiratory, kidney, liver, and lung effects. Toxic effects demonstrated in animals by the oral route include irritation and corrosion of mucosal surfaces, kidney, liver, and lung effects, and by long term inhalation include respiratory effects, and eye irritation. No significant adverse effects were observed from long term administration of the compound in the animals diet. Animal testing indicates this compound

(HEALTH HAZARD INFORMATION - CONTINUED)

does not have carcinogenic, or reproductive effects. Tests for embryotoxic activity in animals have been inconclusive, with positive results in some studies, and negative results in others. Tests in bacterial cell cultures demonstrate mutagenic activity.

HUMAN HEALTH EFFECTS OF OVEREXPOSURE:

Contact with liquid Chlorine may cause skin and eyes burns. Eye contact with Chlorine gas may cause eye irritation with tearing, or blurring of vision. Inhalation may include nausea, headache, or weakness; corrosion of teeth; or irritation of the upper respiratory passages. High exposures to Chlorine gas may cause skin irritation with discomfort or rash; temporary lung irritation, cough, difficulty breathing, or shortness of breath; followed in hours by severe shortness of breath, requiring prompt medical attention; asthma-like reactions with shortness of breath, wheezing, or cough, possibly occurring on subsequent reexposure to concentrations below established exposure limits; or temporary alteration of the heart's electrical activity with irregular pulse, palpitations, or inadequate circulation; or death from gross overexposure.

Epidemiologic studies demonstrate no significant risk of human cancer from exposure to this compound. Individuals with preexisting diseases of the eyes, skin, lungs, central nervous system, or cardiovascular system may have increased susceptibility to the toxicity of excessive exposures.

Carcinogenicity

None of the components in this chemical is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

4 Exposure Limits for Chlorine

| | | |
|---|---|---|
| TLV * | (ACGIH) | : 0.5 ppm, 1.5 mg/m3 - 8 Hr. TWA<br>STEL 1 ppm, 3 mg/m3 |
| PEL | (OSHA) | : 0.5 ppm, 1.5 mg/m3 - 8 Hr. TWA<br>STEL 1 ppm, 3 mg/m3 |

* TLV is a registered trademark.

Safety Precautions

Do not breathe gas. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling.

FIRST AID

INHALATION:

If inhaled, remove to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician.

EYE CONTACT:

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION:

If swallowed, do not induce vomiting. Give large quantities of water. Call a physician immediately. Never give anything by mouth to an unconscious person.

**********

PROTECTION INFORMATION

Generally Applicable Control Measures and Procedures

Use ventilation that is adequate to keep airborne concentrations below exposure limits.

Personal Protective Equipment

Have available and wear as appropriate for exposure conditions: chemical splash goggles; safety glasses, (side shields preferred); full length face shield; gloves, pants, jacket, apron, and footwear or acid suit made of Butyl, Chemfab, Chloropel, Neoprene, Nitrile, "Saranex" coated Tyvek, Urethane, or Viton and OSHA permissible respiratory protection.

**********

DISPOSAL INFORMATION

Aquatic Toxicity :
The 96-hr LC50, rainbow trout: 0.132 Mg/L.

Spill, Leak, or Release

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS

(DISPOSAL INFORMATION - CONTINUED)

before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.
Evacuate personnel, thoroughly ventilate area, use self-contained breathing apparatus. Keep upwind of leak - evacuate until gas has dispersed. Dissipate vapor with water spray. Prevent liquid from entering sewers, waterways or low areas.
Superfund reportable discharge = 10 lbs.
Specially trained personnel should stop the leak if possible, dike the spill, and neutralize any water that may be used with caustic. Comply with Federal, State, and local regulations on reporting releases.

Waste Disposal

Treatment, storage, transportation and disposal must be in accordance with applicable Federal, State/Provincial, and Local regulations.

**********

SHIPPING INFORMATION

DOT
Proper Shipping Name :
CHLORINE
Hazard Class : NON-FLAMMABLE GAS
UN/NA No. : 1017
DOT Label(s) : NON-FLAMMABLE GAS POISON
DOT Placard : CHLORINE

DOT/IMO
Proper Shipping Name :
CHLORINE
Hazard Class : POISON GAS, 2.3
UN No. : 1017
DOT/IMO Label : POISON GAS

Reportable Quantity : 10 lbs.
Shipping Containers
Tank Car
If material is shipped in quantities greater than 10 lbs. per container, the Proper Shipping Name is RQ CHLORINE.

**********

STORAGE CONDITIONS

Store in a cool place away from heat, sparks, and flame.
Keep containers tightly closed.

TITLE III HAZARD CLASSIFICATIONS

Acute: Yes
Chronic: Yes
Fire: No
Reactivity: Yes
Pressure: Yes

LISTS:

Extremely Hazardous Substance - Yes - (THPQ-100) (RQ-10)
CERCLA Hazardous Substance - Yes - (RQ-10)
Toxic Chemicals - Yes

**********

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Date of latest Revision : 89/02/10
Latest Revision Number : 4
Responsibility for MSDS : E. I. Du Pont de Nemours & Co.
Corporate MSDS Office - ERD
Barley Mill Plaza, P14-2150
Wilmington, DE 19898
302-992-6704

Du Pont Material Safety Data Sheet

MATERIAL IDENTIFICATION

NUMBER : 04213318
NAME : CAUSTIC SODA SOLUTION

GRADE : INTERMEDIATE
CHEMICAL FAMILY : ALKALI
TRADE NAMES AND SYNONYMS :
SODIUM HYDROXIDE (liquid)
SODA - CAUSTIC
SODIUM HYDROXIDE LIQUID
SODIUM HYDROXIDE SOLUTION
SODIUM HYDRATE SOLUTION
CAUSTIC SODA 20%
SODA CAUSTIC LIQUID 20%
SODA CAUSTIC-A - BLDG 9031

CAS NAME : SODIUM HYDROXIDE (liquid)
CAS NUMBER : 1310-73-2
FORMULA : NaOH
MOLECULAR WEIGHT : 40.00
MANUFACTURER/DISTRIBUTOR: E.I. du Pont de Nemours & Co., Inc.
1007 Market Street
Wilmington, DE 19898
PRODUCT INFORMATION PHONE : 1-(800)441-7515
TRANSPORTATION EMERGENCY PHONE : 1-(800)424-9300
MEDICAL EMERGENCY PHONE : 1-(800)441-3637

**********

COMPONENTS

| Material | CAS Number | % |
|---|---|---|
| *Sodium Hydroxide | 1310-73-2 | 0-20 |
| Water | 7732-18-5 | 80-100 |

* Regulated as a toxic chemical under section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372.

**********

PHYSICAL DATA

Boiling Point : 100 to 105 deg C at 760 mm Hg.
Melting Point : -27 to 0 deg C at 760 mm Hg.
Odor : Odorless
Form : Liquid Solution
Color : Colorless to light amber.
Specific Gravity : 1.15 at 20 deg C

**********

HAZARDOUS REACTIVITY

Instability : Stable.
Incompatibility : Incompatible with strong acids, copper, wool, leather, aluminum, tin, zinc, nitrocarbons, phosphorus and chlorinated hydrocarbons.

(HAZARDOUS REACTIVITY - CONTINUED)

Decomposition : Decomposes by reaction with aluminum, tin, and zinc forming flammable hydrogen gas.
Polymerization : Polymerization will not occur.

**********

FIRE AND EXPLOSION DATA

Will not burn.

FIRE AND EXPLOSION HAZARDS

None.

EXTINGUISHING MEDIA

This material is not combustible. Use media suitable for surrounding materials.

SPECIAL FIRE FIGHTING INSTRUCTIONS

Material may react with other materials such as aluminum, tin, or zinc forming flammable hydrogen gas.

Water flooding recommended to reduce the rate of reaction.

**********

HEALTH HAZARD INFORMATION

EXPOSURE LIMITS:

Sodium hydroxide:

AEL [DUPONT]: 2 mg/m3 (15 min TWA)
TLV [ACGIH]: 2 mg/m3, ceiling
PEL [OSHA]: 2 mg/m3

DEGREE OF TOXICITY (MIXTURE):

ORAL: Moderate

AQUATIC TOXICITY:

Sodium hydroxide is slightly toxic to aquatic life. The 48 hour LC50 in bluegill sunfish is 99 mg/l.

HEALTH HAZARD INFORMATION:

Principal Health Hazards: Corrosive to skin, eyes and mucous membranes.

Sodium hydroxide:

(HEALTH HAZARD INFORMATION - CONTINUED)

ORAL ALD, rabbits; 500 mg/kg

Sodium hydroxide is corrosive to skin and eyes and is untested for animal sensitization. Toxic effects in animals include irritation or corrosion of mucosal surfaces. No animal test reports are available to define embryotoxic or reproductive hazards. Animal testing indicates that this compound does not have carcinogenic nor mutagenic effects.

Human health effects of overexposure to sodium hydroxide may include eye irritation with discomfort, tearing, or blurring of vision; skin burns or ulceration; or irritation of upper respiratory passages. There are no reports of human sensitization.

Carcinogenicity

None of the components in this chemical is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

Exposure Limits for CAUSTIC SODA SOLUTION

AEL * (DuPont): See Above
TLV ** (ACGIH) : See Above
PEL (OSHA) : See Above

* AEL is DuPont's Acceptable Exposure Limit.
** TLV is a registered trademark.

Safety Precautions

Do not breathe vapor or mist. Do not get in eyes. Do not get on skin. Do not get on clothing. Wash thoroughly after handling. Wash clothing after use. Discard shoes if contaminated.

**********

FIRST AID

INHALATION: If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT: Flush skin with plenty of water after excessive contact.

EYE CONTACT: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION: If swallowed, do not induce vomiting. Immediately give two glasses of water, or activated

(FIRST AID - CONTINUED)

charcoal slurry. Never give anything by mouth to an unconscious person. Call a physician.

NOTES TO PHYSICIANS:

To prepare activated charcoal slurry suspend 50 g activated charcoal in 400 ml water in plastic bottle and shake well. Administer 5 ml/kg, or 350 ml for an average adult.

**********

PROTECTION INFORMATION

Generally Applicable Control Measures and Procedures

Use a totally enclosed system. Do not mix with Acids Do not consume food, drink or tobacco in the areas where they may become contaminated with this material.

Personal Protective Equipment

| | |
|---|---|
| Eye/Face | : Full Acid Suit required when handling material. |
| Additional | : Full Acid Suit with Rubber Boots when handling material. |
| Protective Gloves | : Rubber |

**********

DISPOSAL INFORMATION

Spill, Leak, or Release

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.
Flush all spills to the Building Ditch system with copious quantities of water.

Waste Disposal

Any spilled material should be flushed to the Building Ditch System.

**********

STORAGE CONDITIONS

Store in steel or plastic tanks.

**********

ADDITIONAL INFORMATION AND REFERENCES

Follow Building Operating Instructions.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Date of latest Revision : 86/10/09
Responsibility for MSDS : R. F. Murphy
Petchem Office/Chambers Works
609-540-4320

Du Pont Material Safety Data Sheet

MATERIAL IDENTIFICATION

NUMBER : 04213318
NAME : CAUSTIC SODA SOLUTION

GRADE : INTERMEDIATE
CHEMICAL FAMILY : ALKALI
TRADE NAMES AND SYNONYMS :
SODIUM HYDROXIDE (liquid)
SODA - CAUSTIC
SODIUM HYDROXIDE LIQUID
SODIUM HYDROXIDE SOLUTION
SODIUM HYDRATE SOLUTION
CAUSTIC SODA 20%
SODA CAUSTIC LIQUID 20%
SODA CAUSTIC-A - BLDG 9031

CAS NAME : SODIUM HYDROXIDE (liquid)
CAS NUMBER : 1310-73-2
FORMULA : NaOH
MOLECULAR WEIGHT : 40.00
MANUFACTURER/DISTRIBUTOR: E.I. du Pont de Nemours & Co., Inc.
1007 Market Street
Wilmington, DE 19898
PRODUCT INFORMATION PHONE : 1-(800)441-7515
TRANSPORTATION EMERGENCY PHONE : 1-(800)424-9300
MEDICAL EMERGENCY PHONE : 1-(800)441-3637

**********

COMPONENTS

| Material | CAS Number | % |
|---|---|---|
| *Sodium Hydroxide | 1310-73-2 | 0-20 |
| Water | 7732-18-5 | 80-100 |

* Regulated as a toxic chemical under section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372.

**********

PHYSICAL DATA

Boiling Point : 100 to 105 deg C at 760 mm Hg.
Melting Point : -27 to 0 deg C at 760 mm Hg.
Odor : Odorless
Form : Liquid Solution
Color : Colorless to light amber.
Specific Gravity : 1.15 at 20 deg C

**********

HAZARDOUS REACTIVITY

Instability : Stable.
Incompatibility : Incompatible with strong acids, copper, wool, leather, aluminum, tin, zinc, nitrocarbons, phosphorus and chlorinated hydrocarbons.

(HAZARDOUS REACTIVITY - CONTINUED)

Decomposition : Decomposes by reaction with aluminum, tin, and zinc forming flammable hydrogen gas.
Polymerization : Polymerization will not occur.

**********

FIRE AND EXPLOSION DATA

Will not burn.

FIRE AND EXPLOSION HAZARDS

None.

EXTINGUISHING MEDIA

This material is not combustible. Use media suitable for surrounding materials.

SPECIAL FIRE FIGHTING INSTRUCTIONS

Material may react with other materials such as aluminum, tin, or zinc forming flammable hydrogen gas.

Water flooding recommended to reduce the rate of reaction.

**********

HEALTH HAZARD INFORMATION

EXPOSURE LIMITS:

Sodium hydroxide:

AEL [DUPONT]: 2 mg/m3 (15 min TWA)
TLV [ACGIH]: 2 mg/m3, ceiling
PEL [OSHA]: 2 mg/m3

DEGREE OF TOXICITY (MIXTURE):

ORAL: Moderate

AQUATIC TOXICITY:

Sodium hydroxide is slightly toxic to aquatic life. The 48 hour LC50 in bluegill sunfish is 99 mg/l.

HEALTH HAZARD INFORMATION:

Principal Health Hazards: Corrosive to skin, eyes and mucous membranes.

Sodium hydroxide:

(HEALTH HAZARD INFORMATION - CONTINUED)

ORAL ALD, rabbits; 500 mg/kg

Sodium hydroxide is corrosive to skin and eyes and is untested for animal sensitization. Toxic effects in animals include irritation or corrosion of mucosal surfaces. No animal test reports are available to define embryotoxic or reproductive hazards. Animal testing indicates that this compound does not have carcinogenic nor mutagenic effects.

Human health effects of overexposure to sodium hydroxide may include eye irritation with discomfort, tearing, or blurring of vision; skin burns or ulceration; or irritation of upper respiratory passages. There are no reports of human sensitization.

Carcinogenicity

None of the components in this chemical is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

Exposure Limits for CAUSTIC SODA SOLUTION

AEL * (DuPont): See Above
TLV ** (ACGIH) : See Above
PEL (OSHA) : See Above

* AEL is DuPont's Acceptable Exposure Limit.
** TLV is a registered trademark.

Safety Precautions

Do not breathe vapor or mist. Do not get in eyes. Do not get on skin. Do not get on clothing. Wash thoroughly after handling. Wash clothing after use. Discard shoes if contaminated.

**********

FIRST AID

INHALATION: If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT: Flush skin with plenty of water after excessive contact.

EYE CONTACT: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION: If swallowed, do not induce vomiting. Immediately give two glasses of water, or activated

(FIRST AID - CONTINUED)

charcoal slurry. Never give anything by mouth to an unconscious person. Call a physician.

NOTES TO PHYSICIANS:

To prepare activated charcoal slurry suspend 50 g activated charcoal in 400 ml water in plastic bottle and shake well. Administer 5 ml/kg, or 350 ml for an average adult.

**********

PROTECTION INFORMATION

Generally Applicable Control Measures and Procedures

Use a totally enclosed system. Do not mix with Acids Do not consume food, drink or tobacco in the areas where they may become contaminated with this material.

Personal Protective Equipment

| | |
|---|---|
| Eye/Face | : Full Acid Suit required when handling material. |
| Additional | : Full Acid Suit with Rubber Boots when handling material. |
| Protective Gloves | : Rubber |

**********

DISPOSAL INFORMATION

Spill, Leak, or Release

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.
Flush all spills to the Building Ditch system with copious quantities of water.

Waste Disposal

Any spilled material should be flushed to the Building Ditch System.

**********

STORAGE CONDITIONS

Store in steel or plastic tanks.

**********

ADDITIONAL INFORMATION AND REFERENCES

Follow Building Operating Instructions.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Date of latest Revision : 86/10/09
Responsibility for MSDS : R. F. Murphy
Petchem Office/Chambers Works
609-540-4320

Du Pont Material Safety Data Sheet

## MATERIAL IDENTIFICATION

NUMBER : 2004CR
CORPORATE NUMBER : DU000034
NAME : Sodium Hydroxide (2) (50% Solution)

CHEMICAL FAMILY : ALKALI
TRADE NAMES AND SYNONYMS :
Caustic Soda Solution
Lye Solution
Sodium Hydrate Solution
White Caustic Solution
Liquid Caustic Soda
Sodium Hydroxide - 50%

CAS NAME : SODIUM HYDROXIDE
CAS NUMBER : 1310-73-2
FORMULA : NaOH
MOLECULAR WEIGHT : 40.01
TSCA INVENTORY STATUS : Reported/Included
NFPA RATING : Health: 3 Flammability: 0 Reactivity: 1
NPCA-HMIS RATING : Health: 3 Flammability: 0 Reactivity: 1
Personal Protection rating to be supplied by user depending on use conditions.
MANUFACTURER/DISTRIBUTOR: E.I. du Pont de Nemours & Co., Inc.
1007 Market Street
Wilmington, De 19898
PRODUCT INFORMATION PHONE : 1-(800)441-7515
TRANSPORTATION EMERGENCY PHONE : 1-(800)424-9300
MEDICAL EMERGENCY PHONE : 1-(800)441-3637

**********

## COMPONENTS

| Material | CAS Number | % |
|---|---|---|
| *SODIUM HYDROXIDE | 1310-73-2 | 50 |
| WATER | 7732-18-5 | 50 |

* Regulated as a toxic chemical under section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372.

**********

## PHYSICAL DATA

Boiling Point : 142 deg C (287.6 deg F) at 760 mm Hg.
Vapor Pressure : 2.9 mm Hg at 25 deg C (77 deg F)
: 18 mm Hg at 65.5 deg C (150 deg F)
Melting Point : 13 deg C (55 deg F)
Solubility in Water : Infinite
pH : >12
Odor : None
Form : Liquid
Color : Clear to sightly turbid
Specific Gravity : 1.530 at 20 deg C (68 deg F)

HAZARDOUS REACTIVITY

Instability : Stable. Reacts with aluminum, tin,and zinc, nitrocarbons,trichloroethylene, phosphorus. Product absorbs water and carbon dioxide from the air.
Incompatibility : Incompatible with acid, iron, copper,wool,leather, hydroquinone, organic halogens.
Decomposition : Decomposes by reaction with amphoteric metals such as aluminum,tin,and zinc to form flammable and explosive hydrogen gas.
Polymerization : Polymerization will not occur.
May react violently with water with boiling, spattering, or violent eruption if added too rapidly, becomes too concentrated in one area, or is added to hot or cold liquid.

Always add caustic soda to luke warm (80-100 F) liquids with constant agitation. Never add water to caustic soda solutions or start with hot or cold liquids.

**********

FIRE AND EXPLOSION DATA

Will not burn.

FIRE AND EXPLOSION HAZARDS

Contact with aluminum, tin, and zinc metals can generate flammable and explosive hydrogen gas.

EXTINGUISHING MEDIA

Use media appropriate for surrounding material.
Water may liberate large amounts of heat and cause spattering if it contacts sodium hydroxide solutions.
Prevent water from entering containers.

SPECIAL FIRE FIGHTING INSTRUCTIONS

Evacuate personnel to a safe area. Keep personnel removed & upwind of fire. Wear self-contained breathing apparatus. Wear full protective equipment. Cool tank/container with water spray. Fight fire from a distance, heat may rupture containers.

**********

HEALTH HAZARD INFORMATION

This product is corrosive to the skin, eyes, and all body tissues If not removed from the skin and eyes immediately, it can produce severe burns and deep ulceration of the skin and cause corneal and conjunctival ulceration of the eyes with permanent eye damage and loss of sight. Ingestion can cause

(HEALTH HAZARD INFORMATION - CONTINUED)

perforation of the gastrointestinal tract and is corrosive to the mouth, throat, esophagus, and stomach. It can cause severe abdominal pain, vomiting, diarrhea, collapse and death. Inhalation of vapors or mist may lead to irritation of the nose and upper respiratory tract.

ANIMAL DATA:

Sodium Hydroxide:

Oral ALD: 500 mg/kg in rabbits

In animals this compound is corrosive to skin and eyes.

The effects in animals from short exposure by inhalation include acute laryngitis.

Rats ingesting 0.8 percent sodium hydroxide solution resulted in extensive necrosis of the gastrointestinal tract and death occurred when cats were administered 1 mL of a 30.5% solution.

Animal testing indicates that this compound does not have carcinogenic effects. Tests in bacterial or mammalian cell cultures demonstrate no mutagenic activity.

HUMAN HEALTH EFFECTS OF OVEREXPOSURE:

Skin and eye contact contact may include skin burns or ulceration and eye corrosion with corneal or conjunctival ulceration with permanent eye damage.

Ingestion may include abdominal discomfort, nausea, severe pain, diarrhea, and collapse.

Inhalation may include irritation of the upper respiratory passages.

An in-plant epidemiology study of 26 kidney cancer deaths was conducted at a facility which produced multiple chemicals including chlor-alkali products. Significantly elevated risk estimates were noted for the chlorine production area. While presumptive exposure to asbestos and sodium hydroxide were judged likely to occur in chlorine cell maintenance, each case may also have been exposed to at least one of 64 different chemicals. These increased risk estimates are based on a small number of exposed persons and may be spurious due to the problem of multiple comparisons.

Individuals with preexisting diseases of the lungs may

(HEALTH HAZARD INFORMATION - CONTINUED)

be more susceptable to the systemic toxic effects of over exposure to thia compound.

Carcinogenicity

None of the components in this chemical is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

Exposure Limits for Sodium Hydroxide (2) (50% Solution)

AEL * (DuPont): 2 mg/m3 - 15 Min. TWA
TLV ** (ACGIH) : 2 mg/m3 (Ceiling)
PEL (OSHA) : 2 mg/m3

* AEL is DuPont's Acceptable Exposure Limit.
** TLV is a registered trademark.

Safety Precautions

Do not breathe vapor or mist. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. Discard shoes if contaminated.
After handling, change and launder clothes immediately upon finishing the work shift.

**********

FIRST AID

INHALATION
If inhaled, remove to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician.

EYE CONTACT
In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION
If swallowed, do not induce vomiting. Give large quantities of water. Never give anything by mouth to an unconscious person. Call a physician.

PROTECTION INFORMATION

Generally Applicable Control Measures and Procedures

Keep container tightly closed. Close container after each use. Use ventilation that is adequate to keep airborne concentrations below exposure limits.

Personal Protective Equipment

EYE/FACE PROTECTION
Wear safety glasses. Wear coverall chemical splash goggles and/or face shield when the possibility exists for eye contact due to splashing or spraying of material. A full face mask respirator provides protection from eye irritation.

RESPIRATORS
A NIOSH/MESA approved air purifying respirator with a dust/mist cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air purifying respirators is limited. Use a positive pressure air supplied respirator if there is any potential for an uncontrolled release or any other circumstances where air purifying respirators may not provide adequate protection.

PROTECTIVE CLOTHING
Wear impervious clothing, such as whole bodysuit, gloves, an boots made from Neoprene, as appropriate.

**********

DISPOSAL INFORMATION

Spill, Leak, or Release

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.
Evacuate personnel, thoroughly ventilate area, use self-contained breathing apparatus. Dike spill. Prevent liquid from entering sewers, waterways or low areas.
Superfund reportable discharge - 1000 lbs.
Aquatic Toxicity: LC50 (Mosquito Fish) 125 ppm/96 hours; LC50 (Bluegill Sunfish) 99 ppm/48 hrs.; ALD (Brook Trout) 25 ppm/24 hrs.; pH 10.9 Lethal for Goldfish.

Small spills of caustic soda should be carefully flushed with water. Dilute acid, preferably acetic acid, may be used to neutralize the final traces of caustic after flushing.

(DISPOSAL INFORMATION - CONTINUED)

Waste Disposal

Cleaned-up material is a RCRA Hazardous Waste. Treatment, storage, transportation and disposal must be in accordance with applicable Federal, State/Provincial, and Local regulations. Do not flush to surface water or sanitary sewer system.

**********

SHIPPING INFORMATION

DOT
Proper Shipping Name :
SODIUM HYDROXIDE SOLUTION
Hazard Class : CORROSIVE LIQUID
UN/NA No. : 1824
DOT Label(s) : CORROSIVE
DOT Placard : CORROSIVE

DOT/IMO
Proper Shipping Name :
SODIUM HYDROXIDE SOLUTION
Hazard Class : CORROSIVE LIQUID 8
UN No. : 1824
DOT/IMO Label : CORROSIVE

Reportable Quantity : 1000 lbs.
Shipping Containers
Tank Car
Tank Truck
Steel Drums
If material is shipped in quantities greater than 1000 lbs. per container, the Proper Shipping Name is RQ SODIUM HYDROXIDE, LIQUID.

**********

STORAGE CONDITIONS

Keep container tightly closed.
Store in clean, dry place to keep drums from rusting. Keep drums in upright position. Do not roll on side. Do not store with Aluminum or Magnesium. Do not mix with acids or organic materials. Use only dry, clean utensils in handling. Wash thoroughly after handling.

**********

TITLE III HAZARD CLASSIFICATIONS

Acute: Yes
Chronic: No
Fire: No
Reactivity: Yes
Pressure: No

Lists: Extremely Hazardous Substance - No

(TITLE III HAZARD CLASSIFICATIONS - CONTINUED)

Cercla Hazardous Substance - Yes
Toxic Chemicals - Yes

**********

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Date of latest Revision : 89/03/14
Latest Revision Number : 15
Responsibility for MSDS : E. I. Du Pont de Nemours & Co.
Corporate MSDS Office - ERD
Barley Mill Plaza, P14-2150
Wilmington, DE 19898
302-992-6704

Du Pont Material Safety Data Sheet

MATERIAL IDENTIFICATION

NUMBER : 04210379
CORPORATE NUMBER : DU000177
NAME : SODIUM CARBONATE

CHEMICAL FAMILY : INORGANIC CARBONATES
TRADE NAMES AND SYNONYMS :
SODA ASH
SODA ASH LIGHT
SODA ASH BASE

CAS NAME : CARBONIC ACID, DISODIUM SALT
CAS NUMBER : 497-19-8
FORMULA : Na2CO3
MOLECULAR WEIGHT : 105.99
TSCA INVENTORY STATUS : Reported/Included
NFPA RATING : Health: 2 Flammability: 0 Reactivity: 1
NPCA-HMIS RATING : Health: 2 Flammability: 0 Reactivity: 1
Personal Protection rating to be supplied by user depending on use conditions.
MANUFACTURER/DISTRIBUTOR: PURCHASED MATERIAL
TRANSPORTATION EMERGENCY PHONE : CHEMTREC 1-800-424-9300
MEDICAL EMERGENCY PHONE : 1-(800)441-3637

**********

COMPONENTS

| Material | CAS Number | % |
|---|---|---|
| SODIUM CARBONATE | 497-19-8 | 99+ |

**********

PHYSICAL DATA

Boiling Point : Decomposes
Melting Point : 851 deg C (1564 deg F)
Solubility in Water : 17 WT % at 20 deg C
pH : 11.5 (1% Aqueous Solution)
Odor : Odorless
Form : Hygroscopic powder
Color : White
Specific Gravity : 2.533 at 20 deg C

**********

HAZARDOUS REACTIVITY

Instability : Stable at normal temperatures and storage conditions. Combines with water with evolution of heat.
Incompatibility : Incompatible with strong acids, and aluminum. Decomposes by acids with effervesence of carbon dioxide.
Decomposition : Decomposition temperature 400 deg C. Decomposes by reaction with acids. Hazardous gases/vapors produced are carbon monoxide and carbon dioxide.
Polymerization : Polymerization will not occur.

(HAZARDOUS REACTIVITY - CONTINUED)

Sodium carbonate can liberate considerable amount of heat when added to water. It should be added cautiously with adequate stirring to prevent overheating and possible eruption with spattering of corrosive solutions.

**********

FIRE AND EXPLOSION DATA

Noncombustible.

FIRE AND EXPLOSION HAZARDS

Hazardous gases/vapors produced in fire are carbon dioxide and carbon monoxide.
Can be used as an ingredient in fire extinguishers.

EXTINGUISHING MEDIA

Use media appropriate for surrounding material.

SPECIAL FIRE FIGHTING INSTRUCTIONS

Keep personnel removed & upwind of fire. Wear self-contained breathing apparatus. Wear full protective equipment.

**********

HEALTH HAZARD INFORMATION

Oral LD50: 4200 mg/kg in rats

CAUTION: Material is corrosive to skin, eyes and respiratory tract.

The compound is a skin and eye irritant, and is untested for animal sensitization. Toxic effects in animals occurring only with inhalation exposures are lung irritation. No animal test reports are available to define carcinogenic, or reproductive hazards. Animal testing indicates that this compound does not have mutagenic, nor embryotoxic effects.

Human health effects of overexposure by inhalation, ingestion, or skin or eye contact may initially include: eye irritation with tearing, or blurring of vision; or skin irritation or rash. Data to evaluate the skin permeation hazard of this compound are insufficient. There are no reports of human sensitization.

Carcinogenicity

None of the components in this chemical is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

(HEALTH HAZARD INFORMATION - CONTINUED)

Exposure Limits for SODIUM CARBONATE

AEL * (DuPont): 5 mg/m3 - 8 Hr. TWA
TLV ** (ACGIH) : None Established
PEL (OSHA) : None Established

* AEL is DuPont's Acceptable Exposure Limit.
** TLV is a registered trademark.

Safety Precautions

Avoid breathing dust. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling.

**********

FIRST AID

INHALATION
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT
Call a physician. In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.

EYE CONTACT
In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION
If swallowed, do not induce vomiting. Give large quantities of water. Never give anything by mouth to an unconscious person. Call a physician.

**********

PROTECTION INFORMATION

Generally Applicable Control Measures and Procedures

Keep container tightly closed. Avoid dust generation. Do not mix with acids.
Use ventilation that is adequate to keep airborne concentrations below exposure limits.

Keep dry.

Personal Protective Equipment

EYE/FACE PROTECTION

(PROTECTION INFORMATION - CONTINUED)

Wear safety glasses. Wear coverall chemical splash goggles, and face shield when the possibility exists for eye or face contact from airborne material.

RESPIRATORS
A NIOSH/MESA approved air purifying respirator with a dust cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air purifying respirators is limited. Use a positive pressure air supplied respirator if there is any potential for an uncontrolled release, exposure levels are not known, or any other circumstances where air purifying respirators may not provide adequate protection.

PROTECTIVE CLOTHING
Wear impervious clothing, such as gloves, apron, boots, or whole bodysuit made from Neoprene, as appropriate.

**********

DISPOSAL INFORMATION

Aquatic Toxicity :
96 hour TLM, sunfish: 300 mg/L
96 hour TLM, mosquito fish: 1200 mg/L

Spill, Leak, or Release

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.
Dike spill. Recover undamaged and minimally contaminated material for reuse or reclamation. Shovel or sweep up.
Residual amounts may be flushed with water and neutralized with dilute acid. Hydrolysis and neutralization reactions will generate heat and should be undertaken cautiously. Neutralization with acid will liberate carbon dioxide, so ventilation adequate to maintain carbon dioxide levels below exposure limits is required.

Spilled sodium carbonate solutions may be slippery.

Waste Disposal

Treatment, storage, transportation and disposal must be in accordance with applicable Federal, State/Provincial, and Local regulations. Remove nonusable solid material and/or contaminated soil, for disposal in an approved and permitted landfill. Do not flush to surface water or sanitary sewer system.

STORAGE CONDITIONS

Keep container tightly closed.
Keep dry. Material is quite hydroscopic and will absorb atmospheric moisture and cause caking.

**********

TITLE III HAZARD CLASSIFICATIONS

| | |
|---|---|
| Acute: | Yes |
| Chronic: | No |
| Fire: | No |
| Reactivity: | No |
| Pressure: | No |

**********

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Date of latest Revision : 88/11/07
Responsibility for MSDS : E. I. du Pont de Nemours & Co.
Corporate MSDS Office - ERD
Barley Mill Plaza, P14-2150
Wilmington, DE 19898
302-992-6704

Du Pont Material Safety Data Sheet

MATERIAL IDENTIFICATION

NUMBER : 1086CR
NAME : p-Nitrotoluene

GRADE : Flaked, Cast Solid, and Molten Technical
CHEMICAL FAMILY : Aromatic Nitro
TRADE NAMES AND SYNONYMS :
PNT
Paranitrotoluol
4-Methylnitrobenzene

CAS NAME : Benzene, 1-methyl-4-nitro
CAS NUMBER : 99-99-0
FORMULA : CH3C6H4NO2
MANUFACTURER/DISTRIBUTOR: E.I. du Pont de Nemours & Co., Inc.
1007 Market Street
Wilmington, DE 19898
PRODUCT INFORMATION PHONE : 1-(800)441-7515
TRANSPORTATION EMERGENCY PHONE : 1-(800)424-9300
MEDICAL EMERGENCY PHONE : 1-(800)441-3637

**********

COMPONENTS

| Material | CAS Number | % |
|---|---|---|
| p-Nitrotoluene | 99-99-0 | 99.5 |

**********

PHYSICAL DATA

Boiling Point : 238 deg C at 760 mm Hg. (460 F)
Vapor Density : 4.7 (Air = 1.0)
Melting Point : 52 deg C (125 F)
Evaporation Rate : _< 1
Solubility in Water : 0.04 WT % at 30 deg C
Odor : Aromatic nitro
Form : Solid or molten
Color : Light yellow
Specific Gravity : 1.139 at 55 deg C
Vapor Pressure : 5 mmHg @ 85 C
40 mmHg @ 136 C
pH Information : 6.6 (water extract)
Appearance : Flakes; crystalline solid; oily liquid

**********

HAZARDOUS REACTIVITY

Incompatibility : Incompatible with strong oxidizers, sulfuric acid, or reducing agents.
Decomposition : See Instability. Releases hazardous oxide of nitrogen gases.
Polymerization : Polymerization will not occur.

(HAZARDOUS REACTIVITY - CONTINUED)

Instability : Stable at normal temperatures and conditions of storage. Decomposes slowly at 200 C (392 F). Temperatures above 220 C (428 F) are normally required to initiate rapid exothermic decomposition but foreign matter may lower the decomposition temperature substantially.

**********

FIRE AND EXPLOSION DATA

Flash Point : 106 deg C
Method : SFCC
Flammable Limits in Air, % by Vol.
LEL : 1.6
UEL : Not determined
Autoignition Temperature : 390 deg C
Autodecomposition Temp: 200 C, (See Instability)

FIRE AND EXPLOSION HAZARDS

OSHA Class III B Combustible Liquid. May decompose exothermically at high temperatures.

EXTINGUISHING MEDIA

Small fires: Dry chemical or carbon dioxide (CO2)
Large fires: Water spray, fog, or foam

SPECIAL FIRE FIGHTING INSTRUCTIONS

Evacuate area. Stay upwind; avoid smoke and fumes. Use water spray to cool tanks and reduce vapors. If smoke and fumes cannot be avoided, wear chemical-proof suit with hood and breathing air supply. Fight fire from maximum distance. Use care when approaching advanced or massive fire. Product may decompose from heat and rupture container.

**********

HEALTH HAZARD INFORMATION

Harmful if inhaled or absorbed through skin; reduced blood's oxygen carrying capacity. Symptoms may be delayed.

Inhalation 1-hour ALC: >41 ppm in rats
Skin absorption ALD: >200 mg/kg in rabbits
Oral LD50: 2144 mg/kg in rats

Toxic effects described in animals from short exposures include methemoglobinemia, anemia, and nonspecific effects such as weight loss and and irritation. Tests for mutagenic activity in bacterial or mammalian cell cultures have been

(HEALTH HAZARD INFORMATION - CONTINUED)

inconclusive, with positive results in some studies, and negative results in others.

Human health effects of overexposure may initially include: reduction of the blood's oxygen carrying capacity with cyanosis (bluish discoloration), weakness, or shortness of breath by formation of methemoglobin; abnormal blood forming system function with anemia; or red blood cell destruction. There are no reports of human sensitization. Individuals with preexisting diseases of the cardiovascular system or bone marrow may have increases susceptibility to the toxicity of excessive exposures.

Carcinogenicity

None of the components in this chemical is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

Exposure Limits for p-Nitrotoluene

TLV * (ACGIH) : See Below
PEL (OSHA) : See Below

* TLV is a registered trademark.

Other Applicable Exposure Limits:

OSHA 8-hour Time Weighted Average (TWA) = 5 ppm or 30 mg/m3, ACGIH "TLV"-TWA = 2 ppm or 11 mg/m3 for all isomers of Nitrotoluene. Both limits have "SKIN" notation indicating that liquid and vapor are capable of penetrating skin and mucous membrane. Control of vapor inhalation alone may not be sufficient to prevent absorption of an excessive dose.

Safety Precautions

Avoid breathing vapors or mist. Avoid contact with eyes. Avoid contact with skin. Avoid contact with clothing. Wash thoroughly after handling.

**********

FIRST AID

If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physican.

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing before reuse and destroy contaminated shoes.

(FIRST AID - CONTINUED)

If swallowed, induce vomiting immediately by giving two glasses of water and sticking finger down throat. Call a physician. Never give anything by mouth to an unconscious person.

NOTE TO PHYSICIAN: Absorption of this product into the body leads to the formation of methemoglobin which, in sufficient concentration, causes cyanosis. In case of skin absorption, symptoms may be delayed. Since reversion of methemoglobin to hemoglobin occurs spontaneously after termination of exposure, moderate degrees of cyanosis need be treated only by supportive measures such as bed rest and oxygen inhalation. Thorough cleansing of the entire contaminated area of the body including scalp and nails is of utmost importance. If cyanosis is severe, intravenous injection of methylene blue, 1 mg/kg of body weight, may be of value. Cyanocobalamin (Vitamin B-12), 1 mg intramuscularly, will speed recovery. Intravenous fluids and blood transfusions may be indicated in very severe exposures.

**********

PROTECTION INFORMATION

Generally Applicable Control Measures and Procedures

Good general ventilation should be provided to keep vapor concentrations below exposure limits.

Personal Protective Equipment

| | |
|---|---|
| Eye/Face | : Coverall chemical splash goggles. Safety glasses (side shield pref.); full-length face shield |
| Respirator | : Air supplied respirator. with hood and chemical-proof suit if direct exposure likely. |
| Additional | : Protective footwear. hard hat w/brim, butyl rubber pants, jacket, apron |
| Protective Gloves | : Neoprene for routine work, Butyl rubber for liquid contact |

**********

DISPOSAL INFORMATION

Spill, Leak, or Release

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.
Evacuate area and keep upwind of spill. Contain spill with sand or earth dam, allow to freeze and transfer to a covered metal container for disposal. Flush area with detergent and water. Wear appropriate protective equipment. Comply with Federal, State, and local regulations on reporting releases.

(DISPOSAL INFORMATION - CONTINUED)

Waste Disposal

Comply w/Fed., St. & loc. reg. If approved may be incinerated, sent to an approved hazardous material disposal area, or transferred to a disposal contractor. Very dilute solutions are biodegradable by specially acclimated bacteria.

**********

SHIPPING INFORMATION

DOT

| | |
|---|---|
| Proper Shipping Name | : Nitrotoluene* |
| Hazard Class | : ORM-E |
| UN/NA No. | : 1664 |
| Special Information | : *Not regulated by DOT in containers of les s than 1000 lbs. |

DOT/IMO

| | |
|---|---|
| Proper Shipping Name | : Nitrotoluenes |
| Hazard Class | : Poison B, 6.1 |
| UN No. | : 1664 |
| DOT/IMO Label | : Poison |
| Special Information | : Flash Point: 106 C (223 F) |

Reportable Quantity : 1000 lbs.
Shipping Containers
Tank cars, tank trucks, drums

**********

STORAGE CONDITIONS

Store in well ventilated area. Keep container tightly closed.
Store in a dry area away from heat, sparks, and flame.
Handle in a manner to prevent human contact.

**********

ADDITIONAL INFORMATION AND REFERENCES

For further information, see Du Pont "p-Nitrotoluene, Technical" Data Sheet.

TSCA Inventory Status: Reported/Included

| NPCA-HMIS RATINGS | | NFPA RATINGS | |
|---|---|---|---|
| Health (Acute) | 2 | Health | 3 |
| Flammability | 1 | Flammability | 1 |
| Reactivity | 1 | Reactivity | 0 |
| Personal Protection | _ | Unusual Hazards | |

(ADDITIONAL INFORMATION AND REFERENCES - CONTINUED)

Personal Protection Rating to
be supplied by user depending
on use conditions.

**********

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Date of latest Revision : 87/06/23
Responsibility for MSDS : J. C. Watts
Chestnut Run Site, C&P Dept.
Wilmington, DE 19898
302-999-4946

Du Pont Material Safety Data Sheet

## MATERIAL IDENTIFICATION

NUMBER : 1076CR
NAME : 2-Chloro-4-Nitrotoluene

GRADE : Technical
CHEMICAL FAMILY : Aromatic
TRADE NAMES AND SYNONYMS :
p-Nitro-o-chlorotoluene

CAS NAME : Benzene, 2-chloro-1-methyl-4-nitro
CAS NUMBER : 121-86-8
FORMULA : C1C6H3(NO2)CH3
TSCA INVENTORY STATUS : Reported/Included
NFCA-HMIS RATING : Health: 2 Flammability: 1 Reactivity: 0
Personal Protection rating to be supplied by user depending on use conditions.
MANUFACTURER/DISTRIBUTOR: E.I. du Pont de Nemours & Co., Inc.
1007 Market Street
Wilmington, DE 19898
PRODUCT INFORMATION PHONE : 1-(800)441-7515
TRANSPORTATION EMERGENCY PHONE : 1-(800)424-9300
MEDICAL EMERGENCY PHONE : 1-(800)441-3637

**********

## COMPONENTS

| Material | CAS Number | % |
|---|---|---|
| 2-Chloro-4-Nitrotoluene | 121-86-8 | 93 |
| 2,6-Dichloro-4-Nitrotoluene | 7149-69-1 | 4 |
| p-Nitrotoluene | 99-99-0 | 3 |

**********

## PHYSICAL DATA

Boiling Point : 260 deg C at 760 mm Hg. (500 F)
Melting Point : 57 to 60 deg C 135-140 F
Evaporation Rate : <1
Solubility in Water : 0.17 WT % at 20 deg C
Odor : Sweet, pungent
Form : Crystalline
Color : Medium to dark brown
Specific Gravity : 1.27 at 70 deg C
Vapor Pressure: 0.016 mmHg @ 25 C (77 F)
0.044 mmHg @ 38 C (100 F)
Vapor Density: Not determined
pH Information: 7.3 (water extract)

HAZARDOUS REACTIVITY

Instability : Stable at normal temperatures and conditions of storage.
Incompatibility : None reasonably foreseeable.
Polymerization : Polymerization will not occur.
Decomposition: Will occur at temperatures above 260 C (500 F), releasing hazardous nitrogen oxide and hydrochloric acid gases. Acidic conditions, and/or contamination by foreign materials, will substantially lower this decomposition temperature.

**********

FIRE AND EXPLOSION DATA

Flash Point : 133 deg C
Method : SFCC
Flammable Limits in Air, % by Vol.
LEL : Not available.
UEL : Not available.
Autoignition Temperature : Not available.
Autodecomposition Temp: >260 C (see "Decomposition)

FIRE AND EXPLOSION HAZARDS

OSHA Class III B Combustible material.

EXTINGUISHING MEDIA

Small fires: Dry chemical, carbon dioxide (CO2)
Large fires: Water spray, fog, or foam

SPECIAL FIRE FIGHTING INSTRUCTIONS

Evacuate personnel to a safe area. Keep personnel removed & upwind of fire. Wear self-contained breathing apparatus. Cool tank/container with water spray.
Use caution approaching an advanced or massive fire.
Product may decompose at high temperatures and rupture container.

**********

HEALTH HAZARD INFORMATION

Harmful if inhaled or absorbed through skin; reduces blood's oxygen carrying capacity. Symptoms may be delayed. Causes skin and eye irritation.

Oral LD50: 1499 mg/kg in rats

(HEALTH HAZARD INFORMATION - CONTINUED)

The compound is an eye irritant and is a slight skin irritant.

Human health effects of overexposure may initially include: reduction of the blood's oxygen carrying capacity with cyanosis (bluish discoloration), weakness, or shortness of breath by formation of methemoglobin; abnormal blood forming system function with anemia; or red blood cell destruction. Skin permeation can occur in amounts capable of producing the effects of systemic toxicity. There are no reports of human sensitization. Individuals with preexisting diseases of the cardiovascular system or bone marrow may have increased susceptibility to the toxicity of excessive exposures.

Carcinogenicity

None of the components in this chemical is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

Exposure Limits for 2-Chloro-4-Nitrotoluene

TLV ** (ACGIH) : None Established
PEL (OSHA) : None Established

Other Applicable Exposure Limits:

Exposure Limits for p-Nitrotoluene

AEL * (DuPont): None Established
TLV ** (ACGIH) : 2 ppm, 11 mg/m3, skin
PEL (OSHA) : 5 ppm, 30 mg/m3, skin

* AEL is DuPont's Acceptable Exposure Limit.
** TLV is a registered trademark.

Safety Precautions

Avoid breathing vapors or mist. Avoid contact with eyes. Avoid contact with skin. Avoid contact with clothing. Avoid breathing dust. Wash thoroughly after handling.

**********

FIRST AID

If inhaled: Remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

In case of contact: Immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash

(FIRST AID - CONTINUED)

clothing before reuse and destroy contaminated shoes.

If swallowed: Induce vomiting immediatealy by giving 2 glasses of water and sticking finger down throat. Call a physician. Never give anything by mouth to an unconscious person.

Note to Physician: Absorption of this product into the body leads to the formation of methemoglobin which, in sufficient concentration, causes cyanosis. In case of skin absorption, symptoms may be delayed. Since reversion of methemoblogin to hemoglobin occurs spontaneously after termination of exposure, moderate degrees of cyanosis need be treated only by supportive measures such as bed rest and oxygen inhalation. Thorough cleansing of the entire contaminated area of the body including scalp and nails is of utmost importance. If cyanosis is severe, intravenous injection of methylene blue, 1 mg/kg body weight, may be of value. Cyanocobalamin (Vitamin B-12), 1 mg intramuscularly, will speed recovery. Intravenous fluids and blood transfusions may be indicated in very severe exposures.

**********

PROTECTION INFORMATION

Generally Applicable Control Measures and Procedures

Good general ventilation should be provided to minimize personal contact.

Personal Protective Equipment

| | |
|---|---|
| Eye/Face | : Coverall chemical splash goggles. Safety glassed (side shields); full-length face shield |
| Respirator | : (w/chemical-proof suit w/hood) if direct exposure is likely. |
| Additional | : Protective footwear. Pants, jacket, and apron |
| Protective Gloves | : Butyl rubber gauntlet gloves |

**********

DISPOSAL INFORMATION

Spill, Leak, or Release

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.
Evacuate area and keep upwind of spill. Contain spill with sand or earth dam. Allow to freeze or soak up with sand or earth and transfer to a covered metal container for disposal. Flush area with detergent and water. Comply with Federal, State, and local regulations on reporting releases.

(DISPOSAL INFORMATION - CONTINUED)

Waste Disposal

Comply w/Fed., State & local reg. If approved may be incinerated, sent to an approved hazardous material disposal area, or transferred to a licensed disposal contractor. Dilute solutions are biodegradeable by specially acclimated bacteria.

**********

SHIPPING INFORMATION

DOT

Proper Shipping Name :
RQ Hazardous Substance*, Liquid, N.O.S. (contains p-Nitrotoluene)
Hazard Class : ORM-E
UN/NA No. : 9188

DOT/IMO

Proper Shipping Name :
Poisonous Solid, N.O.S. (2-Chloro-4-Nitrotoluene)
Hazard Class : Poison B, 6.1
UN No. : 2811
Special Information : IMO Label: Harmful - stow away from food stuffs

Shipping Containers
Tank cars, tank trucks
REPORTABLE QUANTITY 1000 lb/454 kg

**********

STORAGE CONDITIONS

Store in well ventilated area. Keep container tightly closed. Store away from heat, sparks, and flame. Handle in a manner to prevent human contact.

**********

ADDITIONAL INFORMATION AND REFERENCES

*Regulated as a hazardous material by DOT only when shipped in containers in excess of 1000 pounds each.

Title III Classifications:

Acute Health - Yes
Chronic Health - Yes
Fire Hazard - No
Reactivity - No
Pressure - No

For further information, see Du Pont "2-Chloro-4-Nitrotoluene, Technical" Data Sheet.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Date of latest Revision : 88/02/11
Responsibility for MSDS : J. C. Watts
Du Pont Co., C&P Dept.
Chestnut Run, Bldg. 709
Wilmington, DE 19898
302-999-4946

Du Pont Material Safety Data Sheet

MATERIAL IDENTIFICATION

NUMBER : 04210430
NAME : THIONYL CHLORIDE

CHEMICAL FAMILY : INORGANIC SULFUR COMPOUND
TRADE NAMES AND SYNONYMS :
SULFUR OXYCHLORIDE
SULFUROUS OXYCHLORIDE

CAS NUMBER : 7719-09-7
FORMULA : SO Cl2
MOLECULAR WEIGHT : 118.98
MANUFACTURER/DISTRIBUTOR: OCCIDENTAL CHEMICAL CORPORATION
INDUSTRIAL & SPECIALITY CHEMICALS DIV
OCCIDENTAL CHEMICAL CENTER
360 RAINBOW BOULEVARD SOUTH
P. O. BOX 728
NIAGARA FALLS
NEW YORK 14302
PRODUCT INFORMATION PHONE : 1-716-286-3000
TRANSPORTATION EMERGENCY PHONE : CHEMTREC: 1-800-424-9300
MEDICAL EMERGENCY PHONE : 1-716-278-7021

**********

COMPONENTS

| Material | CAS Number | % |
|---|---|---|
| THIONYL CHLORIDE | 7719-09-7 | 99 |

**********

PHYSICAL DATA

Boiling Point : 77 deg C
Vapor Pressure : 92 mm Hg at 20 deg C
Vapor Density : 4.1
Melting Point : -104.5 deg C
Solubility in Water : DECOMPOSES
Odor : VERY PUNGENT
Form : LIQUID
Color : COLORLESS TO PALE YELLOW
Specific Gravity : 1.63

**********

HAZARDOUS REACTIVITY

Instability : Stable.
Incompatibility : Incompatible with REACTS VIOLENTLY WITH STRONG ALKALIES, WATER, AND REDUCING AGENTS. CAN REACT WITH MAX OXYGEN CONTAINERS ORGANIC COMPOUN
Decomposition : Decomposes with heat. Decomposes by reaction with ABOVE COMPOUNDS Hazardous gases/vapors produced are H CL, SO2, CL2
Polymerization : Polymerization will not occur.

FIRE AND EXPLOSION DATA

NOT FLAMMABLE

FIRE AND EXPLOSION HAZARDS

Hazardous gases/vapors produced in fire are SO2, CL2 H CL

EXTINGUISHING MEDIA

Dry Chemical. CO2.

SPECIAL FIRE FIGHTING INSTRUCTIONS

Wear self-contained breathing apparatus. Wear full protective equipment. Cool tank/container with water spray.
PREVENT WATER FORM CONTACTING MATERIAL

**********

HEALTH HAZARD INFORMATION

EFFECTS OF OVEREXPOSURE: Thionyl Chloride is severly irritating and corrosive to the eyes, skin and respiratory tract. Repeated exposure to vapor may cause chronic respiratory irritation. Significant overexposure to vapors can cause delayed pulmonary edema. Direct contact with the liquid may cause severe dammage to the skin and eyes.

In the presence of moisture thionyl chloride decomposes into hydrogen chloride and sulfur dioxide which substances are toxic and constitute serious toxicity hazards.

TOXICITY: Lethal dose by inhalation in cats is reported as 17.5 ppm for 20 minutes.

Carcinogenicity

None of the components in this chemical is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

Exposure Limits for THIONYL CHLORIDE

| | | |
|---|---|---|
| AEL * | (DuPont): | None Established |
| TLV ** | (ACGIH) : | 1 ppm, 5 mg/m3 (Ceiling) |
| PEL | (OSHA) : | None Established |

* AEL is DuPont's Acceptable Exposure Limit.
** TLV is a registered trademark.

Safety Precautions

(HEALTH HAZARD INFORMATION - CONTINUED)

Do not breathe vapor or mist. Do not get in eyes. Do not get on skin. Do not get on clothing. Wash thoroughly after handling.

**********

FIRST AID

INGESTION

FIRST AID MEASURES

EYE CONTACT: Immediately flush eyes with a directed stream of water for at least 15 minutes. Forcibly hold eyelids apart to ensure complete irrigation of all eye and lid tissue. GET IMMEDIATE MEDICAL ATTENTION. Contact lenses should not be worn when working with this chemical.

SKIN CONTACT: Immediately flush contaminated skin with water and wash with soap and water. If large areas of the body are contaminated, remove clothing and immediately use safety shower. flush exposed area with large amounts of water for at least 15 minutes. GET PROMPT MEDICAL ATTENTION IF IRRITATION OCCURS. Discard contaminated clothing and shoes.

INGESTION: If person is conscious immediately administer large quantities of water. DO NOT INDUCE VOMITING. GET MEDICAL ATTENTION.

INHALATION: Move the exposed person to fresh air at once. If breathing has stopped perform artificial respiration. Keep the affected person warm and at rest. GET MEDICAL ATENTION AS SOON AS POSSIBLE.

**********

PROTECTION INFORMATION

Generally Applicable Control Measures and Procedures

Use only with adequate ventilation. Keep away from heat, sparks and flames. Keep container in a cool place. Keep container in a dark place. Keep container tightly closed. Do not consume food, drink or tobacco in the areas where they may become contaminated with this material.
Keep dry must be sealed to prevent entry of atomospheric moisture. Hydrogen gas may be formed upon reaction of so cl, will, steel in mesure of moisture.

Personal Protective Equipment

| | |
|---|---|
| Eye/Face | : Safety Glasses. Face shield. Coverall chemical splash goggles. side shield Do not wear contact lenses,safety eye wear. |
| Filter Respirator | : Niosh/msha acid gas vapor respirator |
| Additional | : imprevious coveralls & rubber gloves is |

(PROTECTION INFORMATION - CONTINUED)

suggested
Protective Gloves : rubber or neoprene

**********

DISPOSAL INFORMATION

Spill, Leak, or Release

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.

ENVIRONMENTAL PROTECTION

PROCEDURE IN CASE OF SPILL OR RELEASE: Obtain full protective equipment and self-contained breathing apparatus. Contain release or spill by dike to prevent flow to sewers or streams. Pump into marked containers for reclamation or disposal. Soak up small spills with absorbent material. Scoop and sweep up the spilled product and place in marked disposal containers. If possible, clean up spill area on a dry basis and then flush with plenty of water.

Waste Disposal

WASTE DISPOSAL METHOD:

Drown by feeding slowly into large volume of water in retention area, adjust ph with caustic before disposal; or incinerate in equipment designed to handle hydrogen chloride and sulfur dioxide as combustion products.

**********

SHIPPING INFORMATION

DOT
Proper Shipping Name :
THIONYL CHLORIDE
Hazard Class : Corrosive
UN/NA No. : UN 1836
DOT Label(s) : Corrosive, poision.

**********

STORAGE CONDITIONS

Store in cool place. Store in dark place. Keep container tightly closed.
Keep dry

Container must be sealed to prevent entry of Atomospheric moisture.

Storage tanks should be diked to hold 110% of tank volume.

ADDITIONAL INFORMATION AND REFERENCES

The above information is based on a MSDS issued by Occidental Chemical Corporation - April, 1986.

Follow standard plant procedures and safety rules for first aid and personnel protective equipment when handling this material.

**********

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Date of latest Revision : 88/03/14
Responsibility for MSDS : MSDS COORDINATOR
E. I. DuPONT - CHAMBERS WORKS
C & P
609-540-3039

# Du Pont Material Safety Data Sheet

## MATERIAL IDENTIFICATION

NUMBER : E0000153
NAME : Chloral

CHEMICAL FAMILY : Chlorinated aliphatic Aldehydes
TRADE NAMES AND SYNONYMS :
Trichloroacetaldehyde

CAS NAME : 2,2,2-Trichloroethanal
CAS NUMBER : 75-87-6
FORMULA : CCl3-CHO
MOLECULAR WEIGHT : 147.4
MANUFACTURER/DISTRIBUTOR: Lobel Chemical Company
100 Church Street
New York,New York 10007
PRODUCT INFORMATION PHONE : 1-800-441-7515
TRANSPORTATION EMERGENCY PHONE : CHEMTREC: 1-800-424-9300
MEDICAL EMERGENCY PHONE : 1-800-441-3637

**********

## COMPONENTS

| Material | CAS Number | % |
|---|---|---|
| 2,2,2,- Trichloroethanal | 75-87-6 | 99.3 |
| 2,2-Dichloroethanal | | 0.3 |
| 2,2,3-Trichlorobutanal | | 0.1 |
| Water | | 0.1 |
| HCL | | 0.25 |
| Chloroform | 67-66-3 | 0.20 |
| Carbon Tetrachloride | 56-23-5 | 0.10 |

**********

## PHYSICAL DATA

Boiling Point : 94 deg C 101.3 kPa
Vapor Pressure : 40 mm Hg at 20 deg C
Vapor Density : 5.1 (Air = 1.0)
% Volatiles : 100 WT %
Solubility in Water : 73.6 WT % @62.6 degF
Odor : Very acrid
Form : Oily Liquid
Color : Colorless (15 Hazem max.)
Specific Gravity : 1.516 at 20 deg C
Melting Point: -60 degC (approximate)

**********

## HAZARDOUS REACTIVITY

Instability : Stable.
Incompatibility : None reasonably foreseeable.
Decomposes with heat and aging.

Chloral, although stabilized, should not be stored longer

(HAZARDOUS REACTIVITY - CONTINUED)

than 60 days as the material may polymerize on aging.

**********

FIRE AND EXPLOSION DATA

Flash Point : 75 deg C
Method : Closed cup
Flammable Limits in Air, % by Vol.
LEL : 20%
UEL : 55%
Autodecomposition Temperature : 440 deg C

FIRE AND EXPLOSION HAZARDS

Combustible. Hazardous gases produced in fire are Chloroform, CO, COC12 (Phosgene), HCl
Chloral and it's hydrate react with metal to form hydrogen gas.

EXTINGUISHING MEDIA

Water. Water Spray. Water Fog. Chemical Foam. Dry Chemical. CO2.

SPECIAL FIRE FIGHTING INSTRUCTIONS

Evacuate personnel to a safe area. Keep personnel removed & upwind of fire. Wear self-contained breathing apparatus. Wear full protective equipment (eye, body, respiratory). Use water spray.

**********

HEALTH HAZARD INFORMATION

Principle Health Hazard: HIGHLY TOXIC BY INHALATION; also sedative, narcotic, abuse may lead to habituation or addiction.
SEVERE SKIN IRRITANT: Human contact allergen.
Overexposure produces pulmonary edema, shortness of bre and weakness.

Toxicity Information:
Inhalation rat LC50 (4hr.) 73 ppm
Oral rat LD50 480-725 mg/kg
Dermal guinea pig LD50 >1000 mg/kg
Severe skin irritant
Mortality produced in 6 of 10 rats exposed ten times, 6 hour/day to 13 ppm by inhalation
Mutagenic in Ames assay

Carcinogenicity

The following components are listed by IARC, NTP, or OSHA as carcinogens.

(HEALTH HAZARD INFORMATION - CONTINUED)

| Chemical | IARC | NTP | OSHA |
|---|---|---|---|
| Chloroform | x | x | x |
| Carbon Tetrachloride | x | x | x |

DuPont controls the following chemicals as potential carcinogens : Chloroform . Carbon Tetrachloride .

Exposure Limits for Chloral

AEL * (DuPont): See Below
TLV ** (ACGIH) : See Below
PEL (OSHA) : See Below
WEEL (AIHA) : None Established

* AEL is DuPont's Acceptable Exposure Limit.
** TLV is a registered trademark.

Other Applicable Exposure Limits:

AEL (DuPONT) 10 ppb for Chloral, 5 ppm for Carbon tetrachloride, 10 ppm for Chloroform
*TLV (ACGIH) 5 ppm for Carbon Tetrachloride, 10 ppm for Chloroform
PEL (OSHA) 10 ppm for Carbon Tetrachloride, ceiling 50 ppm for Chloroform

Safety Precautions

Do not breathe vapor or mist. Do not get in eyes. Do not get on skin. Do not get on clothing. Wash thoroughly after handling. Wash clothing after use.

**********

FIRST AID

INHALATION
If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT
Call a physician. In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

EYE CONTACT
In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION
If swallowed, induce vomiting immediately by giving two glasses of water and sticking finger down throat. Never give anything by mouth

(FIRST AID - CONTINUED)

to an unconscious person. Call a physician.

**********

PROTECTION INFORMATION

Generally Applicable Control Measures and Procedures

Use a totally enclosed system. Use only with adequate ventilation. Keep away from heat, sparks and flames. Keep container in a cool place. Keep container in a dark place. Keep container tightly closed.
Keep in a dry, well ventilated, cool area.

Personal Protective Equipment

Eye/Face : Safety Glasses. Face shield.
Respirator : Air supplied respirator.
Protective Gloves : Neoprene gloves and apron

**********

DISPOSAL INFORMATION

Aquatic Toxicity : Not Available

Spill, Leak, or Release

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.
Evacuate personnel, thoroughly ventilate area, use self-contained breathing apparatus. Remove source of heat, sparks, flame, impact, friction or electricity. Keep upwind of leak - evacuate until gas has dispersed. Dike spill. Prevent liquid from entering sewers, waterways or low areas. Soak up with sawdust, sand, oil dry or other absorbent material. Neutralize with soda ash
Shovel or scoop up. Control access to area and remove sources of heat or impact.
Superfund Reportable Discharge = 1 pound

Waste Disposal

Cleaned-up material is a RCRA Hazardous Waste. Treatment, storage, transportation and disposal must be in accordance with applicable Federal, State, and Local regulations. Recover nonusable free liquid and/or contaminated water, and dispose of in an approved and permitted biological treatment system or an approved and permitted deepwell. Remove nonusable solid material and/or contaminated soil, for disposal in an approved and permitted landfill. Do not burn. Do not flush to surface water or sanitary sewer system.
Comply with applicable Federal, State, and Local regulations

SHIPPING INFORMATION

DOT
Proper Shipping Name :
Poisonous Liquid, N.O.S.
Hazard Class : Poison B
UN/NA No. : UN 2810
DOT Label(s) : Poison
Special Information : See "ADDITIONAL INFORMATION AND REFERENCES " Section
DOT Placard : Poison
Freight Class : Surface Only

DOT/IMO
Proper Shipping Name :
Chloral, Anhydrous, Inhabited
Hazard Class : 6.1
UN No. : UN 2075
DOT/IMO Label : Poison
Special Information : Cargo vessel (1) passenger vessel (5)
Packaging Group : II

**********

STORAGE CONDITIONS

Store in well ventilated area. Store in cool place. Store in dark place. Keep container tightly closed. Provide storage with automatic extinguishing system.

**********

ADDITIONAL INFORMATION AND REFERENCES

SHIPPING INFORMATION
Special Information: CAN NOT BE SHIPPED BY AIR
(Toxic by inhalation)
Packaging 173.345 & 173.346 in49 CFR

**********

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Date of latest Revision : 87/10/21
Person Responsible for MSDS : R.E. Yule
DuPont Company- Ag Prod. Dept.
Experimental Station,Bldg. 308
Wilmington, Delaware 19898
302-695-7987

Du Pont Material Safety Data Sheet

MATERIAL IDENTIFICATION

NUMBER : B0000134
NAME : Hydrogen Chloride, Anhydrous

CHEMICAL FAMILY : Mineral Acid
TRADE NAMES AND SYNONYMS :
Anhydrous Hydrochloric Acid

CAS NAME : Hydrochloric Acid
CAS NUMBER : 7647-01-1
FORMULA : HCl
MANUFACTURER/DISTRIBUTOR : E.I. du Pont de Nemours & Co., Inc.
1007 Market Street
Wilmington, DE 19898
PRODUCT INFORMATION PHONE : 1-(800)441-7515
TRANSPORTATION EMERGENCY PHONE : 1-(800)424-9300
MEDICAL EMERGENCY PHONE : 1-(800)441-3637

**********

COMPONENTS

| Material | CAS Number | % |
|---|---|---|
| Hydrogen Chloride | 7647-01-1 | 100 |

**********

PHYSICAL DATA

Boiling Point : -85.1 deg C at 760 mm Hg. (-121 F)
Vapor Density : 1.3 (Air = 1.0)
Melting Point : -115 deg C (-175 F)
Evaporation Rate : _> 1
Solubility in Water : 42 WT % at 20 deg C
Odor : Sharp
Form : Liquid
Color : Colorless
Specific Gravity : 1.5
Appearance : Clear, fuming
Vapor Pressure : 606 psi, 31,333 mmHg @ 25 C (77 F)
874 psi, 45,186 mmHg @ 38 C (100 F)
pH Information : <1.0 (in aqueous solution)

**********

HAZARDOUS REACTIVITY

Instability : Stable

Incompatibility : Very corrosive when wet. Reacts with alkalis, many organic materials, and oxidizing agents.

Decomposition : Contact with most metals, in the presence of water, releases flammable hydrogen gas; reaction with oxidizing agents releases chlorine gas. Improper storage may build high pressures and result in the release of HCl

(HAZARDOUS REACTIVITY - CONTINUED )

vapors.

Polymerization : Polymerization will not occur.

FIRE AND EXPLOSION DATA

Flash Point : Will not burn
Flammable Limits in Air, % by Vol.
LEL : Not applicable
UEL : Not applicable
Autoignition Temperature : Not applicable
Autodecomposition Temperature : Not applicable

FIRE AND EXPLOSION HAZARDS

Hydrogen chloride dissolves readily in water and will then attack most metals to evolve potentially explosive hydrogen gas.

EXTINGUISHING MEDIA

Small fire: Dry chemical or CO2.
Large fire: Water spray or fog. Cool tanks with water from maximum distance until well after fire is out.

SPECIAL FIRE FIGHTING INSTRUCTIONS

Evacuate area. Stay upwind. Wear full protective equipment with breathing air supply-hydrogen chloride vapors are heavier than air and settle rapidly to ground. Use water spray or fog to knock down vapors. Do not apply water directly to leak. Cool containers with water spray. Run-off water should be neutralized with soda ash, lime, etc.

HEALTH HAZARD INFORMATION

Causes skin and eye burns. Harmful if inhaled: extremely irritating to nose, throat, and lungs.

Inhalation 1 hour LC50: 3,124 ppm in rats.

The compound is corrosive to skin and eyes. Toxic effects described in animals from exposure by inhalation include respiratory irritation, and corrosion of mucosal surfaces. Tests in animals demonstrate no carcinogenic activity. Tests in bacterial and mammalian cell cultures demonstrate no mutagenic activity. Tests in bacterial and mammalian cell cultures demonstrate no mutagenic activity.

(HEALTH HAZARD INFORMATION - CONTINUED )

Human health effects of overexposure may initially include: skin irritation with discomfort or rash: eye irritation with discomfort, tearing, or blurring of vision; and irritation of the upper respiratory passages. Higher exposures may lead to these effects: skin burns or ulceration; eye corrosion with corneal or conjunctival ulceration; and corrosion of mucosal surfaces with temporary lung irritation effects with cough, discomfort, difficult breathing, or shortness of breath, or corrosion of the upper gastrointestinal tract; dental erosion, and fatality from gross overexposure. Significant skin permeation and systemic toxicity after contact appears unlikely. There are no reports of human sensitization.

Carcinogenicity

None of the components in this chemical is listed by IARC, NTP, or OSHA as a carcinogen.

Exposure Limits for Hydrogen Chloride, Anhydrous

AEL * (DuPont): See below
TLV ** (ACGIH) : See below
PEL (OSHA) : See below

* AEL is DuPont's Acceptable Exposure Limit.
** TLV is a registered trademark.

The OSHA 8-hour Time Weighted Average (TWA) and ACGIH TLV-TWA = 5 ppm, 7 mg/m3. These are also the ceiling limits. The Du Pont AEL 15 minute TWA is 5 ppm.

Safety Precautions

Do not get in eyes. Do not get on skin. Do not get on clothing. Do not breathe vapor. Wash thoroughly after handling.

**********

FIRST AID

If inhaled: Remove to fresh air immediately. Call a physician. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen.

In case of contact: Immediately flush eyes or skin with plenty of water for 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing before reuse.

If swallowed: Do not induce vomiting. Give large quantities

(FIRST AID - CONTINUED )

of water. Call a physician immediately. Never give anything by mouth to an unconscious person.

**********

PROTECTION INFORMATION

Generally Applicable Control Measures and Procedures

Use only in closed systems with ventilation adequate to keep air concentrations below exposure limits.

Personal Protective Equipment

Have available and wear as appropriate for exposure conditions when handling containers or operating equipment containing anhydrous hydrogen chloride: Chemical splash goggles; full-length face shield/splash goggle combination; Neoprene gauntlet gloves, boots, and apron; hard hat with brim; acid resistant long sleeve clothing such as Nomex(R) or wool, (do not wear cotton or porous clothing which may absorb HCl vapors); Neoprene rubber, or plastic coated fabric, positive pressure acid suit with hood and OSHA permissible air supplied respiratory protection.

A self-contained air escape mask (3-5 minute capacity) is advised anytime entering a location where there may be an unexcepted HCl vapor release which would block exit.

Have OSHA permissible air supplied respirator or self-contained breathing apparatus available for use if ceiling exposure limits are exceeded.

**********

DISPOSAL INFORMATION

Aquatic Toxicity : The 96-hr LC50 in mosquito fish is 282 mg/l.

Spill, Leak, or Release

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.
Evacuate area. Stay upwind. Wear full protective equipment. Use water spray to knock down fumes and protect emergency personnel. Do not apply water directly to leak. Stop leak. Leaks readily detected with ammonia by formation of white smoke. Washings should be contained and neutralized with lime or soda ash. Comply with Federal, State, and local regulations on reporting releases.

Waste Disposal

(DISPOSAL INFORMATION - CONTINUED )

Comply with Federal, State, and local regulations. Gaseous waste may be absorbed in a packed tower with water or alkaline solution. Liquid wastes are neutralized and disposed of in disposal well, or drained to waste treatment plant.

**********

SHIPPING INFORMATION

DOT
- Proper Shipping Name : Hydrogen Chloride, Refrigerated Liquid
- Hazard Class : Nonflammable Gas
- UN/NA No. : 2186
- DOT Label(s) : Nonflammable Gas
- DOT Placard : Nonflammable Gas -

DOT/IMO
- Proper Shipping Name : Hydrogen Chloride, Anhydrous
- Hazard Class : Nonflammable Gas, 2.2
- UN No. : 1050
- Subsidiary Risk : Corrosive

Reportable Quantity : 5,000 lbs.

Shipping Containers
- Tank cars, Tank trucks

**********

STORAGE CONDITIONS

Store in properly designed storage systems equipped with suitable refrigeration equipment, venting and absorption or neutralization facilities to prevent toxic fume release in failure or emergency conditions.

**********

ADDITIONAL INFORMATION AND REFERENCES

NCPA-HMIS Ratings: Health (Acute) - 3
Flammability - 0
Reactivity - 1
Personal Protection - -

Personal Protection rating to be supplied by user depending on use conditions.

NFPA Ratings: Health - 3
Flammability - 0
Reactivity - 0
Unusual Hazards - -

Belle Plant Personal Protective Equipment Requirements:
For sampling and breaking into lines, wear neoprene gloves sealed to chemical suit, boots, chemical hood, and air supplied respirator.

(ADDITIONAL INFORMATION AND REFERENCES - CONTINUED )

Latest MSDS Revision Date: 87/05.
(Reference E-94782)

**********

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Person Responsible for MSDS : J. C. Watts
Du Pont Co.
Chestnut Run Site, C&P Dept.
Wilmington, DE 19898
302-999-4946

Du Pont Material Safety Data Sheet

MATERIAL IDENTIFICATION

NUMBER : 80000133
NAME : Chlorine

CHEMICAL FAMILY : Halogen
CAS NAME : Chlorine
CAS NUMBER : 7782-50-5
FORMULA : Cl2
MANUFACTURER/DISTRIBUTOR : E.I. du Pont de Nemours & Co., Inc.
1007 Market Street
Wilmington, DE 19898
PRODUCT INFORMATION PHONE : 1-(800)441-7515
TRANSPORTATION EMERGENCY PHONE : 1-(800)424-9300
MEDICAL EMERGENCY PHONE : 1-(800)441-3637

**********

COMPONENTS

| Material | CAS Number | % |
|---|---|---|
| Chlorine | 7782-50-5 | 100 |

**********

PHYSICAL DATA

Boiling Point : -34.6 deg C at 760 mm Hg. (-30.1 F)
Vapor Pressure : 4800 mm Hg at 20 deg C
Vapor Density : 2.5 (Air = 1.0)
Melting Point : -101 deg C (-149.8 F)
Evaporation Rate : _> 1
Solubility in Water : 0.57 WT % at 30 deg C
Odor : Acrid, Threshold : 0.2-0.4ppm
Form : Gas; liquid
pH Information: Not applicable
Color: Gas: greenish yellow
Liquid: amber
Specific Gravity: 1.56 (liquid)

**********

HAZARDOUS REACTIVITY

Instability : Reacts with Dry chlorine is stable in steel containers at room temp.
Decomposition : Hydrochloric and unstable hypochlorus acids are formed with water.
Polymerization : Polymerization will not occur.
Incompatibility: Reacts explosively or forms explosive compounds with acetylene, turpentine, fuel gas, hydrogen, ether, ammonia gas, and finely pulverized metals. May also form explosive mixtures with certain organic vapors and causes runaway reactions with certain polymers if contacted in confined areas. Combines with carbon monoxide and sulfur dioxide to form toxic and corrosive phosgene and sulfuryl chloride.

(HAZARDOUS REACTIVITY - CONTINUED )

**********

FIRE AND EXPLOSION DATA

Flash Point : Will not burn
Flammable Limits in Air, % by Vol.
LEL : Not applicable
UEL : Not applicable
Autoignition Temperature : Not applicable
Autodecomposition Temperature : Not applicable

FIRE AND EXPLOSION HAZARDS

Strong oxidizer. Contact with certain combustible materials may cause fire.

EXTINGUISHING MEDIA

As appropriate for combustibles in area.

SPECIAL FIRE FIGHTING INSTRUCTIONS

Isolate hazard and evacuate confined areas. Stay upwind; avoid smoke and fumes. Firefighters must use self-contained breathing apparatus and full protective clothing when fighting fires in which chlorine is involved. Run-off from fire control may cause pollution.

**********

HEALTH HAZARD INFORMATION

Hazardous liquid and gas under pressure. Causes severe eye and skin burns. Harmful if inhaled; causes damage to nose, throat, and lungs.

Inhalation 1 hour LC50: 293 ppm in rats.

The compound is corrosive to the eyes and skin. Toxic effects described in animals from short exposures by inhalation include respiratory, kidney, liver, and lung effects. Animal testing indicates that this compound does not have carcinogenic, developmental, or reproductive effects.

Human health effects of overexposure may initially include: skin burns or ulceration; eye corrosion with corneal or conjunctival ulceration; irritation of the upper respiratory passages; temporary lung irritation effects with cough, discomfort, difficult breathing, or shortness of breath; possibly modest initial symptoms, followed in hours by severe shortness of breath, requiring prompt medical

(HEALTH HAZARD INFORMATION - CONTINUED )

attention: asthma-like reactions with shortness of breath, wheezing, or cough, and possibly occuring on subsequent reexposure to concentrations below established exposure limits: nonspecific discomfort, such as nausea, headache, or weakness; or temporary alteration of the heart's electrical activity with irregular pulse, palpitations, or inadequate circulation. Higher exposures may lead to these effects: fatality from gross overexposure. There are no reports of human sensitization. Individuals with preexisting diseases of the lungs, central nervous system, or cardiovascular system may have increased susceptibility to the toxicity of excessive exposure.

Carcinogenicity

None of the components in this chemical is listed by IARC, NTP, or OSHA as a carcinogen.

Exposure Limits for Chlorine

AEL * (DuPont): See below
TLV ** (ACGIH) : See below
PEL (OSHA) : See below

* AEL is DuPont's Acceptable Exposure Limit.
** TLV is a registered trademark.

AEL (Du Pont): 0.5 mg/m3 (8-hour TWA)
TLV* (ACGIH): 0.5 ppm, 1.5 mg/m3
STEL: 1 ppm, 3 mg/m3
PEL (OSHA): 1 ppm, 3 mg/m3 (ceiling value)

Safety Precautions

Do not get in eyes. Do not get on skin. Do not get on clothing. Wash thoroughly after handling.
Do not breathe gas.

**********

FIRST AID

In case of contact: Immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing before reuse.

If inhaled: Remove to fresh air immediately. If not breathing give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

If swallowed: Do not induce vomiting. Immediately give two

(FIRST AID - CONTINUED )

glasses of water or activated charcoal slurry. Call a physician. Never give anything by mouth to an unconscious person.

Note: To prepare activated charcoal slurry, suspend 50 gm of activated charcoal in 400 ml of water in a bottle and shake well.

**********

PROTECTION INFORMATION

Generally Applicable Control Measures and Procedures

Good general ventilation should be provided to keep gas concentrations below the exposure limits.

Personal Protective Equipment

| | |
|---|---|
| Eye/Face | : Coverall chemical splash goggles. |
| Respirator | : Self-contained breathing apparatus |
| Protective Gloves | : Chemical resistant gloves |

**********

DISPOSAL INFORMATION

Aquatic Toxicity : The 96-hr LC50, rainbow trout, is _<1 ppm (extremely toxic).

Spill, Leak, or Release

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.
Keep upwind of leak; evacuate until gas has dispersed.
Specially trained personnel should stop the leak if possible, dike the spill, and neutralize any water that may be used with caustic. Comply with Federal, State, and local regulations on reporting releases.

Waste Disposal

Comply with Federal, State, and local regulations.

**********

SHIPPING INFORMATION

DOT

| | |
|---|---|
| Proper Shipping Name | : Chlorine |
| Hazard Class | : Non-flammable Gas |
| UN/NA No. | : 1017 |
| DOT Label(s) | : Non-flammable Gas Poison |
| DOT Placard | : Chlorine |

(SHIPPING INFORMATION - CONTINUED )

DOT/IMO
Proper Shipping Name : Chlorine
Hazard Class : Poison Gas, 2.3
UN No. : 1017
DOT/IMO Label : Poison Gas

Shipping Containers
Tank cars

**********

STORAGE CONDITIONS

Store in a cool place away from heat, sparks, and flame. Keep containers tightly closed.

**********

ADDITIONAL INFORMATION AND REFERENCES

NPCA-HMIS RATINGS

| | |
|---|---|
| Health | 3 |
| Flammability | 0 |
| Reactivity | 1 |
| Personal Protection | .- |

Personal Protection ratings to be supplied by user depending on use conditions.

Belle Plant Personal Protective Equipment Requirements: For sampling, wear neoprene gloves, chemical suit, boots, chemical hood, and air supplied respirator. For breaking into lines, wear neoprene gloves sealed to chemical suit, boots, hood, and air supplied respirator.

Latest MSDS revision date: 87/03/18.

**********

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Person Responsible for MSDS : J. C. Watts
Du Pont Co.
Chestnut Run Site, C&P Dept.
Wilmington, DE 19898
302-999-4996

DuPont
Material Safety Data Sheet



"Lannate" Insecticide
M0000060 Revised 12-OCT-1996 Printed 6-NOV-1996

## CHEMICAL PRODUCT/COMPANY IDENTIFICATION

### Material Identification

"Lannate" is a registered trademark of DuPont.

Corporate MSDS Number : DU003803
Grade : A 90% FORMULATION

### Tradenames and Synonyms

"Lannate" 90-WD
90-WD

### Company Identification

MANUFACTURER/DISTRIBUTOR
DuPont
1007 Market Street
Wilmington, DE 19898

PHONE NUMBERS
Product Information : 1-800-441-7515
Transport Emergency : CHEMTREC 1-800-424-9300
Medical Emergency : 1-800-441-3637

## COMPOSITION/INFORMATION ON INGREDIENTS

### Components

| Material | CAS Number | % |
|---|---|---|
| METHOMYL (S-METHYL-N-[(METHYLCARBAMOYL)OXY]THIO-ACETIMIDATE) | 16752-77-5 | 90 |
| INERT INGREDIENTS | | 10 |

## HAZARDS IDENTIFICATION

### Potential Health Effects

DANGER! POISON! Fatal if swallowed. May be fatal if inhaled or absorbed through eyes. Harmful if absorbed through the skin.

WARNING SYMPTOMS

Methomyl poisoning produces effects associated with anticholinesterase activity which may include weakness, blurred vision, headache, nausea, abdominal cramps,

(HAZARDS IDENTIFICATION - Continued)

discomfort in the chest, constriction of pupils, sweating, slow pulse, muscle tremors.

ANIMAL DATA

Acute Oral LD50: (Active ingredient, fasted rats)
17 mg/kg (males); 24 mg/kg (females)
Highly toxic by ingestion.

Acute Dermal LD50: (Active ingredient, aqueous slurry)
> 5,000 mg/kg (male rabbits; intact skin
Slightly toxic by contact.

INHALATION

4 hour LC50: 0.30 mg/L (male albino rats). Toxic by inhalation.

SKIN IRRITATION AND SENSITIZATION

(Guinea pigs): Application to shaved skin as a 60% paste in propylene glycol, a 5% solution in propylene glycol or in water, or as 24% or 29% liquid formulation resulted in mild to no irritation and no sensitization.

EYE IRRITATION

(Rabbit): Ten mg of unformulated Methomyl, either as a powder or solution in propylene glycol, caused mild transient conjuctivitis and iritic congestion on the day of treatment; no corneal injury was observed. Excessive quantities of the unformulated powder were lethal via ocular exposure. This exposure was within the equivalent range that produced mortalities via oral administration.

Both unformulated Methomyl and various formulations caused pupillary constriction and other effects associated with anticholinesterase activity.

CHRONIC STUDIES - METHOMYL

2-year feeding in rats: Feeding levels 0, 50, 100, 200, and 400 ppm; no effect level (NOEL) of 100 ppm based on slight hemolytic anemia and/or body weight effects observed at the higher dietary concentrations. No compound related neoplastic lesions were observed.

2-year feeding in mice: Feeding levels 0, 50, 75, and 200 ppm; no compound related neoplastic or non-neoplastic histologic effects were found at any level. The NOEL was considered to be 50 ppm based on transient hemolytic anemia and increased mortality at the higher dietary concentrations.

(HAZARDS IDENTIFICATION - Continued)

2-year feeding in dogs: Feeding levels 0, 50, 100, 400, and 1,000 ppm. The NOEL of 100 ppm was based on hemolytic anemia and non-neoplastic changes within the kidney and spleen at the higher dietary concentrations. There were no neoplastic effects at any dose.

REPRODUCTION

Three-generation rat reproduction study at dietary rates of 50 and 100 ppm showed no adverse effect upon fertility, and no compound related histologic effect. A 2-generation rat study conducted at 75, 600, and 1,200 ppm in the diet showed similar results.

TERATOGENICITY

In rats, no embryotoxic or teratogenic effects were observed at levels up to 400 ppm (highest level fed). In rabbits, the highest dietary dose level (equivalent to 100 mg/kg body wt.) did not cause any observed compound related abnormalities.

MUTAGENICITY

Methomyl was negative in numerous assays to evaluate mutagenicity and genotoxicity, including Ames test, Reverse Mutation Assay, Recessive Lethal Assay, three DNA damage studies, an unscheduled DNA Synthesis Assay, and in vitro and in vivo cytogenetic assays.

ACCEPTABLE DAILY INTAKE

Based on the 100 ppm no-observable effect level of the 2-year dog feeding study, and utilizing a 100 fold safety factor, the U.S. EPA has established an Acceptable Daily Intake of 0.025 mg per kilogram of body weight per day.

Carcinogenicity Information

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

---

FIRST AID MEASURES

---

First Aid

This Product is an N-Methyl Carbamate insecticide.

IF SWALLOWED: Call a physician or Poison Control Center. Drink 1 or 2 glasses of water and induce vomiting by touching back of throat with finger. Do not induce vomiting or give anything by mouth to an unconscious person.

(FIRST AID MEASURES - Continued)

IF INHALED: Remove from exposure and have patient lie down and keep quiet. If patient is not breathing, start artifical respiration immediately. Never give anything by mouth to an unconscious person. Call a physician if necessary.

IN CASE OF CONTACT: Wash skin with plenty of soap and water; for eyes, flush with water for 15 minutes and get medical attention; remove and wash contaminated clothing before re-use.

Notes to Physicians

Atropine sulfate should be used for treatment. Administer repeated doses, 1.2 to 2.0 mg. intravenously every 10 to 30 minutes until full atropinization is achieved. Maintain atropinization until the patient recovers. Artificial respiration or oxygen may be necessary. Allow no further exposure to any cholinesterase inhibitor until recovery is assured.

Do not use 2-PAM for exposure to "Lannate" alone. However, for exposure to combinations of "Lannate" and organophosphorous insecticides, 2-PAM may be used as required to supplement the atropine sulfate treatment. Do not use morphine.

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FIRE FIGHTING MEASURES

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Flammable Properties

Flammable limits in Air, % by Volume
LEL : 0.096 g/L
Autodecomposition : 136 C (277 F)

Will ignite if exposed to intense heat or open flame.

Dust forms explosive mixture with air.

Fire and Explosion Hazards:

Fire or intense heat may cause violent rupture of packages. Heating can release vapors which can be ignited. Hazardous gases produced in fire under conditions that produce incomplete combustion may consist of SO2, NO2, CO2, HCN, CH3NCO, CO, CS2. Complete combustion greatly reduces the amounts of CS2, CO, HCN, and CH3NCO generated.

Extinguishing Media

Water Spray, Water Fog, Dry Chemical, CO2.

(FIRE FIGHTING MEASURES - Continued)

Fire Fighting Instructions

Evacuate personnel to a safe area. Keep personnel removed and upwind of fire. Wear self-contained breathing apparatus. Wear full protective equipment. Use water spray. Cool tank/container with water spray. Isolate area. Fight fire from maximum distance, use extreme caution as heat may decompose material and rupture containers.

If area is heavily exposed to fire and if conditions permit, let fire burn itself out since water may increase the area contaminated.

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ACCIDENTAL RELEASE MEASURES

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Safeguards (Personnel)

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Initial Containment

Remove source of heat, sparks, flame, impact, friction or electricity.

Accidental Release Measures

Contain spill. Shovel or sweep up powder. Use sawdust, sand, oil dry or other absorbent material as an aid to removing remaining traces of spilled material. Do not allow the material to enter sewers, waterways or low areas.

If product enters crevices and can not be removed, treat with a sodium hydroxide solution and allow to stand 4 hours.

NOTE: Sodium hydroxide is caustic and causes burns. Do not get in eyes, on skin, or on clothing. In case of contact, flush eyes or skin with plenty of water and call a physician. When handling, wear goggles in addition to boots and gloves.

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HANDLING AND STORAGE

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Handling (Personnel)

Do not breathe vapor or mist. Do not breathe dust. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. Wash clothing after use. Do not store or consume food, drink or tobacco in areas where they may become contaminated with this material.

(HANDLING AND STORAGE - Continued)

USERS SHOULD: Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet. Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. Remove personal protective equipment immediately after handling this product. Wash the outside of gloves before removing.

Handling (Physical Aspects)

Avoid dust generation. Keep away from heat, sparks and flames.

Storage

Handle this package carefully to prevent breakage of inner bag when stored at low temperatures. Allow to warm above 50 deg F for normal handling. Store product in original container only. Do not contaminate water, other pesticides, fertilizer, food or feed in storage. Not for use or storage in or around the home.

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EXPOSURE CONTROLS/PERSONAL PROTECTION

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Engineering Controls

Use only with adequate ventilation. Keep container tightly closed.

Personal Protective Equipment

Applicators and other handlers must wear:
- Long-sleeved shirt and long pants
- Waterproof gloves
- Shoes plus socks.
- Protective eyewear

For exposures in enclosed areas, a respirator with either an organic vapor-removing cartridge with a prefilter approved for pesticides (MSHA/NIOSH approval number prefix TC-23C), or a canister approved for pesticides (MSHA/NIOSH approval number prefix TC-14G).

For exposures outdoors, a dust/mist filtering respirator (MSHA/NIOSH approval number prefix TC-21C).

Discard clothing or other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

PPE required for early reentry to treated areas that is permitted under the Workers Protection Standard and that involves contact with anything that has been treated, such

(EXPOSURE CONTROLS/PERSONAL PROTECTION - Continued)

as plants, soil, or water, is:
Coveralls
Waterproof gloves
Shoes plus socks
Protective eyewear

# Exposure Guidelines

Applicable Exposure Limits
METHOMYL
PEL (OSHA) : None Established
TLV (ACGIH) : 2.5 mg/m3, 8 Hr. TWA, A4
AEL * (DuPont) : None Established

* AEL is DuPont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence..

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PHYSICAL AND CHEMICAL PROPERTIES

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Physical Data

Solubility in Water : 5.8 WT% @ 25 C (77 F)
Odor : Slightly sulfurous
Form : Solid
Color : White
Specific Gravity : 1.2946 @ 25C (77F)
Bulk Density (Loose) : 30-38 lb/cu ft
Bulk Density (Packed) : 37-43 lb/cu ft

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STABILITY AND REACTIVITY

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Chemical Stability

Stable at normal temperatures and storage conditions.

Incompatibility with Other Materials

Incompatible with strong bases.

Polymerisation

Polymerization will not occur.

Other Hazards

Decomposition : Thermal decomposition and combustion will produce hazardous gases. These may include sulfur oxides, methyl isocyanate and hydrogen cyanide.

## ECOLOGICAL INFORMATION

### Ecotoxicological Information

Aquatic Toxicity

Methomyl is extremely toxic:
96 hour LC50, bluegill sunfish: 0.72 ppm
96 hour LC50, rainbow trout: 3.4 ppm

## DISPOSAL CONSIDERATIONS

### Waste Disposal

Treatment, storage, transportation and disposal must be in accordance with applicable Federal, State/Provincial, and Local regulations. Do not flush to surface water or sanitary sewer system.

DISPOSAL: Do not contaminate water, food or feed by storage. Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER DISPOSAL: Completely empty bag into application equipment. Then dispose of empty package in a sanitary landfill or by incineration, or, if allowed by State and Local authorities, by burning. If burned, stay out of smoke.

## TRANSPORTATION INFORMATION

### Shipping Information

DOT/IMO

| | |
|---|---|
| Proper Shipping Name | : CARBAMATE PESTICIDE, SOLID, TOXIC (methomyl) |
| Hazard Class | : 6.1 |
| UN No. | : UN 2757 |
| Special Information | : Marine Pollutant (water or bulk) |
| Packing Group | : II |

## REGULATORY INFORMATION

### U.S. Federal Regulations

TITLE III HAZARD CLASSIFICATIONS SECTIONS 311, 312

| | |
|---|---|
| Acute | : Yes |
| Chronic | : No |
| Fire | : No |
| Reactivity | : No |
| Pressure | : No |

ADDITIONAL REGULATORY INFORMATION

Section 302 Extremely Hazardous Substance:
Methomyl - Threshold Planning Quantity (TPQ)
(500/10,000 lbs)

SARA/CERCLA Reportable Quantity:
Methomyl (100 lbs)

REGULATORY CONTROLS:
This product is registered under EPA/FIFRA regulations. It is a violation of Federal Laws to use this product in any manner inconsistant with its labeling. Read and follow all label directions. This product is excluded from listing requirements under EPA/TSCA.

EPA Reg. No. 352-342

## OTHER INFORMATION

### NFPA, NPCA-HMIS

NFPA Rating

| | |
|---|---|
| Health | : 2 |
| Flammability | : 1 |
| Reactivity | : 1 |

NPCA-HMIS Rating

| | |
|---|---|
| Health | : 3 |
| Flammability | : 1 |
| Reactivity | : 1 |

Personal Protection rating to be supplied by user depending on use conditions.

(Continued)

Additional Information

RESTRICTED USE PESTICIDE

Due to High Acute Toxicity to Humans

For retail sale and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification. Direct supervision for this product requires the certified applicator to review federal and supplemental label instructions with all personnel prior to application, mixing, loading, or repair or cleaning of application equipment.

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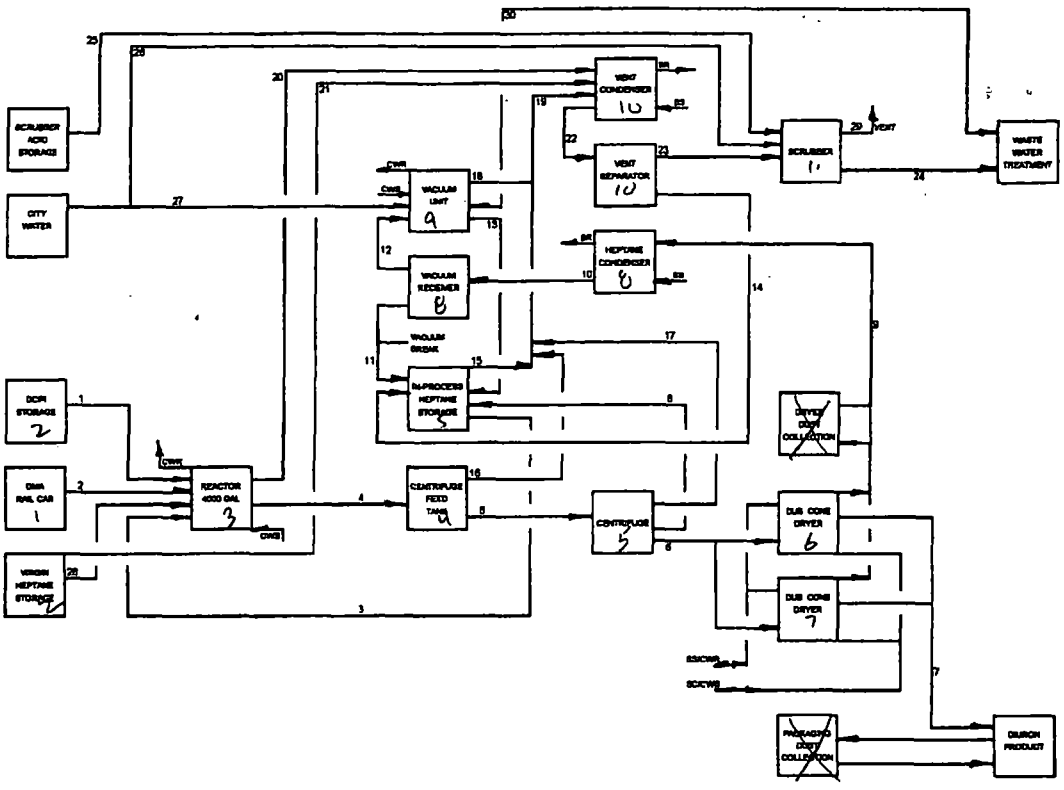
The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS : DuPont
Address : Agricultural Products
Wilmington DE 19898
Telephone : 800-441-7515

# Indicates updated section.

End of MSDS

UNIT 2 DIURON PROCESS FLOWSHEET




| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| REACTOR DCPI FEED | REACTOR DMA FEED | REACTOR RECYCLED HEPTANE FEED | DIURON HEPTANE SLURRY | DIURON HEPTANE SLURRY | CENTRIFUGE SOLID DISCHARGE | DIURON PRODUCT | CENTRIFUGE LIQUID DISCHARGE | DRYER OVERHEAD HEPTANE VAPOR | HEPTANE CONDENSATE & VAPOR |

| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|
| RECOVERED DRYER HEPTANE | HEPTANE VAPOR TO VACUUM UNIT | HEPTANE LIQUID FROM VACUUM PUMP | VENT SEPARATOR HEPTANE CONDENSATE | IN PROCESS HEPTANE STORAGE VENT | CENTRIFUGE FEED TANK VENT | CENTRIFUGE VENT | VACUUM UNIT VENT | MAIN HEPTANE VENT | REACTOR VENT |

| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|
| VIRGIN HEPTANE STORAGE VENT | VENT VAPOR & CONDENSATE | VENT VAPOR | SPENT SCRUBBER LIQUOR | SCRUBBER MAKEUP ACID | SCRUBBER MAKEUP WATER | VACUUM PUMP WATER SUPPLY | HEPTANE MAKEUP | SYSTEM VENT. | VACUUM UNIT WATER BLOWDOWN |

DIURON REPLACEMENT REACTOR INSTALLATION 5/2/96

| ITEM | COST | |
|---|---|---|
| 1 EQUIPMENT REMOVAL | 20,000 | |
| | | 20,000 |
| 2 DMA SYSTEM | | |
| 1 Run DMA piping to new reactor. | 4,000 | |
| 2 Relocate control valve and instrumentation | 3,000 | |
| | | 7,000 |
| 3 HEPTANE SYSTEM | | |
| 1 Run heptane piping to new reactor. | 4,000 | |
| 2 Relocate valving and instrumentation | 1,000 | |
| | | 5,000 |
| 4 DCPI SYSTEM | | |
| 1 Run DCPI piping to new reactor. | 4,000 | |
| 2 Relocate valving and instrumentation. | 1,000 | |
| | | 5,000 |
| 5 REACTOR | | |
| 1 Concrete and steel, installed | 40,000 | |
| 2 Install reactor | 10,000 | |
| 3 Agitator and manway cover | 20,000 | |
| 4 Install new slurry transfer pump & piping | 18,000 | |
| 5 Vessel Repairs | 4,000 | |
| 6 Process piping | 5,000 | |
| 7 Utility piping | 12,000 | |
| 8 Instrumentation | 15,000 | |
| 9 Insulation | 4,000 | |
| | | 128,000 |
| 6 CENTRIFUGE FEED TANK | | |
| 1 Installation | 20,000 | |
| 2 Slurry transfer pump & piping | 18,000 | |
| 3 Instrumentation | 4,000 | |
| | | 42,000 |
| 7 CENTRIFUGE | | |
| 1 Centrifuge | 10,000 | |
| 2 Installation | 12,000 | |
| 3 Instrumentation | 5,000 | |
| 4 Conveyor | 20,000 | |
| 5 Piping | 8,000 | |
| | | 55,000 |
| 8 DRYERS | | |
| 1 Dryers | 150,000 | |
| 2 Installation | 100,000 | |
| 3 Vent Condenser | 30,000 | |
| | | 280,000 |
| SUB-TOTAL | | 542,000 |
| CONTINGENCY (10%) | | 54,200 |
| TOTAL | | 596,200 |



AB0000057997/2

# Staveley Chemicals Limited

## Methods of analysis of active ingredient (Diuron)

a) The method of assay is by acid hydrolysis followed by estimation of the liberated dimethylamine (the method sheet is attached).

b) Tetrachlorocarbanilide is estimated by sulphuric acid hydrolysis of a sample followed by bromination of the liberated aromatic amines. The carbanilide content is the difference between the total aromatic amine thus found and the 3.4 dichloro aniline equivalent to the dimethylaniline shown in the diuron assay (see (a) above) after allowing for the free aromatic amine (see (e) below).

c) Water by Karl Fischer method.

d) Other impurities by difference. Gas chromatography shows these to be similar to DuPont's Karmex.

e) Free aromatic amine by bromination of the HCl extract obtained during treatment of the sample for assay (see (a) above). The method sheet is attached.



AB0000057997/3

# MATERIAL SAFETY DATA SHEET

DU PONT

M S D S

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MATERIAL IDENTIFICATION

Methylamines, Anhydrous

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MSDS NUMBER : 8461CR
CORPORATE NUMBER : DU000329

Revision Date : 14-Nov-92
Date Printed : 13-Jul-93

MANUFACTURER/DISTRIBUTOR
Du Pont
1007 Market Street
Wilmington, DE 19898

PHONE NUMBERS
PRODUCT INFORMATION : 1-800-441-9442
TRANSPORT EMERGENCY : CHEMTREC: 1-800-424-9300
MEDICAL EMERGENCY : 1-800-441-3637

GRADE : MONOMETHYLAMINE; DIMETHYLAMINE; TRIMETHYLAMINE
CHEMICAL FAMILY : AMINE

TRADE NAMES / SYNONYMS
MONOMETHYLAMINE = METHYLAMINE; MMA
DIMETHYLAMINE = DMA
TRIMETHYLAMINE = TMA

CAS NAME : MMA = METHYLAMINE; DMA = N-METHYL METHYLAMINE; TMA = N,N-DIMETHYL METHYLAMINE
FORMULA : MMA = CH3NH2; DMA = (CH3)2NH; TMA = (CH3)3N
TSCA INVENTORY STATUS : Reported/Included
NFPA RATINGS : Health: 3 Flammability: 4 Reactivity: 0
NPCA-HMIS RATINGS : Health: 3 Flammability: 4 Reactivity: 0
Personal Protection rating to be supplied by user depending on use conditions.

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COMPONENTS

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| Material | CAS Number | % |
|---|---|---|
| MONOMETHYLAMINE | 74-89-5 | 99.6 |
| OR | | |
| DIMETHYLAMINE | 124-40-3 | 99.8 |
| OR | | |
| TRIMETHYLAMINE | 75-50-3 | 99.3 |

## FIRE AND EXPLOSION DATA

Flash Point : Flammable gases
Autodecomposition: Not determined

Flammable Limits in Air, % by Volume:

Lower:

MMA: 4.9
DMA: 2.8
TMA: 2.0

Upper:

MMA: 20.7
DMA: 14.4
TMA: 11.6

Autoignition Temperature:

MMA: 430 deg C (806 deg F)
DMA: 400 deg C (752 deg F)
TMA: 190 deg C (374 deg F)

Actual AITs can be affected by the concentration of vapor and oxygen, vapor/air contact time, pressure, volume, catalytic impurities, etc. Processing conditions should be analyzed to determine if the AITs may be higher or lower.

## FIRE AND EXPLOSION HAZARDS

Extremely flammable gases. Flame is nearly invisible in daylight; vapors are heavier than air and may travel to a source of ignition and flash back. Follow appropriate National Fire Protection Association (NFPA) codes.

## EXTINGUISHING MEDIA

Water Spray. Dry Chemical.

"Alcohol" Foam. Carbon Dioxide (CO2).

## SPECIAL FIRE FIGHTING INSTRUCTIONS

Allow to burn until flow of gas can be stopped. Use water spray to cool containers and protect personnel. Wear self-contained breathing apparatus and protective clothing. Aqueous methylamine solutions will burn unless thoroughly diluted using a water spray.

(HEALTH HAZARD INFORMATION - Continued)

demonstrate no carcinogenic activity. DMA does not produce genetic damage in bacterial or mammalian cell cultures, but it has not been tested in animals. Tests for developmental or reproductive toxicity have not been performed.

TRIMETHYLAMINE

The compound is a severe eye irritant in animals, but is untested for skin irritation or sensitization. Toxic effects described in animals from repeated inhalation exposures include respiratory irritation, hematological effects, and nonspecific effects such as weight loss. By ingestion, the effects in animals to a single high dose include vomiting and diarrhea. Repeated oral doses caused slight abnormalities in seminal vesicals and prostate. No animal test reports are available to define the carcinogenic, developmental, or reproductive hazards of TMA. The compound does not produce genetic damage in bacterial cell cultures, but has not been tested in animals.

HUMAN HEALTH EFFECTS:

The human health effects of overexposure to these compounds by skin contact may include burns or ulceration. In addition, animal data suggests that skin contact with DMA may cause allergic skin rashes. However, there are no reports of human sensitization. By eye contact with these compounds, the effects may include eye irritation with discomfort, tearing, or blurring of vision. Higher exposures by eye contact may cause corneal opacity, or eye corrosion with corneal or conjunctival ulceration. By inhalation, the effects may include irritation of the respiratory passages, and temporary lung irritation effects with cough, discomfort, difficulty breathing, or shortness of breath. Individuals exposed briefly to 20-100 ppm MMA experienced transient eye, nose, and throat irritation. By ingestion, the effects include irritation of the mucous membranes of the gastrointestinal tract. Higher exposures to DMA may lead to abnormal liver function as detected by laboratory tests.

Individuals with preexisting diseases of the lung or skin may have increased susceptibility to the toxicity of excessive exposures.

CARCINOGENICITY

None of the components in this material is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

# APPLICABLE EXPOSURE LIMITS

MONOMETHYLAMINE

AEL * (Du Pont): 10 ppm - 8 & 12 Hr. TWA
TLV (ACGIH) : 5 ppm, 6.4 mg/m3 - 8 Hr TWA

## PROTECTION INFORMATION

GENERALLY APPLICABLE CONTROL MEASURES AND PRECAUTIONS

Good general ventilation should be provided to keep vapor concentrations below exposure limits.

PERSONAL PROTECTIVE EQUIPMENT

Have available and use as appropriate:

EYE/FACE PROTECTION

Safety glasses (side shields preferred) or coverall chemical splash goggles. In addition, wear a chemical-proof hood where the possibility exists for face contact due to splashing or spraying of material.

RESPIRATORS

A NIOSH/MSHA approved full-face mask equipped with chemical cartridges approved for methylamine may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air purifying respirators is limited. Use a positive pressure air supplied respirator if there is any potential for an uncontrolled release, when exposure levels are not known, or in any other circumstances where air purifying respirators may not provide adequate protection.

PROTECTIVE CLOTHING

Impervious gloves, apron, pants, jacket, hood, boots, or totally encapsulating chemical suit with breathing air supply.

## DISPOSAL INFORMATION

AQUATIC TOXICITY

MMA: 24-hour LC50, killifish : 1,000 mg/L

DMA: 96-hour LC50, rainbow trout: 120 mg/L

TMA: 24-hour LC50, killifish : 1,000 mg/L

SPILL, LEAK, OR RELEASE

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.

(SHIPPING INFORMATION - Continued)

Proper Shipping Name : DIMETHYLAMINE, ANHYDROUS
Hazard Class : 2.1
UN No. : 1032
DOT/IMO Label : FLAMMABLE GAS
Reportable Quantity : 100 lbs/45.4 kg

TMA:
Proper Shipping Name : TRIMETHYLAMINE, ANHYDROUS
Hazard Class : 2.1
UN No. : 1083
DOT/IMO Label : FLAMMABLE GAS
Reportable Quantity : 100 lbs/45.4 kg

## STORAGE CONDITIONS

Store in a well ventilated area away from heat, sparks, and flame. Keep containers tightly closed. Do not store with oxidizing materials. Water scrubber and water sprinkler or deluge system are recommended in storage area.

## TITLE III HAZARD CLASSIFICATIONS

Acute : Yes
Chronic : No
Fire : Yes
Reactivity : No
Pressure : No

LISTS:

Extremely Hazardous Substance -No
CERCLA Hazardous Substance -Yes
Toxic Chemical -No

CANADIAN WHMIS CLASSIFICATION:

MMA: A; B-1; D-1B; E
DMA: A, B-1; D-1B; E
TMA: A, B-1; D-1B; E

## ADDITIONAL INFORMATION AND REFERENCES

For further information, see Du Pont "Methylamines Data Sheet" and "Methylamines Storage and Handling Bulletin".

DU PONT

# MATERIAL SAFETY DATA SHEET

## SECTION I

| | |
|---|---|
| MANUFACTURER'S NAME: E. I. du Pont de Nemours & Co. (Inc.) | EMERGENCY TELEPHONE NO.: (302) 774-7500 |
| ADDRESS (Number, Street, City, State, and ZIP Code): Wilmington, DE 19898 | |
| CHEMICAL NAME AND SYNONYMS: Chlorosulfonic Acid, Chlorosulfuric Acid | TRADE NAME AND SYNONYMS: Chlorosulfonic Acid, CSA |
| CHEMICAL FAMILY: Inorganic Acid | FORMULA: $ClSO_3H$ |

## SECTION II HAZARDOUS INGREDIENTS OF MIXTURES

N.A.*

## SECTION III PHYSICAL DATA

| | | | | |
|---|---|---|---|---|
| BOILING POINT | 152 C | 305 F | SPECIFIC GRAVITY (H$_2$O=1) | 1.752 |
| VAPOR PRESSURE (mm Hg) @ 30 C (86 F) | 0.8 | | PERCENT VOLATILE BY VOLUME (%) | 0 |
| VAPOR DENSITY (AIR=1) | 4.0 | | EVAPORATION RATE (butyl acetate = 1) | less than 1 |

SOLUBILITY IN WATER: On contact with water, decomposes violently into sulfuric & hydrochloric acid.

APPEARANCE AND ODOR: Clear to cloudy, colorless to light yellow fuming liquid with a pungent odor

## SECTION IV FIRE AND EXPLOSION HAZARD DATA

| | | | |
|---|---|---|---|
| FLASH POINT (Method Used): N.A. (non-flammable) | FLAMMABLE LIMITS: N.A. | LEL: | UEL: |
| EXTINGUISHING MEDIA: Dry chemical or carbon dioxide | | AUTO. IGNIT. TEMP. | |

SPECIAL FIRE FIGHTING PROCEDURES: Cool tank with water if exposed to fire. Do not get water in tank. Wear full protective clothing including boots. Wear self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Avoid contact with water since reaction is violent (explosive) with evolution of heat and dense white fumes. CSA can cause ignition by contact with combustible material.

## SECTION V HEALTH HAZARD DATA

| | |
|---|---|
| THRESHOLD LIMIT VALUE (ACGIH): not determined (5 ppm recommended per MCA SD-33) | TIME WEIGHTED AVERAGE (OSHA): Not determined |

EFFECTS OF OVEREXPOSURE: Causes severe burns. Harmful if inhaled--may cause delayed lung injury. Contact with water or moist air releases irritating gas.

EMERGENCY AND FIRST AID PROCEDURES: In case of contact, flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. If inhaled, remove person to fresh air. If not breathing, apply artificial respiration; give oxygen if breathing is difficult. Vomiting should not be induced. In all cases, call a physician.

*N.A. - Not applicable

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process. The information set forth herein is furnished free of charge and is based on technical data that Du Pont believes to be reliable. It is intended for use by persons having technical skill and at their own discretion and risk. Since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information. Nothing herein is to be taken as a license to operate under or a recommendation to infringe any patents.

## SECTION VI REACTIVITY DATA

| | | | |
|---|---|---|---|
| STABILITY | UNSTABLE | | CONDITIONS TO AVOID: Violent reaction with water. Corrosive to most metals, particularly when exposed to moisture. |
| | STABLE | X | |

INCOMPATIBILITY (Materials to avoid): Water, organic materials, and products such as nitrates, carbides, chlorates

HAZARDOUS DECOMPOSITION PRODUCTS: Hydrochloric acid, sulfuric acid and mist, sulfur trioxide, hydrogen

| | | | |
|---|---|---|---|
| HAZARDOUS POLYMERIZATION | MAY OCCUR | | CONDITIONS TO AVOID |
| | WILL NOT OCCUR | X | |

## SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:
Do not get on skin, in eyes, on clothing. Keep people upwind of leak or spill. Remove all sources of ignition. Wear full protective clothing including self-contained breathing apparatus.

WASTE DISPOSAL METHOD:
Flush away spill by flooding with water applied quickly to entire spill from a distance. Dry sand, ashes, or gravel may be used to absorb for later disposal. Neutralize remaining traces of acid with soda ash or lime. Avoid drainage to sewers.

## SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specific Type): None for normal use. For emergencies use complete rubber suit with hood.

| | | |
|---|---|---|
| VENTILATION | LOCAL EXHAUST: Maintain adequate ventilation | SPECIAL: Fume scrubbers |
| | MECHANICAL (General): Unknown | OTHER: Mist eliminators |

PROTECTIVE GLOVES: Long rubber gloves to cover forearms

EYE PROTECTION: Acid-proof goggles or rubber hood.

OTHER PROTECTIVE EQUIPMENT:
Long rubber apron, rubber boots, long sleeved shirt & trousers of ORLON® and hat with brim

## SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

SEE ATTACHED SHEET

OTHER PRECAUTIONS

E-18960

Date: 11/77

For more information refer to: Du Pont Chlorosulfonic Acid Bulletin A-96540
Manufacturing Chemists Assn. SD-33
National Fire Protection Assn. Manuals 49, 491M

DUPONT

# CHLOROSULFONIC ACID

## PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Do not breathe vapor or mist. Do not get in eyes, on skin or clothing. Wash thoroughly after handling. Protect containers against damage. Drums should be stored in well ventilated areas away from combustible materials. Keep drums closed with bungs up. Keep drum storage periods to a minimum and vent once per week, or more often in hot weather.

## OTHER PRECAUTIONS

Never dilute or contact directly with water because of violent reaction. Keep fire and sparks away from container openings; do not strike fittings with tools.

DU PONT

INDUSTRIAL CHEMICALS department

PRODUCT
DATA SHEET

# CHLOROSULFONIC ACID

Chlorosulfonic acid is a clear, corrosive, straw colored liquid with a pungent odor. It reacts violently with water with evolution of heat and large quantities of dense white fumes. Hydrochloric acid and sulfuric acid are formed on decomposition.

Chlorosulfonic acid is used principally in organic synthesis as a sulfating, sulfonating or chlorosulfonating agent. Its chemical formula is $ClSO_2OH$.

## PHYSICAL PROPERTIES

| | |
|---|---|
| Molecular weight | 116.531 |
| Boiling point*, °C | 155 |
| °F | 311 |
| Freezing point, °C | −80 |
| °F | −112 |
| Specific gravity (15.6°C, 60°F) | 1.752 |
| Density (15.6°C, 60°F), lb/gal | 14.6 |
| Vapor pressure, mm Hg (30°C) | 0.8 |
| (38°C) | 2.5 |
| (60°C) | 11.0 |

*with some decomposition

## AVERAGE ANALYSIS

| | |
|---|---|
| Total chlorosulfonic acid ($HClSO_3$), % | 99.4 |
| Total chlorides as HCl, % | 31.2 |
| Sulfuric acid ($H_2SO_4$), % | 0.2 |
| Free $SO_3$, % | 0.4 |
| Iron** (Fe), ppm | 1.0 |
| Aluminum (Al), ppm | less than 1 |

**"as loaded" basis

## CHEMICAL PROPERTIES

**Sulfation**

$$ROH + ClSO_2OH \rightarrow ROSO_2OH + HCl$$

**Sulfonation**

$$RH + ClSO_2OH \rightarrow RSO_2OH + HCl$$

**Chlorosulfonation**

$$RH + 2ClSO_2OH \rightarrow RSO_2Cl + H_2SO_4 + HCl$$

**Reaction with salts**

$$NaCl + ClSO_3H \rightarrow NaOSO_2Cl + HCl$$

## USES

**Pharmaceuticals**—synthesis of sulfa drugs, saccharin, sterilizing agents.

**Detergents and Wetting Agents**—formation of alkyl sulfates; also reacts with unsaturated oils to yield sulfonic acid derivatives.

**Synthetic Dyes**—used as sulfonating agent in synthesis of intermediates for acid and vat dyes; solvent or reaction medium for dyestuffs.

**Resins**—catalyst in the production of thermosetting resins; sulfonating agent in preparation of resin-based ion exchange resins.

**Organic Synthesis**—catalyst in esterification and alkylation reactions; preparation of alkyl halides and unsaturated ketones, short chain dialkyl sulfates.

## STORAGE AND HANDLING

Drums of chlorosulfonic acid should be stored away from nitrates, carbides, chlorates, metallic powders and organic materials. Contact with these and other combustible materials may cause fire.

Store drums with bungs up. Keep drums out of sun and away from heat. Keep lights, fire and sparks away

from drum openings. Storage periods and temperatures should be kept to a minimum.

Glass lined steel tanks are most preferred for bulk storage of chlorosulfonic acid, although stainless steel tanks can be used if nominal iron pickup can be tolerated. Storage in steel tanks results in product discoloration and formation of sediment.

Although chlorosulfonic acid is produced with an iron content of 1 ppm or less, the acid may pick up iron after delivery depending on the shipping container as well as elapsed time and temperature during shipment.

## PERSONAL SAFETY

Chlorosulfonic acid is a corrosive material that causes severe burns on contact. Do not get in eyes, on skin or on clothing. Do not breathe vapor or mist. Rubber gloves, rubber apron and acid proof goggles should be worn when handling chlorosulfonic acid.

Contact with water or moist air releases irritating gas. Do not allow water to enter container because of violent eruption.

Vapors of chlorosulfonic acid are harmful if inhaled and may cause delayed lung injury. Use with adequate ventilation.

In case of personal contact immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes; for eyes, call a physician. Wash contaminated clothing before reuse.

For inhalation, remove person to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, administer oxygen. Call a physician. Do not induce vomiting.

For more information consult the Du Pont bulletin on chlorosulfonic acid and Chemical Safety Data Sheet SD-33 published by the Manufacturing Chemists Association (MCA).

## PACKAGES

Chlorosulfonic acid is available in returnable 55-gal steel and stainless steel drums; it is also available in tank cars and tank trucks. Containers carry the white acid label as prescribed by the Department of Transportation (DOT). Freight classification: Corrosive Liquid.

This data sheet is for guidance in using Du Pont chlorosulfonic acid. It is based upon information and tests believed to be reliable, but suitability for any particular use should be confirmed by user's own tests. The advice contained in this data sheet is given and accepted at the user's risk and the Du Pont Company makes no guarantee of results and assumes no obligation or liability in connection therewith. This publication is not to be taken as a license to operate under or recommendation to infringe any patents.

**E. I. DU PONT DE NEMOURS & CO. (INC.) • INDUSTRIAL CHEMICALS DEPARTMENT • WILMINGTON, DELAWARE 19898**

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**CHARLOTTE, N.C. 28210**
6250 Fairview Rd., P.O. Box 1909
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**CHICAGO, ILL. 60646**
7250 N. Cicero Ave., Lincolnwood
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**CLEVELAND, OHIO 44124**
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AR000011068B/5

DUE TO CHANGING DEPARTMENT OF TRANSPORTATION (DOT) REGULATIONS, REFERENCES HEREIN TO DOT REQUIREMENTS MAY NO LONGER BE CORRECT. YOU SHOULD CHECK THE CURRENT DOT REGULATIONS SUCH AS HAZARD CLASSIFICATION, LABELING AND PLACARDING FOR THE UP-TO-DATE DOT REQUIREMENTS FOR THE PRODUCT DESCRIBED IN THIS LITERATURE.

DU PONT

# MATERIAL SAFETY DATA SHEET

## SECTION I

| | |
|---|---|
| MANUFACTURER'S NAME: E. I. du Pont de Nemours & Co. (Inc.) | EMERGENCY TELEPHONE NO.: (302) 774-7500 |
| ADDRESS (Number, Street, City, State, and ZIP Code): Wilmington, DE 19898 | |
| CHEMICAL NAME AND SYNONYMS: Chlorosulfonic Acid, Chlorosulfuric Acid | TRADE NAME AND SYNONYMS: Chlorosulfonic Acid, CSA |
| CHEMICAL FAMILY: Inorganic Acid | FORMULA: $ClSO_3H$ |

## SECTION II HAZARDOUS INGREDIENTS OF MIXTURES

N.A.*

## SECTION III PHYSICAL DATA

| | | | | | |
|---|---|---|---|---|---|
| BOILING POINT | 152 C | 305 F | SPECIFIC GRAVITY ($H_2O$=1) | | 1.752 |
| VAPOR PRESSURE (mm Hg) | @ 30 C (86 F) | 0.8 | PERCENT VOLATILE BY VOLUME (%) | | 0 |
| VAPOR DENSITY (AIR=1) | | 4.0 | EVAPORATION RATE (butyl acetate = 1) | less than | 1 |

SOLUBILITY IN WATER: On contact with water, decomposes violently into sulfuric & hydrochloric acid.

APPEARANCE AND ODOR: Clear to cloudy, colorless to light yellow fuming liquid with a pungent odor.

## SECTION IV FIRE AND EXPLOSION HAZARD DATA

| | | | |
|---|---|---|---|
| FLASH POINT (Method Used): N.A. (non-flammable) | FLAMMABLE LIMITS: N.A. | LEL | UEL |
| EXTINGUISHING MEDIA: Dry chemical or carbon dioxide | | AUTO. IGNIT. TEMP. | |

SPECIAL FIRE FIGHTING PROCEDURES: Cool tank with water if exposed to fire. Do not get water in tank. Wear full protective clothing including boots. Wear self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Avoid contact with water since reaction is violent (explosive) with evolution of heat and dense white fumes. CSA can cause ignition by contact with combustible material.

## SECTION V HEALTH HAZARD DATA

| | |
|---|---|
| THRESHOLD LIMIT VALUE (ACGIH): not determined (5 ppm recommended per MCA SD-33) | TIME WEIGHTED AVERAGE (OSHA): Not determined |

EFFECTS OF OVEREXPOSURE: Causes severe burns. Harmful if inhaled--may cause delayed lung injury. Contact with water or moist air releases irritating gas.

EMERGENCY AND FIRST AID PROCEDURES: In case of contact, flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. If inhaled, remove person to fresh air. If not breathing, apply artificial respiration; give oxygen if breathing is difficult. Vomiting should not be induced. In all cases, call a physician.

*N.A. - Not applicable

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process. The information set forth herein is furnished free of charge and is based on technical data that Du Pont believes to be reliable. It is intended for use by persons having technical skill and at their own discretion and risk. Since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information. Nothing herein is to be taken as a license to operate under or a recommendation to infringe any patents.

## SECTION VI REACTIVITY DATA

| | | | |
|---|---|---|---|
| STABILITY | UNSTABLE | | CONDITIONS TO AVOID Violent reaction with water. Corrosive to most metals, particularly when exposed to moisture. |
| | STABLE | x | |

INCOMPATIBILITY (Materials to avoid) Water, organic materials, and products such as nitrates, carbides, chlorates

HAZARDOUS DECOMPOSITION PRODUCTS Hydrochloric acid, sulfuric acid and mist, sulfur trioxide, hydrogen

| | | | |
|---|---|---|---|
| HAZARDOUS POLYMERIZATION | MAY OCCUR | | CONDITIONS TO AVOID |
| | WILL NOT OCCUR x | | |

## SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Do not get on skin, in eyes, on clothing. Keep people upwind of leak or spill. Remove all sources of ignition. Wear full protective clothing including self-contained breathing apparatus.

WASTE DISPOSAL METHOD
Flush away spill by flooding with water applied quickly to entire spill from a distance. Dry sand, ashes, or gravel may be used to absorb for later disposal. Neutralize remaining traces of acid with soda ash or lime. Avoid drainage to sewers.

## SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specific Type) None for normal use. For emergencies use complete rubber suit with hood.

| | | |
|---|---|---|
| VENTILATION | LOCAL EXHAUST Maintain adequate ventilation | SPECIAL Fume scrubbers |
| | MECHANICAL (General) Unknown | OTHER Mist eliminators |

PROTECTIVE GLOVES Long rubber gloves to cover forearms

EYE PROTECTION Acid-proof goggles or rubber hood.

OTHER PROTECTIVE EQUIPMENT
Long rubber apron, rubber boots, long sleeved shirt & trousers of ORLON® and hat with brim

## SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

SEE ATTACHED SHEET

OTHER PRECAUTIONS

E-18960 Date: 11/77

For more information refer to: Du Pont Chlorosulfonic Acid Bulletin A-96540
Manufacturing Chemists Assn. SD-33
National Fire Protection Assn. Manuals 49, 491M

DUPONT
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# CHLOROSULFONIC ACID

## PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Do not breathe vapor or mist. Do not get in eyes, on skin or clothing. Wash thoroughly after handling. Protect containers against damage. Drums should be stored in well ventilated areas away from combustible materials. Keep drums closed with bungs up. Keep drum storage periods to a minimum and vent once per week, or more often in hot weather.

## OTHER PRECAUTIONS

Never dilute or contact directly with water because of violent reaction. Keep fire and sparks away from container openings; do not strike fittings with tools.

---

# MATERIAL IDENTIFICATION

**DDA-1000**

---

MSDS NUMBER : 1796PC
CORPORATE NUMBER : DU000209

Revision Date : 20-Nov-89
Date Printed : 02-Nov-90

MANUFACTURER/DISTRIBUTOR
Du Pont
1007 Market Street
Wilmington, DE 19898

PHONE NUMBERS
PRODUCT INFORMATION : 1-(800)441-7515
TRANSPORT EMERGENCY : 1-(800)424-9300
MEDICAL EMERGENCY : 1-(800)441-3637

CHEMICAL FAMILY : ALKYL NITRATE

TRADE NAMES / SYNONYMS
DUPONT DIESEL ADDITIVE 1000
2-ETHYL HEXYL NITRATE

CAS NAME : NITRIC ACID, 2-ETHYLHEXYL ESTER
CAS NUMBER : 27247-96-7
DU PONT REGISTRY NUMBER: 191977
FORMULA : C8H17NO3
MOLECULAR WEIGHT : 175.0
TSCA INVENTORY STATUS : Reported/Included
NPCA-HMIS RATINGS : Health: 2 Flammability: 2 Reactivity: 3
Personal Protection rating to be supplied by user depending on use conditions.

---

## COMPONENTS

---

| Material | CAS Number | % |
|---|---|---|
| 2-ETHYL HEXYL NITRATE | 27247-96-7 | 98-100 |
| 2-ETHYLHEXYL ALCOHOL | 104-76-7 | 0-2 |

---

## PHYSICAL DATA

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Boiling Point : Decomposes above 100 deg C (212 deg F)
Vapor Pressure : .035 mm Hg at 20 deg C (68 deg F)
Vapor Density : >1 (air = 1.0)
Evaporation Rate : _< 1 (Butyl Acetate = 1.0)
Water Solubility : .02 WT %
Odor : Ester
Form : Liquid
Color : Straw colored

CONFIDENTIAL

(PHYSICAL DATA - Continued)

Specific Gravity : 0.96 at 16 deg C (60 deg F)

## HAZARDOUS REACTIVITY

Instability : Stable at normal temperatures and storage conditions.
Incompatibility : Incompatible with strong acids, strong bases.
Polymerization : Polymerization will not occur.

Decomposition : Decomposes with heat. Decomposition temperature is > 100 deg C (> 212 deg F). Hazardous gases/vapors produced are oxides of nitrogen and carbon monoxide.

## FIRE AND EXPLOSION DATA

Flash Point : 79 deg C (175 deg F)
Method : TCC
Flammable Limits in Air, % by Volume
LEL : 0.25
Autoignition : 130 deg C (266 deg F)
Autodecomposition: 185 deg C (365 deg F)

Exotherm initiation temperature 120 deg C (248 deg F). (Self-heating rate sustained due to decomposition)

### FIRE AND EXPLOSION HAZARDS

Combustible. Heating can release vapors which can be ignited. Hazardous gases/vapors produced in fire are carbon monoxide and oxides of nitrogen.

Risk of explosion if heated under confinement.

### EXTINGUISHING MEDIA

Water Spray. Foam. Dry Chemical. CO2.

### SPECIAL FIRE FIGHTING INSTRUCTIONS

Evacuate personnel to a safe area. Wear self-contained breathing apparatus. Cool tank/container with water spray. Fight fire from maximum distance, use extreme caution as heat may decompose material and rupture containers.

## OTHER PHYSICAL HAZARDS

2-ETHYLHEXYL NITRATE SHOULD NOT BE EXPOSED TO STEAM, SPARK, FLAME, OR HOT SURFACES. RAPID GAS EVOLUTION DURING DECOMPOSITION MAY LEAD TO BURSTING OF CONTAINER AND MAY BE EXPLOSIVE IF HEATED UNDER CONFINEMENT.

## HEALTH HAZARD INFORMATION

ANIMAL DATA

Inhalation 1 hour LC50: 4.6 mg/L in rats
Skin Absorption ALD: > 4,820 mg/kg in rabbits
Oral ALD: 7,500 mg/kg in rats.

The product is a slight skin irritant but is not an eye irritant in animals. Toxicity described in animals from exposure by ingestion include weight loss, weakness, ataxia, lacrimation, and nonspecific preterminal effects. Intra-arterial administration to spontaneously hypertensive male rats produced a reduction in blood pressure. This is not an occupational route of exposure. By inhalation, the product caused kidney changes and decreased body weight gain in exposed animals. No significant increase in methemoglobin was observed in rats exposed by inhalation to 417 ppm for 6 hours. No animal test data are available to define carcinogenic, mutagenic, developmental, or reproductive hazards.

HUMAN HEALTH EFFECTS

Contact with the liquid may cause slight skin irritation with discomfort or redness. Significant skin permeation, and systemic toxicity after contact appears unlikely. Overexposure by inhalation to the product may cause nonspecific discomfort, such as nausea, headache, or weakness. Low level exposure has caused headache and fatigue in humans.

**CARCINOGENICITY**

None of the components in this material is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

**EXPOSURE LIMITS**

DDA-1000

**AEL * (Du Pont): 5 ppm - 8 & 12 Hr. TWA**
**TLV (ACGIH) : None Established**
**PEL (OSHA) : None Established**

(HEALTH HAZARD INFORMATION - Continued)

OTHER APPLICABLE EXPOSURE LIMITS

2-ETHYLHEXYL ALCOHOL

AEL * (Du Pont): 20 ppm - 8 Hr. TWA
TLV (ACGIH) : None Established
PEL (OSHA) : None Established

* AEL is Du Pont's Acceptable Exposure Limit.

SAFETY PRECAUTIONS

Avoid breathing vapors or mist. Avoid contact with eyes, skin, or clothing. Wash thoroughly after handling.

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FIRST AID

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INHALATION

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT

Flush skin with water after contact. Wash contaminated clothing before reuse.

EYE CONTACT

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION

If swallowed, do not induce vomiting. Immediately give two glasses of water, or activated charcoal slurry. Never give anything by mouth to an unconscious person. Call a physician.

NOTES TO PHYSICIAN

To prepare activated charcoal slurry suspend 50 g activated charcoal slurry in 400 ml water in plastic bottle and shake well. Administer 5 ml/kg, or 350 ml for an average adult.

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PROTECTION INFORMATION

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GENERALLY APPLICABLE CONTROL MEASURES AND PROCEDURES

Keep away from heat, sparks and flames.

Use ventilation that is adequate to keep airborne concentrations below exposure limits.

(PROTECTION INFORMATION - Continued)

**PERSONAL PROTECTIVE EQUIPMENT**

EYE/FACE PROTECTION
Wear safety glasses or coverall chemical splash goggles.

RESPIRATORS
Where there is potential for airborne exposures in excess of applicable limits, wear NIOSH/MSHA approved respiratory protection.

PROTECTIVE CLOTHING
Wear gloves and clothing sufficient to minimize contact.

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## DISPOSAL INFORMATION

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**SPILL, LEAK, OR RELEASE**

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.
Soak up with sawdust, sand, oil dry or other absorbent material.

**WASTE DISPOSAL**

Treatment, storage, transportation and disposal must be in accordance with applicable Federal, State/Provincial, and Local regulations.

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## SHIPPING INFORMATION

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**DOT**

**Proper Shipping Name :** NOT REGULATED UNLESS SHIPPED IN PORTABLE TANK > 110 GAL

**DOT/IMO**

**Proper Shipping Name :** NOT REGULATED

**Shipping Containers**
Steel Drums - DOT 17E

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## STORAGE CONDITIONS

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Store in well ventilated area.

(STORAGE CONDITIONS - Continued)

Refer to Dupont Bulletin " DDA-1000 Cetane Improver Thermal Stability" for detailed storage and handling guidance. This bulletin presents background information on thermal stability for storage and safe handling. Important considerations are:

Properly insulated tank car or tank truck.

Cap steam coils and valves on tank car, truck and storage tanks.

Water deluge system for storage tank.

One or more of the following safeguards is recommended:
Unrestricted recirculation loop
Thermal sensor and relief in pump system
Low flow pump interlock

This bulletin also describes proper, safe unloading of equipment from bulk containers.

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## TITLE III HAZARD CLASSIFICATIONS

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**Acute** : Yes
**Chronic** : No
**Fire** : Yes
**Reactivity** : Yes
**Pressure** : No

---

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS : R. V. Daum
Chemicals & Pigments
Wilmington, DE 19898
800-441-9442

# Indicates updated section.

**End of MSDS**

Cedar

Chemical

---

Unknown

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PLANT OVERVIEW
WEST HELENA PLANT - DECEMBER 1992

## 1.0 FINANCIAL DATA

| | DECEMBER | | YTD | |
|---|---|---|---|---|
| | ACT | BGT | ACT | BGT |
| Net Sales | 2,046 | 826 | 45,279 | 48,381 |
| C.O.G.S. | 1,518 | 841 | 35,688 | 38,220 |
| Gross Margin | 528 | (15) | 9,591 | 10,160 |
| Gross Margin (%) | 25.5 | (1.8) | 21.0 | 20.8 |

## 2.0 OPERATIONS

2.1 Unit 1 - The Orfom run for Phillips was completed. There were several problems during the run caused by analytical difficulties. Their resolution caused the run to be extended by a few days.

2.2 PROPANIL - Operations were normal with the unit being operated to minimize raw material costs at the expense of cycle times.

2.4 Unit 4 - The first batch of ADPA for A&W unexpectedly precipitated out of solution during the strip stage. Production was discontinued until January to better assess the situation.

2.6 DCA - Operations were routine with the unit operating on a modified schedule to control inventories. Inventory targets for DCA in drums were increased to reflect high 1993 demands.

## 3.0 HEALTH, SAFETY and ENVIRONMENTAL

There was one OSHA recordable accident and one minor accident during the month. The safety record for 1992 was a significant improvement over 1991. A comparison of injury statistics is as follows:

| Year to Date in: | 1992 | 1991 |
|---|---|---|
| Total Accidents | 34 | 44 |
| OSHA Recordables | 18 | 21 |
| Injury Frequency Index: | | |
| Month | 1.87 | 1.40 |
| Y-T-D | 2.33 | 2.87 |

There were no new environmental problems encountered during December. The Facility Investigation CAO received preliminary approval from the state.

## 4.0 BUDGET VARIANCE ANALYSIS

### 4.1 DECEMBER BUDGET SUMMARY

| Expense Category | Actual | Budget | Variance Amount | Variance % |
|---|---|---|---|---|
| Payroll | 273,702 | 318,446 | (44,744) | (14.1) |
| Fringes | 85,178 | 94,932 | (9,454) | (10.0) |
| Utilities | 80,316 | 108,332 | (28,016) | (25.9) |
| Maintenance w/ Labor* | 117,635 | 236,271 | (118,636) | (50.2) |
| Miscellaneous | (189,452) | 123,916 | (313,368) | (252.9) |
| Total Controllable | 338,173 | 831,409 | (493,236) | (59.3) |
| Non-Controllable | 72,104 | 143,847 | (71,743) | (49.9) |
| Total Plant Oper Cost | 410,27 | 975,256 | (564,979) | (57.9) |

* Figure shows maintenance labor which is also included in payroll total. This is not double counted in the Total Costs.

### 4.2 DECEMBER VARIANCE ANALYSIS

| Amount | Comments |
|---|---|
| (331) | Waste Disposal - Partial accrual for the Wormald settlement. |
| (59) | Wages & Salaries - Continue to run below budgeted staffing level. |
| (56) | Contract Labor - Running below budget as outside labor is used on capital improvements. |
| (46) | Maintenance Supplies - Maintenance in general was low in December. |
| (29) | Electricity - Running below budget most of the year. |
| (551) | Total of variances more than $20M |
| 58 | Total of variances less than $20M |
| (493) | Total Controllable Variance |

DMH

6

**CEDAR INTERNAL CORRESPONDENCE**

Date: January 8, 1993

To: D. Hoppel

From: M. J. Pocrass

cc: R. Johns
J. Walker

Subject: **December Monthly Operations Report**

1.0 UNIT 1: The **Phillips** Orfom campaign ended on December 31. Allyl chloride was successfully handled in a bulk storage system installed prior to this run. The CO-300 processing rate exceeded that of the previous run. Wastewater was treated without incident. Analytical difficulties during the CO-800 phase of the campaign led to additional and, as it turned out, unnecessary processing steps. The method provided by Phillips for this run was abandoned in favor of the method successfully employed during previous campaigns. Once this change was made the remaining CO-800 processing proceeded normally. All shipped product met specifications. D-8 production was uneventful except for a $CS_2$ shortage which delayed the completion of the last batch until drummed material was received. A **B. F. Goodrich** campaign was scheduled to start up on January 6, 1993.

2.0 UNIT 2: Propanil reactor R-1 was again operated on a five-day " minimum raw material cost " schedule ( i.e. longer time cycle, more propionic acid, less propionic anhydride ) the entire month in response to softened sales demand. Production was in the form of 3 lb. formulation and **Rohm & Haas** Stam. It appears that production volume will increase in January as compared to December.

| | December | YTD |
|---|---|---|
| Tech Produced (M lbs) | 289.9 | 10,094.5 |
| Yield on DCA (%) | 108.2 | 98.4 |

3.0 UNIT 4: Modifications for the **A & W** ADPA campaign were completed. The campaign started on December 18. Operational problems during the stripping of the first batch dictated tabling the start of the second batch till after the start of the new year. The first batch solidified in the reactor due to insufficient dilution. The batch was completed after steps had been taken to " fluidize " it so that the stripping could be completed. Instructional changes were made to address the solidification problem.

| | December | YTD |
|---|---|---|
| Perborate (lbs) | 0 | 85,080 |
| ADPA 60 | 0 | 0 |

4.0 UNIT 5: The cleanout of the formaldehyde tank was completed after the remaining formaldehyde was shipped to **Grace**.

5.0 DCA UNIT: The unit operated on a 5-day schedule due to softened Propanil sales demand the entire month. Intermediate cut receiver V-316 was reconnected to the process and successfully placed back into service. The nitric acid was emptied, inspected repaired and put back into service. Additional drumming of DCA for sales was carried out and will continue on an as needed basis. A line was installed to allow transfer of DCA accumulated in the unit's wastewater treatment tank to the crude tank as well as the transfer of water in the crude tank to the wastewater treatment tank. This will alleviate operational difficulties which ensue due to the unwanted presence of these materials in these tanks ( DCA in the wastewater tank, water in the crude tank ). The 5-day schedule will continue into January. The need to resume 7-day operation will be reevaluated in mid-January.

| | December | YTD |
|---|---|---|
| DCA (lbs) | 390,586 | 7,851,348 |

M. J. Pocrass

8

CEDAR INTERNAL CORRESPONDENCE

DATE: Jan. 8, 1992

TO: Dave Hoppel

FROM: Tom Lodice

CC:

SUBJECT: Monthly Activities

DCA

- The replacement valve for the hydrogen feed to the autoclave has been installed.

- All of the stainless steel DCNB tranfer piping has been replaced with Teflon lined pipe.

- The bottoms drumming system has been completed however, some additional work will be required on fume control.

- The repairs to V-316 have been completed and the vessel has been put back into service.

BFG

- Tracing and insulation were installed on the R-1107 overhead system and receiver in order to minimize freezing problems during the nitrogen sparge.

- A cylinder flush station was installed on the bottom floor.

- The operating procedures were revised by George Foehringer.

PROPANIL

- A valve was installed on T-2204 (emulsifier tank) so that a level transmitter could be installed at a later date.

PERBORATE

- A meeting with DuPont will be held on Jan. 8 to dicuss future production of the Perborate. I have contacted one manufacturer to obtain design information for a conveying system for the raw material.

PHILLIPS

- The allyl chloride tank was put into service and all three of the Phillips products were produced in unit one during December.

- Piping modifications were made to R-1108 to charge 3 drums of carbon disulfide to complete the last batch of D-8.

ACID CHLORIDE

- Preliminary P&ID's have been prepared the preparation of acid chloride in unit one. A CAR has been submitted for the project with startup scheduled for mid-February.

A&W

- A hazop review of the ADPA process was held on December 11.

- Modifications to unit four were completed and the process was started on December 18. The first batch ran extremely well except for the strip. A water addition system is being designed for R-4104 to insure that the correct water charge is added to the reactor.e

OTHER

- NuTemp has completed the repairs on the exchanger heads and is in the process of sealing them. The other materials are on hand ate NuTemp. They are due to be here during the second week of January to complete the repairs to the "new" machine.

- George Foehringer has completed an initial draft of the "Mechanical Integrity" section for our PSM manual.

# ENVIRONMENTAL MONTHLY REPORT FOR DECEMBER 1992

## FACILITY INVESTIGATION (CAO)

PC&E conditionally approved the Preliminary Report on December 21, dependent upon correcting noted deficiencies to the second revision. A meeting has been scheduled (Jeff Bennett, Allen Malone and me) with PC&E for January 5 to discuss their comments and their opinion of Cedar's effort. In talking to Joe Hoover on December 29 about our relationship, he says he is pleased with the way we are proceeding, however the tone of the approval letter indicated to me otherwise.

The Work Plan has been completed, and is due at PC&E on January 20.

Proposals for the Work Plan Assessment Project have been received from Roy F. Weston and Chemical Waste Management. Costs range from $280K to $450K (40-60% is for laboratory analyses). Proposals are still outstanding from EnecoTech and Ensafe.

## TOXICITY REDUCTION EVALUATION (CAO)

A general construction permit has been submitted, and approved, to cover any changes to the stormwater or biotreatment system that occur during the length of this CAO.

An extension has been granted to the task requiring submission of a Best Management Practices Plan in order to allow us to review new EPA directives on the subject.

Higher discharge rates from outfall 002 have been granted for COD, BOD, TSS and total pesticides. These limits are based on a revised production rate of Propanil and DCA, and are sufficient to remove these parameters as a limiting factor.

I was informed verbally that a violation of any permit limit at 002 will not be penalized during the course of this CAO. Written verification of this is being prepared at PC&E.

## AIR DIVISION

I met with our new engineer to find out if there is any way to speed up the permit application approval process. I also presented some ideas on how to improve the structure of our permit, which would in turn allow her to more easily understand information when we submit it. This will require a major rewrite of the permit, of which I am in the initial stages. Updated P&ID's and process descriptions currently being prepared in-house will be the basis of this.

Since the majority of the permit applications she receives do not require quick turnaround, she agreed to look at ours on a priority basis when we request it.

She also agreed to waive the requirement for Cedar to do screening models, which had been a condition of approving the ADPA-60 permit.

I think we now have a good relationship with the air division.

## PAD 3 WASTE DRUMS

The next to last truck from the original accumulation is awaiting profile approval from the disposal facility. The last truck of drums is staged and samples/profiles are being prepared.

Twenty waste drums were received from operations this month, and twenty-five were disposed.

CEDAR CHEMICAL CORPORATION

12

January 11, 1993

## Laboratory Monthly Report - December

### Propanil

| Material, | # Batches, | % Assay, | lb\gallon, | % In Spec. |
|---|---|---|---|---|
| Prop Tech | 20 | 97.8 | | 100 |
| Prop 3lb | 4 | 36.6 | 3.06 | 100 |
| Stam | 16 | 45.3 | 4.05 | 100 |

### 3,4-DCA

| Material, | # Batches, | % 3,4-DCNB, | % 3,4-DCA, | % In Spec. |
|---|---|---|---|---|
| DCNB | 28 | 88.6 | | 100 |
| DCA-Hydro. | 43 | | *79.6 | 100 |
| DCA- Dist. | 14 | | 97.9 | 100 |

*There were only 3 samples pulled out of 43 Hydrogenations.

### Phillips

| Material, | # Batches, | %CO300, | % D-8, | % CO800 | % In Spec. |
|---|---|---|---|---|---|
| CO300 | 12 | 96.3 | | | 100 |
| D-8 | 8 | | 38.3 | | 100 |
| CO800 | 10 | | | 39.5 | 100 |

### Workload

| Unit number | Unit Name | # of Analyses Performed |
|---|---|---|
| 1. | Phillips | 496 |
| 2. | Propanil | 754 |
| 6. | 3,4-DCA | 339 |
| | Total | 1,589 |

### Safety

There were no safety infractions recorded during the month of December. No near misses or accidents were noted for the period.

**Review of December Objectives**

1. Goodrich installation still is pending. The hood came in damaged and must be sent back to Security Steelcraft for refabrication. This will take several months to complete.
2. Unit one startup was done in December. There were problems encountered with the new CO800 analytical methods supplied by Phillliips and caused numerous delays. A separate report was issued to explain this in detail.

3. All analytical preparations for ADPA were completed. Validation prior to startup was limited due to unavailability of raw materials and products.
4. Drum assessments remain to be completed.

Objectives for January

1. Restart ADPA
2 Continued work on the Goodrich Hood.
3. Initiate work on FMC analytical for February start-up.
4. Work on Diuron
5. Write ISO 9000 procedures with Mike Cobb.

WEST HELENA PLANT

MONTHLY PERSONNEL REPORT

12-31-92

EO CLASSIFICATION

| OFFICIALS/MANAGER | This Mo. | Last Mo. |
|---|---|---|
| dministration | 1 | 1 |
| Production Manager | 1 | 1 |
| Plant Supervisors | 11 | 11 |
| epartment Heads | 2 | 2 |
| PROFESSIONALS | | |
| Chemists | 2 | 2 |
| ngineers | 7 | 7 |
| Other (Purch. Agent) | 1 | 1 |
| TECHNICIANS | | |
| ab Techs | 9 | 9 |
| OFFICE/CLERICAL | | |
| Secretaries | 6 | 6 |
| lerks | 3 | 3 |
| SKILLED | | |
| Mechanics | 16 | 16 |
| ead Operators | 21 | 21 |
| OPERATIONS | | |
| Operators | 24 | 24 |
| ackaging | 7 | 7 |
| SERVICE | | |
| Safety | 6 | 6 |
| laid | 1 | 1 |
| Total Plant Employee | 118 | 118 |

| TOTAL PLANT EMPLOYEES | |
|---|---|
| Executive | 10 |
| Salaried Employees | 23 |
| Hourly Employees | 82 |
| Part Time Employees | 3 |
| Total Plant Employee | 118 |

MAN HOURS WORKED
SUBJECT TO OVERTIME

| Date | Reg.Hrs. | O.T. Hrs. | Total Hrs | % O.T. |
|---|---|---|---|---|
| 11-29-92 | 1,556.95 | 182.20 | 1,739.15 | 10.48% |
| 12-06-92 | 2,885.50 | 246.80 | 3,132.30 | 7.88% |
| 12-13-92 | 3,116.60 | 325.30 | 3,441.90 | 9.45% |
| 12-20-92 | 2,877.00 | 313.60 | 3,190.60 | 9.83% |
| 12-27-92 | 1,595.70 | 325.20 | 1,920.90 | 16.93% |
| Total | 12,031.75 | 1,393.10 | 13,424.85 | 10.38% |

ACCIDENTS

| | | | |
|---|---|---|---|
| Darrell Cavett | 12/10/92 | Puncture wound L. Foot | Recordable |
| reg Satterfield | 12/16/92 | Lac. 2 finers L. Hand | 1st Aid |

To: Dave Hoppel

Date: February 15, 1993

From: Bill Gastrock

Subject: Research and Development
January Monthly Summary

Halex Chemistry

1- Sulfolane recovery and recycle.

A 93% recovery of sulfolane was obtained by distillation of a halex reaction on 3,4-DCNB. The recovered sulfolane was used in a subsequent reaction and a similar reaction time and conversion (11-12 hrs and 95%) was observed.

2- Phase Transfer Catalyst

A halex reaction using octadecyltrimethyl ammonium chloride as catalyst (described in a Hoechst patent) gave essentially no reaction with normal agitation in glassware. Improved reaction rate was obtained using the Parr autoclave but only 25% conversion was observed after 15 hrs. It was interesting to note that for the first time selectivity for reaction of 3,4-DCNB over 2,3-DCNB with KF was observed, where the halex product was 17:1 (4-fluoro: 2-fluoro).

3- In a comparison of the halex reaction using steel balls with the Parr autoclave @ 600 rpm showed a faster reaction using the steel balls in addition to a higher conversion. A high sheer radial flow impeller has been ordered in an attempt to improve the reaction in the autoclave.

2,3-DCA

A request for a 1 kg sample of >99% 2,3-DCA from Marubeni prompted lab work on it's separation from the DCA lights fraction. Acceptable quality 2,3-DCA was prepared by the very tedious distillation of lights. The crystallization of 2,3-DCA out of the lights fraction was also investigated and found to provide the 2,3-isomer in purity of 97-98% fairly readily. Should Marubeni be able to utilize a lower purity2,3-DCA a crystallization process may be a better means of isolating 2,3-DCA.

CEDAR - WEST HELENA

CONSOLIDATED INCOME STATEMENT

INST2C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH BUDGETED $ AMOUNT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE BUDGETED $ AMOUNT |
|---|---|---|---|---|
| 2,070,376.93 | 830,404.00 | SALES | 45,710,388.63 | 48,819,938.00 |
| 9,170.62 | 3,636.00 | LESS-FREIGHT OUT | 254,695.73 | 353,569.00 |
| 2,509.62 | | LESS TRNFRS FREIGHT | 7,215.42 | |
| 12,626.47 | 768.00 | LESS WAREHOUSING | 169,501.07 | 85,869.00 |
| 2,046,070.22 | 826,000.00 | NET SALES | 45,278,976.41 | 48,380,500.00 |
| | | COST OF GOODS SOLD | | |
| 1,281,764.65 | 271,311.00 | COST OF SALES | 25,428,715.76 | 26,542,606.00 |
| 91,893.00- | | ROYALTIES | 3,485,258.00 | 3,198,360.00 |
| 371,785.00 | 468,818.00 | TOLLING COST | 5,320,081.64 | 7,273,652.00 |
| 7,044.58 | 12,983.00 | START-UP COST | 298,298.56 | 155,796.00 |
| | | PRODUCT COMPLAINT | 11,777.00 | |
| 160.00 | 20,833.00 | CONSENT DECREE | 456,841.23 | 249,996.00 |
| 50,512.00- | 66,666.00 | TASK FORCE EXP | 635,069.00 | 799,992.00 |
| | | OTHER | 52,198.77 | |
| 1,518,349.23 | 840,611.00 | TOTAL C.O.G.S. | 35,688,239.96 | 38,220,402.00 |
| 527,720.99 | 14,611.00- | GROSS MARGIN | 9,590,736.45 | 10,160,098.00 |
| 25.49 % | 1.76-% | GROSS MARGIN PERCENTAGE | 20.98 % | 20.81 % |
| 262,276.13 | 91,243.00 | SELLING EXPENSES | 1,989,540.49 | 1,436,816.00 |
| 88,455.90 | 167,562.00 | ADMINISTRATIVE EXP. | 845,963.37 | 902,419.00 |
| 45,261.87 | 104,334.00 | INTEREST EXPENSE | 1,299,447.93 | 1,341,946.00 |
| 9,307.04- | 20,658.00- | INTEREST INCOME | 224,428.05- | 247,896.00- |
| 141,034.13 | 357,092.00- | NET INCOME (LOSS) | 5,680,212.71 | 6,726,813.00 |

[redacted] 27

DATE 12/31/92 CEDAR CHEMICAL CORPORATION PAGE 3

PESTICIDES / CEDAR LINE OF BUSINESS INCOME STATEMENT INST20

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH BUDGETED $ AMOUNT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE BUDGETED $ AMOUNT |
|---|---|---|---|---|
| 1,811,967.18 | 356,404.00 | SALES | 37,125,840.12 | 38,519,938.00 |
| 9,170.62 | 3,636.00 | LESS-FREIGHT OUT | 254,695.73 | 353,569.00 |
| 2,509.62 | | LESS TRNFRS FREIGHT | 7,215.42 | |
| 12,626.47 | 768.00 | LESS WAREHOUSING | 169,501.07 | 85,869.00 |
| 1,787,660.47 | 352,000.00 | NET SALES | 36,694,427.90 | 38,080,500.00 |
| | | COST OF GOODS SOLD | | |
| 1,281,047.52 | 271,311.00 | COST OF SALES | 25,427,998.63 | 26,542,606.00 |
| 91,893.00- | | ROYALTIES | 3,485,258.00 | 3,198,360.00 |
| 7,044.58 | 7,045.00 | START-UP COST | 84,534.96 | 84,540.00 |
| | | PRODUCT COMPLAINT | 11,777.00 | |
| 160.00 | 20,833.00 | CONSENT DECREE | 456,841.23 | 249,996.00 |
| 50,512.00- | 66,666.00 | TASK FORCE EXP | 635,069.00 | 799,992.00 |
| | | OTHER | 52,198.77 | |
| 1,145,847.10 | 365,855.00 | TOTAL C.O.G.S. | 30,153,677.59 | 30,875,494.00 |
| 641,813.37 | 13,855.00- | GROSS MARGIN | 6,540,750.31 | 7,205,006.00 |
| 35.42 % | 3.89-% | GROSS MARGIN PERCENTAGE | 17.62 % | 18.70 % |
| 232,397.88 | 71,410.00 | SELLING EXPENSES | 1,620,393.05 | 1,143,820.00 |
| 66,928.26 | 139,724.00 | ADMINISTRATIVE EXP. | 710,335.94 | 710,340.00 |
| 25,819.68 | 65,817.00 | INTEREST EXPENSE | 918,834.64 | 846,537.00 |
| 8,131.43- | 17,226.00- | INTEREST INCOME | 190,502.13- | 206,712.00- |
| 324,798.98 | 273,580.00- | NET INCOME (LOSS) | 3,481,688.81 | 4,711,021.00 |

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CONTRACTS / CEDAR LINE OF BUSINESS INCOME STATEMENT INST20

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH BUDGETED $ AMOUNT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE BUDGETED $ AMOUNT |
|---|---|---|---|---|
| 258,409.75 | 474,000.00 | SALES | 8,584,548.51 | 10,300,000.00 |
| | | LESS-FREIGHT OUT | | |
| 258,409.75 | 474,000.00 | NET SALES | 8,584,548.51 | 10,300,000.00 |
| | | COST OF GOODS SOLD | | |
| 717.13 | | COST OF SALES | 717.13 | |
| 371,785.00 | 468,818.00 | TOLLING COST | 5,320,081.64 | 7,273,652.00 |
| | 5,938.00 | START-UP COST | 213,763.60 | 71,256.00 |
| 372,502.13 | 474,756.00 | TOTAL C.O.G.S. | 5,534,562.37 | 7,344,908.00 |
| 114,092.38- | 756.00- | GROSS MARGIN | 3,049,986.14 | 2,955,092.00 |
| 44.15-% | .16-% | GROSS MARGIN PERCENTAGE | 35.53 % | 28.69 % |
| 29,878.25 | 19,833.00 | SELLING EXPENSES | 369,147.44 | 292,996.00 |
| 21,527.64 | 27,838.00 | ADMINISTRATIVE EXP. | 135,627.43 | 192,079.00 |
| 19,442.19 | 38,517.00 | INTEREST EXPENSE | 380,613.29 | 495,409.00 |
| 1,175.61- | 3,432.00- | INTEREST INCOME | 33,925.92- | 41,184.00- |
| 183,764.85- | 83,512.00- | NET INCOME (LOSS) | 2,198,523.90 | 2,015,792.00 |

PRGM: INST30 CONSOLIDATED YEAR-TO-DATE

CEDAR CHEMICAL CORPORATION
SUMMARY INCOME STATEMENT BY PRODUCT
DATE 12/31/92



| PRODUCT NAME | UNITS SOLD | NET SALES | COST OF SALES | GROSS MARGIN | % | SELLING | ADMIN | INTEREST EXP | INTEREST INCOME | NET INCOME |
|---|---|---|---|---|---|---|---|---|---|---|
| WEST HELENA OTHER | | 19,327 | 456,841 | 437,514- | 263.75- | 1,620,393 | 710,336 | 918,835 | 190,502- | 3,496,576- |
| PROPANIL 360 | | | | | | | | | | |
| PROPANIL TECH | 1,862,020 | 5,109,968 | 2,516,645 | 2,593,323 | 50.75 | | | | | 2,593,323 |
| DCA | 411,840 | 449,418 | 541,645 | 92,227- | 20.52- | | | | | 92,227- |
| FLAKED TECH | 613,983 | 1,123,602 | 1,199,300 | 75,698- | 6.74- | | | | | 75,698- |
| DCPI | | | | | | | | | | |
| STAMPEDE | 22,602 | 245,173 | 245,172 | 1 | | | | | | 1 |
| PROPANIL BLEND | | | 83 | 83- | | | | | | 83- |
| 50 WDG | 32,800 | 49,685 | 102,265 | 52,580- | 105.83- | | | | | 52,580- |
| WHAM 80% | 135,140 | 419,933 | 187,713 | 232,220 | 55.30 | | | | | 232,220 |
| WHAM | 97,580 | 1,479,376 | 1,131,434 | 347,942 | 23.52 | | | | | 347,942 |
| PROPANIL 4# | 399,574 | 6,184,097 | 3,571,538 | 2,612,559 | 42.25 | | | | | 2,612,559 |
| STAM | 1,301,179 | 15,569,569 | 15,379,874 | 189,695 | 1.22 | | | | | 189,695 |
| PROPANEX-4 | 54,950 | 856,858 | 507,235 | 349,623 | 40.80 | | | | | 349,623 |
| PROPANIL 3# | 311,477 | 2,495,670 | 2,560,501 | 64,831- | 2.60- | | | | | 64,831- |
| *S/T PROPANIL | | 33,983,349 | 27,943,405 | 6,039,944 | 17.77 | | | | | 6,039,944 |
| PYRIDATE 3.75 EC | | | | | | | | | | |
| BUTOXONE 175 | 98,321 | 1,853,875 | 1,089,378 | 764,497 | 41.24 | | | | | 764,497 |
| BUTOXONE 200 | 30,024 | 615,804 | 464,036 | 151,768 | 24.65 | | | | | 151,768 |
| BUTOXONE ESTER | 14,040 | 222,075 | 200,017 | 22,058 | 9.93 | | | | | 22,058 |
| BUTOXONE OTHER | | | | | | | | | | |
| *S/T BUTOXONE | | 2,691,754 | 1,753,431 | 938,323 | 34.86 | | | | | 938,323 |
| ** TOTAL PESTICIDES | | 36,694,430 | 30,153,677 | 6,540,753 | 17.82 | 1,620,393 | 710,336 | 918,835 | 190,502- | 3,481,691 |

PRGM: INST30 CONSOLIDATED YEAR-TO-DATE

CEDAR CHEMICAL CORPORATION
SALES VARIANCE REPORT BY PRODUCT
DATE 12/31/92



| PRODUCT NAME | ACTUAL UNITS | ACTUAL NET SALES | ACTUAL AVERAGE PER UNIT | PLAN UNITS | PLAN NET SALES | PLAN AVERAGE PER UNIT | VARIANCE VOLUME | VARIANCE PRICE | VARIANCE TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| WEST HELENA OTHER | | 19,327 | | | | | 19,327 | | 19,327 |
| PROPANIL 360 | | | | | | | | | |
| PROPANIL TECH | 1,862,020 | 5,109,968 | 2.74 | 2,500,000 | 6,250,000 | 2.50 | 1,594,950- | 454,918 | 1,140,032- |
| DCA | 411,840 | 449,418 | 1.09 | | | | 449,418 | | 449,418 |
| FLAKED TECH | 613,983 | 1,123,602 | 1.83 | 1,000,000 | 2,000,000 | 2.00 | 772,034- | 104,364- | 876,398- |
| DCPI | | | | | | | | | |
| STAMPEDE | 22,602 | 245,173 | 10.85 | | | | 245,173 | | 245,173 |
| PROPANIL BLEND | | | | | | | | | |
| 50 WDG | 32,800 | 49,685 | 1.51 | 300,000 | 600,000 | 2.00 | 534,400- | 15,915- | 550,315- |
| WHAM 80% | 135,140 | 419,933 | 3.11 | 500,000 | 1,175,000 | 2.35 | 857,421- | 102,354 | 755,067- |
| WHAM | 97,580 | 1,479,376 | 15.16 | 150,000 | 2,362,500 | 15.75 | 825,615- | 57,509- | 883,124- |
| PROPANIL 4# | 399,574 | 6,184,097 | 15.48 | 300,000 | 4,785,000 | 15.95 | 1,588,205 | 189,108- | 1,399,097 |
| STAM | 1,301,179 | 15,569,569 | 11.97 | 1,300,000 | 14,820,500 | 11.40 | 13,441 | 735,628 | 749,069 |
| PROPANEX-4 | 54,950 | 856,858 | 15.59 | | | | 856,858 | | 856,858 |
| PROPANIL 3# | 311,477 | 2,495,670 | 8.01 | 400,000 | 3,520,000 | 8.80 | 779,002- | 245,328- | 1,024,330- |
| *S/T PROPANIL | | 33,983,349 | | | 35,513,000 | | 2,210,327- | 680,676 | 1,529,651- |
| PYRIDATE 3.75 EC | | | | | | | | | |
| BUTOXONE 175 | 98,321 | 1,853,875 | 18.86 | 105,000 | 1,890,000 | 18.00 | 120,222- | 84,097 | 36,125- |
| BUTOXONE 200 | 30,024 | 615,804 | 20.51 | 25,000 | 437,500 | 17.50 | 87,920 | 90,384 | 178,304 |
| BUTOXONE ESTER | 14,040 | 222,075 | 15.82 | 10,000 | 240,000 | 24.00 | 96,960 | 114,885- | 17,925- |
| BUTOXONE OTHER | | | | | | | | | |
| *S/T BUTOXONE | | 2,691,754 | | | 2,567,500 | | 64,658 | 59,596 | 124,254 |
| ** TOTAL PESTICIDES | | 36,694,430 | | | 38,080,500 | | 2,126,342- | 740,272 | 1,386,070- |

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PRGM: INST30 CONSOLIDATED YEAR-TO-DATE

CEDAR CHEMICAL CORPORATION
COST OF SALES VARIANCE REPORT
DATE 12/31/92



| | ACTUAL | | | PLAN | | | VARIANCE | | |
|---|---|---|---|---|---|---|---|---|---|
| PRODUCT NAME | UNITS | COST OF SALES | AVERAGE PER UNIT | UNITS | COST OF SALES | AVERAGE PER UNIT | VOLUME | PRICE | TOTAL |
| WEST HELENA OTHER | | 456,841 | | | 249,998 | | 206,843- | | 206,843- |
| PROPANIL 360 | | | | | | | | | |
| PROPANIL TECH | 1,862,020 | 2,516,645 | 1.35 | 2,500,000 | 3,460,918 | 1.38 | 880,412 | 63,861 | 944,273 |
| DCA | 411,840 | 541,645 | 1.32 | | 24,465- | | 566,110- | | 566,110- |
| FLAKED TECH | 613,983 | 1,199,300 | 1.95 | 1,000,000 | 1,492,511 | 1.49 | 575,165 | 281,954- | 293,211 |
| DCPI | | | | | | | | | |
| STAMPEDE | 22,602 | 245,172 | 10.85 | | | | 245,172- | | 245,172- |
| PROPANIL BLEND | | 83 | | | | | 83- | | 83- |
| 50 WDG | 32,800 | 102,265 | 3.12 | 300,000 | 535,007 | 1.78 | 475,616 | 42,874- | 432,742 |
| WHAM 80% | 135,140 | 187,713 | 1.39 | 500,000 | 946,502 | 1.89 | 689,585 | 69,204 | 758,789 |
| WHAM | 97,580 | 1,131,434 | 11.59 | 150,000 | 1,585,315 | 10.57 | 554,079 | 100,198- | 453,881 |
| PROPANIL 4# | 399,574 | 3,571,538 | 8.94 | 300,000 | 2,747,395 | 9.16 | 912,098- | 87,955 | 824,143- |
| STAM | 1,301,179 | 15,379,874 | 11.82 | 1,300,000 | 15,001,344 | 11.54 | 13,606- | 364,924- | 378,530- |
| PROPANEX-4 | 54,950 | 507,235 | 9.23 | | | | 507,235- | | 507,235- |
| PROPANIL 3# | 311,477 | 2,560,501 | 8.22 | 400,000 | 2,921,525 | 7.30 | 646,218 | 285,194- | 361,024 |
| *S/T PROPANIL | | 27,943,405 | | | 28,666,052 | | 1,576,771 | 854,124- | 722,647 |
| PYRIDATE 3.75 EC | | | | | | | | | |
| BUTOXONE 175 | 98,321 | 1,089,378 | 11.08 | 105,000 | 1,411,324 | 13.44 | 89,766 | 232,180 | 321,946 |
| BUTOXONE 200 | 30,024 | 464,036 | 15.46 | 25,000 | 383,042 | 15.32 | 76,968- | 4,026- | 80,994- |
| BUTOXONE ESTER | 14,040 | 200,017 | 14.25 | 10,000 | 165,078 | 16.51 | 66,700- | 31,761 | 34,939- |
| BUTOXONE OTHER | | | | | | | | | |
| *S/T BUTOXONE | | 1,753,431 | | | 1,959,444 | | 53,902- | 259,915 | 206,013 |
| ** TOTAL PESTICIDES | | 30,153,677 | | | 30,875,494 | | 1,316,026 | 594,209- | 721,817 |

PRGM: INST30 CONSOLIDATED YEAR-TO-DATE

CEDAR CHEMICAL CORPORATION
GROSS MARGIN VARIANCE REPORT
DATE 12/31/92



| | ( - - - - - - GROSS MARGIN - - - - - - ) | | | (- - - - - - - - - VARIANCE DUE TO - - - - - - - - - ) | | | |
|---|---|---|---|---|---|---|---|
| PRODUCT NAME | ACTUAL | PLAN | VARIANCE | VOLUME | SALES PRICE | COST | TOTAL |
| WEST HELENA OTHER | 437,514- | 249,998- | 187,516- | 187,516- | | | 187,516- |
| PROPANIL 360 | | | | | | | |
| PROPANIL TECH | 2,593,323 | 2,789,082 | 195,759- | 714,538- | 454,918 | 63,861 | 195,759- |
| DCA | 92,227- | 24,465 | 116,692- | 116,692- | | | 116,692- |
| FLAKED TECH | 75,698- | 507,489 | 583,187- | 196,869- | 104,364- | 281,954- | 583,187- |
| DCPI | | | | | | | |
| STAMPEDE | 1 | | 1 | 1 | | | 1 |
| PROPANIL BLEND | 83- | | 83- | 83- | | | 83- |
| 50 WDG | 52,580- | 64,993 | 117,573- | 58,784- | 15,915- | 42,874- | 117,573- |
| WHAM 80% | 232,220 | 228,498 | 3,722 | 167,836- | 102,354 | 69,204 | 3,722 |
| WHAM | 347,942 | 777,185 | 429,243- | 271,536- | 57,509- | 100,198- | 429,243- |
| PROPANIL 4# | 2,612,559 | 2,037,605 | 574,954 | 676,107 | 189,108- | 87,955 | 574,954 |
| STAM | 189,695 | 180,844- | 370,539 | 165- | 735,628 | 364,924- | 370,539 |
| PROPANEX-4 | 349,623 | | 349,623 | 349,623 | | | 349,623 |
| PROPANIL 3# | 64,831- | 598,475 | 663,306- | 132,784- | 245,328- | 285,194- | 663,306- |
| *S/T PROPANIL | 6,039,944 | 6,846,948 | 807,004- | 633,556- | 680,676 | 854,124- | 807,004- |
| PYRIDATE 3.75 EC | | | | | | | |
| BUTOXONE 175 | 764,497 | 478,676 | 285,821 | 30,456- | 84,097 | 232,180 | 285,821 |
| BUTOXONE 200 | 151,768 | 54,458 | 97,310 | 10,952 | 90,384 | 4,026- | 97,310 |
| BUTOXONE ESTER | 22,058 | 74,922 | 52,864- | 30,260 | 114,885- | 31,761 | 52,864- |
| BUTOXONE OTHER | | | | | | | |
| *S/T BUTOXONE | 938,323 | 608,056 | 330,267 | 10,756 | 59,596 | 259,915 | 330,267 |
| ** TOTAL PESTICIDES | 6,540,753 | 7,205,006 | 664,253- | 810,316- | 740,272 | 594,209- | 664,253- |

| PRODUCT NAME | UNITS SOLD | NET SALES | COST OF SALES | GROSS MARGIN | % | SELLING | ADMIN | INTEREST EXP | INTEREST INCOME | NET INCOME |
|---|---|---|---|---|---|---|---|---|---|---|
| ANGUS | | | 572 | 572- | | | | | | 572- |
| DRFOM | 1,196,907 | 350,694 | 285,871 | 64,823 | 18.48 | | | | | 64,823 |
| MTPO | | | 7,716 | 7,716- | | | | | | 7,716- |
| GRACE | 2,258,355 | 4,318,167 | 2,117,856 | 2,200,311 | 50.95 | | | | | 2,200,311 |
| AKZO-SMA | | | 958 | 958- | | | | | | 958- |
| CTBL | 515,125 | 815,215 | 371,343 | 443,872 | 54.45 | | | | | 443,872 |
| A&W-DEHPA | 4,848,210 | 2,372,765 | 1,560,986 | 811,779 | 34.21 | | | | | 811,779 |
| SECTAGON II | | | 16,411 | 16,411- | | | | | | 16,411- |
| A&W-ADPA | | 64,000 | 61,520 | 2,480 | 3.88 | | | | | 2,480 |
| FMC | | | | | | | | | | |
| B F GOODRICH | | 659,708 | 519,149 | 140,559 | 21.31 | | | | | 140,559 |
| PERBORATE | 85,080 | 4,000 | 32,284 | 28,284- | 707.10- | | | | | 28,284- |
| OTHER CONTRACTS | | | 559,896 | 559,896- | | 369,147 | 135,627 | 380,613 | 33,926- | 1,411,357- |
| ** TOTAL CONTRACTS | | 8,584,549 | 5,534,562 | 3,049,987 | 35.53 | 369,147 | 135,627 | 380,613 | 33,926- | 2,198,526 |

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PRGM: INST30 CONSOLIDATED YEAR-TO-DATE

CEDAR CHEMICAL CORPORATION
SALES VARIANCE REPORT BY PRODUCT
DATE 12/31/92



| PRODUCT NAME | ACTUAL UNITS | ACTUAL NET SALES | ACTUAL AVERAGE PER UNIT | PLAN UNITS | PLAN NET SALES | PLAN AVERAGE PER UNIT | VARIANCE VOLUME | VARIANCE PRICE | VARIANCE TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| ANGUS | | | | | | | | | |
| ORFOM | 1,196,907 | 350,694 | .29 | 410,000 | 123,000 | .30 | 236,072 | 8,378- | 227,694 |
| MTPO | | | | 100,000 | 500,000 | 5.00 | 500,000- | | 500,000- |
| GRACE | 2,258,355 | 4,318,167 | 1.91 | 3,000,000 | 2,892,500 | .96 | 711,979- | 2,137,646 | 1,425,667 |
| AKZO-SMA | | | | | | | | | |
| CTBL | 515,125 | 815,215 | 1.58 | 500,000 | 780,000 | 1.56 | 23,595 | 11,620 | 35,215 |
| A&W-DEHPA | 4,848,210 | 2,372,765 | .49 | 4,830,000 | 4,105,500 | .85 | 15,479 | 1,748,214- | 1,732,735- |
| SECTAGON II | | | | 300,000 | 390,000 | 1.30 | 390,000- | | 390,000- |
| A&W-ADPA | | 64,000 | | | | | 64,000 | | 64,000 |
| FMC | | | | | | | | | |
| B F GOODRICH | | 659,708 | | 1,100,000 | 629,000 | .57 | 627,000- | 657,708 | 30,708 |
| PERBORATE | 85,080 | 4,000 | .05 | 11,000,000 | 880,000 | .08 | 873,194- | 2,806- | 876,000- |
| OTHER CONTRACTS | | | | | | | | | |
| ** TOTAL CONTRACTS | | 8,584,549 | | | 10,300,000 | | 2,763,027- | 1,047,576 | 1,715,451- |

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PRGM: INST30 CONSOLIDATED YEAR-TO-DATE

CEDAR CHEMICAL CORPORATION
COST OF SALES VARIANCE REPORT
DATE 12/31/92



| PRODUCT NAME | ACTUAL UNITS | ACTUAL COST OF SALES | ACTUAL AVERAGE PER UNIT | PLAN UNITS | PLAN COST OF SALES | PLAN AVERAGE PER UNIT | VARIANCE VOLUME | VARIANCE PRICE | VARIANCE TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| ANGUS | | 572 | | | | | 572- | | 572- |
| ORFOM | 1,196,907 | 285,871 | .24 | 410,000 | 103,375 | .25 | 196,727- | 14,231 | 182,496- |
| MTPO | | 7,716 | | 100,000 | 453,671 | 4.54 | 454,000 | 8,045- | 445,955 |
| GRACE | 2,258,355 | 2,117,856 | .94 | 3,000,000 | 2,314,242 | .77 | 571,067 | 374,681- | 196,386 |
| AKZO-SMA | | 958 | | | | | 958- | | 958- |
| CTBL | 515,125 | 371,343 | .72 | 500,000 | 481,590 | .96 | 14,520- | 124,767 | 110,247 |
| A&W-DEHPA | 4,848,210 | 1,560,986 | .32 | 4,830,000 | 2,168,381 | .45 | 8,195- | 615,590 | 607,395 |
| SECTAGON II | | 16,411 | | 300,000 | 331,757 | 1.11 | 333,000 | 17,654- | 315,346 |
| A&W-ADPA | | 61,520 | | | | | 61,520- | | 61,520- |
| FMC | | | | | | | | | |
| B F GOODRICH | | 519,149 | | 1,100,000 | 503,162 | .46 | 506,000 | 521,987- | 15,987- |
| PERBORATE | 85,080 | 32,284 | .38 | 11,000,000 | 708,205 | .06 | 654,895 | 21,026 | 675,921 |
| OTHER CONTRACTS | | 559,896 | | | 280,525 | | 279,371- | | 279,371- |
| ** TOTAL CONTRACTS | | 5,534,562 | | | 7,344,908 | | 1,957,099 | 146,753- | 1,810,346 |

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PRGM: INST30 CONSOLIDATED YEAR-TO-DATE

CEDAR CHEMICAL CORPORATION
GROSS MARGIN VARIANCE REPORT
DATE 12/31/92



| | GROSS MARGIN | | | VARIANCE DUE TO | | | |
|---|---|---|---|---|---|---|---|
| PRODUCT NAME | ACTUAL | PLAN | VARIANCE | VOLUME | SALES PRICE | COST | TOTAL |
| ANGUS | 572- | | 572- | 572- | | | 572- |
| ORFOM | 64,823 | 19,625 | 45,198 | 39,345 | 8,378- | 14,231 | 45,198 |
| MTPO | 7,716- | 46,329 | 54,045- | 46,000- | | 8,045- | 54,045- |
| GRACE | 2,200,311 | 578,258 | 1,622,053 | 140,912- | 2,137,646 | 374,681- | 1,622,053 |
| AKZO-SMA | 958- | | 958- | 958- | | | 958- |
| CTBL | 443,872 | 298,410 | 145,462 | 9,075 | 11,620 | 124,767 | 145,462 |
| A&W-DEHPA | 811,779 | 1,937,119 | 1,125,340- | 7,284 | 1,748,214- | 615,590 | 1,125,340- |
| SECTAGON II | 16,411- | 58,243 | 74,654- | 57,000- | | 17,654- | 74,654- |
| A&W-ADPA | 2,480 | | 2,480 | 2,480 | | | 2,480 |
| FMC | | | | | | | |
| B F GOODRICH | 140,559 | 125,838 | 14,721 | 121,000- | 657,708 | 521,987- | 14,721 |
| PERBORATE | 28,284- | 171,795 | 200,079- | 218,299- | 2,806- | 21,026 | 200,079- |
| OTHER CONTRACTS | 559,896- | 280,525- | 279,371- | 279,371- | | | 279,371- |
| ** TOTAL CONTRACTS | 3,049,987 | 2,955,092 | 94,895 | 805,928- | 1,047,576 | 146,753- | 94,895 |

DATE 12/31/92 CEDAR CHEMICAL CORPORATION PAGE 1

CEDAR - WEST HELENA PLANT INCOME STATEMENT INST20

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH BUDGETED $ AMOUNT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE BUDGETED $ AMOUNT |
|---|---|---|---|---|
| 2,070,376.93 | 830,404.00 | SALES | 45,710,388.63 | 48,819,920.00 |
| 9,170.42 | 3,636.00 | LESS-FREIGHT OUT | 254,626.45 | 353,569.00 |
| 2,509.42 | | LESS TRNFRS FREIGHT | 7,215.42 | |
| 12,626.47 | 768.00 | LESS WAREHOUSING | 169,540.07 | 85,849.00 |
| 2,046,070.22 | 826,000.00 | NET SALES | 45,279,006.69 | 48,380,500.00 |
| | | COST OF GOODS SOLD | | |
| 1,281,764.65 | 271,311.00 | COST OF SALES | 25,428,715.76 | 26,542,606.00 |
| 91,893.00- | | ROYALTIES | 3,485,258.00 | 3,178,360.00 |
| 371,785.00 | 468,818.00 | TOLLING COST | 5,320,081.64 | 7,273,452.00 |
| 7,044.58 | 12,982.00 | START-UP COST | 298,298.56 | 135,796.00 |
| | | PRODUCT COMPLAINT | 11,777.00 | |
| 160.00 | 20,833.00 | CONSENT DECREE | 456,841.23 | 249,996.00 |
| 50,512.00- | 66,666.00 | TASK FORCE EXP | 635,049.00 | 799,992.00 |
| | | OTHER | 52,198.77 | |
| 1,518,349.23 | 840,611.00 | TOTAL C.O.G.S. | 35,688,239.96 | 38,220,402.00 |
| 527,720.99 | 14,611.00- | GROSS MARGIN | 9,590,766.73 | 10,160,098.00 |
| 25.49 % | 1.76-% | GROSS MARGIN PERCENTAGE | 20.98 % | 20.81 % |
| 527,720.99 | 14,611.00- | NET INCOME (LOSS) | 9,590,766.73 | 10,160,098.00 |

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CEDAR - WEST HELENA CONSOLIDATED DCA PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| 38,400 | | | | UNITS IN LBS | 411,840 | | | | 38,400 | |
| 40,704.00 | 1.06 | | | SALES | 471,113.88 | 1.14 | | | 53,760.00 | 1.40 |
| 2,798.28 | .07 | | | LESS-FREIGHT OUT | 19,368.52 | .05 | | | | |
| 1,927.60 | .05 | | | LESS TRNFRS FREIGHT | 1,927.60 | | | | | |
| 400.00 | .01 | | | LESS WAREHOUSING | 400.00 | | | | | |
| 35,578.12 | .93 | | | NET SALES | 449,417.76 | 1.09 | | | 53,760.00 | 1.40 |
| | | | | COST OF GOODS SOLD | | | | | | |
| 31,219.29 | .81 | 3,510.00 | | COST OF SALES | 457,109.57 | 1.11 | 109,005.00- | | 54,861.75- | 1.43- |
| 7,044.58 | .18 | 7,045.00 | | START-UP COST | 84,534.96 | .21 | 84,540.00 | | 366,318.36- | 9.54- |
| 38,263.87 | 1.00 | 10,555.00 | | TOTAL C.O.G.S. | 541,644.53 | 1.32 | 24,465.00- | | 421,180.11- | 10.97- |
| 2,685.75- | .07- | 10,555.00- | | GROSS MARGIN | 92,226.77- | .22- | 24,465.00 | | 474,940.11 | 12.37 |
| 6.60-% | | | % | GROSS MARGIN PERCENTAGE | 19.58-% | | | % | 883.45 % | |
| 2,685.75- | .07- | 10,555.00- | | NET INCOME (LOSS) | 92,226.77- | .22- | 24,465.00 | | 474,940.11 | 12.37 |

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DATE 12/31/92 CEDAR CHEMICAL CORPORATION PAGE 15

CEDAR - WEST HELENA CONSOLIDATED PROPANIL TECH PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | 1,862,020 | | 2,500,000 | | 2,598,720 | |
| | | | | SALES | 5,116,463.80 | 2.75 | 6,250,000.00 | 2.50 | 6,977,926.80 | 2.69 |
| | | | | LESS-FREIGHT OUT | 6,495.64 | | | | 1,434.87 | |
| | | | | NET SALES | 5,109,968.16 | 2.74 | 6,250,000.00 | 2.50 | 6,976,491.93 | 2.68 |
| | | | | COST OF GOODS SOLD | | | | | | |
| 3,100.58- | | 2,131.00- | | COST OF SALES | 2,339,803.73 | 1.26 | 3,238,918.00 | 1.30 | 4,330,712.00 | 1.67 |
| 9,506.78 | | 18,500.00 | | TASK FORCE EXP | 176,841.13 | .09 | 222,000.00 | .09 | 146,854.00 | .06 |
| 6,406.20 | | 16,369.00 | | TOTAL C.O.G.S. | 2,516,644.86 | 1.35 | 3,460,918.00 | 1.38 | 4,477,566.00 | 1.72 |
| 6,406.20- | | 16,369.00- | | GROSS MARGIN | 2,593,323.30 | 1.39 | 2,789,082.00 | 1.12 | 2,498,925.93 | .96 |
| | X | | X | GROSS MARGIN PERCENTAGE | 50.69 X | | 44.63 X | | 35.81 X | |
| 6,406.20- | | 16,369.00- | | NET INCOME (LOSS) | 2,593,323.30 | 1.39 | 2,789,082.00 | 1.12 | 2,498,925.93 | .96 |

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DATE 12/31/92 CEDAR CHEMICAL CORPORATION PAGE 17

CEDAR - WEST HELENA CONSOLIDATED FLAKED TECH PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | 613,983 | | 1,000,000 | | 99,994 | |
| | | | | SALES | 1,193,295.88 | 1.94 | 2,141,396.00 | 2.14 | 206,952.90 | 2.07 |
| 75.00 | | | | LESS-FREIGHT OUT | 9,946.63 | .02 | 121,200.00 | .12 | 2,551.61 | .03 |
| | | | | LESS TRNFRS FREIGHT | 720.00 | | | | | |
| 4,778.28 | | | | LESS WAREHOUSING | 59,027.24 | .10 | 20,196.00 | .02 | 32,450.89 | .32 |
| 4,853.28- | | | | NET SALES | 1,123,602.01 | 1.83 | 2,000,000.00 | 2.00 | 171,950.40 | 1.72 |
| | | | | COST OF GOODS SOLD | | | | | | |
| 1,986.64- | | 5,245.00- | | COST OF SALES | 1,127,607.55 | 1.84 | 1,402,511.00 | 1.40 | 67,015.08 | .67 |
| 3,854.10 | | 7,500.00 | | TASK FORCE EXP | 71,692.35 | .12 | 90,000.00 | .09 | | |
| 1,867.46 | | 2,255.00 | | TOTAL C.O.G.S. | 1,199,299.90 | 1.95 | 1,492,511.00 | 1.49 | 67,015.08 | .67 |
| 6,720.74- | | 2,255.00- | | GROSS MARGIN | 75,697.89- | .12- | 507,489.00 | .51 | 104,935.32 | 1.05 |
| % | | % | | GROSS MARGIN PERCENTAGE | 6.34-% | | 23.70 % | | 50.70 % | |
| 6,720.74- | | 2,255.00- | | NET INCOME (LOSS) | 75,697.89- | .12- | 507,489.00 | .51 | 104,935.32 | 1.05 |

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CEDAR - WEST HELENA CONSOLIDATED PROPANIL BLEND PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | | | | | | |
| | | | | SALES | | | | | | |
| | | | | NET SALES | | | | | | |
| | | | | COST OF GOODS SOLD | | | | | | |
| | | | | COST OF SALES | 82.82 | | | | 13,566.62- | |
| | | | | TOTAL C.O.G.S. | 82.82 | | | | 13,566.62- | |
| | | | | GROSS MARGIN | 82.82- | | | | 13,566.62 | |
| X | | X | | GROSS MARGIN PERCENTAGE | | X | | X | | X |
| | | | | NET INCOME (LOSS) | 82.82- | | | | 13,566.62 | |

CEDAR - WEST HELENA CONSOLIDATED PROPANIL 360 PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH | | | | | YEAR-TO-DATE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ACTUAL | | BUDGETED | | | ACTUAL | | BUDGETED | | PRIOR YR ACTUAL | |
| $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT |
| | | | | UNITS IN GALS | | | | | | |
| | | | | SALES | | | | | | |
| | | | | NET SALES | | | | | | |
| | | | | COST OF GOODS SOLD | | | | | | |
| | | | | COST OF SALES | | | | | | |
| | | | | TOTAL C.O.G.S. | | | | | | |
| | | | | GROSS MARGIN | | | | | | |
| X | | X | | GROSS MARGIN PERCENTAGE | X | | X | | X | |
| | | | | NET INCOME (LOSS) | | | | | | |

CEDAR - WEST HELENA CONSOLIDATED PROPANIL 3# PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| 11,519 | | 40,000 | | UNITS IN GAL | 311,477 | | 400,000 | | 248,463 | |
| 89,158.86 | 7.74 | 356,404.00 | 8.91 | SALES | 2,573,901.53 | 8.26 | 3,564,040.00 | 8.91 | 2,224,120.25 | 8.95 |
| 811.50 | .07 | 3,636.00 | .09 | LESS-FREIGHT OUT | 77,031.76 | .25 | 36,360.00 | .09 | 29,535.37 | .12 |
| | | 768.00 | .02 | LESS TRNFRS FREIGHT LESS WAREHOUSING | 1,200.00 | | 7,680.00 | .02 | 4,679.70 | .02 |
| 88,347.36 | 7.67 | 352,000.00 | 8.80 | NET SALES | 2,495,669.77 | 8.01 | 3,520,000.00 | 8.80 | 2,189,905.18 | 8.81 |
| | | | | COST OF GOODS SOLD | | | | | | |
| 93,079.70 | 8.08 | 291,516.00 | 7.29 | COST OF SALES | 2,531,173.62 | 8.13 | 2,921,525.00 | 7.30 | 1,975,297.97 | 7.95 |
| | | | | OTHER | 29,327.31 | .09 | | | | |
| 93,079.70 | 8.08 | 291,516.00 | 7.29 | TOTAL C.O.G.S. | 2,560,500.93 | 8.22 | 2,921,525.00 | 7.30 | 1,975,297.97 | 7.95 |
| 4,732.34- | .41- | 60,484.00 | 1.51 | GROSS MARGIN | 64,831.16- | .21- | 598,475.00 | 1.50 | 214,607.21 | .86 |
| 5.31-% | | 16.97 % | | GROSS MARGIN PERCENTAGE | 2.52-% | | 16.79 % | | 9.65 % | |
| 4,732.34- | .41- | 60,484.00 | 1.51 | NET INCOME (LOSS) | 64,831.16- | .21- | 598,475.00 | 1.50 | 214,607.21 | .86 |

CEDAR - WEST HELENA CONSOLIDATED PROPANIL 4# PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| 35,000 | | | | UNITS IN GAL | 399,574 | | 300,000 | | 347,863 | |
| 560,000.00 | 16.00 | | | SALES | 6,265,854.83 | 15.68 | 4,848,328.00 | 16.16 | 5,359,441.41 | 15.41 |
| 3,580.75 | .10 | | | LESS-FREIGHT OUT | 48,164.85 | .12 | 54,238.00 | .18 | 42,298.82 | .12 |
| | | | | LESS TRNFRS FREIGHT | 715.31 | | | | | |
| 3,101.15 | .09 | | | LESS WAREHOUSING | 32,877.74 | .08 | 9,090.00 | .03 | 22,171.71 | .06 |
| 553,318.10 | 15.81 | | | NET SALES | 6,184,096.93 | 15.48 | 4,785,000.00 | 15.95 | 5,294,970.88 | 15.22 |
| | | | | COST OF GOODS SOLD | | | | | | |
| 268,018.49 | 7.66 | | | COST OF SALES | 3,482,045.13 | 8.71 | 2,639,395.00 | 8.80 | 3,459,239.19 | 9.94 |
| | | | | PRODUCT COMPLAINT | 3,462.20 | .01 | | | | |
| 4,624.92 | .13 | 9,000.00 | | TASK FORCE EXP | 86,030.82 | .22 | 108,000.00 | .36 | 145,448.00 | .42 |
| | | | | OTHER | | | | | | |
| 272,643.41 | 7.79 | 9,000.00 | | TOTAL C.O.G.S. | 3,571,538.15 | 8.94 | 2,747,395.00 | 9.16 | 3,604,687.19 | 10.36 |
| 280,674.69 | 8.02 | 9,000.00- | | GROSS MARGIN | 2,612,558.78 | 6.54 | 2,037,605.00 | 6.79 | 1,690,283.69 | 4.86 |
| 50.12 % | | % | | GROSS MARGIN PERCENTAGE | 41.70 % | | 42.03 % | | 31.54 % | |
| 280,674.69 | 8.02 | 9,000.00- | | NET INCOME (LOSS) | 2,612,558.78 | 6.54 | 2,037,605.00 | 6.79 | 1,690,283.69 | 4.86 |

CEDAR - WEST HELENA CONSOLIDATED PROPANEX-4 PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN GAL | 54,950 | | | | 100,800 | |
| | | | | SALES | 867,817.65 | 15.79 | | | 1,436,749.85 | 14.25 |
| | | | | LESS-FREIGHT OUT | 8,030.10 | .15 | | | 3,419.68 | .03 |
| | | | | LESS TRNFRS FREIGHT | | | | | | |
| | | | | LESS WAREHOUSING | 2,930.00 | .05 | | | 3,177.50 | .03 |
| | | | | NET SALES | 856,857.55 | 15.59 | | | 1,430,152.67 | 14.19 |
| | | | | COST OF GOODS SOLD | | | | | | |
| 793.43 | | | | COST OF SALES | 507,235.29 | 9.23 | | | 1,282,492.43 | 12.72 |
| | | | | TASK FORCE EXP | | | | | | |
| 793.43 | | | | TOTAL C.O.G.S. | 507,235.29 | 9.23 | | | 1,282,492.43 | 12.72 |
| 793.43- | | | | GROSS MARGIN | 349,622.26 | 6.36 | | | 147,660.24 | 1.46 |
| X | | X | | GROSS MARGIN PERCENTAGE | 40.29 X | | X | | 10.28 X | |
| 793.43- | | | | NET INCOME (LOSS) | 349,622.26 | 6.36 | | | 147,660.24 | 1.46 |

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CEDAR - WEST HELENA CONSOLIDATED 50 WDG PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | 32,800 | | 300,000 | | 240,000 | |
| | | | | SALES | 50,918.00 | 1.55 | 611,212.00 | 2.04 | 523,532.00 | 2.18 |
| | | | | LESS-FREIGHT OUT | 925.00 | .03 | 9,393.00 | .03 | 7,738.95 | .03 |
| | | | | LESS WAREHOUSING | 308.30 | .01 | 1,819.00 | .01 | 2,108.14 | .01 |
| | | | | NET SALES | 49,684.70 | 1.51 | 600,000.00 | 2.00 | 513,684.91 | 2.14 |
| | | | | COST OF GOODS SOLD | | | | | | |
| | | | | COST OF SALES | 59,249.60 | 1.81 | 481,007.00 | 1.60 | 388,039.46 | 1.62 |
| 2,312.46 | | 4,500.00 | | TASK FORCE EXP | 43,015.41 | 1.31 | 54,000.00 | .18 | 98,417.00 | .41 |
| 2,312.46 | | 4,500.00 | | TOTAL C.O.G.S. | 102,265.01 | 3.12 | 535,007.00 | 1.78 | 486,456.46 | 2.03 |
| 2,312.46- | | 4,500.00- | | GROSS MARGIN | 52,580.31- | 1.60- | 64,993.00 | .22 | 27,228.45 | .11 |
| | % | | % | GROSS MARGIN PERCENTAGE | 103.26-% | | 10.63 % | | 5.20 % | |
| 2,312.46- | | 4,500.00- | | NET INCOME (LOSS) | 52,580.31- | 1.60- | 64,993.00 | .22 | 27,228.45 | .11 |

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CEDAR - WEST HELENA CONSOLIDATED WHAM 80% PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | 135,140 | | 500,000 | | 261,690 | |
| | | | | SALES | 430,120.50 | 3.18 | 1,190,151.00 | 2.38 | 551,308.28 | 2.11 |
| | | | | LESS-FREIGHT OUT | 6,548.39 | .05 | 5,051.00 | .01 | 2,190.97 | .01 |
| 44.00 | | | | LESS TRNFRS FREIGHT<br>LESS WAREHOUSING | 3,638.67 | .03 | 10,100.00 | .02 | 10,084.86 | .04 |
| 44.00- | | | | NET SALES | 419,933.44 | 3.11 | 1,175,000.00 | 2.35 | 539,032.45 | 2.06 |
| | | | | COST OF GOODS SOLD | | | | | | |
| | | | | COST OF SALES | 130,359.04 | .96 | 874,502.00 | 1.75 | 475,338.21 | 1.82 |
| 3,083.28 | | 6,000.00 | | TASK FORCE EXP | 57,353.88 | .42 | 72,000.00 | .14 | 123,038.00 | .47 |
| 3,083.28 | | 6,000.00 | | TOTAL C.O.G.S. | 187,712.92 | 1.39 | 946,502.00 | 1.89 | 598,376.21 | 2.29 |
| 3,127.28- | | 6,000.00- | | GROSS MARGIN | 232,220.52 | 1.72 | 228,498.00 | .46 | 59,343.76- | .23- |
| % | | % | | GROSS MARGIN PERCENTAGE | 53.99 % | | 19.20 % | | 10.76-% | |
| 3,127.28- | | 6,000.00- | | NET INCOME (LOSS) | 232,220.52 | 1.72 | 228,498.00 | .46 | 59,343.76- | .23- |

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CEDAR - WEST HELENA CONSOLIDATED SIAM PRODUCT INCOME STATEMENT INST9(

| CURRENT MONTH | | | | | YEAR-TO-DATE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ACTUAL | | BUDGETED | | | ACTUAL | | BUDGETED | | PRIOR YR ACTUAL | |
| $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT |
| 77,000 | | | | UNITS IN GAL | 1,301,179 | | 1,300,000 | | 317,662 | |
| 924,000.00 | 12.00 | | | SALES | 15,582,809.50 | 11.98 | 14,820,500.00 | 11.40 | 4,270,525.55 | 13.44 |
| | | | | LESS-FREIGHT OUT | 3,301.60 | | | | 1,130.15 | |
| 280.00 | | | | LESS TRNFRS FREIGHT | 280.00 | | | | | |
| 1,078.00 | .01 | | | LESS WAREHOUSING | 9,659.28 | .01 | | | 3,380.00 | .01 |
| 922,642.00 | 11.98 | | | NET SALES | 15,569,568.62 | 11.97 | 14,820,500.00 | 11.40 | 4,266,015.40 | 13.43 |
| | | | | COST OF GOODS SOLD | | | | | | |
| 742,654.31 | 9.64 | 16,339.00- | | COST OF SALES | 11,894,616.46 | 9.14 | 11,802,984.00 | 9.08 | 3,409,243.65 | 10.73 |
| 91,893.00- | 1.19- | | | ROYALTIES | 3,485,258.00 | 2.68 | 3,198,360.00 | 2.46 | | |
| | | | | OTHER | | | | | | |
| 650,761.31 | 8.45 | 16,339.00- | | TOTAL C.O.G.S. | 15,379,874.46 | 11.82 | 15,001,344.00 | 11.54 | 3,409,243.65 | 10.73 |
| 271,880.69 | 3.53 | 16,339.00 | | GROSS MARGIN | 189,694.16 | .15 | 180,844.00- | .14- | 856,771.75 | 2.70 |
| 29.42 % | | | % | GROSS MARGIN PERCENTAGE | 1.22 % | | 1.22-% | | 20.06 % | |
| 271,880.69 | 3.53 | 16,339.00 | | NET INCOME (LOSS) | 189,694.16 | .15 | 180,844.00- | .14- | 856,771.75 | 2.70 |

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CEDAR - WEST HELENA CONSOLIDATED STAMPEDE PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN GALS | 22,602 | | | | | |
| | | | | SALES | 246,148.00 | 10.89 | | | | |
| | | | | LESS-FREIGHT OUT | 975.15 | .04 | | | | |
| | | | | NET SALES | 245,172.85 | 10.85 | | | | |
| | | | | COST OF GOODS SOLD | | | | | | |
| | | | | COST OF SALES | 245,172.21 | 10.85 | | | | |
| | | | | TOTAL C.O.G.S. | 245,172.21 | 10.85 | | | | |
| | | | | GROSS MARGIN | .64 | | | | | |
| X | | X | | GROSS MARGIN PERCENTAGE | | X | | X | | X |
| | | | | NET INCOME (LOSS) | .64 | | | | | |

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CEDAR - WEST HELENA CONSOLIDATED WHAM PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| 3,200 | | | | UNITS IN GALS | 97,580 | | 150,000 | | 44,035 | |
| 35,200.00 | 11.00 | | | SALES | 1,542,779.14 | 15.81 | 2,467,794.00 | 16.45 | 631,767.24 | 14.35 |
| 1,203.09 | .38 | | | LESS-FREIGHT OUT | 36,688.19 | .38 | 93,021.00 | .62 | 29,265.09 | .66 |
| 40.00 | .01 | | | LESS TRNFRS FREIGHT | 3,199.20 | .03 | | | | |
| 920.66 | .29 | | | LESS WAREHOUSING | 23,515.95 | .24 | 12,273.00 | .08 | 12,024.41 | .27 |
| 33,036.25 | 10.32 | | | NET SALES | 1,479,375.80 | 15.16 | 2,362,500.00 | 15.75 | 590,477.74 | 13.41 |
| | | | | COST OF GOODS SOLD | | | | | | |
| 32,705.64 | 10.22 | | | COST OF SALES | 1,058,074.86 | 10.84 | 1,531,315.00 | 10.21 | 443,739.43 | 10.08 |
| | | | | PRODUCT COMPLAINT | 8,314.80 | .09 | | | 39,480.10 | .90 |
| 2,312.46 | .72 | 4,500.00 | | TASK FORCE EXP | 43,015.41 | .44 | 54,000.00 | .36 | 61,243.00 | 1.39 |
| | | | | OTHER | 22,029.21 | .23 | | | | |
| 35,018.10 | 10.94 | 4,500.00 | | TOTAL C.O.G.S. | 1,131,434.28 | 11.59 | 1,585,315.00 | 10.57 | 544,462.53 | 12.36 |
| 1,981.85- | .62- | 4,500.00- | | GROSS MARGIN | 347,941.52 | 3.57 | 777,185.00 | 5.18 | 46,015.21 | 1.04 |
| 5.63-% | | | % | GROSS MARGIN PERCENTAGE | 22.55 % | | 31.49 % | | 7.28 % | |
| 1,981.85- | .62- | 4,500.00- | | NET INCOME (LOSS) | 347,941.52 | 3.57 | 777,185.00 | 5.18 | 46,015.21 | 1.04 |

CEDAR - WEST HELENA CONSOLIDATED BUTOXONE 175 PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| 108 | | | | UNITS IN GALS | 98,321 | | 105,000 | | 111,350 | |
| 2,048.76 | 18.97 | | | SALES | 1,894,956.87 | 19.27 | 1,929,876.00 | 18.38 | 1,996,333.17 | 17.93 |
| | | | | LESS-FREIGHT OUT | 20,618.06 | .21 | 24,710.00 | .24 | 26,017.47 | .23 |
| 1,331.85 | 12.33 | | | LESS TRNFRS FREIGHT<br>LESS WAREHOUSING | 20,463.95 | .21 | 15,166.00 | .14 | 18,788.43 | .17 |
| 716.91 | 6.64 | | | NET SALES | 1,853,874.86 | 18.86 | 1,890,000.00 | 18.00 | 1,951,527.27 | 17.53 |
| | | | | COST OF GOODS SOLD | | | | | | |
| 1,010.65 | 9.36 | | | COST OF SALES | 976,248.35 | 9.93 | 1,267,324.00 | 12.07 | 1,281,451.62 | 11.51 |
| | | | | PRODUCT COMPLAINT | | | | | 21,584.00 | .19 |
| 54,868.32- | 508.04- | 12,000.00 | | TASK FORCE EXP<br>OTHER | 113,129.28 | 1.15 | 144,000.00 | 1.37 | 125,573.37 | 1.13 |
| 53,857.67- | 498.68- | 12,000.00 | | TOTAL C.O.G.S. | 1,089,377.63 | 11.08 | 1,411,324.00 | 13.44 | 1,428,608.99 | 12.83 |
| 54,574.58 | 505.32 | 12,000.00- | | GROSS MARGIN | 764,497.23 | 7.78 | 478,676.00 | 4.56 | 522,918.28 | 4.70 |
| 663.79 % | | % | | GROSS MARGIN PERCENTAGE | 40.34 % | | 24.80 % | | 26.19 % | |
| 54,574.58 | 505.32 | 12,000.00- | | NET INCOME (LOSS) | 764,497.23 | 7.78 | 478,676.00 | 4.56 | 522,918.28 | 4.70 |

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CEDAR - WEST HELENA CONSOLIDATED BUTOXONE 200 PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| 3,852 | | | | UNITS IN GALS | 30,024 | | 25,000 | | 33,212 | |
| 85,975.56 | 22.32 | | | SALES | 639,977.60 | 21.32 | 453,914.00 | 18.16 | 667,606.13 | 20.10 |
| | | | | LESS-FREIGHT OUT | 13,199.11 | .44 | 9,596.00 | .38 | 14,494.56 | .44 |
| 761.74 | .20 | | | LESS TRNFRS FREIGHT<br>LESS WAREHOUSING | 10,974.92 | .37 | 6,818.00 | .27 | 7,469.17 | .22 |
| 85,213.82 | 22.12 | | | NET SALES | 615,803.57 | 20.51 | 437,500.00 | 17.50 | 645,642.40 | 19.44 |
| | | | | COST OF GOODS SOLD | | | | | | |
| 46,759.37 | 12.14 | | | COST OF SALES | 432,613.10 | 14.41 | 343,046.00 | 13.72 | 374,738.87 | 11.28 |
| | | | | PRODUCT COMPLAINT | | | | | | |
| 15,241.20- | 3.96- | 3,333.00 | | TASK FORCE EXP | 31,422.80 | 1.05 | 39,996.00 | 1.60 | 31,645.29 | .95 |
| | | | | OTHER | | | | | | |
| 31,518.17 | 8.18 | 3,333.00 | | TOTAL C.O.G.S. | 464,035.90 | 15.46 | 383,042.00 | 15.32 | 406,384.16 | 12.24 |
| 53,695.65 | 13.94 | 3,333.00- | | GROSS MARGIN | 151,767.67 | 5.05 | 54,458.00 | 2.18 | 239,258.24 | 7.20 |
| 62.45 % | | | % | GROSS MARGIN PERCENTAGE | 23.71 % | | 12.00 % | | 35.84 % | |
| 53,695.65 | 13.94 | 3,333.00- | | NET INCOME (LOSS) | 151,767.67 | 5.05 | 54,458.00 | 2.18 | 239,258.24 | 7.20 |

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CEDAR - WEST HELENA CONSOLIDATED BUTOXONE ESTER PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| 4,680 | | | | UNITS IN GALS | 14,040 | | 10,000 | | 8,810 | |
| 74,880.00 | 16.00 | | | SALES | 230,356.00 | 16.41 | 242,727.00 | 24.27 | 216,304.00 | 24.55 |
| 702.00 | .15 | | | LESS-FREIGHT OUT | 3,402.73 | .24 | | | 5,318.29 | .60 |
| 262.02 | .06 | | | LESS TRNFRS FREIGHT | 373.31 | .03 | | | | |
| 210.79 | .05 | | | LESS WAREHOUSING | 4,505.02 | .32 | 2,727.00 | .27 | 309.02 | .04 |
| 73,705.19 | 15.75 | | | NET SALES | 222,074.94 | 15.82 | 240,000.00 | 24.00 | 210,676.69 | 23.91 |
| | | | | COST OF GOODS SOLD | | | | | | |
| 69,893.86 | 14.93 | | | COST OF SALES | 186,607.32 | 13.29 | 149,082.00 | 14.91 | 114,947.90 | 13.05 |
| | | | | PRODUCT COMPLAINT | | | | | | |
| 6,096.48- | 1.30- | 1,333.00 | | TASK FORCE EXP | 12,567.92 | .90 | 15,996.00 | 1.60 | 23,161.09 | 2.63 |
| | | | | OTHER | 842.25 | .06 | | | | |
| 63,797.38 | 13.63 | 1,333.00 | | TOTAL C.O.G.S. | 200,017.49 | 14.25 | 165,078.00 | 16.51 | 138,108.99 | 15.68 |
| 9,907.81 | 2.12 | 1,333.00- | | GROSS MARGIN | 22,057.45 | 1.57 | 74,922.00 | 7.49 | 72,567.70 | 8.24 |
| 13.23 % | | | % | GROSS MARGIN PERCENTAGE | 9.58 % | | 30.87 % | | 33.55 % | |
| 9,907.81 | 2.12 | 1,333.00- | | NET INCOME (LOSS) | 22,057.45 | 1.57 | 74,922.00 | 7.49 | 72,567.70 | 8.24 |

CEDAR - WEST HELENA CONSOLIDATED PYRIDATE 3.75 EC PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH | | | | | YEAR-TO-DATE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ACTUAL | | BUDGETED | | | ACTUAL | | BUDGETED | | PRIOR YR ACTUAL | |
| $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT |
| | | | | UNITS IN GALS | | | | | | |
| | | | | SALES | | | | | | |
| | | | | NET SALES | | | | | | |
| | | | | COST OF GOODS SOLD | | | | | | |
| | | | | COST OF SALES | | | | | | |
| | | | | ROYALTIES | | | | | | |
| | | | | TOTAL C.O.G.S. | | | | | | |
| | | | | GROSS MARGIN | | | | | | |
| X | | X | | GROSS MARGIN PERCENTAGE | X | | X | | X | |
| | | | | NET INCOME (LOSS) | | | | | | |

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CEDAR - WEST HELENA CONSOLIDATED BUTOXONE OTHER PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH | | | | YEAR-TO-DATE | | | | |
|---|---|---|---|---|---|---|---|---|
| ACTUAL | | BUDGETED | | ACTUAL | | BUDGETED | | PRIOR YR ACTUAL |
| $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT |
| | | | UNITS IN GALS | | | | | |
| | | | LESS-FREIGHT OUT | | | | | |
| | | | NET SALES | | | | | |
| | | | NET INCOME (LOSS) | | | | | |

CEDAR - WEST HELENA CONSOLIDATED A&W-ADPA PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | | | | | | |
| 64,000.00 | | | | SALES | 64,000.00 | | | | | |
| 64,000.00 | | | | NET SALES | 64,000.00 | | | | | |
| | | | | COST OF GOODS SOLD | | | | | | |
| 717.13 | | | | COST OF SALES | 717.13 | | | | | |
| 60,802.54 | | | | TOLLING COST | 60,802.54 | | | | | |
| 61,519.67 | | | | TOTAL C.O.G.S. | 61,519.67 | | | | | |
| 2,480.33 | | | | GROSS MARGIN | 2,480.33 | | | | | |
| 3.88 % | | % | | GROSS MARGIN PERCENTAGE | 3.88 % | | % | | % | |
| 2,480.33 | | | | NET INCOME (LOSS) | 2,480.33 | | | | | |

CEDAR - WEST HELENA CONSOLIDATED A&W-DEHPA PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | 4,848,210 | | 4,830,000 | | 1,380,850 | |
| | | | | SALES | 2,372,764.53 | .49 | 4,105,500.00 | .85 | 1,536,958.38 | 1.11 |
| | | | | NET SALES | 2,372,764.53 | .49 | 4,105,500.00 | .85 | 1,536,958.38 | 1.11 |
| 8,543.49 | | | | COST OF GOODS SOLD TOLLING COST | 1,560,986.12 | .32 | 2,168,381.00 | .45 | 741,263.49 | .54 |
| 8,543.49 | | | | TOTAL C.O.G.S. | 1,560,986.12 | .32 | 2,168,381.00 | .45 | 741,263.49 | .54 |
| 8,543.49- | | | | GROSS MARGIN | 811,778.41 | .17 | 1,937,119.00 | .40 | 795,694.89 | .58 |
| % | | % | | GROSS MARGIN PERCENTAGE | 34.21 % | | 47.18 % | | 51.77 % | |
| 8,543.49- | | | | NET INCOME (LOSS) | 811,778.41 | .17 | 1,937,119.00 | .40 | 795,694.89 | .58 |

CEDAR - WEST HELENA CONSOLIDATED ANGUS PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | | | | | 601,312 | |
| | | | | SALES | | | | | 600,000.00 | 1.00 |
| | | | | NET SALES | | | | | 600,000.00 | 1.00 |
| | | | | COST OF GOODS SOLD | | | | | | |
| | | | | TOLLING COST | 572.21 | | | | 416,406.32 | .69 |
| | | | | TOTAL C.O.G.S. | 572.21 | | | | 416,406.32 | .69 |
| | | | | GROSS MARGIN | 572.21- | | | | 183,593.68 | .31 |
| | X | | X | GROSS MARGIN PERCENTAGE | | X | | X | 30.60 | X |
| | | | | NET INCOME (LOSS) | 572.21- | | | | 183,593.68 | .31 |

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CEDAR - WEST HELENA CONSOLIDATED AKZO-SMA PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | | | | | 309,650 | |
| | | | | SALES | | | | | 521,985.72 | 1.69 |
| | | | | NET SALES | | | | | 521,985.72 | 1.69 |
| | | | | COST OF GOODS SOLD | | | | | | |
| 66.03 | | | | TOLLING COST | 958.46 | | | | 304,355.93 | .98 |
| 66.03 | | | | TOTAL C.O.G.S. | 958.46 | | | | 304,355.93 | .98 |
| 66.03- | | | | GROSS MARGIN | 958.46- | | | | 217,629.79 | .70 |
| X | | X | | GROSS MARGIN PERCENTAGE | X | | X | | 41.69 X | |
| 66.03- | | | | NET INCOME (LOSS) | 958.46- | | | | 217,629.79 | .70 |

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CEDAR - WEST HELENA CONSOLIDATED B.F.GOODRICH PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 350,000 | | UNITS IN LBS | | | 1,100,000 | | | |
| 8,000.00 | | 154,000.00 | .44 | SALES | 659,708.27 | | 629,000.00 | .57 | 458,528.91 | |
| 8,000.00 | | 154,000.00 | .44 | NET SALES | 659,708.27 | | 629,000.00 | .57 | 458,528.91 | |
| | | | | COST OF GOODS SOLD | | | | | | |
| 5,658.89 | | 144,744.00 | .41 | TOLLING COST | 519,148.80 | | 503,162.00 | .46 | 269,652.47 | |
| 5,658.89 | | 144,744.00 | .41 | TOTAL C.O.G.S. | 519,148.80 | | 503,162.00 | .46 | 269,652.47 | |
| 2,341.11 | | 9,256.00 | .03 | GROSS MARGIN | 140,559.47 | | 125,838.00 | .11 | 188,876.44 | |
| 29.26 % | | 6.01 % | | GROSS MARGIN PERCENTAGE | 21.31 % | | 20.01 % | | 41.19 % | |
| 2,341.11 | | 9,256.00 | .03 | NET INCOME (LOSS) | 140,559.47 | | 125,838.00 | .11 | 188,876.44 | |

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CEDAR - WEST HELENA CONSOLIDATED CIBL PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | 515,125 | | 500,000 | | 203,055 | |
| | | | | SALES | 815,214.91 | 1.58 | 780,000.00 | 1.56 | 290,500.00 | 1.43 |
| | | | | NET SALES | 815,214.91 | 1.58 | 780,000.00 | 1.56 | 290,500.00 | 1.43 |
| | | | | COST OF GOODS SOLD | | | | | | |
| 3,692.72 | | | | TOLLING COST | 371,343.16 | .72 | 481,590.00 | .96 | 130,315.84 | .64 |
| 3,692.72 | | | | TOTAL C.O.G.S. | 371,343.16 | .72 | 481,590.00 | .96 | 130,315.84 | .64 |
| 3,692.72- | | | | GROSS MARGIN | 443,871.75 | .86 | 298,410.00 | .60 | 160,184.16 | .79 |
| | % | | % | GROSS MARGIN PERCENTAGE | 54.45 % | | 38.26 % | | 55.14 % | |
| 3,692.72- | | | | NET INCOME (LOSS) | 443,871.75 | .86 | 298,410.00 | .60 | 160,184.16 | .79 |

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CEDAR - WEST HELENA CONSOLIDATED DCPI PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH | | | | | YEAR-TO-DATE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ACTUAL | | BUDGETED | | | ACTUAL | | BUDGETED | | PRIOR YR ACTUAL | |
| $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT |
| | | | | UNITS IN LBS | | | | | | |
| | | | | SALES | | | | | | |
| | | | | NET SALES | | | | | | |
| | | | | COST OF GOODS SOLD<br>COST OF SALES | | | | | | |
| | | | | TOTAL C.O.G.S. | | | | | | |
| | | | | GROSS MARGIN | | | | | | |
| X | | X | | GROSS MARGIN PERCENTAGE | X | | X | | X | |
| | | | | NET INCOME (LOSS) | | | | | | |

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CEDAR - WEST HELENA CONSOLIDATED EMC PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH | | | | | YEAR-TO-DATE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ACTUAL | | BUDGETED | | | ACTUAL | | BUDGETED | | PRIOR YR ACTUAL | |
| $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT |
| | | | | UNITS IN LBS | | | | | | |
| | | | | SALES | | | | | | |
| | | | | NET SALES | | | | | | |
| | | | | COST OF GOODS SOLD | | | | | | |
| | | | | TOLLING COST | | | | | 50.00 | |
| | | | | TOTAL C.O.G.S. | | | | | 50.00 | |
| | | | | GROSS MARGIN | | | | | 50.00- | |
| X | | X | | GROSS MARGIN PERCENTAGE | X | | X | | X | |
| | | | | NET INCOME (LOSS) | | | | | 50.00- | |

CEDAR - WEST HELENA CONSOLIDATED GRACE PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 250,000 | | UNITS IN LBS | 2,258,355 | | 3,000,000 | | 1,999,933 | |
| 216.48 | | 240,000.00 | .96 | SALES | 4,318,166.81 | 1.91 | 2,892,500.00 | .96 | 2,797,260.84 | 1.40 |
| 216.48 | | 240,000.00 | .96 | NET SALES | 4,318,166.81 | 1.91 | 2,892,500.00 | .96 | 2,797,260.84 | 1.40 |
| | | | | COST OF GOODS SOLD | | | | | | |
| 25,372.60 | | 186,913.00 | .75 | TOLLING COST | 1,904,092.56 | .84 | 2,242,986.00 | .75 | 1,991,795.20 | 1.00 |
| | | 5,938.00 | .02 | START-UP COST | 213,763.60 | .09 | 71,256.00 | .02 | 71,254.56 | .04 |
| 25,372.60 | | 192,851.00 | .77 | TOTAL C.O.G.S. | 2,117,856.16 | .94 | 2,314,242.00 | .77 | 2,063,049.76 | 1.03 |
| 25,156.12- | | 47,149.00 | .19 | GROSS MARGIN | 2,200,310.65 | .97 | 578,258.00 | .19 | 734,211.08 | .37 |
| 620.53-% | | 19.65 % | | GROSS MARGIN PERCENTAGE | 50.95 % | | 19.99 % | | 26.25 % | |
| 25,156.12- | | 47,149.00 | .19 | NET INCOME (LOSS) | 2,200,310.65 | .97 | 578,258.00 | .19 | 734,211.08 | .37 |

CEDAR - WEST HELENA CONSOLIDATED MIPO PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | | | 100,000 | | 42,930 | |
| | | | | SALES | | | 500,000.00 | 5.00 | 349,879.50 | 8.15 |
| | | | | LESS-FREIGHT OUT | | | | | | |
| | | | | NET SALES | | | 500,000.00 | 5.00 | 349,879.50 | 8.15 |
| | | | | COST OF GOODS SOLD | | | | | | |
| | | | | TOLLING COST | 7,715.77 | | 453,671.00 | 4.54 | 282,691.27 | 6.58 |
| | | | | TOTAL C.O.G.S. | 7,715.77 | | 453,671.00 | 4.54 | 282,691.27 | 6.58 |
| | | | | GROSS MARGIN | 7,715.77- | | 46,329.00 | .46 | 67,188.23 | 1.57 |
| % | | % | | GROSS MARGIN PERCENTAGE | % | | 9.27 % | | 19.20 % | |
| | | | | NET INCOME (LOSS) | 7,715.77- | | 46,329.00 | .46 | 67,188.23 | 1.57 |

CEDAR - WEST HELENA CONSOLIDATED PERBORATE PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1,000,000 | | UNITS IN LBS | 85,080 | | 11,000,000 | | | |
| | | 80,000.00 | .08 | SALES | 4,000.00 | .05 | 880,000.00 | .08 | | |
| | | 80,000.00 | .08 | NET SALES | 4,000.00 | .05 | 880,000.00 | .08 | | |
| | | | | COST OF GOODS SOLD | | | | | | |
| 445.38 | | 62,785.00 | .06 | TOLLING COST | 32,283.83 | .38 | 708,205.00 | .06 | 1,269.51 | |
| 445.38 | | 62,785.00 | .06 | TOTAL C.O.G.S. | 32,283.83 | .38 | 708,205.00 | .06 | 1,269.51 | |
| 445.38- | | 17,215.00 | .02 | GROSS MARGIN | 28,283.83- | .33- | 171,795.00 | .02 | 1,269.51- | |
| X | | 21.52 X | | GROSS MARGIN PERCENTAGE | 707.10-X | | 19.52 X | | X | |
| 445.38- | | 17,215.00 | .02 | NET INCOME (LOSS) | 28,283.83- | .33- | 171,795.00 | .02 | 1,269.51- | |

CEDAR - WEST HELENA CONSOLIDATED OREON PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| 582,809 | | | | UNITS IN LBS | 1,196,907 | | 410,000 | | 116,700 | |
| 186,193.27 | .32 | | | SALES | 350,693.99 | .29 | 123,000.00 | .30 | 67,607.68 | .58 |
| 186,193.27 | .32 | | | NET SALES | 350,693.99 | .29 | 123,000.00 | .30 | 67,607.68 | .58 |
| 116,469.30 | .20 | | | COST OF GOODS SOLD TOLLING COST | 285,871.44 | .24 | 103,375.00 | .25 | 81,981.78 | .70 |
| 116,469.30 | .20 | | | TOTAL C.O.G.S. | 285,871.44 | .24 | 103,375.00 | .25 | 81,981.78 | .70 |
| 69,723.97 | .12 | | | GROSS MARGIN | 64,822.55 | .05 | 19,625.00 | .05 | 14,374.10- | .12- |
| 37.45 % | | | % | GROSS MARGIN PERCENTAGE | 18.48 % | | 15.96 % | | 21.26-% | |
| 69,723.97 | .12 | | | NET INCOME (LOSS) | 64,822.55 | .05 | 19,625.00 | .05 | 14,374.10- | .12- |

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CEDAR - WEST HELENA CONSOLIDATED SECTAGON II PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN GAL | | | 300,000 | | 189,352 | |
| | | | | SALES | | | 390,000.00 | 1.30 | 246,622.60 | 1.30 |
| | | | | NET SALES | | | 390,000.00 | 1.30 | 246,622.60 | 1.30 |
| | | | | COST OF GOODS SOLD | | | | | | |
| | | | | TOLLING COST | 16,410.94 | | 331,757.00 | 1.11 | 240,906.52 | 1.27 |
| | | | | TOTAL C.O.G.S. | 16,410.94 | | 331,757.00 | 1.11 | 240,906.52 | 1.27 |
| | | | | GROSS MARGIN | 16,410.94- | | 58,243.00 | .19 | 5,716.08 | .03 |
| X | | X | | GROSS MARGIN PERCENTAGE | X | | 14.93 X | | 2.32 X | |
| | | | | NET INCOME (LOSS) | 16,410.94- | | 58,243.00 | .19 | 5,716.08 | .03 |

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CEDAR - WEST HELENA CONSOLIDATED OTHER CONTRACTS PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | | | | | | |
| | | | | COST OF GOODS SOLD | | | | | | |
| 150,734.05 | | 74,376.00 | | TOLLING COST | 559,895.81 | | 280,525.00 | | 682,894.66 | |
| 150,734.05 | | 74,376.00 | | TOTAL C.O.G.S. | 559,895.81 | | 280,525.00 | | 682,894.66 | |
| 150,734.05- | | 74,376.00- | | GROSS MARGIN | 559,895.81- | | 280,525.00- | | 682,894.66- | |
| % | | 92.97-% | | GROSS MARGIN PERCENTAGE | 997.40-% | | 31.88-% | | % | |
| 29,878.25 | | 19,833.00 | | SELLING EXPENSES | 369,147.44 | | 292,996.00 | | 243,196.92 | |
| 21,527.64 | | 27,838.00 | | ADMINISTRATIVE EXP. | 135,627.43 | | 192,079.00 | | 141,807.45 | |
| 19,442.19 | | 38,517.00 | | INTEREST EXPENSE | 380,613.29 | | 495,409.00 | | 527,479.47 | |
| 1,175.61- | | 3,432.00- | | INTEREST INCOME | 33,925.92- | | 41,184.00- | | 62,171.98- | |
| 220,406.52- | | 157,132.00- | | NET INCOME (LOSS) | 1,411,358.05- | | 1,219,825.00- | | 1,533,206.52- | |

CEDAR - WEST HELENA CONSOLIDATED WEST HELENA OTHER PRODUCT INCOME STATEMENT INST9C

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN | | | | | | |
| | | | | SALES | 19,326.94 | | | | 25,174.55 | |
| | | | | NET SALES | 19,326.94 | | | | 25,174.55 | |
| | | | | COST OF GOODS SOLD | | | | | | |
| | | | | COST OF SALES | .02- | | 2.00 | | .05 | |
| 160.00 | | 20,833.00 | | CONSENT DECREE | 456,841.23 | | 249,996.00 | | 346,861.87 | |
| | | | | OTHER | | | | | | |
| 160.00 | | 20,833.00 | | TOTAL C.O.G.S. | 456,841.21 | | 249,998.00 | | 346,861.92 | |
| 160.00- | | 20,833.00- | | GROSS MARGIN | 437,514.27- | | 249,998.00- | | 321,687.37- | |
| | % | | % | GROSS MARGIN PERCENTAGE | 263.75-% | | | % | 277.83-% | |
| 232,397.88 | | 71,410.00 | | SELLING EXPENSES | 1,620,393.05 | | 1,143,820.00 | | 1,267,634.26 | |
| 66,928.26 | | 139,724.00 | | ADMINISTRATIVE EXP. | 710,335.94 | | 710,340.00 | | 511,715.32 | |
| 25,819.68 | | 65,817.00 | | INTEREST EXPENSE | 918,834.64 | | 846,537.00 | | 864,316.75 | |
| 8,131.43- | | 17,226.00- | | INTEREST INCOME | 190,502.13- | | 206,712.00- | | 224,994.11- | |
| 317,174.39- | | 280,558.00- | | NET INCOME (LOSS) | 3,496,575.77- | | 2,743,983.00- | | 2,740,359.59- | |

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UNIT COST REPORT BY EXPENSE

| NTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 200 | SALES-PESTICIDES | 1,811,965- | 356,404- | 1,455,561- | 37,106,306- | 38,519,938- | 1,413,632 | 25,116,323- | 11,990,183- |
| 300 | TOLLING REVENUE | 258,409- | 474,000- | 215,591 | 8,584,545- | 10,300,000- | 1,715,455 | 6,869,339- | 1,715,206- |
| 400 | OTHER REVENUE | | | | 19,326- | | 19,326- | 25,174- | 5,848 |
| | SUB TOTAL | 2,070,374- | 830,404- | 1,239,970- | 45,710,377- | 48,819,938- | 3,109,561 | 32,010,836- | 13,699,541- |
| | SALES | 2,070,374- | 830,404- | 1,239,970- | 45,710,377- | 48,819,938- | 3,109,561 | 32,010,836- | 13,699,541- |

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UNIT COST REPORT BY EXPENSE

| NTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 600 | FREIGHT OUT | 4,069 | 3,636 | 433 | 215,507 | 319,637 | 104,130- | 143,895 | 71,612 |
| 610 | FREIGHT ALLOWANCES | 5,100 | | 5,100 | 39,112 | 33,932 | 5,180 | 21,493 | 17,619 |
| 620 | FREIGHT WHSE TRANSF | 2,509 | | 2,509 | 7,214 | | 7,214 | | 7,214 |
| 850 | O/S WAREHOUSE LEASE | 12,623 | 768 | 11,855 | 169,535 | 85,849 | 83,666 | 116,639 | 52,896 |
| 860 | WAREHOUSE ALLOWANCES | | | | | | | | |
| | SUB TOTAL | 24,301 | 4,404 | 19,897 | 431,368 | 439,438 | 8,070- | 282,027 | 149,341 |
| | FREIGHT & COMM | 24,301 | 4,404 | 19,897 | 431,368 | 439,438 | 8,070- | 282,027 | 149,341 |

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UNIT COST REPORT BY EXPENSE

| NTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 100 | COST OF SALES @ STD | 1,339,029 | 292,000 | 1,047,029 | 25,605,972 | 26,658,050 | 1,052,078- | 17,705,505 | 7,900,467 |
| 120 | PUR PRICE VARIANCE | 22,063- | | 22,063- | 148,926 | | 148,926 | 145,538- | 294,464 |
| 140 | DEF MFG VARIANCE | | | | | | | | |
| 160 | FINISHED PROD. LOST | | | | 52,198 | | 52,198 | | 52,198 |
| 170 | PRODUCT COMPLAINT EX | | | | 11,776 | | 11,776 | 61,064 | 49,288- |
| 220 | FUTURE ENVIRON COSTS | 250,000 | | 250,000 | 250,000 | | 250,000 | | 250,000 |
| 250 | START-UP COST | 7,044 | 12,983 | 5,939- | 298,297 | 155,796 | 142,501 | 298,064- | 593,361 |
| 260 | TASK FORCE EXPENSES | 50,514- | 64,666 | 117,180- | 635,064 | 799,992 | 164,928- | 755,379 | 120,315- |
| 280 | GAIN (LOSS) F/A | | | | | | | | |
| | SUB TOTAL | 1,523,496 | 371,649 | 1,151,847 | 27,002,233 | 27,613,838 | 611,605- | 18,081,346 | 8,920,887 |
| | COST OF SALES | 1,523,496 | 371,649 | 1,151,847 | 27,002,233 | 27,613,838 | 611,605- | 18,081,346 | 8,920,887 |

HL

UNIT COST REPORT BY EXPENSE

| INTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 510 | BUTOXONE TECH ACID | | | | 630,153 | 1,396,351 | 766,198- | 1,265,650 | 635,497- |
| 520 | DDCB | 167,207 | 330,240 | 163,033- | 3,500,069 | 4,128,000 | 627,931- | 1,633,242 | 1,866,827 |
| 530 | 99% SULFURIC ACID | 23,167 | 60,808 | 37,641- | 519,693 | 760,105 | 240,412- | 163,814 | 355,879 |
| 540 | 98% NITRIC ACID | 24,568 | 49,444 | 24,876- | 539,282 | 618,048 | 78,766- | 279,893 | 259,389 |
| 630 | DCA | | | | 960,432 | 978,750 | 18,318- | 9,410,856 | 8,450,424- |
| 640 | PROPIONIC ACID | 34,915 | 106,920 | 72,005- | 986,453 | 1,407,780 | 421,327- | 1,062,036 | 75,583- |
| 650 | PROPIONIC ANHYDRIDE | 6,186 | 46,980 | 40,794- | 587,322 | 618,570 | 31,248- | 408,231 | 179,091 |
| 660 | MESITYL OXIDE | | 319,200 | 319,200- | 808,771 | 3,456,480 | 2,647,709- | 816,583 | 7,812- |
| 670 | EMULSIFIER | 46,738 | 156,254 | 109,516- | 1,321,886 | 1,577,006 | 255,120- | 833,612 | 488,274 |
| 675 | ARMUL | | | | | | | | |
| 680 | ISOPHORONE | 157,558 | 131,010 | 26,548 | 3,247,371 | 1,246,674 | 2,000,697 | 1,934,351 | 1,313,020 |
| 685 | TENNECO 500 | 3,522 | 38,500 | 34,978- | 138,289 | 284,900 | 146,611- | 252,753 | 114,464- |
| 695 | NCPA | | | | 54,722 | | 54,722 | | 54,722 |
| 700 | DMA-60% | | | | 17,494 | 59,778 | 42,284- | 39,675 | 22,181- |
| 705 | CITRIC ACID | | | | 19,087 | 31,559 | 12,472- | 27,209 | 8,122- |
| 850 | OTHER RAW MATERIALS | 39,494 | 63,649 | 24,155- | 881,074 | 1,597,398 | 716,324- | 944,410 | 63,336- |
| 870 | PACKAGING MATERIALS | 6,473 | | 6,473 | 147,380 | 218,088 | 70,708- | 179,152 | 31,772- |
| 890 | CONTAINERS | 54,976 | 211,351 | 156,375- | 1,341,763 | 1,165,158 | 176,605 | 600,991 | 740,772 |
| 910 | FIN GOODS PURCHASED | | | | 958,581 | | 958,581 | | 958,581 |
| 920 | FRT IN F.G.PURCHASED | | | | | | | | |
| | SUB TOTAL | 564,804 | 1,514,356 | 949,552- | 16,659,822 | 19,544,645 | 2,884,823- | 19,852,458 | 3,192,636- |
| 100 | SALARIES | 114,097 | 109,275 | 4,822 | 1,169,079 | 1,370,403 | 201,324- | 1,053,344 | 115,735 |
| 110 | WAGES | 131,440 | 195,466 | 64,026- | 1,969,939 | 2,571,235 | 601,296- | 1,878,935 | 91,004 |
| 140 | HOLIDAY & VAC PAY | 26,566 | 11,977 | 14,589 | 159,673 | 143,724 | 15,949 | 153,024 | 6,649 |
| 150 | SICK & ALLOWED PAY | 1,458 | 1,223 | 235 | 21,675 | 14,676 | 6,999 | 18,305 | 3,370 |
| 160 | OTHER (CALL-OUT PRE) | 141 | 505 | 364- | 6,282 | 6,060 | 222 | 5,256 | 1,026 |
| 200 | PAYROLL TAXES | 21,218 | 27,191 | 5,973- | 277,235 | 332,812 | 55,577- | 261,784 | 15,451 |
| 210 | GROUP INSURANCE | 38,429 | 25,804 | 12,625 | 462,543 | 315,989 | 146,554 | 258,044 | 204,499 |
| 220 | WORKMANS COMP INSUR | 5,503 | 5,153 | 350 | 61,268 | 63,089 | 1,821- | 55,163 | 6,105 |
| 230 | PENSION PLAN COST | 18,657 | 29,740 | 11,083- | 232,552 | 363,540 | 130,988- | 254,399 | 21,847- |
| 240 | EMPLOYMENT EXPENSE | | 2,620 | 2,620- | 18,615 | 31,440 | 12,825- | 52,517 | 33,902- |
| 260 | MEDICAL EXAMS | 1,266 | 3,328 | 2,062- | 19,947 | 39,936 | 19,989- | 30,894 | 10,947- |
| 270 | BLOOD TEST | 105 | 796 | 691- | 4,167 | 9,552 | 5,385- | 6,409 | 2,242- |
| 280 | SAFETY SUPPLIES | 5,681 | 10,051 | 4,370- | 59,222 | 118,531 | 59,309- | 94,757 | 35,535- |
| 300 | CONTRACT LABOR & MTL | 25,089 | 80,940 | 55,851- | 782,142 | 967,640 | 185,498- | 746,532 | 35,610 |
| 340 | NATURAL GAS | 22,130 | 25,791 | 3,661- | 331,806 | 380,242 | 48,436- | 318,650 | 13,156 |
| 350 | ELECTRICITY | 36,603 | 65,622 | 29,019- | 671,125 | 951,386 | 280,261- | 655,421 | 15,704 |
| 360 | WATER | 2,514 | 3,443 | 929- | 38,614 | 43,571 | 4,957- | 32,272 | 6,342 |
| 370 | COMMUNICATION | 3,380 | 4,890 | 1,510- | 42,933 | 58,680 | 15,747- | 60,002 | 17,069- |
| 380 | AUTO EXPENSE | | 219 | 219- | 30 | 2,628 | 2,598- | 1,733 | 1,703- |
| 390 | TRVL & ENTERTAINMENT | 1,474 | 5,877 | 4,403- | 20,283 | 70,524 | 50,241- | 50,150 | 29,867- |
| 395 | MEALS/ENTERTAINMENT | 852 | 1,701 | 849- | 7,874 | 20,412 | 12,538- | 16,317 | 8,443- |
| 6400 | ORDINARY SUPPLIES | 48,740 | 38,615 | 10,125 | 370,348 | 685,487 | 315,139- | 459,152 | 88,804- |
| 6410 | MAINTENANCE SUPPLIES | 51,357 | 97,222 | 45,865- | 1,067,772 | 1,215,792 | 148,020- | 1,089,699 | 21,927- |
| 6420 | MAINTENANCE TOOLS | 510 | 157 | 353 | 3,027 | 1,884 | 1,143 | 1,926 | 1,101 |
| 6430 | EXPENDABLE ITEMS | 11,473 | 7,764 | 3,709 | 92,289 | 93,168 | 879- | 97,205 | 4,916- |
| 6460 | MISCELLANEOUS | 13,660 | 1,897 | 11,763 | 34,342 | 22,764 | 11,578 | 37,494 | 3,152- |
| 6470 | NITROGEN | 19,069 | 13,476 | 5,593 | 149,612 | 177,494 | 27,882- | 102,395 | 47,217 |
| 6510 | OTH CHEMICALS | | 10 | 10- | 300- | 120 | 420- | 13,959 | 14,259- |
| 6560 | OFF SITE WASTE DISPO | 288,595- | 42,564 | 331,159- | 998,113 | 511,296 | 486,817 | 278,835 | 719,278 |
| 6590 | CONTRACT FORMULATING | 2,599 | | 2,599 | 96,559 | 600,300 | 503,741- | 453,110 | 356,551- |

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UNIT COST REPORT BY EXPENSE

| NTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 600 | INSURANCE-PLANT | 17,611 | 15,909 | 1,702 | 355,335 | 384,842 | 29,507- | 238,393 | 116,942 |
| 610 | DUES & SUBSCRIPTIONS | 27 | 238 | 211- | 6,012 | 2,856 | 3,156 | 3,304 | 2,708 |
| 620 | FEES & TUITIONS | 1,468 | 2,761 | 1,293- | 20,992 | 33,132 | 12,140- | 27,082 | 6,090- |
| 625 | PENALTIES | | | | 80,000 | | 80,000 | | 80,000 |
| 630 | PROFESSIONAL FEES | 12,623 | 5,308 | 7,315 | 215,035 | 67,266 | 147,769 | 447,177 | 232,142- |
| 635 | ROYALTIES | 91,893- | | 91,893- | 3,485,258 | 3,198,360 | 286,898 | | 3,485,258 |
| 650 | RENTALS | 6,951 | 5,709 | 1,242 | 149,231 | 67,146 | 82,085 | 72,326 | 76,905 |
| 660 | LEASE ITEMS | 3,590 | 2,446 | 1,144 | 36,695 | 29,352 | 7,343 | 24,668 | 12,027 |
| 680 | FREIGHT IN (MISC.) | 697 | 1,630 | 933- | 47,490 | 19,560 | 27,930 | 19,283 | 28,207 |
| 710 | PROPERTY TAXES & LIC | 13,976 | 9,425 | 4,551 | 2,999- | 143,699 | 146,698- | 92,214 | 95,213- |
| | SUB TOTAL | 280,464 | 856,743 | 576,277-13,561,815 | | 15,130,588 | 1,568,773- | 9,462,130 | 4,099,685 |
| | COST OF GOODS MFG. | 845,270 | 2,371,099 | 1,525,829-30,221,637 | | 34,675,233 | 4,453,596- | 29,314,588 | 907,049 |

UNIT COST REPORT BY EXPENSE

| NTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST | PRIOR YEAR ACTUAL COST | PRIOR YEAR OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 1730 | POND CLOSURER/CREDIT | | | | 1,677 | | 1,677 | 3,365 | 1,688- |
| 1740 | TRANSFER TO F/G INV | 2,507,200- | 7,099,150- | 4,591,950 | 58,897,660- | 65,838,550- | 6,940,890 | 49,216,075- | 9,681,585- |
| 1810 | PROPANIL TECH USED | 440,430 | 1,358,500 | 918,070- | 10,734,399 | 12,698,400 | 1,964,001- | 11,034,507 | 300,108- |
| 1820 | PROPANIL 36 BULK USE | 57,280 | 330,000 | 272,720- | 2,032,654 | 2,442,000 | 409,346- | 2,584,579 | 551,925- |
| 1825 | STAM BULK USED | 745,767 | 2,535,000 | 1,789,233- | 10,278,954 | 12,252,500 | 1,973,546- | 3,430,569 | 6,848,385 |
| 1830 | PROPANIL 40 BULK USE | | | | 3,079,707 | 1,014,000 | 2,065,707 | 3,214,625 | 134,918- |
| 1835 | FLAKED TECH USED | 20,960 | | 20,960 | 1,651,161 | 1,324,575 | 326,586 | 1,300,756 | 350,405 |
| 1840 | BCA USED | 262,364 | 855,000 | 592,636- | 8,072,555 | 10,616,250 | 2,543,695- | 2,597,164 | 5,475,391 |
| | SUB TOTAL | 980,399- | 2,020,650- | 1,040,251 | 23,046,553- | 25,490,825- | 2,444,272 | 25,050,510- | 2,003,957 |
| | COST OF GOODS MFG | 980,399- | 2,020,650- | 1,040,251 | 23,046,553- | 25,490,825- | 2,444,272 | 25,050,510- | 2,003,957 |

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UNIT COST REPORT BY EXPENSE

| NTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 900 | POWER | 35,808 | 64,685 | 28,877- | 667,739 | 938,576 | 270,837- | 645,877 | 21,862 |
| 960 | WAGE FRINGES | 60,087 | 68,426 | 8,339- | 806,884 | 843,450 | 36,566- | 668,542 | 138,342 |
| 980 | ALLC COST CENTER EXP | | 1- | 1 | 5- | 12- | 7 | 3- | 2- |
| 990 | ALLC COST CENTER TSF | 239,538- | 336,001- | 96,463 | 3,696,496- | 4,216,706- | 520,210 | 3,399,227- | 297,269- |
| 999 | ALLOC PLT OVERHEAD | 143,000 | 202,891 | 59,891- | 2,221,200 | 2,434,692 | 213,492- | 2,084,754 | 136,446 |
| | SUB TOTAL | 643- | | 643- | 678- | | 678- | 57- | 621- |
| | COST OF GOODS MFG. | 643- | | 643- | 678- | | 678- | 57- | 621- |

UNIT COST REPORT BY EXPENSE

| ONTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 7700 | SAMPLE PRODUCT | 668 | | 668 | 16,086 | | 16,086 | | 16,086 |
| | SUB TOTAL | 668 | | 668 | 16,086 | | 16,086 | | 16,086 |
| | SELLING EXPENSES | 668 | | 668 | 16,086 | | 16,086 | | 16,086 |

UNIT COST REPORT BY EXPENSE

| NTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 900 | DEPRECIATION | 129,811 | 118,513 | 11,298 | 1,495,174 | 1,422,156 | 73,018 | 1,199,928 | 295,246 |
| | SUB TOTAL | 129,811 | 118,513 | 11,298 | 1,495,174 | 1,422,156 | 73,018 | 1,199,928 | 295,246 |
| | DEPRECIATION | 129,811 | 118,513 | 11,298 | 1,495,174 | 1,422,156 | 73,018 | 1,199,928 | 295,246 |
| | COMPANY TOTALS | 527,870- | 14,611 | 542,481- | 9,591,110- | 10,160,098- | 568,988 | 8,183,514- | 1,407,596- |
| CEDAR - WEST HELENA | | | | | | | | | |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 47 POWER UNITS: KWH

| CURRENT MONTH | | | | | YEAR-TO-DATE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ACTUAL | | BUDGETED | | | ACTUAL | | BUDGETED | | PRIOR YR ACTUAL | |
| $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT |
| 631,373 | 59 % | 1,078,083 | | QUANTITY PRODUCED | 12,444,290 | 79% | 15,669,032 | | 11,377,407 | |
| 35,811 | .06 | 64,685 | .06 | ELECTRICITY | 667,745 | .05 | 940,142 | .06 | 645,884 | .06 |
| 35,811 | .06 | 64,685 | .06 | SUB TOTAL | 667,745 | .05 | 940,142 | .06 | 645,884 | .06 |
| 35,811 | .06 | 64,685 | .06 | TOTAL MFG. COSTS | 667,745 | .05 | 940,142 | .06 | 645,884 | .06 |
| 35,811- | .06- | 64,685- | .06- | ALLOCATED | 667,745- | .05- | 940,142 | .06- | 645,884- | .06- |
| 35,811- | .06- | 64,685- | .06- | SUB TOTAL | 667,745- | .05- | 940,142 | .06- | 645,884- | .06- |

TOTAL POWER

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 48 ADMINISTRATIVE UNITS:

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | X | | | QUANTITY PRODUCED | | X | | | | |
| 19,248 | | 28,973 | | SALARIES | 200,940 | | 347,676 | | 271,291 | |
| 7,069 | | 6,550 | | FRINGES | 67,928 | | 78,600 | | 63,153 | |
| | | | | EMPLOYMENT EXPENSE | 13,829 | | | | 1,607 | |
| 2,306 | | 6,558 | | ORDINARY SUPPLY | 50,399 | | 78,696 | | 62,640 | |
| 5,576 | | 2,739 | | RENTALS | 46,757 | | 32,868 | | 28,853 | |
| | | 707 | | OUTSIDE LABOR | 6,332 | | 8,484 | | 5,919 | |
| 792 | | 879 | | ELECTRICITY | 3,380 | | 10,548 | | 9,080 | |
| 3,380 | | 4,693 | | COMMUNICATIONS | 42,934 | | 56,316 | | 57,945 | |
| | | 219 | | AUTO EXPENSE | 30 | | 2,628 | | 1,733 | |
| 1,257 | | 3,009 | | TRAVEL & ENTERTAIN | 18,551 | | 36,108 | | 26,955 | |
| 2,933 | | 1,166 | | CONSULTING | 35,300 | | 13,992 | | 9,234 | |
| 21,388 | | 2,612 | | OTHER | 48,230 | | 31,344 | | 45,914 | |
| 63,549 | | 58,105 | | SUB TOTAL | 534,610 | | 697,260 | | 584,324 | |
| 63,549 | | 58,105 | | TOTAL MFG. COSTS | 534,610 | | 697,260 | | 584,324 | |
| 63,547- | | 58,105- | | ALLOCATED | 534,611- | | 697,260 | | 584,332- | |
| 63,547- | | 58,105- | | SUB TOTAL | 534,611- | | 697,260 | | 584,332- | |
| 2 | | | | TOTAL ADMINISTRATIVE | 1- | | | | 8- | |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 49 ENGINEERING UNITS:

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | X | | | QUANTITY PRODUCED | | X | | | | |
| 43,572 | | 25,675 | | SALARIES | 369,127 | | 308,100 | | 236,934 | |
| 8,321 | | 7,371 | | FRINGES | 130,182 | | 88,452 | | 76,435 | |
| | | | | EMPLOYMENT EXPENSE | | | | | 13,118 | |
| 4,642 | | 634 | | ORDINARY SUPPLY | 6,589 | | 7,608 | | 5,858 | |
| | | 94 | | RENTALS | 973 | | 1,128 | | 1,023 | |
| 9,496 | | 4,271 | | OUTSIDE LABOR | 19,268 | | 51,252 | | 55,598 | |
| | | 46 | | ELECTRICITY | | | 552 | | 366 | |
| | | 158 | | COMMUNICATIONS | | | 1,896 | | 1,407 | |
| | | 2,051 | | TRAVEL & ENTERTAIN | 2,810 | | 24,612 | | 19,186 | |
| 4,881 | | 2,495 | | CONSULTING | 18,984 | | 29,940 | | 36,914 | |
| | | 148 | | OTHER | 162 | | 1,776 | | 1,175 | |
| 70,912 | | 42,943 | | SUB TOTAL | 548,095 | | 515,316 | | 448,014 | |
| 70,912 | | 42,943 | | TOTAL MFG. COSTS | 548,095 | | 515,316 | | 448,014 | |
| 70,913- | | 42,943- | | ALLOCATED | 548,094- | | 515,316 | | 448,023- | |
| 70,913- | | 42,943- | | SUB TOTAL | 548,094- | | 515,316 | | 448,023- | |
| 1- | | | | TOTAL ENGINEERING | 1 | | | | 9- | |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 50 RESEARCH & DEVELOP UNITS:

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH ACTUAL % | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE ACTUAL % | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | QUANTITY PRODUCED | | | | | | | |
| 3,565 | | | 6,593 | | SALARIES | 75,349 | | | 78,996 | | 66,947 | |
| 502 | | | | | WAGES | 898 | | | | | | |
| 451 | | | 453 | | FRINGES | 4,968 | | | 5,436 | | 4,472 | |
| | | | | | EMPLOYMENT EXPENSE | | | | | | | |
| 1,433 | | | 2,234 | | ORDINARY SUPPLY | 12,802 | | | 26,808 | | 21,624 | |
| 497 | | | 373 | | OUTSIDE LABOR | 2,524 | | | 4,476 | | 3,519 | |
| | | | 90 | | TRAVEL & ENTERTAIN | 369 | | | 1,080 | | 755 | |
| | | | | | OTHER | 636 | | | | | | |
| 8,448 | | | 9,733 | | SUB TOTAL | 97,546 | | | 116,796 | | 97,317 | |
| 8,448 | | | 9,733 | | TOTAL MFG. COSTS | 97,546 | | | 116,796 | | 97,317 | |
| 8,449- | | | 9,733- | | ALLOCATED | 97,545- | | | 116,796 | | 97,320- | |
| 8,449- | | | 9,733- | | SUB TOTAL | 97,545- | | | 116,796 | | 97,320- | |
| 1- | | | | | TOTAL RESEARCH & DEVELOP | 1 | | | | | 3- | |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 51 GENERAL OVERHEAD UNITS:

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | | | QUANTITY PRODUCED | | % | | | | |
| 991 | | 859 | | SALARIES | 6,286 | | 10,308 | | 8,216 | |
| 15,382 | | 10,140 | | WAGES | 112,469 | | 121,680 | | 108,326 | |
| 8,165 | | 5,348 | | FRINGES | 24,591 | | 64,176 | | 19,157 | |
| | | 2,620 | | EMPLOYMENT EXPENSE | 4,787 | | 31,440 | | 37,792 | |
| 9,284 | | 3,725 | | ORDINARY SUPPLY | 40,430 | | 44,700 | | 36,498 | |
| 3,391 | | 3,381 | | RENTALS | 49,050 | | 40,572 | | 33,311 | |
| | | 373 | | OUTSIDE LABOR | 3,060 | | 4,476 | | 4,317 | |
| 511 | | 606 | | MAINT SUPPLIES | 7,030 | | 7,272 | | 5,464 | |
| | | 10 | | OTHER CHEMICALS | 300- | | 120 | | 7,109 | |
| | | | | GAS | | | | | | |
| 7,537 | | 9,976 | | POWER | 129,245 | | 119,712 | | 114,113 | |
| 16,928 | | 12,079 | | OTHER | 188,358 | | 144,948 | | 140,566 | |
| 62,189 | | 49,117 | | SUB TOTAL | 565,006 | | 589,404 | | 514,869 | |
| 24,992 | | 23,819 | | MAINT LABOR COSTS | 281,587 | | 285,828 | | 306,888 | |
| 19,533 | | 29,946 | | MAINT SUPPLIES | 342,757 | | 359,352 | | 315,633 | |
| 338 | | 5,651 | | MAINT O/S LABOR | 82,115 | | 67,812 | | 44,755 | |
| 3,967 | | 4,101 | | PACKAGING COST | 47,880 | | 49,212 | | 55,213 | |
| 14,282 | | 11,655 | | YARDS & GRDS COSTS | 44,486 | | 139,860 | | 104,618 | |
| 21,757- | | 25,314 | | ENVIRONMENTAL COSTS | 429,538 | | 303,768 | | 299,642 | |
| 27,488 | | 36,342 | | SAFETY & SECURITY | 296,353 | | 436,104 | | 319,158 | |
| 12,867 | | 16,402 | | LABORATORY COST | 131,477 | | 196,824 | | 117,882 | |
| | | 344 | | INSURANCE & TAXES | | | 6,528 | | 5,674 | |
| 80,810 | | 153,774 | | SUB TOTAL | 1,656,195 | | 1,845,288 | | 1,569,463 | |
| 142,999 | | 202,891 | | TOTAL MFG. COSTS | 2,221,201 | | 2,434,692 | | 2,084,332 | |
| 143,003- | | 202,891- | | ALLOCATED | 2,221,204- | | 2,434,692 | | 2,084,385- | |
| 143,003- | | 202,891- | | SUB TOTAL | 2,221,204- | | 2,434,692 | | 2,084,385- | |
| 4- | | | | TOTAL GENERAL OVERHEAD | 3- | | | | 53- | |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 53 DCA UNITS: LBS

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| 390,586 | 61 % | 640,000 | | QUANTITY PRODUCED | 7,851,348 | 98% | 8,000,000 | | 3,116,388 | |
| 35,308 | .09 | 60,808 | .10 | 98% SULFURIC ACID | 635,232 | .08 | 760,105 | .10 | 230,372 | .07 |
| 160,773 | .41 | 330,240 | .52 | DDCB | 3,489,221 | .44 | 4,128,000 | .52 | 1,582,595 | .51 |
| 25,496 | .07 | 49,444 | .08 | 98% NITRIC ACID | 549,678 | .07 | 618,048 | .08 | 230,262 | .07 |
| 35,630 | .09 | 63,649 | .10 | OTHER RAW MATERIALS | 776,886 | .10 | 795,614 | .10 | 435,543 | .14 |
| 257,207 | .66 | 504,141 | .79 | SUB TOTAL | 5,451,017 | .69 | 6,301,767 | .79 | 2,478,772 | .80 |
| 6,138 | .02 | | | CONTAINERS | 20,105 | | | | 2,855 | |
| | | | | PACKAGING MATERIALS | 463 | | | | | |
| 6,138 | .02 | | | SUB TOTAL | 20,568 | | | | 2,855 | |
| 6,905 | .02 | 6,018 | .01 | SALARIES | 69,745 | .01 | 72,196 | .01 | 54,973 | .02 |
| 17,495 | .04 | 23,302 | .04 | WAGES | 250,448 | .03 | 279,624 | .03 | 205,032 | .07 |
| 8,082 | .02 | 7,643 | .01 | FRINGES | 103,993 | .01 | 91,716 | .01 | 69,133 | .02 |
| 1,967 | .01 | 3,879 | .01 | ORDINARY SUPPLY | 22,472 | | 46,548 | .01 | 26,676 | .01 |
| | | 75 | | RENTALS | 3,789 | | 900 | | 6,661 | |
| | | | | OUTSIDE LABOR | 5,767 | | | | 54,901 | .02 |
| 9,651 | .02 | 8,546 | .01 | NITROGEN | 116,510 | .01 | 102,552 | .01 | 83,503 | .03 |
| 4,696 | .01 | 4,707 | .01 | GAS | 52,289 | .01 | 56,484 | .01 | 50,755 | .02 |
| 9,250 | .02 | 20,515 | .03 | POWER | 167,060 | .02 | 246,180 | .03 | 150,908 | .05 |
| 13,699 | .04 | 34,583 | .05 | WASTE DISPOSAL | 764,142 | .10 | 414,996 | .05 | 177,202 | .06 |
| 814 | | 604 | | OTHER | 8,251 | | 7,248 | | 5,238 | |
| | | | | START UP COST | | | | | 246,216 | .08 |
| 71,559 | .18 | 109,867 | .17 | SUB TOTAL | 1,564,466 | .20 | 1,318,404 | .16 | 1,131,198 | .36 |
| 10,274 | .03 | 12,402 | .02 | MAINT LABOR COSTS | 117,574 | .01 | 148,824 | .02 | 77,035 | .02 |
| 18,087 | .05 | 18,815 | .03 | MAINT SUPPLIES | 273,988 | .03 | 225,780 | .03 | 166,769 | .05 |
| 6,719 | .02 | 14,510 | .02 | MAINT O/S LABOR | 137,943 | .02 | 174,120 | .02 | 147,869 | .05 |
| 988 | | | | PACKAGING COST | 4,238 | | | | 3,057 | |
| | | 835 | | ENVIRONMENTAL COSTS | | | 10,020 | | 12,753 | |
| 64 | | 501 | | SAFETY & SECURITY | 2,085 | | 6,012 | | 3,638 | |
| 4,942 | .01 | 7,673 | .01 | LABORATORY COST | 71,961 | .01 | 92,076 | .01 | 62,908 | .02 |
| 6,250 | .02 | 7,167 | .01 | INSURANCE & TAXES | 75,095 | .01 | 86,004 | .01 | 67,700 | .02 |
| 47,324 | .12 | 61,903 | .10 | SUB TOTAL | 682,884 | .09 | 742,836 | .09 | 541,729 | .17 |
| 38,610 | .10 | 54,781 | .09 | GENERAL OVERHEAD | 599,725 | .08 | 657,372 | .08 | 488,438 | .16 |
| 42,872 | .11 | 33,234 | .05 | ADMIN/ENG/R & D | 354,075 | .05 | 398,808 | .05 | 258,786 | .08 |
| 47,634 | .12 | 45,984 | .07 | DEPRECIATION | 560,379 | .07 | 551,808 | .07 | 275,913 | .09 |
| 129,116 | .33 | 133,999 | .21 | SUB TOTAL | 1,514,179 | .19 | 1,607,988 | .20 | 1,023,137 | .33 |
| 511,344 | 1.31 | 809,910 | 1.27 | TOTAL MFG. COSTS | 9,233,114 | 1.18 | 9,970,995 | 1.25 | 5,177,491 | 1.66 |
| 531,197- | 1.36- | 806,400- | 1.26- | PRODUCT TSF @ STD. | 9,261,207- | 1.18- | 10,080,000 | 1.26- | 5,297,859- | 1.70- |
| 531,197- | 1.36- | 806,400- | 1.26- | SUB TOTAL | 9,261,207- | 1.18- | 10,080,000 | 1.26- | 5,297,859- | 1.70- |

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MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 93 BCA UNITS: LBS

| CURRENT MONTH | | | | | YEAR-TO-DATE | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ACTUAL | | BUDGETED | | | ACTUAL | | BUDGETED | | PRIOR YR ACTUAL |
| $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT |
| 390,586 | X | 640,000 | | QUANTITY PRODUCED | 7,851,348 | X | 8,000,000 | | 3,116,388 | |
| 19,853- | .05- | 3,510 | .01 | TOTAL BCA | 28,093- | | 109,003 | .01- | 120,168- | .04- |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 57 DCPI UNITS: LBS

| CURRENT MONTH | | | | YEAR-TO-DATE | | | |
|---|---|---|---|---|---|---|---|
| (- - - ACTUAL - - -) | | (- - BUDGETED - - -) | | (- - - ACTUAL - - -) | | (- - BUDGETED - - -) | (- PRIOR YR ACTUAL -) |
| $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT |
| | % | | | | % | | | | |
| | | QUANTITY PRODUCED | | | | | | | |
| | | DCA | | | | | | | |
| | | ODCB | | | | | | | |
| | | SUB TOTAL | | | | | | | |
| | | FORMULATING FEE | | | | | | | |
| | | SUB TOTAL | | | | | | | |
| | | TOTAL MFG. COSTS | | | | | | | |
| | | PRODUCT TSF @ STD. | | | | | | | |
| | | SUB TOTAL | | | | | | | |
| | | TOTAL DCPI | | | | | | | |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 54 PROPANIL TECH UNITS: LBS

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| 289,940 | 32 % | 900,000 | | QUANTITY PRODUCED | 10,435,265 | 88% | 11,850,000 | | 9,348,270 | |
| 262,365 | .90 | 855,000 | .95 | DCA | 9,161,331 | .88 | 11,595,000 | .98 | 12,033,663 | 1.29 |
| 34,916 | .12 | 106,920 | .12 | PROPIONIC ACID | 983,398 | .09 | 1,407,780 | .12 | 1,013,085 | .11 |
| 6,187 | .02 | 46,980 | .05 | PROPIONIC ANHYDRIDE | 587,412 | .06 | 618,570 | .05 | 408,231 | .04 |
| | | | | FLAKED TECH | 609,889 | .06 | | | | |
| 303,468 | 1.05 | 1,008,900 | 1.12 | SUB TOTAL | 11,342,030 | 1.09 | 13,621,350 | 1.15 | 13,454,979 | 1.44 |
| | | 97 | | CONTAINERS | | | 1,164 | | 772 | |
| | | 221 | | PACKAGING MATERIALS | 921 | | 2,652 | | 1,731 | |
| | | 318 | | SUB TOTAL | 921 | | 3,816 | | 2,503 | |
| 2,817 | .01 | 4,057 | | SALARIES | 37,856 | | 48,684 | | 36,923 | |
| 7,139 | .02 | 12,810 | .01 | WAGES | 136,910 | .01 | 153,720 | .01 | 125,709 | .01 |
| 3,298 | .01 | 5,175 | .01 | FRINGES | 55,377 | .01 | 62,100 | .01 | 47,728 | .01 |
| 1,705 | .01 | 4,008 | | ORDINARY SUPPLY | 3,774 | | 48,096 | | 37,150 | |
| | | | | OUTSIDE LABOR | 20,771 | | | | | |
| 5,274 | .02 | 4,930 | .01 | NITROGEN | 60,882 | .01 | 59,160 | | 57,834 | .01 |
| 4,466 | .02 | 11,310 | .01 | GAS | 213,534 | .02 | 135,720 | .01 | 129,005 | .01 |
| 4,987 | .02 | 14,154 | .02 | POWER | 66,674 | .01 | 169,848 | .01 | 106,317 | .01 |
| | | 7,476 | .01 | WASTE DISPOSAL | 15,282 | | 89,736 | .01 | 42,795 | |
| 1,094 | | 1,117 | | OTHER | 17,397 | | 13,404 | | 11,082 | |
| 30,780 | .11 | 65,039 | .07 | SUB TOTAL | 628,457 | .06 | 780,468 | .07 | 594,540 | .06 |
| 3,489 | .01 | 5,901 | .01 | MAINT LABOR COSTS | 70,783 | .01 | 70,812 | .01 | 50,174 | .01 |
| 9,202 | .03 | 15,236 | .02 | MAINT SUPPLIES | 138,274 | .01 | 182,832 | .02 | 141,127 | .02 |
| | | 882 | | MAINT O/S LABOR | 76,116 | .01 | 10,584 | | 11,444 | |
| 337 | | 93 | | PACKAGING COST | 1,461 | | 1,116 | | 719 | |
| 43 | | 267 | | SAFETY & SECURITY | 2,083 | | 3,204 | | 2,560 | |
| 1,080 | .01 | 9,175 | .01 | LABORATORY COST | 73,672 | .01 | 110,100 | .01 | 80,801 | .01 |
| 4,626 | .02 | 5,831 | .01 | INSURANCE & TAXES | 107,976 | .01 | 83,912 | .01 | 75,733 | .01 |
| 19,577 | .07 | 37,385 | .04 | SUB TOTAL | 470,365 | .05 | 462,560 | .04 | 362,558 | .04 |
| 18,590 | .06 | 20,289 | .02 | GENERAL OVERHEAD | 288,757 | .03 | 243,468 | .02 | 519,987 | .06 |
| 21,436 | .07 | 16,617 | .02 | ADMIN/ENG/R & D | 177,038 | .02 | 199,404 | .02 | 282,327 | .03 |
| 11,865 | .04 | 10,321 | .01 | DEPRECIATION | 134,529 | .01 | 123,852 | .01 | 123,811 | .01 |
| 51,891 | .18 | 47,227 | .05 | SUB TOTAL | 600,324 | .06 | 566,724 | .05 | 926,125 | .10 |
| 405,716 | 1.40 | 1,158,849 | 1.29 | TOTAL MFG. COSTS | 13,042,097 | 1.25 | 15,434,918 | 1.30 | 15,340,705 | 1.64 |
| 408,815- | 1.41- | 1,161,000- | 1.29- | PRODUCT TSF @ STD. | 13,045,246- | 1.25- | 15,446,000 | 1.30- | 15,209,419- | 1.63- |
| 408,815- | 1.41- | 1,161,000- | 1.29- | SUB TOTAL | 13,045,246- | 1.25- | 15,446,000 | 1.30- | 15,209,419- | 1.63- |
| 3,099- | .01- | 2,151- | | TOTAL PROPANIL TECH | 3,149- | | 11,082 | | 131,286 | .01 |

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MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 55 FLAKED TECH UNITS: LBS

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | X | 150,000 | | QUANTITY PRODUCED | 944,810 | 151X | 625,000 | | 1,893,640 | |
| | | 195,000 | 1.30 | PROPANIL TECH | 1,192,158 | 1.26 | 812,500 | 1.30 | 3,163,934 | 1.67 |
| | | | | PACKAGING MATERIALS | 2,841 | | | | 1,243 | |
| | | 195,000 | 1.30 | SUB TOTAL | 1,194,999 | 1.26 | 812,500 | 1.30 | 3,165,177 | 1.67 |
| | | 477 | | SALARIES | 440- | | 1,989 | | 5,643 | |
| | | 1,575 | .01 | WAGES | 3,212- | | 6,564 | .01 | 22,562 | .01 |
| | | 618 | | FRINGES | 1,176- | | 2,575 | | 7,227 | |
| | | 2,121 | .01 | ORDINARY SUPPLY | 11,468 | .01 | 8,839 | .01 | 24,756 | .01 |
| | | | | RENTALS | | | | | | |
| | | 303 | | POWER | | | 1,264 | | 2,155 | |
| 587 | | | | OTHER | 587 | | | | | |
| 2,599 | | | | FORMULATING FEE | 49,433 | .05 | | | | |
| 3,186 | | 5,094 | .03 | SUB TOTAL | 56,660 | .06 | 21,231 | .03 | 62,343 | .03 |
| | | 1,258 | .01 | MAINT LABOR COSTS | 906 | | 5,248 | .01 | 3,873 | |
| | | 459 | | MAINT SUPPLIES | 646 | | 1,914 | | 4,180 | |
| 437 | | | | MAINT O/S LABOR | 733 | | | | | |
| | | 472 | | PACKAGING COST | 410 | | 1,967 | | 3,740 | |
| | | 787 | .01 | LABORATORY COST | | | 3,281 | .01 | 9,283 | |
| 139 | | 123 | | INSURANCE & TAXES | 9,473 | .01 | 12,626 | .02 | 3,330 | |
| 776 | | 3,099 | .02 | SUB TOTAL | 12,168 | .01 | 25,036 | .04 | 24,386 | .01 |
| | | | | GENERAL OVERHEAD | | | | | 10,471 | .01 |
| | | | | ADMIN/ENG/R & D | | | | | 6,704 | |
| 1,562 | | 1,562 | .01 | DEPRECIATION | 18,739 | .02 | 18,744 | .03 | 18,738 | .01 |
| 1,562 | | 1,562 | .01 | SUB TOTAL | 18,739 | .02 | 18,744 | .03 | 35,913 | .02 |
| 5,524 | | 204,755 | 1.37 | TOTAL MFG. COSTS | 1,282,566 | 1.36 | 877,511 | 1.40 | 3,287,819 | 1.74 |
| 7,511- | | 210,000- | 1.40- | PRODUCT TSF @ STD. | 1,282,524- | 1.36- | 875,000 | 1.40- | 3,385,686- | 1.79- |
| 7,511- | | 210,000- | 1.40- | SUB TOTAL | 1,282,524- | 1.36- | 875,000 | 1.40- | 3,385,686- | 1.79- |
| 1,987- | | 5,245- | .03- | TOTAL FLAKED TECH | 42 | | 2,511 | | 97,867- | .05- |

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MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 56 55% BLEND UNITS: LBS

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| % | | | | QUANTITY PRODUCED | % | | | | 71,280 | |
| | | | | PROPANIL TECH | | | | | 63,510 | .89 |
| | | | | MESITYL OXIDE | | | | | 8,578 | .12 |
| | | | | SUB TOTAL | | | | | 72,088 | 1.01 |
| | | | | CONTAINERS | | | | | 4,157 | .06 |
| | | | | SUB TOTAL | | | | | 4,157 | .06 |
| | | | | TOTAL MFG. COSTS | | | | | 76,245 | 1.07 |
| | | | | PRODUCT TSF @ STD. | | | | | 89,812- | 1.26- |
| | | | | SUB TOTAL | | | | | 89,812- | 1.26- |
| | | | | TOTAL 55% BLEND | | | | | 13,567- | .19- |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 61 30 PROPANIL UNITS: GAL

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| 9,165 | 18 % | 50,000 | | QUANTITY PRODUCED | 292,895 | 79% | 370,000 | | 333,990 | |
| 39,029 | 4.26 | 208,000 | 4.16 | PROPANIL TECH | 1,187,619 | 4.05 | 1,539,200 | 4.16 | 1,683,379 | 5.04 |
| | | | | MESITYL OXIDE | | | | | | |
| 6,053 | .66 | 33,540 | .67 | EMULSIFIER | 211,781 | .72 | 248,196 | .67 | 204,618 | .61 |
| 9,055 | .99 | 50,160 | 1.00 | ISOPHORONE | 341,091 | 1.16 | 371,184 | 1.00 | 444,371 | 1.33 |
| | | | | ARMUL EMULSIFIER | | | | | | |
| 3,166 | .35 | 38,500 | .77 | TENNCO 500 | 138,181 | .47 | 284,900 | .77 | 182,348 | .55 |
| | | | | OTHER RAW MATERIALS | 9,081 | .03 | | | 42,716 | .13 |
| 57,303 | 6.25 | 330,200 | 6.60 | SUB TOTAL | 1,887,753 | 6.45 | 2,443,480 | 6.60 | 2,557,432 | 7.66 |
| 5,502 | .60 | 26,968 | .54 | CONTAINERS | 161,609 | .55 | 199,564 | .54 | 175,381 | .53 |
| 425 | .05 | | | PACKAGING MATERIALS | 20,213 | .07 | | | 328 | |
| 5,927 | .65 | 26,968 | .54 | SUB TOTAL | 181,822 | .62 | 199,564 | .54 | 175,709 | .53 |
| | | | | WAGES | 1,429 | | | | | |
| | | | | ORDINARY SUPPLY | 843 | | | | | |
| | | | | SUB TOTAL | 2,272 | .01 | | | | |
| | | | | MAINT LABOR COSTS | 907 | | | | 46 | |
| | | | | MAINT SUPPLIES | | | | | | |
| 2,363 | .26 | 5,384 | .11 | PACKAGING COST | 97,244 | .33 | 39,858 | .11 | 44,749 | .13 |
| | | | | LABORATORY COST | 2,082 | .01 | | | | |
| 554 | .06 | 1,962 | .04 | INSURANCE & TAXES | 21,135 | .07 | 19,623 | .05 | 15,650 | .05 |
| 2,917 | .32 | 7,348 | .15 | SUB TOTAL | 121,368 | .41 | 59,481 | .16 | 60,445 | .18 |
| | | | | ADMIN/ENG/R & D | | | | | | |
| | | | | SUB TOTAL | | | | | | |
| 66,147 | 7.22 | 364,516 | 7.29 | TOTAL MFG. COSTS | 2,193,215 | 7.49 | 2,702,525 | 7.30 | 2,793,586 | 8.36 |
| 65,817- | 7.18- | 365,000- | 7.30- | PRODUCT TSF @ STD. | 2,193,117- | 7.49- | 2,701,000 | 7.30- | 2,859,452- | 8.56- |
| 65,817- | 7.18- | 365,000- | 7.30- | SUB TOTAL | 2,193,117- | 7.49- | 2,701,000 | 7.30- | 2,859,452- | 8.56- |
| 330 | .04 | 484- | .01- | TOTAL 30 PROPANIL | 98 | | 1,525 | | 65,866- | .20- |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 62 40 PROPANIL UNITS: GAL

| CURRENT MONTH - ACTUAL $ AMOUNT | CURRENT MONTH - ACTUAL PER UNIT | CURRENT MONTH - BUDGETED $ AMOUNT | CURRENT MONTH - BUDGETED PER UNIT | | YEAR-TO-DATE - ACTUAL $ AMOUNT | YEAR-TO-DATE - ACTUAL PER UNIT | YEAR-TO-DATE - BUDGETED $ AMOUNT | YEAR-TO-DATE - BUDGETED PER UNIT | YEAR-TO-DATE - PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE - PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| % | | | | QUANTITY PRODUCED | 464,289 | 172% | 270,000 | | 451,890 | |
| | | | | PROPANIL TECH | 2,193,192 | 4.72 | 1,474,200 | 5.46 | 2,902,460 | 6.42 |
| | | | | PROPANIL 3E | | | | | | |
| | | | | MESITYL OXIDE | 834,978 | 1.80 | 492,480 | 1.82 | 850,235 | 1.88 |
| 25,914- | | | | EMULSIFIER | 258,202 | .56 | 189,329 | .70 | 266,280 | .59 |
| 800- | | | | ISOPHORONE | 239,998 | .52 | 124,740 | .46 | 245,419 | .54 |
| 26,714- | | | | SUB TOTAL | 3,525,470 | 7.59 | 2,280,749 | 8.45 | 4,264,394 | 9.44 |
| 402 | | | | CONTAINERS | 170,916 | .37 | 73,714 | .27 | 184,691 | .41 |
| | | | | PACKAGING MATERIALS | 340 | | 490 | | 2,334 | .01 |
| 402 | | | | SUB TOTAL | 171,256 | .37 | 74,204 | .27 | 187,025 | .41 |
| | | | | OTHER | 5,099 | .01 | | | | |
| | | | | SUB TOTAL | 5,099 | .01 | | | | |
| | | | | PACKAGING COST | 29,445 | .06 | 4,266 | .02 | 23,665 | .05 |
| | | | | LABORATORY COST | 1,876 | | | | | |
| 3,480 | | | | INSURANCE & TAXES | 41,939 | .09 | 26,676 | .10 | 29,128 | .06 |
| 3,480 | | | | SUB TOTAL | 73,260 | .16 | 30,942 | .11 | 52,793 | .12 |
| | | | | ADMIN/ENG/R & D | | | | | | |
| | | | | SUB TOTAL | | | | | | |
| 22,832- | | | | TOTAL MFG. COSTS | 3,775,085 | 8.13 | 2,385,895 | 8.84 | 4,504,212 | 9.97 |
| | | | | PRODUCT TSF @ STD. | 3,767,335- | 8.11- | 2,387,100 | 8.84- | 4,521,192- | 10.01- |
| | | | | SUB TOTAL | 3,767,335- | 8.11- | 2,387,100 | 8.84- | 4,521,192- | 10.01- |
| 22,832- | | | | TOTAL 40 PROPANIL | 7,750 | .02 | 1,205 | | 16,980- | .04- |

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MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 73 PROPANEX 40 UNITS: GLS

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | X | | | QUANTITY PRODUCED | 91,350 | X | | | 34,343 | |
| | | | | 40 BULK | 748,227 | 8.19 | | | 309,891 | 8.97 |
| | | | | SUB TOTAL | 748,227 | 8.19 | | | 309,891 | 8.97 |
| | | | | CONTAINERS | 53,247 | .58 | | | 21,467 | .62 |
| 793 | | | | PACKAGING MATERIALS | 1,353 | .02 | | | 1,012 | .03 |
| 793 | | | | SUB TOTAL | 54,800 | .60 | | | 22,479 | .65 |
| | | | | MAINT LABOR COSTS | 79 | | | | | |
| | | | | PACKAGING COST | 8,400 | .09 | | | 2,267 | .07 |
| | | | | INSURANCE & TAXES | 3,808 | .04 | | | 8,871 | .26 |
| | | | | SUB TOTAL | 12,287 | .13 | | | 11,138 | .32 |
| 793 | | | | TOTAL MFG. COSTS | 815,314 | 8.93 | | | 343,508 | 9.94 |
| | | | | PRODUCT TSF @ STD. | 814,496- | 8.92- | | | 341,387- | 9.88- |
| | | | | SUB TOTAL | 814,496- | 8.92- | | | 341,387- | 9.88- |
| 793 | | | | TOTAL PROPANEX 40 | 818 | .01 | | | 2,121 | .06 |

92

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 68 WHAM 50 DF UNITS: LBS

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| % | | | | QUANTITY PRODUCED | | % | 300,000 | | 271,800 | |
| | | | | FLAKED TECH | | | 261,000 | .87 | 240,826 | .89 |
| | | | | OTHER RAW MATERIALS | | | 45,451 | .15 | 36,174 | .13 |
| | | | | SUB TOTAL | | | 306,451 | 1.02 | 277,000 | 1.02 |
| | | | | PACKAGING MATERIALS | 3,823 | | 21,211 | .07 | 19,026 | .07 |
| | | | | SUB TOTAL | 3,823 | | 21,211 | .07 | 19,026 | .07 |
| | | | | FORMULATING FEE | | | 150,000 | .50 | 136,620 | .50 |
| | | | | SUB TOTAL | | | 150,000 | .50 | 136,620 | .50 |
| | | | | INSURANCE & TAXES | 1,098 | | 3,345 | .01 | 2,745 | .01 |
| | | | | SUB TOTAL | 1,098 | | 3,345 | .01 | 2,745 | .01 |
| | | | | ADMIN/ENG/R & D | | | | | | |
| | | | | SUB TOTAL | | | | | | |
| | | | | TOTAL MFG. COSTS | 4,921 | | 481,007 | 1.60 | 435,391 | 1.60 |
| | | | | PRODUCT TSF @ STD. | | | 480,000 | 1.60- | 387,550- | 1.43- |
| | | | | SUB TOTAL | | | 480,000 | 1.60- | 387,550- | 1.43- |
| | | | | TOTAL WHAM 50 DF | 4,921 | | 1,007 | | 47,841 | .18 |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 63 WHAM 80% UNITS: LBS

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| % | | | | QUANTITY PRODUCED | 130,850 | 26% | 500,000 | | 288,756 | |
| | | | | PROPANIL TECH | | | | | | |
| | | | | FLAKED TECH | 189,720 | 1.45 | 522,000 | 1.04 | 331,912 | 1.15 |
| | | | | OTHER RAW MATERIALS | 24,701- | .19- | 75,751 | .15 | 43,331 | .15 |
| | | | | SUB TOTAL | 165,019 | 1.26 | 597,751 | 1.20 | 375,243 | 1.30 |
| | | | | PACKAGING MATERIALS | 2,466 | .02 | 20,200 | .04 | 11,778 | .04 |
| | | | | SUB TOTAL | 2,466 | .02 | 20,200 | .04 | 11,778 | .04 |
| | | | | FORMULATING FEE | 36,554- | .28- | 250,000 | .50 | 142,127 | .49 |
| | | | | SUB TOTAL | 36,554- | .28- | 250,000 | .50 | 142,127 | .49 |
| | | | | LABORATORY COST | 111 | | | | | |
| | | | | INSURANCE & TAXES | 1,587 | .01 | 6,551 | .01 | 4,465 | .02 |
| | | | | SUB TOTAL | 1,698 | .01 | 6,551 | .01 | 4,465 | .02 |
| | | | | TOTAL MFG. COSTS | 132,629 | 1.01 | 874,502 | 1.75 | 533,613 | 1.85 |
| | | | | PRODUCT TSF @ STD. | 302,710- | 2.31- | 875,000 | 1.75- | 542,357- | 1.88- |
| | | | | SUB TOTAL | 302,710- | 2.31- | 875,000 | 1.75- | 542,357- | 1.88- |
| | | | | TOTAL WHAM 80% | 170,081- | 1.30- | 498 | | 8,744- | .03- |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 59 STAMPEDE UNITS: GALS

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| X | | | | QUANTITY PRODUCED | 22,602 | X | | | | |
| | | | | FREIGHT | 975 | .04 | | | | |
| | | | | SUB TOTAL | 975 | .04 | | | | |
| | | | | PROPANIL TECH | 85,680 | 3.79 | | | | |
| | | | | EMULSIFIER | 66,455 | 2.94 | | | | |
| | | | | ISOPHORONE | 27,485 | 1.22 | | | | |
| | | | | MCPA | 54,723 | 2.42 | | | | |
| | | | | OTHER RAW MATERIALS | 6,547 | .29 | | | | |
| | | | | SUB TOTAL | 240,890 | 10.66 | | | | |
| | | | | SALARIES | 262 | .01 | | | | |
| | | | | WAGES | 1,174 | .05 | | | | |
| | | | | FRINGES | 480 | .02 | | | | |
| | | | | SUB TOTAL | 1,916 | .08 | | | | |
| | | | | MAINT O/S LABOR | 1,072 | .05 | | | | |
| | | | | LABORATORY COST | 353 | .02 | | | | |
| | | | | INSURANCE & TAXES | 942 | .04 | | | | |
| | | | | SUB TOTAL | 2,367 | .10 | | | | |
| | | | | TOTAL MFG. COSTS | 246,148 | 10.89 | | | | |
| | | | | PRODUCT TSF @ STD. | 246,409- | 10.90- | | | | |
| | | | | SUB TOTAL | 246,409- | 10.90- | | | | |
| | | | | TOTAL STAMPEDE | 261- | .01- | | | | |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 70 STAM PROPANIL UNITS: GAL

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| 66,948 | 38 % | 175,000 | | QUANTITY PRODUCED | 1,170,830 | 72% | 1,625,000 | | 478,997 | |
| 401,402 | 6.00 | 955,500 | 5.46 | PROPANIL TECH | 6,075,753 | 5.19 | 8,872,500 | 5.46 | 3,221,224 | 6.72 |
| | | | | FLAKED TECH | 72,101 | .06 | | | | |
| | | 319,200 | 1.82 | MESITYL OXIDE | | | 2,964,000 | 1.82 | | |
| 40,685 | .61 | 122,714 | .70 | EMULSIFIER | 742,106 | .63 | 1,139,481 | .70 | 342,362 | .71 |
| 148,504 | 2.22 | 80,850 | .46 | ISOPHORONE | 2,643,739 | 2.26 | 750,750 | .46 | 1,230,375 | 2.57 |
| 590,591 | 8.82 | 1,478,264 | 8.45 | SUB TOTAL | 9,533,699 | 8.14 | 13,726,731 | 8.45 | 4,793,961 | 10.01 |
| 44,474 | .66 | 184,286 | 1.05 | CONTAINERS | 907,458 | .78 | 890,716 | .55 | 204,322 | .43 |
| 6,469 | .10 | | | PACKAGING MATERIALS | 18,116 | .02 | | | | |
| 50,943 | .76 | 184,286 | 1.05 | SUB TOTAL | 925,574 | .79 | 890,716 | .55 | 204,322 | .43 |
| | | | | SALARIES | 2,966 | | | | | |
| | | | | WAGES | 14,473 | .01 | | | | |
| | | | | FRINGES | 5,915 | .01 | | | | |
| | | | | OUTSIDE LABOR | 23,266 | .02 | | | | |
| | | | | OTHER | 11,548 | .01 | | | | |
| | | | | SUB TOTAL | 58,168 | .05 | | | | |
| | | | | MAINT LABOR COSTS | | | | | | |
| 2,878 | .04 | 12,861 | .07 | PACKAGING COST | 90,166 | .08 | 62,163 | .04 | 18,066 | .04 |
| 6,425 | .10 | | | LABORATORY COST | 22,204 | .02 | | | | |
| 5,742 | .09 | | | INSURANCE & TAXES | 65,483 | .06 | 82,624 | .05 | 22,983 | .05 |
| 15,045 | .22 | 12,861 | .07 | SUB TOTAL | 177,853 | .15 | 144,787 | .09 | 41,049 | .09 |
| | | | | ADMIN/ENG/R & D | | | | | | |
| | | | | SUB TOTAL | | | | | | |
| 656,579 | 9.81 | 1,675,411 | 9.57 | TOTAL MFG. COSTS | 10,695,294 | 9.13 | 14,762,234 | 9.08 | 5,039,332 | 10.52 |
| 669,855- | 10.01- | 1,691,750- | 9.67- | PRODUCT TSF @ STD. | 10,695,369- | 9.13- | 14,760,750 | 9.08- | 5,064,692- | 10.57- |
| 669,855- | 10.01- | 1,691,750- | 9.67- | SUB TOTAL | 10,695,369- | 9.13- | 14,760,750 | 9.08- | 5,064,692- | 10.57- |
| 13,276- | .20- | 16,339- | .09- | TOTAL STAM PROPANIL | 75- | | 1,484 | | 25,360- | .05- |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 64 WHAM UNITS: GALS

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | | | QUANTITY PRODUCED | 26,820 | 36% | 75,000 | | 101,130 | |
| | | | | PROPANIL TECH | | | | | | |
| | | | | FLAKED TECH | 198,839 | 7.41 | 541,575 | 7.22 | 728,018 | 7.20 |
| 43 | | | | OTHER RAW MATERIALS | 39,697 | 1.48 | 88,628 | 1.18 | 119,039 | 1.18 |
| 43 | | | | SUB TOTAL | 238,536 | 8.89 | 630,203 | 8.40 | 847,057 | 8.38 |
| | | | | PACKAGING MATERIALS | 36,022 | 1.34 | 45,071 | .60 | 64,530 | .64 |
| | | | | SUB TOTAL | 36,022 | 1.34 | 45,071 | .60 | 64,530 | .64 |
| | | | | ORDINARY SUPPLY | 310 | .01 | 2,121 | .03 | 2,848 | .03 |
| | | | | FORMULATING FEE | 31,104 | 1.16 | 75,000 | 1.00 | 101,130 | 1.00 |
| | | | | SUB TOTAL | 31,414 | 1.17 | 77,121 | 1.03 | 103,978 | 1.03 |
| | | | | PACKAGING COST | 1,859 | .07 | | | 3,637 | .04 |
| | | | | LABORATORY COST | | | | | | |
| 219 | | | | INSURANCE & TAXES | 10,337 | .39 | 13,170 | .18 | 3,743 | .04 |
| 219 | | | | SUB TOTAL | 12,196 | .45 | 13,170 | .18 | 7,380 | .07 |
| | | | | ADMIN/ENG/R & D | | | | | | |
| | | | | SUB TOTAL | | | | | | |
| 262 | | | | TOTAL MFG. COSTS | 318,168 | 11.86 | 765,565 | 10.21 | 1,022,945 | 10.12 |
| | | | | PRODUCT TSF @ STD. | 308,118- | 11.49- | 765,750 | 10.21- | 1,001,145- | 9.90- |
| | | | | SUB TOTAL | 308,118- | 11.49- | 765,750 | 10.21- | 1,001,145- | 9.90- |
| 262 | | | | TOTAL WHAM | 10,050 | .37 | 185 | | 21,800 | .22 |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 91 BUTOXONE 175 UNITS: GALS

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | X | | | QUANTITY PRODUCED | 40,493 | 39% | 105,000 | | 98,298 | |
| | | | | TECH ACID USED | 344,203 | 8.50 | 1,013,959 | 9.66 | 932,516 | 9.49 |
| | | | | DMA-60% | 9,773 | .24 | 45,728 | .44 | 27,300 | .28 |
| | | | | CITRIC ACID | 9,966 | .25 | 22,800 | .22 | 19,668 | .20 |
| | | | | PACKAGING MATERIALS | 37,711 | .93 | 106,050 | 1.01 | 88,778 | .90 |
| | | | | SUB TOTAL | 401,653 | 9.92 | 1,188,537 | 11.32 | 1,068,262 | 10.87 |
| | | | | FORMULATING FEE | 26,463 | .65 | 68,250 | .65 | 61,112 | .62 |
| | | | | SUB TOTAL | 26,463 | .65 | 68,250 | .65 | 61,112 | .62 |
| 13 | | | | INSURANCE & TAXES | 12,532 | .31 | 10,537 | .10 | 13,891 | .14 |
| 13 | | | | SUB TOTAL | 12,532 | .31 | 10,537 | .10 | 13,891 | .14 |
| 13 | | | | TOTAL MFG. COSTS | 440,648 | 10.88 | 1,267,324 | 12.07 | 1,143,265 | 11.63 |
| | | | | PRODUCT TSF @ STD. | 464,352- | 11.47- | 1,267,350 | 12.07- | 1,128,382- | 11.48- |
| | | | | SUB TOTAL | 464,352- | 11.47- | 1,267,350 | 12.07- | 1,128,382- | 11.48- |
| 13 | | | | TOTAL BUTOXONE 175 | 23,704- | .59- | 26 | | 14,883 | .15 |

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MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 94 BUTOXONE 200 UNITS: GALS

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | | | QUANTITY PRODUCED | 24,473 | 98% | 25,000 | | 35,805 | |
| | | | | TECH ACID USED | 252,902 | 10.33 | 275,392 | 11.02 | 373,184 | 10.42 |
| | | | | DMA-60% | 7,721 | .32 | 14,050 | .56 | 12,375 | .35 |
| | | | | CITRIC ACID | 9,122 | .37 | 8,759 | .35 | 7,541 | .21 |
| | | | | PACKAGING MATERIALS | 39,512 | 1.61 | 25,250 | 1.01 | 13,902 | .39 |
| | | | | SUB TOTAL | 309,257 | 12.64 | 323,451 | 12.94 | 407,002 | 11.37 |
| | | | | FORMULATING FEE | 26,113 | 1.07 | 16,250 | .65 | 12,121 | .34 |
| | | | | SUB TOTAL | 26,113 | 1.07 | 16,250 | .65 | 12,121 | .34 |
| 534 | | | | INSURANCE & TAXES | 5,297 | .22 | 3,345 | .13 | 3,804 | .11 |
| 534 | | | | SUB TOTAL | 5,297 | .22 | 3,345 | .13 | 3,804 | .11 |
| 534 | | | | TOTAL MFG. COSTS | 340,667 | 13.92 | 343,046 | 13.72 | 422,927 | 11.81 |
| | | | | PRODUCT TSF @ STD. | 332,361- | 13.58- | 343,000 | 13.72- | 467,255- | 13.05- |
| | | | | SUB TOTAL | 332,361- | 13.58- | 343,000 | 13.72- | 467,255- | 13.05- |
| 534 | | | | TOTAL BUTOXONE 200 | 8,306 | .34 | 46 | | 44,328- | 1.24- |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 92 BUTOXONE ESTER UNITS: GALS

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | | | QUANTITY PRODUCED | | % | 10,000 | | | |
| | | | | TECH ACID USED | 217 | | 107,000 | 10.70 | | |
| | | | | PACKAGING MATERIALS | | | 306 | .03 | 1,521 | |
| | | | | SUB TOTAL | 217 | | 107,306 | 10.73 | 1,521 | |
| | | | | FORMULATING FEE | | | 40,800 | 4.08 | | |
| | | | | SUB TOTAL | | | 40,800 | 4.08 | | |
| 465 | | | | INSURANCE & TAXES | 2,206 | | 976 | .10 | 1,641 | |
| 465 | | | | SUB TOTAL | 2,206 | | 976 | .10 | 1,641 | |
| 465 | | | | TOTAL MFG. COSTS | 2,423 | | 149,082 | 14.91 | 3,162 | |
| | | | | PRODUCT TSF @ STD. | 2,137- | | 149,100 | 14.91- | | |
| | | | | SUB TOTAL | 2,137- | | 149,100 | 14.91- | | |
| 465 | | | | TOTAL BUTOXONE ESTER | 286 | | 18 | | 3,162 | |

001

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 71 PYRIDATE 3.75 EC UNITS: GALS

| CURRENT MONTH | | | | YEAR-TO-DATE | | | |
|---|---|---|---|---|---|---|---|
| ACTUAL | | BUDGETED | | ACTUAL | | BUDGETED | PRIOR YR ACTUAL |
| $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT |
| X | | | | X | | | | | |
| QUANTITY PRODUCED | | | | | | | | | |
| CONSULTING | | | | | | | | | |
| FORMULATING FEE | | | | | | | | | |
| SUB TOTAL | | | | | | | | | |
| TOTAL MFG. COSTS | | | | | | | | | |
| PRODUCT TSF @ STD. | | | | | | | | | |
| SUB TOTAL | | | | | | | | | |
| TOTAL PYRIDATE 3.75 EC | | | | | | | | | |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 80 A&W-ADPA UNITS: LBS

| CURRENT MONTH (- - - ACTUAL - - -) | | (- - BUDGETED - - -) | | YEAR-TO-DATE (- - - ACTUAL - - -) | | (- - BUDGETED - - -) | | (- PRIOR YR ACTUAL -) | |
|---|---|---|---|---|---|---|---|---|---|
| $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT |
| | % | | | | % | | | | |
| | | | QUANTITY PRODUCED | | | | | | |
| 2,323 | | | SALARIES | 2,323 | | | | | |
| 5,087 | | | WAGES | 5,087 | | | | | |
| 2,719 | | | FRINGES | 2,719 | | | | | |
| 247 | | | ORDINARY SUPPLY | 247 | | | | | |
| 520 | | | GAS | 520 | | | | | |
| 2,734 | | | POWER | 2,734 | | | | | |
| 5,462 | | | START UP COST | 5,462 | | | | | |
| | | | SHUT DOWN COST | | | | | | |
| 19,892 | | | SUB TOTAL | 19,892 | | | | | |
| 4,576 | | | MAINT LABOR COSTS | 4,576 | | | | | |
| 2,605 | | | MAINT SUPPLIES | 2,605 | | | | | |
| 337 | | | ENVIRONMENTAL COSTS | 337 | | | | | |
| 510 | | | LABORATORY COST | 510 | | | | | |
| 1,597 | | | INSURANCE & TAXES | 1,597 | | | | | |
| 9,625 | | | SUB TOTAL | 9,625 | | | | | |
| 11,440 | | | GENERAL OVERHEAD | 11,440 | | | | | |
| 11,433 | | | ADMIN/ENG/R & D | 11,433 | | | | | |
| 9,129 | | | DEPRECIATION | 9,129 | | | | | |
| 32,002 | | | SUB TOTAL | 32,002 | | | | | |
| 61,519 | | | TOTAL A&W-ADPA | 61,519 | | | | | |

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MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 79 A&W-DEHPA UNITS: LBS

| CURRENT MONTH - ACTUAL $ AMOUNT | CURRENT MONTH - ACTUAL PER UNIT | CURRENT MONTH - BUDGETED $ AMOUNT | CURRENT MONTH - BUDGETED PER UNIT | | YEAR-TO-DATE - ACTUAL $ AMOUNT | YEAR-TO-DATE - ACTUAL PER UNIT | YEAR-TO-DATE - BUDGETED $ AMOUNT | YEAR-TO-DATE - BUDGETED PER UNIT | YEAR-TO-DATE - PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE - PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | | | QUANTITY PRODUCED | 4,848,210 | 100% | 4,830,000 | | 1,380,850 | |
| 2,000 | | | | OTHER RAW MATERIALS | 30,190 | .01 | 246,330 | .05 | 7,941 | .01 |
| 2,000 | | | | SUB TOTAL | 30,190 | .01 | 246,330 | .05 | 7,941 | .01 |
| | | | | SALARIES | 44,681 | .01 | 48,752 | .01 | 16,684 | .01 |
| | | | | WAGES | 176,703 | .04 | 212,772 | .04 | 72,932 | .05 |
| | | | | FRINGES | 70,701 | .01 | 47,596 | .01 | 19,583 | .01 |
| 555 | | | | ORDINARY SUPPLY | 21,049 | | 198,692 | .04 | 36,567 | .03 |
| 805 | | | | RENTALS | 2,450 | | | | 70 | |
| | | | | OUTSIDE LABOR | 2,042 | | | | | |
| 4,626 | | | | GAS | 18,104 | | 80,283 | .02 | 38,725 | .03 |
| | | | | POWER | 79,017 | .02 | 159,705 | .03 | 29,075 | .02 |
| | | | | CONSULTING | | | | | 1,282 | |
| | | | | WASTE DISPOSAL | 567 | | | | | |
| 36 | | | | OTHER | 22,738 | | | | 4,353 | |
| | | | | START UP COST | 56 | | | | 75,696 | .05 |
| 165 | | | | SHUT DOWN COST | 9,072 | | 3,200 | | | |
| 6,187 | | | | SUB TOTAL | 447,180 | .09 | 751,000 | .16 | 294,967 | .21 |
| 198 | | | | MAINT LABOR COSTS | 62,414 | .01 | 146,831 | .03 | 31,068 | .02 |
| 158 | | | | MAINT SUPPLIES | 119,571 | .02 | 101,325 | .02 | 62,915 | .05 |
| | | | | MAINT O/S LABOR | 11,109 | | | | 5,317 | |
| | | | | PACKAGING COST | 556 | | | | 562 | |
| | | | | ENVIRONMENTAL COSTS | | | | | 450 | |
| | | | | LABORATORY COST | 55,621 | .01 | 48,638 | .01 | 17,414 | .01 |
| | | | | INSURANCE & TAXES | 48,426 | .01 | 53,923 | .01 | 16,719 | .01 |
| 356 | | | | SUB TOTAL | 297,697 | .06 | 370,717 | .08 | 134,443 | .10 |
| | | | | GENERAL OVERHEAD | 383,143 | .08 | 383,460 | .08 | 129,216 | .09 |
| | | | | ADMIN/ENG/R & D | 188,714 | .04 | 193,865 | .04 | 82,265 | .06 |
| | | | | DEPRECIATION | 214,062 | .04 | 223,009 | .05 | 92,408 | .07 |
| | | | | SUB TOTAL | 785,919 | .16 | 800,334 | .17 | 303,889 | .22 |
| 8,543 | | | | TOTAL A&W-DEHPA | 1,560,986 | .32 | 2,168,381 | .45 | 741,242 | .54 |

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MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 89 AKZO-SNA UNITS: LBS

| CURRENT MONTH - ACTUAL $ AMOUNT | CURRENT MONTH - ACTUAL PER UNIT | CURRENT MONTH - BUDGETED $ AMOUNT | CURRENT MONTH - BUDGETED PER UNIT | | YEAR-TO-DATE - ACTUAL $ AMOUNT | YEAR-TO-DATE - ACTUAL PER UNIT | YEAR-TO-DATE - BUDGETED $ AMOUNT | YEAR-TO-DATE - BUDGETED PER UNIT | YEAR-TO-DATE - PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE - PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| X | | | | QUANTITY PRODUCED | X | | | | 309,650 | |
| | | | | PACKAGING MATERIALS | | | | | 79 | |
| | | | | SUB TOTAL | | | | | 79 | |
| | | 71 | | SALARIES | | | | | 13,065 | .04 |
| | | 359 | | WAGES | | | | | 39,281 | .13 |
| | | 143 | | FRINGES | | | | | 17,158 | .06 |
| | | | | ORDINARY SUPPLY | | | | | 31 | |
| | | | | RENTALS | | | | | 350 | |
| | | | | OUTSIDE LABOR | | | | | 895 | |
| | | | | OTHER CHEMICALS | | | | | | |
| | | | | NITROGEN | | | | | | |
| | | | | GAS | | | | | 7,922 | .03 |
| | | | | POWER | | | | | 10,811 | .03 |
| | | | | OTHER | | | | | 2,022 | .01 |
| | | | | START UP COST | | | | | | |
| | | | | SHUT DOWN COST | | | | | 7,240 | .02 |
| | | 573 | | SUB TOTAL | | | | | 98,775 | .32 |
| | | 320 | | MAINT LABOR COSTS | | | | | 5,334 | .02 |
| 66 | | 66 | | MAINT SUPPLIES | | | | | 6,924 | .02 |
| | | | | MAINT O/S LABOR | | | | | 1,774 | .01 |
| | | | | PACKAGING COST | | | | | 21,230 | .07 |
| | | | | LABORATORY COST | | | | | 14,190 | .05 |
| | | | | INSURANCE & TAXES | | | | | 7,910 | .03 |
| 66 | | 386 | | SUB TOTAL | | | | | 57,362 | .19 |
| | | | | GENERAL OVERHEAD | | | | | 53,356 | .17 |
| | | | | ADMIN/ENG/R & D | | | | | 42,128 | .14 |
| | | | | DEPRECIATION | | | | | 52,640 | .17 |
| | | | | SUB TOTAL | | | | | 148,124 | .48 |
| 66 | | 959 | | TOTAL AKZO-SNA | | | | | 304,340 | .98 |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 90 ANGUS UNITS: LBS

| CURRENT MONTH - ACTUAL | | CURRENT MONTH - BUDGETED | | | YEAR-TO-DATE - ACTUAL | | YEAR-TO-DATE - BUDGETED | | YEAR-TO-DATE - PRIOR YR ACTUAL | |
|---|---|---|---|---|---|---|---|---|---|---|
| $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT |
| X | | | | QUANTITY PRODUCED | X | | | | 601,312 | |
| | | | | PACKAGING MATERIALS | | | | | | |
| | | | | SUB TOTAL | | | | | | |
| | | | | SALARIES | | | | | 14,463 | .02 |
| | | | | WAGES | | | | | 33,078 | .06 |
| | | | | FRINGES | | | | | 14,572 | .02 |
| | | | | ORDINARY SUPPLY | | | | | 80 | |
| | | | | RENTALS | | | | | | |
| | | | | OTHER CHEMICALS | | | | | | |
| | | | | GAS | | | | | 8,451 | .01 |
| | | | | POWER | | | | | 15,671 | .03 |
| | | | | OTHER | | | | | 1,470 | |
| | | | | START UP COST | | | | | 147,639 | .25 |
| | | | | SHUT DOWN COST | | | | | 5,982 | .01 |
| | | | | SUB TOTAL | | | | | 241,306 | .40 |
| | | | | MAINT LABOR COSTS | | | | | 10,467 | .02 |
| | | | | MAINT SUPPLIES | | | | | 12,743 | .02 |
| | | | | MAINT O/S LABOR | | | | | 1,202 | |
| | | | | PACKAGING COST | | 573 | | | 93 | |
| | | | | LABORATORY COST | | | | | 14,769 | .02 |
| | | | | INSURANCE & TAXES | | | | | 4,642 | .01 |
| | | | | SUB TOTAL | | 573 | | | 44,116 | .07 |
| | | | | GENERAL OVERHEAD | | | | | 72,282 | .12 |
| | | | | ADMIN/ENG/R & D | | | | | 40,122 | .07 |
| | | | | DEPRECIATION | | | | | 18,562 | .03 |
| | | | | SUB TOTAL | | | | | 130,966 | .22 |
| | | | | TOTAL ANGUS | | 573 | | | 416,388 | .69 |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 78 CTBL UNITS: LBS

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | $ | | | QUANTITY PRODUCED | 515,125 | 103% | 500,000 | | 203,055 | |
| 1,397 | | | | OTHER RAW MATERIALS | 1,210- | | | | | |
| 1,397 | | | | SUB TOTAL | 1,210- | | | | | |
| 64 | | | | SALARIES | 9,102 | .02 | 30,662 | .06 | 2,357 | .01 |
| 142 | | | | WAGES | 27,176 | .05 | 69,464 | .14 | 10,555 | .05 |
| 75 | | | | FRINGES | 12,094 | .02 | 30,018 | .06 | 2,779 | .01 |
| 70 | | | | ORDINARY SUPPLY | 1,188 | | 164 | | 2,811- | .01- |
| | | | | RENTALS | 333 | | 304 | | | |
| | | | | NITROGEN | | | | | | |
| 1,116 | | | | GAS | 3,179 | .01 | 17,072 | .03 | 7,475 | .04 |
| | | | | POWER | 9,881 | .02 | 31,656 | .06 | 9,910 | .05 |
| | | | | CONSULTING | 22,089 | .04 | | | 13,149 | .06 |
| 814 | | | | OTHER | 1,936 | | 2,970 | .01 | 692 | |
| 81- | | | | START UP COST | 102,452 | .20 | 71,173 | .14 | 19,101 | .09 |
| 60- | | | | SHUT DOWN COST | 3,897 | .01 | 8,827 | .02 | 1,022 | .01 |
| 2,160 | | | | SUB TOTAL | 193,327 | .38 | 262,310 | .52 | 64,229 | .32 |
| 14- | | | | MAINT LABOR COSTS | 8,846 | .02 | 21,882 | .04 | 3,309 | .02 |
| 151 | | | | MAINT SUPPLIES | 23,792 | .05 | 25,996 | .05 | 10,457 | .05 |
| | | | | MAINT O/S LABOR | 13,271 | .03 | 1,134 | | | |
| | | | | PACKAGING COST | | | | | 125 | |
| | | | | LABORATORY COST | 11,354 | .02 | 31,512 | .06 | 5,497 | .03 |
| | | | | INSURANCE & TAXES | 10,201 | .02 | 5,806 | .01 | 2,656 | .01 |
| 137 | | | | SUB TOTAL | 67,464 | .13 | 86,330 | .17 | 22,044 | .11 |
| | | | | GENERAL OVERHEAD | 69,669 | .14 | 73,040 | .15 | 23,625 | .12 |
| | | | | ADMIN/ENG/R & D | 29,355 | .06 | 44,312 | .09 | 13,642 | .07 |
| | | | | DEPRECIATION | 12,739 | .02 | 15,598 | .03 | 6,760 | .03 |
| | | | | SUB TOTAL | 111,763 | .22 | 132,950 | .27 | 44,027 | .22 |
| 3,694 | | | | TOTAL CTBL | 371,344 | .72 | 481,590 | .96 | 130,300 | .64 |

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MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 76 B F GOODRICH UNITS: LBS

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | PRIOR YR ACTUAL $ AMOUNT | PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | X 350,000 | | QUANTITY PRODUCED | | | X 1,100,000 | | | |
| | | | | PACKAGING MATERIALS | | | | | | |
| | | | | SUB TOTAL | | | | | | |
| | | 3,369 | .01 | SALARIES | 16,107 | | 10,587 | .01 | 5,825 | |
| | | 13,537 | .04 | WAGES | 59,812 | | 42,544 | .04 | 24,636 | |
| | | 4,544 | .01 | FRINGES | 25,738 | | 14,282 | .01 | 7,748 | |
| | | 861 | | ORDINARY SUPPLY | 456 | | 2,706 | | 1,207 | |
| | | 228 | | RENTALS | 2,261 | | 717 | | 275 | |
| | | | | OUTSIDE LABOR | 2,370 | | | | | |
| | | | | NITROGEN | | | | | | |
| 4,626 | | 4,953 | .01 | GAS | 10,940 | | 15,567 | .01 | 7,005 | |
| | | 5,327 | .02 | POWER | 26,706 | | 16,742 | .02 | 12,703 | |
| | | | | CONSULTING | | | | | 11,397 | |
| | | | | WASTE DISPOSAL | 47 | | | | | |
| 36 | | 382 | | OTHER | 1,901 | | 1,201 | | 538 | |
| 584 | | 11,103 | .03 | START UP COST | 73,251 | | 44,412 | .04 | 46,583 | |
| 11- | | 2,220 | .01 | SHUT DOWN COST | 10,897 | | 8,880 | .01 | 3,468 | |
| 5,235 | | 46,524 | .13 | SUB TOTAL | 230,486 | | 157,638 | .14 | 121,585 | |
| 389 | | 12,943 | .04 | MAINT LABOR COSTS | 10,696 | | 40,684 | .04 | 19,772 | |
| 34 | | 13,999 | .04 | MAINT SUPPLIES | 25,136 | | 43,999 | .04 | 20,416 | |
| | | 3,716 | .01 | MAINT O/S LABOR | 26,992 | | 11,678 | .01 | 5,204 | |
| | | | | PACKAGING COST | 746 | | | | | |
| | | 235 | | SAFETY & SECURITY | | | 739 | | 330 | |
| | | 5,063 | .01 | LABORATORY COST | 23,793 | | 15,914 | .01 | 9,163 | |
| | | 1,328 | | INSURANCE & TAXES | 11,071 | | 5,383 | | 4,589 | |
| 423 | | 37,284 | .11 | SUB TOTAL | 98,434 | | 118,397 | .11 | 59,474 | |
| | | 36,520 | .10 | GENERAL OVERHEAD | 112,824 | | 146,080 | .13 | 39,511 | |
| | | 14,617 | .05 | ADMIN/ENG/R & D | 44,530 | | 49,851 | .05 | 29,600 | |
| | | 7,799 | .02 | DEPRECIATION | 32,875 | | 31,196 | .03 | 19,463 | |
| | | 60,936 | .17 | SUB TOTAL | 190,229 | | 227,127 | .21 | 88,574 | |
| 5,658 | | 144,744 | .41 | TOTAL B F GOODRICH | 519,149 | | 503,162 | .46 | 269,633 | |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 74 FMC UNITS: LBS

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | X | | | QUANTITY PRODUCED | | X | | | | |
| | | | | PACKAGING MATERIALS | | | | | | |
| | | | | SUB TOTAL | | | | | | |
| | | | | SALARIES | | | | | | |
| | | | | WAGES | | | | | | |
| | | | | FRINGES | | | | | | |
| | | | | ORDINARY SUPPLY | | | | | | |
| | | | | RENTALS | | | | | 50 | |
| | | | | OUTSIDE LABOR | | | | | | |
| | | | | NITROGEN | | | | | | |
| | | | | GAS | | | | | | |
| | | | | POWER | | | | | | |
| | | | | OTHER | | | | | | |
| | | | | START UP COST | | | | | | |
| | | | | SHUT DOWN COST | | | | | | |
| | | | | SUB TOTAL | | | | | 50 | |
| | | | | MAINT LABOR COSTS | | | | | | |
| | | | | MAINT SUPPLIES | | | | | | |
| | | | | PACKAGING COST | | | | | | |
| | | | | SAFETY & SECURITY | | | | | | |
| | | | | LABORATORY COST | | | | | | |
| | | | | INSURANCE & TAXES | | | | | | |
| | | | | SUB TOTAL | | | | | | |
| | | | | GENERAL OVERHEAD | | | | | | |
| | | | | ADMIN/ENG/R & D | | | | | | |
| | | | | DEPRECIATION | | | | | | |
| | | | | SUB TOTAL | | | | | | |
| | | | | TOTAL FMC | | | | | 50 | |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 87 GRACE UNITS: LBS

| CURRENT MONTH - ACTUAL $ AMOUNT | CURRENT MONTH - ACTUAL PER UNIT | CURRENT MONTH - BUDGETED $ AMOUNT | CURRENT MONTH - BUDGETED PER UNIT | | YEAR-TO-DATE - ACTUAL $ AMOUNT | YEAR-TO-DATE - ACTUAL PER UNIT | YEAR-TO-DATE - BUDGETED $ AMOUNT | YEAR-TO-DATE - BUDGETED PER UNIT | YEAR-TO-DATE - PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE - PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | % 250,000 | | QUANTITY PRODUCED | 2,258,355 | 75% | 3,000,000 | | 1,999,933 | |
| 202 | | 6,368 | .03 | SALARIES | 45,792 | .02 | 76,416 | .03 | 68,545 | .03 |
| 512 | | 20,928 | .08 | WAGES | 184,687 | .08 | 251,136 | .08 | 242,099 | .12 |
| 237 | | 7,893 | .03 | FRINGES | 72,766 | .03 | 94,716 | .03 | 86,453 | .04 |
| 470 | | 293 | | ORDINARY SUPPLY | 871 | | 3,516 | | 3,207 | |
| | | 455 | | RENTALS | 74,500 | .03 | 5,460 | | 4,130 | |
| | | 211 | | OUTSIDE LABOR | 11,004 | | 2,532 | | 1,863 | |
| | | | | OTHER CHEMICALS | | | | | | |
| | | | | NITROGEN | | | | | | |
| | | 4,821 | .02 | GAS | 30,818 | .01 | 57,852 | .02 | 60,954 | .03 |
| 820 | | 9,379 | .04 | POWER | 122,193 | .05 | 112,548 | .04 | 119,420 | .06 |
| | | | | CONSULTING | 2,406- | | | | 1,434 | |
| | | 715 | | OTHER | 7,892 | | 8,580 | | 8,655 | |
| | | | | START UP COST | | | | | | |
| 2,067 | | | | SHUT DOWN COST | 6,551 | | | | | |
| 4,308 | | 51,063 | .20 | SUB TOTAL | 556,668 | .25 | 612,756 | .20 | 596,760 | .30 |
| 949 | | 8,329 | .03 | MAINT LABOR COSTS | 71,256 | .03 | 99,948 | .03 | 92,531 | .05 |
| 1,455 | | 11,085 | .04 | MAINT SUPPLIES | 118,847 | .05 | 133,020 | .04 | 138,605 | .07 |
| | | 1,740 | .01 | MAINT O/S LABOR | 65,762 | .03 | 20,880 | .01 | 20,749 | .01 |
| | | 162 | | PACKAGING COST | 2,736 | | 1,944 | | 4,891 | |
| | | 7,893 | .03 | LABORATORY COST | 53,081 | .02 | 94,716 | .03 | 82,643 | .04 |
| 837 | | 6,212 | .02 | INSURANCE & TAXES | 59,867 | .03 | 74,574 | .02 | 50,191 | .03 |
| 3,141 | | 35,421 | .14 | SUB TOTAL | 371,549 | .16 | 425,082 | .14 | 389,610 | .19 |
| 4,290 | | 46,665 | .19 | GENERAL OVERHEAD | 428,111 | .19 | 559,980 | .19 | 426,191 | .21 |
| 4,287 | | 22,156 | .09 | ADMIN/ENG/R & D | 188,239 | .08 | 265,872 | .09 | 180,743 | .09 |
| 9,345 | | 31,608 | .13 | DEPRECIATION | 359,525 | .16 | 379,296 | .13 | 398,471 | .20 |
| 17,922 | | 100,429 | .40 | SUB TOTAL | 975,875 | .43 | 1,205,148 | .40 | 1,005,405 | .50 |
| 25,371 | | 186,913 | .75 | TOTAL GRACE | 1,904,092 | .84 | 2,242,986 | .75 | 1,991,775 | 1.00 |

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MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 75 MTPO UNITS: LBS

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| X | | | | QUANTITY PRODUCED | X | | 100,000 | | 42,930 | |
| | | | | OTHER RAW MATERIALS | | | 149,784 | 1.50 | 68,549 | 1.60 |
| | | | | SUB TOTAL | | | 149,784 | 1.50 | 68,549 | 1.60 |
| | | | | SALARIES | | | 8,480 | .08 | 4,452 | .10 |
| | | | | WAGES | | | 35,700 | .36 | 18,197 | .42 |
| | | | | FRINGES | | | 8,780 | .09 | 4,262 | .10 |
| | | | | ORDINARY SUPPLY | | | 24,240 | .24 | 13,858 | .32 |
| | | | | RENTALS | | | 152 | | 75 | |
| | | | | NITROGEN | | | 4,220 | .04 | 2,088 | .05 |
| | | | | GAS | | | 16,244 | .16 | 7,874 | .18 |
| | | | | POWER | | | 17,780 | .18 | 8,802 | .21 |
| | | 4,801 | | WASTE DISPOSAL | | | 528 | .01 | 260 | .01 |
| | | 2,678 | | OTHER | | | 2,096 | .02 | 1,733 | .04 |
| | | | | START UP COST | | | 34,627 | .35 | 66,442 | 1.55 |
| | | | | SHUT DOWN COST | | | 1,414 | .01 | 30 | |
| | | 7,479 | | SUB TOTAL | | | 154,261 | 1.54 | 128,073 | 2.98 |
| | | | | MAINT LABOR COSTS | | | 6,732 | .07 | 3,212 | .07 |
| | | 237 | | MAINT SUPPLIES | | | 10,218 | .10 | 5,944 | .14 |
| | | | | MAINT O/S LABOR | | | | | 821 | .02 |
| | | | | PACKAGING COST | | | 130 | | 60 | |
| | | | | ENVIRONMENTAL COSTS | | | 606 | .01 | 300 | .01 |
| | | | | LABORATORY COST | | | 6,446 | .06 | 3,164 | .07 |
| | | | | INSURANCE & TAXES | | | 3,622 | .04 | 2,219 | .05 |
| | | 237 | | SUB TOTAL | | | 27,754 | .28 | 15,720 | .37 |
| | | | | GENERAL OVERHEAD | | | 73,040 | .73 | 39,684 | .92 |
| | | | | ADMIN/ENG/R & D | | | 33,234 | .33 | 21,470 | .50 |
| | | | | DEPRECIATION | | | 15,598 | .16 | 9,174 | .21 |
| | | | | SUB TOTAL | | | 121,872 | 1.22 | 70,328 | 1.64 |
| | | 7,716 | | TOTAL MTPO | | | 453,671 | 4.54 | 282,670 | 6.58 |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 58 ORFON UNITS: LBS

| CURRENT MONTH - ACTUAL $ AMOUNT | CURRENT MONTH - ACTUAL PER UNIT | CURRENT MONTH - BUDGETED $ AMOUNT | CURRENT MONTH - BUDGETED PER UNIT | | YEAR-TO-DATE - ACTUAL $ AMOUNT | YEAR-TO-DATE - ACTUAL PER UNIT | YEAR-TO-DATE - BUDGETED $ AMOUNT | YEAR-TO-DATE - BUDGETED PER UNIT | YEAR-TO-DATE - PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE - PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| 582,809 | % | | | QUANTITY PRODUCED | 1,196,907 | 292% | 410,000 | | 116,700 | |
| 2,739- | | | | OTHER RAW MATERIALS | 2,665 | | | | 5,283 | .05 |
| 2,739- | | | | SUB TOTAL | 2,665 | | | | 5,283 | .05 |
| 6,757 | .01 | | | SALARIES | 11,083 | .01 | 3,871 | .01 | 2,403 | .02 |
| 17,120 | .03 | | | WAGES | 35,777 | .03 | 16,896 | .04 | 10,481 | .09 |
| 7,909 | .01 | | | FRINGES | 14,886 | .01 | 3,780 | .01 | 2,507 | .02 |
| 3,982 | .01 | | | ORDINARY SUPPLY | 4,086 | | | | 2,737 | .02 |
| | | | | RENTALS | | | 201 | | 275 | |
| | | | | NITROGEN | | | | | | |
| 2,080 | | | | GAS | 2,426 | | 1,020 | | 484 | |
| 4,101 | .01 | | | POWER | 9,010 | .01 | | | | |
| | | | | WASTE DISPOSAL | | | | | | |
| | | | | OTHER | 544 | | | | | |
| 169 | | | | START UP COST | 30,988 | .03 | 2,452 | .01 | 2,266 | .02 |
| 908 | | | | SHUT DOWN COST | 987 | | 1,350 | | 1,653 | .01 |
| 43,026 | .07 | | | SUB TOTAL | 109,787 | .09 | 29,570 | .07 | 22,806 | .20 |
| 2,409 | | | | MAINT LABOR COSTS | 6,445 | .01 | 4,240 | .01 | 2,429 | .02 |
| 2,892 | | | | MAINT SUPPLIES | 12,464 | .01 | 230 | | 5,157 | .04 |
| 1,650 | | | | MAINT O/S LABOR | 35,752 | .03 | 6,169 | .02 | 357 | |
| 14- | | | | PACKAGING COST | 432 | | 257 | | 369 | |
| 8,400 | .01 | | | LABORATORY COST | 13,461 | .01 | 4,946 | .01 | 4,691 | .04 |
| 3,163 | .01 | | | INSURANCE & TAXES | 6,091 | .01 | 2,566 | .01 | 1,380 | .01 |
| 18,500 | .03 | | | SUB TOTAL | 74,645 | .06 | 18,408 | .04 | 14,383 | .12 |
| 21,450 | .04 | | | GENERAL OVERHEAD | 38,157 | .03 | 36,520 | .09 | 16,994 | .15 |
| 21,436 | .04 | | | ADMIN/ENG/R & D | 37,160 | .03 | 11,078 | .03 | 11,842 | .10 |
| 14,797 | .03 | | | DEPRECIATION | 23,456 | .02 | 7,799 | .02 | 10,657 | .09 |
| 57,683 | .10 | | | SUB TOTAL | 98,773 | .08 | 55,397 | .14 | 39,493 | .34 |
| 116,470 | .20 | | | TOTAL ORFON | 285,870 | .24 | 103,375 | .25 | 81,965 | .70 |

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MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 77 PERBORATE UNITS: L

| CURRENT MONTH - ACTUAL $ AMOUNT | CURRENT MONTH - ACTUAL PER UNIT | CURRENT MONTH - BUDGETED $ AMOUNT | CURRENT MONTH - BUDGETED PER UNIT | | YEAR-TO-DATE - ACTUAL $ AMOUNT | YEAR-TO-DATE - ACTUAL PER UNIT | YEAR-TO-DATE - BUDGETED $ AMOUNT | YEAR-TO-DATE - BUDGETED PER UNIT | YEAR-TO-DATE - PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE - PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | X1,000,000 | | QUANTITY PRODUCED | 85,080 | 1X | 11,000,000 | | | |
| | | | | OTHER RAW MATERIALS | | | | | | |
| | | | | SUB TOTAL | | | | | | |
| | | 2,025 | | SALARIES | 512 | .01 | 22,275 | | | |
| | | 8,009 | .01 | WAGES | 1,028 | .01 | 88,099 | .01 | | |
| | | 1,936 | | FRINGES | 552 | .01 | 21,296 | | | |
| | | 867 | | ORDINARY SUPPLY | 120 | | 9,537 | | | |
| | | | | RENTALS | | | | | | |
| | | | | OUTSIDE LABOR | | | | | 1,269 | |
| | | | | NITROGEN | | | | | | |
| | | | | GAS | | | | | | |
| | | 4,741 | | POWER | | | 52,151 | | | |
| | | 980 | | OTHER | | | 10,780 | | | |
| | | 606 | | START UP COST | 4,728 | .06 | 22,822 | | | |
| | | | | SHUT DOWN COST | 673 | .01 | 1,414 | | | |
| | | 19,164 | .02 | SUB TOTAL | 7,613 | .09 | 228,374 | .02 | 1,269 | |
| | | 4,785 | | MAINT LABOR COSTS | 1,183 | .01 | 52,635 | | | |
| | | 7,566 | .01 | MAINT SUPPLIES | 2,029 | .02 | 83,226 | .01 | | |
| | | 13,377 | .01 | MAINT O/S LABOR | | | 147,147 | .01 | | |
| 445 | | 2,071 | | LABORATORY COST | 473 | .01 | 22,781 | | | |
| | | 2,167 | | INSURANCE & TAXES | 46 | | 23,837 | | | |
| 445 | | 29,966 | .03 | SUB TOTAL | 3,731 | .04 | 329,626 | .03 | | |
| | | 8,116 | .01 | GENERAL OVERHEAD | 16,249 | .19 | 89,276 | .01 | | |
| | | 5,539 | .01 | ADMIN/ENG/R & D | 4,689 | .06 | 60,929 | .01 | | |
| | | | | DEPRECIATION | | | | | | |
| | | 13,655 | .01 | SUB TOTAL | 20,938 | .25 | 150,205 | .01 | | |
| 445 | | 62,785 | .04 | TOTAL PERBORATE | 32,282 | .38 | 708,205 | .06 | 1,269 | |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 85 SECTAGON II UNITS: GAL

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| X | | | | QUANTITY PRODUCED | | X | 300,000 | | 189,352 | |
| | | | | OTHER RAW MATERIALS | 16,067 | | 195,840 | .65 | 127,318 | .67 |
| | | | | SUB TOTAL | 16,067 | | 195,840 | .65 | 127,318 | .67 |
| | | | | PACKAGING MATERIALS | | | | | | |
| | | | | SUB TOTAL | | | | | | |
| | | | | SALARIES | | | 3,209 | .01 | 1,932 | .01 |
| | | | | WAGES | | | 12,662 | .04 | 7,721 | .04 |
| | | | | FRINGES | | | 3,064 | .01 | 1,906 | .01 |
| | | | | ORDINARY SUPPLY | | | 1,377 | | 850 | |
| | | | | RENTALS | | | | | | |
| | | | | NITROGEN | | | 11,562 | .04 | 7,226 | .04 |
| | | | | GAS | | | | | | |
| | | | | POWER | | | 7,510 | .03 | 4,694 | .02 |
| | | | | OTHER | | | 1,552 | .01 | 970 | .01 |
| | | | | START UP COST | | | 26,546 | .09 | 16,449 | .09 |
| | | | | SHUT DOWN COST | | | 2,236 | .01 | 144 | |
| | | | | SUB TOTAL | | | 69,718 | .23 | 41,892 | .22 |
| | | | | MAINT LABOR COSTS | | | 7,552 | .03 | 1,576 | .01 |
| | | | | MAINT SUPPLIES | 224 | | 12,017 | .04 | 7,673 | .04 |
| | | | | MAINT O/S LABOR | | | 21,246 | .07 | 13,519 | .07 |
| | | | | PACKAGING COST | | | | | 1,627 | .01 |
| | | | | LABORATORY COST | 119 | | 3,277 | .01 | 1,977 | .01 |
| | | | | INSURANCE & TAXES | | | 2,913 | .01 | 2,917 | .02 |
| | | | | SUB TOTAL | 343 | | 47,005 | .16 | 29,289 | .15 |
| | | | | GENERAL OVERHEAD | | | 8,116 | .03 | 23,920 | .13 |
| | | | | ADMIN/ENG/R & D | | | 11,078 | .04 | 18,471 | .10 |
| | | | | DEPRECIATION | | | | | | |
| | | | | SUB TOTAL | | | 19,194 | .06 | 42,391 | .22 |
| | | | | TOTAL SECTAGON II | 16,410 | | 331,757 | 1.11 | 240,890 | 1.27 |

MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 95 DRUM BURIAL 2ND PHAS UNITS: LBS

| CURRENT MONTH - ACTUAL | | CURRENT MONTH - BUDGETED | | | YEAR-TO-DATE - ACTUAL | | YEAR-TO-DATE - BUDGETED | | YEAR-TO-DATE - PRIOR YR ACTUAL | |
|---|---|---|---|---|---|---|---|---|---|---|
| $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT | $ AMOUNT | PER UNIT |
| % | | | | QUANTITY PRODUCED | | % | | | | |
| | | | | ORDINARY SUPPLY | 6,212 | | | | | |
| | | | | RENTALS | 787 | | | | | |
| | | | | OUTSIDE LABOR | 10,457 | | | | | |
| | | | | CONSULTING | 33,729 | | | | | |
| | | | | WASTE DISPOSAL | 872,365 | | | | | |
| | | | | SUB TOTAL | 923,550 | | | | | |
| | | | | TOTAL DRUM BURIAL 2ND PHAS | 923,550 | | | | | |

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MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 96 DRUM BURIAL COST UNITS: GALS

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | X | | | QUANTITY PRODUCED | | X | | | | |
| | | | | SALARIES | | | | | | |
| | | | | WAGES | | | | | 3,175 | |
| | | | | FRINGES | | | | | | |
| | | | | ORDINARY SUPPLY | 258 | | | | 1,741 | |
| | | | | RENTALS | 447 | | | | 80 | |
| | | 20,833 | | OUTSIDE LABOR | 478 | | 249,996 | | 3,115 | |
| | | | | MAINT SUPPLIES | | | | | 529 | |
| 160 | | | | CONSULTING | 11,333 | | | | 338,219 | |
| 250,000- | | | | WASTE DISPOSAL | 809,222- | | | | | |
| | | | | OTHER | 80,000 | | | | | |
| 249,840- | | 20,833 | | SUB TOTAL | 716,706- | | 249,996 | | 346,859 | |
| 250,000 | | | | ENVIRONMENTAL COSTS | 250,000 | | | | | |
| 250,000 | | | | SUB TOTAL | 250,000 | | | | | |
| 160 | | 20,833 | | TOTAL DRUM BURIAL COST | 466,706- | | 249,996 | | 346,859 | |

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MANUFACTURING COST REPORT BY PRODUCT

PRODUCT: 99 IDLE PLANT UNITS: LBS

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT | YEAR-TO-DATE PRIOR YR ACTUAL $ AMOUNT | YEAR-TO-DATE PRIOR YR ACTUAL PER UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | | | QUANTITY PRODUCED | | % | | | | |
| | | | | OTHER RAW MATERIALS | 8,795 | | | | | |
| | | | | SUB TOTAL | 8,795 | | | | | |
| | | | | PACKAGING MATERIALS | | | | | 3,682 | |
| | | | | SUB TOTAL | | | | | 3,682 | |
| 1,196 | | | | SALARIES | 3,825 | | | | 191 | |
| 3,030 | | | | WAGES | 10,728 | | | | 793 | |
| 781 | | | | FRINGES | 4,453 | | | | 229 | |
| | | | | ORDINARY SUPPLY | | | | | 56 | |
| | | | | RENTALS | 70 | | | | 400 | |
| | | | | OUTSIDE LABOR | | | | | 100 | |
| | | | | OTHER CHEMICALS | | | | | 1,120 | |
| 4,146 | | | | NITROGEN GAS | 27,791- | | | | 48,255- | |
| 7,382 | | | | POWER | 55,227 | | | | 59,008 | |
| | | | | CONSULTING | 3,056 | | | | | |
| | | | | WASTE DISPOSAL | 57,784 | | | | 53,079 | |
| | | | | OTHER | | | | | | |
| | | | | SHUT DOWN COST | | | | | | |
| 16,535 | | | | SUB TOTAL | 107,362 | | | | 66,721 | |
| 531 | | | | MAINT LABOR COSTS | 3,023 | | | | 15,347 | |
| 546 | | | | MAINT SUPPLIES | 11,660 | | | | 37,597 | |
| 3,600 | | | | MAINT O/S LABOR | 23,189 | | | | 22,532 | |
| | | | | PACKAGING COST | | | | | | |
| | | | | ENVIRONMENTAL COSTS | 1,677 | | | | 3,365 | |
| | | | | LABORATORY COST | 153 | | | | | |
| 3,976 | | | | INSURANCE & TAXES | 143,857- | | | | 21,973- | |
| 8,653 | | | | SUB TOTAL | 104,155- | | | | 56,868 | |
| 48,621 | | 36,520 | | GENERAL OVERHEAD | 273,129 | | 164,340 | | 241,079 | |
| 41,443 | | 16,617 | | ADMIN/ENG/R & D | 145,018 | | 60,929 | | 141,203 | |
| 35,484 | | 21,239 | | DEPRECIATION | 129,746 | | 55,256 | | 173,331 | |
| 125,548 | | 74,376 | | SUB TOTAL | 547,893 | | 280,525 | | 555,613 | |
| 150,736 | | 74,376 | | TOTAL IDLE PLANT | 559,895 | | 280,525 | | 682,884 | |

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COST REPORT BY DEPARTMENT

ADMINSTRATIVE

| NTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 100 | SALARIES | 19,248 | 28,973 | 9,725- | 200,940 | 347,676 | 146,736- | 271,291 | 70,351- |
| 200 | PAYROLL TAXES | 2,056 | 714 | 1,342 | 6,695 | 8,568 | 1,873- | 10,365 | 3,670- |
| 210 | GROUP INSURANCE | 2,702 | 2,631 | 71 | 27,849 | 31,572 | 3,723- | 23,993 | 3,856 |
| 220 | WORKMANS COMP INSUR | 387 | 489 | 102- | 3,712 | 5,868 | 2,156- | 4,834 | 1,122- |
| 230 | PENSION PLAN COST | 1,924 | 2,716 | 792- | 29,672 | 32,592 | 2,920- | 23,961 | 5,711 |
| 240 | EMPLOYMENT EXPENSE | | | | 13,829 | | 13,829 | 1,607 | 12,222 |
| 300 | CONTRACT LABOR & MTL | | 707 | 707- | 6,332 | 8,484 | 2,152- | 5,919 | 413 |
| 350 | ELECTRICITY | 792 | 879 | 87- | 3,380 | 10,548 | 7,168- | 9,080 | 5,700- |
| 360 | WATER | | 18 | 18- | 50 | 216 | 166- | 226 | 176- |
| 370 | COMMUNICATION | 3,380 | 4,693 | 1,313- | 42,934 | 56,316 | 13,382- | 57,945 | 15,011- |
| 380 | AUTO EXPENSE | | 219 | 219- | 30 | 2,628 | 2,598- | 1,733 | 1,703- |
| 390 | TRVL & ENTERTAINMENT | 797 | 1,994 | 1,197- | 12,349 | 23,928 | 11,579- | 17,238 | 4,889- |
| 395 | MEALS/ENTERTAINMENT | 460 | 1,015 | 555- | 6,202 | 12,180 | 5,978- | 9,717 | 3,515- |
| 400 | ORDINARY SUPPLIES | 2,306 | 6,558 | 4,252- | 50,399 | 78,696 | 28,297- | 62,640 | 12,241- |
| 460 | MISCELLANEOUS | 21,361 | 1,757 | 19,604 | 38,964 | 21,084 | 17,880 | 36,387 | 2,577 |
| 610 | DUES & SUBSCRIPTIONS | 27 | 211 | 184- | 2,965 | 2,532 | 433 | 1,760 | 1,205 |
| 620 | FEES & TUITIONS | | 626 | 626- | 6,251 | 7,512 | 1,261- | 7,541 | 1,290- |
| 630 | PROFESSIONAL FEES | 2,533 | 1,166 | 1,367 | 35,300 | 13,992 | 21,308 | 9,234 | 26,066 |
| 650 | RENTALS | 1,985 | 379 | 1,606 | 10,249 | 4,548 | 5,701 | 4,872 | 5,377 |
| 660 | LEASE ITEMS | 3,591 | 2,360 | 1,231 | 36,508 | 28,320 | 8,188 | 23,981 | 12,527 |
| 680 | FREIGHT IN (MISC.) | | | | | | | | |
| | DEPARTMENT TOTALS ADMINSTRATIVE | 63,549 | 58,105 | 5,444 | 534,610 | 697,260 | 162,650- | 584,324 | 49,714- |

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COST REPORT BY DEPARTMENT

CONTRACT FORMULATION

| ONTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 5120 | PUR PRICE VARIANCE | | | | 33,524- | | 33,524- | 41,817 | 75,341- |
| 5510 | BUTOXONE TECH ACID | | | | 630,154 | 1,396,351 | 766,197- | 1,265,650 | 635,496- |
| 5700 | DMA-60% | | | | 17,494 | 59,778 | 42,284- | 39,675 | 22,181- |
| 5705 | CITRIC ACID | | | | 19,088 | 31,559 | 12,471- | 27,209 | 8,121- |
| 5850 | OTHER RAW MATERIALS | 43 | | 43 | 14,265 | 209,830 | 195,565- | 196,564 | 182,299- |
| 5870 | PACKAGING MATERIALS | | | | 111,751 | 218,088 | 106,337- | 175,550 | 63,799- |
| 5560 | OFF SITE WASTE DISPO | 587 | | 587 | 587 | | 587 | | 587 |
| 5590 | CONTRACT FORMULATING | 2,599 | | 2,599 | 96,559 | 600,300 | 503,741- | 453,110 | 356,551- |
| 5630 | PROFESSIONAL FEES | | | | | | | | |
| 5035 | FLAKED TECH USED | | | | 1,070,549 | 1,324,575 | 254,026- | 1,300,756 | 230,207- |
| | DEPARTMENT TOTALS CONTRACT FORMULATION | 3,229 | | 3,229 | 1,926,923 | 3,840,491 | 1,913,568- | 3,500,331 | 1,573,408- |

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COST REPORT BY DEPARTMENT

ENGINEERING

| NTROL | CONTROL DESCRIPTION | CURRENT MONTH ACTUAL COST | CURRENT MONTH SCHEDULED COST | CURRENT MONTH OVER/UNDER SCHED.COST | YEAR-TO-DATE ACTUAL COST | YEAR-TO-DATE SCHEDULED COST | YEAR-TO-DATE OVER/UNDER SCHED.COST | PRIOR YEAR ACTUAL COST | PRIOR YEAR OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 100 | SALARIES | 43,572 | 25,675 | 17,897 | 369,127 | 308,100 | 61,027 | 236,934 | 132,193 |
| 200 | PAYROLL TAXES | 4,580 | 3,850 | 730 | 53,750 | 46,200 | 7,550 | 37,067 | 16,683 |
| 210 | GROUP INSURANCE | | 1,692 | 1,692- | 45,479 | 20,304 | 25,175 | 16,976 | 28,503 |
| 220 | WORKMANS COMP INSUR | 876 | 452 | 424 | 6,829 | 5,424 | 1,405 | 4,030 | 2,799 |
| 230 | PENSION PLAN COST | 2,865 | 1,377 | 1,488 | 24,124 | 16,524 | 7,600 | 18,362 | 5,762 |
| 240 | EMPLOYMENT EXPENSE | | | | | | | 13,118 | 13,118- |
| 300 | CONTRACT LABOR & MTL | 9,496 | 4,271 | 5,225 | 19,268 | 51,252 | 31,984- | 56,867 | 37,599- |
| 350 | ELECTRICITY | | 46 | 46- | | 552 | 552- | 366 | 366- |
| 370 | COMMUNICATION | | 158 | 158- | | 1,896 | 1,896- | 1,407 | 1,407- |
| 390 | TRVL & ENTERTAINMENT | | 1,765 | 1,765- | 2,474 | 21,180 | 18,706- | 15,919 | 13,445- |
| 395 | MEALS/ENTERTAINMENT | | 286 | 286- | 336 | 3,432 | 3,096- | 3,267 | 2,931- |
| 400 | ORDINARY SUPPLIES | 4,428 | 588 | 3,840 | 6,071 | 7,056 | 985- | 5,330 | 741 |
| 410 | MAINTENANCE SUPPLIES | 214 | 46 | 168 | 518 | 552 | 34- | 528 | 10- |
| 460 | MISCELLANEOUS | | 130 | 130- | | 1,560 | 1,560- | 1,030 | 1,030- |
| 610 | DUES & SUBSCRIPTIONS | | 18 | 18- | 162 | 216 | 54- | 145 | 17 |
| 620 | FEES & TUITIONS | | | | | | | | |
| 630 | PROFESSIONAL FEES | 4,881 | 2,495 | 2,386 | 41,723 | 29,940 | 11,783 | 64,376 | 22,653- |
| 650 | RENTALS | | 94 | 94- | 785 | 1,128 | 343- | 1,023 | 238- |
| 660 | LEASE ITEMS | | | | 180 | | 188 | | 188 |
| 680 | FREIGHT IN (MISC.) | | | | | | | | |
| | DEPARTMENT TOTALS ENGINEERING | 70,912 | 42,943 | 27,969 | 570,834 | 515,316 | 55,518 | 476,745 | 94,089 |

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COST REPORT BY DEPARTMENT

ENVIRONMENTAL

| NTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 1220 | FUTURE ENVIRON COSTS | 250,000 | | 250,000 | 250,000 | | 250,000 | | 250,000 |
| 1100 | SALARIES | 3,927 | 4,377 | 450- | 45,505 | 52,524 | 7,019- | 43,976 | 1,529 |
| 1110 | WAGES | 7,632 | 4,412 | 3,220 | 118,418 | 52,944 | 65,474 | 86,140 | 32,278 |
| 1140 | HOLIDAY & VAC PAY | | | | | | | | |
| 1200 | PAYROLL TAXES | 468 | 711 | 243- | 7,180 | 8,532 | 1,352- | 7,117 | 63 |
| 1210 | GROUP INSURANCE | 6,668 | 587 | 6,081 | 12,428 | 7,044 | 5,384 | 5,242 | 7,186 |
| 1220 | WORKMANS COMP INSUR | 79 | 98 | 19- | 840 | 1,176 | 336- | 959 | 119- |
| 1230 | PENSION PLAN COST | 258 | 3,693 | 3,435- | 2,973 | 44,316 | 41,343- | 3,422 | 449- |
| 1240 | EMPLOYMENT EXPENSE | | 2,620 | 2,620- | 4,787 | 31,440 | 26,653- | 37,792 | 33,005- |
| 1300 | CONTRACT LABOR & MTL | 1,625 | 27,540 | 25,915- | 26,882 | 331,086 | 304,204- | 63,340 | 36,458- |
| 1350 | ELECTRICITY | | 12 | 12- | | 144 | 144- | 91 | 91- |
| 1370 | COMMUNICATION | | 39 | 39- | | 468 | 468- | 345 | 345- |
| 1390 | TRVL & ENTERTAINMENT | 192 | 629 | 437- | 2,259 | 7,548 | 5,289- | 5,257 | 2,998- |
| 1395 | MEALS/ENTERTAINMENT | 39 | 120 | 81- | 368 | 1,440 | 1,072- | 1,010 | 642- |
| 1400 | ORDINARY SUPPLIES | 10,996 | 3,142 | 7,854 | 68,508 | 37,704 | 30,804 | 34,356 | 34,152 |
| 1410 | MAINTENANCE SUPPLIES | 1,294 | 1,181 | 113 | 21,675 | 14,172 | 7,503 | 12,017 | 9,658 |
| 1460 | MISCELLANEOUS | | | | 149 | | 149 | | 149 |
| 1560 | OFF SITE WASTE DISPO | 289,182- | 42,564 | 331,746- | 997,529 | 511,296 | 486,233 | 278,835 | 718,694 |
| 1610 | DUES & SUBSCRIPTIONS | | | | 812 | | 812 | 934 | 122- |
| 1620 | FEES & TUITIONS | 1,426 | 1,924 | 498- | 14,208 | 23,088 | 8,880- | 16,400 | 2,192- |
| 1625 | PENALTIES | | | | 80,000 | | 80,000 | | 80,000 |
| 1630 | PROFESSIONAL FEES | 5,212 | 1,647 | 3,565 | 122,810 | 19,764 | 103,046 | 364,414 | 241,604- |
| 1650 | RENTALS | | 51 | 51- | 1,584 | 612 | 972 | 375 | 1,209 |
| 1730 | POND CLOSURER/CREDIT | | | | 1,677 | | 1,677 | 3,365 | 1,688- |
| 1900 | POWER | | | | | | | | |
| 1960 | WAGE FRINGES | 3,525 | 1,761 | 1,764 | 48,965 | 21,132 | 27,833 | 31,725 | 17,240 |
| | DEPARTMENT TOTALS ENVIRONMENTAL | 4,159 | 97,108 | 92,949- | 1,829,557 | 1,166,430 | 663,127 | 997,112 | 832,445 |

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COST REPORT BY DEPARTMENT

FRINGES

| INTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 200 | PAYROLL TAXES | 13,897 | 21,463 | 7,566- | 205,088 | 264,076 | 58,988- | 202,763 | 2,325 |
| 210 | GROUP INSURANCE | 29,059 | 20,894 | 8,165 | 376,788 | 257,069 | 119,719 | 211,833 | 164,955 |
| 220 | WORKMANS COMP INSUR | 4,163 | 4,114 | 49 | 49,889 | 50,621 | 732- | 45,340 | 4,549 |
| 230 | PENSION PLAN COST | 13,611 | 21,954 | 8,343- | 175,785 | 270,108 | 94,323- | 208,654 | 32,869- |
| | DEPARTMENT TOTALS FRINGES | 60,730 | 68,425 | 7,695- | 807,550 | 841,874 | 34,324- | 668,590 | 138,960 |

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COST REPORT BY DEPARTMENT

FRINGES

| NTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| | COMPANY TOTALS | 527,722- | 14,611 | 542,333- | 9,590,773-0,160,098- | | 569,325 | 8,183,497- | 1,407,276- |
| | REPORT TOTALS | 527,722- | 14,611 | 542,333- | 9,590,773-0,160,098- | | 569,325 | 8,183,497- | 1,407,276- |

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COST REPORT BY DEPARTMENT

GENERAL PLANT

| NTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 1280 | GAIN (LOSS) F/A | | | | | | | | |
| 1600 | INSURANCE-PLANT | 17,617 | 15,909 | 1,708 | 335,346 | 384,842 | 29,496- | 238,393 | 116,953 |
| 1710 | PROPERTY TAXES & LIC | 13,978 | 9,425 | 4,553 | 2,996- | 143,699 | 146,695- | 92,214 | 95,210- |
| 1900 | DEPRECIATION | 129,816 | 118,313 | 11,303 | 1,495,179 | 1,422,156 | 73,023 | 1,199,928 | 295,251 |
| | DEPARTMENT TOTALS GENERAL PLANT | 161,411 | 143,847 | 17,564 | 1,847,529 | 1,950,697 | 103,168- | 1,530,535 | 316,994 |

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COST REPORT BY DEPARTMENT

LABORATORY

| NTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 100 | SALARIES | 6,870 | 7,599 | 729- | 81,427 | 98,133 | 16,706- | 72,039 | 9,388 |
| 110 | WAGES | 12,010 | 24,428 | 12,418- | 183,684 | 327,802 | 144,118- | 176,671 | 7,013 |
| 140 | HOLIDAY & VAC PAY | 4,512 | 1,401 | 3,111 | 19,660 | 16,812 | 2,848 | 19,876 | 216- |
| 150 | SICK & ALLOWED PAY | | 11 | 11- | 2,110 | 132 | 1,978 | 513 | 1,597 |
| 160 | OTHER (CALL-OUT PRE) | | 33 | 33- | 463 | 396 | 67 | 256 | 207 |
| 300 | CONTRACT LABOR & MTL | | 50 | 50- | 8,114 | 600 | 7,514 | 4,264 | 3,850 |
| 370 | COMMUNICATION | | | | | | | 305 | 305- |
| 390 | TRVL & ENTERTAINMENT | 488 | 190 | 298 | 1,185 | 2,280 | 1,095- | 1,572 | 387- |
| 395 | MEALS/ENTERTAINMENT | 354 | 12 | 342 | 705 | 144 | 561 | 148 | 557 |
| 400 | ORDINARY SUPPLIES | 5,185 | 7,313 | 2,128- | 72,174 | 102,100 | 29,926- | 76,207 | 4,033- |
| 410 | MAINTENANCE SUPPLIES | 11 | 504 | 493- | 6,701 | 6,048 | 653 | 5,165 | 1,536 |
| 610 | DUES & SUBSCRIPTIONS | | | | 384 | | 384 | | 384 |
| 620 | FEES & TUITIONS | | | | | | | | |
| 630 | PROFESSIONAL FEES | | | | 6,500 | | 6,500 | | 6,500 |
| 650 | RENTALS | 491 | 239 | 252 | 2,765 | 2,868 | 103- | 2,098 | 667 |
| 960 | WAGE FRINGES | 5,548 | 7,132 | 1,584- | 76,429 | 91,372 | 14,943- | 64,274 | 12,155 |
| 700 | SAMPLE PRODUCT | 668 | | 668 | 16,089 | | 16,089 | | 16,089 |
| | DEPARTMENT TOTALS LABORATORY | 36,137 | 48,912 | 12,775- | 478,390 | 648,687 | 170,297- | 423,388 | 55,002 |

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COST REPORT BY DEPARTMENT

MAINTENANCE-INSTR

| | | (----CURRENT MONTH AMOUNTS----) | | | (-----YEAR-TO-DATE AMOUNTS----) | | | (- - PRIOR YEAR - - -) | |
|---|---|---|---|---|---|---|---|---|---|
| INTROL | CONTROL DESCRIPTION | ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | ACTUAL COST | OVER/UNDER PRIOR ACT. |
| 100 | SALARIES | 3,148 | 2,896 | 252 | 36,256 | 42,234 | 5,978- | 31,984 | 4,272 |
| 110 | WAGES | 9,369 | 13,145 | 3,776- | 125,777 | 182,316 | 56,539- | 118,589 | 7,188 |
| 140 | HOLIDAY & VAC PAY | 1,650 | 1,037 | 613 | 9,749 | 12,444 | 2,695- | 11,599 | 1,850- |
| 150 | SICK & ALLOWED PAY | | 25 | 25- | 109 | 300 | 191- | 641 | 532- |
| 160 | OTHER (CALL-OUT PRE) | | 8 | 8- | 438 | 96 | 342 | 65 | 373 |
| 300 | CONTRACT LABOR & MTL | 2,855 | 6,400 | 3,545- | 169,282 | 76,800 | 92,482 | 38,630 | 130,652 |
| 390 | TRVL & ENTERTAINMENT | | 505 | 505- | 778 | 6,060 | 5,282- | 2,997 | 2,219- |
| 395 | MEALS/ENTERTAINMENT | | 91 | 91- | 25 | 1,092 | 1,067- | 538 | 513- |
| 400 | ORDINARY SUPPLIES | 6,200 | 1,669 | 4,531 | 10,644 | 20,028 | 9,384- | 10,443 | 201 |
| 410 | MAINTENANCE SUPPLIES | 5,953 | 21,687 | 15,734- | 233,270 | 262,388 | 29,118- | 176,203 | 57,067 |
| 460 | MISCELLANEOUS | | | | 30 | | 30 | | 30 |
| 630 | PROFESSIONAL FEES | | | | 3,229 | | 3,229 | | 3,229 |
| 650 | RENTALS | | 48 | 48- | 73,940 | 576 | 73,364 | 5,288 | 68,652 |
| 960 | WAGE FRINGES | 4,329 | 4,188 | 141 | 51,472 | 56,901 | 5,429- | 40,272 | 11,200 |
| | DEPARTMENT TOTALS MAINTENANCE-INSTR | 33,504 | 51,699 | 18,195- | 714,999 | 661,235 | 53,764 | 437,249 | 277,750 |

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COST REPORT BY DEPARTMENT

MAINTENANCE-MECH

| NTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 1250 | START-UP COST | | | | | | | | |
| 1100 | SALARIES | 3,064 | 4,382 | 1,318- | 35,294 | 50,450 | 15,156- | 39,077 | 3,783- |
| 1110 | WAGES | 19,837 | 37,043 | 17,206- | 295,980 | 476,416 | 180,436- | 386,275 | 90,295- |
| 1140 | HOLIDAY & VAC PAY | 4,649 | 1,948 | 2,701 | 29,454 | 23,376 | 6,078 | 31,600 | 2,146- |
| 1150 | SICK & ALLOWED PAY | 535 | 298 | 237 | 3,692 | 3,576 | 116 | 3,057 | 635 |
| 1160 | OTHER (CALL-OUT PRE) | | 116 | 116- | 1,347 | 1,392 | 45- | 1,524 | 177- |
| 1300 | CONTRACT LABOR & MTL | 10,201 | 35,270 | 25,069- | 456,046 | 418,994 | 37,052 | 465,194 | 9,148- |
| 1390 | TRVL & ENTERTAINMENT | | 644 | 644- | 151 | 7,728 | 7,577- | 5,116 | 4,965- |
| 1395 | MEALS/ENTERTAINMENT | | 165 | 165- | 24 | 1,980 | 1,956- | 1,311 | 1,287- |
| 1400 | ORDINARY SUPPLIES | 7,667 | 3,527 | 4,140 | 21,850 | 66,876 | 45,026- | 65,449 | 43,599- |
| 1410 | MAINTENANCE SUPPLIES | 39,741 | 62,615 | 22,874- | 681,030 | 805,706 | 124,676- | 788,924 | 107,894- |
| 1420 | MAINTENANCE TOOLS | 511 | 157 | 354 | 2,740 | 1,884 | 856 | 1,926 | 814 |
| 1430 | EXPENDABLE ITEMS | 11,473 | 7,764 | 3,709 | 92,289 | 93,168 | 879- | 97,205 | 4,916- |
| 1460 | MISCELLANEOUS | | 10 | 10- | | 120 | 120- | 77 | 77- |
| 1510 | OTH CHEMICALS | | | | | | | 5,748 | 5,748- |
| 1610 | DUES & SUBSCRIPTIONS | | 9 | 9- | | 108 | 108- | 84 | 84- |
| 1620 | FEES & TUITIONS | 42 | 106 | 64- | 399 | 1,272 | 873- | 2,313 | 1,914- |
| 1630 | PROFESSIONAL FEES | | | | | 3,570 | 3,570- | 9,153 | 9,153- |
| 1650 | RENTALS | 1,454 | 923 | 531 | 6,396 | 9,714 | 3,318- | 17,419 | 11,023- |
| 1730 | POND CLOSURER/CREDIT | | | | | | | | |
| 1960 | WAGE FRINGES | 9,164 | 14,255 | 5,091- | 123,520 | 165,193 | 41,673- | 139,423 | 15,903- |
| | DEPARTMENT TOTALS MAINTENANCE-MECH | 108,338 | 169,232 | 60,894- | 1,750,212 | 2,131,523 | 381,311- | 2,060,875 | 310,663- |

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COST REPORT BY DEPARTMENT

PRODUCTION

| NTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 100 | SALARIES | 21,255 | 23,168 | 1,913- | 247,327 | 337,389 | 90,062- | 235,672 | 11,655 |
| 110 | WAGES | 53,857 | 83,964 | 30,107- | 909,719 | 1,214,817 | 305,098- | 841,339 | 68,380 |
| 140 | HOLIDAY & VAC PAY | 12,007 | 5,503 | 6,504 | 76,902 | 66,036 | 10,866 | 66,206 | 10,696 |
| 150 | SICK & ALLOWED PAY | 812 | 707 | 105 | 13,643 | 8,484 | 5,159 | 12,301 | 1,342 |
| 160 | OTHER (CALL-OUT PRE) | 51 | 127 | 76- | 2,215 | 1,524 | 691 | 1,556 | 659 |
| 300 | CONTRACT LABOR & MTL | | 584 | 584- | 68,280 | 7,008 | 61,272 | 62,076 | 6,204 |
| 340 | NATURAL GAS | 22,130 | 25,791 | 3,661- | 331,810 | 380,242 | 48,432- | 318,650 | 13,160 |
| 350 | ELECTRICITY | 35,811 | 64,685 | 28,874- | 667,745 | 940,142 | 272,397- | 645,884 | 21,861 |
| 360 | WATER | 2,514 | 3,425 | 911- | 38,565 | 43,355 | 4,790- | 31,782 | 6,783 |
| 390 | TRVL & ENTERTAINMENT | | 8 | 8- | | 96 | 96- | 625 | 625- |
| 395 | MEALS/ENTERTAINMENT | | 4 | 4- | | 48 | 48- | 127 | 127- |
| 400 | ORDINARY SUPPLIES | 5,257 | 10,045 | 4,788- | 67,955 | 303,261 | 235,306- | 124,446 | 56,491- |
| 410 | MAINTENANCE SUPPLIES | 4,152 | 8,094 | 3,942- | 112,082 | 90,019 | 22,063 | 81,429 | 30,653 |
| 420 | MAINTENANCE TOOLS | | | | 288 | | 288 | | 288 |
| 440 | MISCELLANEOUS | | | | 2,900 | | 2,900 | | 2,900 |
| 470 | NITROGEN | 19,071 | 13,476 | 5,595 | 149,611 | 177,494 | 27,883- | 102,395 | 47,216 |
| 510 | OTH CHEMICALS | | 10 | 10- | 300- | 120 | 420- | 8,211 | 8,511- |
| 610 | DUES & SUBSCRIPTIONS | | | | | | | 381 | 381- |
| 630 | PROFESSIONAL FEES | | | | | | | | |
| 650 | RENTALS | 3,022 | 3,541 | 519- | 42,701 | 42,492 | 209 | 37,812 | 4,889 |
| 660 | LEASE ITEMS | | 86 | 86- | | 1,032 | 1,032- | 687 | 687- |
| 680 | FREIGHT IN (MISC.) | | | | 32,930 | | 32,930 | 2,067 | 30,863 |
| 960 | WAGE FRINGES | 24,241 | 28,779 | 4,538- | 371,275 | 391,563 | 20,288- | 290,816 | 80,459 |
| | DEPARTMENT TOTALS PRODUCTION | 204,200 | 271,997 | 67,797- | 3,135,648 | 4,005,122 | 869,474- | 2,864,462 | 271,186 |

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COST REPORT BY DEPARTMENT

RAW MATERIALS

| CONTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 1120 | PUR PRICE VARIANCE | 22,066- | | 22,066- | 182,450 | | 182,450 | 187,348- | 369,798 |
| 1520 | DBCB | 167,208 | 330,240 | 163,032- | 3,500,070 | 4,128,000 | 627,930- | 1,633,242 | 1,866,828 |
| 1530 | 99% SULFURIC ACID | 23,167 | 60,808 | 37,641- | 519,694 | 760,105 | 240,411- | 163,814 | 355,880 |
| 1540 | 98% NITRIC ACID | 24,569 | 49,444 | 24,875- | 539,283 | 618,048 | 78,765- | 279,893 | 259,390 |
| 1630 | BCA | | | | 960,433 | 978,750 | 18,317- | 9,410,856 | 8,450,423- |
| 1640 | PROPIONIC ACID | 34,916 | 106,920 | 72,004- | 986,454 | 1,407,780 | 421,326- | 1,062,036 | 75,582- |
| 1650 | PROPIONIC ANHYDRIDE | 6,187 | 46,980 | 40,793- | 587,322 | 618,570 | 31,248- | 408,231 | 179,091 |
| 1660 | MESITYL OXIDE | | 319,200 | 319,200- | 808,772 | 3,456,480 | 2,647,708- | 816,583 | 7,811- |
| 1670 | EMULSIFIER | 46,738 | 156,254 | 109,516- | 1,321,889 | 1,577,006 | 255,117- | 833,612 | 488,277 |
| 1675 | ARMUL | | | | | | | | |
| 1680 | ISOPHORONE | 157,559 | 131,010 | 26,549 | 3,247,375 | 1,246,674 | 2,000,701 | 1,934,351 | 1,313,024 |
| 1685 | TENNECO 500 | 3,323 | 38,500 | 34,977- | 138,290 | 284,900 | 146,610- | 252,753 | 114,463- |
| 1695 | NCPA | | | | 54,723 | | 54,723 | | 54,723 |
| 1850 | OTHER RAW MATERIALS | 39,453 | 63,649 | 24,196- | 866,811 | 1,387,568 | 520,757- | 747,846 | 118,965 |
| 1870 | PACKAGING MATERIALS | 6,474 | | 6,474 | 35,634 | | 35,634 | 3,602 | 32,032 |
| 1890 | CONTAINERS | 54,979 | 211,351 | 156,372- | 1,341,769 | 1,165,158 | 176,611 | 596,834 | 744,935 |
| | DEPARTMENT TOTALS RAW MATERIALS | 542,707 | 1,514,356 | 971,649- | 15,090,969 | 17,629,039 | 2,538,070- | 17,956,305 | 2,865,336- |

SOLVENTS: PETRO TENN 500
OTHER ISOPH
M.O.

TOXICANTS: SYN NONE → 240 BAD
ORGAN NONE

SURFACTANTS EMUL
ARMUL

ALL BALANCE

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COST REPORT BY DEPARTMENT

RESEARCH & DEVELOPMT

| ONTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 5100 | SALARIES | 5,565 | 4,583 | 1,018- | 75,349 | 78,996 | 3,647- | 66,947 | 8,402 |
| 5110 | WAGES | 502 | | 502 | 898 | | 898 | | 898 |
| 5200 | PAYROLL TAXES | 219 | 453 | 234- | 4,524 | 5,436 | 912- | 4,472 | 52 |
| 5240 | EMPLOYMENT EXPENSE | | | | | | | | |
| 5300 | CONTRACT LABOR & NTL | 497 | 373 | 124 | 2,524 | 4,476 | 1,952- | 3,519 | 995- |
| 5390 | TRVL & ENTERTAINMENT | | 82 | 82- | 349 | 984 | 635- | 648 | 299- |
| 5395 | MEALS/ENTERTAINMENT | | 8 | 8- | 20 | 96 | 76- | 107 | 87- |
| 5400 | ORDINARY SUPPLIES | 1,433 | 2,138 | 705- | 11,597 | 25,656 | 14,059- | 20,803 | 9,206- |
| 5410 | MAINTENANCE SUPPLIES | | 96 | 96- | 1,205 | 1,152 | 53 | 821 | 384 |
| 5610 | DUES & SUBSCRIPTIONS | | | | 158 | | 158 | | 158 |
| 5620 | FEES & TUITIONS | | | | | | | | |
| 5630 | PROFESSIONAL FEES | | | | 5,478 | | 5,478 | | 5,478 |
| 5960 | WAGE FRINGES | 232 | | 232 | 444 | | 444 | | 444 |
| | DEPARTMENT TOTALS RESEARCH & DEVELOPMT | 8,448 | 9,733 | 1,285- | 102,544 | 116,796 | 14,250- | 97,317 | 5,229 |

COST REPORT BY DEPARTMENT

SAFETY & SECURITY

| NTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 100 | SALARIES | 3,042 | 3,239 | 197- | 35,079 | 38,868 | 3,789- | 33,094 | 1,985 |
| 110 | WAGES | 9,189 | 13,638 | 4,449- | 101,334 | 163,656 | 62,322- | 102,699 | 1,365- |
| 140 | HOLIDAY & VAC PAY | 1,497 | 786 | 711 | 10,790 | 9,432 | 1,358 | 9,535 | 1,255 |
| 150 | SICK & ALLOWED PAY | | 10 | 10- | 946 | 120 | 826 | 76 | 870 |
| 160 | OTHER (CALL-OUT PRE) | | 34 | 34- | | 408 | 408- | 229 | 229- |
| 260 | MEDICAL EXAMS | 1,266 | 3,328 | 2,062- | 19,947 | 39,936 | 19,989- | 30,894 | 10,947- |
| 270 | BLOOD TEST | 107 | 796 | 689- | 4,168 | 9,552 | 5,384- | 6,409 | 2,241- |
| 280 | SAFETY SUPPLIES | 5,682 | 10,051 | 4,369- | 59,222 | 118,531 | 59,309- | 94,757 | 35,535- |
| 300 | CONTRACT LABOR & RTL | | 87 | 87- | 998 | 1,044 | 46- | 691 | 307 |
| 360 | WATER | | | | | | | 264 | 264- |
| 390 | TRVL & ENTERTAINMENT | | 60 | 60- | 110 | 720 | 610- | 536 | 426- |
| 400 | ORDINARY SUPPLIES | 2,567 | 520 | 2,047 | 24,121 | 6,240 | 17,881 | 7,826 | 16,295 |
| 610 | DUES & SUBSCRIPTIONS | | | | 1,534 | | 1,534 | | 1,534 |
| 620 | FEES & TUITIONS | | 105 | 105- | 135 | 1,260 | 1,125- | 828 | 693- |
| 960 | WAGE FRINGES | 4,245 | 4,553 | 308- | 42,137 | 54,636 | 12,499- | 37,016 | 5,121 |
| | DEPARTMENT TOTALS SAFETY & SECURITY | 27,595 | 37,207 | 9,612- | 300,521 | 444,403 | 143,882- | 324,854 | 24,333- |

COST REPORT BY DEPARTMENT

SHIPPING & PACKAGING

| INTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 890 | CONTAINERS | | | | | | | 4,157 | 4,157- |
| 100 | SALARIES | 2,183 | 2,383 | 200- | 26,186 | 16,033 | 10,153 | 22,331 | 3,855 |
| 110 | WAGES | 8,135 | 12,941 | 4,806- | 167,764 | 82,544 | 85,220 | 100,996 | 66,768 |
| 140 | HOLIDAY & VAC PAY | 1,678 | 961 | 717 | 9,544 | 11,532 | 1,988- | 8,966 | 578 |
| 150 | SICK & ALLOWED PAY | 61 | 161 | 100- | 1,126 | 1,932 | 806- | 1,630 | 504- |
| 160 | OTHER (CALL-OUT PRE) | | 75 | 75- | 816 | 900 | 84- | 580 | 236 |
| 390 | TRVL & ENTERTAINMENT | | | | 633 | | 633 | 242 | 391 |
| 395 | MEALS/ENTERTAINMENT | | | | 199 | | 199 | 92 | 107 |
| 400 | ORDINARY SUPPLIES | 2,713 | 531 | 2,182 | 28,903 | 6,862 | 22,041 | 34,460 | 5,557- |
| 410 | MAINTENANCE SUPPLIES | 4 | 891 | 887- | 6,552 | 10,459 | 3,907- | 7,454 | 902- |
| 460 | MISCELLANEOUS | 7,700- | | 7,700- | 7,700- | | 7,700- | | 7,700- |
| 650 | RENTALS | | | | 4,141 | | 4,141 | | 4,141 |
| 960 | WAGE FRINGES | 3,758 | 5,353 | 1,595- | 64,578 | 33,793 | 30,785 | 38,111 | 26,467 |
| | DEPARTMENT TOTALS SHIPPING & PACKAGING | 10,932 | 23,296 | 12,464- | 302,742 | 164,055 | 138,687 | 219,019 | 83,723 |

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COST REPORT BY DEPARTMENT

STORE & RECEIVING

| NTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 100 | SALARIES | 2,246 | | 2,246 | 13,546 | | 13,546 | | 13,546 |
| 110 | WAGES | 1,447 | 4,531 | 3,084- | 35,840 | 54,372 | 18,532- | 45,447 | 9,607- |
| 140 | HOLIDAY & VAC PAY | 575 | 341 | 234 | 3,576 | 4,092 | 516- | 5,242 | 1,666- |
| 150 | SICK & ALLOWED PAY | 51 | 11 | 40 | 51 | 132 | 81- | 87 | 36- |
| 160 | OTHER (CALL-OUT PRE) | 91 | 112 | 21- | 1,006 | 1,344 | 338- | 1,046 | 40- |
| 300 | CONTRACT LABOR & MTL | | | | 1,284 | | 1,284 | | 1,284 |
| 400 | ORDINARY SUPPLIES | | 708 | 708- | 7,743 | 8,496 | 753- | 6,768 | 975 |
| 410 | MAINTENANCE SUPPLIES | | 403 | 403- | 3,280 | 4,836 | 1,556- | 3,180 | 100 |
| 680 | FREIGHT IN (MISC.) | 698 | 1,630 | 932- | 14,562 | 19,560 | 4,998- | 17,216 | 2,654- |
| 960 | WAGE FRINGES | 668 | 1,741 | 1,073- | 14,662 | 20,892 | 6,230- | 16,582 | 1,920- |
| | DEPARTMENT TOTALS STORE & RECEIVING | 5,776 | 9,477 | 3,701- | 95,550 | 113,724 | 18,174- | 95,568 | 18- |

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COST REPORT BY DEPARTMENT

YARDS & GROUNDS

| NTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 100 | SALARIES | | | | | | | | |
| 110 | WAGES | 9,484 | 1,364 | 8,120 | 15,740 | 16,368 | 628- | 20,780 | 5,040- |
| 300 | CONTRACT LABOR & MTL | 417 | 5,658 | 5,241- | 20,435 | 67,896 | 47,461- | 46,032 | 25,597- |
| 400 | ORDINARY SUPPLIES | | 1,876 | 1,876- | 403 | 22,512 | 22,109- | 10,424 | 10,021- |
| 410 | MAINTENANCE SUPPLIES | | 1,659 | 1,659- | 470 | 19,908 | 19,438- | 13,620 | 13,150- |
| 650 | RENTALS | | 434 | 434- | | 5,208 | 5,208- | 3,439 | 3,439- |
| 960 | WAGE FRINGES | 4,381 | 664 | 3,717 | 7,440 | 7,968 | 528- | 10,323 | 2,883- |
| | DEPARTMENT TOTALS YARDS & GROUNDS | 14,282 | 11,655 | 2,627 | 44,488 | 139,860 | 95,372- | 104,618 | 60,130- |

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COST REPORT BY DEPARTMENT

WAREHOUSE

| INTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 1309 | CONTRACT LABOR & MTL | | | | 2,719 | | 2,719 | | 2,719 |
| 1410 | MAINTENANCE SUPPLIES | | 46 | 46- | 1,010 | 552 | 458 | 358 | 652 |
| 1650 | RENTALS | | | | 6,677 | | 6,677 | | 6,677 |
| | DEPARTMENT TOTALS WAREHOUSE | | 46 | 46- | 10,406 | 552 | 9,854 | 358 | 10,048 |

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COST REPORT BY DEPARTMENT

ALLOCATIONS & TBF

| NTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 910 | FIN GOODS PURCHASED | | | | 958,581 | | 958,581 | | 958,581 |
| 920 | FRT IN F.G.PURCHASED | | | | | | | | |
| 740 | TRANSFER TO F/G INV | 2,507,204- | 7,099,150- | 4,591,946 | 58,897,669- | 65,838,550- | 6,940,881 | 49,216,075- | 9,681,594- |
| 810 | PROPANIL TECH USED | 440,431 | 1,358,500 | 918,069- | 10,734,402 | 12,698,400 | 1,963,998- | 11,034,507 | 300,105- |
| 820 | PROPANIL 30 BULK USE | 57,282 | 330,000 | 272,718- | 2,032,657 | 2,442,000 | 409,343- | 2,584,579 | 551,922- |
| 825 | BTAM BULK USED | 745,767 | 2,535,000 | 1,789,233- | 10,278,954 | 12,252,500 | 1,973,546- | 3,430,569 | 6,848,385 |
| 830 | PROPANIL 4# BULK USE | | | | 3,079,709 | 1,014,000 | 2,065,709 | 3,214,625 | 134,916- |
| 835 | FLAKED TECH USED | 20,960 | | 20,960 | 580,614 | | 580,614 | | 580,614 |
| 840 | BCA USED | 262,365 | 855,000 | 592,635- | 8,072,555 | 10,616,250 | 2,543,695- | 2,597,164 | 5,475,391 |
| 900 | POWER | 35,811 | 64,685 | 28,874- | 667,747 | 938,576 | 270,829- | 645,877 | 21,870 |
| 960 | WAGE FRINGES | | | | | | | | |
| 980 | ALLC COST CENTER EXP | 2- | 1- | 1- | 1 | 12- | 13 | 4 | 3- |
| 990 | ALLC COST CENTER TBF | 239,544- | 336,001- | 96,457 | 3,696,500- | 4,216,706- | 520,206 | 3,399,227- | 297,273- |
| 999 | ALLOC PLT OVERHEAD | 143,001 | 202,891 | 59,890- | 2,221,204 | 2,434,692 | 213,488- | 2,084,754 | 136,450 |
| | DEPARTMENT TOTALS ALLOCATIONS & TBF | 1,041,133- | 2,089,076- | 1,047,943 | 23,967,743- | 27,658,850- | 3,691,105 | 27,023,223- | 3,055,478 |

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COST REPORT BY DEPARTMENT

COST OF REWORK

| NTROL | CONTROL DESCRIPTION | (----CURRENT MONTH AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (-----YEAR-TO-DATE AMOUNTS----) ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | (- - PRIOR YEAR - - -) ACTUAL COST | OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 100 | SALARIES | | | | 3,087 | | 3,087 | | 3,087 |
| 110 | WAGES | | | | 14,832 | | 14,832 | | 14,832 |
| 960 | WAGE FRINGES | | | | 6,010 | | 6,010 | | 6,010 |
| | DEPARTMENT TOTALS COST OF REWORK | | | | 23,929 | | 23,929 | | 23,929 |

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COST REPORT BY DEPARTMENT

SALES & COS

| NTROL | CONTROL DESCRIPTION | CURRENT MONTH ACTUAL COST | CURRENT MONTH SCHEDULED COST | CURRENT MONTH OVER/UNDER SCHED.COST | YEAR-TO-DATE ACTUAL COST | YEAR-TO-DATE SCHEDULED COST | YEAR-TO-DATE OVER/UNDER SCHED.COST | PRIOR YEAR ACTUAL COST | PRIOR YEAR OVER/UNDER PRIOR ACT. |
|---|---|---|---|---|---|---|---|---|---|
| 200 | SALES-PESTICIDES | 1,811,968- | 356,404- | 1,455,564- | 37,106,516- | 38,519,938- | 1,413,422 | 25,116,323- | 11,990,193- |
| 300 | TOLLING REVENUE | 258,409- | 474,000- | 215,591 | 8,584,549- | 10,300,000- | 1,715,451 | 6,869,339- | 1,715,210- |
| 400 | OTHER REVENUE | | | | 19,327- | | 19,327- | 25,174- | 5,847 |
| 600 | FREIGHT OUT | 4,070 | 3,636 | 434 | 215,514 | 319,637 | 104,123- | 143,895 | 71,619 |
| 610 | FREIGHT ALLOWANCES | 5,101 | | 5,101 | 39,113 | 33,932 | 5,181 | 21,493 | 17,620 |
| 620 | FREIGHT WHSE TRANSF | 2,510 | | 2,510 | 7,215 | | 7,215 | | 7,215 |
| 850 | O/S WAREHOUSE LEASE | 12,627 | 768 | 11,859 | 169,540 | 85,869 | 83,671 | 116,639 | 52,901 |
| 860 | WAREHOUSE ALLOWANCES | | | | | | | | |
| 100 | COST OF SALES @ STD | 1,339,031 | 292,000 | 1,047,031 | 25,605,979 | 26,658,050 | 1,052,071- | 17,705,505 | 7,900,474 |
| 140 | DEF MFG VARIANCE | | | | | | | | |
| 160 | FINISHED PROD. LOST | | | | 52,198 | | 52,198 | | 52,198 |
| 170 | PRODUCT COMPLAINT EX | | | | 11,777 | | 11,777 | 61,064 | 49,287- |
| 250 | START-UP COST | 7,045 | 12,983 | 5,938- | 298,299 | 155,796 | 142,503 | 295,068- | 593,362 |
| 260 | TASK FORCE EXPENSES | 50,512- | 66,666 | 117,178- | 635,068 | 799,992 | 164,924- | 755,379 | 120,311- |
| 910 | FIN GOODS PURCHASED | | | | | | | | |
| 638 | ROYALTIES | 91,893- | | 91,893- | 3,485,258 | 3,198,360 | 286,898 | | 3,485,258 |
| | DEPARTMENT TOTALS SALES & COS | 842,398- | 454,351- | 388,047- | 15,190,431- | 17,568,302- | 2,377,871 | 13,501,924- | 1,688,507- |

CEDAR CHEMICAL CORPORATION  LOCATION  West Helena  Page 1 of 2
CONSTRUCTION IN PROCESS  DATE  12/31/92
REVISED

| Project Description | Project Number | Spending: Prior to 1/1/92 | Spending: Current Year | Spending: Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over <Under> Budget |
|---|---|---|---|---|---|---|---|---|
| Propanil Scrubber Sys | 9207 | | 34,765 | 34,765 | 1,235 | 36,000 | | |
| Rplc Refrig Sys | 9209 | | 118,424 | 118,424 | 15,576 | 134,000 | | |
| DCA V-D316 Repairs | 9211 | | 31,072 | 31,072 | 312 | 18,110 | | |
| DCA V-D316 Repairs\Sup | 9211 | | | | | 12,650 | | |
| TFE Lined Pipe DCA | 9212 | | 58,764 | 58,764 | 5,966 | 64,730 | | |
| Prop Unit Upgrd-Ph I | 9213 | | 60,048 | 60,048 | | 58,300 | | |
| New Chg Rm | 9214 | | 196,531 | 196,531 | 23,469 | 220,000 | | |
| Prop Unit Upgrd-Ph II | 9216 | | 255,820 | 255,820 | | 248,000 | | |
| Rail Spur Drainage Imprv | 9217 | | 10,258 | 10,258 | 242 | 10,500 | | |
| DCA/Bottoms Drumming | 9218 | | 24,763 | 24,763 | 5,887 | 30,650 | | |
| Control Rm Press | 9220 | | 27,320 | 27,320 | 5,680 | 33,000 | | |
| API Separator | 9221 | | 20,523 | 20,523 | 17,477 | 38,000 | | |
| DuPont Perborate Proj-Ph | 9222 | | 89,092 | 89,092 | | 82,000 | | |
| Absorption Nitrogen Gener | 9223 | | 8,703 | 8,703 | 38,297 | 47,000 | | |
| UPS Sys For DCA | 9224 | | 4,454 | 4,454 | 1,546 | 6,000 | | |
| Allyl Chloride Strg Tk | 9225 | | 15,997 | 15,997 | | 10,000 | | |
| New Propanil Pkg Facility | 9226 | | 105,209 | 105,209 | 275,681 | 380,890 | | |
| DCA Srubber Mod | 9227 | | 6,838 | 6,838 | 5,517 | 12,355 | | |
| A & W - ADPA Proj | 9228 | | 116,656 | 116,656 | | 102,350 | | |
| Unit 4 - Control Room Upg | 9229 | | 47,723 | 47,723 | 11,277 | 59,000 | | |
| Drainage Imprv @ Lab | 9230 | | 9,366 | 9,366 | 134 | 9,500 | | |
| Envirn Drm Storage Cover | 9231 | | 6,500 | 6,500 | | 6,500 | | |
| TOTAL C I P | | | 1,248,826 | 1,248,826 | 408,296 | 1,619,535 | | |

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CEDAR CHEMICAL CORPORATION — LOCATION West Helena — Page 2 of 2

COMPLETED PROJECTS — DATE 12/31/92

REVISED

| Project Description | Project Number | Spending: Prior to 1/1/92 | Spending: Current Year | Spending: Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over <Under> Budget |
|---|---|---|---|---|---|---|---|---|
| Custom Mfg Unit | 9009 | | 2,369 | 2,369 | | | | |
| Centrifuge Speed Ctrl | 9109 | 139 | 6,780 | 6,919 | | 9,000 | | |
| Ofc Site Imprv | 9111 | 17,690 | 4,793 | 22,483 | | 21,700 | | |
| Dehpa Plt Mod | 9113 | 232,490 | 4,618 | 237,108 | | N/A | | |
| Cooling Water pump | 9114 | 12,105 | 33,955 | 46,060 | | 32,000 | | |
| Scrubber Tnk/Gls Reactor | 9117 | 58,690 | 0 | 58,690 | | 74,000 | | |
| 2 New Mass Flow Meters | 9118 | 18,900 | 16,551 | 35,451 | | 12,000 | | |
| DCA Wash Vessel Wgt | 9119 | 5,359 | 17,689 | 23,048 | | 20,300 | | |
| Plant Air Sys | 9120 | 10,082 | | 10,082 | | 12,000 | | |
| Brinkmann Particle Sizer | 9121 | | 31,655 | 31,655 | | 32,000 | | |
| DCA Nitric Piping | 9122 | | 19,711 | 19,711 | | 35,000 | | |
| Replace Agitator | 9123 | 6,101 | 5 | 6,106 | | 9,500 | | |
| Install New Agitator | 9124 | | 6,691 | 6,691 | | 7,000 | | |
| CTBL Plant Mod | 9125 | 520,819 | 33,672 | 554,491 | | N/A | | |
| Unit 1-Contrl Rm-Roof | 9201 | | 7,634 | 7,634 | | 7,500 | | |
| Lime System | 9202 | | 14,236 | 14,236 | | 14,000 | | |
| Secondary Dehydr Condenso | 9203 | | 9,798 | 9,798 | | 15,000 | | |
| R-PE108 Foundation Rplc | 9204 | | 12,314 | 12,314 | | 15,450 | | |
| Gas Chromatagraph | 9205 | | 24,710 | 24,710 | | 24,650 | | |
| RR Spur Culvert | 9206 | | 13,944 | 13,944 | | 16,000 | | |
| Lime Conveyor DCA | 9208 | | 9,093 | 9,093 | | 9,735 | | |
| Revamp Boiler Blowdown | 9210 | | 17,317 | 17,317 | | 21,000 | | |
| Unit 3 Sump Repairs | 9215 | | 7,200 | 7,200 | | 7,200 | | |
| Nitric Acid Scrubber | 9219 | | 8,713 | 8,713 | | 6,000 | | |
| Sub Total Completed | | 882,375 | 303,448 | 1,185,823 | | 401,035 | | |
| Total CIP & Completed Proj | | 882,375 | 1,552,275 | 2,434,650 | 408,296 | 2,020,570 | | |

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CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
REVISED COST

DATE 12/31/92

LOCATION West Helena

| | BALANCE 1/1/92 | ADDITIONS | RETIREMENTS | TRANSFER TO (FROM )CIP | TRANSFER <TO> FM OTHER PLANTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND | 67,260.00 | | | | | | 67,260.00 |
| LAND IMPROVEMENTS | 802,716.55 | | | | 36,426.86 | | 839,143.41 |
| BUILDINGS | 1,049,784.67 | | | | | | 1,049,784.67 |
| MACHINERY & EQUIPMENT | 19,485,774.16 | | | | 1,103,505.71 | | 20,589,279. |
| TRANSPORATION EQUIPMENT | | | | | | | |
| OFFICE EQUIPMENT | 103,297.42 | | | | 45,890.67 | | 149,188.09 |
| CIP | 882,375.98 | 1,552,274.65 | | | -1,185,823.24 | | 1,248,827.39 |
| TOTAL COST | 22,391,208.78 | 1,552,274.65 | | | | | 23,943,483.43 |

CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
ACCUMULATED DEPRECIATION

DATE 12/31/92

LOCATION West Helena

| | BALANCE 1/1/92 | CURRENT YEAR DEPRECIATION | RETIREMENTS | | TRANSFER <TO> FM OTHER PLANTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| LAND IMPROVEMENTS | 517,562.19 | 41,992.14 | | | | | 559,554.33 |
| BUILDINGS | 338,717.02 | 50,917.08 | | | | | 389,634.10 |
| MACHINERY & EQUIPMENT | 9,080,942.34 | 1,392,092.84 | | | | | 10,473,035.18 |
| TRANSPORTATION EQUIPMENT | | | | | | | |
| OFFICE EQUIPMENT | 71,433.60 | 10,176.98 | | | | | 81,610.58 |
| TOTAL ACCUMULATED DEPRECIATION | 10,008,655.15 | 1,495,179.04 | | | | | 11,503,834.19 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/92 SUMMARY INVENTORY PAGE 1

FINISHED GOODS VALUE REPORT CEDAR - WEST HELENA SINVRP

| PRODUCT GROUP DESCRIPTION | WH # | UNIT | QTY ON HAND | UNIT COST | EXTENDED VALUE | |
|---|---|---|---|---|---|---|
| DCA | 04 | LBS | 520,251 | 1.70 | 884,426.70 | |
| TOTAL DCA | | | 520,251 | 1.70 | 884,426.70 | * |
| WHAM | 04 | GAL | 80 | 9.93 | 794.40 | |
| WHAM | 10 | GAL | 6,800 | 9.93 | 67,524.00 | |
| WHAM | 86 | GAL | 120 | 9.93 | 1,191.60 | |
| WHAM | 88 | GAL | 4,840 | 9.93 | 48,061.20 | |
| TOTAL WHAM | | | 11,840 | 9.93 | 117,571.20 | * |
| PROPANIL TECH | 04 | GAL | 71,280 | 1.26 | 89,812.80 | |
| TOTAL PROPANIL TECH | | | 71,280 | 1.26 | 89,812.80 | * |
| PROPANIL 3# | 04 | GAL | 118,286 | 8.64 | 1,022,303.68 | |
| TOTAL PROPANIL 3# | | | 118,286 | 8.64 | 1,022,303.68 | * |
| PROPANIL 4# | 04 | GAL | 31,404 | 10.79 | 338,897.20 | |
| PROPANIL 4# | 10 | GAL | 55,405 | 10.44 | 578,428.20 | |
| PROPANIL 4# | 15 | GAL | 350 | 10.44 | 3,654.00 | |
| PROPANIL 4# | 88 | GAL | 140 | 10.44 | 1,461.60 | |
| TOTAL PROPANIL 4# | | | 87,301 | 10.57 | 922,401.00 | * |
| FLAKED TECH | 04 | LBS | 208,181 | .52 | 107,430.43 | |
| FLAKED TECH | 10 | LBS | 862,817 | 1.79 | 1,543,653.04 | |
| FLAKED TECH | 86 | LBS | 1,400 | 1.79 | 2,506.00 | |
| TOTAL FLAKED TECH | | | 1,072,398 | 1.54 | 1,653,589.47 | * |
| 50 WDG | 10 | LBS | 12,500 | 2.40 | 30,000.00 | |
| 50 WDG | 86 | LBS | 4,000 | 2.40 | 9,600.00 | |
| 50 WDG | 88 | LBS | 15,500 | 2.40 | 37,200.00 | |
| TOTAL 50 WDG | | | 32,000 | 2.40 | 76,800.00 | * |
| WHAM 80% | 04 | LBS | 1,260 | 1.87 | 2,356.20 | |
| TOTAL WHAM 80% | | | 1,260 | 1.87 | 2,356.20 | * |
| PROPANEX-4 | 04 | GAL | 48,020 | 9.88 | 474,437.60 | |
| TOTAL PROPANEX-4 | | | 48,020 | 9.88 | 474,437.60 | * |
| BUTOXONE | 10 | GAL | 4,032 | 11.28 | 45,480.96 | |
| BUTOXONE | 11 | GAL | 4,968 | 11.28 | 56,039.04 | |
| BUTOXONE | 20 | GAL | 15,508 | 11.28 | 174,930.24 | |
| BUTOXONE | 30 | GAL | 12 | 11.28 | 135.36 | |
| TOTAL BUTOXONE | | | 24,520 | 11.28 | 276,585.60 | * |
| BUTOXONE ESTER | 40 | GAL | 6,185 | 10.36 | 64,076.60 | |
| TOTAL BUTOXONE ESTER | | | 6,185 | 10.36 | 64,076.60 | * |
| BUTOXONE AMINE | 11 | GAL | 3,231 | 13.05 | 42,164.55 | |
| BUTOXONE AMINE | 20 | GAL | 3,861 | 13.05 | 50,386.05 | |
| BUTOXONE AMINE | 30 | GAL | 355 | 13.05 | 4,632.75 | |
| BUTOXONE AMINE | 57 | GAL | 3,575 | 13.05 | 46,653.75 | |
| TOTAL BUTOXONE AMINE | | | 11,022 | 13.05 | 143,837.10 | * |
| TOTAL FINISHED GOODS | | | | | 5,728,197.95 | ** |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/92 SUMMARY INVENTORY PAGE 2

RAW MATERIALS VALUE REPORT CEDAR - WEST HELENA SINVRP

| PRODUCT GROUP DESCRIPTION | WH # | UNIT | QTY ON HAND | UNIT COST | EXTENDED VALUE |
|---|---|---|---|---|---|
| PROPIONIC ACID | 04 | LBS | 69,840 | .33 | 23,047.20 |
| PROPIONIC ANHYDRIDE | 04 | LBS | 41,195 | .87 | 35,839.65 |
| ISOPHORONE | 04 | LBS | 57,006 | .65 | 37,053.90 |
| EMULSIFIER | 04 | LBS | 150,000 | .70 | 105,000.00 |
| TENNECO 500/100 | 04 | LBS | 29,657 | .17 | 5,041.69 |
| ARMUL 1287 EMULSIFIER | 04 | LBS | 12,160 | .82 | 9,971.20 |
| TM-2 EMULSIFIER | 04 | LBS | 35,790 | 1.65 | 59,053.50 |
| POLY SOLV DPM | 04 | LBS | 11,839 | .71 | 8,405.69 |
| MCPA-IOE | 04 | LBS | 4,780 | 1.78 | 8,508.40 |
| ODCB | 04 | LBS | 434,645 | .40 | 173,858.00 |
| SULFURIC ACID | 04 | LBS | 143,037 | .07 | 10,012.59 |
| NITRIC ACID | 04 | LBS | 134,232 | .14 | 18,792.48 |
| PLATINUM | 04 | TOZ | 29 | 375.00 | 10,875.00 |
| SODA ASH | 04 | LBS | 22,050 | .13 | 2,866.50 |
| LIME | 04 | LBS | 25,450 | .06 | 1,527.00 |
| PLATINUM/CARBON CATALYST | 04 | LBS | 860 | 75.00 | 64,500.00 |
| ISOPHORONE/MIBK BLEND | 04 | LBS | 45,692 | .58 | 26,501.36 |
| CAUSTIC 50% | 04 | LBS | 79,805 | .09 | 7,182.45 |
| CARBON BISULFIDE | 04 | LBS | 9,581 | .28 | 2,682.68 |
| MORPHOLINE | 04 | LBS | 5,520 | 1.06 | 5,851.20 |
| CANS-5 GAL | 04 | EACH | 162 | 3.47 | 562.14 |
| DRUMS-35 GAL--STAM | 04 | EACH | 605 | 17.49 | 10,581.45 |
| DRUMS--35 GAL-4# PROPANIL | 04 | EACH | 43 | 17.49 | 752.07 |
| DRUMS-55 GAL | 04 | EACH | 44 | 27.35 | 1,203.40 |
| SODIUM HYPOCHLORITE | 04 | LBS | 115,680 | .07 | 8,097.60 |
| JUGS-5 GAL WHAM UNIPACK | 10 | EACH | 291 | 2.55 | 742.05 |
| DOWFAX 3B2 | 86 | LBS | 2 | 7.02 | 14.04 |
| MORWET D-425 POWDER | 86 | LBS | 3,300 | .85 | 2,805.00 |
| POLYFON O | 86 | LB | 400 | .54 | 216.00 |
| GLYCERINE 96% | 86 | LB | 6,840 | .76 | 5,198.40 |
| ALFONIC 1412S | 86 | LBS | 15,648 | .82 | 12,831.36 |
| HI SIL 233 | 86 | LBS | 528 | .53 | 279.84 |
| KELZAN | 86 | LBS | 50 | 5.30 | 265.00 |
| VEEGUM | 86 | LBS | 1,000 | 1.74 | 1,740.00 |
| STEPSPERSE | 86 | LBS | 420 | 1.19 | 499.80 |
| NADEX 772 | 86 | LBS | 200 | .56 | 112.00 |
| CONTINENTAL CLAY | 86 | LBS | 280 | .06 | 16.80 |
| DRUMS-30 GAL PLASTIC | 86 | EACH | 62 | 17.95 | 1,112.90 |
| 2,4 D-B ACID | 20 | LBS | 44,080 | 4.98 | 219,518.40 |
| 2,4 D-B ACID | 57 | LBS | 7,160 | 4.98 | 35,656.80 |
| 60% DMA SOLUTION | 57 | LBS | 6,188 | .28 | 1,732.64 |
| CITRIC ACID | 57 | LBS | 2,940 | .87 | 2,557.80 |
| TOTAL RAW MATERIALS | | | | | 923,065.98 ** |

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TOTAL INVENTORY_CEDAR - WEST HELENA 6,651,263.93 **

[redacted]

## PROPANIL USED/PRODUCED

CEDAR WEST HELENA
PROPANIL PRODUCTION AND USAGE
AS OF Dec-92

CC: D Hoppel, B Christian, R Johns, R Fairchild, G Satterfield, J Wagner, B Oberle, J Walker, T Lodice, K Howard, M Pocrass, File Copy

| FINISH GOODS MFG | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Y-T-D | /# or G | Std |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DCA | | 519,641 | 738,352 | 909,031 | 969,189 | 968,467 | 782,113 | 570,145 | 456,103 | 595,343 | 616,423 | 355,935 | 390,586 | 7,851,348 | | |
| | ODCB | 690,146 | 787,054 | 1,022,717 | 1,095,168 | 1,178,122 | 893,152 | 578,664 | 514,470 | 708,770 | 685,481 | 415,889 | 450,139 | 9,019,772 | 1.1488 | 1.1850 |
| | Sulfuric Acid | 581,374 | 650,386 | 861,107 | 891,486 | 960,381 | 742,754 | 489,738 | 440,537 | 585,871 | 567,319 | 322,414 | 357,573 | 7,430,740 | 0.9464 | 0.9900 |
| | Nitric Acid | 279,549 | 328,892 | 443,917 | 467,295 | 506,179 | 389,097 | 238,550 | 230,183 | 312,189 | 298,599 | 168,579 | 189,311 | 3,852,320 | 0.4907 | 0.5050 |
| | Hydrogen | 25,861 | 34,654 | 42,617 | 47,276 | 53,080 | 39,360 | 29,574 | 17,417 | 30,871 | 30,141 | 15,377 | 19,671 | 385,699 | 0.0491 | 0.0500 |
| | Soda Ash | 6,550 | 17,100 | 11,850 | 13,900 | 24,050 | 15,500 | 14,650 | 4,150 | 10,850 | 10,850 | 6,100 | 14,800 | 150,350 | 0.0191 | 0.01[illegible] |
| | Lime | 15,100 | 22,200 | 22,600 | 23,400 | 27,850 | 22,500 | 13,200 | 13,250 | 15,600 | 17,000 | 9,350 | 11,500 | 213,550 | 0.0272 | 0.02. |
| | Plat/Carb Cata | 348 | 466 | 427 | 237 | 280 | 147 | 100 | 122 | 113 | 185 | 67 | 78 | 2,570 | 0.0003 | 0.0006 |
| | Caustic 50% | 7,735 | | 5,928 | | 6,140 | 21,712 | 20,067 | 4,928 | 26,069 | | 66,785 | 6,975 | 166,339 | 0.0212 | 0.0150 |
| | Morpholine | | | | | | | | | | 504 | 1,619 | 1,787 | 3,910 | 0.0005 | |
| Propanil Tech | | 901,290 | 853,200 | 1,548,430 | 1,426,930 | 1,643,690 | 849,440 | 605,000 | 781,260 | 717,290 | 555,755 | 262,840 | 289,940 | 10,435,265 | | |
| | F Tech | | 64,720 | 262,500 | 13,500 | | | | | | | | | 340,720 | | |
| | DCA | 694,324 | 614,010 | 1,034,640 | 1,035,810 | 1,218,030 | 645,531 | 449,710 | 585,600 | 523,162 | 411,380 | 209,400 | 198,930 | 7,620,727 | 0.7549 | 0.7500 |
| | P. Acid | 289,339 | 269,877 | 446,394 | 410,310 | 491,604 | 260,520 | 186,942 | 211,504 | 230,240 | 167,102 | 105,651 | 105,805 | 3,175,088 | 0.3145 | 0.3600 |
| | P. Anhy | 58,766 | 50,480 | 83,302 | 58,128 | 133,900 | 108,108 | 31,631 | 44,826 | 42,280 | 32,440 | 24,113 | 7,111 | 675,083 | 0.0669 | 0.0600 |
| 3# Bulk | | | | | | | 134,887 | 19,517 | 1,281 | 34,387 | 76,595 | 17,063 | 9,165 | 292,895 | | |
| | P. Tech | | | | | | 420,280 | 59,670 | 16,770 | 108,370 | 239,730 | 53,360 | 27,680 | 923,860 | 3.1542 | 3.2000 |
| | Isoph | | | | | | 259,102 | 34,770 | | 65,600 | 144,090 | 31,980 | 13,930 | 549,472 | 1.8760 | 1.5200 |
| | Tenn 500 | | | | | | 382,256 | 52,640 | | 93,232 | 217,878 | 46,740 | 20,723 | 813,469 | 2.7773 | 3.0800 |
| | Armul | | | | | | 138,382 | 18,770 | 300 | 29,463 | 67,114 | 15,731 | 7,382 | 277,142 | 0.9462 | 0.8600 |
| 4# Bulk | | 70 | | 104,860 | 134,460 | 124,003 | 53,016 | | | | 33,939 | 13,941 | | 464,289 | | |
| | P. Tech | | | 435,300 | 524,965 | 503,510 | 189,650 | | | | 138,530 | 56,720 | | 1,848,675 | 3.9817 | 4.2000 |
| | Isoph | | | 81,830 | 105,290 | 106,662 | 34,260 | | | | 26,200 | 9,890 | | 364,132 | 0.7843 | 0.7000 |
| | M. O. | | | 320,915 | 411,940 | 396,092 | 136,830 | | | | 102,860 | 45,070 | | 1,413,707 | 3.0449 | 3.04 |
| | Emul | | | 89,560 | 120,000 | 115,585 | 33,110 | | | | 30,620 | 12,533 | | 401,408 | 0.8646 | 0.89[illegible] |
| Stam Bulk | | 219,271 | 205,758 | 159,128 | 198,016 | 266,454 | 15,787 | | | | | 39,468 | 66,948 | 1,170,830 | | |
| | P. Tech | 901,290 | 788,480 | 661,840 | 768,110 | 1,159,480 | 63,620 | | | | | 158,200 | 282,270 | 4,783,290 | 4.0854 | 4.3000 |
| | F Tech | | 40,280 | | | | | | | | | | | 40,280 | 0.0344 | |
| | Isoph/Mibk | 855,778 | 811,032 | 618,630 | 753,821 | 1,056,097 | 60,442 | | | | | -29,040 | 254,768 | 4,381,528 | 3.7422 | |
| | Isoph | | | | | | | | | | | 100,579 | 1,137 | 101,716 | 0.0869 | 3.6460 |
| | Emul | 184,261 | 192,147 | 153,230 | 167,729 | 251,246 | 13,550 | | | | | 35,455 | 58,122 | 1,055,740 | 0.9017 | 0.8990 |
| | Mibk | | | | | | | | | | | 44,640 | | 44,640 | 0.0093 | |
| Stampede | | | | 24,915 | -2,313 | | | | | | | | | 22,602 | | |
| | P. Tech | | | 72,610 | | | | | | | | | | 72,610 | 3.2125 | 3.1270 |
| | Isoph | | | 44,330 | | | | | | | | | | 44,330 | 1.9613 | 2.1130 |
| | TM-2 Emul | | | 42,870 | | | | | | | | | | 42,870 | 1.8967 | 1.8000 |
| | PolySolv | | | 10,550 | | | | | | | | | | 10,550 | 0.4666 | 0.4500 |
| | MCPA | | | 29,760 | | | | | | | | | | 29,760 | 1.3167 | 1.5100 |



AB0000078182/134

## PROPANIL USED/PRODUCED

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flaked Tech | | | | 27,055 | | 148,500 | 309,000 | 253,500 | 148,500 | 58,255 | | | 944,810 | | |
| | P. Tech | | | 27,055 | | 148,500 | 309,000 | 253,500 | 148,500 | 58,255 | | | 944,810 | 1.0000 | 1.0000 |
| Wham | | | | | | | | | | | | | | | |
| | Wham-Rew | | | | | | | | | | | | | | |
| | F Tech | | | | | | | | | | | | | | 4.1500 |
| | Morwet D-425 | | | | | | | | | | | | | | 0.4850 |
| | Polyfon O | | | | | | | | | | | | | | 0.0194 |
| | Glycerine 96% | | | | | | | | | | | | | | 0.2425 |
| | Alfonic 1412S | | | | | | | | | | | | | | 0.3380 |
| | Ketzan | | | | | | | | | | | | | | 0.0049 |
| | Veegum | | | | | | | | | | | | | | 0.0873 |
| Wham DF | | | | | | | | | | | | | | | |
| | F Tech | | | | | | | | | | | | | | 0.50 |
| | Other r/m | | | | | | | | | | | | | | |
| 60 DF | | | | | | | | | | | | | | | |
| | F Tech | | | | | | | | | | | | | | 0.8000 |
| | Other r/m | | | | | | | | | | | | | | |
| Wham 80% | | | | 130,850 | | | | | | | | | 130,850 | | |
| | F Tech | | | 105,989 | | | | | | | | | 105,989 | 0.8100 | 0.8100 |
| | Other r/m | | | | | | | | | | | | | | |
| FINISH GOODS PKG (Number Containers ) | | | | | | | | | | | | | | | |
| | 3# 20L | | | 500 | | 102 | 25,337 | 500 | 1,931 | | | 720 | 1,070 | 30,160 | |
| | 3# 200L | | | -51 | | -10 | | 89 | -248 | 744 | 1,369 | 29 | 56 | 1,978 | |
| | 3# 55 | | | | | | | 216 | | 233 | 88 | 213 | | 750 | |
| | 4# 35 | 2 | | 1,754 | 1,241 | 4,035 | 1,557 | | | | | | | 8,589 | |
| | 4# 55 | | | | | | | | | | | | | | |
| | Propanex 4# 35 | | | 1,242 | | | | | | | 687 | 681 | | 2,610 | |
| | Stam 35 | 6,090 | 5,833 | 6,020 | 7,673 | 6,303 | 1,276 | | | | 423 | 152 | 2,438 | 36,208 | |
| | Wham 5 | | | | | | | | | | | | | | |
| | Wham 30 | | | | | | 638 | | 230 | | | | | 868 | |
| | 175 4x1 | 78 | | | 1,404 | 6,000 | | | | | | | | 7,482 | |
| | 175 2x2.5 | 2,113 | | | | | | | | | | | | 2,113 | |
| | 200 4x1 | 2,500 | | | | 1,042 | | | | | | | | 3,542 | |
| | 200 2x2.5 | | | | | 2,017 | | | | | | | | 2,017 | |
| | 200 55 | | | | | 4 | | | | | | | | 4 | |
| | Ester gls | | | | | | | | | | | | | | |
| | Wham DF 40# | | | | | | | | | | | | | | |
| | 60 DF 35# | | | | | | | | | | | | | | |
| | 60 DF 33.33# | | | | | | | | | | | | | | |
| | 60 WDG 35# | | | | | | | | | | | | | | |
| | Wham 80DF 50# | | | | | | | | | | | | | | |
| | Flaked Tech 25Kg | 1,839 | | | | | | | | 1,711 | | 2,160 | 317 | 6,027 | |



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PLANT OVERVIEW

WEST HELENA PLANT - DECEMBER 1988

1.Ø Financial - Plant income for the month was $244M versus budget of <$121M>, which includes picking up $28ØM of accrued task force expense from Propanil. YTD income was $2158M versus budget of $1ØØØM. Plant spending for the month was $416M versus YTD average of $414M. This reflects operation of three units with staffing for two and start up of two processes.

2.Ø Operations - 1. Propanil - production of Cedar 4 began with a change in formulation from the previously agreed all M.O. to 8Ø/2Ø M.O./isophorone used for the 1988 season. The rental flaker was installed and started up and has operated very well. 2. ICIA - plant operated with no major problems. The contract was extended on a daily rate basis for the first quarter of 1989. 3. MBC - this project for DuPont was started up after some plant modications. After a successful start the operation was slowed due to failure of one of the product dryers.

3.Ø Personnel - plans were completed for reduction of manpower to a two unit operation level. This will incur high overtime costs through December and at least the first quarter 1989 to cover the required three process operation requirements. The safety record continued to be good, ending the year with no lost time and only seven recordable accidents. The annual Christmas parties were a success with attendance by several Memphis office employees.

4.Ø Technical - 1. Engineering - major efforts were Grace capital review, Propanil flaker installation and start up, and MBC plant modification and start up. 2. Environmental - A. The RCRA closure plan as implemented under the consent order was accepted by ADPCE. We will operate as a generator only facility once our part B application is denied; B. A new double wall waste storage tank was oredered to comply with new regulations for 1989; and C. Most of the MBC waste water is being treated in the bio ponds.

**CEDAR INTERNAL CORRESPONDENCE**

2

DATE: 1/17/89

TO: John Miles

FROM: Russell Fairchild

CC:

SUBJECT: Monthly Operations Report: December, 1988

1.0 ICIA

| Production | Permethrin | Cypermethrin | PACL |
|---|---|---|---|
| MTD | 28,564 | 266,487 | 6,309 |
| YTD | 1,296,514 | 1,848,690 | 146,853 |

Permethrin was produced from 12/1 to 12/3. Cypermethrin was produced from 12/5 to 12/31. There was a quality problem with batch K128180E. A drum of PBA instead of PBALD raw material was charged during production. Disposition of this material is being considered by ICIA at this time. Most all parameters were out of spec.

2.0 Propanil

| Production | Tech-lbs | SREL-gal | 4 lb-gal | Flake-lbs for Wham |
|---|---|---|---|---|
| MTD | 432,480 | 0 | 66,395 | 126,357 |
| YTD | 5,144,490 | 0 | 635,551 | 126,357 |

Raw Mtrl. Use - #/# - Tech

| | DCA | Acid | Anhyd. |
|---|---|---|---|
| MTD | .855 | .353 | .051 |
| YTD | .759 | .351 | .055 |
| STD | .76 | .384 | .073 |

Propanil production continued through the month. No quality problems were experienced with any of the products in this unit. The flaker was installed and some minor control problems were experienced. These problems have been ironed out and preparations are in process for the full sized unit. Estimated rate for the present flaker is now at 5500 #/day.

3.0 DuPont

| Production | #MBC |
|---|---|
| MTD | 15,657 |
| YTD | 15,657 |

The MBC process began 12/15/88. The first six batches were in spec. Batches 7, 8, & 9 were out of spec. due to high chloride and low assay. The main problem encountered with these batches was the wash on the filter belt. In order to reach a maximum production rate, operations sped up the filter process. A standard speed of about 4 hrs. for filtering has been determined to give in spec product. Batches 7, 8 & 9 were filtered in less than 3 hours.

The daily production average for December was 1,819 lbs. This includes 1 day down time during the holiday. Dryer DN601 on 12/22 experienced 6 days down time due to bearings being changed out on the dryer agitator, limiting production with DN602. The overall average to date is 2,757 lbs. and the daily rate is 5,100 lbs. with both dryers in service.

4.0 Or-Cal - Sectagon

| | |
|---|---|
| MTD | 0 |
| YTD | 499,631 |

No production this month.

4

**CEDAR INTERNAL CORRESPONDENCE**

DATE: January 19, 1989

TO: John Miles

FROM: Charlie Parker

CC: Accounting

SUBJECT: Purchasing Recap for December, 1988

1.0 Storeroom

| | |
|---|---|
| Beginning Inventory | 299,645.03 |
| Issues & Adjustments | 29,187.97 |
| Purchases & Adjustments | 39,818.16 |
| Ending Inventory | 310,275.20 |

2.0 Purchasing

Propanil

Began 4# production using 100% M.O. formulation. Changed to 80/20 formulation on 12/8. Will rework 292 drums of flammable formulation. Will begin production of STREL in January, when we run out of M.O. Began flaking Propanil Tech on 12/9 and shipped 3 T/L to Red Panther. WHAM is scheduled to start in mid January in Clarksdale.

DuPont

Production began 12/16/88. Had numerous mechanical problems. Raw materials were received with little problems.

**CEDAR INTERNAL CORRESPONDENCE**

5

DATE: January 16, 1989

TO: John Miles

FROM: Tom Lodice

CC:

SUBJECT: December Engineering Report

Grace Project

A capital cost estimate for the project was prepared by Delta Process Management in order to reflect the changes incorporated into the project since last March. The total capital cost was then estimated to be $3.8 million, a 41% increase over the March estimate. This cost increase was primarily due to additional process equipment and waste treatment facilities beyond the scope of the original estimate. A meeting was held at the West Helena plant with Delta Process in order to review the P&ID's and remove all non-essential equipment in an attempt to conserve capital. A second meeting was held at Delta Process Management on December 29 in order to review the revised P&ID's and capital cost estimate in preparation for a review meeting with Grace on January 5th and 6th. As a result of the "cost-cutting" meetings, the capital cost was estimated to be $3,061,000, a 13% increase over the March estimate. A total of $180,000 was a result of additional distillation equipment added by Grace and much of the additional cost increase was a result of rising stainless steel prices.

DuPont MBC

Construction work was completed in the Diphone unit in preparation for the production of MBC for DuPont. The construction cost was estimated to be $50,000, however, it ended up costing approximately $101,000, primarily due to scope changes by DuPont ($26,000) and repairs to the unit resulting from Diphone production ($22,000).

Production was begun on December 16 and proceeded with relative ease until the gear reducer on one of the dryers broke. Once the gear reducer was repaired, production continued for 4 days until the dryer broke again as a result of agitator bearing failures. Through the end of December, a total of 20,599 lbs. of MBC were produced.

Propanil

Following verbal approval of the Flake CAR, the flaker was ordered from Sandvik. The approval drawings were submitted to Sandvik on December 6 and a check request for the initial 30% payment was prepared at that time.

A delivery date for the flaker has not been determined yet because Sandvik has not yet received the 30% payment.

The rental flaker unit was started up on December 8 and has performed extremely well with a daily production rate of approximately 5500 lbs.

The new DCA tank was received and installed on December 19. Insulation work was started later that week and maintenance expects to get the tank into service by mid January.

Other Projects

The mechanical installation of the emergency power generator and building was completed in December. The instrument department should begin to wire up the unit next month. It is anticipated that the project will be complete in 60 days.

A replacement double-walled wastewater tank has been ordered in order to comply with new EPA regulations which will go into effect on January 19. The tank is expected to arrive during the first week of February.

Goals for January

Begin Sectagon production.
Achieve steady production in MBC unit.
Begin installation of new flaker system.

**CEDAR INTERNAL CORRESPONDENCE**

DATE: January 9, 1989

TO: J.H. Miles

FROM: J.E. Porter

CC: T.J. Lodice
G. Satterfield

SUBJECT: Environmental Report
December 1988

A summary report of all waste shipped off-site in 1988 for disposal is attached. The report includes NPDES discharges of treated effluent and stormwater.

Closure Plan/Consent Order

Our Closure Plan as implemented was accepted by ADPC & E in December. This satisfies that portion of the Consent Order. We must still maintain our facility to meet Interim Status Standards of a Treatment-Storage-Disposal facility until ADPC&E denies our Part B application.

Accumulation Tank

The tanks used for accumulation of waste from the ICIA unit will cease to be used on or about Jan 12, 1989 in compliance with the Federal Regulations. A double-walled tank meeting requirements for accumulation of hazardous waste is due for installation the first week in February.

Treatment System

The MBC wastewater is being treated in our biological treatment system. To date, it appears to respond well. This will be evaluated on a week to week basis. DuPont has provided us with a sufficient number of railcars to handle the stream should we become overloaded. The two critical items are chloride and organic loading. Chloride has been diluted with the wet weather and a problem with the cooling towers losing water, but with Propanil running the organic loading may lead to problems.

J Porter

L
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| Summary Report: Waste Disposal - 1988 | | | | | | January 10, 1989 J.E. Porter | |
|---|---|---|---|---|---|---|---|
| | Outfall 001 Stormwater | Outfall 002 Final | Permethrin Unit | | Cypermethrin Unit | | |
| | Gallons | Gallons | Pounds | Gallons | Pounds | Gallons | |
| January | 0 | 1,204,464 | 3,298,100 | 372,028 | 416,580 | 46,567 | |
| February | 0 | 799,514 | 1,273,380 | 141,761 | 1,716,520 | 193,228 | |
| March | 100,000 | 1,050,308 | 1,675,200 | 186,848 | 1,978,800 | 221,119 | |
| April | 280,000 | 512,136 | 1,240,380 | 137,305 | 2,104,620 | 233,183 | |
| May | 140,000 | 1,294,096 | 1,564,740 | 172,698 | 1,003,920 | 111,665 | |
| June | 0 | 1,077,976 | 1,252,000 | 138,351 | 781,720 | 85,816 | |
| July | 0 | 323,164 | 1,831,100 | 203,320 | 92,000 | 10,110 | |
| August | 0 | 1,142,512 | 0 | 0 | 1,646,700 | 184,316 | |
| September | 0 | 1,757,936 | 1,460,200 | 161,995 | 567,100 | 62,095 | |
| October | 0 | 1,267,380 | 632,220 | 69,842 | 1,516,200 | 168,472 | |
| November | 140,000 | 810,888 | 2,566,100 | 283,301 | 561,300 | 61,907 | |
| December | 0 | 830,148 | 370,000 | 41,111 | 2,186,200 | 243,139 | |
| Totals | 660,000 | 12,070,522 | 17,163,420 | 1,908,560 | 14,571,660 | 1,621,617 | |

| | Diphone Unit | | Phillips CO-300 | | Phillips MES | | Other |
|---|---|---|---|---|---|---|---|
| | Pounds | Gallons | Pounds | Gallons | Pounds | Gallons | |
| January | | | | | | | DNOC 5740# |
| February | | | | | | | |
| March | 716,920 | 84,363 | | | | | |
| April | 932,600 | 107,721 | | | | | |
| May | | | 189,160 | 20,849 | | | |
| June | 569,620 | 62,440 | 93,520 | 10,523 | | | SCI Btms |
| July | 571,080 | 64,303 | 86,140 | 10,083 | | | 18 Drums Hazardous |
| August | | | | | | | Waste |
| September | 79,860 | 9,395 | | | | | |
| October | | | | | | | |
| November | | | | | 953,180 | 98,129 | |
| December | | | | | | | |
| Totals | 2,870,080 | 328,222 | 368,820 | 41,455 | 953,180 | 98,129 | |

**CEDAR INTERNAL CORRESPONDENCE**

DATE: 1/12/89

TO: John Miles

FROM: Joe Forthman

CC:

SUBJECT: Monthly Report for December 1988

#51 Overhead

Made repairs to the plant's air pumps, and made hook ups necessary to clean reactors in the P-10 unit. Repaired eye wash, outside of 30% caustic tank wall. Made repairs to the front breakroom floor. Made repairs to the #1 & #2 drum snatchers. Made checks on plant rolling equipment. Did routine maintenance and completed 6 orders.

#22 Effluent

Removed both river pumps and cleaned out debre that was stopping up suction lines.

#54 Propanil

Cleaned out bottom stage, put new vanes in, put new gasket in the exhaust line and repaired the oiler on R-1 Vac. pump. Welded up a leak in the DCA charge line to the unit. Cleaned top and bottom stages and replaced the vanes in R-3 vac. pump. Replaced the Dan Foss water control valve on R-1 vac. pump. Welded up a leak in the line from the bottom of R-2 column to the reactor. Made repairs to the Isophorone line and put devcon on a hole in the good acid pot. Replaced a section of 2" pipe on the R-1 header. Did routine maintenance and completed 26 work orders.

#89 DuPont

Installed the gate and iris valves on the bottom of DN601. Added packing to both dryers and made ready for start-up of DuPont. remodified the scraper at the end of the filter belt. Made repairs to PN103 A and B. Installed rota meters in the filter wash line and in the pond line from TB103. Replaced the shear pin in DN601 and inspected the inside for obstructions. Made repairs to the P.H. loop. Did routine maintenance, and completed 58 work orders.

#90 Permethrin

Made repairs to the R-3 vacumn jets and flushed salt from the flow line to the top of the scrubber column. Put blades back on R-1 agitator and drilled hole in key way to secure the blades and hub to the shaft. Traced and insulated the 50% caustic meter. Built and installed a new wooden door on the west end of the hot house. Replaced R-7 vac. pump exhaust check valve and exhaust block. Boarded up 3 trucks for shipments. Did routine maintenance, and completed 31 work orders.

**CEDAR INTERNAL CORRESPONDENCE**

DATE: January 17, 1989

TO: John Miles

FROM: Greg Satterfield

CC:

SUBJECT: Laboratory Monthly Report for December, 1988

ICI

During December there were both cypermethrin and permethrin technicals produced for ICI Americas. There were 28 batches of "K" cypermethrin produced with an average purity of 92.0%. There was one "N" batch produced with a purity of 93.3%. There was 1 batch out of specification which is not suitable for rework or reblending. The material was 38.3% purity cypermethrin. The permethrin produced consisted of 3 batches which had an average purity of 92.9%. There was one batch produced with a 3.0% PBA and this material has been reblended.

Propanil

During December there were 35 batches of Propanil Tech produced with an average assay of 97.4% 3,4 Propanil. There were 13 batches flaked, 21 batches formulated into 4 lb. Propanil and 1 batch of Stam. The 4 lb. Proapnil produced averaged 3.99 lb/gallon Propanil with an average assay of 45.3%.

DuPont

During December, production began of MBC for DuPont. There were 9 batches produced with an average assay of 98.3% active. Three of the 9 batches were off-spec. due to a variety of mechanical problems. The Nacl % was high due to filter belt problems and there was a proportionate decrease in the MBC assay due to filtrate contamination.

Environmental

During December there were 830,148 gallons of treated water discharged to the Mississippi per our permit parameters.

Safety

There were no accidents, near misses or safety violations reported during December.

Objectives for January

1. Sectagon start-up
2. MBC process improvement
3. Hazardous drum assessments
4. Ziram process parameter

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**CEDAR INTERNAL CORRESPONDENCE**

DATE: January 9, 1989

TO: John Miles

FROM: Janice Spakes

CC:

SUBJECT: December Personnel Report

Staffing

With the recall of two packaging employees, staffing was at 73 for year-end. However, the two recalled employees will be classified as seasonal employees and one employee (maid) is part-time, leaving permanent full time staffing at 70.

Several factors, namely, production workload, two operators on STD and heavy vacation schedule, created understaffing problems in December. This was a contributing factor to high overtime cost for the month.

With ICI extending production through March and plans to reduce permanent staffing more in January, the understaffing situation will continue for several months.

According to present schedule for last half of year, the understaffing is a temporary problem and workload will be covered with present staffing which will require some overtime, especially in Production.

Overtime

Overtime was up to 19% for December. Several factors contributed to this high overtime.

1) Holiday & vacation coverage
2) Understaffing in production for three unit production by 3 operators. (Two operators on short-term disability, and short 1 operator on staffing for three units).
3) Maintenance and production departments also had high overtime for DuPont and Flaked Propanil start-ups.
4) Standard overtime for sixth-day & shower time increased with increase in production schedule.

Standard overtime was at 10.8% for shower time, sixth day, safety meetings and holiday & vacation coverage.

Other overtime was 8.2%. Start-up for DuPont and Flaked Propanil and having three units running accounted for 6.7% of this.

With start-ups complete and holiday and vacation schedule light, February should be lower but overtime will be necessary to meet production schedule with present staffing.

Insurance

Insurance claims for December totaled $17694.20 We will also need to accrue another $30,000 for year end claims to cover outstanding claims in process.

General

Employee Christmas Party was big success. Several guest from our Memphis office added to the holiday celebration.

With new year beginning, I will concentrate on setting up new files and records in January.

PERSONNEL REPORT

WEST HELENA

December 1988

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STAFFING

| | ACTUAL STAFFING | NEW HIRES THIS MONTH | PRIOR MONTH'S ACTUAL STAFFING | TERMINATIONS THIS MONTH | TOTAL MINORITY |
|---|---|---|---|---|---|
| OFFICIAL/MANAGERS | | | | | |
| Administration | 1 | 0 | 1 | 0 | 0 |
| Plant Supervisors | 10 | 0 | 10 | 0 | 0 |
| Department Heads | 3 | 0 | 3 | 0 | 0 |
| Sub Total | 14 | 0 | 14 | 0 | 0 |
| PROFESSIONALS | | | | | |
| Chemists | 1 | 0 | 1 | 0 | 0 |
| Engineers | 4 | 0 | 4 | 0 | 0 |
| Other | 1 | 0 | 1 | 0 | 0 |
| Accountants | 0 | 0 | 0 | 0 | 0 |
| Sub Total | 6 | 0 | 6 | 0 | 0 |
| TECHNICIANS | | | | | |
| Lab | 7 | 0 | 7 | 0 | 1 |
| Other | 0 | 0 | 0 | 0 | 0 |
| Sub Total | 7 | 0 | 7 | 0 | 1 |
| OFFICE/CLERICAL | | | | | |
| Secretaries | 2 | 0 | 2 | 0 | 0 |
| Clerks | 2 | 0 | 2 | 0 | 0 |
| Other | 0 | 0 | 0 | 0 | 0 |
| Sub Total | 4 | 0 | 4 | 0 | 0 |
| SKILLED | | | | | |
| Mechanics | 12 | 0 | 12 | 0 | 2 |
| Other | 14 | 0 | 14 | 0 | 3 |
| Sub Total | 26 | 0 | 26 | 0 | 5 |
| OPERATION | | | | | |
| Operators | 7 | 0 | 7 | 0 | 1 |
| Other | 4 | 2 | 2 | 0 | 4 |
| Sub Total | 11 | 2 | 9 | 0 | 5 |

PERSONNEL REPORT

WEST HELENA

December 1988

16

STAFFING

| | ACTUAL STAFFING | NEW HIRES THIS MONTH | PRIOR MONTH'S ACTUAL STAFFING | TERMINATIONS THIS MONTH | TOTAL MINORITY |
|---|---|---|---|---|---|
| UNSKILLED | | | | | |
| Labor (Maid) | 1 | 0 | 1 | 0 | 1 |
| Other | 0 | 0 | 0 | 0 | 0 |
| Sub Total | 1 | 0 | 1 | 0 | 1 |
| | (Part Time) | | | | |
| SERVICE | | | | | |
| Other | 4 | 0 | 4 | 0 | 2 |
| Guards | 0 | 0 | 0 | 0 | 0 |
| Sub Total | 4 | 0 | 4 | 0 | 2 |
| SALES | 0 | 0 | 0 | 0 | 0 |
| Sub Total | 0 | 0 | 0 | 0 | 0 |
| TOTAL | *73 | *2 | 71 | 0 | 14 |
| | | (seasonal) | | | |

*Staffing includes 2 seasonal packaging employees

SAFETY

| | | CURRENT MONTH | LAST MONTH | 1988 YEAR TO DATE |
|---|---|---|---|---|
| Man Hours Worked | Hourly | 7,824 | 6,805 | 110,133 |
| | Salary | 2,837 | 3,074 | 40,598 |
| Total First Aid Cases Non-Recordable | | 1 | 1 | 12 |
| *Total First Aid Cases Recordable | | 0 | 0 | 7 |
| *Total Cases (Lost Time) | | 0 | 0 | 0 |
| Work Days Lost | | 0 | 0 | 0 |
| Severity Rate | | 0 | 0 | 0 |
| Frequency Rate | | 0 | 0 | 0 |
| Incident Rate | | 0 | 0 | 9.3 |

*Explantion necessary as to why the incident took place and steps taken to prevent a reocurrance. (Attached)

GENERAL

New Hires 2 Lay-Offs 0

Terminations 0 Turnover Rate 0

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VERTAC CONSOLIDATED
DIVISION: WEST HELENA PLANT
SUMMARY: OCCUPATIONAL INJURIES & ILLNESSES

| OCCUPATIONAL INJURIES & ILLNESSES (RECORDABLE) | NUMBER OF CASES | NUMBER DAYS LOST | MANHOURS WORKED | FREQUENCY RATE | SEVERITY RATE | INCIDENT RATE |
|---|---|---|---|---|---|---|
| CURRENT MONTH (1) | 0 | 0 | 10,661 | 0 | 0 | 0 |
| CARRY OVER PRIOR MONTH (2) | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL FOR MONTH | 0 | 0 | 10,661 | 0 | 0 | 0 |
| TOTAL YEAR TO DATE | 7 | 0 | 150,731 | 0 | 0 | 9.3% |

FREQUENCY RATE: # OF LOST TIME CASES X 200,000 / MANHOURS WORKED

INCIDENT RATE: # OF ALL RECORDABLE CASES X 200,000 / MANHOURS WORKED

SEVERITY RATE: # OF WORK DAYS LOST X 200,000 / MANHOURS WORKED

CURRENT MONTH (1) - RECORDABLE INJURIES & ILLNESSES

| LAST NAME | DATE OF INJURY | NATURE OF INJURY | CAUSE OF INJURY | ACTION TO PREVENT | DATE RETURNE TO WORK |
|---|---|---|---|---|---|
| NO RECORDABLES IN DECEMBER!! | | | | | |

CARRY OVER FROM PRIOR MONTHS (2) - RECORDABLE INJURIES & ILLNESSES

| LAST NAME | DATE OF INJURY | NATURE OF INJURY | DATE RETURN TO WORK | COMMENTS |
|---|---|---|---|---|
| | | | | |

# CEDAR CHEMICAL CORPORATION

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24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

REPLY TO. P. O. BOX 2749
WEST HELENA. AR 72390
(501) 572-3701

## PERSONNEL DEPARTMENT - MONTHLY REPORT

CATEGORY: HIRES

| NAME | HIRED | CODE | JOB | STATUS | EEO-1 CATEGORY |
|---|---|---|---|---|---|
| Mitchell, Rafe | 12/27/88 | BM | Shipper | Hourly | Operations/Other |
| Gray, Larry | 12/28/88 | MM | Shipper 1 | Hourly | Operations/Other |

Note: These two employees were recalled as "Seasonal Employees" for Propanil Packaging and will not be considered permanent staffing.

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PLANT West Helena Plant

December 1988

DAILY LOG

ACCIDENT - ILLNESS CASES

| DATE | TIME | EMPLOYEE'S NAME | EMPLOYEE NUMBER | DEPT. | TYPE OF INJURY | TREATMENT | TYPE OF REPORT SPI | OSHA | NONE | SUPV/NURSE INITIALS |
|---|---|---|---|---|---|---|---|---|---|---|
| 12/7/88 | 12:45 pm | David White | --- | Maint. | Phenol Burn (minor) on R. hip. | First Air on the job. | | | X | RR |
| | | | | | | | | | | |
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# MONTHLY OVERTIME REPORT

MONTH: December 89

(1) Standard = 813.2 = 10.8%  (2) OTHER — 626.3 = 8.2%

| W/E: | SHOWER TIME | 6TH DAY | SAFETY | SICK. COVERAGE | PERS. REA. COVERAGE | VAC. COVERAGE | HOL. COVERAGE | WORKLOAD INCREASE | MAINT. | MISC. | TOTAL OVERTIME | TOTAL REG. HRS | O.T. % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12-4-88 | 56.5 | 24.0 | | | | 116.0 | | | Prop. - 2.8<br>Flaked Prod - 28.0 | .3 | 119.6 | 1925.0 | 6.2 |
| 12-11-88 | 67.4 | 48.0 | 6.0 | 4.3 | | 85.5 | 8.0 | (Start-up)<br>DuPont Prod.<br>31.3 | Prop. .5<br>Perm. - 11.4<br>(START-up)<br>FLAKED Prod - 9.8<br>DuPont - 32.0 | | 308.4 | 1866.5 | 16.5 |
| 12-18-88 | 101.3 | 48.0 | | 72.0 | | 88.0 | | (Start-up)<br>DuPont-<br>Prod - 114.1<br>PKG - 5.0 | Prop. - 12.6<br>"Flaked .5<br>(START-up)<br>DuPont - 159.6 | | 606.1 | 1924.5 | 31.5 |
| 12-25-88 | 65.0 | 8.0 | | 40.0 | | 47.5 | 144.0 | PROD &<br>DuPont - 10.4<br>Prop. 1.0<br>Perm. 36.0<br>PKG:<br>Flaked - 6.5 | Prop. - 12.8<br>DuPont - 32.0<br>Perm - 2.0 | .2 | 405.4 | 1854.7 | 21.9 |
| | (1) | (1) | (1) | (2) | | (1) | (1) | (2) | (2) | (2) | | | |
| Total | 290.2 | 128.0 | 6.0 | 116.3 | | 337.0 | 152.0 | 204.3 | 305.2 | .5 | 1439.5 | 7570.7 | 19.0 |

**CEDAR INTERNAL CORRESPONDENCE**

DATE: January 16, 1989 21

TO: John Miles

FROM: B. Schaffhauser

CC:

SUBJECT: Monthly Report for December 1988

On December 9th, there was a process and Material Safety Data sheet meeting for operators for the MBC process.

Because of holidays and vacation the safety committee meeting for December was hold on January 10th.

The safety topic for December was a drug video entitled "Dick and Jane", also included in the safety meetings was the reporting of Hazardous Chemical Releases.

There was one First Aid for the month of December.

The safety meetings for January will be Scott Air Pak Training.

DATE 12/31/88 CEDAR CHEMICAL CORPORATION PAGE 1

CEDAR - WEST HELENA PLANT INCOME STATEMENT INST20

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH BUDGETED $ AMOUNT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE BUDGETED $ AMOUNT |
|---|---|---|---|---|
| 745,088.37 | 265,837.00 | SALES | 16,994,524.39 | 16,835,047.00 |
| 8,825.00 | | LESS-FREIGHT OUT | 129,271.91 | 125,692.00 |
| | | LESS-COMMISSIONS | | 6,400.00 |
| 2,423.60 | 1,675.00 | LESS WAREHOUSE RENT | 143,066.56 | 147,735.00 |
| 733,839.77 | 264,162.00 | NET SALES | 16,724,185.92 | 16,555,220.00 |
| | | COST OF GOODS SOLD | | |
| 327,350.14 | | COST OF SALES @ STD | 11,906,633.57 | 11,404,354.00 |
| 124,608.78- | 53,881.00- | MFG.VARIANCE | 1,615,797.17- | 1,453,079.00- |
| 756,352.68 | | RAW MATERIALS USED | 8,365,708.66 | 9,538,394.00 |
| 1,204,115.95 | | FINISH GOODS USED | 13,963,397.72 | 12,298,550.00 |
| 288,205.58 | 85,239.00 | DIRECT COST | 2,505,962.22 | 2,275,939.00 |
| 175,991.48 | 182,935.00 | FIXED COST | 2,506,103.35 | 2,615,008.00 |
| 2,015,495.10- | | T.S.F. @ STD | 24,606,626.44- | 22,900,729.00- |
| 11,429.40 | | R/M PRICE VARIANCE | 276,006.90- | 394,825.00- |
| | | TOLLING COST | | |
| | | PRODUCT COMPLAINT | | |
| 35,679.23 | 59,000.00 | PLANT OVERHEAD | 928,172.36 | 901,759.00 |
| 55,239.77 | 47,369.00 | PLANT ADMINISTRATIVE | 567,972.17 | 577,391.00 |
| 279,500.00- | 14,500.00 | TASK FORCE EXP | 421,841.97- | 107,213.00 |
| | | OTHER | 38.00 | 38.00 |
| 434,760.35 | 335,162.00 | TOTAL C.O.G.S. | 13,803,715.57 | 14,970,013.00 |
| 299,079.42 | 71,000.00- | GROSS MARGIN | 2,920,470.35 | 1,585,207.00 |
| 40.14 % | 26.71-% | GROSS MARGIN PERCENTAGE | 17.18 % | 9.42 % |
| 55,508.08 | 50,300.00 | DEPRECIATION | 762,280.69 | 580,383.00 |
| 243,571.34 | 121,300.00- | NET INCOME (LOSS) | 2,158,189.66 | 1,004,824.00 |

1,434,000

724,000

223,000 Buyout Refund Task Force

198,000 Prepaid. YEAR END

303,000 vs 120,000

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DATE 12/31/88 — CEDAR CHEMICAL CORPORATION — PAGE 1 — INST19

CEDAR - WEST HELENA — PROPONIL TECH — PRODUCT INCOME STATEMENT

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | 1,296,660 | | 882,300 | |
| | | | | SALES | 2,253,246.00 | 1.74 | 1,411,200.00 | 1.60 |
| | | | | LESS-FREIGHT OUT | | | | |
| | | | | NET SALES | 2,253,246.00 | 1.74 | 1,411,200.00 | 1.60 |
| | | | | COST OF GOODS SOLD | | | | |
| | | | | COST OF SALES @ STD | 1,880,157.00 | 1.45 | 1,279,335.00 | 1.45 |
| 1,805.70 | | | | MFG.VARIANCE | 634,834.60 | .49 | 634,539.00 | .72 |
| 534,117.73 | | | | RAW MATERIALS USED | 5,913,436.21 | 4.56 | 6,267,111.00 | 7.10 |
| 17,036.07 | | | | DIRECT COST | 212,536.43 | .16 | 166,398.00 | .19 |
| 42,860.59 | | | | FIXED COST | 419,101.38 | .32 | 342,993.00 | .39 |
| 627,096.00- | | | | T.S.F. @ STD | 7,459,510.50- | 5.75- | 7,787,909.00- | 8.83- |
| 7,289.40 | | | | R/M PRICE VARIANCE | 194,611.05- | .15- | 264,389.00- | .30- |
| 9,633.39 | | 27,000.00 | | PLANT OVERHEAD | 192,835.91 | .15 | 231,864.00 | .26 |
| | | | | PLANT ADMINISTRATIVE | 83,726.11 | .06 | 25,895.00 | .03 |
| 185,000.00- | | 14,500.00 | | TASK FORCE EXP | 52,000.00 | .04 | 251,584.00 | .29 |
| 199,353.12- | | 41,500.00 | | TOTAL C.O.G.S. | 1,734,504.09 | 1.34 | 1,147,421.00 | 1.30 |
| 199,353.12 | | 41,500.00- | | GROSS MARGIN | 518,739.91 | .40 | 263,779.00 | .30 |
| | % | | % | GROSS MARGIN PERCENTAGE | 23.02 % | | 18.69 % | |
| 20,891.17 | | 22,000.00 | | DEPRECIATION | 145,095.45 | .11 | 196,046.00 | .22 |
| 178,461.95 | | 63,500.00- | | NET INCOME (LOSS) | 373,644.46 | .29 | 67,733.00 | .08 |

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CEDAR - WEST HELENA FLAKED TECH PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | | | | |
| | | | | SALES | | | | |
| | | | | NET SALES | | | | |
| | | | | COST OF GOODS SOLD | | | | |
| 36,641.60- | | | | MFG.VARIANCE | 36,641.60- | | | |
| 186,151.00 | | | | FINISH GOODS USED | 186,151.00 | | | |
| 37,574.06 | | | | DIRECT COST | 54,861.83 | | | |
| 5,553.85 | | | | FIXED COST | 5,553.85 | | | |
| 195,853.35- | | | | T.S.F. @ STD | 195,853.35- | | | |
| 1,783.96 | | | | PLANT OVERHEAD | 1,783.96 | | | |
| 1,432.08- | | | | TOTAL C.O.G.S. | 15,855.69 | | | |
| 1,432.08 | | | | GROSS MARGIN | 15,855.69- | | | |
| | % | | % | GROSS MARGIN PERCENTAGE | | % | | % |
| 1,432.08 | | | | NET INCOME (LOSS) | 15,855.69- | | | |

CEDAR - WEST HELENA PROPANIL BLEND PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | 35,640 | | 155,640 | |
| | | | | SALES | 44,550.00 | 1.25 | 207,750.00 | 1.33 |
| | | | | LESS-FREIGHT OUT | 9,048.61 | .25 | 16,714.00 | .11 |
| | | | | LESS-COMMISSIONS | | | | |
| | | | | NET SALES | 35,501.39 | 1.00 | 191,036.00 | 1.23 |
| | | | | COST OF GOODS SOLD | | | | |
| | | | | COST OF SALES @ STD | 39,560.40 | 1.11 | 179,961.00 | 1.16 |
| | | | | MFG.VARIANCE | 19,198.32- | .54- | 28,798.00- | .19- |
| | | | | RAW MATERIALS USED | 47,796.10 | 1.34 | 72,996.00 | .47 |
| | | | | FINISH GOODS USED | 165,053.50 | 4.63 | 255,054.00 | 1.64 |
| | | | | DIRECT COST | 12,236.23 | .34 | 18,913.00 | .12 |
| 22.32 | | | | FIXED COST | 1,367.72 | .04 | 2,066.00 | .01 |
| | | | | T.S.F. @ STD | 244,205.55- | 6.85- | 377,406.00- | 2.42- |
| | | | | PLANT ADMINISTRATIVE | 145.27 | | 22,320.00 | .14 |
| 22.32 | | | | TOTAL C.O.G.S. | 2,755.35 | .08 | 145,106.00 | .93 |
| 22.32- | | | | GROSS MARGIN | 32,746.04 | .92 | 45,930.00 | .30 |
| % | | % | | GROSS MARGIN PERCENTAGE | 73.50 % | | 22.11 % | |
| 22.32- | | | | NET INCOME (LOSS) | 32,746.04 | .92 | 45,930.00 | .30 |

CEDAR - WEST HELENA PROPANIL 3# PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| 37,886 | | | | UNITS IN GAL | 224,955 | | 152,533 | |
| 274,859.50 | 7.25 | | | SALES | 1,679,181.61 | 7.46 | 1,160,609.00 | 7.61 |
| 8,819.55 | .23 | | | LESS-FREIGHT OUT | 21,040.45 | .09 | 8,629.00 | .06 |
| | | | | LESS-COMMISSIONS | | | 6,400.00 | .04 |
| 1,615.60 | .04 | | | LESS WAREHOUSE RENT | 3,154.40 | .01 | 1,292.00 | .01 |
| 264,424.35 | 6.98 | | | NET SALES | 1,654,986.76 | 7.36 | 1,144,288.00 | 7.50 |
| | | | | COST OF GOODS SOLD | | | | |
| 283,766.14 | 7.49 | | | COST OF SALES @ STD | 1,684,905.46 | 7.49 | 1,142,472.00 | 7.49 |
| 1,040.97 | .03 | | | MFG.VARIANCE | 138,426.40- | .62- | 101,172.00- | .66- |
| 22,052.88- | .58- | | | RAW MATERIALS USED | 434,605.27 | 1.93 | 171,916.00 | 1.13 |
| 41,745.50- | 1.10- | | | FINISH GOODS USED | 2,548,473.29 | 11.33 | 1,346,503.00 | 8.83 |
| 721.63 | .02 | | | DIRECT COST | 142,822.61 | .63 | 108,726.00 | .71 |
| 2,689.43 | .07 | | | FIXED COST | 30,449.68 | .14 | 20,882.00 | .14 |
| 44,073.20 | 1.16 | | | T.S.F. @ STD | 3,149,439.49- | 14.00- | 1,493,728.00- | 9.79- |
| | | | | R/M PRICE VARIANCE | 13,044.25 | .06 | 5,091.00- | .03- |
| 20,531.35 | .54 | | | PLANT ADMINISTRATIVE | 85,994.87 | .38 | 44,940.00 | .29 |
| | | | | OTHER | | | | |
| 289,024.34 | 7.63 | | | TOTAL C.O.G.S. | 1,652,429.54 | 7.35 | 1,235,448.00 | 8.10 |
| 24,599.99- | .65- | | | GROSS MARGIN | 2,557.22 | .01 | 91,160.00- | .60- |
| 8.95-% | | | % | GROSS MARGIN PERCENTAGE | .15 % | | 7.85-% | |
| 24,599.99- | .65- | | | NET INCOME (LOSS) | 2,557.22 | .01 | 91,160.00- | .60- |

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| 4,375 | | | | UNITS IN GAL | 471,546 | | 503,217 | |
| 95,290.93 | 21.78 | | | SALES | 5,232,022.83 | 11.10 | 5,691,106.00 | 11.31 |
| 5.45 | | | | LESS-FREIGHT OUT | 78,215.15 | .17 | 72,708.00 | .14 |
| | | | | LESS WAREHOUSE RENT | 127,977.10 | .27 | 129,160.00 | .26 |
| 95,285.48 | 21.78 | | | NET SALES | 5,025,830.58 | 10.66 | 5,489,238.00 | 10.91 |
| | | | | COST OF GOODS SOLD | | | | |
| 42,000.00 | 9.60 | | | COST OF SALES @ STD | 4,483,977.51 | 9.51 | 4,818,933.00 | 9.58 |
| 56,360.29 | 12.88 | | | MFG.VARIANCE | 306,417.29- | .65- | 370,616.00- | .74- |
| 215,638.39 | 49.29 | | | RAW MATERIALS USED | 1,095,210.34 | 2.32 | 1,061,055.00 | 2.11 |
| 1,059,710.45 | 242.22 | | | FINISH GOODS USED | 5,462,568.85 | 11.58 | 5,095,843.00 | 10.13 |
| 34,563.50 | 7.90 | | | DIRECT COST | 170,887.59 | .36 | 154,737.00 | .31 |
| 2,390.91 | .55 | | | FIXED COST | 18,870.02 | .04 | 21,097.00 | .04 |
| 1,236,618.95- | 282.66- | | | T.G.F. @ STD | 6,575,000.76- | 13.94- | 6,316,117.00- | 12.55- |
| 4,140.00 | .95 | | | R/M PRICE VARIANCE | 136,503.49- | .29- | 145,921.00- | .29- |
| 7,118.00 | 1.63 | | | PLANT ADMINISTRATIVE | 137,635.22 | .29 | 158,084.00 | .31 |
| | | | | OTHER | 38.00 | | 38.00 | |
| 185,302.59 | 42.35 | | | TOTAL C.O.G.S. | 4,351,265.99 | 9.23 | 4,477,133.00 | 8.90 |
| 90,017.11- | 20.58- | | | GROSS MARGIN | 674,564.59 | 1.43 | 1,012,105.00 | 2.01 |
| 94.47-% | | % | | GROSS MARGIN PERCENTAGE | 12.89 % | | 17.78 % | |
| 90,017.11- | 20.58- | | | NET INCOME (LOSS) | 674,564.59 | 1.43 | 1,012,105.00 | 2.01 |

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CEDAR - WEST HELENA SIGM PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN GAL | 306,250 | | 306,250 | |
| | | | | SALES | 2,886,981.62 | 9.43 | 2,604,126.00 | 8.50 |
| | | | | LESS-FREIGHT OUT | | | | |
| | | | | NET SALES | 2,886,981.62 | 9.43 | 2,604,126.00 | 8.50 |
| | | | | COST OF GOODS SOLD | | | | |
| | | | | COST OF SALES @ STD | 2,930,812.50 | 9.57 | 2,930,813.00 | 9.57 |
| | | | | MFG.VARIANCE | 361,609.74- | 1.18- | 249,417.00- | .81- |
| | | | | RAW MATERIALS USED | 853,955.89 | 2.79 | 853,956.00 | 2.79 |
| | | | | FINISH GOODS USED | 4,631,654.85 | 15.12 | 4,631,654.00 | 15.12 |
| | | | | DIRECT COST | 145,891.75 | .48 | 145,892.00 | .48 |
| 176.99 | | | | FIXED COST | 11,868.80 | .04 | 11,689.00 | .04 |
| | | | | T.S.F. @ STD | 5,648,151.25- | 18.44- | 5,648,152.00- | 18.44- |
| | | | | R/M PRICE VARIANCE | 8,962.80 | .03 | 8,964.00 | .03 |
| | | | | PLANT ADMINISTRATIVE | 70,763.21 | .23 | 57,631.00 | .19 |
| 176.99 | | | | TOTAL C.O.G.S. | 2,644,148.81 | 8.63 | 2,743,030.00 | 8.96 |
| 176.99- | | | | GROSS MARGIN | 242,832.81 | .79 | 138,904.00- | .45- |
| % | | % | | GROSS MARGIN PERCENTAGE | 8.41 % | | 5.33-% | |
| 176.99- | | | | NET INCOME (LOSS) | 242,832.81 | .79 | 138,904.00- | .45- |

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CEDAR - WEST HELENA BUTOXONE PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| 180 | | | | UNITS IN GALS | 65,556 | | 62,000 | |
| 4,786.60 | 26.59 | | | SALES | 858,067.32 | 13.09 | 786,088.00 | 12.68 |
| | | | | LESS-FREIGHT OUT | 16,611.82 | .25 | 22,448.00 | .36 |
| 372.00 | 2.07 | 700.00 | | LESS WAREHOUSE RENT | 6,989.32 | .11 | 7,479.00 | .12 |
| 4,414.60 | 24.53 | 700.00- | | NET SALES | 834,466.18 | 12.73 | 756,161.00 | 12.20 |
| | | | | COST OF GOODS SOLD | | | | |
| 1,584.00 | 8.80 | | | COST OF SALES @ STD | 578,871.36 | 8.83 | 707,385.00 | 11.41 |
| 81,698.81- | 453.88- | | | MFG.VARIANCE | 81,698.81- | 1.25- | | |
| | | | | FINISH GOODS USED | 689,155.73 | 10.51 | 689,156.00 | 11.12 |
| | | | | DIRECT COST | 247,994.59 | 3.78 | 247,994.00 | 4.00 |
| | | | | T.S.F. @ STD | 939,840.19- | 14.34- | 1,003,671.00- | 16.19- |
| | | | | R/M PRICE VARIANCE | | | | |
| | | | | PRODUCT COMPLAINT | | | | |
| 94,500.00- | 525.00- | | | TASK FORCE EXP | 473,841.97- | 7.23- | 144,371.00- | 2.33- |
| | | | | OTHER | | | | |
| 174,614.81- | 970.08- | | | TOTAL C.O.G.S. | 20,440.71 | .31 | 496,493.00 | 8.01 |
| 179,029.41 | 994.61 | 700.00- | | GROSS MARGIN | 813,825.47 | 12.41 | 259,668.00 | 4.19 |
| 740.22 % | | % | | GROSS MARGIN PERCENTAGE | 94.84 % | | 33.03 % | |
| | | 2,300.00 | | DEPRECIATION | 163,311.66 | 2.49 | 33,310.00 | .54 |
| 179,029.41 | 994.61 | 3,000.00- | | NET INCOME (LOSS) | 650,513.81 | 9.92 | 226,358.00 | 3.65 |

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| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN GALS | 15,871 | | 21,000 | |
| | | | | SALES | 267,020.30 | 16.82 | 310,987.00 | 14.81 |
| | | | | LESS-FREIGHT OUT | 412.19 | .03 | 1,250.00 | .06 |
| 436.00 | | 700.00 | | LESS WAREHOUSE RENT | 5,790.94 | .36 | 8,800.00 | .42 |
| 436.00- | | 700.00- | | NET SALES | 260,817.17 | 16.43 | 300,937.00 | 14.33 |
| | | | | COST OF GOODS SOLD | | | | |
| | | | | COST OF SALES @ STD | 125,288.39 | 7.89 | 162,394.00 | 7.73 |
| 4,796.80- | | | | MFG.VARIANCE | 4,796.80- | .30- | | |
| | | | | FINISH GOODS USED | 221,489.30 | 13.96 | 221,489.00 | 10.55 |
| | | | | DIRECT COST | 69,404.23 | 4.37 | 69,404.00 | 3.30 |
| | | | | T.S.F. @ STD | 270,143.45- | 17.02- | 177,350.00- | 8.45- |
| | | | | R/M PRICE VARIANCE | | | | |
| | | | | PRODUCT COMPLAINT | | | | |
| | | | | OTHER | | | | |
| 4,796.80- | | | | TOTAL C.O.G.S. | 141,241.67 | 8.90 | 275,937.00 | 13.14 |
| 4,360.80 | | 700.00- | | GROSS MARGIN | 119,575.50 | 7.53 | 25,000.00 | 1.19 |
| | % | | % | GROSS MARGIN PERCENTAGE | 44.78 % | | 8.04 % | |
| 4,360.80 | | 700.00- | | NET INCOME (LOSS) | 119,575.50 | 7.53 | 25,000.00 | 1.19 |

CEDAR - WEST HELENA BUTOXONE ESTER PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN GALS | 16,165 | | 16,000 | |
| | | | | SALES | 260,184.77 | 16.10 | 242,532.00 | 15.16 |
| | | | | LESS-FREIGHT OUT | 3,943.69 | .24 | 3,943.00 | .25 |
| | | 275.00 | | LESS WAREHOUSE RENT | 845.20- | .05- | 1,004.00 | .06 |
| | | 275.00- | | NET SALES | 257,086.28 | 15.90 | 237,585.00 | 14.85 |
| | | | | COST OF GOODS SOLD | | | | |
| | | | | COST OF SALES @ STD | 183,060.95 | 11.32 | 183,061.00 | 11.44 |
| | | | | FINISH GOODS USED | 58,851.20 | 3.64 | 58,851.00 | 3.68 |
| 495.47- | | | | DIRECT COST | 39,779.39 | 2.46 | 39,069.00 | 2.44 |
| | | | | T.S.F. @ STD | 124,481.90- | 7.70- | 96,396.00- | 6.02- |
| | | | | R/M PRICE VARIANCE | | | | |
| | | | | PRODUCT COMPLAINT | | | | |
| | | | | OTHER | | | | |
| 495.47- | | | | TOTAL C.O.G.S. | 157,209.64 | 9.73 | 184,585.00 | 11.54 |
| 495.47 | | 275.00- | | GROSS MARGIN | 99,876.64 | 6.18 | 53,000.00 | 3.31 |
| | X | | X | GROSS MARGIN PERCENTAGE | 38.39 X | | 21.85 X | |
| 495.47 | | 275.00- | | NET INCOME (LOSS) | 99,876.64 | 6.18 | 53,000.00 | 3.31 |

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| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN GALS | | | | |
| | | | | SALES | | | | |
| | | | | LESS-FREIGHT OUT | | | | |
| | | | | LESS WAREHOUSE RENT | | | | |
| | | | | NET SALES | | | | |
| | | | | COST OF GOODS SOLD | | | | |
| | | | | COST OF SALES @ STD | | | | |
| | | | | R/M PRICE VARIANCE | 16,871.30 | | 16,871.00 | |
| | | | | TOTAL C.O.G.S. | 16,871.30 | | 16,871.00 | |
| | | | | GROSS MARGIN | 16,871.30- | | 16,871.00- | |
| % | | % | | GROSS MARGIN PERCENTAGE | % | | % | |
| | | | | NET INCOME (LOSS) | 16,871.30- | | 16,871.00- | |

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CEDAR - WEST HELENA ICI CONTRACT PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| 301,360 | | 350,000 | | UNITS IN LBS | 3,242,087 | | 2,931,574 | |
| 212,614.00 | .71 | 203,437.00 | .58 | SALES | 2,430,807.80 | .75 | 2,140,999.00 | .73 |
| 212,614.00 | .71 | 203,437.00 | .58 | NET SALES | 2,430,807.80 | .75 | 2,140,999.00 | .73 |
| | | | | COST OF GOODS SOLD | | | | |
| 18,749.57 | .06 | 28,853.00 | .08 | DIRECT COST | 223,569.13 | .07 | 245,207.00 | .08 |
| 59,412.05 | .20 | 65,997.00 | .19 | FIXED COST | 685,165.35 | .21 | 708,488.00 | .24 |
| 14,271.69 | .05 | 27,000.00 | .08 | PLANT OVERHEAD | 379,114.07 | .12 | 343,172.00 | .12 |
| 15,881.76 | .05 | 35,757.00 | .10 | PLANT ADMINISTRATIVE | 127,724.93 | .04 | 122,971.00 | .04 |
| 108,315.07 | .36 | 157,607.00 | .45 | TOTAL C.O.G.S. | 1,415,573.48 | .44 | 1,419,838.00 | .48 |
| 104,298.93 | .35 | 45,830.00 | .13 | GROSS MARGIN | 1,015,234.32 | .31 | 721,161.00 | .25 |
| 49.06 % | | 22.53 % | | GROSS MARGIN PERCENTAGE | 41.77 % | | 33.68 % | |
| 7,086.59 | .02 | 8,000.00 | .02 | DEPRECIATION | 83,639.86 | .03 | 86,711.00 | .03 |
| 97,212.34 | .32 | 37,830.00 | .11 | NET INCOME (LOSS) | 931,594.46 | .29 | 634,450.00 | .22 |

CEDAR - WEST HELENA OREGON PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| 9,000- | | 250,000 | | UNITS IN LBS | 910,893 | | 896,735 | |
| 1,530.00- | .17 | 62,400.00 | .25 | SALES | 170,665.36 | .19 | 206,426.00 | .23 |
| 1,530.00- | .17 | 62,400.00 | .25 | NET SALES | 170,665.36 | .19 | 206,426.00 | .23 |
| | | | | COST OF GOODS SOLD | | | | |
| | | 4,334.00 | .02 | DIRECT COST | 33,889.04 | .04 | 34,125.00 | .04 |
| 807.46 | .09- | 9,657.00 | .04 | FIXED COST | 82,708.77 | .09 | 74,521.00 | .08 |
| | | | | TOLLING COST | | | | |
| | | 5,000.00 | .02 | PLANT OVERHEAD | 35,092.65 | .04 | 33,070.00 | .04 |
| 114.29- | .01 | 11,612.00 | .05 | PLANT ADMINISTRATIVE | 4,266.09 | | 17,470.00 | .02 |
| 693.17 | .08- | 30,603.00 | .12 | TOTAL C.O.G.S. | 155,956.55 | .17 | 159,186.00 | .18 |
| 2,223.17- | .25 | 31,797.00 | .13 | GROSS MARGIN | 14,708.81 | .02 | 47,240.00 | .05 |
| 145.31 % | | 50.96 % | | GROSS MARGIN PERCENTAGE | 8.62 % | | 22.88 % | |
| | | 1,000.00 | | DEPRECIATION | 41,839.01 | .05 | 25,806.00 | .03 |
| 2,223.17- | .25 | 30,797.00 | .12 | NET INCOME (LOSS) | 27,130.20- | .03- | 21,434.00 | .02 |

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CEDAR - WEST HELENA SCI CONTRACT PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | 184,573 | | 184,573 | |
| | | | | SALES | 104,223.95 | .56 | 104,224.00 | .56 |
| | | | | NET SALES | 104,223.95 | .56 | 104,224.00 | .56 |
| | | | | COST OF GOODS SOLD | | | | |
| | | | | DIRECT COST | 29,835.27 | .16 | 29,836.00 | .16 |
| 1,008.02 | | | | FIXED COST | 91,888.28 | .50 | 90,880.00 | .49 |
| | | | | PLANT OVERHEAD | 41,112.16 | .22 | 40,089.00 | .22 |
| | | | | PLANT ADMINISTRATIVE | 2,319.91 | .01 | 2,320.00 | .01 |
| 1,008.02 | | | | TOTAL C.O.G.S. | 165,155.62 | .89 | 163,125.00 | .88 |
| 1,008.02- | | | | GROSS MARGIN | 60,931.67- | .33- | 58,901.00- | .32- |
| % | | % | | GROSS MARGIN PERCENTAGE | 58.46-% | | 56.51-% | |
| | | | | DEPRECIATION | 18,510.90 | .10 | 18,510.00 | .10 |
| 1,008.02- | | | | NET INCOME (LOSS) | 79,442.57- | .43- | 77,411.00- | .42- |

CEDAR - WEST HELENA DUPONT-MRC PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| 15,657 | | | | UNITS IN LBS | 15,657 | | | |
| 140,203.38 | 8.95 | | | SALES | 140,203.38 | 8.95 | | |
| 140,203.38 | 8.95 | | | NET SALES | 140,203.38 | 8.95 | | |
| | | | | COST OF GOODS SOLD | | | | |
| 105,634.86 | 6.75 | | | DIRECT COST | 110,660.11 | 7.07 | | |
| 41,546.64 | 2.65 | | | FIXED COST | 41,546.64 | 2.65 | | |
| | | | | TOLLING COST | | | | |
| 10,346.98 | .66 | | | PLANT OVERHEAD | 10,346.98 | .66 | | |
| 10,472.86 | .67 | | | PLANT ADMINISTRATIVE | 10,472.86 | .67 | | |
| 168,001.34 | 10.73 | | | TOTAL C.O.G.S. | 173,026.59 | 11.05 | | |
| 27,797.96- | 1.78- | | | GROSS MARGIN | 32,823.21- | 2.10- | | |
| 19.83-% | | | % | GROSS MARGIN PERCENTAGE | 23.41-% | | | % |
| 22,162.23 | 1.42 | | | DEPRECIATION | 22,162.23 | 1.42 | | |
| 49,960.19- | 3.19- | | | NET INCOME (LOSS) | 54,985.44- | 3.51- | | |

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CEDAR - WEST HELENA SECTAGON II PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN GAL | 499,631 | | | |
| 17,801.96 | | | | SALES | 292,301.81 | .59 | | |
| 17,801.96 | | | | NET SALES | 292,301.81 | .59 | | |
| | | | | COST OF GOODS SOLD | | | | |
| | | | | RAW MATERIALS USED | | | | |
| | | | | DIRECT COST | 48,575.45 | .10 | | |
| 1,330.10 | | | | FIXED COST | 104,738.07 | .21 | | |
| | | | | R/M PRICE VARIANCE | 2,659.57 | .01 | | |
| | | | | TOLLING COST | | | | |
| | | | | PLANT OVERHEAD | 66,946.56 | .13 | | |
| 1,329.76 | | | | PLANT ADMINISTRATIVE | 22,427.39 | .04 | | |
| 2,659.86 | | | | TOTAL C.O.G.S. | 245,347.04 | .49 | | |
| 15,142.10 | | | | GROSS MARGIN | 46,954.77 | .09 | | |
| 85.06 % | | % | | GROSS MARGIN PERCENTAGE | 16.06 % | | % | |
| | | | | DEPRECIATION | 23,681.68 | .05 | | |
| 15,142.10 | | | | NET INCOME (LOSS) | 23,273.09 | .05 | | |

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| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN KILOS | 127,069 | | 990,350 | |
| | | | | SALES | 106,200.00 | .84 | 1,973,000.00 | 1.99 |
| | | | | NET SALES | 106,200.00 | .84 | 1,973,000.00 | 1.99 |
| | | | | COST OF GOODS SOLD | | | | |
| 28,649.44 | | | | RAW MATERIALS USED | 20,704.85 | .16 | 1,111,360.00 | 1.12 |
| 23,037.52 | | | | DIRECT COST | 187,972.06 | 1.48 | 243,142.00 | .25 |
| 5,927.56 | | | | FIXED COST | 362,782.71 | 2.86 | 595,934.00 | .60 |
| | | | | R/M PRICE VARIANCE | 6,430.28- | .05- | 5,259.00- | .01- |
| | | | | TOLLING COST | | | | |
| | | | | PLANT OVERHEAD | 170,091.24 | 1.34 | 253,564.00 | .26 |
| | | | | PLANT ADMINISTRATIVE | 4,843.95 | .04 | 125,760.00 | .13 |
| 57,614.52 | | | | TOTAL C.O.G.S. | 739,964.53 | 5.82 | 2,324,501.00 | 2.35 |
| 57,614.52- | | | | GROSS MARGIN | 633,764.53- | 4.99- | 351,501.00- | .35- |
| % | | % | | GROSS MARGIN PERCENTAGE | 596.77-% | | 17.82-% | |
| | | | | DEPRECIATION | 229,167.07 | 1.80 | 159,000.00 | .16 |
| 57,614.52- | | | | NET INCOME (LOSS) | 862,931.60- | 6.79- | 510,501.00- | .52- |

CEDAR - WEST HELENA MES PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| 1,180 | | | | UNITS IN LBS | 138,600 | | | |
| 1,062.00 | .90 | | | SALES | 124,740.00 | .90 | | |
| 1,062.00 | .90 | | | NET SALES | 124,740.00 | .90 | | |
| | | | | COST OF GOODS SOLD | | | | |
| 1,622.48 | 1.37 | | | DIRECT COST | 17,403.85 | .13 | | |
| 167.81- | .14- | | | FIXED COST | 47,720.73 | .34 | | |
| | | | | TOLLING COST | | | | |
| 356.79- | .30- | | | PLANT OVERHEAD | 30,848.83 | .22 | | |
| 79.33 | .07 | | | PLANT ADMINISTRATIVE | 17,711.36 | .13 | | |
| 1,177.21 | 1.00 | | | TOTAL C.O.G.S. | 113,684.77 | .82 | | |
| 115.21- | .10- | | | GROSS MARGIN | 11,055.23 | .08 | | |
| 10.85-% | | | % | GROSS MARGIN PERCENTAGE | 8.86 % | | | % |
| | | | | DEPRECIATION | 9,472.67 | .07 | | |
| 115.21- | .10- | | | NET INCOME (LOSS) | 1,582.56 | .01 | | |

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CEDAR - WEST HELENA WEST HELENA OTHER PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN | | | | |
| | | | | SALES | 146,127.64 | | 4,000.00- | |
| | | | | NET SALES | 146,127.64 | | 4,000.00- | |
| | | | | COST OF GOODS SOLD | | | | |
| 60,678.53- | | 53,881.00- | | MFG.VARIANCE | 1,301,842.81- | | 1,337,615.00- | |
| 49,761.36 | | 52,052.00 | | DIRECT COST | 757,642.66 | | 772,496.00 | |
| 12,433.37 | | 107,281.00 | | FIXED COST | 602,341.35 | | 746,458.00 | |
| | | | | T.&.F. @ STD | | | | |
| | | | | R/M PRICE VARIANCE | | | | |
| | | | | TOLLING COST | | | | |
| | | | | PLANT OVERHEAD | | | | |
| 59.00- | | | | PLANT ADMINISTRATIVE | 59.00- | | | |
| 1,457.20 | | 105,452.00 | | TOTAL C.O.G.S. | 58,082.20 | | 181,339.00 | |
| 1,457.20- | | 105,452.00- | | GROSS MARGIN | 88,045.44 | | 185,339.00- | |
| | % | | % | GROSS MARGIN PERCENTAGE | | 60.25 % | | 633.48 % |
| 5,368.09 | | 17,000.00 | | DEPRECIATION | 25,400.16 | | 61,000.00 | |
| 6,825.29- | | 122,452.00- | | NET INCOME (LOSS) | 62,645.28 | | 246,339.00- | |

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 5510 | BUTOXONE TECH ACID | | | | 969,495 | 969,496 | 1- |
| 5630 | DCA | 506,869 | | 506,869 | 5,234,078 | 5,467,862 | 233,784- |
| 5640 | PROPIONIC ACID | 11,010 | | 11,010 | 440,857 | 508,736 | 67,879- |
| 5650 | PROPIONIC ANHYDRIDE | 16,237 | | 16,237 | 236,500 | 290,513 | 54,013- |
| 5660 | MESITYL OXIDE | 116,607 | | 116,607 | 693,318 | 705,338 | 12,020- |
| 5670 | EMULSIFIER | 41,227 | | 41,227 | 396,905 | 366,120 | 30,785 |
| 5675 | ARMUL | 1,258 | | 1,258 | 81,959 | 36,702 | 45,257 |
| 5680 | ISOPHORONE | 33,032 | | 33,032 | 1,164,600 | 1,015,479 | 149,121 |
| 5685 | TENNECO 500 | | | | 93,321 | 36,284 | 57,037 |
| 5690 | XYLENE | 134 | | 134 | 134 | | 134 |
| 5695 | MIBK | 1,325 | | 1,325 | 1,325 | | 1,325 |
| 5850 | OTHER RAW MATERIALS | 28,649 | | 28,649 | 20,704 | 1,111,360 | 1,090,656- |
| 5870 | PACKAGING MATERIALS | 495- | | 495- | 710 | | 710 |
| 5890 | CONTAINERS | 35,091 | | 35,091 | 464,703 | 423,595 | 41,108 |
| | SUB-TOTAL | 790,944 | | 790,944 | 9,800,609 | 10,931,485 | 1,130,876- |
| 6100 | SALARIES | 32,657 | 34,816 | 2,159- | 385,348 | 383,437 | 1,911 |
| 6110 | WAGES | 76,559 | 89,781 | 13,222- | 1,042,229 | 1,164,999 | 122,770- |
| 6140 | HOLIDAY & VAC PAY | 41,448 | 7,126 | 34,322 | 128,369 | 70,373 | 49,996 |
| 6150 | SICK & ALLOWED PAY | 1,088 | 729 | 359 | 9,572 | 8,854 | 718 |
| 6160 | OTHER (CALL-OUT PRE) | 91- | 213 | 304- | 7,619 | 2,295 | 5,324 |
| 6200 | PAYROLL TAXES | 9,229 | 13,000 | 3,771- | 89,111 | 159,986 | 70,875- |
| 6210 | GROUP INSURANCE | 16,760 | 18,600 | 1,840- | 183,637 | 217,650 | 34,021- |
| 6220 | WORKMANS COMP INSUR | 2,930 | 3,700 | 770- | 45,684 | 44,432 | 1,252 |
| 6230 | PENSION PLAN COST | | 12,900 | 12,900- | 143,584 | 151,328 | 7,744- |
| 6260 | MEDICAL EXAMS | | 1,280 | 1,280- | 13,907 | 18,281 | 4,374- |
| 6270 | BLOOD TEST | | | | 1,975 | 3,080 | 1,105- |
| 6280 | SAFETY SUPPLIES | 4,376 | 3,580 | 796 | 44,558 | 43,850 | 708 |
| 6300 | CONTRACT LABOR & MTL | 36,646 | 4,405 | 32,241 | 103,852 | 60,674 | 43,178 |
| 6340 | NATURAL GAS | 16,877 | 6,876 | 10,001 | 160,625 | 120,589 | 40,036 |
| 6350 | ELECTRICITY | 24,999 | 23,955 | 1,044 | 277,799 | 311,173 | 33,374- |
| 6360 | WATER | 1,730 | 744 | 986 | 20,374 | 19,854 | 520 |
| 6390 | TRVL & ENTERTAINMENT | 17 | 155 | 138- | 217 | 1,134 | 917- |
| 6400 | ORDINARY SUPPLIES | 12,836- | 3,618 | 16,454- | 77,000 | 81,741 | 4,741- |
| 6410 | MAINTENANCE SUPPLIES | 46,535 | 15,225 | 31,310 | 370,846 | 410,809 | 39,963- |
| 6420 | MAINTENANCE TOOLS | | 200 | 200- | 133 | 1,400 | 1,267- |
| 6430 | EXPENDABLE ITEMS | 1,259 | 1,100 | 159 | 24,772 | 19,633 | 5,139 |
| 6470 | NITROGEN | 522- | 204 | 726- | 62,532 | 51,156 | 11,376 |
| 6510 | OTHR CHEM & SOLVENTS | | 75 | 75- | 19,004 | 18,054 | 950 |
| 6560 | OFF SITE WASTE DISPO | 4,490 | | 4,490 | 25,797 | 82 | 25,715 |
| 6580 | OTHR WSTE TREAT CHEM | | | | | | |
| 6590 | CONTRACT FORMULATING | | | | 356,466 | 356,467 | 1- |
| 6600 | INSURANCE-PLANT | 12,146 | 17,205 | 5,059- | 329,088 | 285,122 | 43,966 |
| 6620 | FEES & TUITIONS | 75 | 1,075 | 1,000 | 3,789 | 8,910 | 5,121- |
| 6650 | RENTALS | 4,956 | 1,464 | 3,492 | 39,920 | 33,946 | 5,974 |
| 6680 | FREIGHT IN (MISC.) | 222 | 1,275 | 1,053- | 8,666 | 13,986 | 5,320- |

CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY EXPENSE PAGE 5 BCOSTE

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 6710 | PROPERTY TAXES & LIC | 15,924- | 2,150 | 18,074- | 49,375 | 39,947 | 9,428 |
| | SUB-TOTAL | 305,626 | 265,451 | 40,175 | 4,025,848 | 4,111,250 | 85,402- |
| | COST OF GOODS MFG. | 1,096,570 | 265,451 | 831,119 | 13,826,457 | 15,042,735 | 1,216,278- |

CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY EXPENSE PAGE 9 BCOSTE

**********

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 8100 | SALARIES | 27,424 | 22,997 | 4,427 | 314,349 | 285,746 | 28,623 |
| 8140 | HOLIDAY & VAC PAY | 6,766 | | 6,766 | 6,517 | 914 | 5,603 |
| 8150 | SICK PAY | | | | | 142 | 142- |
| 8160 | OTHER PAY | | | | | 26 | 26- |
| 8200 | PAYROLL TAXES | 3,296 | 3,550 | 254- | 41,916 | 47,814 | 5,898- |
| 8210 | GROUP INSURANCE | 4,169 | 3,400 | 769 | 38,881 | 39,713 | 832- |
| 8220 | WKMNS COMP INSURANCE | 1,197 | 240 | 957 | 9,662 | 3,656 | 6,006 |
| 8230 | PENSION PLAN COST | | 2,500 | 2,500- | 30,616 | 29,222 | 1,394 |
| 8310 | TEMPORARY HELP | | | | | | |
| 8350 | ELECTRICITY | | 400 | 400- | 10,430 | 12,548 | 2,118- |
| 8360 | COURRIER EXP. | 428 | 120 | 308 | 2,786 | 1,818 | 968 |
| 8370 | COMMUNICATIONS | 3,974 | 3,000 | 974 | 37,445 | 37,075 | 370 |
| 8390 | TRAVEL | 3,047 | 640 | 2,407 | 21,289 | 9,557 | 11,732 |
| 8395 | MEALS/ENTERTAINMENT | 330 | 400 | 70- | 4,853 | 4,403 | 450 |
| 8400 | OFFICE SUPPLIES | 1,475 | 1,380 | 95 | 15,554 | 15,033 | 521 |
| 8420 | CONTRIBUTIONS | 27 | | 27 | 1,837 | 285 | 1,552 |
| 8460 | MISCELLANEOUS | 1,882 | 730 | 1,152 | 7,385 | 9,459 | 2,074- |
| 8560 | AUTO RENTALS | 384 | 400 | 16- | 4,049 | 3,657 | 392 |
| 8610 | DUES & SUBSCRIPTIONS | 115 | 120 | 5- | 2,165 | 1,591 | 574 |
| 8620 | FEES & TUITIONS | 68 | 95 | 27- | 5,625 | 4,212 | 1,413 |
| 8650 | ADVERTISING | | | | 2,663 | 2,366 | 297 |
| 8660 | CONSULTING FEES | | | | | | |
| 8695 | OTHER LEASE EXPENSE | 646 | 1,105 | 459- | 9,919 | 12,550 | 2,631- |
| 8899 | MANAGEMENT FEE EDDY | 2- | 6,292 | 6,294- | 6- | 55,604 | 55,610- |
| | SUB-TOTAL | 55,226 | 47,369 | 7,857 | 567,955 | 577,391 | 9,436- |
| | ADMINISTRATIVE EXP | 55,226 | 47,369 | 7,857 | 567,955 | 577,391 | 9,436- |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY EXPENSE PAGE 10 BCOSTE

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 8900 | DEPRECIATION | 55,507 | 48,000 | 7,507 | 590,965 | 547,073 | 51,892 |
| 8910 | AMORTIZIATION EXP | | 2,300 | 2,300- | 143,311 | 33,310 | 130,001 |
| | SUB-TOTAL | 55,507 | 50,300 | 5,207 | 762,276 | 580,383 | 181,893 |
| | DEPRECIATION | 55,507 | 50,300 | 5,207 | 762,276 | 580,383 | 181,893 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 1

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % | THIS MONTH | | YEAR-TO-DATE | ACTUAL % | |
|---|---|---|---|---|---|---|
| | 109% | 433,281 | ACTUAL | 4,922,540 | 92% | |
| CEDAR - WEST HELENA | | 399,000 | SCHEDULED | 5,369,299 | | PROD--POWER |
| | | | CAPACITY | | | UNIT--KWH |

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| ELECTRICITY | 24,999 | 23,955 | 1,044 | 277,800 | 311,173 | 33,373- | .058 | .060 | .056 | .061 |
| TOTAL | 24,999 | 23,955 | 1,044 * | 277,800 | 311,173 | 33,373-* | .058 | .060 | .056 | .061 |
| TOTAL MANUF.COSTS | 24,999 | 23,955 | 1,044 | 277,800 | 311,173 | 33,373- | .058 | .060 | .056 | .061 |
| ALLOCATION TSF | 24,999- | 23,955- | 1,044- | 277,800- | 311,173- | 33,373 | .058- | .060- | .056- | .061 |
| TOTAL | 24,999- | 23,955- | 1,044 * | 277,800- | 311,173- | 33,373 * | .058- | .060- | .056- | .061 |

PRODUCT TOTALS
POWER

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 2

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | | YEAR-TO-DATE | ACTUAL % | |
|---|---|---|---|---|---|---|
| CEDAR - WEST HELENA | % | ACTUAL SCHEDULED CAPACITY | | | % | PROD--OVERHEAD UNIT-- |

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| SALES | | | | 146,128- | | 146,128- | | | | |
| PLANT OVERHEAD | 22,882- | | 22,882- | 22,882- | | 22,882- | | | | |
| PLANT ADMIN | 55,241 | 47,369 | 7,872 | 567,972 | 577,391 | 9,419- | | | | |
| PLANT DEPRECIATION | 55,508 | 50,300 | 5,208 | 762,201 | 580,383 | 181,898 | | | | |
| TOTAL | 87,867 | 97,669 | 9,802-* | 1,161,243 | 1,157,774 | 3,469 * | | | | |
| ORDINARY SUPPLY | 14,081- | 6,146 | 20,227- | 78,803 | 84,835 | 6,033- | | | | |
| RENTALS | 4,682 | 700 | 3,982 | 30,976 | 14,712 | 16,264 | | | | |
| OUTSIDE LABOR | 36,295 | 1,840 | 34,455 | 60,463 | 20,811 | 39,652 | | | | |
| MAINT SUPPLIES | 13,611 | 6,178 | 7,433 | 164,020 | 146,509 | 17,511 | | | | |
| OTHER CHEMICALS | | 75 | 75- | 16,176 | 16,701 | 525- | | | | |
| WASTE CHEMICALS | | | | | | | | | | |
| GAS | | | | 37,676 | 37,675 | 1 | | | | |
| POWER | 5,564 | 9,553 | 3,989- | 77,132 | 96,382 | 19,250- | | | | |
| WASTE DISPOSAL | | | | | | | | | | |
| OTHER | 1,574 | 3,605 | 2,031- | 37,444 | 43,663 | 6,219- | | | | |
| TOTAL | 47,645 | 28,097 | 19,548 * | 502,689 | 461,288 | 41,401 * | | | | |
| SALARY | 6,445 | 8,515 | 2,070- | 92,226 | 92,339 | 113- | | | | |
| WAGES | 34,019 | 29,381 | 4,638 | 375,173 | 343,568 | 31,605 | | | | |
| FRINGES | 4,770 | 9,170 | 4,400- | 90,433 | 111,176 | 20,743- | | | | |
| SAFETY & SECURITY | | 1,280 | 1,280- | 14,758 | 18,355 | 3,597- | | | | |
| INSURANCE & TAXES | 22,560- | 565 | 23,125- | 16,565- | 6,635 | 23,200- | | | | |
| TOTAL | 22,674 | 48,911 | 26,237-* | 556,025 | 572,073 | 16,048-* | | | | |
| TOTAL MANUF.COSTS | 158,186 | 174,677 | 16,491- | 2,219,957 | 2,191,135 | 28,822 | | | | |
| ALLOCATION TSF | 35,677- | 75,902- | 40,225 | 1,024,043- | 1,027,594- | 3,551 | | | | |
| TOTAL | 35,677- | 75,902- | 40,225 *1,024,043- | | 1,027,594- | 3,551 * | | | | |
| PRODUCT TOTALS OVERHEAD | 122,509 | 98,775 | 23,734 | 1,195,914 | 1,163,541 | 32,373 | | | | |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 3 BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % | THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|---|
| | % | 432,480 | ACTUAL | 5,144,490 | 96% |
| CEDAR - WEST HELENA | | | SCHEDULED CAPACITY | 5,370,970 | |

PROD--PROPANIL TECH
UNIT--LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLANT OVERHEAD | | | | | | 15,110 | 15,110- | | | | | .027 |
| TOTAL | | | | * | | 15,110 | 15,110- | * | | | | .027 |
| DCA | 506,870 | | 506,870 | | 5,236,079 | 5,467,862 | 231,783- | | 1.172 | | 1.018 | .935 |
| PROPIONIC ACID | 11,010 | | 11,010 | | 440,857 | 508,736 | 67,879- | | .025 | | .086 | .092 |
| PROPIONIC ANHYDRIDE | 16,238 | | 16,238 | | 236,500 | 290,513 | 54,013- | | .038 | | .046 | .042 |
| TOTAL | 534,118 | | 534,118 | * | 5,913,436 | 6,267,111 | 353,675- | * | 1.235 | | 1.149 | 1.068 |
| CONTAINERS | | | | | | | | | | | | |
| ORDINARY SUPPLY | 516 | | 516 | | 4,850 | 4,128 | 722 | | .001 | | .001 | .001 |
| RENTALS | 175 | | 175 | | 1,666 | 4,451 | 2,785- | | | | | .002 |
| OUTSIDE LABOR | 300 | | 300 | | 14,481 | 940 | 13,541 | | .001 | | .003 | .002 |
| MAINT SUPPLIES | 4,508 | | 4,508 | | 46,225 | 41,217 | 5,008 | | .010 | | .009 | .014 |
| OTHER CHEMICALS | | | | | 2,830 | 1,353 | 1,477 | | | | .001 | |
| NITROGEN | 2,427- | | 2,427- | | 31,957 | 27,574 | 4,383 | | .006- | | .006 | .012 |
| GAS | 7,909 | | 7,909 | | 56,220 | 32,460 | 23,760 | | .018 | | .011 | .002 |
| POWER | 5,480 | | 5,480 | | 47,833 | 47,746 | 87 | | .013 | | .009 | .009 |
| OTHER | 577 | | 577 | | 6,475 | 6,529 | 54- | | .001 | | .001 | .002 |
| TOTAL | 17,038 | | 17,038 | * | 212,537 | 166,398 | 46,139 | * | .039 | | .041 | .044 |
| SALARY | 6,505 | | 6,505 | | 55,256 | 48,948 | 6,308 | | .015 | | .011 | .010 |
| WAGES | 19,836 | | 19,836 | | 153,050 | 127,970 | 25,080 | | .046 | | .030 | .032 |
| FRINGES | 5,828 | | 5,828 | | 72,126 | 44,664 | 7,462 | | .013 | | .014 | .013 |
| COOLING WATER | | | | | 1,861 | 1,861 | | | | | | .002 |
| STEAM | | | | | 10,745 | 10,745 | | | | | .002 | .008 |
| AIR | | | | | 1,617 | 1,618 | 1- | | | | | .001 |
| EFFLUENT CONTROL | | | | | 7,431 | 7,433 | 2- | | | | .001 | .005 |
| SAFETY & SECURITY | | | | | 1,125 | 3,006 | 1,881- | | | | | .001 |
| INSURANCE & TAXES | 10,692 | | 10,692 | | 115,691 | 76,540 | 39,143 | | .025 | | .022 | .018 |
| TOTAL | 42,861 | | 42,861 | * | 419,102 | 342,993 | 76,109 | * | .099 | | .081 | .090 |
| TOTAL MANUF.COSTS | 594,017 | | 594,017 | | 6,545,075 | 6,721,613 | 246,537- | | 1.374 | | 1.272 | 1.230 |
| PRODUCT TSF @ STD. | 627,096- | | 627,096- | | 7,459,511- | 7,787,909- | 328,398 | | 1.450- | | 1.450- | 1.470 |
| TOTAL | 627,096- | | 627,096- | * | 7,459,511- | 7,787,909- | 328,398 | * | 1.450- | | 1.450- | 1.470 |
| PRODUCT TOTALS PROPANIL TECH | 33,079- | | 33,079- | | 914,436- | 996,297- | 81,861 | | .076- | | .178- | .240 |

current year 1.326
& 7/31/88

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 5 BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|---|
| | % | 126,357 | ACTUAL | 126,357 | % |
| CEDAR - WEST HELENA | | | SCHEDULED CAPACITY | | |

PROD—FLAKED TECH
UNIT—LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| PROPANIL TECH | 186,151 | | 186,151 | 186,151 | | 186,151 | 1.473 | | 1.473 | |
| TOTAL | 186,151 | | 186,151 * | 186,151 | | 186,151 * | 1.473 | | 1.473 | |
| ORDINARY SUPPLY | 3,250 | | 3,250 | 6,723 | | 6,723 | .026 | | .053 | |
| MAINT SUPPLIES | 709 | | 709 | 709 | | 709 | .006 | | .006 | |
| POWER | 1,015 | | 1,015 | 1,015 | | 1,015 | .008 | | .008 | |
| START UP COST | 32,600 | | 32,600 | 46,416 | | 46,416 | .258 | | .367 | |
| TOTAL | 37,574 | | 37,574 * | 54,863 | | 54,863 * | .297 | | .434 | |
| SALARY | 1,223 | | 1,223 | 1,223 | | 1,223 | .010 | | .010 | |
| WAGES | 3,168 | | 3,168 | 3,168 | | 3,168 | .025 | | .025 | |
| FRINGES | 1,162 | | 1,162 | 1,162 | | 1,162 | .009 | | .009 | |
| TOTAL | 5,553 | | 5,553 * | 5,553 | | 5,553 * | .044 | | .044 | |
| TOTAL MANUF.COSTS | 229,278 | | 229,278 | 246,567 | | 246,567 | 1.815 | | 1.951 | |
| PRODUCT TSF @ STD. | 195,853- | | 195,853- | 195,853- | | 195,853- | 1.550- | | 1.550- | |
| TOTAL | 195,853- | | 195,853-* | 195,853- | | 195,853-* | 1.550- | | 1.550- | |
| PRODUCT TOTALS FLAKED TECH | 33,425 | | 33,425 | 50,714 | | 50,714 | .265 | | .401 | |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 14

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | ACTUAL | 220,005 | 65% |
| CEDAR - WEST HELENA | | SCHEDULED | 340,005 | |
| | | CAPACITY | | |

PROD—BLEND BULK
UNIT—LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MESITYL OXIDE | | | | | 47,796 | 72,996 | 25,200- | | | .217 | |
| ISOPHORONE | | | | | | | | | | | .225 |
| TOTAL | | | | * | 47,796 | 72,996 | 25,200-* | | | .217 | .225 |
| PROPANIL TECH | | | | | 165,054 | 255,054 | 90,000- | | | .750 | .746 |
| TOTAL | | | | * | 165,054 | 255,054 | 90,000-* | | | .750 | .746 |
| TOTAL MANUF.COSTS | | | | | 212,850 | 328,050 | 115,200 | | | .967 | .971 |
| PRODUCT TSF @ STD. | | | | | 244,206- | 377,406- | 133,200 | | | 1.110- | 1.120 |
| TOTAL | | | | * | 244,206- | 377,406- | 133,200 * | | | 1.110- | 1.120 |
| PRODUCT TOTALS BLEND BULK | | | | | 31,356- | 49,356- | 18,000 | | | .143- | .149 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 16

BCOST2

SUMMARY

PRODUCTION

| ACTUAL % THIS MONTH | | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| % | ACTUAL | | 220,275 | 65% |
| CEDAR - WEST HELENA | SCHEDULED | | 339,475 | |
| | CAPACITY | | | |

PROD--BLEND 55'S
UNIT--LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLANT OVERHEAD | | | | | | | | | | | | .003 |
| TOTAL | | | | * | | | | * | | | | .003 |
| PROPANIL BLEND | | | | | | | | | | | | |
| TOTAL | | | | * | | | | * | | | | |
| CONTAINERS | | | | | 12,015 | 18,422 | 6,407- | | | | .055 | .055 |
| ORDINARY SUPPLY | | | | | 221 | 491 | 270- | | | | .001 | .006 |
| TOTAL | | | | * | 12,236 | 18,913 | 6,677- | * | | | .056 | .061 |
| SALARY | | | | | 178 | 478 | 300- | | | | .001 | .002 |
| WAGES | 22 | | 22 | | 881 | 1,159 | 278- | | | | .004 | .005 |
| FRINGES | | | | | 309 | 429 | 120- | | | | .001 | .002 |
| TOTAL | 22 | | 22 | * | 1,360 | 2,066 | 698- | * | | | .006 | .009 |
| TOTAL MANUF.COSTS | 22 | | 22 | | 13,604 | 20,979 | 7,375- | | | | .062 | .073 |
| PRODUCT TSF @ STD. | | | | | | | | | | | | |
| TOTAL | | | | * | | | | * | | | | |
| PRODUCT TOTALS BLEND 55'S | 22 | | 22 | | 13,604 | 20,979 | 7,375- | | | | .062 | .073 |

CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 7

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % | THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|---|
| | % | 5,070- | ACTUAL | 225,391 | 194% |
| CEDAR - WEST HELENA | | | SCHEDULED CAPACITY | 116,270 | |

PROD--3# BULK
UNIT--GAL

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MESITYL OXIDE | 19,470- | | 19,470- | | 32,842 | 20,999 | 11,843 | | 3.840 | | .146 | |
| EMULSIFIER | 5,301- | | 5,301- | | 9,790 | 6,142 | 3,648 | | 1.046 | | .043 | .225 |
| ISOPHORONE | | | | | 215,233 | 71,789 | 143,444 | | | | .955 | .446 |
| MIBK USED | 1,325 | | 1,325 | | 1,325 | | 1,325 | | .261- | | .006 | .802 |
| XYLENE USED | 135 | | 135 | | 135 | | 135 | | .027- | | .001 | .083 |
| ARMUL EMULSIFIER | 1,258 | | 1,258 | | 81,959 | 36,702 | 45,257 | | .248- | | .364 | .263 |
| TENNCO 500 | | | | | 93,321 | 36,284 | 57,037 | | | | .414 | .262 |
| OTHER RAW MATERIALS | | | | | | | | | | | | .002 |
| TOTAL | 22,053- | | 22,053- | * | 434,605 | 171,916 | 262,689 | * | 4.350 | | 1.928 | 2.083 |
| PROPANIL TECH | 41,746- | | 41,746- | | 1,022,463 | 553,413 | 469,050 | | 8.234 | | 4.536 | 3.881 |
| PROPANIL BLEND | | | | | | | | | | | | |
| TOTAL | 41,746- | | 41,746- | * | 1,022,463 | 553,413 | 469,050 | * | 8.234 | | 4.536 | 3.881 |
| FRINGES | | | | | | | | | | | | |
| TOTAL | | | | * | | | | * | | | | |
| TOTAL MANUF.COSTS | 63,799- | | 63,799- | | 1,457,068 | 725,329 | 731,739 | | 12.584 | | 6.465 | 5.964 |
| PRODUCT TSF @ STD. | 34,172 | | 34,172 | | 1,519,135- | 783,660- | 735,475- | | 6.740- | | 6.740- | 7.420 |
| TOTAL | 34,172 | | 34,172 | * | 1,519,135- | 783,660- | 735,475- | * | 6.740- | | 6.740- | 7.420 |
| PRODUCT TOTALS 3# BULK | 29,627- | | 29,627- | | 62,067- | 58,331- | 3,736- | | 5.844 | | .275- | 1.456 |

CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 9 BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | 159- | 167,135 | 199% |
| CEDAR - WEST HELENA | | ACTUAL SCHEDULED CAPACITY | 84,015 | |

PROD--3# 200L
UNIT--GAL

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLANT OVERHEAD | | | | | | | | | | | | .028 |
| TOTAL | | | | * | | | | * | | | | .028 |
| PROPANIL 3 LB | | | | | 1,177,552 | 686,328 | 491,224 | | | | 7.046 | 7.420 |
| TOTAL | | | | *1,177,552 | | 686,328 | 491,224 | * | | | 7.046 | 7.420 |
| CONTAINERS | 675 | | 675 | | 110,997 | 97,731 | 13,266 | | 4.245- | | .664 | .494 |
| ORDINARY SUPPLY | | | | | 3,702 | 2,140 | 1,562 | | | | .022 | .013 |
| MAINT SUPPLIES | 47 | | 47 | | 810 | 507 | 303 | | .296- | | .005 | .002 |
| TOTAL | 722 | | 722 | * | 115,509 | 100,378 | 15,131 | * | 4.541- | | .691 | .508 |
| SALARY | 785 | | 785 | | 6,788 | 2,438 | 4,350 | | 4.937- | | .041 | .011 |
| WAGES | 1,218 | | 1,218 | | 9,790 | 11,353 | 1,563- | | 7.660- | | .059 | .030 |
| FRINGES | 328 | | 328 | | 4,834 | 2,003 | 2,831 | | 2.063- | | .029 | .015 |
| TOTAL | 2,331 | | 2,331 | * | 21,412 | 15,794 | 5,618 | * | 14.660- | | .128 | .056 |
| TOTAL MANUF.COSTS | 3,053 | | 3,053 | | 1,314,473 | 802,500 | 511,973 | | 19.201- | | 7.865 | 8.012 |
| PRODUCT TSF @ STD. | 9,901 | | 9,901 | | 1,243,071- | 591,426- | 651,645 | | 62.270- | | 7.438- | 7.960 |
| TOTAL | 9,901 | | 9,901 | *1,243,071- | | 591,426- | 651,645- | * | 62.270- | | 7.438- | 7.960 |
| PRODUCT TOTALS 3# 200L | 12,954 | | 12,954 | | 71,402 | 211,074 | 139,672- | | 81.472- | | .427 | .052 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 11

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | ACTUAL | 52,195 | 330% |
| CEDAR - WEST HELENA | | SCHEDULED CAPACITY | 15,840 | |

PROD--3# 55'S
UNIT--GALS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLANT OVERHEAD | | | | | | | | | | | | .011 |
| TOTAL | | | | * | | | | * | | | | .011 |
| PROPANIL 3 LB | | | | | 348,458 | 106,762 | 241,696 | | | | 6.676 | 7.420 |
| TOTAL | | | | * | 348,458 | 106,762 | 241,696 | * | | | 6.676 | 7.420 |
| CONTAINERS | | | | | 25,623 | 7,776 | 17,847 | | | | .491 | .449 |
| ORDINARY SUPPLY | | | | | 866 | 82 | 784 | | | | .017 | .113 |
| MAINT SUPPLIES | | | | | 824 | 490 | 334 | | | | .016 | .012 |
| TOTAL | | | | * | 27,313 | 8,348 | 18,965 | * | | | .523 | .574 |
| SALARY | 86 | | 86 | | 1,822 | 749 | 1,073 | | | | .035 | .017 |
| WAGES | 236 | | 236 | | 4,839 | 3,005 | 1,834 | | | | .093 | .045 |
| FRINGES | 36 | | 36 | | 2,377 | 1,334 | 1,043 | | | | .046 | .023 |
| TOTAL | 358 | | 358 | * | 9,038 | 5,088 | 3,950 | * | | | .173 | .085 |
| TOTAL MANUF.COSTS | 358 | | 358 | | 384,809 | 120,198 | 264,611 | | | | 7.373 | 8.091 |
| PRODUCT TSF @ STD. | | | | | 387,233- | 118,642- | 268,591- | | | | 7.419- | 7.960 |
| TOTAL | | | | * | 387,233- | 118,642- | 268,591- | * | | | 7.419- | 7.960 |
| PRODUCT TOTALS 3# 55'S | 358 | | 358 | | 2,424- | 1,556 | 3,980- | | | | .046- | .131 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 8

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % | THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|---|
| | % | 66,395 | ACTUAL | 383,676 | 99% |
| CEDAR - WEST HELENA | | | SCHEDULED CAPACITY | 386,304 | |

PROD--4# BULK
UNIT--GAL

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| MESITYL OXIDE | 136,078 | | 136,078 | 612,681 | 611,343 | 1,338 | 2.050 | | 1.597 | .040 |
| EMULSIFIER | 46,529 | | 46,529 | 221,581 | 194,442 | 27,139 | .701 | | .578 | .524 |
| ISOPHORONE | 33,032 | | 33,032 | 260,948 | 255,270 | 5,678 | .498 | | .680 | 2.042 |
| TOTAL | 215,639 | | 215,639 * | 1,095,210 | 1,061,055 | 34,155 * | 3.248 | | 2.855 | 2.607 |
| PROPANIL TECH | 461,492 | | 461,492 | 2,331,427 | 2,358,629 | 27,202- | 6.951 | | 6.077 | 5.186 |
| PROPANIL BLEND | | | | 193,656 | 44,755 | 148,901 | | | .505 | .026 |
| TOTAL | 461,492 | | 461,492 * | 2,525,083 | 2,403,384 | 121,699 * | 6.951 | | 6.581 | 5.212 |
| TOTAL MANUF.COSTS | 677,131 | | 677,131 | 3,620,293 | 3,464,439 | 155,854 | 10.199 | | 9.436 | 7.819 |
| PRODUCT TSF @ STD. | 598,219- | | 598,219- | 3,456,921- | 3,447,349- | 9,572- | 9.010- | | 9.010- | 9.140 |
| TOTAL | 598,219- | | 598,219- * | 3,456,921- | 3,447,349- | 9,572- * | 9.010- | | 9.010- | 9.140 |
| PRODUCT TOTALS 4# BULK | 78,912 | | 78,912 | 163,372 | 17,090 | 146,282 | 1.189 | | .426 | 1.321 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 10

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % | |
|---|---|---|---|---|---|
| | % | ACTUAL | | % | |
| CEDAR - WEST HELENA | | SCHEDULED CAPACITY | 5,005 | | PROD--4# 55'S UNIT--GAL |

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLANT OVERHEAD | | | | | | | | | | | | .047 |
| TOTAL | | | | * | | | | * | | | | .047 |
| PROPANIL 4 LB | | | | | | | | | | | | 9.140 |
| TOTAL | | | | * | | | | * | | | | 9.140 |
| CONTAINERS | | | | | | | | | | | | .478 |
| ORDINARY SUPPLY | | | | | | | | | | | | .006 |
| MAINT SUPPLIES | | | | | | | | | | | | .003 |
| TOTAL | | | | * | | | | * | | | | .487 |
| SALARY | 196 | | 196 | | 196 | | 196 | | | | | .021 |
| WAGES | 226 | | 226 | | 226 | | 226 | | | | | .055 |
| FRINGES | 82 | | 82 | | 02 | | 82 | | | | | .039 |
| TOTAL | 504 | | 504 | * | 504 | | 504 | * | | | | .116 |
| TOTAL MANUF.COSTS | 504 | | 504 | | 504 | | 504 | | | | | 9.790 |
| PRODUCT TSF @ STD. | | | | | | | | | | | | 9.700 |
| TOTAL | | | | * | | | | * | | | | 9.700 |
| PRODUCT TOTALS 4# 55'S | 504 | | 504 | | 504 | | 504 | | | | | .090 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 12

BCOST2

SUMMARY

**********PRODUCTION**********

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | 66,500 | 325,080 | 102% |
| CEDAR - WEST HELENA | | ACTUAL | 325,080 | |
| | | SCHEDULED | 318,830 | |
| | | CAPACITY | | |

PROD--4# 35'S
UNIT--GALS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLANT OVERHEAD | | | | | | 22 | 22- | | | | | .012 |
| TOTAL | | | | * | | 22 | 22- | * | | | | .012 |
| PROPANIL 4 LB | 598,219 | | 598,219 | | 2,937,485 | 2,692,459 | 245,026 | | 8.996 | | 9.036 | 9.141 |
| TOTAL | 598,219 | | 598,219 | * | 2,937,485 | 2,692,459 | 245,026 | * | 8.996 | | 9.036 | 9.141 |
| CONTAINERS | 34,416 | | 34,416 | | 170,208 | 153,806 | 16,402 | | .518 | | .524 | .534 |
| ORDINARY SUPPLY | 148 | | 148 | | 140 | 260 | 112- | | .002 | | | .003 |
| MAINT SUPPLIES | | | | | 532 | 671 | 139- | | | | .002 | .002 |
| TOTAL | 34,564 | | 34,564 | * | 170,888 | 154,737 | 16,151 | * | .520 | | .526 | .539 |
| SALARY | 628 | | 628 | | 5,069 | 5,959 | 90- | | .009 | | .018 | .008 |
| WAGES | 997 | | 997 | | 8,484 | 10,405 | 1,921- | | .015 | | .026 | .021 |
| FRINGES | 263 | | 263 | | 4,014 | 4,733 | 719- | | .004 | | .012 | .009 |
| TOTAL | 1,888 | | 1,888 | * | 18,367 | 21,097 | 2,730- | * | .028 | | .056 | .038 |
| TOTAL MANUF.COSTS | 634,671 | | 634,671 | | 3,126,740 | 2,868,315 | 258,425 | | 9.544 | | 9.618 | 9.730 |
| PRODUCT TSF @ STD. | 638,400- | | 638,400- | | 3,118,080- | 2,868,768- | 249,312- | | 9.600- | | 9.592- | 9.700 |
| TOTAL | 638,400- | | 638,400- | * | 3,118,080- | 2,868,768- | 249,312- | * | 9.600- | | 9.592- | 9.700 |
| PRODUCT TOTALS 4# 35'S | 3,729- | | 3,729- | | 8,660 | 453- | 9,113 | | .056- | | .027 | .030 |

CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 13 BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | ACTUAL | 304,045 | 100% |
| CEDAR - WEST HELENA | | SCHEDULED CAPACITY | 304,045 | |

PROD--STAM BULK
UNIT--GAL

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| EMULSIFIER | | | | 165,537 | 165,536 | 1 | | | .544 | .517 |
| ISOPHORONE | | | | 680,419 | 688,420 | 1- | | | 2.264 | 2.123 |
| TOTAL | | | | * 853,956 | 853,956 | * | | | 2.809 | 2.639 |
| PROPANIL TECH | | | | 1,892,209 | 1,892,209 | | | | 6.223 | 5.225 |
| TOTAL | | | | *1,892,209 | 1,892,209 | * | | | 6.223 | 5.225 |
| TOTAL MANUF.COSTS | | | | 2,746,165 | 2,746,165 | | | | 9.032 | 7.865 |
| PRODUCT TSF @ STD. | | | | 2,739,445- | 2,739,446- | 1 | | | 9.010- | 8.960 |
| TOTAL | | | | *2,739,445- | 2,739,446- | 1 * | | | 9.010- | 8.960 |
| PRODUCT TOTALS STAM BULK | | | | 6,720 | 6,719 | 1 | | | .022 | 1.095 |

CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 15 BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | ACTUAL | 304,045 | 100% |
| CEDAR - WEST HELENA | | SCHEDULED | 304,045 | |
| | | CAPACITY | | |

PROD--STAM 35'S
UNIT--GAL

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLANT OVERHEAD | | | | | | 126 | 126- | | | | | .006 |
| TOTAL | | | | * | | 126 | 126-* | | | | | .006 |
| STAM | | | | | 2,739,445 | 2,739,445 | | | | | 9.010 | 8.960 |
| TOTAL | | | | | *2,739,445 | 2,739,445 | | * | | | 9.010 | 8.960 |
| CONTAINERS | | | | | 145,840 | 145,840 | | | | | .480 | .495 |
| ORDINARY SUPPLY | | | | | | | | | | | | |
| MAINT SUPPLIES | | | | | 32 | 32 | | | | | | |
| TOTAL | | | | * | 145,892 | 145,892 | | * | | | .480 | .495 |
| SALARY | | | | | 2,154 | 2,153 | 1 | | | | .007 | .007 |
| WAGES | 177 | | 177 | | 6,245 | 6,067 | 178 | | | | .021 | .023 |
| FRINGES | | | | | 3,470 | 3,469 | 1 | | | | .011 | .009 |
| TOTAL | 177 | | 177 | * | 11,869 | 11,689 | 180 | * | | | .039 | .039 |
| TOTAL MANUF.COSTS | 177 | | 177 | | 2,897,206 | 2,897,152 | 54 | | | | 9.529 | 9.500 |
| PRODUCT TGF @ STD. | | | | | 2,908,706- | 2,908,706- | | | | | 9.567- | 9.460 |
| TOTAL | | | | | *2,908,706- | 2,908,706- | | * | | | 9.567- | 9.460 |
| PRODUCT TOTALS STAM 35'S | 177 | | 177 | | 11,500- | 11,554- | 54 | | | | .038- | .040 |

CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 25

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | ACTUAL | 104,733 | 76% |
| CEDAR - WEST HELENA | | SCHEDULED CAPACITY | 137,733 | |

PROD—BUTOXONE 175
UNIT--GALS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TECH ACID USED | | | | | 689,156 | 689,156 | | | | | 6.580 | |
| TOTAL | | | | * | 689,156 | 689,156 | | * | | | 6.580 | |
| FORMULATING FEE | | | | | 247,995 | 247,994 | 1 | | | | 2.368 | |
| TOTAL | | | | * | 247,995 | 247,994 | 1 | * | | | 2.368 | |
| TOTAL MANUF.COSTS | | | | | 937,151 | 937,150 | 1 | | | | 8.948 | |
| PRODUCT TSF @ STD. | | | | | 939,840- | 1,003,671- | 63,831 | | | | 8.974- | |
| TOTAL | | | | * | 939,840- | 1,003,671- | 63,831 | * | | | 8.974- | |
| PRODUCT TOTALS BUTOXONE 175 | | | | | 2,689- | 66,521- | 63,832 | | | | .026- | |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 26

BCOST2

SUMMARY

**********PRODUCTION**********

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | ACTUAL | 9,455 | 100% |
| CEDAR - WEST HELENA | | SCHEDULED | 9,455 | |
| | | CAPACITY | | |

PROD--BUTOXONE ESTER
UNIT--GALS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| TECH ACID USED | | | | 58,851 | 58,851 | | | | 6.224 | |
| TOTAL | | | * | 58,851 | 58,851 | * | | | 6.224 | |
| PACKAGING MATERIALS | 495- | | 495- | 710 | | 710 | | | .075 | |
| FORMULATING FEE | | | | 39,069 | 39,069 | | | | 4.132 | |
| TOTAL | 495- | | 495-* | 39,779 | 39,069 | 710 * | | | 4.207 | |
| TOTAL MANUF.COSTS | 495- | | 495- | 98,630 | 97,920 | 710 | | | 10.432 | |
| PRODUCT TSF @ STD. | | | | 124,482- | 96,396- | 28,086- | | | 13.166- | |
| TOTAL | | | * | 124,482- | 96,396- | 28,086-* | | | 13.166- | |
| PRODUCT TOTALS BUTOXONE ESTER | 495- | | 495- | 25,852- | 1,524 | 27,376- | | | 2.734- | |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 27

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | ACTUAL | 29,308 | 85% |
| CEDAR - WEST HELENA | | SCHEDULED | 34,308 | |
| | | CAPACITY | | |

PROD--BUTOXONE 200
UNIT--GALS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TECH ACID USED | | | | | 221,489 | 221,489 | | | | | 7.557 | |
| TOTAL | | | | * | 221,489 | 221,489 | | * | | | 7.557 | |
| FORMULATING FEE | | | | | 69,404 | 69,404 | | | | | 2.368 | |
| TOTAL | | | | * | 69,404 | 69,404 | | * | | | 2.368 | |
| TOTAL MANUF.COSTS | | | | | 290,893 | 290,893 | | | | | 9.925 | |
| PRODUCT TSF @ STD. | | | | | 270,143- | 177,350- | 92,793- | | | | 9.217- | |
| TOTAL | | | | * | 270,143- | 177,350- | 92,793- | * | | | 9.217- | |
| PRODUCT TOTALS BUTOXONE 200 | | | | | 20,750 | 113,543 | 92,793- | | | | .708 | |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 18
BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | ACTUAL | 184,573 | 100% |
| CEDAR - WEST HELENA | | SCHEDULED | 184,573 | |
| | | CAPACITY | | |

PROD--SCI CONTRACT
UNIT--LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLANT OVERHEAD | | | | | | 20,190 | 20,190- | | | | | .189 |
| TOTAL | | | | * | | 20,190 | 20,190- | * | | | | .189 |
| ORDINARY SUPPLY | | | | | | | | | | | | .013 |
| RENTALS | | | | | 672 | 672 | | | | | .004 | .006 |
| OUTSIDE LABOR | | | | | | | | | | | | .006 |
| MAINT SUPPLIES | | | | | 3,632 | 3,633 | 1- | | | | .020 | .036 |
| NITROGEN | | | | | 11,916 | 11,916 | | | | | .065 | .009 |
| GAS | | | | | 2,618 | 2,618 | | | | | .014 | .009 |
| POWER | | | | | 9,701 | 9,701 | | | | | .053 | .055 |
| OTHER | | | | | 1,296 | 1,296 | | | | | .007 | .003 |
| TOTAL | | | | * | 29,835 | 29,836 | 1- | * | | | .162 | .137 |
| SALARY | | | | | 13,283 | 13,283 | | | | | .072 | .059 |
| WAGES | 1,008 | | 1,008 | | 33,468 | 32,458 | 1,010 | | | | .181 | .232 |
| FRINGES | | | | | 19,283 | 19,284 | 1- | | | | .104 | .087 |
| COOLING WATER | | | | | 1,084 | 1,084 | | | | | .006 | .014 |
| STEAM | | | | | 6,941 | 6,941 | | | | | .038 | .044 |
| AIR | | | | | 459 | 459 | | | | | .002 | .005 |
| EFFLUENT CONTROL | | | | | 4,396 | 4,395 | 1 | | | | .024 | .045 |
| INSURANCE & TAXES | | | | | 12,975 | 12,976 | 1- | | | | .070 | .037 |
| TOTAL | 1,008 | | 1,008 | * | 91,889 | 90,880 | 1,009 | * | | | .498 | .522 |
| PRODUCT TOTALS SCI CONTRACT | 1,008 | | 1,008 | | 121,724 | 140,906 | 19,182- | | | | .659 | .848 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 24 BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % | THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|---|
| | 86% | 301,360 | ACTUAL | 3,242,087 | 111% |
| CEDAR - WEST HELENA | | 350,000 | SCHEDULED CAPACITY | 2,931,574 | |

PROD--PERMETHRIN
UNIT--LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| PLANT OVERHEAD | | | | | 28,190 | 28,190- | | | | .080 |
| TOTAL | | | * | | 28,190 | 28,190-* | | | | .080 |
| ORDINARY SUPPLY | 290 | 820 | 530- | 6,390 | 14,994 | 8,604- | .001 | .002 | .002 | .014 |
| RENTALS | | 670 | 670- | 1,791 | 5,681 | 3,890- | | .002 | .001 | .003 |
| OUTSIDE LABOR | 53 | 2,425 | 2,372- | 1,543 | 9,805 | 8,262- | | .007 | | .008 |
| MAINT SUPPLIES | 2,392 | 7,132 | 4,740- | 69,462 | 95,135 | 25,673- | .008 | .020 | .021 | .036 |
| OTHER CHEMICALS | | | | | | | | | | |
| GAS | 7,320 | 6,803 | 517 | 47,583 | 37,291 | 10,292 | .024 | .019 | .015 | |
| POWER | 8,118 | 10,318 | 2,200- | 89,895 | 74,452 | 15,443 | .027 | .029 | .028 | .033 |
| OTHER | 577 | 685 | 108- | 6,906 | 7,849 | 943- | .002 | .002 | .002 | .003 |
| TOTAL | 18,750 | 28,853 | 10,103-* | 223,570 | 245,207 | 21,637-* | .062 | .082 | .069 | .097 |
| SALARY | 9,853 | 9,844 | 9 | 118,001 | 93,930 | 24,071 | .033 | .028 | .036 | .028 |
| WAGES | 32,635 | 26,087 | 6,548 | 311,967 | 277,676 | 34,291 | .108 | .075 | .096 | .110 |
| FRINGES | 8,896 | 12,572 | 3,676- | 129,617 | 135,215 | 5,598- | .030 | .036 | .040 | .044 |
| COOLING WATER | | | | 2,851 | 6,290 | 3,439- | | | .001 | .006 |
| STEAM | | | | 16,804 | 18,727 | 1,923- | | | .005 | .024 |
| AIR | | | | 2,340 | 3,432 | 1,092- | | | .001 | .002 |
| EFFLUENT CONTROL | | 6,324 | 6,324- | 11,884 | 59,510 | 47,626- | | .018 | .004 | .016 |
| INSURANCE & TAXES | 8,027 | 11,170 | 3,143- | 91,701 | 113,708 | 22,007- | .027 | .032 | .028 | .046 |
| TOTAL | 59,411 | 65,997 | 6,584-* | 685,165 | 708,488 | 23,323-* | .197 | .189 | .211 | .276 |
| PRODUCT TOTALS PERMETHRIN | 78,161 | 94,850 | 16,689- | 908,735 | 981,885 | 73,150- | .259 | .271 | .280 | .452 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 6 BCOST2

**********

SUMMARY

**********PRODUCTION**********

| | ACTUAL % | THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|---|
| | 4% | 9,000- | ACTUAL | 910,893 | 102% |
| CEDAR - WEST HELENA | | 250,000 | SCHEDULED CAPACITY | 896,735 | |

PROD--ORFOM
UNIT--LBS

| EXPENSE DESCRIPTION | | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PLANT OVERHEAD | | | | | | | | | | | .152 |
| TOTAL | | | | * | | | * | | | | .152 |
| ORDINARY SUPPLY | | | 232 | 232- | 7,871 | 8,246 | 375- | | .001 | .009 | .016 |
| RENTALS | | | 94 | 94- | 294 | 396 | 102- | | | | .001 |
| OUTSIDE LABOR | | | 140 | 140- | | 226 | 226- | | .001 | | .001 |
| MAINT SUPPLIES | | | 2,115 | 2,115- | 3,821 | 7,041 | 3,220- | | .008 | .004 | .012 |
| NITROGEN | | | 204 | 204- | 8,134 | 6,715 | 1,419 | | .001 | .009 | .005 |
| GAS | | | 73 | 73- | 5,330 | 4,288 | 1,042 | | | .006 | .002 |
| POWER | | | 1,417 | 1,417- | 7,058 | 6,429 | 629 | | .006 | .008 | .024 |
| WASTE DISPOSAL | | | | | 41 | 41 | | | | | |
| OTHER | | | 59 | 59- | 1,120 | 743 | 377 | | | .001 | .004 |
| START UP COST | | | | | 221 | | 221 | | | | |
| TOTAL | | | 4,334 | 4,334-* | 33,890 | 34,125 | 235-* | | .017 | .037 | .065 |
| SALARY | | | 2,198 | 2,198- | 10,218 | 10,043 | 175 | | .009 | .011 | .035 |
| WAGES | | 808 | 4,900 | 4,092- | 28,100 | 27,123 | 977 | .090- | .020 | .031 | .084 |
| FRINGES | | | 1,569 | 1,569- | 6,320 | 11,882 | 5,562- | | .006 | .007 | .039 |
| COOLING WATER | | | | | 110 | 110 | | | | | .006 |
| STEAM | | | | | 586 | 586 | | | | .001 | .005 |
| AIR | | | | | 146 | 146 | | | | | .003 |
| EFFLUENT CONTROL | | | | | 490 | 490 | | | | .001 | .021 |
| INSURANCE & TAXES | | | 990 | 990- | 36,741 | 24,141 | 12,600 | | .004 | .040 | .029 |
| TOTAL | | 808 | 9,657 | 8,849-* | 82,711 | 74,521 | 8,190 * | .090- | .039 | .091 | .224 |
| | PRODUCT TOTALS ORFOM | 808 | 13,991 | 13,103- | 116,601 | 108,646 | 7,955 | .090- | .056 | .128 | .441 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 19

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | ACTUAL | 127,069 | 13% |
| CEDAR - WEST HELENA | | SCHEDULED | 990,350 | |
| | | CAPACITY | | |

PROD--DIPHONE C
UNIT--KILOS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| PLANT OVERHEAD | | | | | | | | | | |
| TOTAL | | | * | | | * | | | | |
| OTHER RAW MATERIALS | 28,649 | | 28,649 | 20,705 | 1,111,360 | 1,090,655- | | | .163 | |
| TOTAL | 28,649 | | 28,649 * | 20,705 | 1,111,360 | 1,090,655-* | | | .163 | |
| ORDINARY SUPPLY | | | | 7,900 | 10,415 | 2,515- | | | .062 | |
| RENTALS | | | | 4,275 | 8,034 | 3,759- | | | .034 | |
| OUTSIDE LABOR | | | | 27,015 | 28,892 | 1,877- | | | .213 | |
| MAINT SUPPLIES | 18,547 | | 18,547 | 64,450 | 116,939 | 52,489- | | | .507 | |
| NITROGEN | | | | 7,004 | 4,951 | 2,053 | | | .055 | |
| GAS | | | | 8,082 | 6,257 | 1,825 | | | .064 | |
| POWER | | | | 40,863 | 64,176 | 23,313- | | | .322 | |
| WASTE DISPOSAL | 4,491 | | 4,491 | 25,757 | 41 | 25,716 | | | .203 | |
| OTHER | | | | 2,625 | 3,437 | 812- | | | .021 | |
| TOTAL | 23,038 | | 23,038 * | 187,971 | 243,142 | 55,171-* | | | 1.479 | |
| SALARY | 339 | | 339 | 41,274 | 77,435 | 36,161- | | | .325 | |
| WAGES | 5,259 | | 5,259 | 166,974 | 310,026 | 143,052- | | | 1.314 | |
| FRINGES | 329 | | 329 | 69,435 | 125,107 | 55,672- | | | .546 | |
| COOLING WATER | | | | 2,535 | 2,535 | | | | .020 | |
| STEAM | | | | 12,948 | 12,948 | | | | .102 | |
| AIR | | | | 2,256 | 2,256 | | | | .018 | |
| EFFLUENT CONTROL | | | | 8,187 | 8,187 | | | | .064 | |
| INSURANCE & TAXES | | | | 57,175 | 57,440 | 1,735 | | | .466 | |
| TOTAL | 5,927 | | 5,927 * | 369,784 | 595,934 | 233,150-* | | | 2.855 | |
| PRODUCT TOTALS DIPHONE C | 57,614 | | 57,614 | 571,460 | 1,950,436 | 1,378,976- | | | 4.497 | |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 20 BCOST2

SUMMARY

PRODUCTION

| ACTUAL % | THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| % | 1,180 | ACTUAL | 138,600 | % |
| | | SCHEDULED | | |
| | | CAPACITY | | |

CEDAR - WEST HELENA PROD--MES UNIT--L

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH-- ACTUAL | SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| PLANT OVERHEAD | | | | | | | | | | .340 |
| TOTAL | | | * | | | * | | | | .340 |
| ORDINARY SUPPLY | | | | | | | | | | |
| RENTALS | | | | | | | | | | .002 |
| OUTSIDE LABOR | | | | | | | | | | .001 |
| MAINT SUPPLIES | | | | 5,604 | | 5,604 | | | .040 | .026 |
| NITROGEN | 1,905 | | 1,905 | 3,525 | | 3,525 | 1.614 | | .025 | .046 |
| GAS | 118- | | 118- | 1,353 | | 1,353 | .100- | | .010 | .009 |
| POWER | 203- | | 203- | 3,782 | | 3,782 | .172- | | .027 | .061 |
| OTHER | 38 | | 38 | 451 | | 451 | .032 | | .003 | .004 |
| START UP COST | | | | 2,688 | | 2,688 | | | .019 | |
| TOTAL | 1,622 | | 1,622 * | 17,403 | | 17,403 * | 1.375 | | .126 | .150 |
| SALARY | 185- | | 185- | 8,850 | | 8,850 | .157- | | .064 | .103 |
| WAGES | 175 | | 175 | 19,188 | | 19,188 | .148 | | .138 | .255 |
| FRINGES | 158- | | 158- | 9,238 | | 9,238 | .134- | | .067 | .111 |
| COOLING WATER | | | | | | | | | | .005 |
| STEAM | | | | | | | | | | .007 |
| AIR | | | | | | | | | | .004 |
| EFFLUENT CONTROL | | | | | | | | | | .043 |
| INSURANCE & TAXES | | | | 10,446 | | 10,446 | | | .075 | .040 |
| TOTAL | 168- | | 168-* | 47,722 | | 47,722 * | .142- | | .344 | .568 |
| PRODUCT TOTALS MES | 1,454 | | 1,454 | 65,125 | | 65,125 | 1.232 | | .470 | 1.058 |

CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 21

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | ACTUAL | 499,631 | % |
| CEDAR - WEST HELENA | | SCHEDULED CAPACITY | | |

PROD--SECTAGON II
UNIT--GAL

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLANT OVERHEAD | | | | | | | | | | | | .384 |
| TOTAL | | | | * | | | | * | | | | .384 |
| OTHER RAW MATERIALS | | | | | | | | | | | | .924 |
| TOTAL | | | | * | | | | * | | | | .924 |
| ORDINARY SUPPLY | | | | | 2,675 | | 2,675 | | | | .005 | .001 |
| RENTALS | | | | | 150 | | 150 | | | | | .018 |
| OUTSIDE LABOR | | | | | 350 | | 350 | | | | .001 | |
| MAINT SUPPLIES | | | | | 4,103 | | 4,103 | | | | .008 | .182 |
| NITROGEN | | | | | | | | | | | | .007 |
| GAS | | | | | | | | | | | | .016 |
| POWER | | | | | 13,984 | | 13,984 | | | | .028 | .154 |
| OTHER | | | | | 966 | | 966 | | | | .002 | .010 |
| START UP COST | | | | | 26,347 | | 26,347 | | | | .053 | |
| TOTAL | | | | * | 48,575 | | 48,575 | * | | | .097 | .387 |
| SALARY | | | | | 19,370 | | 19,370 | | | | .039 | .095 |
| WAGES | 1,330 | | 1,330 | | 43,748 | | 43,748 | | | | .088 | .392 |
| FRINGES | | | | | 21,295 | | 21,295 | | | | .043 | .147 |
| COOLING WATER | | | | | | | | | | | | .045 |
| STEAM | | | | | | | | | | | | .101 |
| AIR | | | | | | | | | | | | .009 |
| EFFLUENT CONTROL | | | | | | | | | | | | .093 |
| INSURANCE & TAXES | | | | | 20,326 | | 20,326 | | | | .041 | .108 |
| TOTAL | 1,330 | | 1,330 | * | 104,739 | | 104,739 | * | | | .210 | .989 |
| PRODUCT TOTALS SECTAGON II | 1,330 | | 1,330 | | 153,314 | | 153,314 | | | | .307 | 2.684 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 23 BCOST2

SUMMARY

PRODUCTION

| ACTUAL % THIS MONTH | | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| % | 15,657 | ACTUAL | 15,657 | % |
| CEDAR - WEST HELENA | | SCHEDULED CAPACITY | | |

PROD---DUPONT-MBC
UNIT---LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| PLANT OVERHEAD | | | | | | | | | | .128 |
| TOTAL | | | * | | | * | | | | .128 |
| ORDINARY SUPPLY | 1,421 | | 1,421 | 1,421 | | 1,421 | .091 | | .091 | .015 |
| RENTALS | 100 | | 100 | 100 | | 100 | .006 | | .006 | .005 |
| OUTSIDE LABOR | | | | | | | | | | .008 |
| MAINT SUPPLIES | 6,731 | | 6,731 | 6,731 | | 6,731 | .430 | | .430 | .068 |
| OTHER CHEMICALS | | | | | | | | | | .011 |
| NITROGEN | | | | | | | | | | .009 |
| GAS | 1,766 | | 1,766 | 1,766 | | 1,766 | .113 | | .113 | .004 |
| POWER | 5,886 | | 5,886 | 5,886 | | 5,886 | .376 | | .376 | .040 |
| OTHER | 539 | | 539 | 539 | | 539 | .034 | | .034 | .004 |
| START UP COST | 89,192 | | 89,192 | 94,217 | | 94,217 | 5.697 | | 6.018 | |
| TOTAL | 105,635 | | 105,635 * | 110,660 | | 110,660 * | 6.747 | | 7.068 | .164 |
| SALARY | 6,790 | | 6,790 | 6,790 | | 6,790 | .434 | | .434 | .045 |
| WAGES | 17,789 | | 17,789 | 17,789 | | 17,789 | 1.136 | | 1.136 | .202 |
| FRINGES | 6,523 | | 6,523 | 6,523 | | 6,523 | .417 | | .417 | .072 |
| COOLING WATER | | | | | | | | | | .012 |
| STEAM | | | | | | | | | | .056 |
| AIR | | | | | | | | | | .003 |
| EFFLUENT CONTROL | | | | | | | | | | .025 |
| INSURANCE & TAXES | 10,446 | | 10,446 | 10,446 | | 10,446 | .667 | | .667 | .045 |
| TOTAL | 41,548 | | 41,548 * | 41,548 | | 41,548 * | 2.654 | | 2.654 | .460 |
| PRODUCT TOTALS DUPONT-MBC | 147,183 | | 147,183 | 152,208 | | 152,208 | 9.400 | | 9.721 | .751 |

CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 28

BCOST2

SUMMARY

PRODUCTION

| ACTUAL % THIS MONTH | | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| % | ACTUAL SCHEDULED CAPACITY | | | % |

CEDAR - WEST HELENA

PROD—IDLE PLANT
UNIT—LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| PLANT OVERHEAD | | | | | | | | | | |
| TOTAL | | | * | | | * | | | | |
| ORDINARY SUPPLY | | | | | | | | | | |
| RENTALS | | | | | | | | | | |
| OUTSIDE LABOR | | | | | | | | | | |
| MAINT SUPPLIES | | | | 35 | 35 | | | | | |
| NITROGEN | | | | | | | | | | |
| GAS | | | | | | | | | | |
| POWER | | | | | | | | | | |
| OTHER | | | | | | | | | | |
| TOTAL | | | * | 35 | 35 | * | | | | |
| SALARY | | 14,259 | 14,259- | 1,879 | 35,682 | 33,803- | | | | |
| WAGES | 140 | 37,481 | 37,341- | 4,753 | 103,711 | 98,958- | | | | |
| FRINGES | | | | 2,152 | 1,371 | 781 | | | | |
| COOLING WATER | | | | | | | | | | |
| STEAM | | | | | | | | | | |
| AIR | | | | | | | | | | |
| EFFLUENT CONTROL | | | | | | | | | | |
| INSURANCE & TAXES | 10,381- | 6,630 | 17,011- | 37,535 | 33,621 | 3,914 | | | | |
| TOTAL | 10,241- | 58,370 | 68,611-* | 46,319 | 174,385 | 128,066-* | | | | |
| TOTAL MANUF.COSTS | 10,241- | 58,370 | 68,611- | 46,354 | 174,420 | 128,066- | | | | |
| PRODUCT TSF @ STD. | | | | | | | | | | |
| TOTAL | | | * | | | * | | | | |
| PRODUCT TOTALS | 10,241- | 58,370 | 68,611- | 46,354 | 174,420 | 128,066- | | | | |
| IDLE PLANT | | | | | | | | | | |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA PRODUCTION — COST REPORT BY DEPARTMENT — PAGE 1 — BCOST4

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH ACTUAL COST | CURRENT MONTH SCHEDULED COST | CURRENT MONTH OVER/UNDER SCHED.COST | YEAR-TO-DATE ACTUAL COST | YEAR-TO-DATE SCHEDULED COST | YEAR-TO-DATE OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 5510 | BUTOXONE TECH ACID | | | | 969,496 | 969,496 | |
| 5630 | DCA | 506,870 | | 506,870 | 5,236,079 | 5,467,862 | 231,783- |
| 5640 | PROPIONIC ACID | 11,010 | | 11,010 | 440,857 | 508,736 | 67,879- |
| 5650 | PROPIONIC ANHYDRIDE | 16,238 | | 16,238 | 236,500 | 290,513 | 54,013- |
| 5660 | MESITYL OXIDE | 116,608 | | 116,608 | 693,319 | 705,338 | 12,019- |
| 5670 | EMULSIFIER | 41,228 | | 41,228 | 396,908 | 366,120 | 30,788 |
| 5675 | ARMUL | 1,258 | | 1,258 | 81,959 | 36,702 | 45,257 |
| 5680 | ISOPHORONE | 33,032 | | 33,032 | 1,164,600 | 1,015,479 | 149,121 |
| 5685 | TENNECO 500 | | | | 93,321 | 36,284 | 57,037 |
| 5690 | XYLENE | 135 | | 135 | 135 | | 135 |
| 5695 | MIBK | 1,325 | | 1,325 | 1,325 | | 1,325 |
| 5850 | OTHER RAW MATERIALS | 28,649 | | 28,649 | 20,705 | 1,111,360 | 1,090,655- |
| 5870 | PACKAGING MATERIALS | 495- | | 495- | 710 | | 710 |
| 6100 | SALARIES | 15,117 | 15,118 | 1- | 181,895 | 176,287 | 5,608 |
| 6110 | WAGES | 38,799 | 42,708 | 3,909- | 463,885 | 521,379 | 57,494- |
| 6140 | HOLIDAY & VAC PAY | 17,842 | 900 | 16,942 | 54,573 | 19,801 | 34,772 |
| 6150 | SICK & ALLOWED PAY | 940 | 350 | 590 | 5,619 | 4,189 | 1,430 |
| 6160 | OTHER (CALL-OUT PRE) | 92- | 108 | 200- | 3,005 | 1,320 | 1,685 |
| 6300 | CONTRACT LABOR & MTL | | | | 2,140 | 140 | 2,000 |
| 6340 | NATURAL GAS | 16,877 | 6,876 | 10,001 | 160,628 | 120,589 | 40,039 |
| 6350 | ELECTRICITY | 24,999 | 23,955 | 1,044 | 277,800 | 311,173 | 33,373- |
| 6360 | WATER | 1,731 | 744 | 987 | 20,378 | 19,854 | 524 |
| 6400 | ORDINARY SUPPLIES | 4,203 | 300 | 3,903 | 28,842 | 22,727 | 6,115 |
| 6410 | MAINTENANCE SUPPLIES | 1,003 | 210 | 793 | 10,475 | 5,254 | 5,221 |
| 6470 | NITROGEN | 522- | 204 | 726- | 62,536 | 51,156 | 11,380 |
| 6510 | OTHR CHEM & SOLVENTS | | | | 19,006 | 17,529 | 1,477 |
| 6590 | CONTRACT FORMULATING | | | | 356,468 | 356,467 | 1 |
| 6650 | RENTALS | 3,712 | 990 | 2,722 | 23,458 | 18,610 | 4,848 |
| 6950 | SALARY FRINGES | | | | | | |
| 6960 | WAGE FRINGES | 14,653 | 9,567 | 5,086 | 207,431 | 213,331 | 5,900- |
| | DEPARTMENT TOTALS | 895,120 | | 793,090 * | | 12,367,694 | * |
| | PRODUCTION | | 102,030 | | 11,214,053 | | 1,153,643- |

CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA COST REPORT BY DEPARTMENT PAGE 2 BCOST4
MAINTENANCE-GENERAL

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 5250 | START-UP COST | 121,792 | | 121,792 | 169,889 | | 169,889 |
| 6100 | SALARIES | 4,998 | 5,000 | 2- | 60,736 | 58,827 | 1,909 |
| 6110 | WAGES | 13,876 | 18,655 | 4,779- | 252,677 | 286,636 | 33,959- |
| 6140 | HOLIDAY & VAC PAY | 9,182 | 2,610 | 6,572 | 34,040 | 26,383 | 7,657 |
| 6150 | SICK & ALLOWED PAY | | 30 | 30- | 2,354 | 1,061 | 1,293 |
| 6160 | OTHER (CALL-OUT PRE) | | 20 | 20- | 2,626 | 196 | 2,430 |
| 6300 | CONTRACT LABOR & MTL | 353 | 3,190 | 2,837- | 49,339 | 48,148 | 1,191 |
| 6390 | TRVL & ENTERTAINMENT | | 100 | 100- | 89 | 740 | 651- |
| 6400 | ORDINARY SUPPLIES | 21,158- | 1,107 | 22,265- | 18,231- | 11,994 | 30,225- |
| 6410 | MAINTENANCE SUPPLIES | 41,590 | 14,250 | 27,340 | 345,914 | 397,248 | 51,334- |
| 6420 | MAINTENANCE TOOLS | | 200 | 200- | 133 | 1,400 | 1,267- |
| 6430 | EXPENDABLE ITEMS | 1,260 | 1,100 | 160 | 24,772 | 19,633 | 5,139 |
| 6510 | OTHR CHEM & SOLVENTS | | 75 | 75- | | 525 | 525- |
| 6620 | FEES & TUITIONS | 75 | 150 | 75- | 1,641 | 1,298 | 343 |
| 6650 | RENTALS | 1,245 | 299 | 946 | 15,624 | 13,208 | 2,416 |
| 6730 | POND CLOSURER/CREDIT | | | | | | |
| 6940 | EFFLUENT COST | | | | 170 | 170 | |
| 6950 | SALARY FRINGES | | | | | | |
| 6960 | WAGE FRINGES | 5,240 | 4,731 | 509 | 109,018 | 122,662 | 13,644- |
| | DEPARTMENT TOTALS | 178,453 | | 124,936 * | | 990,129 | * |
| | MAINTENANCE-GENERAL | | 51,517 | | 1,050,791 | | 60,662 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA STORE & RECEIVING COST REPORT BY DEPARTMENT PAGE 3 BCOST4

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 6110 | WAGES | 1,267 | 1,431 | 164- | 17,958 | 17,437 | 521 |
| 6140 | HOLIDAY & VAC PAY | 1,298 | 148 | 1,150 | 4,053 | 1,872 | 2,181 |
| 6150 | SICK & ALLOWED PAY | | 9 | 7- | 291 | 63 | 228 |
| 6160 | OTHER (CALL-OUT PRE) | | 3 | 3- | 758 | 56 | 702 |
| 6400 | ORDINARY SUPPLIES | | | | | | |
| 6410 | MAINTENANCE SUPPLIES | | | | | | |
| 6680 | FREIGHT IN (MISC.) | 222 | 1,275 | 1,053- | 8,666 | 13,986 | 5,320- |
| 6960 | WAGE FRINGES | 478 | 772 | 294- | 7,911 | 8,925 | 1,014- |
| | DEPARTMENT TOTALS | 3,265 | | 373-* | | 42,339 | * |
| | STORE & RECEIVING | | 3,638 | | 39,637 | | 2,702- |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA COST REPORT BY DEPARTMENT PAGE 4 BCOST4
SAFETY & SECURITY **********

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 6100 | SALARIES | 2,428 | 2,428 | | 27,664 | 29,384 | 280 |
| 6110 | WAGES | 7,015 | 6,109 | 906 | 77,383 | 75,320 | 2,063 |
| 6140 | HOLIDAY & VAC PAY | 3,418 | 961 | 2,457 | 9,645 | 8,621 | 1,024 |
| 6150 | SICK & ALLOWED PAY | | 72 | 72- | 491 | 994 | 503- |
| 6160 | OTHER (CALL-OUT PRE) | | 13 | 13- | | 91 | 91- |
| 6260 | MEDICAL EXAMS | | 1,280 | 1,280- | 13,908 | 18,281 | 4,373- |
| 6270 | BLOOD TEST | | | | 1,975 | 3,080 | 1,105- |
| 6280 | SAFETY SUPPLIES | 4,377 | 3,580 | 797 | 44,558 | 43,850 | 708 |
| 6300 | CONTRACT LABOR & MTL | | 170 | 170- | 614- | 1,280 | 1,894- |
| 6390 | TRVL & ENTERTAINMENT | | | | | | |
| 6400 | ORDINARY SUPPLIES | | | | | | |
| 6620 | FEES & TUITIONS | | 20 | 20- | 700 | 840 | 140- |
| 6950 | SALARY FRINGES | | | | | | |
| 6960 | WAGE FRINGES | 2,650 | 3,297 | 647- | 34,754 | 38,976 | 4,222- |
| | DEPARTMENT TOTALS | 19,888 | | 1,958 * | | 220,717 | * |
| | SAFETY & SECURITY | | 17,930 | | 212,464 | | 8,253- |

CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA LABORATORY COST REPORT BY DEPARTMENT PAGE 5 BCOST4

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 6100 | SALARIES | 5,331 | 5,331 | | 62,463 | 60,400 | 2,063 |
| 6110 | WAGES | 10,049 | 12,350 | 2,301- | 120,369 | 148,310 | 19,941- |
| 6140 | HOLIDAY & VAC PAY | 6,337 | 1,758 | 4,579 | 17,040 | 15,484 | 1,556 |
| 6150 | SICK & ALLOWED PAY | 149 | 122 | 27 | 223 | 928 | 705- |
| 6160 | OTHER (CALL-OUT PRE) | | 28 | 28- | 149 | 345 | 196- |
| 6300 | CONTRACT LABOR & MTL | | 120 | 120- | | 720 | 720- |
| 6390 | TRVL & ENTERTAINMENT | | 5 | 5- | 59 | 75 | 16- |
| 6400 | ORDINARY SUPPLIES | 3,657 | 1,901 | 1,756 | 36,279 | 30,098 | 6,181 |
| 6410 | MAINTENANCE SUPPLIES | 64 | 190 | 126- | 1,699 | 1,767 | 68- |
| 6620 | FEES & TUITIONS | | | | 1,448 | 1,198 | 250 |
| 6650 | RENTALS | | 25 | 25- | 242 | 417 | 175- |
| 6950 | SALARY FRINGES | | | | | | |
| 6960 | WAGE FRINGES | 3,887 | 3,271 | 616 | 57,707 | 65,396 | 7,689- |
| | SUB TOTAL | 29,474 | 25,101 | 4,373 | 305,678 | 325,138 | 19,460- |
| 6980 | ALLC COST CENTER EXP | | | | | | |
| | DEPARTMENT TOTALS LABORATORY | 29,474 | 25,101 | 4,373 * | 305,678 | 325,138 | 19,460- * |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA COST REPORT BY DEPARTMENT PAGE 6 BCOST4
SHIPPING & PACKAGING **********

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 5890 | CONTAINERS | 35,091 | | 35,091 | 464,703 | 423,595 | 41,108 |
| 6100 | SALARIES | 2,088 | 2,088 | | 23,989 | 24,137 | 148- |
| 6110 | WAGES | 2,560 | 680 | 1,880 | 38,023 | 43,814 | 5,791- |
| 6140 | HOLIDAY & VAC PAY | 1,443 | 749 | 694 | 7,089 | 6,212 | 877 |
| 6150 | SICK & ALLOWED PAY | | 146 | 146- | 598 | 1,619 | 1,021- |
| 6160 | OTHER (CALL-OUT PRE) | | 41 | 41- | 1,085 | 287 | 798 |
| 6400 | ORDINARY SUPPLIES | 148 | 100 | 48 | 7,515 | 6,971 | 544 |
| 6410 | MAINTENANCE SUPPLIES | 3,888 | 75 | 3,813 | 8,621 | 2,225 | 6,396 |
| 6950 | SALARY FRINGES | | | | | | |
| 6960 | WAGE FRINGES | 874 | 367 | 507 | 18,298 | 18,362 | 64- |
| | DEPARTMENT TOTALS | 46,092 | | 41,846 * | | 527,222 | * |
| | SHIPPING & PACKAGING | | 4,246 | | 569,921 | | 42,699 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA ENVIRONMENTAL COST REPORT BY DEPARTMENT PAGE 8 BCOST4

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 6100 | SALARIES | 2,703 | 3,396 | 693- | 25,960 | 29,223 | 3,263- |
| 6110 | WAGES | 2,275 | 5,906 | 3,631- | 45,417 | 56,843 | 11,426- |
| 6140 | HOLIDAY & VAC PAY | 1,537 | | 1,537 | 1,537 | | 1,537 |
| 6300 | CONTRACT LABOR & MTL | 35,920 | 600 | 35,320 | 48,130 | 5,647 | 42,483 |
| 6390 | TRVL & ENTERTAINMENT | 17 | 50 | 33- | 69 | 319 | 250- |
| 6400 | ORDINARY SUPPLIES | | 200 | 200- | 22,270 | 9,881 | 12,389 |
| 6410 | MAINTENANCE SUPPLIES | | 500 | 500- | 4,128 | 4,295 | 167- |
| 6560 | OFF SITE WASTE DISPO | 4,491 | | 4,491 | 25,798 | 82 | 25,716 |
| 6580 | OTHR WSTE TREAT CHEM | | | | | | |
| 6620 | FEES & TUITIONS | | 905 | 905- | | 5,574 | 5,574- |
| 6650 | RENTALS | | 150 | 150- | 600 | 1,711 | 1,111- |
| 6710 | PROPERTY TAXES & LIC | 22,560- | 565 | 23,125- | 18,619- | 5,964 | 24,583- |
| 6730 | POND CLOSURER/CREDIT | 22,882- | | 22,882- | 22,882- | | 22,882- |
| 6900 | POWER | | | | 4,728 | 7,306 | 2,578- |
| 6950 | SALARY FRINGES | | | | | | |
| 6960 | WAGE FRINGES | 859 | 3,188 | 2,327 | 19,349 | 28,019 | 8,670- |
| | SUB TOTAL | 2,360 | | 13,100- | | 154,864 | |
| | | | 15,460 | | 156,485 | | 1,621 |
| 6990 | ALLC COST CENTER TSF | 13,919 | 15,460- | 29,379 | 120,953- | 165,580- | 44,627 |
| | DEPARTMENT TOTALS ENVIRONMENTAL | 16,279 | | 14,279 x | 35,532 | 10,716- | 46,248 * |

CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA YARDS & GROUNDS — COST REPORT BY DEPARTMENT — PAGE 9 — BCOST4

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 6100 | SALARIES | | 1,455 | 1,455- | 670 | 5,179 | 4,509- |
| 6110 | WAGES | 734 | 1,942 | 1,208- | 19,541 | 15,260 | 3,281 |
| 6140 | HOLIDAY & VAC PAY | 414 | | 414 | 414 | | 414 |
| 6300 | CONTRACT LABOR & MTL | 375 | 325 | 50 | 4,857 | 4,739 | 118 |
| 6360 | WATER | | | | | | |
| 6400 | ORDINARY SUPPLIES | 317 | 10 | 307 | 336 | 70 | 266 |
| 6410 | MAINTENANCE SUPPLIES | | | | 20 | 20 | |
| 6650 | RENTALS | | | | | | |
| 6950 | SALARY FRINGES | | | | | | |
| 6960 | WAGE FRINGES | 277 | 1,306 | 1,029- | 7,551 | 7,603 | 52- |
| | DEPARTMENT TOTALS | 2,117 | | 2,921-* | | 32,871 | * |
| | YARDS & GROUNDS SUB TOTAL | | 5,038 | | 32,389 | | 482- |

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| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 8100 | SALARIES | 23,000 | 22,997 | 3 | 395,520 | 285,746 | 19,774 |
| 8140 | HOLIDAY & VAC PAY | 6,577 | | 6,577 | 6,328 | 914 | 5,414 |
| 8150 | SICK PAY | | | | | 142 | 142- |
| 8160 | OTHER PAY | | | | | 26 | 26- |
| 8200 | PAYROLL TAXES | 3,297 | 3,550 | 253- | 41,916 | 47,814 | 5,898- |
| 8210 | GROUP INSURANCE | 4,170 | 3,400 | 770 | 38,881 | 39,713 | 832- |
| 8220 | WKMNS COMP INSURANCE | 1,198 | 240 | 958 | 9,662 | 3,656 | 6,006 |
| 8230 | PENSION PLAN COST | | 2,500 | 2,500- | 30,616 | 29,222 | 1,394 |
| 8310 | TEMPORARY HELP | | | | | | |
| 8350 | ELECTRICITY | | 400 | 400- | 10,431 | 12,548 | 2,117- |
| 8360 | COURRIER EXP. | 429 | 120 | 309 | 2,787 | 1,818 | 969 |
| 8370 | COMMUNICATIONS | 3,975 | 3,000 | 975 | 37,446 | 37,075 | 371 |
| 8390 | TRAVEL | 2,618 | 640 | 1,978 | 20,418 | 9,557 | 10,861 |
| 8395 | MEALS/ENTERTAINMENT | 226 | 400 | 174- | 4,749 | 4,403 | 346 |
| 8400 | OFFICE SUPPLIES | 1,475 | 1,380 | 95 | 15,555 | 15,033 | 522 |
| 8420 | CONTRIBUTIONS | 28 | | 28 | 1,838 | 285 | 1,553 |
| 8460 | MISCELLANEOUS | 1,883 | 730 | 1,153 | 7,385 | 9,459 | 2,074- |
| 8560 | AUTO RENTALS | 384 | 400 | 16- | 4,050 | 3,657 | 393 |
| 8610 | DUES & SUBSCRIPTIONS | | 120 | 120- | 2,051 | 1,591 | 460 |
| 8620 | FEES & TUITIONS | 20 | 95 | 75- | 4,612 | 4,212 | 400 |
| 8650 | ADVERTISING | | | | 2,663 | 2,366 | 297 |
| 8660 | CONSULTING FEES | | | | | | |
| 8695 | OTHER LEASE EXPENSE | 647 | 1,105 | 458- | 9,919 | 12,550 | 2,631- |
| 8699 | MANAGEMENT FEE EDDY | | 6,292 | 6,292- | 1- | 55,604 | 55,605- |
| | DEPARTMENT TOTALS | 49,927 | | 2,558 * | | 577,391 | * |
| | ADMINSTRATIVE | | 47,369 | | 556,826 | | 20,565- |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA GENERAL PLANT — COST REPORT BY DEPARTMENT — PAGE 11 — BCOST4

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 5260 | TASK FORCE EXPENSES | 279,500- | 14,500 | 294,000- | 421,843- | 107,213 | 529,055- |
| 6600 | INSURANCE-PLANT | 12,146 | 17,205 | 5,059- | 329,090 | 285,122 | 43,968 |
| 6710 | PROPERTY TAXES & LIC | 6,638 | 1,585 | 5,053 | 65,946 | 33,438 | 32,508 |
| | SUB TOTAL | 260,716- | | 294,006- | | 425,773 | |
| | | | 33,290 | | 26,806- | | 452,579- |
| 6999 | ALLOC PLT OVERHEAD | 35,679 | 59,000 | 23,321- | 928,173 | 853,379 | 74,794 |
| 8900 | DEPRECIATION | 55,508 | 48,000 | 7,508 | 598,969 | 547,073 | 51,896 |
| 8910 | AMORTIZIATION EXP | | 2,300 | 2,300- | 163,312 | 33,310 | 130,002 |
| | DEPARTMENT TOTALS | 169,529- | | 312,119 * | | 1,859,535 | * |
| | GENERAL PLANT | | 142,590 | | 1,663,648 | | 195,887- |

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| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 6710 | PROPERTY TAXES & LIC | | | | 2,054 | 545 | 1,509 |
| | SUB TOTAL | | | | | 545 | |
| | | | | | 2,054 | | 1,509 |
| 8620 | FEES & TUITIONS | | | | 152 | | 152 |
| | DEPARTMENT TOTALS | | | * | | 545 | * |
| | GENERAL PLANT | | | | 2,206 | | 1,661 |
| | SUB TOTAL | | | | | | |

CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA COST REPORT BY DEPARTMENT PAGE 13 BCOST4
RESEARCH & DEVELOPMT **********

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 8100 | SALARIES | 4,425 | | 4,425 | 8,850 | | 8,850 |
| 8140 | HOLIDAY & VAC PAY | 191 | | 191 | 191 | | 191 |
| 8390 | TRAVEL | 430 | | 430 | 872 | | 872 |
| 8395 | MEALS/ENTERTAINMENT | 104 | | 104 | 104 | | 104 |
| 8610 | DUES & SUBSCRIPTIONS | 116 | | 116 | 116 | | 116 |
| 8620 | FEES & TUITIONS | 48 | | 48 | 861 | | 861 |
| | DEPARTMENT TOTALS RESEARCH & DEVELOPMT | 5,314 | | 5,314 * | 10,994 | | 10,994 * |

CEDAR CHEMICAL CORPORATION

DATE 12/31/88 CEDAR - WEST HELENA FRINGES COST REPORT BY DEPARTMENT PAGE 15 BCOST4

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 6200 | PAYROLL TAXES | 9,229 | 13,000 | 3,771- | 89,112 | 159,986 | 70,874- |
| 6210 | GROUP INSURANCE | 16,761 | 18,600 | 1,839- | 183,637 | 217,658 | 34,021- |
| 6220 | WORKMANS COMP INSUR | 2,930 | 3,700 | 770- | 45,684 | 44,432 | 1,252 |
| 6230 | PENSION PLAN COST | | 12,900 | 12,900- | 143,584 | 151,328 | 7,744- |
| | SUB TOTAL | 28,920 | 48,200 | 19,280- | 462,017 | 573,404 | 111,387- |
| 6990 | ALLC COST CENTER TSF | 28,920- | 2,224- | 26,696- | 462,018- | 572,252- | 110,234 |
| | DEPARTMENT TOTALS | | | 45,976-* | | 1,152 | * |
| | FRINGES | | 45,976 | | 1- | | 1,153- |

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COMPANY West Helena - 04

CAPITAL EXPENDITURE STATUS - AFE PROJECTS IN PROGRESS

12/31/88

| DESCRIPTION | CEDAR NO | PLT NO | ACTUAL PRIOR TO 1/1/88 | CAPITAL CURRENT YEAR | SPENDING TOTAL PROJ COST | ESTIM. COST TO COMPLETE | APPROVED C A R. |
|---|---|---|---|---|---|---|---|
| Emulsifier Tank - | | 8704 | 25,479 | 21,743 | 47,222 | 50,000 | 50,000 |
| Grace Project | | 8805 | | 103,392 | 103,392 | 2,700,000 | |
| Back-up generator | | 8806 | | 21,633 | 21,633 | 38,500 | 38,500 |
| Flaker for flaked tech | | 8807 | | | 0 | 200,000 | |
| Waste water accumulation tank | | 8808 | | 26,000 | 26,000 | 31,140 | |
| Total | | | 25,479 | 172,768 | 198,247 | 3,019,640 | 88,500 |

Note: Capital work being done without an approved CAR in hand.



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COMPANY West Helena - 04

CAPITAL EXPENDITURE STATUS - AFE COMPLETED PROJECTS

12/31/88

| DESCRIPTION | CEDAR NO | PLT NO | ACTUAL CAPITAL SPENDING PRIOR TO 1/1/88 | CURRENT YEAR | TOTAL PROJ COST | ESTIM. COST TO COMPLETE | APPROVED C A R |
|---|---|---|---|---|---|---|---|
| Drum Storage Area | | 8705 | 5,104 | 126 | 5,230 | 10,000 | 10,000 |
| Used Plaudler Exc 301 | | 8707 | | 6,880 | 6,880 | 8,000 | 6,000 |
| Mobile Loading Dock | | 8803 | | 9,015 | 9,015 | 9,100 | 8,825 |
| P.C. Computer System | | 8804 | | 7,708 | 7,708 | 7,500 | 7,500 |
| Environmental Cost(Purchase Agreement) | | | | 66,000 | 66,000 | | |
| Yorkshire-Diphone C Plant Expansion | | 8706 | 380,118 | 488,176 | 868,294 | 860,000 | 650,000 |
| Spare Vacuum Pump | | 8801 | | 24,790 | 24,790 | 25,000 | 25,000 |
| Lab Office | | 8802 | | 10,133 | 10,133 | 10,000 | 9,888 |
| Total | | | 385,222 | 611,928 | 997,150 | 927,600 | 717,213 |



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CEDAR CHEMICAL CORPORATION

DATE 12/31/80 SUMMARY INVENTORY PAGE 1

FINISHED GOODS VALUE REPORT CEDAR - WEST HELENA SINVRP

| | PRODUCT GROUP / DESCRIPTION | WH | UNIT | QTY ON HAND | UNIT COST | EXTENDED VALUE |
|---|---|---|---|---|---|---|
| | PROPANIL TECH | 04 | GAL | 24,520 | 1.31 | 32,188.00 |
| TOTAL | PROPANIL TECH | | | 24,520 | 1.31 | 32,188.00 * |
| | PROPANIL 3# | 04 | GAL | 5,770 | 7.49 | 43,142.40 |
| | PROPANIL 3# | 10 | GAL | 29,009 | 7.49 | 217,277.41 |
| TOTAL | PROPANIL 3# | | | 34,779 | 7.49 | 260,419.81 * |
| | PROPANIL 4# | 04 | GAL | 62,020 | 9.60 | 595,392.00 |
| | PROPANIL 4# | 10 | GAL | 30,345 | 9.60 | 291,312.00 |
| | PROPANIL 4# | 15 | GAL | 3,570 | 9.60 | 34,272.00 |
| TOTAL | PROPANIL 4# | | | 95,935 | 9.60 | 920,976.00 * |
| | FLAKED TECH | 04 | LBS | 27,464 | 1.55 | 42,569.20 |
| | FLAKED TECH | 39 | LBS | 98,893 | 1.55 | 153,284.15 |
| TOTAL | FLAKED TECH | | | 126,357 | 1.55 | 195,853.35 * |
| | BUTOXONE | 10 | GAL | 10,960 | 8.86 | 97,105.60 |
| | BUTOXONE | 11 | GAL | 5,704 | 8.88 | 52,309.44 |
| | BUTOXONE | 15 | GAL | 3,060 | 8.80 | 26,928.00 |
| | BUTOXONE | 20 | GAL | 2,700 | 8.86 | 26,402.00 |
| | BUTOXONE | 40 | GAL | 288 | 8.86 | 2,551.68 |
| | BUTOXONE | 55 | GAL | 13,272 | 8.86 | 118,653.12 |
| | BUTOXONE | 56 | GAL | 8,472 | 8.86 | 75,259.12 |
| TOTAL | BUTOXONE | | | 44,676 | 8.86 | 399,109.76 * |
| | BUTOXONE AMINE | 10 | GAL | 1,520 | 9.77 | 14,920.56 |
| | BUTOXONE AMINE | 30 | GAL | 2,144 | 9.77 | 20,746.88 |
| | BUTOXONE AMINE | 55 | GAL | 15,696 | 9.77 | 153,347.92 |
| TOTAL | BUTOXONE AMINE | | | 19,360 | 9.77 | 189,225.36 * |
| | TOTAL FINISHED GOODS | | | | | 1,997,852.20 ** |

CEDAR CHEMICAL CORPORATION

DATE 12/31/88 SUMMARY INVENTORY PAGE 2

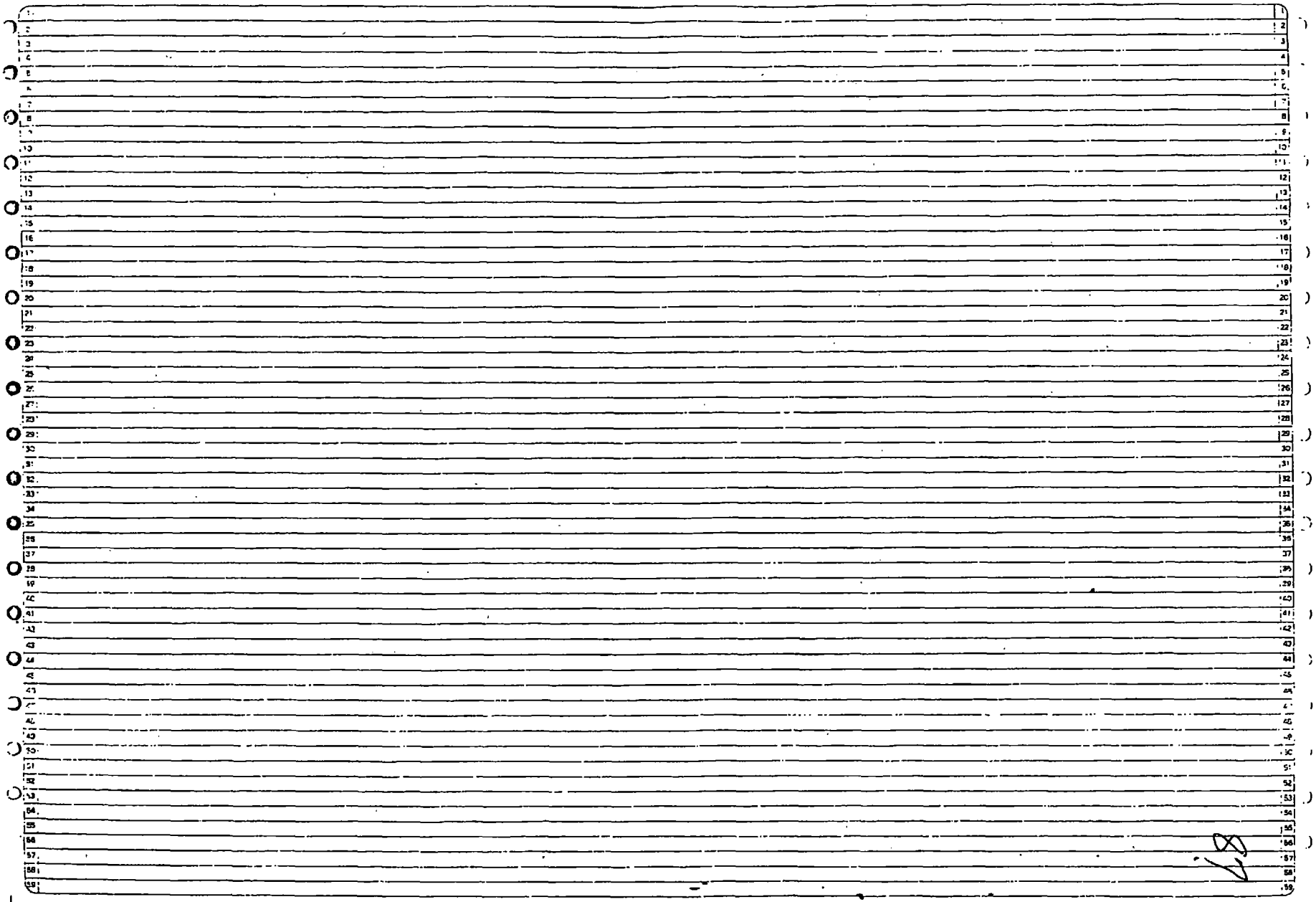
RAW MATERIALS VALUE REPORT CEDAR - WEST HELENA SINVRP

| PRODUCT GROUP DESCRIPTION | WT UNIT $ | QTY ON HAND | UNIT COST | EXTENDED VALUE |
|---|---|---|---|---|
| BCA | 04 LBS | 90,270 | 1.37 | 123,669.90 |
| PROPIONIC ACID | 04 LBS | 61,824 | .26 | 16,074.76 |
| PROPIONIC ANHYDRIDE | 04 LBS | 31,601 | .84 | 26,544.84 |
| MESITYL OXIDE | 04 LBS | 20,760 | .55 | 11,176.00 |
| ISOPHORONE | 04 LBS | 84,756 | .49 | 42,169.64 |
| EMULSIFIER | 04 LBS | 101,072 | .57 | 57,611.04 |
| TENNECO 530/100 | 04 LBS | 99,947 | .18 | 6,388.64 |
| ARMUL 1287 EMULSIFIER | 04 LBS | 84,747 | .40 | 54,608.20 |
| CAUSTIC 50% | 04 LBS | 44,944 | .07 | 4,195.52 |
| DRUMS--30 GAL-45 PROPANIL | 04 EACH | 211 | 18.00 | 3,798.00 |
| DRUMS-55 GAL | 04 EACH | 175 | 27.00 | 4,725.00 |
| TOTAL RAW MATERIALS | | | | 368,951.54 ** |

TOTAL INVENTORY CEDAR WEST HELENA 2,356,801.84 **

AB0000078981/88

TOTAL INVENTORY CEDAR WEST HELENA 2,356,803.84 **



AB0000078981/89

CEDAR-WEST HELENA
TOTAL PLANT EXPENSES COMPARISON TO BUDGET
FOR PERIOD ENDING DEC 31, 1988

| | YEAR TO DATE ACTUAL | BUDGET | DIFF | AVERAGE MONTH | % TO TOTAL |
|---|---|---|---|---|---|
| START - UP COST | 169,887 | | 169,887 | 14,157 | 3.094% |
| SALARIES,WAGES & FRINGES | 2,051,035 | 2,232,723 | -181,688 | 170,920 | 37.351% |
| SAFETY SUPPLIES | 44,558 | 43,850 | 708 | 3,713 | 0.811% |
| CONTR LABOR | 69,182 | 60,674 | 8,508 | 5,765 | 1.260% |
| NATURAL GAS | 160,625 | 120,589 | 40,036 | 13,385 | 2.925% |
| ELECTRICITY | 277,799 | 311,173 | -33,374 | 23,150 | 5.059% |
| WATER | 20,374 | 19,854 | 520 | 1,698 | 0.371% |
| T & E | 217 | 1,134 | -917 | 18 | 0.004% |
| ORDINARY SUPLIES | 77,000 | 81,741 | -4,741 | 6,417 | 1.402% |
| MAINTENANCE SUPPLIES | 370,846 | 410,809 | -39,963 | 30,904 | 6.753% |
| MAINTENANCE TOOLS | 133 | 1,400 | -1,267 | 11 | 0.002% |
| EXPENDABLE ITEMS | 24,772 | 19,633 | 5,139 | 2,064 | 0.451% |
| NITROGEN | 62,532 | 51,158 | 11,378 | 5,211 | 1.139% |
| WASTE DISPOSAL COST | 44,801 | 18,136 | 26,665 | 3,733 | 0.816% |
| CONTR FORM | 356,466 | 356,467 | -1 | 29,706 | 6.491% |
| INS-PLANT | 329,088 | 285,122 | 43,966 | 27,424 | 5.993% |
| FEES & TUITION | 3,789 | 8,910 | -5,121 | 316 | 0.069% |
| RENTALS | 39,920 | 33,946 | 5,974 | 3,327 | 0.727% |
| FREIGHT IN | 8,666 | 13,986 | -5,320 | 722 | 0.158% |
| PROPERTY TAXES | 49,375 | 39,947 | 9,428 | 4,115 | 0.899% |
| SUB-TOTAL | 4,161,065 | 4,111,250 | 49,815 | 346,755 | 75.776% |
| ADMIN EXPENSE | 567,965 | 577,391 | -9,438 | 47,330 | 10.343% |
| DEPR & AMORT | 762,276 | 580,383 | 181,893 | 63,523 | 13.882% |
| SUB-TOTAL | 1,330,231 | 1,157,774 | 172,457 | 110,853 | 24.224% |
| TOTAL COST | 5,491,296 | 5,269,024 | 222,272 | 457,608 | 100.000% |
| LESS BUTOXONE COST: | | | | | |
| CONTRACT FORM | 356,466 | 356,467 | -1 | 29,706 | |
| AMORTIZATION | 163,311 | 33,310 | 130,001 | 13,609 | |
| TOTAL PLANT OPERATING COST | 4,971,519 | 4,879,247 | 92,272 | 414,293 | |

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AB0000078981/90

CEDAR-WEST HELENA
PLANT COST SUMMARY
AS OF 12/31/88

| MONTH | YEAR | MO COST | YTD COST | YTD AVG | MONTHLY MAN HRS | Y-T-D MAN HRS | MONTHLY COST PER M. HRS | Y-T-D COST PER M. HRS | MONTHLY PLT HRS | Y-T-D PLT HRS | MONTHLY COST PER PLT HRS | Y-T-D COST PER PLT HRS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JAN | 1988 | 373,834 | 373,834 | 373,834 | 8,985 | 8,985 | 41.61 | 41.61 | 600 | 600 | 623 06 | 623.06 |
| FEB | 1988 | 498,726 | 872,589 | 436,295 | 13,213 | 22,198 | 37.75 | 39.31 | 840 | 1,440 | 593.72 | 605.96 |
| MAR | 1988 | 497,790 | 1,431,232 | 477,077 | 9,872 | 32,070 | 50.42 | 44.63 | 744 | 2,184 | 669 07 | 655.33 |
| APR | 1988 | 406,387 | 1,777,352 | 444,338 | 8,548 | 41,618 | 42.57 | 42.71 | 720 | 2,904 | 564 43 | 612.04 |
| MAY | 1988 | 404,184 | 2,181,584 | 436,317 | 11,280 | 52,896 | 35.83 | 41.24 | 744 | 3,648 | 543.26 | 598 02 |
| JUN | 1988 | 396,109 | 2,577,760 | 429,626 | 7,939 | 60,835 | 49.89 | 42 37 | 720 | 4,368 | 550.15 | 590.14 |
| JUL | 1988 | 377,609 | 2,949,601 | 421,372 | 9,506 | 70,341 | 39.72 | 41.93 | 744 | 5,112 | 507.54 | 577.00 |
| AUG | 1988 | 389,935 | 3,339,582 | 417,448 | 7,898 | 78,239 | 49.37 | 42.68 | 744 | 5,856 | 524.11 | 570.28 |
| SEP | 1988 | 391,212 | 3,730,843 | 414,538 | 7,550 | 85,789 | 51.82 | 43.49 | 720 | 6,576 | 543.35 | 567.34 |
| OCT | 1988 | 320,887 | 4,078,267 | 407,827 | 9,716 | 95,504 | 33.03 | 42.70 | 744 | 7,320 | 431.30 | 557.14 |
| NOV | 1988 | 389,683 | 4,467,992 | 406,181 | 6,805 | 102,309 | 57.26 | 43 67 | 720 | 8,040 | 541.23 | 555.72 |
| DEC | 1988 | 503,482 | 4,971,519 | 414,293 | 7,824 | 110,133 | 64 35 | 45 14 | 744 | 8,784 | 676.72 | 565.97 |
| DEC | 1987 | 403,203 | 4,592,296 | 382,691 | 9,734 | 117,023 | 41.42 | 39.24 | 744 | 8,760 | 541.84 | 524.23 |
| DEC | 1986 | 414,716 | 4,374,137 | 364,511 | 9,283 | 111,154 | 44.67 | 39.35 | 744 | 8,784 | 557.41 | 497.97 |
| DEC | 1985 | 207,128 | 4,604,654 | 383,721 | 9,227 | 123,743 | 22.45 | 37.21 | 744 | 8,760 | 278.40 | 525.65 |



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CEDAR WEST HELENA
CONTIBUTION TO FIXED COST
AS OF DEC 31, 1988

(000'S)

| | P. TECH | FLK'D | 3# | 4# | STAM | BLEND | TOTAL PROP | SCI | DIPH | ICI | ORFOM | MES | DUPT | SECT'G | TOTAL TOLL | BUTOX 175 | BUTOX 200 ESTER | BUTOX | TOTAL BUTOX | IDLE PLT | COMP TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SALES & REV | 2,253 | 0 | 1,655 | 6,026 | 2,887 | 36 | 11,857 | 104 | 106 | 2,430 | 171 | 125 | 140 | 292 | 3,368 | 834 | 261 | 257 | 1,352 | 146 | 16,723 |
| LESS TECH USED | -6,596 | 186 | 1,022 | 2,331 | 1,892 | 166 | 0 | | | | | | | | | | | | | | |
| NET SALES | 7,849 | -186 | 633 | 2,695 | 995 | -129 | 11,857 | 104 | 106 | 2,430 | 171 | 125 | 140 | 292 | 3,368 | 834 | 261 | 257 | 1,352 | 146 | 16,723 |
| RAW MATERIALS: | | | | | | | | | | | | | | | | | | | | | |
| DCA | 5,238 | | | | | | 5,238 | | | | | | | | | | | | | | 5,238 |
| P. ACID | 441 | | | | | | 441 | | | | | | | | | | | | | | 441 |
| P. ANHY | 236 | | | | | | 236 | | | | | | | | | | | | | | 236 |
| EMUL & ARMUL | | | 92 | 222 | 166 | | 480 | | | | | | | | | | | | | | 480 |
| ISOPH | | | 215 | 281 | 688 | | 1,184 | | | | | | | | | | | | | | 1,184 |
| M. O. | | | 33 | 612 | | 48 | 693 | | | | | | | | | | | | | | 693 |
| OTHER | | | 94 | 193 | | | 287 | | 21 | | | | | | 21 | 689 | 221 | 59 | 969 | | 1,277 |
| TOTAL R. M. | 5,913 | 0 | 434 | 1,288 | 854 | 48 | 8,537 | | 21 | | | | | | 21 | 689 | 221 | 59 | 969 | | 9,527 |
| DIRECT COST: | | | | | | | | | | | | | | | | | | | | | |
| ORD SUPPLIES | 5 | 7 | 5 | | | | 17 | | 8 | 6 | 8 | | 1 | 3 | 26 | | | | | | 43 |
| RENTALS | 2 | 1 | | | | | 3 | 1 | 4 | 2 | | | | | 7 | | | | | | 10 |
| O. S. LABOR | 14 | | | | | | 14 | | 27 | 2 | | | | | 29 | | | | | | 43 |
| MAINT SUPPLIES | 46 | | 2 | 1 | | | 49 | 4 | 64 | 69 | 4 | 6 | 7 | 4 | 158 | | | | | | 207 |
| NITROGEN | 32 | | | | | | 32 | 12 | 7 | | 8 | 2 | | | 29 | | | | | | 61 |
| GAS | 56 | | | | | | 56 | 2 | 8 | 48 | 5 | 2 | 2 | | 67 | | | | | | 123 |
| POWER | 48 | 1 | | | | | 49 | 10 | 41 | 89 | 7 | 4 | 6 | 14 | 171 | | | | | | 220 |
| START-UP COST | | 46 | | | | | 46 | | | | | 3 | 94 | 26 | 123 | | | | | | 169 |
| OTHER | 8 | | | | | | 9 | 1 | 28 | 7 | 1 | | | 2 | 39 | 248 | 68 | 40 | 357 | | 405 |
| CONTAINERS | | | 136 | 170 | 146 | 12 | 464 | | | | | | | | | | | | | | 464 |
| TOTAL D. C. | 212 | 55 | 143 | 171 | 146 | 12 | 739 | 30 | 187 | 223 | 33 | 17 | 110 | 49 | 649 | 248 | 69 | 40 | 357 | 0 | 1,745 |
| CONTR' TO FIXED | 1,724 | -241 | 56 | 1,236 | -5 | -189 | 2,581 | 74 | -102 | 2,207 | 138 | 108 | 30 | 243 | 2,698 | -103 | -29 | 158 | 26 | 146 | 5,451 |
| FIXED & VARIABLE PLANT EXPENSE | | | | | | | | | | | | | | | | | | | | | |
| SAL, WAGE & FRG | 280 | 6 | 30 | 19 | 12 | 1 | 348 | 66 | 277 | 561 | 44 | 38 | 31 | 84 | 1,101 | | | | | 9 | 1,458 |
| ALLOCATIONS: STEAM, COOL'G W, AIR, EFFL & SAF | 23 | | | | | | 23 | 13 | 28 | 33 | 1 | | | | 73 | | | | | | 96 |
| INS & TAXES | 116 | | | | | | 116 | 13 | 59 | 91 | 37 | 10 | 10 | 20 | 240 | | | | | 37 | 393 |
| SUB-TOTAL | 419 | 6 | 30 | 19 | 12 | 1 | 487 | 92 | 382 | 685 | 82 | 48 | 41 | 104 | 1,414 | | | | | 46 | 1,947 |
| TASK FORCE | 52 | | | | | | 52 | | | | | | | | | -474 | | | -474 | | -422 |
| PLANT O. H. | 182 | 2 | | | | | 194 | 41 | 170 | 379 | 35 | 31 | 10 | 67 | 733 | | | | | | 927 |
| PLANT ADMIN | 84 | | 85 | 137 | 71 | | 377 | 2 | 5 | 127 | 4 | 18 | 10 | 22 | 188 | | | | | | 565 |
| DEPRECIATION | 145 | | | | | | 145 | 19 | 229 | 89 | 42 | 9 | 22 | 24 | 426 | 183 | | | 183 | 25 | 781 |
| TOTAL F. & V. P. E | 892 | 8 | 115 | 156 | 83 | 1 | 1,255 | 164 | 766 | 1,274 | 163 | 106 | 83 | 217 | 2,763 | -311 | | | -311 | 71 | 3,778 |



AB0000078981/92

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOT VAR/TRANSF | 459 | -234 | -61 | 406 | -330 | -222 | 18 | -1 | -5 | 1 | 2 | 0 | 1 | 3 | 1 | -426 | -148 | 69 | -515 | 11 | -485 |
| PLT PROFIT | 373 | -15 | 2 | 674 | 242 | 32 | 1,308 | -79 | -863 | 932 | -27 | 2 | -54 | 23 | -66 | 634 | 119 | 99 | 852 | 64 | 2,158 |
| ACT PLT PROFIT | 373 | -15 | 2 | 674 | 242 | 32 | 1,308 | -79 | -863 | 932 | -27 | 2 | -54 | 23 | -66 | 634 | 119 | 99 | 852 | 64 | 2,158 |

CEDAR WEST HELENA
PROPANIL AND TOLLING UNITS ORIGINALLY BUDGETED AND SOLD
AS OF 12/31/88

| | STAM GAL | | | 4# GAL | | | 3# GAL | | | BLEND # | | | TECH # | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BUD | ACT | OV (UN) | BUD | ACT | OV (UN) | BUD | ACT | OV (UN) | BUD | ACT | OV (UN) | BUD | ACT | OV (UN) |
| JAN | 116,125 | 116,125 | 0 | 25,200 | 25,200 | 0 | | | 0 | | | 0 | | | 0 |
| FEB | 86,250 | 86,250 | 0 | 67,550 | 67,550 | 0 | 27,252 | 27,252 | 0 | 176,200 | 176,200 | 0 | 157,180 | 157,180 | 0 |
| MAR | 91,875 | 91,875 | 0 | 107,205 | 107,205 | 0 | 11,412 | 11,412 | 0 | -106,920 | -106,920 | 0 | 310,760 | 310,760 | 0 |
| APR | | | 0 | 88,160 | 88,160 | 0 | 30,085 | 30,085 | 0 | | | 0 | 114,360 | 114,360 | 0 |
| MAY | | | 0 | 122,102 | 122,102 | 0 | 3,804 | 3,804 | 0 | -36,640 | -36,640 | 0 | | | 0 |
| JUN | | | 0 | 70,000 | 55,874 | -14,126 | 10,000 | 11,412 | 1,412 | 40,000 | 0 | -40,000 | 100,000 | 0 | -100,000 |
| JUL | | | 0 | 20,000 | 2,800 | -17,200 | 10,000 | 31,056 | 21,056 | | | 0 | 200,000 | 112,840 | -87,160 |
| AUG | | | 0 | | 280 | 280 | 20,000 | 40,114 | 20,114 | | | 0 | | 517,820 | 517,820 |
| SEP | | | 0 | 5,000 | | -5,000 | 20,000 | 20,173 | 173 | | | 0 | | 83,700 | 83,700 |
| OCT | | | 0 | | | 0 | 20,000 | 8,082 | -11,918 | 40,000 | | -40,000 | | | 0 |
| NOV | | | 0 | | | 0 | | 3,888 | 3,888 | 40,000 | | -40,000 | | | 0 |
| DEC | | | 0 | | 4,375 | 4,375 | | 37,886 | 37,886 | | | 0 | | | 0 |
| TOTAL | 306,250 | 306,250 | 0 | 503,217 | 471,546 | -31,671 | 152,533 | 224,955 | 72,422 | 156,640 | 36,640 | -120,000 | 882,300 | 1,296,680 | 414,380 |

| | BUTOXONE 175 | | | BUTOXONE 200 | | | BUTOXONE ESTER | | | MES | | | BECTAGON II | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) |
| JAN | 720 | 720 | 0 | | | 0 | 4,320 | 4,320 | 0 | | | 0 | | | 0 |
| FEB | 720 | 720 | 0 | | | 0 | 2,520 | 2,520 | 0 | | | 0 | | | 0 |
| MAR | 160 | 160 | 0 | | | 0 | 6,300 | 6,300 | 0 | | | 0 | | | 0 |
| APR | 3,528 | 3,528 | 0 | | | 0 | 2,520 | 2,520 | 0 | | | 0 | | | 0 |
| MAY | 29,160 | 29,160 | 0 | 13,484 | 13,484 | 0 | 340 | 505 | 165 | | | 0 | | | 0 |
| JUN | 27,712 | 7,056 | -20,656 | 7,538 | 1,399 | -6,137 | | | 0 | | | 0 | | | 0 |
| JUL | | 12,368 | 12,368 | | 1,008 | 1,008 | | | 0 | | | 0 | | | 0 |
| AUG | | 2,160 | 2,160 | | | 0 | | | 0 | | | 0 | | 103,460 | 103,460 |
| SEP | | | 0 | | | 0 | | | 0 | | | 0 | | 272,341 | 272,341 |
| OCT | | 9,504 | 9,504 | | | 0 | | | 0 | | | 0 | | 123,830 | 123,830 |
| NOV | | | 0 | | | 0 | | | 0 | | 137,420 | 137,420 | | | 0 |
| DEC | | 180 | 180 | | | 0 | | | 0 | | 1,180 | 1,180 | | | 0 |
| TOTAL | 62,000 | 65,556 | 3,556 | 21,000 | 15,871 | -5,129 | 16,000 | 16,165 | 165 | 0 | 138,600 | 138,600 | 0 | 499,631 | 499,631 |

| | ICIA | | | ORFOM | | | SCI | | | MTPO | | | DIPHONE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) |
| JAN | 197,142 | 197,142 | 0 | | | 0 | 87,740 | 87,740 | 0 | | | 0 | | | 0 |
| FEB | 305,325 | 305,325 | 0 | | | 0 | 95,603 | 95,603 | 0 | | | 0 | | | 0 |
| MAR | 351,825 | 351,825 | 0 | 128,820 | 128,820 | 0 | 1,230 | 1,230 | 0 | | | 0 | 11,728 | 11,728 | 0 |
| APR | 358,976 | 358,976 | 0 | 159,600 | 159,600 | 0 | | | 0 | | | 0 | 26,624 | 26,624 | 0 |
| MAY | 316,506 | 316,506 | 0 | 108,315 | 108,315 | 0 | | | 0 | | | 0 | | | 0 |



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| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | 350,000 | 289,453 | -50,547 | | 400 | 400 | | 0 | | 0 | 120,000 | 44,894 | -75,106 |
| JUL | 350,000 | 191,222 | -158,778 | | | 0 | | 0 | | 0 | 152,000 | 43,825 | -108,175 |
| AUG | 350,000 | 92,317 | -257,683 | | | 0 | | 0 | | 0 | 170,000 | | -170,000 |
| SEP | | 210,776 | 210,776 | 250,000 | | -250,000 | | 0 | | 0 | 170,000 | | -170,000 |
| OCT | | 338,080 | 338,080 | | 512,870 | 512,870 | | 0 | | 0 | 170,000 | | -170,000 |
| NOV | | 276,325 | 276,325 | | 9,788 | 9,788 | | 0 | | 0 | 170,000 | | -170,000 |
| DEC | 350,000 | 301,360 | -48,640 | 250,000 | -9,000 | -259,000 | | 0 | | 0 | | | 0 |
| TOTAL | 2,931,574 | 3,242,087 | 310,513 | 896,735 | 510,893 | 14,158 | 184,573 | 184,573 | 0 | 0 | 0 | 0 | 990,360 | 127,069 | -863,291 |

| | DUPONT | | |
|---|---|---|---|
| | BUD | ACT | OV(UN) |
| JAN | | | 0 |
| FEB | | | 0 |
| MAR | | | 0 |
| APR | | | 0 |
| MAY | | | 0 |
| JUN | | | 0 |
| JUL | | | 0 |
| AUG | | | 0 |
| SEP | | | 0 |
| OCT | | | 0 |
| NOV | | | 0 |
| DEC | | 16,657 | 16,657 |
| TOTAL | 0 | 16,657 | 16,657 |

CEDAR-WEST HELENA
PLANT INCOME STATEMENT COMPARISON TO BUDGET
FOR PERIOD ENDING DEC 31, 1988

| | PROPANIL | | | BUTOXONE | | | STAM | | | ICIA | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ACTUAL | BUDGET | DIFF | ACTUAL | BUDGET | DIFF | ACTUAL | BUDGET | DIFF | ACTUAL | BUDGET | DIFF |
| NET SALES | 8,969,665 | 8,235,762 | 733,903 | 1,352,369 | 1,294,683 | 57,686 | 2,886,982 | 2,604,126 | 282,856 | 2,430,808 | 2,140,999 | 289,809 |
| COST OF SALES | 7,756,813 | 7,005,108 | 751,705 | 335,964 | 973,886 | -637,922 | 2,644,149 | 2,743,030 | -98,881 | 1,415,573 | 1,418,838 | -4,265 |
| GROSS MARGIN | 1,212,752 | 1,230,654 | -17,902 | 1,016,405 | 320,797 | 695,608 | 242,833 | -138,904 | 381,737 | 1,015,235 | 721,161 | 294,074 |
| DEPRECIATION | 145,086 | 196,048 | -50,961 | 183,312 | 33,310 | 130,002 | | | | 83,640 | 86,711 | -3,071 |
| NET INCOME | 1,067,667 | 1,034,606 | 33,049 | 853,093 | 287,487 | 565,606 | 242,833 | -138,904 | 381,737 | 931,595 | 634,450 | 297,145 |

| | DUPONT | | | SCI | | | ORFOM | | | MES | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ACTUAL | BUDGET | DIFF | ACTUAL | BUDGET | DIFF | ACTUAL | BUDGET | DIFF | ACTUAL | BUDGET | DIFF |
| NET SALES | 140,203 | | 140,203 | 104,224 | 104,224 | 0 | 170,665 | 206,426 | -35,761 | 124,740 | | 124,740 |
| COST OF SALES | 173,027 | | 173,027 | 165,156 | 163,125 | 2,031 | 155,957 | 159,186 | -3,229 | 113,685 | | 113,685 |
| GROSS MARGIN | -32,824 | 0 | -32,824 | -60,932 | -58,901 | -2,031 | 14,708 | 47,240 | -32,532 | 11,055 | 0 | 11,055 |
| DEPRECIATION | 22,162 | | 22,162 | 18,511 | 18,510 | 1 | 41,839 | 25,808 | 16,033 | 9,473 | | 9,473 |
| NET INCOME | -54,986 | 0 | -54,986 | -79,443 | -77,411 | -2,032 | -27,131 | 21,434 | -48,565 | 1,582 | 0 | 1,582 |

| | DIPHONE C | | | SECTAGON II | | | IDLE PLANT & OTHER | | | TOTAL PLANT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ACTUAL | BUDGET | DIFF | ACTUAL | BUDGET | DIFF | ACTUAL | BUDGET | DIFF | ACTUAL | BUDGET | DIFF |
| NET SALES | 106,200 | 1,973,000 | -1,866,800 | 292,302 | | 292,302 | 146,128 | -4,000 | 150,128 | 16,724,186 | 16,566,220 | -120,843 |
| COST OF SALES | 739,965 | 2,324,501 | -1,584,536 | 245,347 | | 245,347 | 58,082 | 181,339 | -123,257 | 13,803,718 | 14,970,013 | -1,162,030 |
| GROSS MARGIN | -633,765 | -351,501 | -282,264 | 46,955 | 0 | 46,955 | 88,046 | -185,339 | 273,385 | 2,920,468 | 1,586,207 | 1,041,187 |
| DEPRECIATION | 229,167 | 159,000 | 70,167 | 23,682 | | 23,682 | 25,400 | 61,000 | -35,600 | 762,281 | 580,383 | 184,969 |
| NET INCOME | -862,932 | -510,501 | -352,431 | 23,273 | 0 | 23,273 | 62,646 | -246,339 | 308,985 | 2,158,187 | 1,004,824 | 856,218 |



AB0000078981/96

CEDAR WEST HELENA
CONTIBUTION TO FIXED COST
AS OF DEC 31, 1988

(000'S)

| | P. TECH | FLK'D | 3# | 4# | STAM | BLEND | TOTAL PROP | SCI | DIPH | ICI | ORFOM | MES | DUPT | SECT'D | TOTAL TOLL | BUTOX 175 | BUTOX 200 | BUTOX ESTER | TOTAL BUTOX | IDLE PLT | COMP TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SALES & REV | 2,253 | 0 | 1,655 | 6,026 | 2,687 | 36 | 11,857 | 104 | 106 | 2,430 | 171 | 125 | 140 | 292 | 3,368 | 834 | 261 | 257 | 1,352 | 146 | 16,723 |
| LESS TECH USED | -6,598 | 186 | 1,022 | 2,331 | 1,692 | 166 | 0 | | | | | | | | | | | | | | |
| NET SALES | 7,849 | -186 | 633 | 2,696 | 995 | -129 | 11,857 | 104 | 106 | 2,430 | 171 | 125 | 140 | 292 | 3,368 | 834 | 261 | 257 | 1,352 | 146 | 16,723 |
| RAW MATERIALS: | | | | | | | | | | | | | | | | | | | | | |
| DCA | 6,236 | | | | | | 6,236 | | | | | | | | | | | | | | 6,236 |
| P. ACID | 441 | | | | | | 441 | | | | | | | | | | | | | | 441 |
| P. ANHY | 238 | | | | | | 236 | | | | | | | | | | | | | | 238 |
| EMUL & ARMUL | | | 92 | 222 | 166 | | 480 | | | | | | | | | | | | | | 480 |
| ISOPH | | | 216 | 261 | 686 | | 1,164 | | | | | | | | | | | | | | 1,164 |
| M. O. | | | 33 | 612 | | 48 | 693 | | | | | | | | | | | | | | 693 |
| OTHER | | | 94 | 193 | | | 287 | | 21 | | | | | | 21 | 689 | 221 | 59 | 969 | | 1,277 |
| TOTAL R. M. | 6,913 | 0 | 434 | 1,288 | 854 | 48 | 8,537 | | 21 | | | | | | 21 | 689 | 221 | 59 | 969 | | 9,627 |
| DIRECT COST: | | | | | | | | | | | | | | | | | | | | | |
| ORD SUPPLIES | 5 | 7 | 5 | | | | 17 | | 8 | 8 | 8 | | 1 | 3 | 26 | | | | | | 43 |
| RENTALS | 2 | 1 | | | | | 3 | 1 | 4 | 2 | | | | | 7 | | | | | | 10 |
| O. S. LABOR | 14 | | | | | | 14 | | 27 | 2 | | | | | 29 | | | | | | 43 |
| MAINT SUPPLIES | 46 | | 2 | 1 | | | 49 | 4 | 64 | 69 | 4 | 6 | 7 | 4 | 158 | | | | | | 207 |
| NITROGEN | 32 | | | | | | 32 | 12 | 7 | | 8 | 2 | | | 29 | | | | | | 61 |
| GAS | 56 | | | | | | 56 | 2 | 8 | 48 | 5 | 2 | 2 | | 67 | | | | | | 123 |
| POWER | 48 | 1 | | | | | 49 | 10 | 41 | 88 | 7 | 4 | 6 | 14 | 171 | | | | | | 220 |
| START-UP COST | | 48 | | | | | 48 | | | | | 3 | 94 | 26 | 123 | | | | | | 169 |
| OTHER | 9 | | | | | | 9 | 1 | 28 | 7 | 1 | | | 2 | 38 | 248 | 69 | 40 | 357 | | 405 |
| CONTAINERS | | | 136 | 170 | 148 | 12 | 484 | | | | | | | | | | | | | | 484 |
| TOTAL D. C. | 212 | 55 | 143 | 171 | 148 | 12 | 739 | 30 | 187 | 223 | 33 | 17 | 110 | 49 | 849 | 248 | 69 | 40 | 357 | 0 | 1,745 |
| CONTR' TO FIXED | 1,724 | -241 | 56 | 1,236 | -5 | -189 | 2,561 | 74 | -102 | 2,207 | 138 | 108 | 30 | 243 | 2,698 | -103 | -29 | 156 | 28 | 146 | 5,451 |
| FIXED & VARIABLE PLANT EXPENSE | | | | | | | | | | | | | | | | | | | | | |
| SAL, WAGE & FRG | 280 | 6 | 30 | 19 | 12 | 1 | 348 | 66 | 277 | 561 | 44 | 38 | 31 | 84 | 1,101 | | | | | 8 | 1,458 |
| ALLOCATIONS: STEAM, COOL'G W, AIR, EFFL & SAF | 23 | | | | | | 23 | 13 | 26 | 33 | 1 | | | | 73 | | | | | | 96 |
| INS & TAXES | 118 | | | | | | 116 | 13 | 59 | 91 | 37 | 10 | 10 | 20 | 240 | | | | | 37 | 393 |
| SUB-TOTAL | 419 | 6 | 30 | 19 | 12 | 1 | 487 | 92 | 362 | 685 | 82 | 48 | 41 | 104 | 1,414 | | | | | 46 | 1,947 |
| TASK FORCE | 52 | | | | | | 52 | | | | | | | | | -474 | | | -474 | | -422 |
| PLANT O. H. | 192 | 2 | | | | | 194 | 41 | 170 | 378 | 36 | 31 | 10 | 67 | 733 | | | | | | 927 |
| PLANT ADMIN | 84 | | 86 | 137 | 71 | | 377 | 2 | 6 | 127 | 4 | 18 | 10 | 22 | 188 | | | | | | 565 |
| DEPRECIATION | 146 | | | | | | 145 | 19 | 229 | 83 | 42 | 9 | 22 | 24 | 428 | 183 | | | 183 | 25 | 781 |
| TOTAL F. & V. P. E. | 892 | 8 | 116 | 156 | 83 | 1 | 1,266 | 164 | 766 | 1,274 | 163 | 106 | 83 | 217 | 2,763 | -311 | | | -311 | 71 | 3,778 |



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| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOT VAR/TRANSF | 459 | -234 | -61 | 406 | -330 | -222 | 18 | -1 | -5 | 1 | 2 | 0 | 1 | 3 | 1 | -426 | -148 | 59 | -515 | 11 | -485 |
| PLT PROFIT | 373 | -15 | 2 | 674 | 242 | 32 | 1,308 | -79 | -863 | 932 | -27 | 2 | -54 | 23 | -66 | 634 | 119 | 99 | 852 | 64 | 2,158 |
| ACT PLT PROFIT | 373 | -15 | 2 | 674 | 242 | 32 | 1,308 | -79 | -863 | 932 | -27 | 2 | -54 | 23 | -66 | 634 | 119 | 99 | 852 | 64 | 2,158 |



AB0000078981/98

CEDAR-WEST HELENA
TOTAL PLANT EXPENSES COMPARISON TO BUDGET
FOR PERIOD ENDING DEC 31, 1988

| | YEAR TO DATE ACTUAL | BUDGET | DIFF | AVERAGE MONTH | % TO TOTAL |
|---|---|---|---|---|---|
| START - UP COST | 169,887 | | 169,887 | 14,157 | 3.084% |
| SALARIES,WAGES & FRINGES | 2,051,035 | 2,232,723 | -181,688 | 170,920 | 37.351% |
| SAFETY SUPPLIES | 44,558 | 43,850 | 708 | 3,713 | 0.811% |
| CONTR LABOR | 69,182 | 60,674 | 8,508 | 5,765 | 1.260% |
| NATURAL GAS | 160,625 | 120,589 | 40,036 | 13,386 | 2.925% |
| ELECTRICITY | 277,799 | 311,173 | -33,374 | 23,150 | 5 059% |
| WATER | 20,374 | 19,854 | 520 | 1,698 | 0 371% |
| T & E | 217 | 1,134 | -917 | 18 | 0.004% |
| ORDINARY SUPLIES | 77,000 | 81,741 | -4,741 | 6,417 | 1.402% |
| MAINTENANCE SUPPLIES | 370,846 | 410,809 | -39,963 | 30,904 | 6.753% |
| MAINTENANCE TOOLS | 133 | 1,400 | -1,267 | 11 | 0 002% |
| EXPENDABLE ITEMS | 24,772 | 19,633 | 5,139 | 2,064 | 0 451% |
| NITROGEN | 62,532 | 51,156 | 11,376 | 5,211 | 1.139% |
| WASTE DISPOSAL COST | 44,801 | 18,136 | 26,665 | 3,733 | 0 816% |
| CONTR FORM | 356,466 | 356,467 | -1 | 29,706 | 6 491% |
| INS-PLANT | 329,088 | 285,122 | 43,966 | 27,424 | 5.993% |
| FEES & TUITION | 3,789 | 8,910 | -5,121 | 316 | 0.069% |
| RENTALS | 39,920 | 33,946 | 5,974 | 3,327 | 0.727% |
| FREIGHT IN | 8,666 | 13,986 | -5,320 | 722 | 0.158% |
| PROPERTY TAXES | 49,375 | 39,947 | 9,428 | 4,115 | 0.899% |
| SUB-TOTAL | 4,161,065 | 4,111,260 | 49,816 | 346,755 | 75.776% |
| ADMIN EXPENSE | 567,955 | 577,391 | -9,436 | 47,330 | 10.343% |
| DEPR & AMORT | 762,276 | 580,383 | 181,893 | 63,523 | 13.882% |
| SUB-TOTAL | 1,330,231 | 1,157,774 | 172,457 | 110,853 | 24.224% |
| TOTAL COST | 5,491,288 | 5,269,024 | 222,272 | 457,608 | 100 000% |
| LESS BUTOXONE COST: | | | | | |
| CONTRACT FORM | 356,466 | 356,467 | -1 | 29,706 | |
| AMORTIZATION | 163,311 | 33,310 | 130,001 | 13,609 | |
| TOTAL PLANT OPERATING COST | 4,971,519 | 4,879,247 | 92,272 | 414,293 | |

CEDAR-WEST HELENA
PLANT COST SUMMARY
AS OF 12/31/88

| MONTH | YEAR | MO COST | YTD COST | YTD AVG | MONTHLY MAN HRS | Y-T-D MAN HRS | MONTHLY COST PER M. HRS | Y-T-D COST PER M. HRS | MONTHLY PLT HRS | Y-T-D PLT HRS | MONTHLY COST PER PLT HRS | Y-T-D COST PER PLT HRS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JAN | 1988 | 373,834 | 373,834 | 373,834 | 8,985 | 8,985 | 41.61 | 41.61 | 600 | 600 | 623.06 | 623.06 |
| FEB | 1988 | 498,726 | 872,589 | 436,295 | 13,213 | 22,198 | 37.75 | 39.31 | 840 | 1,440 | 593.72 | 605.96 |
| MAR | 1988 | 497,780 | 1,431,232 | 477,077 | 9,872 | 32,070 | 50.42 | 44.63 | 744 | 2,184 | 668.07 | 655.33 |
| APR | 1988 | 406,367 | 1,777,362 | 444,338 | 8,546 | 41,616 | 42.67 | 42.71 | 720 | 2,904 | 564.43 | 612.04 |
| MAY | 1988 | 404,184 | 2,181,584 | 436,317 | 11,280 | 52,896 | 35.83 | 41.24 | 744 | 3,648 | 543.26 | 598.02 |
| JUN | 1988 | 386,108 | 2,577,750 | 429,625 | 7,939 | 60,835 | 48.69 | 42.37 | 720 | 4,368 | 550.15 | 590.14 |
| JUL | 1988 | 377,608 | 2,949,601 | 421,372 | 9,506 | 70,341 | 39.72 | 41.93 | 744 | 5,112 | 507.54 | 577.00 |
| AUG | 1988 | 389,935 | 3,339,582 | 417,448 | 7,898 | 78,239 | 49.37 | 42.68 | 744 | 5,856 | 524.11 | 570.28 |
| SEP | 1988 | 391,212 | 3,730,843 | 414,538 | 7,550 | 85,789 | 51.82 | 43.49 | 720 | 6,576 | 543.35 | 567.34 |
| OCT | 1988 | 320,887 | 4,078,267 | 407,827 | 9,715 | 95,504 | 33.03 | 42.70 | 744 | 7,320 | 431.30 | 557.14 |
| NOV | 1988 | 389,683 | 4,467,992 | 406,181 | 6,805 | 102,309 | 57.26 | 43.67 | 720 | 8,040 | 541.23 | 555.72 |
| DEC | 1988 | 503,482 | 4,971,518 | 414,293 | 7,824 | 110,133 | 64.35 | 45.14 | 744 | 8,784 | 676.72 | 565.97 |
| DEC | 1987 | 403,203 | 4,592,296 | 382,691 | 9,734 | 117,023 | 41.42 | 39.24 | 744 | 8,780 | 541.94 | 524.23 |
| DEC | 1986 | 414,718 | 4,374,137 | 364,511 | 9,283 | 111,164 | 44.67 | 39.35 | 744 | 8,784 | 557.41 | 497.97 |
| DEC | 1985 | 207,126 | 4,604,654 | 383,721 | 9,227 | 123,743 | 22.45 | 37.21 | 744 | 8,760 | 278.40 | 525.65 |



AB0000078981/100

CEDAR WEST HELENA
PROPANIL PRODUCTION AND USAGE
AS OF 12/31/88

CC: J Miles, C Parker, R Johns, R Fairchild, G Setterfield, J Porter, B Oberle, J Walker, T Lodice, K Howard

**FINISH GOODS MFG**

| | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Y-T-D #/# or Gal | | Std |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Propanil** | Tech | 608,030 | 911,710 | 888,370 | 707,630 | 266,330 | 98,620 | 341,650 | 673,470 | 198,510 | | 28,780 | 432,480 | 5,144,490 | | |
| | DCA | 458,019 | 686,282 | 632,450 | 544,440 | 205,949 | 71,060 | 251,280 | 516,390 | 146,580 | -10,082 | 31,410 | 368,978 | 3,903,756 | .759 | 0.76 |
| | P. Acid | 248,985 | 306,687 | 280,350 | 271,404 | 83,270 | 31,390 | 113,590 | 230,030 | 75,349 | 583 | 13,640 | 152,687 | 1,805,945 | .351 | 0.364 |
| | P. Anhy | 42,389 | 64,216 | 42,580 | 41,114 | 9,410 | 6,077 | 13,470 | 32,031 | 8,512 | 608 | 1,670 | 22,166 | 284,243 | .055 | 0.073 |
| **3# Bulk** | | | 9,257 | 18,394 | 18,619 | | 18,657 | 72,232 | 43,480 | 43,560 | | 6,262 | -6,070 | 225,391 | | |
| | P. Tech | | 36,627 | 42,260 | 58,310 | | 41,690 | 241,010 | 170,450 | 114,810 | | 28,790 | -28,790 | 705,147 | 3.13 | 3.9 |
| | M. O. | | 20,180 | 18,000 | | | | 9,760 | 9,482 | | 2,300 | 35,400 | -35,400 | 59,712 | 0.26 | 3.08 |
| | Isoph | | 8,658 | 20,950 | 12,900 | | 32,510 | 130,550 | 45,539 | 81,670 | 38,315 | | | 371,092 | 1.65 | 1.52 |
| | Tenn 500 | | | | 38,380 | | 76,799 | 171,220 | 119,471 | 122,830 | -12,247 | | | 516,453 | 2.30 | 3.08 |
| | Amul | | | | 15,600 | | 15,400 | 55,720 | 9,679 | 40,200 | -2,097 | | 2,097 | 136,599 | 0.61 | 0.86 |
| | Emul | | 1,775 | 9,000 | | | | 6,400 | | | 2,667 | 9,300 | -9,300 | 19,842 | 0.09 | 0.86 |
| **4# Bulk** | | 18,061 | 42,872 | 40,730 | 126,720 | 63,921 | 28,719 | | -742 | | | | 66,395 | 383,676 | | |
| | Blend | | | | | | 134,145 | | | | | | | 134,145 | 0.35 | |
| | P. Tech | 77,242 | 188,870 | 178,379 | 534,660 | 266,330 | 56,930 | | | | | | 318,270 | 1,807,881 | 4.19 | 4.4 |
| | Isoph | 13,491 | 29,650 | 58,338 | 110,660 | 119,370 | 61,450 | | | | | | 56,952 | 449,911 | 1.17 | 0.7 |
| | Emul | 8,175 | 39,800 | 37,675 | 123,700 | 47,150 | 47,942 | | | | | | 81,629 | 386,071 | 1.01 | 0.899 |
| | M. O | 102,500 | 100,159 | 91,480 | 395,000 | 177,413 | | | | | | | 247,414 | 1,113,966 | 2.90 | 2.81 |
| **Stam Bulk** | | 124,110 | 96,874 | 84,261 | | | | | | | | | | 304,045 | | |
| | P. Tech | 530,788 | 417,203 | 356,981 | | | | | | | | | | 1,304,972 | 4.28 | 4.4 |
| | Isoph | 462,236 | 364,529 | 323,252 | | | | | | | | | | 1,170,017 | 3.86 | 3.646 |
| | Emul | 119,725 | 94,086 | 76,605 | | | | | | | | | | 290,416 | 0.98 | 0.899 |
| **P. Blend** | | | 220,005 | | | | | | | | | | | 220,005 | | |
| | P. Tech | | 113,830 | | | | | | | | | | | 113,830 | 0.52 | 0.61 |
| | M. O. | | 86,902 | | | | | | | | | | | 86,902 | 0.40 | 0.39 |
| **Flaked Tech** | | | | | | | | | | | | | 126,357 | 126,357 | | |
| | P. Tech | | | | | | | | | | | | 128,380 | 128,380 | 1.02 | |
| **FINISH GOODS PKG** | | | | | | | | | | | | | | | | |
| | 3# 200L | | -40 | -21 | 488 | 27 | 157 | 746 | 868 | 738 | -75 | 178 | -3 | 3,163 | | |
| | 3# 55 | | 288 | | | | | 288 | 301 | | 72 | | | 949 | | |
| | 4# 35 | 650 | 1,158 | 1,185 | 3,205 | 360 | 414 | | 436 | | | | 1,900 | 9,288 | | |
| | 4# 55 | | | | | | | | | | | | | 0 | | |
| | Stam 35 | 3,546 | 2,600 | 2,541 | -3 | | | | | | | | | 8,684 | | |
| | Blend 55 | | 445 | | | | | | | | | | | 445 | | |



AB0000078981/101

CEDAR -WEST HELENA
OVERTIME DOLLARS COMPARISONS STARTING 1986 12-31-88

| | 1986 | | | 1987 | | | % Ch to | 1988 | | | % Ch to | % Ch to |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WEEK NO | BY WK $ | Y-T-D $ | Y-T-D Avg | BY WK $ | Y-T-D $ | Y-T-D Avg | 1986 | BY WK $ | Y-T-D $ | Y-T-D Avg | 1987 | 1986 |
| 1 | 8,733 | 8,733 | 8,733 | 7,714 | 7,714 | 7,714 | 79 26% | 6,716 | 6,716 | 6,716 | 87.06% | 69.00% |
| 2 | 6,770 | 15,503 | 7,752 | 6,388 | 14,102 | 7,051 | 90.96% | 3,527 | 10,243 | 5,122 | 72.64% | 66.07% |
| 3 | 4,171 | 19,674 | 6,558 | 5,197 | 19,299 | 6,433 | 98.09% | 3,848 | 14,091 | 4,697 | 73.01% | 71.62% |
| 4 | 3,452 | 23,126 | 5,782 | 7,181 | 26,480 | 6,620 | 114.50% | 5,418 | 19,509 | 4,877 | 73.67% | 84 36% |
| 5 | 3,733 | 26,859 | 5,372 | 6,434 | 32,914 | 6,583 | 122.54% | 6,745 | 26,254 | 5,251 | 79 77% | 97.75% |
| 6 | 3,713 | 30,572 | 5,095 | 6,599 | 39,513 | 6,586 | 129 26% | 5,979 | 32,233 | 5,372 | 81.58% | 105 43% |
| 7 | 3,866 | 34,540 | 4,934 | 5,390 | 44,903 | 6,416 | 130 00% | 7,330 | 39,563 | 5,652 | 88.11% | 114.64% |
| 8 | 3,496 | 38,035 | 4,754 | 5,789 | 50,692 | 6,337 | 133.28% | 6,090 | 47,653 | 5,957 | 94.00% | 125.28% |
| 9 | 4,178 | 42,213 | 4,690 | 4,883 | 55,575 | 6,175 | 131.65% | 7,982 | 55,635 | 6,182 | 100.11% | 131.80% |
| 10 | 2,606 | 44,719 | 4,472 | 6,209 | 61,784 | 6,178 | 138.16% | 6,518 | 62,153 | 6,216 | 100.60% | 138.98% |
| 11 | 3,616 | 48,234 | 4,385 | 5,310 | 67,094 | 6,099 | 139.10% | 3,312 | 65,465 | 5,951 | 97.67% | 135.72% |
| 12 | 3,168 | 51,402 | 4,284 | 4,290 | 71,384 | 5,949 | 138.87% | 4,754 | 70,219 | 5,852 | 98 37% | 136 61% |
| 13 | 2,863 | 54,265 | 4,174 | 3,960 | 75,344 | 5,796 | 138.84% | 5,663 | 75,882 | 5,837 | 100.71% | 139 84% |
| 14 | 4,417 | 58,682 | 4,192 | 4,454 | 79,798 | 5,700 | 135 98% | 5,149 | 81,031 | 5,788 | 101 55% | 138 08% |
| 15 | 3,162 | 61,834 | 4,122 | 4,022 | 83,820 | 5,588 | 135 66% | 4,305 | 85,336 | 5,689 | 101.81% | 138.01% |
| 16 | 6,608 | 68,343 | 4,271 | 6,426 | 89,246 | 5,578 | 130 59% | 3,999 | 89,335 | 5,583 | 100.10% | 130.72% |
| 17 | 3,456 | 71,801 | 4,224 | 8,135 | 97,381 | 5,728 | 135.63% | 4,110 | 93,445 | 5,497 | 95.96% | 130.14% |
| 18 | 2,477 | 74,278 | 4,127 | 4,321 | 101,702 | 5,650 | 136.92% | 3,366 | 96,801 | 5,378 | 95.18% | 130.32% |
| 19 | 2,949 | 77,227 | 4,065 | 4,249 | 105,951 | 5,576 | 137.19% | 2,921 | 99,722 | 5,249 | 94.12% | 129.13% |
| 20 | 3,447 | 80,674 | 4,034 | 3,799 | 109,750 | 5,488 | 136 04% | 2,765 | 102,487 | 5,124 | 93 38% | 127 04% |
| 21 | 3,021 | 83,695 | 3,985 | 3,632 | 113,382 | 5,394 | 135.35% | 1,959 | 104,446 | 4,974 | 92 20% | 124 79% |
| 22 | 3,045 | 86,740 | 3,943 | 3,383 | 116,665 | 5,303 | 134 50% | 1,442 | 105,888 | 4,813 | 90 76% | 122 08% |
| 23 | 5,478 | 92,218 | 4,009 | 4,012 | 120,677 | 5,247 | 130.86% | 1,714 | 107,602 | 4,678 | 89.17% | 116.68% |
| 24 | 3,870 | 96,088 | 4,004 | 2,766 | 123,432 | 5,143 | 128.46% | 290 | 107,892 | 4,496 | 87.41% | 112.28% |
| 25 | 2,151 | 98,239 | 3,930 | 3,347 | 126,779 | 5,071 | 129.05% | 1,586 | 109,478 | 4,379 | 86.35% | 111.44% |
| 26 | 2,512 | 100,751 | 3,875 | 3,912 | 130,691 | 5,027 | 129.72% | 1,705 | 111,183 | 4,276 | 85.07% | 110.35% |
| 27 | 2,627 | 103,378 | 3,829 | 3,153 | 133,844 | 4,957 | 129.47% | 2,591 | 113,774 | 4,214 | 85.00% | 110.06% |
| 28 | 4,877 | 108,255 | 3,866 | 3,382 | 137,226 | 4,901 | 126.76% | 5,877 | 119,651 | 4,273 | 87.19% | 110.53% |
| 29 | 3,235 | 111,490 | 3,844 | 3,958 | 141,185 | 4,868 | 126.63% | 1,781 | 121,432 | 4,187 | 86.01% | 108.92% |
| 30 | 2,399 | 113,889 | 3,796 | 3,421 | 144,606 | 4,820 | 126 97% | 2,258 | 123,690 | 4,123 | 85.54% | 108 61% |
| 31 | 1,560 | 115,449 | 3,724 | 2,408 | 147,014 | 4,742 | 127.34% | 851 | 124,541 | 4,017 | 84.71% | 107 88% |
| 32 | 2,811 | 118,260 | 3,698 | 1,438 | 148,452 | 4,639 | 125 53% | 2,607 | 127,148 | 3,973 | 85.65% | 107 52% |
| 33 | 2,443 | 120,703 | 3,658 | 1,202 | 149,654 | 4,535 | 123.99% | 2,458 | 129,606 | 3,927 | 86.60% | 107.38% |
| 34 | 2,623 | 123,326 | 3,627 | 869 | 150,523 | 4,430 | 122.13% | 2,128 | 131,734 | 3,875 | 87.46% | 106.82% |
| 35 | 3,117 | 126,443 | 3,613 | 1,021 | 151,544 | 4,333 | 119 93% | 1,647 | 133,381 | 3,811 | 87.96% | 105.49% |
| 36 | 2,972 | 129,415 | 3,595 | 700 | 152,344 | 4,232 | 117 72% | 1,114 | 134,495 | 3,736 | 88.28% | 103.93% |
| 37 | 2,256 | 131,671 | 3,559 | 748 | 153,092 | 4,138 | 116 27% | 2,867 | 137,362 | 3,712 | 89.73% | 104.32% |
| 38 | 1,726 | 133,398 | 3,510 | 597 | 153,689 | 4,044 | 115.21% | 2,838 | 140,300 | 3,692 | 91.29% | 105.18% |
| 39 | 2,608 | 136,802 | 3,485 | 336 | 154,025 | 3,949 | 113.34% | 1,575 | 141,875 | 3,638 | 92.11% | 104.40% |
| 40 | 2,610 | 138,412 | 3,460 | 575 | 154,600 | 3,865 | 111 70% | 2,058 | 143,931 | 3,598 | 93.10% | 103.99% |
| 41 | 2,592 | 141,004 | 3,439 | 327 | 154,927 | 3,779 | 109.87% | 1,996 | 145,927 | 3,559 | 94.19% | 103.49% |
| 42 | 2,838 | 143,840 | 3,420 | 2,765 | 157,692 | 3,755 | 108.78% | 2,089 | 148,016 | 3,524 | 93.86% | 103.05% |
| 43 | 2,571 | 146,211 | 3,400 | 3,822 | 161,514 | 3,756 | 110.47% | 2,092 | 150,108 | 3,491 | 92.94% | 102.67% |
| 44 | 3,610 | 149,821 | 3,405 | 1,975 | 163,489 | 3,716 | 109.12% | 2,058 | 152,166 | 3,458 | 93 07% | 101 57% |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 45 | 7,521 | 157,342 | 3,496 | 1,038 | 164,527 | 3,656 | 104.57% | 1,732 | 153,898 | 3,420 | 93.54% | 97.81% |
| 46 | 5,210 | 162,552 | 3,534 | 1,073 | 165,600 | 3,600 | 101.88% | 2,149 | 156,047 | 3,392 | 94.23% | 96.00% |
| 47 | 4,864 | 167,408 | 3,562 | 1,255 | 166,855 | 3,550 | 99.67% | 1,382 | 157,409 | 3,349 | 94.34% | 94.03% |
| 48 | 4,663 | 171,969 | 3,582 | 1,135 | 167,990 | 3,500 | 97.69% | 4,055 | 161,464 | 3,364 | 96.12% | 93.90% |
| 49 | 8,226 | 180,185 | 3,677 | 1,291 | 169,281 | 3,455 | 93.95% | 1,724 | 163,188 | 3,330 | 96.40% | 90.57% |
| 50 | 6,325 | 186,510 | 3,730 | 3,667 | 172,948 | 3,459 | 92.73% | 4,407 | 167,595 | 3,352 | 89.90% | 89.86% |
| 51 | 5,807 | 192,317 | 3,771 | 5,112 | 178,060 | 3,491 | 92.59% | 8,592 | 176,187 | 3,455 | 98.95% | 91.61% |
| 52 | 5,975 | 198,292 | 3,813 | 5,071 | 183,131 | 3,522 | 92.35% | 5,745 | 181,932 | 3,499 | 99.35% | 91.75% |
| TOTALS | 198,292 | | | 183,131 | | | 92.35% | 181,932 | | | 99.35% | 91.75% |

CEDAR-WEST HELENA
NITROGEN CONSUMTION
MONTH JAN YEAR 1989

CC: John Miles, Charlie Parker, Richard Johns, Robert Ray, Tom Lodice, Ken Howard, Joe Porter, Joel Walker, Joe Forthman

83%

| READINGS | Date | Propanil 164-6470 | BSC | Perm 788-1230 | DRA #1 | DRA #2 | Dupont | Check | Total |
|---|---|---|---|---|---|---|---|---|---|
| Meter Reading | 12/27/88 | 5,827,830 | 1,822,780 | 6,250,497 | 1,495,729 | 6,414,813 | 317,683 | | 22,128,332 |
| Meter Reading | 1/25/89 | 5,911,647 | 1,860,974 | 6,279,997 | 1,496,725 | 6,414,815 | 591,662 | | 22,555,820 |
| C/F Meter Consumtion | | 83,817 | 38,194 | 29,500 | 996 | 2 | 273,979 | 426,488 | 426,488 |
| % Meter Consumtion | | 0 19652839 | 0 08956488 | 0.06916959 | 0.00233635 | 4 6895E-06 | 0 64240729 | 1 | |

| | Gauge | Date | Cu Ft | Cost | Dollars | check |
|---|---|---|---|---|---|---|
| Inventory | 80 | 12/27/88 | 288,100 | 0 0043 | 1,281.83 | |
| Purchases for the period | | | 3,474,012 | 0.0043 | 14,938.25 | |
| Inventory | 160 | 1/25/89 | 705,600 | 0 0043 | 3,034 08 | |
| Total Cu Ft Cons | | | 3,066,512 | 0.0043 | 13,186 00 | 13,186 00 |

| DISTRIBUTION | FACT | T. C.F. | BY PROD | Cost/ c f. | T. Cost | Acct No. | Check |
|---|---|---|---|---|---|---|---|
| Propanil | 0 288423 | 3,066,512 | 884,453 | 0.00459923 | 4,067.80 | 164-8470 | |
| SCI | | 3,066,512 | 0 | 0.00459923 | 0.00 | | |
| ICI | 0.06917 | 3,066,512 | 212,109 | 0.00459923 | 975.64 | 788-1230 | |
| DuPont-MBC | 0 642407 | 3,066,512 | 1,969 950 | [illegible] | | | |
| Orcal | | | | | | | |

CEDAR-WEST HELENA
NITROGEN CONSUMTION
MONTH JAN YEAR 1989

CC: John Miles, Charlie Parker, Richard Johns, Robert Ray, Tom Lodice, Ken Howard, Joe Porter, Joel Walker, Joe Forthman

83%

| READINGS | Date | Propanil 154-6470 | BSO | Perm 766-1230 | DRA #1 | DRA #2 | Dupont | Check | Total |
|---|---|---|---|---|---|---|---|---|---|
| Meter Reading | 12/27/88 | 5,827,830 | 1,822,780 | 6,260,497 | 1,496,729 | 6,414,813 | 317,683 | | 22,129,332 |
| Meter Reading | 1/25/89 | 5,911,647 | 1,860,974 | 6,279,997 | 1,496,725 | 6,414,815 | 591,662 | | 22,555,820 |
| C/F Meter Consumtion | | 83,817 | 38,194 | 29,500 | 996 | 2 | 273,979 | 426,488 | 426,488 |
| % Meter Consumtion | | 0 19652839 | 0 08955489 | 0.06916959 | 0.00233535 | 4 6895E-06 | 0 64240729 | 1 | |

| | Gauge | Date | Cu Ft | Cost | Dollars | check |
|---|---|---|---|---|---|---|
| Inventory | 80 | 12/27/88 | 288,100 | 0 0043 | 1,281.83 | |
| Purchases for the period | | | 3,474,012 | 0.0043 | 14,936.25 | |
| Inventory | 180 | 1/25/89 | 705,600 | 0 0043 | 3,034 08 | |
| Total Cu Ft Cons | | | 3,066,512 | 0.0043 | 13,186 00 | 13,186 00 |

| DISTRIBUTION | FACT | T. C.F. | BY PROD | Cost/ c.f. | T. Cost | Acct No. | Check |
|---|---|---|---|---|---|---|---|
| Propanil | 0 288423 | 3,066,512 | 884,453 | 0.00459923 | 4,067.80 | 154-6470 | |
| SCI | | 3,066,512 | 0 | 0.00459923 | 0.00 | | |
| ICI | 0.06917 | 3,066,512 | 212,109 | 0.00459923 | 975.64 | 766-1230 | |
| DuPont-MBC | 0 642407 | 3,066,512 | 1,969 950 | | | | |
| Orcal | | | | | | | |

14,103 58

check

| Total cost of nitrogen Purchases for the mo | |
|---|---|
| Nitrogen | 14,316.92 |
| Tank | 900 00 |
| S Tax | 760 85 |
| Total | 16,977 77 |
| T. Cons | 3,474,012 |
| T Cost | 0.00459923 |

14,243.45

B.T.

MAKE COPIES FOR THE ABOVE

PLUS ONE FOR THE BOOK.



AB0000078981/104

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AB0000078448/2

# PLANT OVERVIEW
# WEST HELENA PLANT - DECEMBER 1990

## 1.0 FINANCIAL

| | DEC | | YTD | |
|---|---|---|---|---|
| | ACT | BGT | ACT | BGT |
| Net Sales | 3181 | 441 | 28526 | 24545 |
| C.O.G.S. | 2661 | 483 | 23115 | 19514 |
| Gross Margin | 520 | (42) | 5410 | 5031 |

The MTD G.M. was about 75% from ICIA Propanil sales and 25% from toll projects. The YTD G.M. is substantially above budget and recent projections. This is mainly due to 4th quarter Propanil sales.

## 2.0 OPERATIONS

2.1 MBC - production was 125,510 lbs. with no major problems.

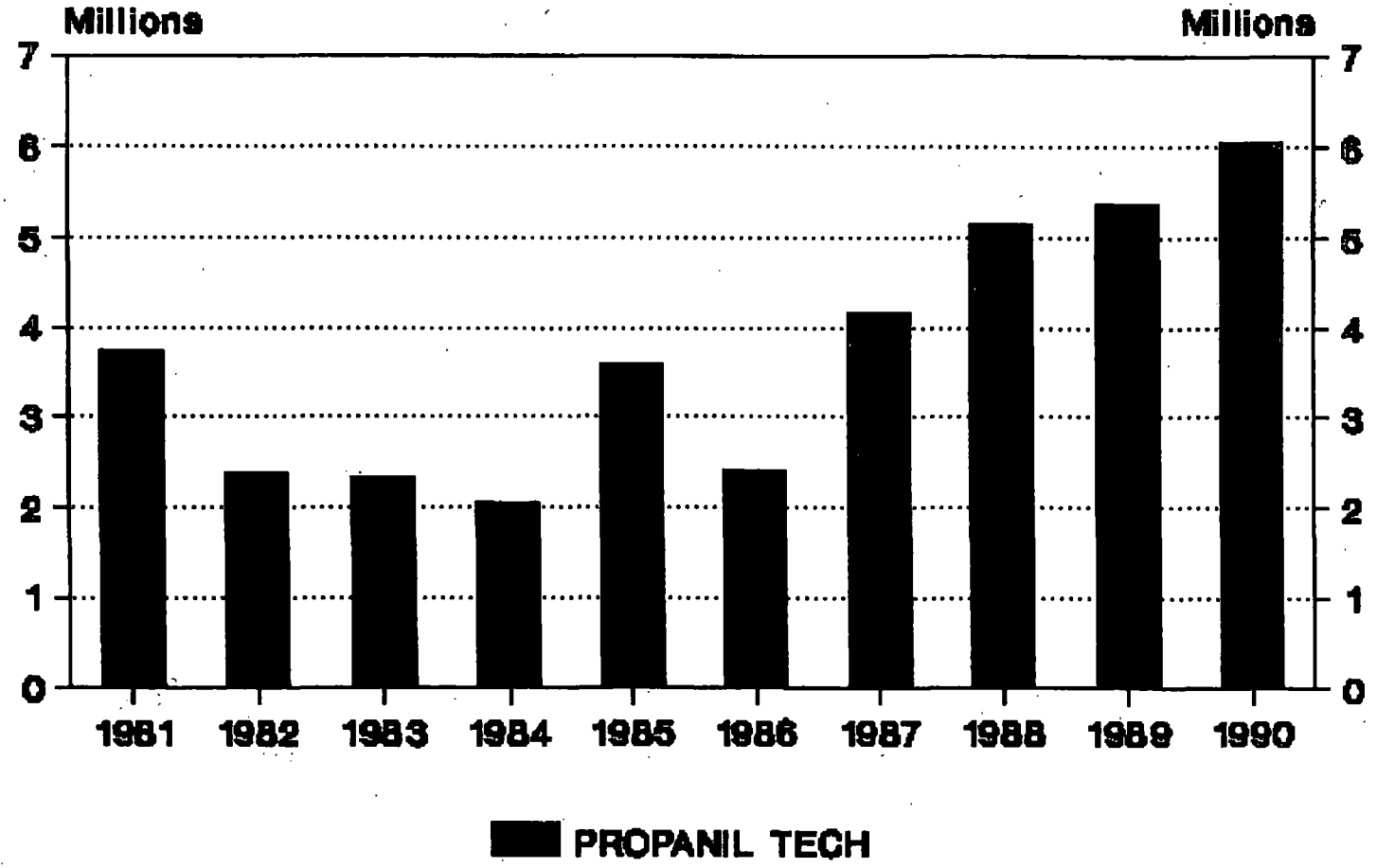
2.2 GRACE - this was the initial production month for 2-AB with 37,916 lbs. produced.

2.3 PROPANIL - production was 1,094,748 lbs. of Tech. This was a record production month for Tech. YTD production was 6,063,037 lbs. of Tech, which is also a record production year. The attached chart shows Tech production for the last ten years.

3.0 PERSONNEL - permanent staffing is 102 to meet plant operations requirements.

4.0 TECHNICAL - major efforts were in BFG and DCA. Construction costs and schedule continue to be in line for the DCA project.

# WEST HELENA PRODUCTION






AB00000784481/4

B

CEDAR INTERNAL CORRESPONDENCE

DATE:01/15/91

TO: John Miles

FROM: Russell Fairchild

cc: Tom Lodice

SUBJECT: Nov.& Dec. Monthly Operations Report

1.0 UNIT 1:

MTPO

| PRODUCTION | NOV. LBS MTPO | DEC. * | YEAR TOTAL |
|---|---|---|---|
| MTD | 22,610 | -0- | 130,955 |
| YTD | 130,955 | 130,955 | |

Two batches of completed material were produced in November. This included 5 completions of MTP to MTPO.
There were no quality problems for the month. No production problems were encountered. The average production rate for the month was 3500#/day. Production ended 11/8/90, and the unit was modified for BFG Telene-RIM.

2.0 UNIT 2: PROPANIL

| PRODUCTION NOVEMBER | TECH-LBS | FLAKE | 4LB-GAL | 3LB-GAL | WHAM |
|---|---|---|---|---|---|
| MTD | 609,195 | 79,335 | 11,944 | -0- | -0- |
| YTD | 4,968,289 | 385,204 | 231,249 | 222,792 | 106,110 |

| PRODUCTION DECEMBER | TECH-LBS | FLAKE | 4LB-GAL | 3LB-GAL | WHAM |
|---|---|---|---|---|---|
| MTD | 1,094,748 | 192,648 | 87,406 | 59,815 | -0- |
| YTD | 6,063,037 | 577,852 | 318,655 | 282,247 | 106,110 |
| YEAR TOTALS | 6,063,037 | 577,852 | 318,655 | 282,247 | 106,110 |

105 batches of propanil tech. were produced in November and December. The average per-cent active was 98.2. Forty one trucks for Ordram were shipped during the two months.
The average % active for the trucks was 98.3.

FOR BOTH MONTHS:
Average production rate(tech @ 100%): 27,833#/day
Quality Performance: 100%
Quality Performance-formulations: 100%
Percent Capacity-tech: 94.7

3.0 UNIT 4: DuPONT: MBC

| PRODUCTION | MBC - LBS NOV. | DEC. | YEAR TOTAL |
|---|---|---|---|
| MTD | 86,240 | 125,510 | 285,340 |
| YTD | 159,830 | 285,340 | |

58 batches were produced November and December. The following is an account of the quality problems for the two months:

| BATCH | SPECS. BREACHED |
|---|---|
| 19B | >0.5% CHLORIDE |
| 30b | >0.5% CHLORIDE, %ACTIVE <98.0 |
| 37A | >0.5% CHLORIDE, %WATER >0.2 |
| 37B | >0.5% CHLORIDE,>0.5% ASH,>0.2 % WATER |

All batches were successfully blended with regular production following written permission from DuPont.

5.0 GRACE

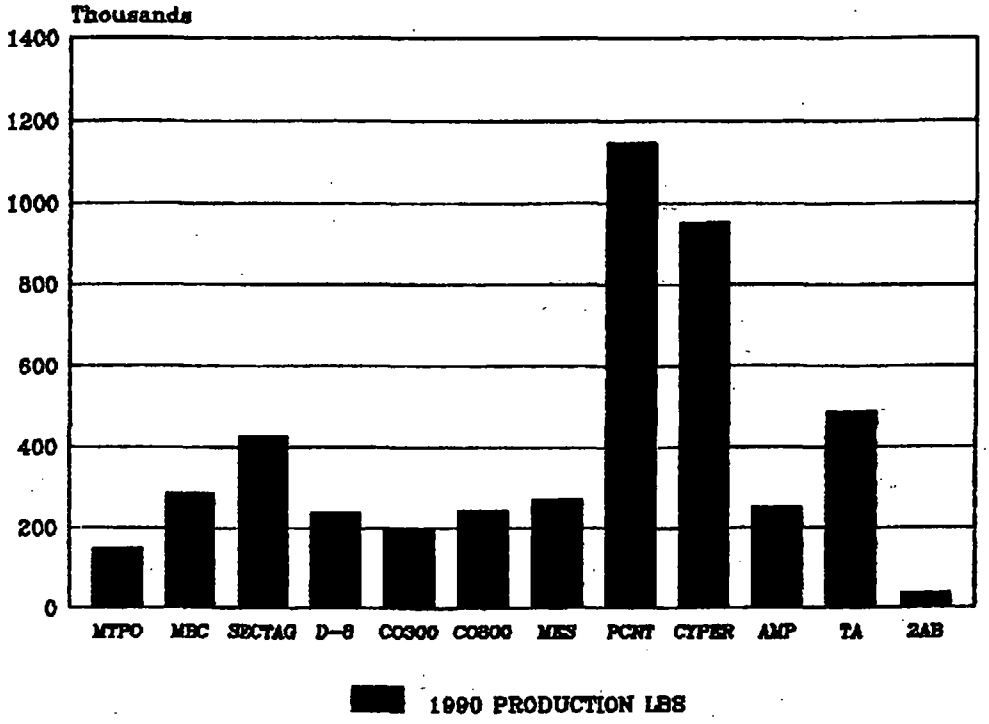
NOVEMBER:

| PRODUCTION | AMP-LBS | TA-LBS |
|---|---|---|
| MTD | 68,880 | 31,040 |
| YTD | 250,320 | 486,504 |
| YEAR TOTALS | 250,320 | 486,504 |

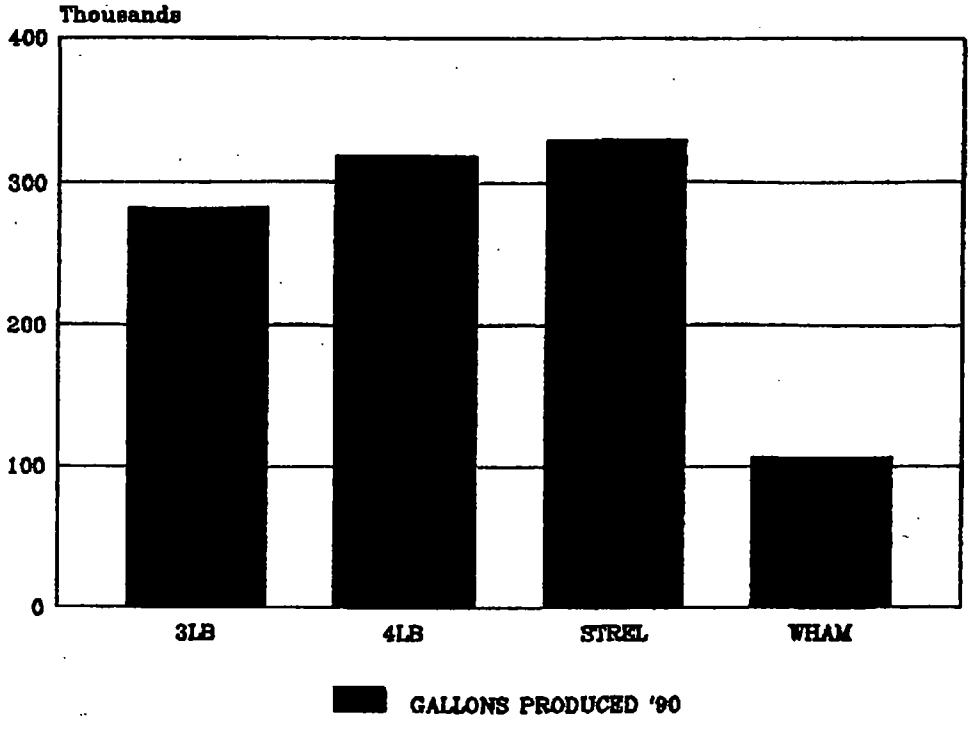
DECEMBER:

| PRODUCTION | 2AB-LBS |
|---|---|
| MTD | 37,916 |
| YTD | 37,916 |
| YEAR TOTAL | 37,916 |

The TN production ended 11/7/90. AMP was produced from 11/7 to 11/30. 2AB production started 12/5/90 and continued for the month. Seven final distillation batches of 2AB were produced in December. Batch ZC002 was out of spec on color (220 APHA, spec is < 80). This batch will be reworked in the coming months. There were no quality problems for AMP production in November.




| Legends: Labels | 1990 PRODUCTION |
|---|---|
| PROPANIL | 6,063,037.00 |
| MTPO | 148,800.00 |
| MBC | 285,340.00 |
| SECTAGON-gals | 425,794.00 |
| D-8 | 238,260.00 |
| CO300 | 197,280.00 |
| CO800 | 241,450.00 |
| MES | 272,100.00 |
| PCNT | 1,145,200.00 |
| CYPERMETRIN | 951,403.00 |
| AMP | 250,320.00 |
| TA | 486,504.00 |
| 2AB | 37,916.00 |




| Legends: GALLONS PRODUCED '90 | |
|---|---|
| Labels | |
| 3LB | 282,247.00 |
| 4LB | 318,655.00 |
| STREL | 329,945.00 |
| WHAM | 106,110.00 |

**CEDAR INTERNAL CORRESPONDENCE**

DATE: Jan. 2, 1991

TO: John Miles

FROM: Tom Lodice

CC:

SUBJECT: December Engineering Report

GRACE

2-AB production started on December 3. Production has continued at a relatively slow pace, with some improvement by the end of the month. The variable speed drives for the metering pumps have arrived and will be installed by maintenance next month. This modification will enhance the reliability of the metering pump system although it appears to be less of a problem than originally thought.

Gene Pearce reviewed the design of the autoclave cooling coil system which was done by Delta Process Management. It has been determined that the "refrigeration problem" which we have been experiencing is not caused by lack of capacity of the refrigeration machines, but by the extremely low velocity of the brine through the coils resulting in poor heat transfer. A flow orifice installed on the brine piping to the autoclave revealed that we were only getting 120 gallons per minute to the coils. By restricting brine flow to other equipment items, the rate was increased to 180 gallons per minute resulting in a one hour reduction in the hydrogenation reaction rate. We will be examining other ways to increase the heat transfer over the next month.

DCA

Insulation work was started in December. Both product tanks and the brine storage tanks have been insulated. All of the tanks and vessels will be insulated by mid February. The piping insulation work will begin in January.

The refrigeration systems have been installed and the foundations for the boiler system have been prepared. The boiler is scheduled to ship in late January.

The motor starters and much of the conduit have been installed. Lights have also been installed in the unit. Most of the pump and equipment lighting will be completed this month.

All of the instrument specifications have been prepared and most of the instruments have been ordered. Fabrication of the control panel has been started by FBD and the panel will be assembled and tested in their shop prior to shipment.

DCA (continued)

The piping work has continued at a moderate pace although work has been hampered by the unusually wet weather. All of the utility headers and vent lines have been installed as well as the pump manifolds and suction lines.

Ken Howard has completed the initial draft of the operating instructions in preparation for the Hazop review to be held on January 3 and 4. Operator will begin in early February. The plant will be ready for pressure testing and water batching in early March.

GOODRICH

Modifications to the ICI unit are nearly complete for the production of Telene RIM starting on January 7. George Foehringer has prepared the operating procedures for the process and they were reviewed by Goodrich. Operator training is scheduled for January 3.

OTHER

A report on the xanthate production was prepared by Fran using equipment in the ICI unit. A capital cost and production rate estimate will be prepared in January.

GOALS FOR JANUARY

1. Complete Goodrich production.
2. Complete painting of DCA unit.
3. Complete modifications in the ICI unit for February production.
4. Begin insulation of DCA piping.

9

**CEDAR INTERNAL CORRESPONDENCE**

DATE: January 15, 1991

TO: J.H. Miles

FROM: Joe E. Porter

CC: T. Lodice
G. Satterfield
G. Pearce

SUBJECT: Environmental Report
December 1990

Treatment System
Outfall 001 - Stormwater - 220,160 gallons
Outfall 002 - Treatment System - 257,968 gallons
In the second month of our new permit, we again exceeded our permit limit for ammonia. However, the high ammonia value appears to be, at least in part, an analytical problem. The laboratory switched to an electrode method which apparently has a lot of interference from amines.

Wet weather created enough stormwater to warrant a discharge to the road ditch. Consequently, with our new permit we had a bioassay test done. We failed it completely but with no real surprise. Construction on the plant site has created a very unsettled condition in our storm-water system.

The State says not to expect any progress toward a consent order until early 1991. Apparently we are pretty low on their priority list.

Offsite Disposal
Grace Unit - AMP 141,910 pounds
94,460 pounds

BPC-1240-A

ND

**CEDAR INTERNAL CORRESPONDENCE**

DATE: January 15, 1991

TO: J.H. Miles

FROM: J.E. Porter

CC: T. Lodice
G. Satterfield
G. Pearce

SUBJECT: Environmental Report
November 1990

Treatment System
Outfall 001 - Stormwater -0-
Outfall 002 - Treatment System - 329,132 gallons
In the first month of our new permit, we exceeded our permit limit for ammonia nitrogen. A combination of ammonia salts from the MBC process and ammonia used to neutralize propanil wastewater resulted in exceeding the daily maximum discharge limit. The heavy salt loading and hydraulic load from MBC has resulted in greatly diminished biological activity. We have ceased to take MBC wastewater into the system until it recovers.

Our first bioassay under the new permit is scheduled for the first week in December. We chose Environmental Testing and Consulting (ETC) of Memphis to perform these tests.

BPC-1140-A

CEDAR CHEMICAL CORPORATION

January 14, 1991

Laboratory Monthly Report for December, 1990

Propanil

There were 63 batches of Propanil Technical produced in December. The average percent tech was 98.3% There were 16 batches sent to ICI, and 7 went to the flaker. Ten batches went to Cedar 4 lb. and 6 went to Cedar Propanil 36%. The Cedar 4 lb. averaged 45.6% and 4.00 lbs/gallon active. The Propanil 36% averaged 36.3% and 363 grams per liter active.

Dupont- MBC

There were 36 batches of MBC produced and all batches were in specification. The active was 99.1% and required no reblending.

Grace- 2AB

There were 18 condensation batches produced during December. The average 2-NB content was 40.3% and .07% Formaldehyde. There were 29 hydrogenation batches run and these averaged 42.2% 2-AB. There were 7 distillation batches produced with the assay averaging 98.7%. Three batches were out of specification with color,and the NMAB levels being high.

Safety

There were no accidents, safety violations, or near misses recorded during the month of December.

Environmental

There were 257,968 gallons of treated water discharged to the Mississippi River during the month of December. There was one permit violation during the third week of December. There was a discharge of 33.9 lbs. of Ammonia Nitrogen released during the week versus a maximum of 20 lbs. In addition, there were 4 violations concerning the storm water discharge. There were 2 high COD discharges, 1 High PH discharge, and 1 Oil and Grease discharge. There were 220,160 gallons of water discharged down the storm water ditch.

Review of December Objectives

1. The catalyst verification phase of DCA work was completed and report issued.

2. Work was done to verify the low pressure reduction approach requested by Recirca. A report was issued.

3. Work was initiated on the Chemical hygiene plan. There still remains the inventory update and formal write up of the program. These will hopefully be completed by January 1991.

4. A trip was made to Recirca to aid in start-up of the nitration phase of the work they are doing for us. This was a reasonable success, with no major problems noted with the nitration.

Objectives for January 1991

1. B.F. Goodrich start-up should commence in January.

2. Set-up for Cypermethrin Analytical to begin in February.

3. Complete Chemical Hygiene plan.

**CEDAR INTERNAL CORRESPONDENCE**

DATE: January 15, 1991

TO: John Miles

FROM: Beaver Schaffhauser

CC:

SUBJECT: Monthly Report for December, 1990

On December 3rd, there was a hazardous communication training for Grace operators for the 2AB process.

On December 4th, the safety committee had its' November meeting.

On December 4th, I visited the Emergency Response groups such as the Fire Departments and hospital emergency room for the purpose of installing 2AB Material Safety Data Sheet booklets in their hazardous communication volumes for Cedar.

On December 7th, there was an emergency response spill control drill for operators.

December 10th through 13th there was a safety orientation for a new employee.

On December 14th, there was a emergency response spill control drill.

The safety meetings for December consisted of the video "Straight Dope on Drug Testing", and Hazardous Communications for 2AB and Telene Rim.

The January safety meeting will consist of Hazardous Communications for Cypermethrin, the cyanide antidote kit, the cyanide alarm and plan, monitox monitors and work permits for the Cypermethrin/Propanil production unit.

There were three first aids for December.

**CEDAR INTERNAL CORRESPONDENCE**

DATE: January 15, 1991

TO: Tom Lodice

FROM: Bill Gastrock WHG

CC: John Miles

SUBJECT: Research and Development December Monthly Summary

Project 91

Lab experiments have been directed at the first step in the process, the preparation of IPN from isophorone and HCN. Thus far the reactions have not proceeded to completion as indicated in the literature. The use of various basic catalysts (NaCN, KCN, tetramethylammonium hydroxide, basic ion exchange risin and poly DMAP) have been explored without solvent and with methyl proposal as solvent. Temperatures from 80° C to 150° C have been investigated with somewhat higher conversions at the higher temperatures.

All conditions have generated varying amounts of high boiling impurities, indicating distillation of the IPN will be required in addition to recovery and recycle of unreacted isophorone.

Efforts are continuing to drive the reaction further to completion while minimizing formation of side products.

GPC-1140-A

DATE 12/31/90 CEDAR CHEMICAL CORPORATION PAGE 1

CEDAR - WEST HELENA PLANT INCOME STATEMENT INST20

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH BUDGETED $ AMOUNT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE BUDGETED $ AMOUNT |
|---|---|---|---|---|
| 3,208,028.93 | 443,750.00 | SALES | 28,043,337.45 | 24,920,307.00 |
| 8,566.38 | 1,575.00 | LESS-FREIGHT OUT | 149,641.21 | 185,058.00 |
| 18,730.74 | 1,068.00 | LESS WAREHOUSE RENT | 168,066.56 | 190,351.00 |
| 3,180,731.81 | 441,107.00 | NET SALES | 28,525,629.68 | 24,544,898.00 |
| | | COST OF GOODS SOLD | | |
| 2,153,442.13 | 194,250.00 | COST OF SALES @ STD | 16,470,568.95 | 13,488,602.00 |
| 8,554.85- | 30,733.00- | MFG.VARIANCE | 126,605.56 | 103,110.00 |
| 169.91 | | R/M PRICE VARIANCE | 1,912.11 | |
| 402,086.12 | 271,328.00 | TOLLING COST | 5,932,465.59 | 5,346,168.00 |
| 5,937.88 | | START-UP COST | 77,336.23- | |
| | | PRODUCT COMPLAINT | | |
| 107,999.99 | 48,000.00 | TASK FORCE EXP | 657,500.00 | 576,000.00 |
| | | OTHER | 3,710.05 | |
| 2,661,081.18 | 482,845.00 | TOTAL C.O.G.S. | 23,115,426.03 | 19,513,880.00 |
| 519,650.63 | 41,738.00- | GROSS MARGIN | 5,410,203.65 | 5,031,018.00 |
| 16.20 % | 9.41-% | GROSS MARGIN PERCENTAGE | 18.76 % | 20.19 % |
| 519,650.63 | 41,738.00- | NET INCOME (LOSS) | 5,410,203.65 | 5,031,018.00 |

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DATE 12/31/90 CEDAR CHEMICAL CORPORATION PAGE 1

CEDAR - WEST HELENA PROPANIL TECH PRODUCT INCOME STATEMENT INGT19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| 324,220 | | | | UNITS IN LBS | 1,918,404 | | | |
| 719,768.40 | 2.22 | | | SALES | 4,236,342.64 | 2.21 | | |
| 60.00 | | | | LESS-FREIGHT OUT | 6,710.61 | | | |
| 719,708.40 | 2.22 | | | NET SALES | 4,229,632.03 | 2.20 | | |
| | | | | COST OF GOODS SOLD | | | | |
| 466,876.80 | 1.44 | | | COST OF SALES @ STD | 2,762,501.76 | 1.44 | | |
| 41,026.46 | .13 | 14,286.00- | | MFG.VARIANCE | 471,190.96 | .25 | 26,654.00 | |
| 507,903.26 | 1.57 | 14,286.00- | | TOTAL C.O.G.S. | 3,233,692.72 | 1.69 | 26,654.00 | |
| 211,805.14 | .65 | 14,286.00 | | GROSS MARGIN | 995,939.31 | .52 | 26,654.00- | |
| 29.43 % | | % | | GROSS MARGIN PERCENTAGE | 23.51 % | | % | |
| 211,805.14 | .65 | 14,286.00 | | NET INCOME (LOSS) | 995,939.31 | .52 | 26,654.00- | |

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CEDAR - WEST HELENA FLAKED TECH PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| 20,230 | | | | UNITS IN LBS | 152,258 | | | |
| 45,517.50 | 2.25 | | | SALES | 274,990.50 | 1.81 | | |
| 56.46 | | | | LESS-FREIGHT OUT | 7,894.35 | .05 | | |
| 385.00 | .02 | | | LESS WAREHOUSE RENT | 5,228.42 | .03 | | |
| 45,076.04 | 2.23 | | | NET SALES | 261,867.73 | 1.72 | | |
| | | | | COST OF GOODS SOLD | | | | |
| 33,581.80 | 1.66 | | | COST OF SALES @ STD | 253,412.28 | 1.66 | | |
| 29,581.91- | 1.46- | 20,511.00- | | MFG.VARIANCE | 4,593.22- | .03- | 3,142.00 | |
| 169.91 | .01 | | | R/M PRICE VARIANCE | 1,912.11 | .01 | | |
| 4,169.80 | .21 | 20,511.00- | | TOTAL C.O.G.S. | 250,731.17 | 1.65 | 3,142.00 | |
| 40,906.24 | 2.02 | 20,511.00 | | GROSS MARGIN | 11,136.56 | .07 | 3,142.00- | |
| 89.87 % | | | % | GROSS MARGIN PERCENTAGE | 4.05 % | | | % |
| 40,906.24 | 2.02 | 20,511.00 | | NET INCOME (LOSS) | 11,136.56 | .07 | 3,142.00- | |

CEDAR - WEST HELENA PROPANIL 3# PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| 85,125 | | 25,000 | | UNITS IN GAL | 427,348 | | 300,000 | |
| 765,005.89 | 8.99 | 193,750.00 | 7.75 | SALES | 3,642,876.55 | 8.52 | 2,325,000.00 | 7.75 |
| 4,173.12 | .05 | 1,575.00 | .06 | LESS-FREIGHT OUT | 28,048.51 | .07 | 18,900.00 | .06 |
| 5,197.55 | .06 | 50.00 | | LESS WAREHOUSE RENT | 8,470.46 | .02 | 600.00 | |
| 755,635.22 | 8.88 | 192,125.00 | 7.69 | NET SALES | 3,606,357.58 | 8.44 | 2,305,500.00 | 7.69 |
| | | | | COST OF GOODS SOLD | | | | |
| 722,614.88 | 8.49 | 194,250.00 | 7.77 | COST OF SALES @ STD | 3,403,734.43 | 7.96 | 2,331,000.00 | 7.77 |
| 19,400.81- | .23- | 1,922.00- | .08- | MFG.VARIANCE | 35,160.51- | .08- | 330.00- | |
| | | | | OTHER | | | | |
| 703,214.07 | 8.26 | 192,328.00 | 7.69 | TOTAL C.O.G.S. | 3,368,573.92 | 7.88 | 2,330,670.00 | 7.77 |
| 52,421.15 | .62 | 203.00- | .01- | GROSS MARGIN | 237,783.66 | .56 | 25,170.00- | .08- |
| 6.85 % | | .10-% | | GROSS MARGIN PERCENTAGE | 6.53 % | | 1.08-% | |
| 52,421.15 | .62 | 203.00- | .01- | NET INCOME (LOSS) | 237,783.66 | .56 | 25,170.00- | .08- |

CEDAR - WEST HELENA PROPANIL 4# PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| 86,765 | | | | UNITS IN GAL | 391,154 | | 500,000 | |
| 1,089,943.52 | 12.56 | | | SALES | 5,306,729.71 | 13.57 | 6,445,000.00 | 12.89 |
| 3,251.75 | .04 | | | LESS-FREIGHT OUT | 32,649.88 | .08 | 75,167.00 | .15 |
| 7,732.60 | .09 | 465.00 | | LESS WAREHOUSE RENT | 80,571.94 | .21 | 134,818.00 | .27 |
| 1,078,959.17 | 12.44 | 465.00- | | NET SALES | 5,193,507.89 | 13.28 | 6,235,015.00 | 12.47 |
| | | | | COST OF GOODS SOLD | | | | |
| 810,385.10 | 9.34 | | | COST OF SALES @ STD | 3,622,739.76 | 9.26 | 4,670,000.00 | 9.34 |
| 2,557.13- | .03- | | | MFG.VARIANCE | 29,892.56- | .08- | 2,165.00 | |
| 161,333.33 | 1.86 | 25,000.00 | | TASK FORCE EXP | 552,500.00 | 1.41 | 300,000.00 | .60 |
| | | | | OTHER | | | | |
| 969,161.30 | 11.17 | 25,000.00 | | TOTAL C.O.G.S. | 4,145,347.20 | 10.60 | 4,972,165.00 | 9.94 |
| 109,797.87 | 1.27 | 25,465.00- | | GROSS MARGIN | 1,048,160.69 | 2.68 | 1,262,850.00 | 2.53 |
| 10.07 % | | % | | GROSS MARGIN PERCENTAGE | 19.75 % | | 19.59 % | |
| 109,797.87 | 1.27 | 25,465.00- | | NET INCOME (LOSS) | 1,048,160.69 | 2.68 | 1,262,850.00 | 2.53 |

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CEDAR - WEST HELENA PROPANEX-4 PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| 9,450 | | | | UNITS IN GALS | 52,266 | | | |
| 103,539.45 | 10.96 | | | SALES | 736,134.00 | 14.08 | | |
| | | | | LESS-FREIGHT OUT | 2,941.00 | .06 | | |
| 1,527.06 | .16 | | | LESS WAREHOUSE RENT | 15,173.92 | .29 | | |
| 102,012.39 | 10.79 | | | NET SALES | 718,019.08 | 13.74 | | |
| | | | | COST OF GOODS SOLD | | | | |
| 119,803.95 | 12.68 | | | COST OF SALES @ STD | 685,954.55 | 13.12 | | |
| 1,187.95- | .13- | | | MFG.VARIANCE | 1,187.95- | .02- | | |
| 118,616.00 | 12.55 | | | TOTAL C.O.G.S. | 684,766.60 | 13.10 | | |
| 16,603.61- | 1.76- | | | GROSS MARGIN | 33,252.48 | .64 | | |
| 16.04-% | | | % | GROSS MARGIN PERCENTAGE | 4.52 % | | | % |
| 16,603.61- | 1.76- | | | NET INCOME (LOSS) | 33,252.48 | .64 | | |

CEDAR - WEST HELENA 50 WDG PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | 95,720 | | 200,000 | |
| 2,380.00- | | | | SALES | 172,999.32 | 1.81 | 350,000.00 | 1.75 |
| | | | | LESS-FREIGHT OUT | 317.18 | | 13,118.00 | .07 |
| | | 60.00 | | LESS WAREHOUSE RENT | 1,125.60 | .01 | 720.00 | |
| 2,380.00- | | 60.00- | | NET SALES | 171,556.54 | 1.79 | 336,162.00 | 1.68 |
| | | | | COST OF GOODS SOLD | | | | |
| | | | | COST OF SALES @ STD | 141,673.49 | 1.48 | 296,000.00 | 1.48 |
| 27.31 | | | | MFG.VARIANCE | 764.06 | .01 | 780.00- | |
| 27.31 | | | | TOTAL C.O.G.S. | 142,437.55 | 1.49 | 295,220.00 | 1.48 |
| 2,407.31- | | 60.00- | | GROSS MARGIN | 29,118.99 | .30 | 40,942.00 | .20 |
| 101.15 % | | % | | GROSS MARGIN PERCENTAGE | 16.83 % | | 11.70 % | |
| 2,407.31- | | 60.00- | | NET INCOME (LOSS) | 29,118.99 | .30 | 40,942.00 | .20 |

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| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | 257,641 | | | |
| | | | | SALES | 541,045.88 | 2.10 | | |
| | | | | NET SALES | 541,045.88 | 2.10 | | |
| | | | | COST OF GOODS SOLD | | | | |
| | | | | COST OF SALES @ STD | 425,101.67 | 1.65 | | |
| | | | | MFG.VARIANCE | 436.16 | | | |
| | | | | TOTAL C.O.G.S. | 425,537.83 | 1.65 | | |
| | | | | GROSS MARGIN | 115,508.05 | .45 | | |
| X | | X | | GROSS MARGIN PERCENTAGE | 21.35 X | | X | |
| | | | | NET INCOME (LOSS) | 115,508.05 | .45 | | |

CEDAR - WEST HELENA SIREL PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN GAL | 329,420 | | 329,406 | |
| 9,820.80 | | | | SALES | 3,964,301.70 | 12.03 | 3,656,406.00 | 11.10 |
| | | | | LESS-FREIGHT OUT | 193.00 | | | |
| 9,820.80 | | | | NET SALES | 3,964,108.70 | 12.03 | 3,656,406.00 | 11.10 |
| | | | | COST OF GOODS SOLD | | | | |
| | | | | COST OF SALES @ STD | 3,271,140.71 | 9.93 | 3,271,002.00 | 9.93 |
| 112.68- | | | | MFG.VARIANCE | 170,749.52- | .52- | 431.00 | |
| | | | | OTHER | | | | |
| 112.68- | | | | TOTAL C.O.G.S. | 3,100,391.19 | 9.41 | 3,271,433.00 | 9.93 |
| 9,933.48 | | | | GROSS MARGIN | 863,717.51 | 2.62 | 384,973.00 | 1.17 |
| 101.15 % | | % | | GROSS MARGIN PERCENTAGE | 21.79 % | | 10.53 % | |
| 9,933.48 | | | | NET INCOME (LOSS) | 863,717.51 | 2.62 | 384,973.00 | 1.17 |

CEDAR - WEST HELENA WHAM PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN GALS | 90,835 | | 150,000 | |
| 17,961.70- | | | | SALES | 1,159,863.15 | 12.77 | 1,987,500.00 | 13.25 |
| 1,025.05 | | | | LESS-FREIGHT OUT | 46,319.18 | .51 | 36,741.00 | .24 |
| 1,703.94 | | | | LESS WAREHOUSE RENT | 37,009.79 | .41 | 44,694.00 | .30 |
| 20,690.69- | | | | NET SALES | 1,076,534.18 | 11.85 | 1,906,065.00 | 12.71 |
| | | | | COST OF GOODS SOLD | | | | |
| 179.60 | | | | COST OF SALES @ STD | 820,098.90 | 9.03 | 1,347,000.00 | 8.98 |
| 2,468.85 | | | | MFG.VARIANCE | 27,942.41- | .31- | 333.00- | |
| | | | | OTHER | 89.80 | | | |
| 2,648.45 | | | | TOTAL C.O.G.S. | 792,246.29 | 8.72 | 1,346,667.00 | 8.98 |
| 23,339.14- | | | | GROSS MARGIN | 284,287.89 | 3.13 | 559,398.00 | 3.73 |
| 129.94 % | | % | | GROSS MARGIN PERCENTAGE | 24.51 % | | 28.15 % | |
| 23,339.14- | | | | NET INCOME (LOSS) | 284,287.89 | 3.13 | 559,398.00 | 3.73 |

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CEDAR - WEST HELENA BUTOXONE 175 PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN GALS | 77,014 | | 100,000 | |
| 7,367.54 | | | | SALES | 1,158,498.43 | 15.04 | 1,550,000.00 | 15.50 |
| | | | | LESS-FREIGHT OUT | 15,215.32 | .20 | 26,030.00 | .26 |
| 1,207.24 | | 300.00 | | LESS WAREHOUSE RENT | 11,568.87 | .15 | 3,803.00 | .04 |
| 6,160.30 | | 300.00- | | NET SALES | 1,131,714.24 | 14.69 | 1,520,167.00 | 15.20 |
| | | | | COST OF GOODS SOLD | | | | |
| | | | | COST OF SALES @ STD | 835,036.32 | 10.84 | 1,083,000.00 | 10.83 |
| 338.39 | | | | MFG.VARIANCE | 139,260.85- | 1.81- | 330.00 | |
| | | | | PRODUCT COMPLAINT | | | | |
| 53,333.34- | | 23,000.00 | | TASK FORCE EXP | 105,000.00 | 1.36 | 276,000.00 | 2.76 |
| | | | | OTHER | 909.72 | .01 | | |
| 52,994.95- | | 23,000.00 | | TOTAL C.O.G.S. | 801,685.19 | 10.41 | 1,359,330.00 | 13.59 |
| 59,155.25 | | 23,300.00- | | GROSS MARGIN | 330,029.05 | 4.29 | 160,837.00 | 1.61 |
| 802.92 % | | % | | GROSS MARGIN PERCENTAGE | 28.49 % | | 10.38 % | |
| 59,155.25 | | 23,300.00- | | NET INCOME (LOSS) | 330,029.05 | 4.29 | 160,837.00 | 1.61 |

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CEDAR - WEST HELENA BUTOXONE 200 PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN GALS | 8,154 | | 20,000 | |
| 146.30- | | | | SALES | 130,322.96 | 15.98 | 340,000.00 | 17.00 |
| | | | | LESS-FREIGHT OUT | 2,302.42 | .28 | 7,502.00 | .38 |
| 753.22 | | 193.00 | | LESS WAREHOUSE RENT | 5,195.72 | .64 | 2,316.00 | .12 |
| 899.52- | | 193.00- | | NET SALES | 122,824.82 | 15.06 | 330,182.00 | 16.51 |
| | | | | COST OF GOODS SOLD | | | | |
| | | | | COST OF SALES @ STD | 98,126.28 | 12.03 | 243,600.00 | 12.18 |
| 424.60 | | | | MFG.VARIANCE | 70,389.81 | 8.63 | 1.00- | |
| | | | | PRODUCT COMPLAINT | | | | |
| | | | | OTHER | 915.04- | .11- | | |
| 424.60 | | | | TOTAL C.O.G.S. | 167,601.05 | 20.55 | 243,599.00 | 12.18 |
| 1,324.12- | | 193.00- | | GROSS MARGIN | 44,776.23- | 5.49- | 86,583.00 | 4.33 |
| 905.07 % | | % | | GROSS MARGIN PERCENTAGE | 34.36-% | | 25.47 % | |
| 1,324.12- | | 193.00- | | NET INCOME (LOSS) | 44,776.23- | 5.49- | 86,583.00 | 4.33 |

CEDAR - WEST HELENA BUTOXONE ESTER PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN GALS | 14,580 | | 20,000 | |
| | | | | SALES | 308,273.40 | 21.14 | 406,400.00 | 20.32 |
| | | | | LESS-FREIGHT OUT | 7,049.76 | .48 | 7,600.00 | .38 |
| 224.13 | | | | LESS WAREHOUSE RENT | 3,721.84 | .26 | 3,400.00 | .17 |
| 224.13- | | | | NET SALES | 297,501.80 | 20.40 | 395,400.00 | 19.77 |
| | | | | COST OF GOODS SOLD | | | | |
| | | | | COST OF SALES @ STD | 151,048.80 | 10.36 | 247,000.00 | 12.35 |
| | | | | MFG.VARIANCE | 7,388.41- | .51- | | |
| | | | | PRODUCT COMPLAINT | | | | |
| | | | | OTHER | | | | |
| | | | | TOTAL C.O.G.S. | 143,660.39 | 9.85 | 247,000.00 | 12.35 |
| 224.13- | | | | GROSS MARGIN | 153,841.41 | 10.55 | 148,400.00 | 7.42 |
| % | | % | | GROSS MARGIN PERCENTAGE | 49.90 % | | 36.52 % | |
| 224.13- | | | | NET INCOME (LOSS) | 153,841.41 | 10.55 | 148,400.00 | 7.42 |

CEDAR - WEST HELENA DUPONT-CNT PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | 1,145,200 | | 284,210 | |
| | | | | SALES | 589,903.78 | .52 | 270,000.00 | .95 |
| | | | | NET SALES | 509,903.78 | .52 | 270,000.00 | .95 |
| | | | | COST OF GOODS SOLD TOLLING COST | 425,709.60 | .37 | 229,197.00 | .81 |
| | | | | TOTAL C.O.G.S. | 425,709.60 | .37 | 229,197.00 | .81 |
| | | | | GROSS MARGIN | 164,194.18 | .14 | 40,803.00 | .14 |
| % | | % | | GROSS MARGIN PERCENTAGE | 27.83 % | | 15.11 % | |
| | | | | NET INCOME (LOSS) | 164,194.18 | .14 | 40,803.00 | .14 |

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CEDAR - WEST HELENA DUPONT-MBC PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| 125,510 | | | | UNITS IN LBS | 285,340 | | 419,689 | |
| 278,806.96 | 2.22 | | | SALES | 820,043.54 | 2.87 | 810,000.00 | 1.93 |
| 278,806.96 | 2.22 | | | NET SALES | 820,043.54 | 2.87 | 810,000.00 | 1.93 |
| 155,367.37 | 1.24 | | | COST OF GOODS SOLD TOLLING COST | 636,370.91 | 2.23 | 576,805.00 | 1.37 |
| 155,367.37 | 1.24 | | | TOTAL C.O.G.S. | 636,370.91 | 2.23 | 576,805.00 | 1.37 |
| 123,439.59 | .98 | | | GROSS MARGIN | 183,672.63 | .64 | 233,195.00 | .56 |
| 44.27 % | | | % | GROSS MARGIN PERCENTAGE | 22.40 % | | 28.79 % | |
| 123,439.59 | .98 | | | NET INCOME (LOSS) | 183,672.63 | .64 | 233,195.00 | .56 |

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CEDAR - WEST HELENA B.F GOODRICH PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | | | 500,000 | |
| | | | | SALES | 70,056.61 | | 1,000,000.00 | 2.00 |
| | | | | NET SALES | 70,056.61 | | 1,000,000.00 | 2.00 |
| | | | | COST OF GOODS SOLD | | | | |
| 892.16 | | | | TOLLING COST | 66,157.60 | | 523,162.00 | 1.05 |
| 892.16 | | | | TOTAL C.O.G.S. | 66,157.60 | | 523,162.00 | 1.05 |
| 892.16- | | | | GROSS MARGIN | 3,899.01 | | 476,838.00 | .95 |
| % | | % | | GROSS MARGIN PERCENTAGE | 5.57 % | | 47.68 % | |
| 892.16- | | | | NET INCOME (LOSS) | 3,899.01 | | 476,838.00 | .95 |

CEDAR - WEST HELENA GRACE PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| 41,276 | | 289,000 | | UNITS IN LBS | 774,740 | | 2,143,000 | |
| 208,433.47 | 5.05 | 250,000.00 | .87 | SALES | 2,614,552.08 | 3.37 | 2,580,000.00 | 1.20 |
| 208,433.47 | 5.05 | 250,000.00 | .87 | NET SALES | 2,614,552.08 | 3.37 | 2,580,000.00 | 1.20 |
| | | | | COST OF GOODS SOLD | | | | |
| 194,942.63 | 4.72 | 171,473.00 | .59 | TOLLING COST | 2,445,660.89 | 3.16 | 2,011,910.00 | .94 |
| 5,937.88 | .14 | | | START-UP COST | 77,336.23- | .10- | | |
| 200,880.51 | 4.87 | 171,473.00 | .59 | TOTAL C.O.G.S. | 2,368,324.66 | 3.06 | 2,011,910.00 | .94 |
| 7,552.96 | .18 | 78,527.00 | .27 | GROSS MARGIN | 246,227.42 | .32 | 568,090.00 | .27 |
| 3.62 % | | 31.41 % | | GROSS MARGIN PERCENTAGE | 9.42 % | | 22.02 % | |
| 7,552.96 | .18 | 78,527.00 | .27 | NET INCOME (LOSS) | 246,227.42 | .32 | 568,090.00 | .27 |

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CEDAR - WEST HELENA ICI CONTRACT PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | 1,022,962 | | 674,847 | |
| | | | | SALES | 1,199,566.60 | 1.17 | 1,100,001.00 | 1.63 |
| | | | | NET SALES | 1,199,566.60 | 1.17 | 1,100,001.00 | 1.63 |
| 2,463.66 | | | | COST OF GOODS SOLD TOLLING COST | 620,152.65 | .61 | 377,655.00 | .56 |
| 2,463.66 | | | | TOTAL C.O.G.S. | 620,152.65 | .61 | 377,655.00 | .56 |
| 2,463.66- | | | | GROSS MARGIN | 579,413.95 | .57 | 722,346.00 | 1.07 |
| % | | % | | GROSS MAROIN PERCENTAGE | 48.30 % | | 65.67 % | |
| 2,463.66- | | | | NET INCOME (LOSS) | 579,413.95 | .57 | 722,346.00 | 1.07 |

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CEDAR - WEST HELENA MEB PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | 272,100 | | 457,317 | |
| | | | | SALES | 258,870.30 | .95 | 375,000.00 | .82 |
| | | | | NET SALES | 258,870.30 | .95 | 375,000.00 | .82 |
| | | | | COST OF GOODS SOLD TOLLING COST | 289,105.44 | 1.06 | 322,202.00 | .70 |
| | | | | TOTAL C.O.G.S. | 289,105.44 | 1.06 | 322,202.00 | .70 |
| | | | | GROSS MARGIN | 30,235.14- | .11- | 52,798.00 | .12 |
| % | | % | | GROSS MARGIN PERCENTAGE | 11.68-% | | 14.08 % | |
| | | | | NET INCOME (LOSS) | 30,235.14- | .11- | 52,798.00 | .12 |

CEDAR - WEST HELENA MTPO PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | 148,800 | | 205,102 | |
| | | | | SALES | 879,120.46 | 5.91 | 1,005,000.00 | 4.90 |
| | | | | NET SALES | 879,120.46 | 5.91 | 1,005,000.00 | 4.90 |
| 20,453.71 | | | | COST OF GOODS SOLD TOLLING COST | 403,003.22 | 2.71 | 763,700.00 | 3.72 |
| 20,453.71 | | | | TOTAL C.O.G.S. | 403,003.22 | 2.71 | 763,700.00 | 3.72 |
| 20,453.71- | | | | GROSS MARGIN | 476,117.24 | 3.20 | 241,300.00 | 1.18 |
| X | | X | | GROSS MARGIN PERCENTAGE | 54.16 X | | 24.01 X | |
| 20,453.71- | | | | NET INCOME (LOSS) | 476,117.24 | 3.20 | 241,300.00 | 1.18 |

CEDAR - WEST HELENA OREGON PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | 793,070 | | 1,200,000 | |
| | | | | SALES | 229,457.27 | .29 | 240,000.00 | .20 |
| | | | | NET SALES | 229,457.27 | .29 | 240,000.00 | .20 |
| | | | | COST OF GOODS SOLD TOLLING COST | 339,742.40 | .43 | 95,596.00 | .08 |
| | | | | TOTAL C.O.G.S. | 339,742.40 | .43 | 95,596.00 | .08 |
| | | | | GROSS MARGIN | 110,285.13- | .14- | 144,404.00 | .12 |
| % | | % | | GROSS MARGIN PERCENTAGE | 48.06-% | | 60.17 % | |
| | | | | NET INCOME (LOSS) | 110,285.13- | .14- | 144,404.00 | .12 |

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CEDAR - WEST HELENA SECTAGON II PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN GAL | 425,794 | | 369,231 | |
| | | | | SALES | 537,422.68 | 1.26 | 480,000.00 | 1.30 |
| | | | | NET SALES | 537,422.68 | 1.26 | 480,000.00 | 1.30 |
| | | | | COST OF GOODS SOLD | | | | |
| 614.56 | | | | TOLLING COST | 505,457.02 | 1.19 | 387,508.00 | 1.05 |
| 614.56 | | | | TOTAL C.O.G.S. | 505,457.02 | 1.19 | 387,508.00 | 1.05 |
| 614.56- | | | | GROSS MARGIN | 31,965.66 | .08 | 92,492.00 | .25 |
| % | | % | | GROSS MARGIN PERCENTAGE | 5.95 % | | 19.27 % | |
| 614.56- | | | | NET INCOME (LOSS) | 31,965.66 | .08 | 92,492.00 | .25 |

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CEDAR - WEST HELENA OTHER CONTRACTS PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN LBS | | | | |
| | | | | COST OF GOODS SOLD | | | | |
| 27,352.03 | | 99,855.00 | | TOLLING COST | 201,105.86 | | 58,433.00 | |
| 27,352.03 | | 99,855.00 | | TOTAL C.O.G.S. | 201,105.86 | | 58,433.00 | |
| 27,352.03- | | 99,855.00- | | GROSS MARGIN | 201,105.86- | | 58,433.00- | |
| % | | % | | GROSS MARGIN PERCENTAGE | 77.69-% | | 15.58-% | |
| 27,352.03- | | 99,855.00- | | NET INCOME (LOSS) | 201,105.86- | | 58,433.00- | |

CEDAR - WEST HELENA WEST HELENA OTHER PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | UNITS IN | | | | |
| 313.40 | | | | SALES | 11,965.89 | | | |
| 313.40 | | | | NET SALES | 11,965.89 | | | |
| | | | | COST OF GOODS SOLD | | | | |
| .02 | | 5,986.00 | | MFG.VARIANCE | | | 71,832.00 | |
| | | | | OTHER | 3,625.57 | | | |
| .02 | | 5,986.00 | | TOTAL C.O.G.S. | 3,625.57 | | 71,832.00 | |
| 313.38 | | 5,986.00- | | GROSS MARGIN | 8,340.32 | | 71,832.00- | |
| 99.99 % | | % | | GROSS MARGIN PERCENTAGE | 69.70 % | | % | |
| 313.38 | | 5,986.00- | | NET INCOME (LOSS) | 8,340.32 | | 71,832.00- | |

CEDAR - WEST HELENA WEST HELENA OTHER PRODUCT INCOME STATEMENT INST19

| CURRENT MONTH ACTUAL $ AMOUNT | CURRENT MONTH ACTUAL PER UNIT | CURRENT MONTH BUDGETED $ AMOUNT | CURRENT MONTH BUDGETED PER UNIT | | YEAR-TO-DATE ACTUAL $ AMOUNT | YEAR-TO-DATE ACTUAL PER UNIT | YEAR-TO-DATE BUDGETED $ AMOUNT | YEAR-TO-DATE BUDGETED PER UNIT |
|---|---|---|---|---|---|---|---|---|
| 519,650.63 | | 41,738.00- | | PLANT NET INCOME (LOSS) | 5,410,203.65 | | 5,031,018.00 | |

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CEDAR CHEMICAL CORPORATION BCOSTE

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY EXPENSE PAGE 1

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 4200 | SALES-PESTICIDES | 2,720,472- | 193,750- | 2,524,722- | 21,632,372- | 17,060,306- | 4,572,066- |
| 4300 | TOLLING REVENUE | 487,239- | 250,000- | 237,239- | 7,178,989- | 7,060,001- | 661,012 |
| 4400 | OTHER REVENUE | 313- | | 313 | 11,965- | | 11,965- |
| | SUB-TOTAL | 3,208,024- | 443,750- | 2,764,274- | 28,843,326- | 24,920,307- | 3,923,019- |
| | SALES | 3,208,024- | 443,750- | 2,764,274- | 28,843,326- | 24,920,307- | 3,923,019- |

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| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 4600 | FREIGHT OUT | 8,565 | 1,575 | 6,990 | 120,185 | 99,490 | 20,695 |
| 4610 | FREIGHT ALLOWANCES | | | | 21,452 | 85,568 | 64,116- |
| 4850 | O/S WAREHOUSE LEASE | 18,728 | 1,068 | 17,660 | 102,116 | 19,066 | 83,050 |
| 4860 | WAREHOUSE ALLOWANCES | | | | 65,944 | 171,285 | 105,341 |
| | SUB-TOTAL | 27,293 | 2,643 | 24,650 | 317,697 | 375,409 | 57,712- |
| | FREIGHT & COMM | 27,293 | 2,643 | 24,650 | 317,697 | 375,409 | 57,712- |

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 5100 | COST OF SALES @ STD | 2,121,522 | 194,250 | 1,927,272 | 16,424,328 | 13,488,602 | 2,935,726 |
| 5120 | PUR PRICE VARIANCE | 25,741- | | 25,741- | 175,835- | | 175,835- |
| 5140 | DEF MFG VARIANCE | | | | 2 | | 2 |
| 5160 | FINISHED PROD. LOST | | | | 83 | | 83 |
| 5170 | PRODUCT COMPLAINT EX | | | | | | |
| 5250 | START-UP COST | 5,937 | | 5,937 | 77,336- | 51,000 | 128,336- |
| 5260 | TASK FORCE EXPENSES | 108,000 | 48,000 | 60,000 | 657,500 | 576,000 | 81,500 |
| 5280 | GAIN (LOSS) F/A | | | | 3,625 | | 3,625 |
| | SUB-TOTAL | 2,209,718 | 242,250 | 1,967,460 | 16,832,367 | 14,115,602 | 2,716,765 |
| | COST OF SALES | 2,209,718 | 242,250 | 1,967,460 | 16,832,367 | 14,115,602 | 2,716,765 |

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 5510 | BUTOXONE TECH ACID | | | | 733,346 | 799,425 | 66,079- |
| 5520 | ODCB | | | | | | |
| 5530 | 99% SULFURIC ACID | | | | | | |
| 5540 | 98% NITRIC ACID | | | | | | |
| 5630 | DCA | 1,413,626 | 871,875 | 541,751 | 7,344,219 | 6,553,710 | 790,509 |
| 5640 | PROPIONIC ACID | 111,875 | 70,200 | 41,675 | 544,533 | 527,679 | 16,854 |
| 5650 | PROPIONIC ANHYDRIDE | 52,793 | 37,800 | 14,993 | 254,970 | 284,135 | 29,165- |
| 5660 | MESITYL OXIDE | 152,074 | | 152,074 | 518,669 | 729,600 | 210,931- |
| 5670 | EMULSIFIER | 104,880 | 15,910 | 88,970 | 609,217 | 626,224 | 17,007- |
| 5675 | ARMUL | | | | | | |
| 5680 | ISOPHORONE | 117,143 | 22,420 | 94,723 | 1,252,846 | 923,645 | 329,201 |
| 5685 | TENNECO 500 | 49,747 | 13,860 | 35,887 | 165,202 | 110,880 | 54,322 |
| 5700 | DMA-60% | | | | 13,529 | 27,672 | 14,143- |
| 5705 | CITRIC ACID | | | | 32,438 | 24,472 | 7,966 |
| 5850 | OTHER RAW MATERIALS | | | | 802,396 | 878,617 | 76,221- |
| 5870 | PACKAGING MATERIALS | 804 | 1,250 | 446- | 84,641 | 173,323 | 88,682- |
| 5890 | CONTAINERS | 80,865 | 12,207 | 68,658 | 498,169 | 567,655 | 69,486- |
| 5910 | FIN GOODS PURCHASED | | | | 1,269,124 | | 1,269,124 |
| | SUB-TOTAL | 2,083,807 | 1,045,522 | 1,038,285 | 14,123,299 | 12,227,037 | 1,896,262 |
| 6100 | SALARIES | 84,000 | 61,685 | 22,315 | 885,280 | 857,669 | 27,611 |
| 6110 | WAGES | 133,474 | 75,412 | 58,062 | 1,472,972 | 1,338,165 | 134,807 |
| 6140 | HOLIDAY & VAC PAY | 1,841 | 10,201 | 8,360 | 106,995 | 115,380 | 8,385- |
| 6150 | SICK & ALLOWED PAY | 1,403 | 938 | 465 | 9,229 | 11,256 | 2,027- |
| 6160 | OTHER (CALL-OUT PRE) | 230 | 405 | 175- | 5,312 | 4,860 | 452 |
| 6200 | PAYROLL TAXES | 16,903 | 19,866 | 2,963- | 225,631 | 233,758 | 8,127- |
| 6210 | GROUP INSURANCE | 18,468 | 19,950 | 1,482- | 222,951 | 223,300 | 349- |
| 6220 | WORKMANS COMP INSUR | 3,225- | 5,000 | 8,225- | 37,339 | 61,600 | 24,261- |
| 6230 | PENSION PLAN COST | 39,970- | 25,776 | 65,746 | 202,769 | 309,312 | 106,543- |
| 6240 | EMPLOYMENT EXPENSE | | | | 29,290 | | 29,290 |
| 6260 | MEDICAL EXAMS | 136 | 650 | 514- | 14,073 | 7,800 | 8,273 |
| 6270 | BLOOD TEST | | 270 | 270- | 2,028 | 2,160 | 132- |
| 6280 | SAFETY SUPPLIES | 6,786 | 4,000 | 2,786 | 81,280 | 48,525 | 32,755 |
| 6300 | CONTRACT LABOR & MTL | 9,643 | 2,718 | 6,925 | 488,979 | 40,649 | 448,330 |
| 6340 | NATURAL GAS | 19,083 | 12,485 | 6,598 | 171,780 | 159,781 | 11,999 |
| 6350 | ELECTRICITY | 46,731 | 21,750 | 24,981 | 485,217 | 391,185 | 94,032 |
| 6360 | WATER | 2,190 | 2,140 | 50 | 24,623 | 44,605 | 19,982- |
| 6370 | COMMUNICATION | 2,572 | 3,200 | 628- | 38,775 | 38,400 | 375 |
| 6380 | AUTO EXPENSE | | 230 | 230- | 397- | 2,760 | 3,157- |
| 6390 | TRVL & ENTERTAINMENT | 6,996 | 2,410 | 4,586 | 41,994 | 28,920 | 13,074 |
| 6395 | MEALS/ENTERTAINMENT | 560 | 765 | 205- | 8,686 | 9,180 | 494- |
| 6400 | ORDINARY SUPPLIES | 28,053 | 18,827 | 9,226 | 206,878 | 210,945 | 4,067- |
| 6410 | MAINTENANCE SUPPLIES | 31,451 | 21,108 | 10,343 | 836,374 | 359,426 | 476,948 |
| 6420 | MAINTENANCE TOOLS | | 275 | 275- | 4,592 | 3,300 | 1,292 |
| 6430 | EXPENDABLE ITEMS | 6,219 | 2,400 | 3,819 | 49,416 | 28,800 | 20,616 |
| 6460 | MISCELLANEOUS | 8,896 | 100 | 8,796 | 17,906 | 1,200 | 16,706 |
| 6470 | NITROGEN | 5,987 | 9,290 | 3,303- | 70,685 | 130,540 | 59,855- |

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 6510 | OTH CHEMICALS | | 10 | 10- | 20,225 | 5,520 | 14,705 |
| 6560 | OFF SITE WASTE DISPO | | | | 263,820 | 257,100 | 6,720 |
| 6590 | CONTRACT FORMULATING | | | | 209,641 | 184,897 | 24,744 |
| 6600 | INSURANCE-PLANT | 36,803- | 8,285 | 45,000- | 1,715 | 1,200 | 515 |
| 6610 | DUES & SUBSCRIPTIONS | | 100 | 100- | 24,605 | 24,180 | 425 |
| 6620 | FEES & TUITIONS | 2,067 | 2,015 | 52 | 67,735 | | 67,735 |
| 6630 | PROFESSIONAL FEES | 3,362 | | 3,362 | 37,212 | 19,696 | 17,516 |
| 6650 | RENTALS | 1,255 | 1,624 | 369- | 23,667 | 12,000 | 11,667 |
| 6660 | LEASE ITEMS | 3,963 | 1,000 | 2,963 | 12,587 | 8,100 | 4,487 |
| 6680 | FREIGHT IN (MISC.) | 5,354 | 675 | 4,679 | 55,698 | 91,230 | 35,532- |
| 6710 | PROPERTY TAXES & LIC | 4,626 | 5,975 | 1,349- | 6,459,642 | 5,267,399 | 1,192,243 |
| | SUB-TOTAL | 372,251 | 341,535 | 30,716 | | | |
| | COST OF GOODS MFG. | 2,456,058 | 1,387,057 | 1,069,001 | 20,582,941 | 17,494,436 | 3,088,505 |

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 8900 | DEPRECIATION | 82,870 | 68,687 | 14,183 | 703,205 | 824,244 | 121,039- |
| 8910 | AMORTIZIATION EXP | | | | | | |
| | SUB-TOTAL | 82,870 | 68,687 | 14,183 | 703,205 | 824,244 | 121,039- |
| | DEPRECIATION | 82,870 | 68,687 | 14,183 | 703,205 | 824,244 | 121,039 |

CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 1

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % | THIS MONTH | | YEAR-TO-DATE | ACTUAL % | |
|---|---|---|---|---|---|---|
| | 171% | 853,798 | ACTUAL | 8,204,900 | 152% | |
| CEDAR - WEST HELENA | | 498,093 | SCHEDULED CAPACITY | 5,395,759 | | PROD--POWER UNIT--KWH |

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| ELECTRICITY | 46,214 | 21,150 | 25,064 | 472,960 | 383,985 | 88,975 | .054 | .042 | .058 | .062 |
| TOTAL | 46,214 | 21,150 | 25,064 * | 472,960 | 383,985 | 88,975 * | .054 | .042 | .058 | .062 |
| TOTAL MANUF.COSTS | 46,214 | 21,150 | 25,064 | 472,960 | 383,985 | 88,975 | .054 | .042 | .058 | .062 |
| ALLOCATION TSF | 46,214- | 21,150- | 25,064 | 472,960- | 383,985- | 88,975- | .054- | .042- | .058- | .062 |
| TOTAL | 46,214- | 21,150- | 25,064 * | 472,960 | 383,985- | 88,975- * | .054- | .042- | .058- | .062 |

PRODUCT TOTALS
POWER

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CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 2
BCOST2

SUMMARY

PRODUCTION

| ACTUAL % THIS MONTH | | YEAR-TO-DATE ACTUAL % |
|---|---|---|
| % | ACTUAL SCHEDULED CAPACITY | % |

CEDAR - WEST HELENA

PROD—OVERHEAD UNIT--

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| ORDINARY SUPPLY | 13,729 | 11,470 | 2,259 | 154,259 | 137,640 | 16,619 | | | | |
| RENTALS | 613 | 1,360 | 747- | 25,455 | 16,320 | 9,135 | | | | |
| OUTSIDE LABOR | 6,627 | 1,320 | 5,307 | 180,267 | 15,840 | 164,427 | | | | |
| MAINT SUPPLIES | 2,117 | 12,530 | 10,413- | 266,337 | 150,360 | 115,977 | | | | |
| OTHER CHEMICALS | | 10 | 10- | 32,853 | 120 | 32,733 | | | | |
| GAS | | | | 9,481 | | 9,481 | | | | |
| POWER | 8,364 | 5,500 | 2,864 | 88,823 | 66,000 | 22,823 | | | | |
| OTHER | 17,229 | 4,965 | 12,264 | 88,087 | 59,580 | 29,307 | | | | |
| TOTAL | 48,679 | 37,155 | 11,524 * | 846,362 | 445,860 | 400,502 * | | | | |
| SALARY | 10,427 | 6,201 | 4,226 | 102,785 | 74,429 | 28,356 | | | | |
| WAGES | 36,507 | 26,432 | 10,075 | 484,561 | 307,961 | 176,600 | | | | |
| FRINGES | 11,986 | 7,346 | 4,640 | 154,002 | 99,193 | 54,809 | | | | |
| SAFETY & SECURITY | 136 | 650 | 514- | 16,294 | 7,800 | 8,494 | | | | |
| INSURANCE & TAXES | 67 | | 67 | 1,673 | | 1,673 | | | | |
| TOTAL | 59,123 | 40,629 | 18,494 * | 759,315 | 489,383 | 269,932 * | | | | |
| PLANT OVERHEAD | | | | 13,080- | | 13,080- | | | | |
| PLANT ADMIN | 182 | 5,986 | 5,804- | 3,006 | 71,832 | 68,826- | | | | |
| PLANT DEPRECIATION | | | | | | | | | | |
| TOTAL | 182 | 5,986 | 5,804-* | 10,074- | 71,832 | 81,906-* | | | | |
| TOTAL MANUF.COSTS | 107,984 | 83,770 | 24,214 | 1,595,603 | 1,007,075 | 588,528 | | | | |
| ALLOCATION TSF | 107,985- | 77,784- | 30,201- | 1,595,604- | 935,243- | 660,361- | | | | |
| TOTAL | 107,985- | 77,784- | 30,201 * | 1,595,604- | 935,243- | 660,361-* | | | | |
| PRODUCT TOTALS OVERHEAD | 1- | 5,986 | 5,907- | 1- | 71,832 | 71,833- | | | | |

CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 4 BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % | THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|---|
| | 146% | 1,094,748 | ACTUAL | 6,063,037 | 108% |
| CEDAR - WEST HELENA | | 750,000 | SCHEDULED CAPACITY | 5,637,600 | |

PROD—PROPANIL TECH
UNIT—LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| DCA | 1,398,478 | 871,875 | 526,603 | 7,275,548 | 6,553,710 | 721,838 | 1.277 | 1.163 | 1.200 | 1.042 |
| PROPIONIC ACID | 111,875 | 70,200 | 41,675 | 514,975 | 527,679 | 10,704- | .102 | .094 | .085 | .091 |
| PROPIONIC ANHYDRIDE | 52,793 | 37,800 | 14,993 | 252,849 | 284,135 | 31,286- | .048 | .050 | .042 | .037 |
| TOTAL | 1,563,146 | 979,875 | 583,271 * | 8,045,372 | 7,365,524 | 679,848 * | 1.428 | 1.307 | 1.327 | 1.171 |
| CONTAINERS | | | | 1,858 | | 1,858 | | | | |
| ORDINARY SUPPLY | 279 | | 279 | 354 | | 354 | | | | |
| OUTSIDE LABOR | | 375 | 375- | 24,062 | 2,819 | 21,243 | | .001 | .004 | |
| MAINT SUPPLIES | 2,699 | 4,548 | 1,849- | 91,960 | 34,187 | 57,773 | .002 | .006 | .015 | .006 |
| NITROGEN | 3,127 | 5,290 | 2,163- | 29,910 | 39,760 | 9,850- | .003 | .007 | .005 | .007 |
| GAS | 10,501 | 8,485 | 2,016 | 65,163 | 63,780 | 1,383 | .010 | .011 | .011 | .012 |
| POWER | 9,822 | 7,000 | 2,822 | 75,145 | 70,000 | 5,145 | .009 | .009 | .012 | .010 |
| OTHER | 1,759 | 1,773 | 14- | 19,958 | 13,328 | 6,630 | .002 | .002 | .003 | .005 |
| TOTAL | 28,187 | 27,471 | 716 * | 308,410 | 223,874 | 84,536 * | .026 | .037 | .051 | .041 |
| SALARY | 7,795 | 3,713 | 4,082 | 51,671 | 35,868 | 15,803 | .007 | .005 | .009 | .011 |
| WAGES | 22,278 | 14,985 | 7,293 | 152,405 | 124,690 | 27,715 | .020 | .020 | .025 | .025 |
| FRINGES | 60,811- | 6,010 | 66,821- | 4,109- | 54,701 | 58,810- | .056- | .008 | .001- | .014 |
| SAFETY & SECURITY | | 270 | 270- | 1,807 | 2,160 | 353- | | | | |
| INSURANCE & TAXES | 7,537- | 5,221 | 12,758- | 43,231 | 62,652 | 19,421- | .007- | .007 | .007 | .018 |
| TOTAL | 38,275- | 30,199 | 68,474-* | 245,005 | 280,071 | 35,066-* | .035- | .040 | .040 | .069 |
| PLANT OVERHEAD | 28,022 | 9,798 | 18,224 | 304,590 | 97,487 | 207,111 | .026 | .013 | .050 | .046 |
| PLANT ADMIN | 22,471 | 7,403 | 15,068 | 165,222 | 46,226 | 118,996 | .021 | .010 | .027 | |
| PLANT DEPRECIATION | 13,912 | 10,968 | 2,944 | 132,273 | 131,616 | 657 | .013 | .015 | .022 | .026 |
| TOTAL | 64,405 | 28,169 | 36,236 * | 602,093 | 275,329 | 326,764 * | .059 | .038 | .099 | .073 |
| TOTAL MANUF.COSTS | 1,617,463 | 1,065,714 | 551,749 | 9,200,880 | 8,144,798 | 1,056,082 | 1.477 | 1.421 | 1.518 | 1.353 |
| PRODUCT TSF @ STD. | 1,576,437- | 1,080,000- | 496,437- | 8,729,691- | 8,118,144- | 611,547- | 1.440- | 1.440- | 1.440- | 1.390 |
| TOTAL | 1,576,437- | 1,080,000- | 496,437-* | 8,729,691- | 8,118,144- | 611,547-* | 1.440- | 1.440- | 1.440- | 1.390 |
| PRODUCT TOTALS PROPANIL TECH | 41,026 | 14,286- | 55,312 | 471,189 | 26,654 | 444,535 | .037 | .019- | .078 | .037 |

CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 5 BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|---|
| | 96% | 192,648 | ACTUAL | 577,852 | 39% |
| CEDAR - WEST HELENA | | 200,000 | SCHEDULED CAPACITY | 1,500,000 | |

PROD--FLAKED TECH
UNIT--LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| PROPANIL TECH | 277,413 | 288,000 | 10,587- | 983,985 | 2,304,000 | 1,320,015- | 1.440 | 1.440 | 1.703 | 1.449 |
| TOTAL | 277,413 | 288,000 | 10,587-* | 983,985 | 2,304,000 | 1,320,015-* | 1.440 | 1.440 | 1.703 | 1.449 |
| ORDINARY SUPPLY | 652 | 5,818 | 5,166- | 18,216 | 43,635 | 25,419- | .003 | .029 | .032 | .024 |
| RENTALS | | | | 175 | | 175 | | | | |
| MAINT SUPPLIES | 318- | 350 | 668- | 5,977 | 2,625 | 3,352 | .002- | .002 | .010 | .002 |
| POWER | 1,128 | 1,650 | 522- | 3,875 | 12,375 | 8,500- | .006 | .008 | .007 | .008 |
| START UP COST | | | | | | | | | | .003 |
| TOTAL | 1,462 | 7,818 | 6,356-* | 28,243 | 58,635 | 30,392-* | .008 | .039 | .049 | .038 |
| SALARY | 895 | 1,083 | 188- | 3,436 | 9,792 | 6,356- | .005 | .005 | .006 | .010 |
| WAGES | 2,770 | 4,970 | 2,200- | 9,888 | 37,610 | 27,722- | .014 | .025 | .017 | .024 |
| FRINGES | 1,005 | 1,993 | 988- | 4,148 | 16,590 | 12,442- | .005 | .010 | .007 | .014 |
| INSURANCE & TAXES | 522- | 224 | 746- | 1,945 | 7,348 | 5,403- | .003- | .001 | .003 | |
| TOTAL | 4,148 | 8,270 | 4,122-* | 19,417 | 71,340 | 51,923-* | .022 | .041 | .034 | .047 |
| PLANT OVERHEAD | 3,218 | 3,266 | 48- | 15,035 | 26,843 | 11,808- | .017 | .016 | .026 | .039 |
| PLANT ADMIN | 2,580 | 2,468 | 112 | 8,610 | 12,320 | 3,710- | .013 | .012 | .015 | .004 |
| PLANT DEPRECIATION | 1,562 | 1,667 | 105 | 10,739 | 20,004 | 1,265- | .008 | .008 | .032 | .011 |
| TOTAL | 7,360 | 7,401 | 41-* | 42,384 | 59,167 | 16,783-* | .038 | .037 | .073 | .054 |
| TOTAL MANUF.COSTS | 290,383 | 311,489 | 21,106 | 1,074,029 | 2,493,142 | 1,419,113- | 1.507 | 1.557 | 1.859 | 1.588 |
| PRODUCT TSF @ STD. | 319,796- | 332,000- | 12,204 | 1,076,712- | 2,490,000- | 1,413,288 | 1.660- | 1.660- | 1.863- | 1.484 |
| TOTAL | 319,796- | 332,000- | 12,204 * | 1,076,712- | 2,490,000- | 1,413,288 * | 1.660- | 1.660- | 1.863- | 1.484 |
| PRODUCT TOTALS FLAKED TECH | 29,413- | 20,511- | 8,902- | 2,683- | 3,142 | 5,825- | .153- | .103- | .005- | .105 |

CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 7 BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % | THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|---|
| | 239% | 59,815 | ACTUAL | 282,247 | 141% |
| CEDAR - WEST HELENA | | 25,000 | SCHEDULED CAPACITY | 200,000 | |

PROD--3# PROPANIL
UNIT--GAL

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| PROPANIL TECH | 265,032 | 115,200 | 149,832 | 1,280,310 | 921,600 | 366,710 | 4.431 | 4.608 | 4.564 | 4.756 |
| PROPANIL BLEND | | | | | | | | | | |
| MESITYL OXIDE | | | | | | | | | | |
| EMULSIFIER | 44,019 | 15,910 | 28,109 | 108,083 | 127,280 | 61,603 | .736 | .636 | .669 | .530 |
| ISOPHORONE | 73,033 | 22,420 | 50,613 | 313,447 | 179,360 | 134,087 | 1.221 | .897 | 1.111 | 1.059 |
| ARMUL EMULSIFIER | | | | | | | | | | .185 |
| TENNCO 500 | 41,621 | 13,860 | 27,761 | 164,893 | 110,880 | 54,013 | .696 | .554 | .584 | .491 |
| OTHER RAW MATERIALS | | | | | | | | | | .003 |
| TOTAL | 423,705 | 167,390 | 254,315 * | 1,955,533 | 1,339,120 | 616,413 * | 7.084 | 6.696 | 6.928 | 7.024 |
| CONTAINERS | 28,819 | 12,207 | 16,612 | 154,662 | 97,656 | 57,006 | .482 | .488 | .548 | .535 |
| PACKAGING MATERIALS | 40- | 1,250 | 1,290- | 4,551 | 10,000 | 5,449- | .001- | .050 | .016 | .033 |
| ORDINARY SUPPLY | | 950 | 950- | 2,759 | 7,600 | 4,841- | | .038 | .010 | .041 |
| MAINT SUPPLIES | | 55 | 55- | 39 | 440 | 401- | | .002 | | .001 |
| TOTAL | 28,779 | 14,462 | 14,317 * | 162,011 | 115,696 | 46,315 * | .481 | .578 | .574 | .609 |
| SALARY | | 1,437 | 1,437- | 5,922 | 10,622 | 4,700- | | .057 | .021 | .029 |
| WAGES | 1,214 | 3,275 | 2,061- | 11,941 | 24,000 | 12,059- | .020 | .131 | .042 | .104 |
| FRINGES | 440 | 1,313 | 873- | 5,822 | 10,820 | 4,998- | .007 | .053 | .021 | .044 |
| INSURANCE & TAXES | 8,777- | 451 | 9,228 | 23,163 | 5,412 | 17,751 | .147- | .018 | .082 | |
| TOTAL | 7,123- | 6,476 | 13,599-* | 46,848 | 50,854 | 4,006-* | .119- | .259 | .166 | .177 |
| PLANT ADMIN | | 4,000 | 4,000- | | 48,000 | 48,000- | | .160 | | .424 |
| TOTAL | | 4,000 | 4,000-* | | 48,000 | 48,000-* | | .160 | | .424 |
| TOTAL MANUF.COSTS | 445,361 | 192,328 | 253,033 | 2,164,392 | 1,553,670 | 610,722 | 7.446 | 7.693 | 7.668 | 8.234 |
| PRODUCT TSF @ STD. | 464,762- | 194,250- | 270,512- | 2,199,551- | 1,554,000- | 645,551- | 7.770- | 7.770- | 7.793- | 7.336 |
| TOTAL | 464,762- | 194,250- | 270,512-* | 2,199,551- | 1,554,000- | 645,551-* | 7.770- | 7.770- | 7.793- | 7.336 |
| PRODUCT TOTALS 3# PROPANIL | 19,401- | 1,922- | 17,479- | 35,159- | 330- | 34,829- | .324- | .077- | .125- | .898 |

CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 8

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | 87,406 | 318,655 | 64% |
| CEDAR - WEST HELENA | | ACTUAL SCHEDULED CAPACITY | 500,000 | |

PROD--4# PROPANIL
UNIT--GAL

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| PROPANIL TECH | 517,925 | | 517,925 | 1,846,561 | 3,024,000 | 1,177,439- | 5.926 | | 5.795 | 5.211 |
| PROPANIL BLEND | | | | | | | | | | .025 |
| PROPANIL 3# | | | | | | | | | | .153 |
| MESITYL OXIDE | 152,075 | | 152,075 | 536,258 | 729,600 | 193,342- | 1.740 | | 1.683 | 1.436 |
| EMULSIFIER | 60,871 | | 60,871 | 193,084 | 332,629 | 139,545- | .696 | | .606 | .604 |
| ISOPHORONE | 43,253 | | 43,253 | 170,135 | 206,500 | 36,365- | .495 | | .534 | .467 |
| TOTAL | 774,124 | | 774,124 * | 2,746,038 | 4,292,729 | 1,546,691-* | 8.857 | | 8.618 | 7.895 |
| CONTAINERS | 48,522 | | 48,522 | 150,514 | 285,714 | 135,200- | .555 | | .472 | .366 |
| PACKAGING MATERIALS | | | | 24 | | 24 | | | | .001 |
| ORDINARY SUPPLY | 742 | | 742 | 936 | | 936 | .008 | | .003 | .002 |
| MAINT SUPPLIES | | | | | 750 | 750- | | | | |
| TOTAL | 49,264 | | 49,264 * | 151,474 | 286,464 | 134,990-* | .564 | | .475 | .369 |
| SALARY | | | | 3,676 | 5,037 | 1,361- | | | .012 | .012 |
| WAGES | 4,034 | | 4,034 | 8,809 | 10,961 | 2,152- | .046 | | .028 | .020 |
| FRINGES | 1,464 | | 1,464 | 3,471 | 4,956 | 1,485- | .017 | | .011 | .013 |
| INSURANCE & TAXES | 12,505- | | 12,505- | 27,595 | 15,018 | 12,577 | .143- | | .087 | |
| TOTAL | 7,007- | | 7,007-* | 43,551 | 35,972 | 7,579 * | .080- | | .137 | .045 |
| PLANT ADMIN | | | | | 57,000 | 57,000- | | | | .241 |
| TOTAL | | | * | | 57,000 | 57,000-* | | | | .241 |
| TOTAL MANUF.COSTS | 816,381 | | 816,381 | 2,941,063 | 4,672,165 | 1,731,102- | 9.340 | | 9.230 | 8.550 |
| PRODUCT TSF @ STD. | 818,937- | | 818,937- | 2,970,955- | 4,670,000- | 1,699,045 | 9.369- | | 9.323- | 9.228 |
| TOTAL | 818,937- | | 818,937-* | 2,970,955- | 4,670,000- | 1,699,045 * | 9.369- | | 9.323- | 9.228 |
| PRODUCT TOTALS 4# PROPANIL | 2,556- | | 2,556- | 29,892- | 2,165 | 32,057- | .029- | | .094- | .679 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 11

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SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | ACTUAL | 13,280 | 7% |
| CEDAR - WEST HELENA | | SCHEDULED CAPACITY | 200,000 | |

PROD--50 WDG
UNIT--LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FLAKED TECH | | | | | 10,889 | 166,000 | 155,111- | | | | .820 | .954 |
| OTHER RAW MATERIALS | | | | | 2,313 | 29,500 | 27,187- | | | | .174 | .148 |
| TOTAL | | | | * | 13,202 | 195,500 | 182,298-* | | | | .994 | 1.102 |
| PACKAGING MATERIALS | | | | | 771 | 13,720 | 12,949- | | | | .058 | .069 |
| FORMULATING FEE | | | | | 3,308 | 84,000 | 80,692- | | | | .249 | .420 |
| TOTAL | | | | * | 4,079 | 97,720 | 93,641-* | | | | .307 | .489 |
| INSURANCE & TAXES | 27 | | 27 | | 1,429 | | 1,429 | | | | .108 | |
| TOTAL | 27 | | 27 | * | 1,429 | | 1,429 * | | | | .108 | |
| PLANT ADMIN | | | | | | 2,000 | 2,000- | | | | | .011 |
| TOTAL | | | | * | | 2,000 | 2,000-* | | | | | .011 |
| TOTAL MANUF.COSTS | 27 | | 27 | | 18,710 | 295,220 | 276,510- | | | | 1.409 | 1.602 |
| PRODUCT TSF @ STD. | | | | | 17,946- | 296,000- | 278,054 | | | | 1.351- | 1.486 |
| TOTAL | | | | * | 17,946- | 296,000- | 278,054 * | | | | 1.351- | 1.486 |
| PRODUCT TOTALS 50 WDG | 27 | | 27 | | 764 | 780- | 1,544 | | | | .058 | .115 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 9

BCOST2

SUMMARY

PRODUCTION

| ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|
| % | | 271,440 | % |

CEDAR - WEST HELENA — ACTUAL SCHEDULED CAPACITY — PROD--60 DF UNIT--LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| PROPANIL TECH | | | | 7,127- | | 7,127- | | | .026- | |
| FLAKED TECH | | | | 275,610 | | 275,618 | | | 1.015 | |
| OTHER RAW MATERIALS | | | | 50,923 | | 50,923 | | | .188 | |
| TOTAL | | | * | 319,414 | | 319,414 * | | | 1.177 | |
| FORMULATING FEE | | | | 123,708 | | 123,788 | | | .456 | |
| TOTAL | | | * | 123,788 | | 123,788 * | | | .456 | |
| INSURANCE & TAXES | | | | 5,110 | | 5,110 | | | .019 | |
| TOTAL | | | * | 5,110 | | 5,110 * | | | .019 | |
| TOTAL MANUF.COSTS | | | | 448,312 | | 448,312 | | | 1.652 | |
| PRODUCT TSF @ STD. | | | | 447,875- | | 447,875- | | | 1.650- | |
| TOTAL | | | * | 447,875- | | 447,875-* | | | 1.650- | |
| PRODUCT TOTALS 60 DF | | | | 437 | | 437 | | | .002 | |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 12

BCOST2

SUMMARY

PRODUCTION

| ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|
| % | ACTUAL | 329,945 | 132% |
| CEDAR - WEST HELENA | SCHEDULED | 250,000 | |
| | CAPACITY | | |

PROD--STAM PROPANIL
UNIT--GAL

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| PROPANIL TECH | | | | 1,800,644 | 1,548,000 | 332,644 | | | 5.700 | 5.649 |
| EMULSIFIER | | | | 220,394 | 166,315 | 54,079 | | | .668 | .649 |
| ISOPHORONE | | | | 762,042 | 537,785 | 224,257 | | | 2.310 | 2.391 |
| TOTAL | | | | *2,863,080 | 2,252,100 | 610,980 * | | | 8.677 | 8.688 |
| CONTAINERS | | | | 195,246 | 184,285 | 10,961 | | | .592 | .592 |
| ORDINARY SUPPLY | | | | | | | | | | |
| MAINT SUPPLIES | | | | | | | | | | |
| TOTAL | | | | * 195,246 | 184,285 | 10,961 * | | | .592 | .592 |
| SALARY | | | | 5,066 | 4,227 | 839 | | | .015 | .009 |
| WAGES | | | | 7,150 | 9,196 | 2,046- | | | .022 | .018 |
| FRINGES | | | | 2,983 | 4,158 | 1,175- | | | .009 | .011 |
| INSURANCE & TAXES | 113- | | 113- | 26,865 | 6,465 | 20,400 | | | .081 | |
| TOTAL | 113- | | 113-* | 42,064 | 24,046 | 18,018 * | | | .127 | .038 |
| PLANT ADMIN | | | | | 22,500 | 22,500- | | | | .225 |
| TOTAL | | | * | | 22,500 | 22,500-* | | | | .225 |
| TOTAL MANUF.COSTS | 113- | | 113- | 3,100,390 | 2,402,931 | 617,459 | | | 9.397 | 9.544 |
| PRODUCT TSF @ STD. | | | | 3,271,142- | 2,482,500- | 788,642- | | | 9.914- | 10.060 |
| TOTAL | | | | *3,271,142- | 2,482,500- | 788,642-* | | | 9.914- | 10.060 |
| PRODUCT TOTALS STAM PROPANIL | 113- | | 113- | 170,752- | 431 | 171,183- | | | .518- | .516 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 10

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | X | ACTUAL | 106,110 | 53% |
| CEDAR - WEST HELENA | | SCHEDULED CAPACITY | 200,000 | |

PROD--WHAM
UNIT--GALS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROPANIL TECH | | | | | 111,737- | | 111,737- | | | | 1.053- | |
| FLAKED TECH | | | | | 621,786 | 1,377,800 | 756,014- | | | | 5.860 | 6.279 |
| OTHER RAW MATERIALS | 1,907 | | 1,907 | | 286,058 | 200,090 | 77,968 | | | | 2.696 | 2.085 |
| TOTAL | 1,907 | | 1,907 | * | 796,107 | 1,505,890 | 789,783-* | | | | 7.503 | 8.363 |
| PACKAGING MATERIALS | | | | | 1,055 | 70,145 | 69,090- | | | | .010 | .297 |
| ORDINARY SUPPLY | 356 | | 356 | | 6,171 | | 6,171 | | | | .058 | .022 |
| OTHER | | | | | 268 | | 268 | | | | .003 | |
| FORMULATING FEE | | | | | 85,736 | 120,000 | 34,264- | | | | .808 | .920 |
| START UP COST | | | | | | | | | | | | .042 |
| TOTAL | 356 | | 356 | * | 93,230 | 190,145 | 96,915-* | | | | .879 | 1.282 |
| SALARY | | | | | 87- | | 87- | | | | .001- | .002 |
| WAGES | | | | | 31 | | 31 | | | | | .003 |
| FRINGES | | | | | 33- | | 33- | | | | | .002 |
| INSURANCE & TAXES | 206 | | 206 | | 13,310 | 4,632 | 8,678 | | | | .125 | |
| TOTAL | 206 | | 206 | * | 13,221 | 4,632 | 8,589 * | | | | .125 | .006 |
| PLANT ADMIN | | | | | | 15,000 | 15,000- | | | | | .280 |
| TOTAL | | | | * | | 15,000 | 15,000 -* | | | | | .280 |
| TOTAL MANUF.COSTS | 2,469 | | 2,469 | | 902,558 | 1,795,667 | 893,109- | | | | 8.506 | 9.931 |
| PRODUCT TSF @ STD. | | | | | 930,500- | 1,796,000- | 865,500 | | | | 8.769- | 8.981 |
| TOTAL | | | | * | 930,500- | 1,796,000- | 865,500 * | | | | 8.769- | 8.981 |
| PRODUCT TOTALS WHAM | 2,469 | | 2,469 | | 27,942- | 333- | 27,609- | | | | .263- | .950 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 24

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | ACTUAL | 70,764 | 88% |
| CEDAR - WEST HELENA | | SCHEDULED CAPACITY | 80,000 | |

PROD--BUTOXONE 175
UNIT--GALS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TECH ACID USED | | | | | 542,874 | 700,128 | 157,254- | | | | 7.672 | 6.308 |
| DMA-60% | | | | | 9,931 | 24,000 | 14,069- | | | | .140 | .294 |
| CITRIC ACID | | | | | 26,019 | 20,800 | 5,219 | | | | .368 | .248 |
| TOTAL | | | | * | 578,824 | 744,928 | 166,104-* | | | | 8.180 | 6.850 |
| PACKAGING MATERIALS | 423 | | 423 | | 59,102 | 70,992 | 11,890- | | | | .835 | .874 |
| FORMULATING FEE | | | | | 41,751 | 47,200 | 5,449- | | | | .590 | .586 |
| TOTAL | 423 | | 423 | x | 100,853 | 118,192 | 17,339-* | | | | 1.425 | 1.460 |
| INSURANCE & TAXES | 85- | | 85- | | 10,748 | 3,610 | 7,338 | | | | .155 | |
| TOTAL | 85- | | 85- | * | 10,948 | 3,610 | 7,338 * | | | | .155 | |
| TOTAL MANUF.COSTS | 338 | | 338 | | 690,625 | 866,730 | 176,105- | | | | 9.760 | 8.310 |
| PRODUCT TSF @ STD. | | | | | 829,886- | 866,400- | 36,514 | | | | 11.728- | 8.744 |
| TOTAL | | | | * | 829,886- | 866,400- | 36,514 * | | | | 11.728- | 8.744 |
| PRODUCT TOTALS BUTOXONE 175 | 338 | | 338 | | 139,261- | 330 | 139,591- | | | | 1.968- | .434 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 26

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | ACTUAL | 17,444 | 174% |
| CEDAR - WEST HELENA | | SCHEDULED CAPACITY | 10,000 | |

PROD--BUTOXONE 200
UNIT--GALS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TECH ACID USED | | | | | 100,263 | 99,297 | 966 | | | | 5.748 | 8.500 |
| DMA-60% | | | | | 3,590 | 3,672 | 74- | | | | .206 | .359 |
| CITRIC ACID | | | | | 6,420 | 3,672 | 2,748 | | | | .368 | .362 |
| TOTAL | | | | * | 110,281 | 106,641 | 3,640 | * | | | 6.322 | 9.220 |
| PACKAGING MATERIALS | 423 | | 423 | | 19,143 | 8,466 | 10,677 | | | | 1.097 | 1.218 |
| FORMULATING FEE | | | | | 9,240 | 5,900 | 3,340 | | | | .530 | .589 |
| TOTAL | 423 | | 423 | * | 28,383 | 14,366 | 14,017 | * | | | 1.627 | 1.807 |
| INSURANCE & TAXES | 2 | | 2 | | 1,781 | 792 | 989 | | | | .102 | |
| TOTAL | 2 | | 2 | * | 1,781 | 792 | 989 | * | | | .102 | |
| TOTAL MANUF.COSTS | 425 | | 425 | | 140,445 | 121,799 | 18,646 | | | | 8.051 | 11.028 |
| PRODUCT TSF @ STD. | | | | | 70,054- | 121,800- | 51,746 | | | | 4.016- | 10.664 |
| TOTAL | | | | * | 70,054- | 121,800- | 51,746 | * | | | 4.016- | 10.664 |
| PRODUCT TOTALS BUTOXONE 200 | 425 | | 425 | | 70,391 | 1- | 70,392 | | | | 4.035 | .364 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 25

BCOST2

CUMMARY

PRODUCTION

ACTUAL % THIS MONTH YEAR-TO-DATE ACTUAL %

% %

CEDAR - WEST HELENA

ACTUAL SCHEDULED CAPACITY

PROD--BUTOXONE ESTER
UNIT--GALS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TECH ACID USED | | | | | 493- | | 493- | | | | | 8.674 |
| TOTAL | | | | * | 493- | | 493- | * | | | | 8.674 |
| PACKAGING MATERIALS | | | | | | | | | | | | .031 |
| FORMULATING FEE | | | | | | | | | | | | 3.400 |
| TOTAL | | | | * | | | | * | | | | 3.431 |
| INSURANCE & TAXES | | | | | 5,043 | | 5,043 | | | | | |
| TOTAL | | | | * | 5,043 | | 5,043 | * | | | | |
| TOTAL MANUF.COSTS | | | | | 4,550 | | 4,550 | | | | | 12.105 |
| PRODUCT TSF @ STD. | | | | | 11,938- | | 11,938- | | | | | 11.439 |
| TOTAL | | | | * | 11,938- | | 11,938- | * | | | | 11.439 |
| PRODUCT TOTALS BUTOXONE ESTER | | | | | 7,388- | | 7,388- | | | | | .666 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 15

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | ACTUAL | 1,145,200 | 403% |
| CEDAR - WEST HELENA | | SCHEDULED | 284,210 | |
| | | CAPACITY | | |

PROD--DUPONT-CNT
UNIT--LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ORDINARY SUPPLY | | | | | 3,470 | 6,975 | 3,505- | | | | .003 | .004 |
| RENTALS | | | | | 133 | | 133 | | | | | |
| OUTSIDE LABOR | | | | | 12,026 | 2,700 | 9,326 | | | | .011 | .006 |
| MAINT SUPPLIES | | | | | 24,958 | 23,490 | 1,468 | | | | .022 | .028 |
| NITROGEN | | | | | | | | | | | | |
| GAS | | | | | 4,658 | | 4,658 | | | | .004 | .003 |
| POWER | | | | | 23,053 | 14,400 | 8,653 | | | | .020 | .025 |
| OTHER | | | | | 1,359 | 1,500 | 141- | | | | .001 | .002 |
| START UP COST | | | | | | 15,000 | 15,000- | | | | | .228 |
| TOTAL | | | | * | 69,657 | 64,065 | 5,592 | * | | | .061 | .297 |
| SALARY | | | | | 21,865 | 10,722 | 11,143 | | | | .019 | .045 |
| WAGES | | | | | 65,879 | 23,670 | 42,209 | | | | .058 | .090 |
| FRINGES | | | | | 33,170 | 16,722 | 16,448 | | | | .029 | .048 |
| INSURANCE & TAXES | | | | | 7,746 | 10,344 | 2,598- | | | | .007 | .009 |
| TOTAL | | | | * | 120,660 | 61,458 | 67,202 | * | | | .112 | .192 |
| PLANT OVERHEAD | | | | | 110,141 | 29,806 | 80,335 | | | | .096 | .192 |
| PLANT ADMIN | | | | | 50,905 | 16,988 | 33,917 | | | | .044 | .079 |
| PLANT DEPRECIATION | | | | | 66,346 | 56,080 | 9,466 | | | | .058 | .103 |
| TOTAL | | | | * | 227,392 | 103,674 | 123,718 | * | | | .199 | .374 |
| PRODUCT TOTALS DUPONT-CNT | | | | | 425,709 | 229,197 | 196,512 | | | | .372 | .862 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 22

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|---|
| | % | 125,510 | ACTUAL | 285,340 | 68% |
| CEDAR - WEST HELENA | | | SCHEDULED CAPACITY | 417,689 | |

PROD--DUPONT-MBC
UNIT--LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| ORDINARY SUPPLY | 381 | | 381 | 3,902 | 3,123 | 779 | .003 | | .014 | .006 |
| RENTALS | | | | | | | | | | .005 |
| OUTSIDE LABOR | 3 | | 3 | 17,569 | 1,200 | 16,369 | | | .062 | .004 |
| MAINT SUPPLIES | 6,119 | | 6,119 | 71,814 | 7,599 | 64,215 | .049 | | .252 | .081 |
| OTHER CHEMICALS | | | | | | | | | | |
| NITROGEN | | | | | 12,000 | 12,000- | | | | |
| GAS | 3,842 | | 3,842 | 11,366 | 26,001 | 14,635- | .031 | | .040 | .049 |
| POWER | 11,499 | | 11,499 | 33,612 | 21,000 | 12,612 | .092 | | .118 | .080 |
| OTHER | 730 | | 730 | 1,998 | 2,100 | 102- | .006 | | .007 | .008 |
| START UP COST | | | | | 20,000 | 20,000- | | | | .096 |
| TOTAL | 22,574 | | 22,574 * | 140,261 | 93,023 | 47,238 * | .180 | | .492 | .329 |
| SALARY | 9,127 | | 9,127 | 34,196 | 34,450 | 254- | .073 | | .120 | .082 |
| WAGES | 32,936 | | 32,936 | 119,462 | 134,338 | 14,876- | .262 | | .419 | .204 |
| FRINGES | 11,952 | | 11,952 | 44,302 | 70,464 | 26,162- | .095 | | .155 | .117 |
| INSURANCE & TAXES | 2,877- | | 2,877- | 3,335 | 11,406 | 8,071- | .023- | | .012 | .076 |
| TOTAL | 51,138 | | 51,138 * | 201,295 | 250,658 | 49,363-* | .407 | | .705 | .479 |
| PLANT OVERHEAD | 32,806 | | 32,806 | 132,863 | 121,851 | 11,012 | .261 | | .466 | .270 |
| PLANT ADMIN | 26,307 | | 26,307 | 80,309 | 77,145 | 11,164 | .210 | | .309 | .047 |
| PLANT DEPRECIATION | 22,543 | | 22,543 | 73,642 | 34,128 | 39,514 | .180 | | .258 | .207 |
| TOTAL | 81,656 | | 81,656 * | 294,814 | 233,124 | 61,690 * | .651 | | 1.033 | .524 |
| PRODUCT TOTALS DUPONT-MBC | 155,368 | | 155,368 | 636,370 | 576,805 | 59,565 | 1.238 | | 2.230 | 1.332 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 17

BCOST2

SUMMARY

PRODUCTION

| ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|
| % | ACTUAL SCHEDULED CAPACITY | 500,000 | % |

CEDAR - WEST HELENA

PROD--B F GOODRICH
UNIT--LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ORDINARY SUPPLY | | | | | 1,057 | 3,600 | 2,543- | | | | |
| RENTALS | | | | | | | | | | | |
| OUTSIDE LABOR | | | | | 3,600 | 1,200 | 2,400 | | | | |
| MAINT SUPPLIES | 126 | | 126 | | 3,014 | 14,800 | 11,786- | | | | |
| NITROGEN | | | | | | 16,000 | 16,000- | | | | |
| GAS | | | | | 2,213 | 13,500 | 11,287- | | | | |
| POWER | | | | | 3,666 | 28,000 | 24,334- | | | | |
| WASTE DISPOSAL | | | | | | | | | | | |
| OTHER | | | | | 48 | 2,800 | 2,752- | | | | |
| TOTAL | 126 | | 126 | * | 13,590 | 79,900 | 66,302-* | | | | |
| SALARY | 149 | | 149 | | 3,784 | 32,266 | 28,482- | | | | |
| WAGES | 453 | | 453 | | 9,967 | 85,800 | 75,833- | | | | |
| FRINGES | 165 | | 165 | | 3,932 | 53,300 | 49,448- | | | | |
| INSURANCE & TAXES | | | | | 1,755 | 12,099 | 10,344- | | | | |
| TOTAL | 767 | | 767 | * | 19,438 | 183,545 | 164,107-* | | | | |
| PLANT OVERHEAD | | | | | 19,803 | 113,691 | 93,888- | | | | |
| PLANT ADMIN | | | | | 10,513 | 83,588 | 73,075- | | | | |
| PLANT DEPRECIATION | | | | | 2,805 | 62,438 | 59,633- | | | | |
| TOTAL | | | | * | 33,121 | 259,717 | 226,596-* | | | | |
| PRODUCT TOTALS B F GOODRICH | 893 | | 893 | | 66,157 | 523,162 | 457,005- | | | | |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 21

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | | YEAR-TO-DATE | ACTUAL % | |
|---|---|---|---|---|---|---|
| | 14% | 41,276 | ACTUAL | 774,740 | 36% | |
| CEDAR - WEST HELENA | | 289,000 | SCHEDULED CAPACITY | 2,143,000 | | PROD-- GRACE UNIT--LBS |

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| ORDINARY SUPPLY | 11,386 | 1,320 | 10,066 | 37,252 | 11,250 | 26,002 | .276 | .005 | .048 | |
| RENTALS | | | | 1,094 | | 1,094 | | | .001 | |
| OUTSIDE LABOR | | 283 | 283- | 171,544 | 2,830 | 168,714 | | .001 | .221 | |
| MAINT SUPPLIES | 18,544 | 3,900 | 14,644 | 274,484 | 38,400 | 236,084 | .449 | .013 | .354 | |
| OTHER CHEMICALS | | | | | | | | | | |
| NITROGEN | | 4,000 | 4,000- | | 34,000 | 34,000- | | .014 | | |
| GAS | 4,679 | 4,000 | 679 | 32,314 | 28,000 | 4,314 | .113 | .014 | .042 | |
| POWER | 13,630 | 7,000 | 6,630 | 129,467 | 70,000 | 59,467 | .330 | .024 | .167 | |
| OTHER | 730 | 1,300 | 570- | 5,378 | 11,050 | 5,672- | .018 | .004 | .007 | |
| START UP COST | | | | | | | | | | |
| TOTAL | 48,969 | 21,803 | 27,166 * | 651,533 | 195,530 | 456,003 * | 1.186 | .075 | .841 | |
| SALARY | 10,819 | 7,999 | 2,820 | 121,602 | 96,637 | 25,045 | .262 | .028 | .157 | |
| WAGES | 32,964 | 37,294 | 4,330 | 405,837 | 447,528 | 41,691- | .799 | .129 | .524 | |
| FRINGES | 11,963 | 18,891 | 6,928- | 163,181 | 226,692 | 63,511- | .290 | .065 | .211 | |
| INSURANCE & TAXES | 1,038 | 5,685 | 4,647- | 51,091 | 68,055 | 16,964- | .025 | .020 | .066 | |
| TOTAL | 56,784 | 69,869 | 13,085-* | 741,791 | 838,912 | 97,121-* | 1.376 | .242 | .957 | |
| PLANT OVERHEAD | 38,886 | 29,803 | 9,083 | 555,195 | 408,768 | 146,427 | .942 | .103 | .717 | |
| PLANT ADMIN | 31,182 | 22,516 | 8,666 | 302,905 | 238,916 | 63,989 | .755 | .078 | .391 | |
| PLANT DEPRECIATION | 19,125 | 27,482 | 8,357- | 194,239 | 329,784 | 135,545- | .463 | .095 | .251 | |
| TOTAL | 89,193 | 79,801 | 9,392 * | 1,052,339 | 977,468 | 74,871 * | 2.161 | .276 | 1.358 | |
| PRODUCT TOTALS GRACE | 194,946 | 171,473 | 23,473 | 2,445,663 | 2,011,910 | 433,753 | 4.723 | .593 | 3.157 | |

CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 23

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL X THIS MONTH | | YEAR-TO-DATE | ACTUAL X |
|---|---|---|---|---|
| | % | ACTUAL | 1,022,962 | 152% |
| CEDAR - WEST HELENA | | SCHEDULED CAPACITY | 674,847 | |

PROD--PERMETHRIN
UNIT--LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ORDINARY SUPPLY | | | | | 215 | 4,125 | 3,910- | | | | | .007 |
| RENTALS | | | | | 400 | 225 | 175 | | | | | |
| OUTSIDE LABOR | | | | | 37,314 | 1,800 | 35,514 | | | | .036 | .005 |
| MAINT SUPPLIES | 2,305 | | 2,305 | | 37,379 | 33,699 | 3,680 | | | | .037 | .038 |
| OTHER CHEMICALS | | | | | | 5,400 | 5,400- | | | | | .013 |
| GAS | | | | | 24,143 | 18,000 | 6,143 | | | | .024 | .027 |
| POWER | | | | | 38,309 | 21,000 | 17,309 | | | | .037 | .039 |
| OTHER | | | | | 2,471 | 15,000 | 12,529- | | | | .002 | .005 |
| TOTAL | 2,305 | | 2,305 | * | 140,231 | 99,249 | 40,982 | * | | | .137 | .134 |
| SALARY | 29 | | 29 | | 34,830 | 33,265 | 1,565 | | | | .034 | .047 |
| WAGES | 96 | | 96 | | 112,460 | 84,684 | 27,776 | | | | .110 | .113 |
| FRINGES | 35 | | 35 | | 48,169 | 41,491 | 6,678 | | | | .047 | .068 |
| INSURANCE & TAXES | | | | | 10,595 | 11,784 | 1,189- | | | | .010 | .051 |
| TOTAL | 160 | | 160 | * | 206,054 | 171,224 | 34,830 | * | | | .201 | .278 |
| PLANT OVERHEAD | | | | | 168,438 | 64,056 | 104,382 | | | | .165 | .176 |
| PLANT ADMIN | | | | | 82,991 | 25,672 | 57,319 | | | | .081 | .048 |
| PLANT DEPRECIATION | | | | | 22,439 | 17,454 | 4,985 | | | | .022 | .034 |
| TOTAL | | | | * | 273,868 | 107,182 | 166,686 | * | | | .268 | .258 |
| PRODUCT TOTALS PERMETHRIN | 2,465 | | 2,465 | | 620,153 | 377,655 | 242,498 | | | | .606 | .670 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 18

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL X THIS MONTH | | YEAR-TO-DATE | ACTUAL X | |
|---|---|---|---|---|---|
| | X | | | | |
| CEDAR - WEST HELENA | | ACTUAL | 272,100 | 59% | PROD-- MES |
| | | SCHEDULED | 457,317 | | UNIT--L |
| | | CAPACITY | | | |

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OTHER RAW MATERIALS | | | | | | 36,800 | 36,800- | | | | | .076 |
| TOTAL | | | | * | | 36,800 | 36,800- | * | | | | .076 |
| ORDINARY SUPPLY | | | | | | 3,600 | 3,600- | | | | | .007 |
| RENTALS | | | | | | | | | | | | |
| OUTSIDE LABOR | | | | | 2,960 | 300 | 2,580 | | | | .011 | .013 |
| MAINT SUPPLIES | | | | | 12,892 | 18,072 | 5,190- | | | | .047 | .047 |
| NITROGEN | | | | | 7,628 | 15,080 | 7,452- | | | | .028 | .030 |
| GAS | | | | | 9,563 | | 9,563 | | | | .035 | |
| POWER | | | | | 16,001 | 28,000 | 11,999- | | | | .059 | .063 |
| OTHER | | | | | 1,940 | 2,400 | 460- | | | | .007 | .005 |
| START UP COST | | | | | | | | | | | | .015 |
| TOTAL | | | | * | 50,974 | 67,532 | 16,558- | * | | | .187 | .180 |
| SALARY | | | | | 13,435 | 18,106 | 4,671- | | | | .049 | .060 |
| WAGES | | | | | 43,093 | 62,780 | 19,687- | | | | .158 | .131 |
| FRINGES | | | | | 19,479 | 27,499 | 8,020- | | | | .072 | .084 |
| INSURANCE & TAXES | | | | | 6,009 | 13,856 | 7,847- | | | | .022 | .145 |
| TOTAL | | | | * | 82,016 | 122,241 | 40,225- | * | | | .301 | .419 |
| PLANT OVERHEAD | | | | | 57,724 | 48,972 | 8,752 | | | | .212 | .247 |
| PLANT ADMIN | | | | | 29,853 | 29,203 | 650 | | | | .110 | .047 |
| PLANT DEPRECIATION | | | | | 68,539 | 17,454 | 51,085 | | | | .252 | .099 |
| TOTAL | | | | * | 156,116 | 93,629 | 60,487 | * | | | .574 | .392 |
| PRODUCT TOTALS MES | | | | | 289,106 | 322,202 | 33,096- | | | | 1.062 | 1.067 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 16

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | ACTUAL | 148,800 | 73% |
| CEDAR - WEST HELENA | | SCHEDULED CAPACITY | 205,102 | |

PROD--MTPO
UNIT--LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED. COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED. COST | | UNIT COST CUR. MONTH ACTUAL | CUR. MONTH SCHED. | YTD ACTUAL | LST. YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OTHER RAW MATERIALS | | | | | 148,644 | 379,227 | 230,583- | | | | .999 | 1.142 |
| TOTAL | | | | * | 148,644 | 379,227 | 230,583- | * | | | .999 | 1.142 |
| ORDINARY SUPPLY | | | | | 306 | 1,100 | 794- | | | | .002 | .011 |
| RENTALS | | | | | | | | | | | | .001 |
| OUTSIDE LABOR | 1,591- | | 1,591- | | 6,275 | | 6,275 | | | | .042 | |
| MAINT SUPPLIES | 338- | | 338- | | 13,338 | 31,000 | 17,662- | | | | .090 | .121 |
| NITROGEN | | | | | 8,479 | 6,000 | 2,479 | | | | .057 | |
| GAS | 61 | | 61 | | 6,247 | 10,500 | 4,253- | | | | .042 | .072 |
| POWER | 201 | | 201 | | 12,344 | 42,000 | 29,656- | | | | .083 | .239 |
| OTHER | | | | | 598 | 1,500 | 902- | | | | .004 | .006 |
| START UP COST | | | | | | 10,000 | 10,000- | | | | | .604 |
| TOTAL | 1,667- | | 1,667 | * | 47,587 | 102,100 | 54,513- | * | | | .320 | 1.055 |
| SALARY | 158 | | 158 | | 12,993 | 44,598 | 31,605- | | | | .087 | .194 |
| WAGES | 594 | | 594 | | 49,440 | 68,649 | 19,209- | | | | .332 | .410 |
| FRINGES | 215 | | 215 | | 17,388 | 39,588 | 22,200- | | | | .117 | .175 |
| INSURANCE & TAXES | | | | | 9,079 | 12,478 | 3,399- | | | | .061 | .121 |
| TOTAL | 967 | | 967 | * | 88,900 | 165,313 | 76,413- | * | | | .597 | .899 |
| PLANT OVERHEAD | 572 | | 572 | | 55,650 | 67,517 | 11,867- | | | | .374 | .723 |
| PLANT ADMIN | 459 | | 459 | | 29,947 | 32,089 | 2,142- | | | | .201 | .489 |
| PLANT DEPRECIATION | 20,122 | | 20,122 | | 32,277 | 17,454 | 14,823 | | | | .217 | .204 |
| TOTAL | 21,153 | | 21,153 | * | 117,874 | 117,060 | 814 | * | | | .792 | 1.415 |
| PRODUCT TOTALS MTPO | 20,453 | | 20,453 | | 403,005 | 763,700 | 360,695- | | | | 2.708 | 4.512 |

CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 6

BCOST2

SUMMARY

PRODUCTION

| | ACTUAL X THIS MONTH | | YEAR-TO-DATE | ACTUAL X |
|---|---|---|---|---|
| | % | ACTUAL | 793,070 | 66% |
| CEDAR - WEST HELENA | | SCHEDULED CAPACITY | 1,200,000 | |

PROD--ORFOM
UNIT--LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OTHER RAW MATERIALS | | | | | 30,128 | 24,000 | 6,128 | | | | .038 | .009 |
| TOTAL | | | | * | 30,128 | 24,000 | 6,128 | * | | | .038 | .009 |
| ORDINARY SUPPLY | | | | | 436 | | 436 | | | | .001 | |
| RENTALS | | | | | 1,650 | | 1,650 | | | | .002 | |
| OUTSIDE LABOR | | | | | 179 | | 179 | | | | | |
| MAINT SUPPLIES | | | | | 8,682 | 480 | 8,202 | | | | .011 | .009 |
| NITROGEN | | | | | | 1,700 | 1,700- | | | | | .001 |
| GAS | | | | | | | | | | | | .001 |
| POWER | | | | | 23,811 | 2,000 | 21,811 | | | | .030 | .008 |
| WASTE DISPOSAL | | | | | | | | | | | | |
| OTHER | | | | | 1,610 | 700 | 910 | | | | .002 | .001 |
| START UP COST | | | | | | | | | | | | .011 |
| TOTAL | | | | * | 36,368 | 4,880 | 31,488 | * | | | .046 | .031 |
| SALARY | | | | | 20,695 | 7,716 | 12,979 | | | | .026 | .012 |
| WAGES | | | | | 56,970 | 20,900 | 36,070 | | | | .072 | .025 |
| FRINGES | | | | | 27,970 | 9,788 | 18,182 | | | | .035 | .013 |
| INSURANCE & TAXES | | | | | 4,546 | 2,072 | 2,474 | | | | .006 | .003 |
| TOTAL | | | | * | 110,181 | 40,476 | 69,705 | * | | | .139 | .047 |
| PLANT OVERHEAD | | | | | 99,238 | 8,436 | 90,802 | | | | .125 | .054 |
| PLANT ADMIN | | | | | 45,103 | 6,168 | 38,935 | | | | .057 | .012 |
| PLANT DEPRECIATION | | | | | 18,725 | 11,636 | 7,089 | | | | .024 | .013 |
| TOTAL | | | | * | 163,066 | 26,240 | 136,826 | * | | | .206 | .079 |
| PRODUCT TOTALS ORFOM | | | | | 339,743 | 95,596 | 244,147 | | | | .428 | .166 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 20 BCOST2

SUMMARY

PRODUCTION

| | ACTUAL % THIS MONTH | | YEAR-TO-DATE | ACTUAL % |
|---|---|---|---|---|
| | % | ACTUAL | 425,794 | 115% |
| CEDAR - WEST HELENA | | SCHEDULED CAPACITY | 369,231 | |

PROD--SECTAGON II
UNIT--GAL

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OTHER RAW MATERIALS | | | | | 290,250 | 201,000 | 89,250 | | | | .682 | .674 |
| TOTAL | | | | * | 290,250 | 201,000 | 89,250 | * | | | .682 | .674 |
| ORDINARY SUPPLY | | | | | 248 | 1,490 | 1,242- | | | | .001 | .005 |
| RENTALS | | | | | 50 | 270 | 220- | | | | | |
| OUTSIDE LABOR | | | | | 8,875 | 3,000 | 5,875 | | | | .021 | .009 |
| MAINT SUPPLIES | | | | | 10,444 | 6,024 | 3,620 | | | | .025 | .025 |
| NITROGEN | | | | | 9,515 | 6,000 | 3,515 | | | | .022 | .018 |
| GAS | | | | | | | | | | | | |
| POWER | 57 | | 57 | | 16,120 | 9,210 | 6,910 | | | | .038 | .029 |
| OTHER | | | | | 1,108 | 1,240 | 132- | | | | .003 | .004 |
| START UP COST | | | | | | 6,000 | 6,000- | | | | | .035 |
| TOTAL | 57 | | 57 | * | 46,360 | 34,034 | 12,326 | * | | | .109 | .126 |
| SALARY | 46 | | 46 | | 11,797 | 11,150 | 647 | | | | .028 | .033 |
| WAGES | 162 | | 162 | | 38,093 | 26,894 | 11,199 | | | | .089 | .082 |
| FRINGES | 59 | | 59 | | 18,079 | 16,142 | 1,937 | | | | .042 | .049 |
| INSURANCE & TAXES | | | | | 9,884 | 9,324 | 560 | | | | .023 | .031 |
| TOTAL | 267 | | 267 | * | 77,853 | 63,510 | 14,343 | * | | | .183 | .195 |
| PLANT OVERHEAD | 162 | | 162 | | 43,561 | 41,476 | 2,085 | | | | .102 | .119 |
| PLANT ADMIN | 130 | | 130 | | 24,890 | 24,736 | 154 | | | | .058 | .082 |
| PLANT DEPRECIATION | | | | | 22,543 | 22,752 | 209- | | | | .053 | .099 |
| TOTAL | 292 | | 292 | * | 90,994 | 88,964 | 2,030 | * | | | .214 | .300 |
| PRODUCT TOTALS SECTAGON II | 616 | | 616 | | 505,457 | 387,508 | 117,949 | | | | 1.187 | 1.296 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/90 CEDAR - WEST HELENA UNIT COST REPORT BY PRODUCT PAGE 27

BCOST2

SUMMARY

PRODUCTION

| ACTUAL X THIS MONTH | | YEAR-TO-DATE | ACTUAL X |
|---|---|---|---|
| X | ACTUAL SCHEDULED CAPACITY | | X |

CEDAR - WEST HELENA

PROD--IDLE PLANT
UNIT--LBS

| EXPENSE DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | UNIT COST CUR.MONTH ACTUAL | CUR.MONTH SCHED. | YTD ACTUAL | LST.YR ACTUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| ORDINARY SUPPLY | | | | 198- | | 198- | | | | |
| RENTALS | | | | 525 | | 525 | | | | |
| OUTSIDE LABOR | 4,242 | | 4,242 | 33,596 | | 33,596 | | | | |
| MAINT SUPPLIES | 202 | | 202 | 19,671 | | 19,671 | | | | |
| OTHER CHEMICALS | | | | 12,628- | | 12,628- | | | | |
| NITROGEN | 2,861 | | 2,861 | 15,157 | | 15,157 | | | | |
| GAS | | | | 6,638 | | 6,638 | | | | |
| POWER | 1,514 | | 1,514 | 8,733 | | 8,733 | | | | |
| WASTE DISPOSAL | | | | | | | | | | |
| OTHER | | | | | | | | | | |
| TOTAL | 8,819 | | 8,819 * | 71,494 | | 71,494 * | | | | |
| SALARY | 1,025 | | 1,025 | 6,128 | | 6,128 | | | | |
| WAGES | 2,956 | | 2,956 | 18,543 | | 18,543 | | | | |
| FRINGES | 1,073 | 521 | 552 | 7,459 | 7,036 | 423 | | | | |
| INSURANCE & TAXES | 86 | 2,679 | 2,593- | 409 | 18,780 | 18,371- | | | | |
| TOTAL | 5,140 | 3,200 | 1,940 * | 32,559 | 25,816 | 6,743 * | | | | |
| PLANT OVERHEAD | 4,319 | 38,784 | 34,465- | 33,356 | 44,058- | 77,414 | | | | |
| PLANT ADMIN | 3,464 | 29,301 | 25,837- | 13,054 | 25,969- | 39,023 | | | | |
| PLANT DEPRECIATION | 5,610 | 28,570 | 22,960- | 50,644 | 102,644 | 52,000- | | | | |
| TOTAL | 13,393 | 96,655 | 83,262-* | 97,054 | 32,617 | 64,437 * | | | | |
| PRODUCT TOTALS IDLE PLANT | 27,352 | 99,855 | 72,503- | 201,107 | 58,433 | 142,674 | | | | |

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 6100 | SALARIES | 39,122 | 36,606 | 2,514 | 370,341 | 373,032 | 5,309 |
| 6200 | PAYROLL TAXES | 4,375 | 5,766 | 1,391- | 47,607 | 58,758 | 11,151- |
| 6210 | GROUP INSURANCE | 3,270 | 2,200 | 1,070 | 34,038 | 26,400 | 7,638 |
| 6220 | WORKMANS COMP INSUR | 682 | 1,200 | 518- | 6,850 | 14,400 | 7,550 |
| 6230 | PENSION PLAN COST | 3,868 | 3,400 | 468 | 43,315 | 40,800 | 2,515 |
| 6240 | EMPLOYMENT EXPENSE | | | | 16,026 | | 16,026 |
| 6300 | CONTRACT LABOR & MTL | 363 | | 363 | 14,201 | | 14,201 |
| 6350 | ELECTRICITY | 518 | 600 | 82- | 12,258 | 7,200 | 5,058 |
| 6370 | COMMUNICATION | 2,573 | 3,200 | 627- | 38,775 | 38,400 | 375 |
| 6380 | AUTO EXPENSE | | 230 | 230- | 397- | 2,760 | 3,157- |
| 6390 | TRVL & ENTERTAINMENT | 3,025 | 1,800 | 1,225 | 30,372 | 21,600 | 8,772 |
| 6395 | MEALS/ENTERTAINMENT | 194 | 600 | 406- | 7,458 | 7,200 | 258 |
| 6400 | ORDINARY SUPPLIES | 6,367 | 2,200 | 4,167 | 46,568 | 26,400 | 20,168 |
| 6460 | MISCELLANEOUS | 8,897 | 100 | 8,797 | 17,987 | 1,200 | 16,787 |
| 6610 | DUES & SUBSCRIPTIONS | | 100 | 100- | 1,601 | 1,200 | 401 |
| 6620 | FEES & TUITIONS | 264 | 400 | 136- | 5,942 | 4,000 | 1,142 |
| 6630 | PROFESSIONAL FEES | 2,982 | | 2,982 | 43,122 | | 43,122 |
| 6650 | RENTALS | 93 | 200 | 107- | 5,757 | 2,400 | 3,357 |
| 6660 | LEASE ITEMS | 3,963 | 1,000 | 2,963 | 23,668 | 12,000 | 11,668 |
| 6680 | FREIGHT IN (MISC.) | | 100 | 100- | 172 | 1,200 | 1,028- |
| | SUB TOTAL | 80,556 | 59,702 | 20,854 | 773,661 | 639,750 | 133,911 |
| 6980 | ALLC COST CENTER EXP | 1 | 5,986 | 5,985 | | 71,832 | 71,832- |
| 6990 | ALLC COST CENTER TSF | | | | | | |
| | DEPARTMENT TOTALS ADMINSTRATIVE | 80,557 | 65,688 | 14,869 * | 773,661 | 711,582 | 62,079 * |

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 5250 | START-UP COST | | | | | | |
| 5510 | BUTOXONE TECH ACID | | | | 733,348 | 799,425 | 66,077- |
| 5700 | DMA-60% | | | | 13,529 | 27,672 | 14,143- |
| 5705 | CITRIC ACID | | | | 32,439 | 24,472 | 7,967 |
| 5850 | OTHER RAW MATERIALS | | | | 333,950 | 274,390 | 59,560 |
| 5870 | PACKAGING MATERIALS | 806 | 1,250 | 444- | 84,622 | 173,323 | 88,701- |
| 6590 | CONTRACT FORMULATING | | | | 263,823 | 257,100 | 6,723 |
| 6835 | FLAKED TECH USED | | | | 908,293 | 1,543,000 | 635,507- |
| | DEPARTMENT TOTALS | 806 | | 444-* | | 3,100,182 | * |
| | CONTRACT FORMULATION | | 1,250 | | 2,370,004 | | 730,178- |

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 6100 | SALARIES | 3,147 | 2,997 | 150 | 35,260 | 35,964 | 696- |
| 6110 | WAGES | 4,423 | 3,153 | 1,270 | 55,760 | 36,786 | 18,974 |
| 6140 | HOLIDAY & VAC PAY | | | | | | |
| 6200 | PAYROLL TAXES | 182 | | 182 | 3,005 | | 3,005 |
| 6300 | CONTRACT LABOR & MTL | 4,787 | 750 | 4,037 | 61,528 | 9,000 | 52,528 |
| 6390 | TRVL & ENTERTAINMENT | | 80 | 80- | 371 | 960 | 589- |
| 6395 | MEALS/ENTERTAINMENT | | 40 | 40- | 71 | 480 | 409- |
| 6400 | ORDINARY SUPPLIES | 3,014 | 720 | 2,294 | 17,337 | 8,640 | 8,697 |
| 6410 | MAINTENANCE SUPPLIES | 221 | 500 | 279- | 5,525 | 6,000 | 475- |
| 6560 | OFF SITE WASTE DISPO | | | | | | |
| 6620 | FEES & TUITIONS | 500 | 1,300 | 800- | 14,249 | 15,600 | 1,351- |
| 6630 | PROFESSIONAL FEES | 382 | | 382 | 382 | | 382 |
| 6650 | RENTALS | | 10 | 10- | 425 | 120 | 305 |
| 6710 | PROPERTY TAXES & LIC | 67 | | 67 | 1,673 | | 1,673 |
| 6730 | POND CLOSURER/CREDIT | | | | 13,080- | | 13,080- |
| 6900 | POWER | | | | | | |
| 6960 | WAGE FRINGES | 1,605 | 1,265 | 340 | 23,902 | 16,610 | 7,292 |
| | SUB TOTAL | 18,328 | | 7,513 | | 130,160 | |
| | | | 10,815 | | 206,416 | | 76,256 |
| 6990 | ALLC COST CENTER TSF | 18,327- | 10,815- | 7,512 | 204,418- | 130,160- | 74,258- |
| | DEPARTMENT TOTALS ENVIRONMENTAL | 1 | | 1 * | 2- | | * 2- |

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 6200 | PAYROLL TAXES | 12,092 | 14,100 | 2,008- | 170,551 | 175,000 | 4,449- |
| 6210 | GROUP INSURANCE | 15,200 | 17,750 | 2,550 | 180,913 | 176,700 | 7,987- |
| 6220 | WORKMANS COMP INSUR | 3,907- | 3,800 | 7,707 | 30,470 | 47,200 | 16,710- |
| 6230 | PENSION PLAN COST | 43,838- | 22,376 | 66,214 | 167,455 | 268,512 | 109,057- |
| | SUB TOTAL | 20,453- | | 78,479- | | 687,612 | |
| | | | 58,026 | | 549,409 | | 138,203- |
| 6990 | ALLC COST CENTER TSF | 20,453 | 58,026- | 78,479 | 549,410- | 687,612- | 138,202 |
| | DEPARTMENT TOTALS FRINGES | | | * | 1- | | * 1- |

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 5260 | TASK FORCE EXPENSES | 108,000 | 48,000 | 60,000 | 657,500 | 576,000 | 81,500 |
| 5280 | GAIN (LOSS) F/A | | | | 3,626 | | 3,626 |
| 6600 | INSURANCE-PLANT | 36,807- | 8,285 | 45,092 | 209,649 | 184,897 | 24,752 |
| 6710 | PROPERTY TAXES & LIC | 4,562 | 5,975 | 1,413- | 54,032 | 91,230 | 37,198- |
| | SUB TOTAL | 75,755 | 62,260 | 13,495 | 924,807 | 852,127 | 72,680 |
| 6999 | ALLOC PLT OVERHEAD | 107,985 | 81,651 | 26,334 | 1,595,602 | 984,845 | 610,757 |
| 8900 | DEPRECIATION | 82,874 | 68,687 | 14,187 | 703,211 | 824,244 | 121,033- |
| 8910 | AMORTIZIATION EXP | | | | | | |
| | DEPARTMENT TOTALS | 266,614 | | 54,016 * | | 2,661,216 | * |
| | GENERAL PLANT | | 212,598 | | 3,223,620 | | 562,404 |

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 6100 | SALARIES | 5,968 | 2,702 | 3,266 | 68,587 | 72,867 | 4,280- |
| 6110 | WAGES | 12,560 | 4,965 | 7,595 | 158,647 | 144,741 | 13,906 |
| 6140 | HOLIDAY & VAC PAY | 2,398 | 1,429 | 969 | 15,932 | 16,764 | 832- |
| 6150 | SICK & ALLOWED PAY | 79 | 134 | 55- | 394 | 1,608 | 1,214- |
| 6160 | OTHER (CALL-OUT PRE) | | 10 | 10- | 79 | 120 | 41- |
| 6300 | CONTRACT LABOR & MTL | | | | 2,409 | | 2,409 |
| 6390 | TRVL & ENTERTAINMENT | 1,449 | 10 | 1,439 | 3,126 | 120 | 3,006 |
| 6395 | MEALS/ENTERTAINMENT | 74 | | 74 | 74 | | 74 |
| 6400 | ORDINARY SUPPLIES | 2,497 | 2,830 | 333- | 67,757 | 36,075 | 31,682 |
| 6410 | MAINTENANCE SUPPLIES | 520 | 240 | 280 | 2,215 | 2,980 | 765- |
| 6620 | FEES & TUITIONS | | 35 | 35- | 500 | 420 | 80 |
| 6650 | RENTALS | | | | 34 | | 34 |
| 6960 | WAGE FRINGES | 9,221- | 2,146 | 11,367- | 40,838 | 70,048 | 21,210- |
| | DEPARTMENT TOTALS | 16,324 | | 1,823 * | | 345,743 | * |
| | LABORATORY | | 14,501 | | 368,592 | | 22,849 |

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 5250 | START-UP COST | 5,938 | | 5,938 | 77,336- | 51,000 | 128,336- |
| 6100 | SALARIES | 8,338 | 1,983 | 6,355 | 71,103 | 59,518 | 11,585 |
| 6110 | WAGES | 31,240 | 19,730 | 11,510 | 370,083 | 327,047 | 43,036 |
| 6140 | HOLIDAY & VAC PAY | 189- | 2,834 | 3,023- | 26,389 | 31,236 | 4,847- |
| 6150 | SICK & ALLOWED PAY | 1,058 | 125 | 933 | 2,236 | 1,500 | 736 |
| 6160 | OTHER (CALL-OUT PRE) | 172 | 75 | 97 | 806 | 900 | 94- |
| 6300 | CONTRACT LABOR & MTL | 4,324 | 958 | 3,366 | 373,954 | 19,529 | 354,425 |
| 6390 | TRVL & ENTERTAINMENT | 1,947 | 200 | 1,747 | 3,849 | 2,400 | 1,449 |
| 6395 | MEALS/ENTERTAINMENT | 51 | 60 | 9- | 603 | 720 | 117- |
| 6400 | ORDINARY SUPPLIES | 12,003 | 300 | 11,703 | 19,710 | 10,849 | 8,861 |
| 6410 | MAINTENANCE SUPPLIES | 27,305 | 18,137 | 9,168 | 782,350 | 318,722 | 463,628 |
| 6420 | MAINTENANCE TOOLS | | 275 | 275- | 4,593 | 3,300 | 1,293 |
| 6430 | EXPENDABLE ITEMS | 6,219 | 2,400 | 3,819 | 49,416 | 28,800 | 20,616 |
| 6510 | OTH CHEMICALS | | 10 | 10- | | 120 | 120- |
| 6610 | DUES & SUBSCRIPTIONS | | | | 111 | | 111 |
| 6620 | FEES & TUITIONS | 1,229 | 140 | 1,089 | 3,696 | 1,680 | 2,016 |
| 6650 | RENTALS | 53 | 414 | 361- | 11,529 | 5,176 | 6,353 |
| 6730 | POND CLOSURER/CREDIT | | | | | | |
| 6960 | WAGE FRINGES | 3,759 | 11,388 | 7,629- | 142,591 | 190,085 | 47,494- |
| | DEPARTMENT TOTALS | 103,447 | | 44,418 | | 1,052,582 | |
| | MAINTENANCE-GENERAL | | 59,029 | | 1,785,683 | | 733,101 |

CEDAR CHEMICAL CORPORATION BCOST4

DATE 12/31/90 CEDAR - WEST HELENA PRODUCTION

COST REPORT BY DEPARTMENT

PAGE 1

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 5250 | START-UP COST | | | | | | |
| 5520 | ODCB | | | | | | |
| 5530 | 99% SULFURIC ACID | | | | | | |
| 5540 | 98% NITRIC ACID | | | | | | |
| 5630 | DCA | 1,413,627 | 871,875 | 541,752 | 7,344,220 | 6,553,710 | 790,510 |
| 5640 | PROPIONIC ACID | 111,875 | 70,200 | 41,675 | 544,534 | 527,479 | 16,855 |
| 5650 | PROPIONIC ANHYDRIDE | 52,793 | 37,800 | 14,993 | 254,971 | 284,135 | 29,164- |
| 5660 | MESITYL OXIDE | 152,075 | | 152,075 | 518,670 | 729,600 | 210,930- |
| 5670 | EMULSIFIER | 104,881 | 15,910 | 88,971 | 609,219 | 626,224 | 17,005- |
| 5675 | ARMUL | | | | | | |
| 5680 | ISOPHORONE | 117,144 | 22,420 | 94,724 | 1,252,847 | 923,645 | 329,202 |
| 5685 | TENNECO 500 | 49,747 | 13,860 | 35,887 | 165,203 | 110,880 | 54,323 |
| 5850 | OTHER RAW MATERIALS | | | | 468,449 | 604,227 | 135,778- |
| 5870 | PACKAGING MATERIALS | | | | 24 | | 24 |
| 6100 | SALARIES | 20,322 | 8,472 | 11,850 | 225,086 | 203,443 | 21,643 |
| 6110 | WAGES | 61,991 | 35,239 | 26,752 | 682,517 | 672,687 | 9,830 |
| 6140 | HOLIDAY & VAC PAY | 1,654- | 4,482 | 6,136- | 45,557 | 50,304 | 4,747- |
| 6150 | SICK & ALLOWED PAY | 341 | 590 | 249- | 4,515 | 7,080 | 2,565- |
| 6160 | OTHER (CALL-OUT PRE) | 100 | 300 | 200 | 1,860 | 3,600 | 1,740- |
| 6300 | CONTRACT LABOR & MTL | | | | 350 | | 350 |
| 6340 | NATURAL GAS | 19,083 | 12,485 | 6,598 | 171,786 | 159,781 | 12,005 |
| 6350 | ELECTRICITY | 46,214 | 21,150 | 25,064 | 472,960 | 383,985 | 88,975 |
| 6360 | WATER | 2,190 | 2,140 | 50 | 24,626 | 44,605 | 19,979- |
| 6390 | TRVL & ENTERTAINMENT | | | | 65 | | 65 |
| 6400 | ORDINARY SUPPLIES | 2,407 | 8,127 | 5,720- | 40,956 | 76,582 | 35,626- |
| 6410 | MAINTENANCE SUPPLIES | 2,451 | 1,666 | 785 | 37,985 | 24,394 | 13,591 |
| 6470 | NITROGEN | 5,988 | 9,290 | 3,302- | 70,689 | 130,540 | 59,851- |
| 6510 | OTH CHEMICALS | | | | 20,225 | 5,400 | 14,825 |
| 6630 | PROFESSIONAL FEES | | | | 24,233 | | 24,233 |
| 6650 | RENTALS | 1,110 | 1,000 | 110 | 18,244 | 12,000 | 6,244 |
| 6900 | POWER | | | | | | |
| 6960 | WAGE FRINGES | 25,042- | 16,353 | 41,395- | 240,864 | 348,741 | 107,877- |
| | DEPARTMENT TOTALS | 2,137,643 | | 984,204 * | | 12,483,242 | * |
| | PRODUCTION | | 1,153,359 | | 13,240,655 | | 757,413 |

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | SCHEDULED COST | OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 6100 | SALARIES | 4,425 | 4,646 | 221- | 53,100 | 55,752 | 2,652- |
| 6200 | PAYROLL TAXES | 256 | | 256 | 4,469 | | 4,469 |
| 6240 | EMPLOYMENT EXPENSE | | | | 13,266 | | 13,266 |
| 6300 | CONTRACT LABOR & MTL | | 740 | 740- | 755 | 8,880 | 8,125- |
| 6390 | TRVL & ENTERTAINMENT | 555 | 320 | 235 | 4,109 | 3,840 | 269 |
| 6395 | MEALS/ENTERTAINMENT | 242 | 65 | 177 | 402 | 780 | 290- |
| 6400 | ORDINARY SUPPLIES | 483 | 200 | 283 | 2,357 | 2,400 | 43- |
| 6610 | DUES & SUBSCRIPTIONS | | | | 5 | | 5 |
| 6620 | FEES & TUITIONS | 75 | 15 | 60 | 99 | 180 | 81- |
| | DEPARTMENT TOTALS | 6,036 | | 50 * | | 71,832 | * |
| | RESEARCH & DEVELOPMT | | 5,986 | | 78,642 | | 6,810 |

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 6100 | SALARIES | 2,695 | 2,682 | 13 | 31,407 | 32,184 | 777- |
| 6110 | WAGES | 7,014 | 7,014 | | 83,810 | 83,460 | 350 |
| 6140 | HOLIDAY & VAC PAY | 713 | 735 | 22- | 8,484 | 8,622 | 138- |
| 6150 | SICK & ALLOWED PAY | | 69 | 69- | 146 | 828 | 682- |
| 6160 | OTHER (CALL-OUT PRE) | | 10 | 10- | | 120 | 120- |
| 6260 | MEDICAL EXAMS | 136 | 650 | 514- | 16,073 | 7,800 | 8,273 |
| 6270 | BLOOD TEST | | 270 | 270- | 2,028 | 2,160 | 132- |
| 6280 | SAFETY SUPPLIES | 6,787 | 4,000 | 2,787 | 01,280 | 48,525 | 32,755 |
| 6300 | CONTRACT LABOR & MTL | | 40 | 40- | 3,016 | 480 | 2,536 |
| 6390 | TRVL & ENTERTAINMENT | 24 | | 24 | 106 | | 106 |
| 6400 | ORDINARY SUPPLIES | | | | 459 | | 459 |
| 6620 | FEES & TUITIONS | | 125 | 125- | 120 | 1,500 | 1,380- |
| 6960 | WAGE FRINGES | 2,545 | 2,813 | 268- | 36,758 | 37,680 | 922- |
| | DEPARTMENT TOTALS | 19,914 | | 1,506 * | | 223,359 | * |
| | SAFETY & SECURITY | | 18,408 | | 263,687 | | 40,328 |

SHIPPING & PACKAGING **********

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 5890 | CONTAINERS | 80,867 | 12,207 | 68,660 | 490,173 | 567,635 | 69,482- |
| 6100 | SALARIES | | 1,597 | 1,597- | 22,423 | 24,909 | 2,486- |
| 6110 | WAGES | 11,214 | 3,640 | 7,574 | 50,247 | 53,848 | 3,601- |
| 6140 | HOLIDAY & VAC PAY | 331- | 503 | 834- | 7,400 | 5,898 | 1,502 |
| 6150 | SICK & ALLOWED PAY | 73- | 10 | 83- | 1,784 | 120 | 1,664 |
| 6160 | OTHER (CALL-OUT PRE) | 41- | 5 | 46- | 115 | 60 | 55 |
| 6400 | ORDINARY SUPPLIES | 1,296 | 1,030 | 266 | 8,942 | 8,959 | 17- |
| 6410 | MAINTENANCE SUPPLIES | 8 | 510 | 502- | 1,474 | 6,670 | 5,196- |
| 6960 | WAGE FRINGES | 4,069 | 1,439 | 2,630 | 20,770 | 24,513 | 3,743- |
| | DEPARTMENT TOTALS | 97,009 | | 76,068 * | | 692,632 | * |
| | SHIPPING & PACKAGING | | 20,941 | | 611,328 | | 81,304- |

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 6110 | WAGES | 5,046 | 1,671 | 3,375 | 40,408 | 19,596 | 20,812 |
| 6140 | HOLIDAY & VAC PAY | 903 | 218 | 685 | 3,236 | 2,556 | 680 |
| 6150 | SICK & ALLOWED PAY | | 10 | 10- | 156 | 120 | 36 |
| 6160 | OTHER (CALL-OUT PRE) | | 5 | 5- | 2,454 | 60 | 2,394 |
| 6400 | ORDINARY SUPPLIES | | 20 | 20- | 2,558 | 240 | 2,318 |
| 6410 | MAINTENANCE SUPPLIES | 951 | | 951 | 2,562 | | 2,562 |
| 6680 | FREIGHT IN (MISC.) | 5,354 | 575 | 4,779 | 12,416 | 6,900 | 5,516 |
| 6960 | WAGE FRINGES | 1,831 | 670 | 1,161 | 18,000 | 8,047 | 9,153 |
| | DEPARTMENT TOTALS | 14,085 | | 10,914 * | | 38,319 | * |
| | STORE & RECEIVING | | 3,169 | | 81,790 | | 43,471 |

| CONTROL | CONTROL DESCRIPTION | CURRENT MONTH AMOUNTS ACTUAL COST | CURRENT MONTH AMOUNTS SCHEDULED COST | CURRENT MONTH AMOUNTS OVER/UNDER SCHED.COST | YEAR-TO-DATE AMOUNTS ACTUAL COST | YEAR-TO-DATE AMOUNTS SCHEDULED COST | YEAR-TO-DATE AMOUNTS OVER/UNDER SCHED.COST |
|---|---|---|---|---|---|---|---|
| 6100 | SALARIES | | | | | | |
| 6110 | WAGES | | | | 31,534 | | 31,534 |
| 6300 | CONTRACT LABOR & MTL | 170 | 230 | 60- | 28,814 | 2,760 | 26,054 |
| 6400 | ORDINARY SUPPLIES | | 3,400 | 3,400- | 251 | 40,000 | 40,549- |
| 6410 | MAINTENANCE SUPPLIES | | 55 | 55 | 4,275 | 660 | 3,615 |
| 6650 | RENTALS | | | | 1,225 | | 1,225 |
| 6960 | WAGE FRINGES | | | | 13,162 | | 13,162 |
| | DEPARTMENT TOTALS | 170 | | 3,515-* | | 44,220 | * |
| | YARDS & GROUNDS | | 3,685 | | 79,261 | | 35,041 |

CONSTRUCTION IN PROCESS DATE 31-Dec-90

| Project Description | Project Number | Spending Prior to 1/1/90 | Spending Current Year | Spending Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over (Under) Budget |
|---|---|---|---|---|---|---|---|---|
| Gen Plt-Refrig Comp | 9003 | | 91,837 | 91,837 | | 40,000 | | |
| Reactor-Unit 4-Diph | 9004 | | 31,851 | 31,851 | 9 000 | 40,000 | | |
| Grace-Water Sys/Trac | 9006 | | 16,252 | 16,252 | 6,800 | 23 000 | | |
| Gen Plt-Utility Trns | 9007 | | | | 65 000 | 65,000 | | |
| Custom Mfg Unit/Ph 1 | 9009 | | | | 80 000 | 80,000 | | |
| Sub Total | | | 139 939 | 139 939 | 160,800 | 248,000 | | |
| DCA-Engineering | 1-1799 | | 372 354 | 372,354 | | | | |
| DCA-Lab Equipment | 2-1799 | | 3 405 | 3 405 | | | | |
| DCA-Equipment | 3-1799 | 123.025 | 542,492 | 665 517 | | | | |
| DCA-Ofc Bldg | 4-1799 | | 324 598 | 324 598 | | | | |
| DCA-Plt Sal/Wages | 5-1799 | 52 | (52) | | | | | |
| DCA-Site Prep | 6-1799 | | 48 805 | 48,805 | | | | |
| DCA-Structural | 7-1799 | | 409,086 | 409,086 | | | | |
| DCA-Equip Installati | 8-1799 | | 17 467 | 17,467 | | | | |
| DCA-Piping | 9-1799 | | 339 323 | 339,323 | | | | |
| DCA-Intr & Contrls | 10-1799 | | 71,485 | 71 485 | | | | |
| DCA-Elec | 11-1799 | | 11,920 | 11,920 | | | | |
| DCA-Painting | 12-1799 | | 52,260 | 52,260 | | | | |
| DCA-Concrete | 13-1799 | | 138,548 | 138 548 | | | | |
| DCA-Painting | 14-1799 | | 16,889 | 16,889 | | | | |
| DCA-Freight | 15-1799 | | 25,884 | 25,884 | | | | |
| DCA-Equip Repair | 16-1799 | | 197,861 | 197,861 | | | | |
| DCA-Crane Rental | 17-1799 | | 39,500 | 39,500 | | | | |
| DCA-Waste Handling | 18-1799 | | 19 860 | 19 860 | | | | |
| DCA-Equipment Reloc | 19-1799 | | 149,157 | 149,157 | | | | |
| DCA-Storage Tanks | 20-1799 | | 59,247 | 59,247 | | | | |
| DCA-Lab Expansion | 21-1799 | 2 715 | 111,112 | 113,827 | | | | |
| DCA-Warehouse | 22-1799 | | 96,809 | 96 809 | | | | |
| DCA- | 23-1799 | | | | | | | |
| DCA-Capitalized Int | 24-1799 | | 141,830 | 141,830 | | | | |
| Sub Total-DCA Plant | | 125,792 | 3 189,842 | 3 315,634 | 2,984 366 | 6 000 000 | | |
| TOTAL C I P | | 125,792 | 3,329,781 | 3 455,573 | 3,145,166 | 6 248,000 | | |

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[redacted] CEDAR [redacted] CHEMICAL [redacted] ATION [redacted] ION [redacted] West [redacted] [redacted] Page 2 of 2 Fax [redacted] Hanna [redacted] Otc [redacted]

COMPLETED PROJECTS DATE 31-Dec-90

| Project Description | Project Number | Spending: Prior to 1/1/90 | Spending: Current Year | Spending: Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over (Under) Budget |
|---|---|---|---|---|---|---|---|---|
| Grace Project (Int) | 8805 | 142,613 | 29 | 142,642 | | | | |
| Grace Project | XX-1798 | 3,007 406 | 197,189 | 3,204,595 | | 3,000 000 | | |
| Propanil Bld Tank | 9001 | | 33 067 | 33,067 | | | | |
| Gen Plt-Phone Sys | 9002 | | 4,214 | 4,214 | | | | |
| P Acid Storage Tank | 9005 | | 21,534 | 21,534 | | | | |
| HTPO Plant Mod | 9008 | | 201 224 | 201,224 | | | | |
| Sub Total Completed | | 3 150 019 | 457,257 | 3 607 276 | | 3,000,000 | | |
| Total CIP & Completed Proj | | 3 275,811 | 3,787,038 | 7,062 849 | 3,145,166 | 9,248 000 | | |

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AB0000078448/85

CEDAR [redacted] AL [redacted] ION
SUMMARY OF FIXED ASSETS
COST

DATE 31-Dec-90

LOCATION West Helena

| | BALANCE 1/1/90 | ADDITIONS | RETIREMENTS | TRANSFER TO (FROM )CIP | TRANSFER <TO> FM OTHER PLANTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND | 67,260 00 | | | | | | 67,260 00 |
| LAND IMPROVEMENTS | 802,716 55 | | | | | | 802,716 55 |
| BUILDINGS | 327,595 70 | | | | | | 327,595 70 |
| MACHINERY & EQUIPMENT | 10,010,713 91 | | | 3,603,061 66 | | | 13,613 775 57 |
| TRANSPORATION EQUIPMENT | | | | | | | |
| OFFICE EQUIPMENT | 77,419 56 | | | 4 214 24 | | | 81 633 80 |
| CIP | 3,275,812 00 | 3,787,036 92 | | -3,607,275 90 | | | 3 455 573 02 |
| TOTAL COST | 14 561,517 72 | 3,787,036 92 | | 0 00 | | | 18 348,554 64 |

CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
ACCUMULATED DEPRECIATION

DATE 31-Dec-90

LOCATION West Helena

| | BALANCE 1/1/90 | CURRENT YEAR DEPRECIATION | RETIREMENTS | | TRANSFER <TO> FM OTHER PLANTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| LAND IMPROVEMENTS | 508,929 03 | 3,895 20 | | | | | 512,824 23 |
| BUILDINGS | 238,998 79 | 40,847 76 | | | | | 279,846 55 |
| MACHINERY & EQUIPMENT | 7 317,044 24 | 643,239 70 | | | | | 7,960,283 94 |
| TRANSPORTATION EQUIPMENT | | | | | | | |
| OFFICE EQUIPMENT | 40,537 22 | 15,229 19 | | | | | 55,766 41 |
| TOTAL ACCUMULATED DEPRECIATION | 8 105 509 28 | 703,211 85 | | | | | 8,808,721 13 |

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CEDAR CHEMICAL CORPORATION

DATE 12/31/90 SUMMARY INVENTORY PAGE 1

FINISHED GOODS VALUE REPORT CEDAR - WEST HELENA STNVRF

| | PRODUCT GROUP DESCRIPTION | WH # | UNIT | QTY ON HAND | UNIT COST | EXTENDED VALUE | |
|---|---|---|---|---|---|---|---|
| | WHAM | 04 | GAL | 745 | 8.90 | 6,690.10 | |
| | WHAM | 10 | GAL | 9,100 | 8.98 | 81,718.00 | |
| | WHAM | 39 | GAL | 23,445 | 8.98 | 210,536.10 | |
| TOTAL | WHAM | | | 33,290 | 8.98 | 298,944.20 | * |
| | PROPANIL TECH | 04 | GAL | 34,160 | 1.44 | 49,190.40 | |
| TOTAL | PROPANIL TECH | | | 34,160 | 1.44 | 49,190.40 | * |
| | PROPANIL 3# | 04 | GAL | 54,055 | 7.77 | 420,007.35 | |
| | PROPANIL 3# | 84 | GAL | 1,057 | 7.77 | 8,213.89 | |
| TOTAL | PROPANIL 3# | | | 55,112 | 7.77 | 428,220.24 | * |
| | PROPANIL 4# | 04 | GAL | 10,130 | 8.71 | 88,220.45 | |
| | PROPANIL 4# | 15 | GAL | 4,795 | 9.34 | 44,785.30 | |
| TOTAL | PROPANIL 4# | | | 14,925 | 8.91 | 133,005.75 | * |
| | FLAKED TECH | 04 | LBS | 195,745 | 1.66 | 300,349.98 | |
| | FLAKED TECH | 10 | LBS | 72,406 | 1.66 | 120,326.76 | |
| | FLAKED TECH | 51 | LBS | 1,500 | 1.66 | 2,490.00 | |
| TOTAL | FLAKED TECH | | | 259,739 | 1.66 | 431,164.74 | * |
| | 60 DF | 51 | LBS | 13,792 | 1.65 | 22,768.35 | |
| TOTAL | 60 DF | | | 13,792 | 1.65 | 22,768.35 | * |
| | PROPANEX-4 | 84 | GAL | 78,015 | 13.37 | 1,043,060.55 | |
| TOTAL | PROPANEX-4 | | | 78,015 | 13.37 | 1,043,060.55 | * |
| | BUTOXONE | 10 | GAL | 2,448 | 10.83 | 26,511.84 | |
| | BUTOXONE | 11 | GAL | 2,160 | 10.83 | 23,392.80 | |
| | BUTOXONE | 15 | GAL | 2,796 | 10.83 | 30,280.68 | |
| | BUTOXONE | 20 | GAL | 6,924 | 10.83 | 74,984.92 | |
| | BUTOXONE | 30 | GAL | 4,444 | 10.83 | 48,345.12 | |
| TOTAL | BUTOXONE | | | 18,772 | 10.83 | 203,517.36 | * |
| | BUTOXONE ESTER | 15 | GAL | 2,160 | 10.36 | 22,377.60 | |
| | BUTOXONE ESTER | 55 | GAL | 8,630 | 10.36 | 89,406.80 | |
| TOTAL | BUTOXONE ESTER | | | 10,790 | 10.36 | 111,784.40 | * |
| | BUTOXONE AMINE | 11 | GAL | 1,440 | 12.04 | 17,337.60 | |
| | BUTOXONE AMINE | 30 | GAL | 2,016 | 12.04 | 24,272.64 | |
| | BUTOXONE AMINE | 55 | GAL | 4,348 | 12.04 | 52,349.92 | |
| | BUTOXONE AMINE | 57 | GAL | 6,320 | 12.04 | 76,109.12 | |
| TOTAL | BUTOXONE AMINE | | | 14,152 | 12.04 | 170,149.28 | * |
| | TOTAL FINISHED GOODS | | | | | 2,891,807.27 | ** |

CEDAR CHEMICAL CORPORATION

DATE 12/31/90 SUMMARY INVENTORY PAGE 2

RAW MATERIALS VALUE REPORT CEDAR WEST DEFENSE SINVRP

| PRODUCT GROUP DESCRIPTION | WH # | UNIT | QTY ON HAND | UNIT COST | EXTENDED VALUE |
|---|---|---|---|---|---|
| DCA | 04 | LBS | 845,718 | 1.70 | 1,471,040.40 |
| PROPIONIC ACID | 04 | LBS | 48,[illegible] | .29 | 14,104.77 |
| PROPIONIC ANHYDRIDE | 04 | LBS | 16,[illegible]26 | .87 | 14,607.30 |
| MESITYL OXIDE | 04 | LBS | 143,610 | .57 | 81,857.70 |
| ISOPHORONE | 04 | LBS | 84,742 | .67 | 56,527.23 |
| EMULSIFIER | 04 | LBS | 95,[illegible]17 | .74 | 70,055.91 |
| TENNECO 500/100 | 04 | LBS | 34,[illegible]03 | .29 | 10,034.87 |
| GLYCERINE 96% | 04 | LB | 12,170 | .76 | 9,256.04 |
| ALFONIC 1412S | 04 | LBS | 5,542 | .65 | 3,602.30 |
| SULFURIC ACID 98% | 04 | LBS | 100 | .07 | 7.00 |
| CAUSTIC 50% | 04 | LBS | 46,000 | .09 | 4,320.00 |
| VEEGUM | 04 | LBS | 997 | 1.74 | 1,734.78 |
| DRUMS---55 GAL-4# PROPANIL | 04 | EACH | 710 | 21.75 | 15,442.50 |
| DRUMS-55 GAL | 04 | EACH | 25 | 25.80 | 645.00 |
| SODIUM HYPOCHLORITE | 04 | LBS | 7[illegible],500 | .06 | 4,410.00 |
| CAUSTIC 30% | 04 | LBS | 18,[illegible]63 | .06 | 1,120.98 |
| HYDROXI AMINE SULFATE | 04 | LBS | 4,290 | 1.00 | 4,290.00 |
| MORWET D-425 POWDER | 10 | LBS | 64,[illegible]32 | .77 | 49,689.64 |
| POLYFON O | 10 | LB | 1,880 | .54 | 1,015.20 |
| GLYCERINE 96% | 10 | LB | 16,700 | .76 | 12,692.00 |
| ALFONIC 1412S | 10 | LBS | 21,[illegible]17 | .65 | 13,687.05 |
| KELZAN | 10 | LBS | 75 | 5.46 | 409.50 |
| VEEGUM | 10 | LBS | 1,817 | 1.74 | 3,161.58 |
| JUGS-5 GAL WHAM UNIPACK | 10 | EACH | 1,[illegible]72 | 2.55 | 3,498.60 |
| 2,4 D-B ACID | 57 | LBS | 203,042 | 4.95 | 1,009,052.55 |
| 60% DMA SOLUTION | 57 | LBS | 4,715 | .32 | 1,508.80 |
| CITRIC ACID | 57 | LBS | 1,[illegible]54 | .80 | 1,015.52 |
| TOTAL RAW MATERIALS | | | | | 2,858,067.42 ** |

TOTAL INVENTORY CEDAR WEST HELENA 5,750,674.69 **

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CEDAR - WEST HELENA
PLANT INCOME STATMENT COMPARISON TO BUDGET
FOR YEAR TO DATE PERIOD ENDING DECEMBER 31 1990

( .000 )

| | Propanil | | | Butoxone | | | Strel | | | ICI | | | Orfom | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Actual | Plan | Diff | Actual | Plan | Diff | Actual | Plan | Diff | Actual | Plan | Diff | Actual | Plan | Diff |
| Net Sales | 16 156 | 10 783 | 5 374 | 1 552 | 2 246 | (694) | 3,606 | 3 656 | (50) | 1 200 | 1 100 | 100 | 229 | 240 | (11) |
| Cost of Sales | 12,776 | 8,975 | 3,801 | 1 113 | 1 850 | (737) | 3,369 | 3,271 | 97 | 620 | 378 | 242 | 340 | 96 | 244 |
| Gross Margin | 3,381 | 1,808 | 1,573 | 439 | 396 | 43 | 238 | 385 | (147) | 579 | 722 | (143) | (111) | 144 | (255) |

| | MTPO | | | Grace | | | Dupont-MBC | | | Sectagon II | | | Dupont CNT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Actual | Plan | Diff | Actual | Plan | Diff | Actual | Plan | Diff | Actual | Plan | Diff | Actual | Plan | Diff |
| Net Sales | 879 | 1,005 | (126) | 2,615 | 2,580 | 35 | 820 | 810 | 10 | 537 | 480 | 57 | 590 | 270 | 320 |
| Cost of Sales | 403 | 764 | (361) | 2,368 | 2,012 | 356 | 636 | 577 | 60 | 505 | 388 | 118 | 426 | 229 | 197 |
| Gross Margin | 476 | 241 | 235 | 246 | 568 | (322) | 184 | 233 | (50) | 32 | 92 | (61) | 164 | 41 | 123 |

| | B F Goodrich | | | MES | | | | | | Idle Plant & Other | | | Total Plant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Actual | Plan | Diff | Actual | Plan | Diff | Actual | Plan | Diff | Actual | Plan | Diff | Actual | Plan | Diff |
| Net Sales | 70 | 1 000 | (930) | 259 | 375 | (116) | | | | 12 | | 12 | 28,526 | 24 545 | 3,980 |
| Cost of Sales | 66 | 523 | (457) | 289 | 322 | (33) | | | | 205 | 130 | 74 | 23,116 | 19,514 | 3 602 |
| Gross Margin | 4 | 477 | (473) | (30) | 53 | (83) | | | | (193) | (130) | (63) | 5,410 | 5,031 | 379 |

[redacted] SOLD [redacted] BUDGETED

CEDAR WEST HELENA
UNITS SOLD VS BUDGETED
AS OF 12/31/90

| | TECH # | | | FLAKED TECH | | | 50 WDG | | | 80 DF | | | WHAM | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) |
| JAN | | | | | | | | | | | | | | 9.070 | 9,070 |
| FEB | | | | | 30.000 | 30,000 | | | | | | | 50.000 | 4 320 | -45 680 |
| MAR | | | | | | | 200.000 | 48,000 | -152,000 | | | | 50,000 | 12,020 | -37,980 |
| APR | | 40 204 | 40,204 | | | | | 24,000 | 24,000 | | 169,160 | 169,160 | 50,000 | 3,840 | -46,160 |
| MAY | | | | | 12.000 | 12 000 | | 23 720 | 23,720 | | 80 992 | 80,992 | | 22,960 | 22 960 |
| JUN | | | | | 46 000 | 46 000 | | | | | | | | 14,260 | 14 260 |
| JUL | | | | | | | | | | | 7 499 | 7 499 | | 3,205 | 3,205 |
| AUG | | | | | 15 028 | 15 028 | | | | | | | | | |
| SEP | | 448,060 | 448 060 | | 30,000 | 30 000 | | | | | | | | | |
| OCT | | 613,460 | 613,460 | | | | | | | | | | | 4 520 | 4 520 |
| NOV | | 492,460 | 492,460 | | | | | | | | | | | 16,640 | 16,640 |
| DEC | | 324,220 | 324,220 | | 20 230 | 20 230 | | | | | | | | | |
| TOTAL | | 1,918,404 | 1 918,404 | | 162,258 | 162 258 | 200,000 | 95,720 | -104,280 | | 257,641 | 257,641 | 150,000 | 90,836 | -59,165 |

| | 4# GAL | | | STREL GAL | | | 3# GAL | | | BUTOXONE 175 | | | BUTOXONE 200 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) |
| JAN | | | | 100.000 | | -100 000 | 26,000 | 66 578 | 41,578 | | | | | | |
| FEB | 70.000 | 8.960 | -61 040 | 100 000 | 100,625 | 625 | 26,000 | 793 | -24,207 | | 380 | 380 | | | |
| MAR | 30 000 | 58 910 | -21 090 | 65,000 | 56 875 | -8,125 | 26,000 | 11 883 | -13,117 | | 540 | 540 | | | |
| APR | 140 000 | 22,162 | -117,838 | 64,406 | 61,250 | -3 156 | 26 000 | | -26,000 | 30,000 | 16,020 | -13,980 | 10,000 | | -10 000 |
| MAY | 140 000 | 54,149 | -85,851 | | 96,250 | 96 250 | 26,000 | 38,990 | 13,990 | 30 000 | 23 904 | -6,096 | 10,000 | 844 | -9,156 |
| JUN | 70 000 | 35 818 | -34 182 | | 14 420 | 14,420 | 26,000 | 82,061 | 57,061 | 30,000 | 21 744 | -8,256 | | 2,574 | 2,574 |
| JUL | | 875 | 875 | | | | 26,000 | 1,849 | -23,151 | 10,000 | 11,520 | 1,520 | | 4,736 | 4 736 |
| AUG | | 4,620 | 4,620 | | | | 26 000 | 3,804 | -21,196 | | 1,296 | 1 296 | | | |
| SEP | | | | | | | 26,000 | 94,627 | 69,627 | | | | | | |
| OCT | | 70 | 70 | | | | 26,000 | 33 818 | 8 818 | | 288 | 288 | | | |
| NOV | | 118,825 | 118,825 | | | | 26,000 | 7,820 | -17 180 | | 1,342 | 1,342 | | | |
| DEC | | 86,765 | 86,765 | | | | 26,000 | 86,125 | 60,125 | | | | | | |
| TOTAL | 500 000 | 391,154 | -108,846 | 329,406 | 329 420 | 14 | 300,000 | 427,348 | 127 348 | 100 000 | 77,014 | -22,986 | 20 000 | 8,154 | -11,846 |

| | BUTOXONE ESTER | | | ICIA | | | ORFOM | | | GRACE | | | DUPONT MBC | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) |
| JAN | | 12,960 | 12,960 | | | | | 116,080 | 116,080 | | | | | | |
| FEB | | | | | 221,199 | 221,199 | | | | 152 000 | 117 320 | -34 680 | 139 689 | | -139 689 |
| MAR | | 1,440 | 1 440 | 224,847 | 223,277 | -1 570 | | | | 224,000 | 74 253 | -149,747 | 140,000 | | -140,000 |
| APR | 10,000 | 180 | -9,820 | 225,000 | 291,101 | 66,101 | | | | 250 000 | 65,586 | -184 414 | 140,000 | | -140,000 |
| MAY | 10 000 | | -10,000 | 225,000 | 287,385 | 62,385 | | | | 250,000 | -49 796 | -299,796 | | | |
| JUN | | | | | | | | | | | 32 658 | 32 658 | | | |
| JUL | | | | | | | | 238 260 | 238 260 | 50,000 | 129 319 | 79 319 | | | |
| AUG | | | | | | | | 197 280 | 197 280 | 100,000 | 53 112 | -46,888 | | | |
| SEP | | | | | | | | 241,450 | 241,450 | 250,000 | 113,647 | -136 353 | | | |
| OCT | | | | | | | 600,000 | | -600,000 | 289,000 | 100,805 | -188,195 | | 73 590 | 73 590 |
| NOV | | | | | | | 600,000 | | -600,000 | 289,000 | 96,560 | -192,440 | | 86,240 | 86 240 |
| DEC | | | | | | | | | | 289,000 | 41 276 | -247,724 | | 125 610 | 125 610 |
| TOTAL | 20,000 | 14,580 | -5,420 | 674,847 | 1 022,962 | 348,115 | 1,200,000 | 793,070 | -406,930 | 2,143,000 | 774,740 | -1,368 260 | 419,689 | 285,340 | -134,349 |



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[redacted]SOLL[redacted]UDGE[redacted]

| | SECTAGON II | | | DUPONT CTN | | | MTPO | | | MES | | | XYZ(COBRA) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) | BUD | ACT | OV(UN) |
| JAN | | | | | 924,800 | 924,800 | | | | 153,000 | 48,770 | -104,230 | | | |
| FEB | 184 616 | 174,531 | -10 085 | | | | | | | | 19,140 | 19 140 | | | |
| MAR | 184,615 | | -184,615 | | | | | | | | 147 670 | 147,670 | | | |
| APR | | | | 94,210 | | -94 210 | | | | | 56 620 | 56,620 | | | |
| MAY | | | | 95,000 | 254,930 | 159 930 | | | | | | | | | |
| JUN | | | | 95,000 | 240,070 | 145,070 | 68 367 | | -68,367 | | | | | | |
| JUL | | | | | | | 68,367 | | -68 367 | | | | | | |
| AUG | | 258,672 | 258,672 | | | | 68 368 | | -68 368 | | | | 160 000 | | -160 000 |
| SEP | | | | | 325,400 | 325,400 | | 17,845 | 17,845 | 153 000 | | -153 000 | 160,000 | | -160 000 |
| OCT | | | | | | | | 109,345 | 108 345 | 161 317 | | -161,317 | 180,000 | | -180,000 |
| NOV | | -6 909 | -6 909 | | | | | 22 610 | 22,610 | | | | | | |
| DEC | | | | | | | | | | | | | | | |
| TOTAL | 369,231 | 426,794 | 56,563 | 284,210 | 1,145,200 | 860 990 | 205,102 | 148,800 | -56,302 | 457 317 | 272,100 | 185,217 | 500 000 | | -500 000 |

| | Propanex 4# | | | |
|---|---|---|---|---|
| | BUD | ACT | OV(UN) | |
| JAN | | | | |
| FEB | | | | |
| MAR | | | | |
| APR | | | | |
| MAY | | | | |
| JUN | | | | |
| JUL | | | | |
| AUG | | | | |
| SEP | | | | |
| OCT | | | | |
| NOV | | 42 816 | 42,816 | Transferred from Mphs |
| DEC | | 9,450 | 9,450 | |
| TOTAL | | 52 266 | 52 266 | |



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CEDAR-WEST HELENA
TOTAL PLANT EXPENSES COMPARISON TO BUDGET
FOR YEAR TO DATE PERIOD ENDING Dec-90

| | Current Month | | | Year To Date | | | 12 Month | % To |
|---|---|---|---|---|---|---|---|---|
| | Actual | Budget | Ov (Un) | Actual | Budget | Ov (Un) | Average | Total |
| SALARIES | 84 000 | 61,685 | 22 315 | 885,280 | 857 669 | 27,611 | 73 773 | 12 369% |
| WAGES | 133 474 | 75 412 | 58 062 | 1,472 972 | 1,338,165 | 134,807 | 122 748 | 20 564% |
| HOLIDAY & VAC PAY | 1 841 | 10.201 | (8.360) | 106 996 | 115 380 | (8 385) | 8 916 | 1 494% |
| SICK & ALLOWED PAY | 1,403 | 938 | 465 | 9 229 | 11 256 | (2 027) | 769 | 0 129% |
| OTHER (CALL-OUT) | 230 | 405 | (175) | 5 312 | 4 860 | 452 | 443 | 0 074% |
| PAYROLL TAXES | 16 903 | 19,866 | (2 963) | 226 631 | 233.758 | (8 127) | 18 803 | 3 160% |
| GROUP INSURANCE | 18 468 | 19,950 | (1 482) | 222,951 | 223.300 | (349) | 18 579 | 3 113% |
| WORKMAN'S COMP | -3,225 | 5,000 | (8,225) | 37,939 | 61,600 | (24,261) | 3 112 | 0 521% |
| PENSION PLAN COST | -39 970 | 25 776 | (65 746) | 202 769 | 309 312 | (106 543) | 16 897 | 2 831% |
| EMPLOYMENT EXPENSE | | | 0 | 29,290 | | 29,290 | 2,441 | 0 409% |
| MEDICAL EXAMS | 136 | 650 | (514) | 16 073 | 7 800 | 8 273 | 1,339 | 0 224% |
| BLOOD TEST | | 270 | (270) | 2,028 | 2 160 | (132) | 169 | 0 028% |
| TOTAL SAL WGS. & FRGS | 213,260 | 220,153 | (6 893) | 3,215,869 | 3,185,260 | 60,609 | 267,989 | 44 897% |
| SAFETY SUPPLIES | 6 786 | 4 000 | 2,786 | 81 280 | 48,525 | 32,755 | 6 773 | 1 135% |
| CONTR LABOR | 9,643 | 2 718 | 6,925 | 488,979 | 40 649 | 448,330 | 40 748 | 6 827% |
| NATURAL GAS | 19 083 | 12 485 | 6,598 | 171,780 | 159.781 | 11,999 | 14,315 | 2 398% |
| ELECTRICITY | 46 731 | 21 750 | 24 981 | 485 217 | 391,185 | 94,032 | 40 435 | 6 774% |
| WATER | 2,190 | 2,140 | 50 | 24,623 | 44,605 | (19 982) | 2 052 | 0 344% |
| COMMUNICATIONS | 2,672 | 3,200 | (528) | 38 775 | 38 400 | 375 | 3 231 | 0 541% |
| AUTO EXPENSE | | 230 | (230) | -397 | 2 760 | (3 157) | -33 | -0 006% |
| TRAVEL | 8 996 | 2,410 | 4,586 | 41 994 | 28,920 | 13,074 | 3,500 | 0 588% |
| MEALS & ENTERN | 560 | 765 | (205) | 8 686 | 9,180 | (494) | 724 | 0 121% |
| SUPPLIES | 26 053 | 16,827 | 9,226 | 206 878 | 210 945 | (4 067) | 17 240 | 2 888% |
| MAINTENANCE SUPPLIES | 31,451 | 21,108 | 10,343 | 836 374 | 359,426 | 476 948 | 69 698 | 11 677% |
| MAINTENANCE TOOLS | | 275 | (275) | 4 592 | 3,300 | 1 292 | 383 | 0 064% |
| EXPENDABLE ITEMS | 6 219 | 2,400 | 3,819 | 49,416 | 28,800 | 20 616 | 4,118 | 0 690% |
| MISC | 3 896 | 100 | 8,796 | 17 988 | 1,200 | 16 788 | 1 499 | 0 251% |
| NITROGEN | 5,987 | 9,290 | (3 303) | 70,685 | 130,540 | (59 855) | 5,890 | 0 987% |
| WASTE DISPOSAL COST | | 10 | (10) | 20 226 | 5,520 | 14 705 | 1 685 | 0 282% |
| CONTR FORM | | | 0 | 263 820 | 257,100 | 6 720 | 21 985 | 3 683% |
| INS-PLANT | -36 803 | 8,285 | (45,088) | 209,641 | 184 897 | 24,744 | 17,470 | 2 927% |
| DUES &SUBCR | | 100 | (100) | 1 715 | 1,200 | 515 | 143 | 0 024% |
| FEES & TUITION | 2,067 | 2,015 | 52 | 24,605 | 24,180 | 425 | 2,050 | 0 344% |
| PROFESSIONAL FEES | 3,362 | | 3,362 | 67,735 | | 67,735 | 5,645 | 0 946% |
| RENTALS | 1,255 | 1,624 | (369) | 37 212 | 19,696 | 17 516 | 3,101 | 0 520% |
| LEASE ITEMS | 3,963 | 1,000 | 2,963 | 23,667 | 12,000 | 11,667 | 1,972 | 0 330% |
| FREIGHT IN | 5 354 | 675 | 4,679 | 12,587 | 8,100 | 4,487 | 1 049 | 0 176% |
| PROPERTY TAXES | 4,626 | 5,975 | (1,349) | 55,698 | 91 230 | (35,532) | 4,642 | 0 778% |
| SUB TOTAL | 372,251 | 341,535 | 30,716 | 6,459,642 | 5 267,399 | 1,192,243 | 538,304 | 90 183% |
| DEPR & AMORT | 82,870 | 68,687 | 14,183 | 703,205 | 824,244 | (121,039) | 58 600 | 9 817% |
| TOTAL COST | 455,121 | 410 222 | 44 899 | 7,162,847 | 6,091 643 | 1 071,204 | 596,904 | 100 000% |
| LESS CONTRACT FORM | 0 | 0 | 0 | 263,820 | 257,100 | 6 720 | 21,985 | |
| TOTAL PLANT OPERATING COST | 455,121 | 410,222 | 44,899 | 6,899,027 | 5,834 543 | 1 064,484 | 574 919 | |



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CEDAR - WEST HELENA
PLANT COST SUMMARY
AS OF 12/31/90

| NO | MONTH | YEAR | M COST | YTD COST | YTD AVG | MONTHLY MAN HRS | Y-T-D MAN HRS | MONTHLY COST PER M HRS | Y-T-D COST PER M HRS | MONTHLY PLT HRS | Y-T-D PLT HRS | MONTHLY COST PER PLT HRS | Y-T-D COST PER PLT HRS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | JAN | 1990 | 506,476 | 506,476 | 506,476 | 9 260 | 9 260 | 54 76 | 54 76 | 744 | 744 | 680 75 | 680 76 |
| 2 | FEB | 1990 | 616,987 | 967,490 | 483,745 | 11,881 | 21 131 | 51 93 | 45 79 | 672 | 1,416 | 918 14 | 683 26 |
| 3 | MAR | 1990 | 569,594 | 1,693,164 | 564,388 | 11,960 | 33,091 | 47 62 | 51 17 | 744 | 2,160 | 765 68 | 783 87 |
| 4 | APR | 1990 | 543,037 | 2 236,266 | 559 064 | 9 452 | 42,543 | 57 45 | 52 56 | 720 | 2 880 | 754 22 | 776 48 |
| 5 | MAY | 1990 | 636 564 | 2 872 899 | 574,580 | 12,489 | 55,032 | 50 97 | 52 20 | 744 | 3,624 | 856 60 | 792 74 |
| 6 | JUN | 1990 | 624,094 | 3,516,070 | 585,846 | 9,262 | 64 294 | 67 38 | 54 67 | 720 | 4,344 | 866 80 | 809 18 |
| 7 | JUL | 1990 | 516 939 | 4 092 079 | 576 011 | 11 060 | 75 354 | 46 74 | 53 51 | 744 | 5 088 | 694 81 | 742 47 |
| 8 | AUG | 1990 | 595 456 | 4 627 606 | 578 461 | 9 933 | 85 287 | 59 96 | 54 26 | 744 | 5 832 | 800 34 | 793 49 |
| 9 | SEP | 1990 | 580 660 | 5 208,339 | 578 704 | 9,965 | 95 252 | 58 27 | 54 68 | 720 | 6,552 | 806 47 | 794 92 |
| 10 | OCT | 1990 | 637,270 | 5,845,676 | 584,568 | 10 912 | 106 164 | 58 40 | 55 06 | 744 | 7 296 | 856 55 | 801 22 |
| 11 | NOV | 1990 | 598,076 | 6 443 833 | 585 803 | 9,702 | 115,866 | 61 64 | 55 61 | 720 | 8,016 | 830 66 | 803 87 |
| 12 | DEC | 1990 | 455,121 | 6,899 027 | 574,919 | 10,573 | 126,439 | 43 04 | 54 56 | 744 | 8 760 | 611 72 | 787 66 |
| | | | | | | | | | | | | | |
| 12 | DEC | 1989 | 267,592 | 5,063,143 | 421,929 | 9 153 | 103,679 | 29 24 | 48 83 | 744 | 8,760 | 359 67 | 577 98 |
| 12 | DEC | 1988 | 503 482 | 4 971 519 | 414,293 | 7 824 | 110,133 | 64 35 | 45 14 | 744 | 8,784 | 676 72 | 565 97 |
| 12 | DEC | 1987 | 403,203 | 4,592,296 | 382,691 | 9,734 | 117 023 | 41 42 | 39 24 | 744 | 8,760 | 541 94 | 524 23 |
| 12 | DEC | 1986 | 414 716 | 4,374,137 | 364,511 | 9 283 | 111,154 | 44 67 | 39 35 | 744 | 8,784 | 557 41 | 497 97 |
| 12 | DEC | 1985 | 207 128 | 4,604,654 | 383,721 | 9,227 | 123,743 | 22 45 | 37 21 | 744 | 8,760 | 278 40 | 525 65 |

[redacted] [redacted] C[redacted]ME D[redacted]S CO[redacted]SONS[redacted]TING[redacted] [redacted]2-31 [redacted] [redacted] [redacted]ris [redacted] D W[redacted] [redacted]

J Forthman B Tucker
R Ray J Walker
G Satterfield G Pearce

| WEEK NO | 1986 BY WK $ | 1986 Y-T-D $ | 1986 Y-T-D Avg | 1987 BY WK $ | 1987 Y-T-D $ | 1987 Y-T-D Avg | 1988 BY WK $ | 1988 Y-T-D $ | 1988 Y-T-D Avg | 1989 BY WK $ | 1989 Y-T-D $ | 1989 Y-T-D Avg | 1990 BY WK $ | 1990 Y-T-D $ | 1990 Y-T-D Avg | Gross | OT/GP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9,733 | 9 733 | 9,733 | 7,714 | 7 714 | 7 714 | 6,716 | 6,716 | 6,716 | 6 872 | 6 872 | 6 872 | 6 411 | 6 411 | 6,411 | 28 137 | 22 8% |
| 2 | 5 770 | 15 503 | 7,752 | 6,388 | 14,102 | 7 051 | 3 527 | 10,243 | 5,122 | 7,998 | 14 870 | 7,435 | 6 686 | 13,097 | 6,549 | 27,659 | 24 2% |
| 3 | 4,171 | 19 674 | 6,558 | 5 197 | 19,299 | 6 433 | 3 848 | 14 091 | 4,697 | 4,367 | 19,237 | 6 412 | 6,773 | 19 870 | 6,623 | 26,548 | 25 5% |
| 4 | 3,452 | 23,126 | 5,782 | 7,181 | 26 480 | 6,620 | 5,418 | 19,509 | 4,877 | 4 072 | 23,300 | 5 827 | 6 979 | 26,849 | 6,712 | 29 588 | 23 6% |
| 5 | 3 733 | 26,859 | 5,372 | 6,434 | 32,914 | 6,583 | 6,745 | 26 254 | 5,251 | 4,431 | 27,740 | 5 548 | 7 204 | 34,053 | 6,811 | 29 175 | 24 7% |
| 6 | 3,713 | 30 572 | 5 095 | 6 699 | 39,613 | 6,686 | 5 979 | 32,233 | 5,372 | 4,106 | 31 846 | 5 308 | 7,327 | 41,380 | 6 897 | 29,066 | 25 2% |
| 7 | 3 968 | 34 540 | 4 934 | 5 390 | 44 903 | 6 415 | 7 330 | 39 563 | 5 652 | 4 312 | 36 158 | 5 165 | 8,424 | 49 804 | 7 115 | 30 227 | 27 9% |
| 8 | 3,495 | 38,036 | 4,754 | 5 789 | 50,692 | 6 337 | 8 090 | 47,653 | 5 957 | 4 814 | 40 972 | 5,122 | 9,577 | 59,381 | 7 423 | 32,407 | 29 6% |
| 9 | 4 178 | 42,213 | 4 690 | 4 883 | 55,575 | 6,175 | 7,982 | 55,635 | 6,182 | 3,882 | 44,854 | 4 984 | 10 930 | 70,311 | 7 812 | 33 531 | 32 6% |
| 10 | 2 506 | 44 719 | 4,472 | 6,209 | 61,784 | 6.178 | 6,518 | 62 153 | 6,215 | 3 799 | 48,653 | 4,865 | 10 052 | 80 363 | 8,036 | 32,377 | 31 0% |
| 11 | 3,515 | 48 234 | 4,385 | 5,310 | 67,094 | 6,099 | 3,312 | 65 465 | 5 951 | 2 376 | 51,029 | 4,639 | 10 476 | 90,839 | 8 258 | 32,555 | 32 2% |
| 12 | 3,168 | 51,402 | 4,284 | 4,290 | 71,384 | 5 949 | 4,754 | 70 219 | 5 852 | 3 440 | 54,469 | 4,539 | 9 721 | 100,560 | 8,380 | 32,119 | 30 3% |
| 13 | 2,863 | 54,266 | 4,174 | 3,960 | 75,344 | 5,796 | 5 663 | 75,882 | 5,837 | 4,726 | 59,195 | 4,553 | 10 054 | 110 614 | 8 509 | 32,320 | 31 1% |
| 14 | 4,417 | 58 682 | 4,192 | 4,454 | 79,798 | 5,700 | 5 149 | 81 031 | 5,788 | 2 530 | 61,725 | 4 409 | 7 567 | 118,181 | 8,442 | 29,453 | 25 7% |
| 15 | 3,152 | 61,834 | 4,122 | 4,022 | 83 820 | 5 588 | 4,305 | 85 336 | 5 689 | 2 829 | 64,554 | 4 304 | 11 490 | 129,671 | 8 645 | 34 948 | 32 9% |
| 16 | 6 509 | 68,343 | 4,271 | 5,426 | 89,246 | 5 578 | 3,999 | 89 335 | 5,583 | 4 263 | 68,807 | 4,300 | 10 574 | 140 245 | 8 765 | 34,097 | 31 0% |
| 17 | 3,458 | 71,801 | 4 224 | 8,135 | 97,381 | 5,728 | 4,110 | 93,445 | 5,497 | 3,154 | 71,961 | 4,233 | 6 906 | 147,151 | 8,656 | 29 987 | 23 0% |
| 18 | 2,477 | 74 278 | 4,127 | 4,321 | 101,702 | 5,650 | 3,356 | 96,801 | 5,378 | 2,362 | 74,323 | 4,129 | 6 078 | 153 229 | 8,513 | 29,472 | 20 6% |
| 19 | 2 949 | 77 227 | 4,065 | 4,249 | 105 951 | 5,576 | 2,921 | 99 722 | 5,249 | 2,552 | 76,875 | 4,046 | 5,849 | 159 078 | 8 373 | 29 388 | 19 9% |
| 20 | 3,447 | 80 674 | 4 034 | 3,799 | 109,750 | 5,488 | 2,765 | 102,487 | 5 124 | 2,635 | 79,510 | 3,976 | 4 638 | 163,716 | 8,186 | 28,209 | 16 4% |
| 21 | 3 021 | 83,695 | 3 986 | 3 532 | 113,282 | 5 394 | 1,959 | 104,446 | 4 974 | 2,940 | 82,450 | 3 926 | 10 397 | 174 113 | 8,291 | 34,283 | 30 3% |
| 22 | 3,045 | 86,740 | 3,943 | 3 383 | 116,665 | 5 303 | 1,442 | 105,888 | 4,813 | 2,407 | 84 857 | 3,857 | 7 745 | 181 858 | 8,266 | 31,799 | 24 4% |
| 23 | 5 478 | 92 218 | 4 009 | 4 012 | 120,677 | 5 247 | 1 714 | 107,602 | 4 678 | 3 033 | 87,890 | 3,821 | 9,383 | 191,241 | 8,315 | 34 503 | 27 2% |
| 24 | 3,870 | 96 088 | 4,004 | 2,755 | 123,432 | 5 143 | 290 | 107,892 | 4,496 | 2,336 | 90,226 | 3,759 | 4,687 | 195,928 | 8,164 | 27,791 | 16 9% |
| 25 | 2,151 | 98 239 | 3,930 | 3,347 | 126,779 | 5,071 | 1,586 | 109 478 | 4,379 | 2,577 | 92,803 | 3 712 | 4,117 | 200 045 | 8 002 | 27 071 | 15 2% |
| 26 | 2 512 | 100 751 | 3,875 | 3,912 | 130,691 | 5 027 | 1,705 | 111 183 | 4,276 | 2,859 | 95,662 | 3,679 | 5 992 | 206,037 | 7 925 | 29 569 | 20 3% |
| 27 | 2 627 | 103 378 | 3,829 | 3,153 | 133,844 | 4,957 | 2,591 | 113 774 | 4,214 | 4,067 | 99 729 | 3 694 | 3 622 | 209,659 | 7 765 | 27 007 | 13 4% |
| 28 | 4 877 | 108,255 | 3,866 | 3,382 | 137,226 | 4 901 | 5,877 | 119,651 | 4 273 | 2,945 | 102,674 | 3,667 | 4 071 | 213 730 | 7,633 | 27,793 | 14 6% |
| 29 | 3 235 | 111 490 | 3 844 | 3,959 | 141,185 | 4 868 | 1,781 | 121,432 | 4,187 | 2,750 | 105,424 | 3 635 | 5 320 | 219,050 | 7 553 | 28 280 | 18 8% |
| 30 | 2 399 | 113,889 | 3,796 | 3 421 | 144,606 | 4 820 | 2 258 | 123 690 | 4,123 | 4 568 | 109,992 | 3 666 | 8,220 | 227 270 | 7,576 | 31,608 | 26 0% |
| 31 | 1,560 | 115,449 | 3,724 | 2,408 | 147,014 | 4,742 | 851 | 124,541 | 4 017 | 6,039 | 116,031 | 3 743 | 6 768 | 234 038 | 7 550 | 30 493 | 22 2% |
| 32 | 2 811 | 118 260 | 3,696 | 1,438 | 148,452 | 4,639 | 2,607 | 127,148 | 3,973 | 8,070 | 124,101 | 3,878 | 7,424 | 241,462 | 7,546 | 30,985 | 24 0% |
| 33 | 2,443 | 120,703 | 3,658 | 1,202 | 149,654 | 4,535 | 2,458 | 129,606 | 3,927 | 3,986 | 128,087 | 3,881 | 6 899 | 248,361 | 7 526 | 30,661 | 22 5% |
| 34 | 2 623 | 123 326 | 3,627 | 969 | 150,623 | 4,430 | 2 128 | 131,734 | 3,875 | 3,921 | 132,008 | 3,883 | 6,650 | 255,011 | 7,500 | 30,184 | 22 0% |
| 35 | 3 117 | 126,443 | 3,613 | 1,021 | 151,644 | 4,333 | 1,647 | 133,381 | 3,811 | 6,041 | 138,049 | 3,944 | 9,801 | 264,812 | 7 560 | 33,353 | 28 8% |
| 36 | 2,972 | 129,415 | 3,595 | 700 | 152,344 | 4,232 | 1 114 | 134 495 | 3,736 | 5,807 | 143,856 | 3,996 | 7,720 | 272 332 | 7 565 | 31,493 | 24 5% |
| 37 | 2,256 | 131,671 | 3,559 | 748 | 153,092 | 4,138 | 2,867 | 137,362 | 3 712 | 9,064 | 152,920 | 4,133 | 10,168 | 282,500 | 7 635 | 34,411 | 29 5% |
| 38 | 1,725 | 133,396 | 3,510 | 597 | 153,689 | 4,044 | 2,938 | 140,300 | 3,692 | 3 123 | 156,043 | 4,106 | 9 965 | 292,465 | 7,696 | 34,080 | 29 2% |
| 39 | 2 506 | 135 902 | 3 485 | 336 | 154 025 | 3 949 | 1 575 | 141,875 | 3 638 | 2,778 | 158 821 | 4,072 | 11,502 | 303,967 | 7 794 | 35 474 | 32 4% |
| 40 | 2 510 | 138,412 | 3 460 | 575 | 154 600 | 3,865 | 2,056 | 143,931 | 3 598 | 5,376 | 164,197 | 4 105 | 10 788 | 314 755 | 7 869 | 35,614 | 30 3% |
| 41 | 2 592 | 141,004 | 3,439 | 327 | 154 927 | 3,779 | 1,996 | 145 927 | 3,559 | 4 529 | 168,726 | 4 115 | 9 688 | 324 443 | 7 913 | 34,774 | 27 9% |
| 42 | 2,636 | 143,640 | 3,420 | 2 765 | 157,692 | 3 755 | 2,089 | 148,016 | 3,524 | 3 269 | 171,995 | 4,095 | 11,922 | 336,365 | 8,009 | 36 930 | 32 3% |
| 43 | 2,571 | 146,211 | 3 400 | 3,822 | 161 514 | 3 756 | 2 092 | 150,108 | 3 491 | 4 312 | 176,307 | 4 100 | 9,841 | 346 206 | 8 051 | 35 253 | 27 9% |
| 44 | 3,610 | 149,821 | 3,405. | 1,975 | 163,489 | 3,716 | 2 058 | 152,166 | 3 458 | 4,417 | 180 724 | 4,107 | 10,106 | 356,312 | 8,098 | 35,760 | 28 3% |
| 45 | 7,521 | 157,342 | 3,496 | 1,038 | 164,527 | 3,656 | 1,732 | 153,898 | 3,420 | 5,082 | 185,806 | 4,129 | 10,430 | 366,742 | 8 150 | 36,016 | 29 0% |
| 46 | 5,210 | 162,552 | 3,534 | 1,073 | 165,600 | 3,600 | 2,149 | 156,047 | 3,392 | 4,169 | 189,975 | 4,130 | 10,242 | 376,984 | 8,195 | 35,662 | 28 7% |
| 47 | 4 854 | 167 406 | 3 562 | 1 255 | 166 855 | 3 550 | 1 362 | 157,409 | 3 349 | 3,736 | 193 711 | 4 122 | 7 488 | 384 472 | 8,180 | 32,880 | 22 8% |
| 48 | 4,553 | 171,959 | 3,582 | 1,135 | 167 990 | 3,500 | 4,055 | 161,464 | 3,364 | 4 278 | 197,989 | 4 125 | 9,203 | 393 675 | 8 202 | 35,432 | 26 0% |
| 49 | 8,226 | 180,185 | 3,677 | 1,291 | 169 281 | 3,455 | 1,724 | 163,188 | 3,330 | 4,578 | 202 567 | 4,134 | 8,944 | 402 619 | 8,217 | 34 088 | 26 2% |
| 50 | 6,325 | 186,510 | 3,730 | 3,667 | 172,948 | 3,459 | 4,407 | 167,595 | 3,352 | 6,604 | 209,171 | 4,183 | 10,426 | 413,045 | 8,261 | 36,404 | 28 6% |
| 51 | 5 807 | 192,317 | 3,771 | 5,112 | 178,060 | 3,491 | 8,592 | 176,187 | 3,455 | 5,597 | 214,768 | 4,211 | 9,975 | 423,020 | 8,295 | 35,514 | 28 1% |
| 52 | 5,975 | 198,292 | 3,813 | 5,071 | 183,131 | 3,522 | 5,745 | 181 932 | 3,499 | 4,220 | 218,988 | 4,211 | 9,080 | 432,100 | 8,310 | 34,526 | 26 3% |
| Y-T-D | 198,292 | | | 183,131 | | | 181 932 | | | 218 988 | | | 432,100 | | | 1 660,901 | 26 0% |

CEDAR WEST HELENA
PROPANIL PRODUCTION AND USAGE
AS OF Dec-90

CC J Miles, C Parker, R Johns, R Fairchild; G Satterfield, J Porter, B Oberle, J Walker; T Loduca, K Howard

**FINISH GOODS MFG**

| | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Y-T-D ## | or Gal | Std |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Propanil** | Tech | 267,120 | 637 700 | 414,660 | 887,798 | 623,090 | 416 700 | | 116,960 | 491 166 | 601 900 | 609 195 | 1,094 748 | 6 063,037 | | |
| | DCA | 225 930 | 446 051 | 303 580 | 710 610 | 347 610 | 298,000 | | 94 230 | 368 450 | 468 630 | 439 800 | 831 645 | 4 530,436 | 0 7476 | 0 7600 |
| | P Acid | 111,315 | 201,350 | 131,086 | 294,661 | 149,340 | 126,810 | | 42 740 | 151,290 | 179,601 | 213,110 | 385 776 | 1 987 079 | 0 3277 | 0 3600 |
| | P Anhy | 12 621 | 34,179 | 14,592 | 46 480 | 21,545 | 17,865 | | 5,470 | 20 625 | 34,641 | 19 687 | 60 682 | 298 337 | 0 0492 | 0 0600 |
| **3# Bulk** | | 48 996 | | | | 32,772 | 102,367 | | 21,919 | 16 738 | 67 | -427 | 59 816 | 282 247 | | |
| | P Tech | 153,420 | | | | 82 800 | 333 120 | | 72 027 | 42 320 | | | 184 050 | 867 737 | 3 0744 | 3 2000 |
| | Isoph | 89,324 | | | | 66 216 | 166 590 | | 54,765 | 9,331 | | | 109 005 | 516,221 | 1 8264 | 1 6200 |
| | Tenn 500 | 132,318 | | | | 80 074 | 299,710 | | 83,781 | 81,103 | | -2,838 | 171,642 | 795,690 | 2 8191 | 3 0800 |
| | Emul | 42 975 | | | | 30,120 | 91,950 | | 15 870 | 15 050 | | | 60 300 | 256 265 | 0 9079 | 0 8500 |
| **4# Bulk** | | 16 701 | 53,586 | 24,198 | 98 297 | 22 099 | 14 266 | 159 | | | | 11 944 | 87 406 | 318 655 | | |
| | P Tech | 70 850 | 214 350 | 108 900 | 363 244 | 93 570 | 42 660 | | | | | 47 690 | 359 670 | 1 290,934 | 4 0512 | 4 2000 |
| | Isoph | 13 300 | 25 630 | 20,567 | 88 697 | 27,214 | 8,060 | | | | | 37 324 | 65,837 | 286,619 | 0 8995 | 0 7000 |
| | M O | 89,332 | 141,361 | 86,894 | 279 229 | 64,560 | 48,858 | | | | | 45,057 | 266,798 | 1 022,089 | 3 2076 | 3 0400 |
| | Emul | 24 865 | 38 600 | 23,370 | 72,030 | 18 600 | 9,140 | | | | | 1 461 | 83 372 | 271,338 | 0 8515 | 0 8990 |
| **Strel Bulk** | | | 102,647 | 55,613 | 79,798 | 82,435 | 9,661 | | | | | | | 329 954 | | |
| | P Tech | | 423,350 | 221,160 | 329,780 | 336,730 | 42 920 | | | | | | | 1 353 960 | 4 1035 | 4 3000 |
| | Isoph | | 410,385 | 219,214 | 334,740 | 285 357 | 41,900 | | | | | | | 1,291,596 | 3 9145 | 3 8480 |
| | Emul | | 90,100 | 50,790 | 80 190 | 67,260 | 9 490 | | | | | | | 297 830 | 0 9026 | 0 8990 |
| **Flaked Tech** | | 40 500 | | 91,500 | 160 000 | | | | 14 369 | 9,500 | | 79,335 | 192 648 | 577,852 | | |
| | P Tech | 42,850 | | 84 580 | 164,570 | 19,990 | | | 14 369 | 9,500 | | 79 335 | 192,648 | 597 842 | 1 0346 | 1 0000 |
| **Wham** | | 30 720 | 10,116 | | 24 960 | 40,315 | | | | | | | | 106 110 | | |
| | Wham-Rew | 1,665 | | | | | | | | | | | | | | |
| | F Tech | 138,284 | 20,155 | | 163 914 | 91,078 | | | | | | | | 413 431 | 3 8962 | 4 1500 |
| | Morwet D-4 | 16,368 | 2,800 | | 19,450 | 9,418 | | | | | | | | 47 036 | 0 4433 | 0 4850 |
| | Polyion O | 397 | 95 | | 725 | 375 | | | | | | | | 2 092 | 0 0197 | 0 0194 |
| | Glycerine 9 | 9 388 | 1,089 | | 9,690 | 6 387 | | | | | | | | 24 554 | 0 2314 | 0 2425 |
| | Atlonic 141 | 10,365 | 3 640 | | 14,000 | 8,703 | | | | | | | | 36 608 | 0 3450 | 0 3380 |
| | Kelzan | 152 | 36 | | 326 | 177 | | | | | | | | 689 | 0 0065 | 0 0049 |
| | Veegum | 3,600 | 342 | | 6,702 | 1,899 | | | | | | | | 12 683 | 0 1195 | 0 0873 |
| **60 DF** | | | | | | | | | | | | | | 27,446 | | |
| | F Tech | | | | 162,744 | 10 285 | | | | | | | | 173 029 | 0 6374 | 0 6000 |
| | Other rlm | | | | | | | | | | | | | 0 | 0 0000 | |

**FINISH GOODS PKG (Number Containers )**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | S# 20L | | | | | | | | | | | | | 0 |
| | 3# 200L | 1,322 | -75 | -72 | 91 | 331 | 1 838 | | | 266 | | 64 | 1 132 | 4,897 |
| | 3# 55 | | 72 | 72 | | 194 | | | 792 | | -60 | | | 1,080 |
| | 4# 35 | 795 | 1,531 | 14 | 2,204 | | | 68 | -278 | | -4 | | 2,595 | 6,915 |
| | 4# 55 | | | | 20 | 150 | 148 | | | | | | | 318 |
| | Strel 35 | | 2,875 | 1 641 | 1,941 | 2 666 | 289 | | | | | | | 9,412 |
| | Wham 6 | 6 144 | 2,023 | | 4,992 | 7 958 | | | | | | | | 21,117 |
| | Wham 25 | | | | | 21 | | | | | | | | 21 |
| | 175 gls | | | | | 10 296 | 7,020 | 876 | | | | | | 17 691 |
| | 200 gls | | | | | | | 2 482 | | | | | | 2 482 |
| | Ester gls | | | | | | | | | | | | | 0 |
| | 50 WDG | | 332 | | | | | | | | | | | 332 |





AB0000078448/96

CEDAR WEST HELENA
PROPANIL PRODUCTION AND USAGE
AS OF 12/31/90

| FINISH GOODS MFG | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | Total | #/# or Gal | 1990 Std |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Propanil Tech | | 4,179,501 | 5,144,490 | 4,530,387 | 6,063,937 | | | | | | | | 19,917,415 | | |
| DCA | | 3,065,239 | 3,903,756 | 3,333,129 | 4,532,436 | | | | | | | | 14,834,560 | 0.7448 | 0.7500 |
| P. Acid | | 1,420,267 | 1,805,945 | 1,504,849 | 1,987,079 | | | | | | | | 6,718,240 | 0.3373 | 0.3600 |
| P. Anhy | | 206,789 | 264,243 | 190,044 | 298,337 | | | | | | | | 979,413 | 0.0492 | 0.0600 |
| 3# Bulk | | 167,806 | 225,391 | 245,334 | 282,247 | | | | | | | | 920,778 | | |
| P. Tech | | 526,941 | 705,147 | 760,060 | 867,737 | | | | | | | | 2,859,885 | 3.1059 | 3.2000 |
| M. O. | | 526,841 | 59,712 | | | | | | | | | | 586,553 | 0.6371 | |
| Isoph | | 138,643 | 371,892 | 421,424 | 515,221 | | | | | | | | 1,446,380 | 1.5708 | 1.5200 |
| Tenn 500 | | 258,758 | 516,453 | 689,358 | 795,680 | | | | | | | | 2,262,252 | 2.4569 | 3.0800 |
| Amul | | 73,454 | 136,599 | 84,347 | | | | | | | | | 294,400 | 0.3197 | |
| Emul | | 67,358 | 19,842 | 149,790 | 256,265 | | | | | | | | 493,247 | 0.5036 | 0.8600 |
| MIBK | | 286,840 | | | | | | | | | | | 286,640 | 0.3113 | |
| Xylene | | 72,155 | | | | | | | | | | | 72,155 | 0.0784 | |
| 4# Bulk | | 490,804 | 383,676 | 424,432 | 318,655 | | | | | | | | 1,616,767 | | |
| Blend | | | 134,145 | 9,900 | | | | | | | | | 144,045 | 0.0891 | |
| P. Tech | | 2,852,042 | 1,607,681 | 1,681,614 | 1,280,934 | | | | | | | | 6,632,471 | 4.1023 | 4.2000 |
| 3# bulk | | | | 74,102 | | | | | | | | | 74,102 | 0.0458 | |
| Isoph | | 1,053,165 | 449,911 | 324,965 | 286,819 | | | | | | | | 2,914,668 | 1.8028 | 0.7000 |
| M. O. | | 35,827 | 1,113,866 | 1,266,263 | 1,022,089 | | | | | | | | 3,428,245 | 2.1204 | 3.0450 |
| Emul | | 458,861 | 386,071 | 369,855 | 271,338 | | | | | | | | 1,486,125 | 0.9192 | 0.8990 |
| Steel Bulk | | 316,435 | 304,045 | 363,720 | 329,954 | | | | | | | | 1,314,154 | | |
| P. Tech | | 1,337,748 | 1,304,972 | 1,524,290 | 1,353,960 | | | | | | | | 5,520,970 | 4.2012 | 4.3000 |
| Isoph | | 1,241,083 | 1,178,817 | 1,474,153 | 1,291,596 | | | | | | | | 5,176,829 | 3.9393 | 3.8450 |
| Emul | | 291,869 | 290,416 | 310,437 | 297,880 | | | | | | | | 1,190,621 | 0.9068 | 0.8990 |
| P. Blend | | 110,570 | 220,005 | | | | | | | | | | 330,575 | | |
| P. Tech | | 65,350 | 113,830 | | | | | | | | | | 179,180 | 0.5420 | 0.8180 |
| Isoph | | 45,200 | | | | | | | | | | | 45,200 | 0.1367 | |
| M. O. | | | 86,802 | | | | | | | | | | 86,802 | 0.2629 | 0.3500 |
| Flaked Tech | | | 126,357 | 545,818 | 577,852 | | | | | | | | 1,249,827 | | |
| P. Tech | | | 128,380 | 536,555 | 597,842 | | | | | | | | 1,262,777 | 1.0104 | 1.0000 |
| Wham | | | | 92,603 | 106,110 | | | | | | | | 198,713 | | |
| F Tech | | | | 373,542 | 413,431 | | | | | | | | 786,973 | 3.9603 | 4.1500 |
| Morwet D-425 | | | | 42,026 | 47,036 | | | | | | | | 89,061 | 0.4482 | 0.4650 |
| Polyton O | | | | 1,600 | 2,092 | | | | | | | | 3,692 | 0.0196 | 0.0194 |
| Glycerine 95% | | | | 21,056 | 24,554 | | | | | | | | 45,610 | 0.2295 | 0.2425 |
| Atlonic 1412S | | | | 34,831 | 36,608 | | | | | | | | 71,239 | 0.3585 | 0.3380 |
| Kelzan | | | | 724 | 689 | | | | | | | | 1,413 | 0.0071 | 0.0049 |
| Veegum | | | | 8,640 | 12,683 | | | | | | | | 21,323 | 0.1073 | 0.0873 |
| 60 DF | | | | | 271,440 | | | | | | | | 271,440 | | |
| F Tech | | | | | 173,028 | | | | | | | | 173,028 | 0.6374 | 0.6000 |
| FINISH GOODS PKG (Number Containers) | | | | | | | | | | | | | | | |
| 3# 20L | | | | 20,476 | | | | | | | | | 20,476 | | |
| 3# 200L | | 2,457 | 3,163 | 2,225 | 4,897 | | | | | | | | 12,742 | | |
| 3# 55 | | 872 | 949 | 352 | 1,080 | | | | | | | | 3,053 | | |
| 4# 35 | | 10,849 | 9,288 | 8,113 | 6,916 | | | | | | | | 35,165 | | |
| 4# 55 | | 213 | | 144 | 313 | | | | | | | | 670 | | |
| Steel 35 | | 9,041 | 8,684 | 10,392 | 9,412 | | | | | | | | 37,529 | | |
| Blend 55 | | 219 | 445 | | | | | | | | | | 664 | | |
| Wham 5 | | | | 16,896 | 21,117 | | | | | | | | 38,113 | | |
| Wham 25 | | | | | 21 | | | | | | | | 21 | | |
| 175 gls | | | | 35,800 | 17,691 | | | | | | | | 53,491 | | |
| 200 gls | | | | 17,614 | 2,482 | | | | | | | | 20,096 | | |
| Ester gls | | | | 19,890 | | | | | | | | | 19,890 | | |
| 50 WDG | | | | 2,392 | 332 | | | | | | | | 2,724 | | |

CEDAR-WEST HELENA
NITROGEN CONSUMTION
MONTH DEC YEAR 1990

CC John Miles, Charlie Parker, Richard Johns, Robert Ray, Gene Pearce; Tom Lodice, Ken Howard, Joe Porter, Joel Walker, Joe Forthman

83%

| READINGS | Date | Propanil | Perm | Grace #1 | Grace #2 | Diphone C | Check | Total |
|---|---|---|---|---|---|---|---|---|
| Meter Reading | 11/20/90 | 7 451,078 | 7,104,206 | 2,883,187 | 7,389,050 | 3,132,101 | | 27 959 622 |
| Meter Reading | 12/21/90 | 7,507,733 | 7,166,346 | 2 960,756 | 7,389,050 | 3,269 482 | | 28 283,367 |
| C/F Meter Consumtion | | 56,655 | 62 140 | 77,569 | 0 | 137,381 | 323,745 | 323,745 |
| % Meter Consumtion | | 0 17499884 | 0 16105268 | 0 23959907 | 0 | 0 42434941 1 | | |

| | Gauge | Date | Cu Ft | Cost | Dollars | check |
|---|---|---|---|---|---|---|
| Inventory | 145 | 11/20/90 | 463,000 | 0 00476734 | 2 202 65 | |
| Purchases for the period | | | 3,642 460 | 0 00476734 | 16,852 70 | |
| Inventory | 63 | 12/21/90 | 249,160 | 0 00476734 | 1 185 34 | |
| Total Cu Ft Cons | | | 3,756,300 | 0 00476734 | 17,870 01 | 17,870 01 |

| DISTRIBUTION | FACT | T C F | BY PROD | Cost/ c f | T Cost | JV09-12-27 | Check |
|---|---|---|---|---|---|---|---|
| Propanil | 0 174999 | 3,756,300 | 657,348 | 0 00476734 | 3,127 23 | C164-6470 | |
| Idle Plant | 0 161053 | 3,756,300 | 604,962 | 0 00476734 | 2,878 01 | C199-6470 | |
| ICI | | 3 756,300 | 0 | 0 00476734 | 0 00 | S768-1230 | |
| DuPont-Chlor | | 3 756 300 | 0 | 0 00476734 | 0 00 | S774-1230 | |
| MTPO | | 3 756,300 | 0 | 0 00476734 | 0 00 | C175-6470 | |
| Dupont-MBC | 0 424349 | 3,756,300 | 1 593,984 | 0 00476734 | 7,583 13 | S789-1230 | |
| Grace | 0 239599 | 3 756,300 | 900,006 | 0 00476734 | 4,281 64 | S787-1230 | |
| Sectagon | | 3,756,300 | 0 | 0 00476734 | 0 00 | C185-6470 | |
| B F Goodrich | | 3,756,300 | 0 | 0 00476734 | 0 00 | S776-1230 | |
| TOTALS | 1 | 3,756,300 | 3,756,300 | 0 00476734 | (17,870 01) | S799-1460 | 17 870 01 |

| PURCHASES Date | RR No | Wt | Fact | Cu Ft | Cost pcf | $ | Inv No | check |
|---|---|---|---|---|---|---|---|---|
| 11/21/90 | 3401 | 23,480 | 13 8 | 324,024 | 0 004234 | 1,371 92 | | |
| 11/25/90 | 3407 | 25,540 | 13 8 | 352,452 | 0 004234 | 1,492 28 | | |
| 11/27/90 | 3410 | 26,220 | 13 8 | 348,036 | 0 004234 | 1,473 68 | | |
| 12/1/90 | 3418 | 39,860 | 13 8 | 550,068 | 0 004234 | 2,328 99 | | |
| 12/6/90 | 3427 | 34,580 | 13 8 | 477,204 | 0 004234 | 2,020 48 | | |
| 12/8/90 | 3440 | 25,380 | 13 8 | 350,244 | 0 004234 | 1,482 93 | | |
| 12/11/90 | 3449 | 33,080 | 13 8 | 456,504 | 0 004234 | 1,932 84 | | |
| 12/14/90 | 3457 | 23,800 | 13 8 | 328,440 | 0 004234 | 1,390 61 | | |
| 12/18/90 | 3467 | 25,760 | 13 8 | 355,488 | 0 004234 | 1,505 14 | | |
| | | | 13 8 | 0 | 0 004234 | 0 00 | | |
| | | | 13 8 | 0 | 0 004234 | 0 00 | | |
| | | | 13 8 | 0 | 0 004234 | 0 00 | | |
| | | | 13 8 | 0 | 0 004234 | 0 00 | | |
| | | | 13 8 | 0 | 0 004234 | 0 00 | | |
| | | | 13 8 | 0 | 0 004234 | 0 00 | | |
| | | | 13 8 | 0 | 0 004234 | 0 00 | | |
| Totals | | 256,700 | 13 8 | 3,642,460 | 0 004234 | 14,998 78 | | 14,998 78 |

| Total cost of nitrogen Purchases for the mo | |
|---|---|
| Nitrogen | 14,998 78 |
| Tank | 900 00 |
| S Tax | 953 93 |
| Total | 16,852 70 |
| T Cons | 3,642,460 |
| T Cost | 0 00475734 |



AB0000078448/98

KFD

CEDAR - WEST HELENA
KEY FINANCIAL DATA

As of 1/1/91

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 9 YEAR AVG |
|---|---|---|---|---|---|---|---|---|---|---|
| Net Sales | | | | | | | | | | |
| Pesticides | 5,632 | 7,211 | 7,410 | 9,450 | 5,731 | 7,209 | 13,209 | 14,892 | 21,814 | 10,229 |
| Contract Mfg | 4,108 | 4,564 | 4,786 | 4,039 | 3,732 | 4,456 | 3,515 | 4,964 | 7,211 | 4,597 |
| Total | 9,740 | 11,775 | 12,196 | 13,489 | 9,463 | 11,665 | 16,724 | 19,856 | 28,525 | 14,826 |
| Gross Margin | | | | | | | | | | |
| Pesticides | 1,047 | 1,172 | 993 | 2,042 | 684 | 801 | 2,472 | 1,744 | 4,066 | 1,669 |
| Contract Mfg | 2,002 | 2,212 | 1,840 | 1,361 | 641 | 618 | 448 | 1,363 | 1,344 | 1,314 |
| Total | 3,049 | 3,384 | 2,833 | 3,403 | 1,325 | 1,419 | 2,920 | 3,107 | 5,410 | 2,983 |
| Plant Operating Profit (Excluding Corp.) | 2,247 | 2,712 | 2,176 | 2,865 | 909 | 931 | 2,158 | 3,107 | 5,410 | 2,983 |
| Assets Employed | | | | | | | | | | |
| Current Assets | 1,156 | 2,466 | 1,623 | 2,406 | 1,122 | 2,771 | 3,076 | 4,744 | 7,090 | 2,939 |
| Fixed Assets | 3,304 | 2,685 | 2,271 | 2,424 | 3,362 | 3,716 | 3,885 | 6,622 | 9,753 | 4,225 |
| Total | 4,460 | 5,151 | 3,894 | 4,830 | 4,484 | 6,487 | 6,961 | 11,366 | 16,843 | 7,164 |
| GM as % of Sales | | | | | | | | | | |
| Pesticides | 18.6% | 16.3% | 13.4% | 21.6% | 11.9% | 11.1% | 18.7% | 11.7% | 19.1% | 16.3% |
| Contract Mfg | 48.7% | 48.5% | 38.4% | 33.7% | 17.2% | 13.9% | 12.7% | 27.5% | 18.6% | 28.6% |
| Profit as % of Assets | 50.4% | 52.6% | 55.9% | 59.3% | 20.3% | 14.4% | 31.0% | 27.3% | 32.1% | 41.6% |
| Full Time Employees | 71 | 73 | 83 | 78 | 74 | 76 | 75 | 81 | 101 | |

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6

CEDAR - WEST HELENA
PLANT NET SALES & ACTIVITY BY YEAR AS OF 1/1/91

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|---|---|---|---|---|---|---|---|---|---|
| Sales By Product | | | | | | | | | |
| Propanil | 1,562 | 1,216 | 2,317 | 4,282 | 2,402 | 4,380 | 8,970 | 8,274 | 14,721 |
| Stam/Stret | 4,070 | 4,422 | 3,838 | 4,281 | 3,329 | 2,829 | 2,887 | 3,738 | 3,964 |
| MSMA | | 827 | 255 | (2) | | | | | |
| CACO | | 747 | 1,000 | 889 | | | | | |
| Butoxone | | | | | | | | 2,012 | 1,552 |
| Wham | | | | | | | 1,352 | 867 | 1,077 |
| Total Pesticides | 5,632 | 7,211 | 7,410 | 9,450 | 5,731 | 7,209 | 13,209 | 14,892 | 21,314 |
| ICI | 1,802 | 2,294 | 2,779 | 2,370 | 2,370 | 2,166 | 2,431 | 1,941 | 1,200 |
| Arco | 2,232 | 2,036 | 1,588 | 1,258 | (3) | | | | |
| SCI | | 177 | 87 | 250 | 313 | 210 | 104 | | |
| Chevron | | | 321 | | | | | | |
| 1st Chemical | | | 9 | | | | | | |
| MTPO | | | | 110 | 548 | 361 | | 499 | 879 |
| Grace | | | | | | | | | 2,615 |
| RP-15 | | | | | 501 | 269 | | | |
| RP-10 | | | | | | 1,275 | | | |
| Orthorn | | | | | | 61 | 171 | 235 | 229 |
| DNOC | | | | | | 29 | | | |
| MES | | | | | | 82 | 125 | 270 | 259 |
| Diphone C | | | | | | | 106 | | |
| Dupont MBC | | | | | | | 140 | 449 | 820 |
| Dupont CNT | | | | | | | | 728 | 590 |
| Sectagon II | | | | | | | 292 | 791 | 537 |
| B F Goodrich | | | | | | | | | 70 |
| Other | 74 | 57 | 2 | 61 | 8 | 3 | 146 | 51 | 12 |
| Total Contract Mfg | 4,108 | 4,564 | 4,786 | 4,039 | 3,732 | 4,456 | 3,515 | 4,964 | 7,211 |
| Total Plant | 9,740 | 11,775 | 12,196 | 13,489 | 9,463 | 11,665 | 16,724 | 19,856 | 28,525 |

CEDAR - WEST HELENA
1990 NITROGEN CONSUMPTION

| MONTH | CEDAR'S | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Propanil | | MES | | SECTAGON | | MTPO | | IDLE PLANT | |
| | MCF | $ | MCF | $ | MCF | $ | MCF | $ | MCF | $ |
| JAN | 300,274 | 1,366.19 | | | | | | | | |
| FEB | 307,205 | 1,420.22 | 127,186 | 587.99 | 450,933 | 2,084.68 | | | | |
| MAR | 342,312 | 1,561.22 | 698,012 | 3,183.51 | 123,179 | 561.80 | | | | |
| APR | 431,090 | 1,935.60 | 858,877 | 3,856.37 | | | | | | |
| MAY | 717,583 | 3,217.94 | | | | | | | 979,801 | 4,393.83 |
| JUN | 802,766 | 3,568.76 | | | | | | | | |
| JUL | 852,459 | 3,873.99 | | | | | | | 937,307 | 4,259.58 |
| AUG | 288,970 | 1,353.39 | | | 1,057,178 | 4,951.28 | | | 162,643 | 761.74 |
| SEP | 308,518 | 1,435.58 | | | 411,934 | 1,916.78 | | | | |
| OCT | 597,925 | 2,749.53 | | | | | 611,304 | 2,811.06 | 573,002 | 2,634.93 |
| NOV | 929,793 | 4,300.30 | | | | | 1,225,404 | 5,667.51 | | |
| DEC | 657,348 | 3,127.23 | | | | | | | 604,962 | 2,878.01 |
| TOTAL | 6,536,243 | 29,909.95 | 1,684,075 | 7,627.87 | 2,043,224 | 9,514.54 | 1,836,708 | 8,478.57 | 3,257,715 | 14,928.09 |

CONTRACT'S

| Dupont-CNT | | Dupont-MBC | | MES | | Orfom | | Grace | | ICI | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MCF | $ | MCF | $ | MCF | $ | MCF | $ | MCF | $ | MCF | $ |
| 855,071 | 3,890.39 | | | 502,184 | 2,284.83 | 260,072 | 1,183.27 | 2,065,041 | 9,395.51 | | |
| | | | | | | | | 1,977,459 | 9,141.85 | 239,092 | 1,105.33 |
| | | | | | | | | 2,327,012 | 10,613.08 | 223,870 | 1,021.03 |
| | | | | | | | | 3,365,816 | 15,112.57 | 268,424 | 1,205.23 |
| 170,400 | 764.14 | | | | | | | 2,667,849 | 11,963.74 | 670,401 | 3,006.35 |
| 2,368,761 | 10,530.50 | | | | | | | 3,317,979 | 14,750.31 | 376,426 | 1,673.43 |
| 415,887 | 1,889.99 | | | | | 323,468 | 1,470.00 | 1,330,012 | 6,044.22 | | |
| | | | | | | 159,629 | 747.62 | 807,958 | 3,784.06 | | |
| 1,132,817 | 5,271.15 | | | | | 211,031 | 981.96 | 568,660 | 2,646.05 | | |
| 152,826 | 702.76 | 654,860 | 3,011.34 | | | | | 605,578 | 2,784.72 | | |
| | | 1,685,681 | 7,796.29 | | | | | 818,125 | 3,783.84 | | |
| | | 1,593,984 | 7,583.13 | | | | | 900,006 | 4,281.64 | | |
| 5,095,762 | 23,048.93 | 3,934,525 | 18,390.76 | 502,184 | 2,284.83 | 954,200 | 4,382.85 | 20,751,495 | 94,301.59 | 1,778,213 | 8,011.37 |

| B F GOODRICH | | CEDAR'S | | CONTRACT'S | | TOTAL | |
|---|---|---|---|---|---|---|---|
| MCF | $ | MCF | $ | MCF | $ | MCF | $ |
| | | 300,274 | 1,366.19 | 3,682,368 | 16,754.00 | 3,982,642 | 18,120.19 |
| | | 885,324 | 4,092.89 | 2,216,551 | 10,247.18 | 3,101,875 | 14,340.07 |
| | | 1,163,503 | 5,306.53 | 2,550,882 | 11,634.11 | 3,714,385 | 16,940.64 |
| | | 1,289,967 | 5,791.97 | 3,634,240 | 16,317.80 | 4,924,207 | 22,109.77 |
| | | 1,697,384 | 7,611.77 | 3,508,650 | 15,734.23 | 5,206,034 | 23,346.00 |
| | | 802,766 | 3,568.76 | 6,063,166 | 26,954.24 | 6,865,932 | 30,523.00 |
| 249,139 | 1,132.21 | 1,789,766 | 8,133.57 | 2,318,506 | 10,536.42 | 4,108,272 | 18,669.99 |
| | | 1,508,791 | 7,066.41 | 967,587 | 4,531.68 | 2,476,378 | 11,598.09 |
| | | 720,452 | 3,352.36 | 1,912,508 | 8,899.16 | 2,632,960 | 12,251.52 |
| | | 1,782,231 | 8,195.52 | 1,413,264 | 6,498.82 | 3,195,495 | 14,694.34 |
| | | 2,155,197 | 9,967.81 | 2,503,806 | 11,580.13 | 4,659,003 | 21,547.94 |
| | | 1,262,310 | 6,005.24 | 2,493,990 | 11,864.77 | 3,756,300 | 17,870.01 |
| 249,139 | 1,132.21 | 15,357,965 | 70,459.02 | 33,265,518 | 151,552.54 | 48,623,483 | 222,011.56 |

Cedar - West Helena
Electricity & Gas Cost & Usage
Year 1990

| | Natural Gas | | | Lab 70-768-660 | | | Boiler 49-353-409 | | | Grp Shop 81-895-094 | | | 39-153-684 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | ELECTRICITY | | |
| | Mcf | $ | $MCF | KWH | $ | $KWH | KWH | $ | $KWH | KWH | $ | $KWH | KWH | $ | $KWH |
| Dec Rev | -4,015 | -12,028.46 | 2 995880 | -1,370 | -68 61 | 0 050080 | | 70 07 | | -1,077 | -53 40 | 0 049582 | -1,368 | -69 23 | 0 050607 |
| Dec | 4,214 | 12,841.83 | 2.999960 | 6,631 | 363.26 | 0.054090 | 58,400 | 3,693 05 | 0 063237 | 4,851 | 271 37 | 0 055941 | 6,657 | 363 60 | 0.054819 |
| Jan | 3,667 | 11,105 37 | 3 036749 | 6,409 | 321 04 | 0 050092 | 104,120 | 5,923 56 | 0 056892 | 4,469 | 233 98 | 0 052474 | 8,552 | 420 91 | 0 049218 |
| Mar | 4,776 | 14,597 46 | 3.043857 | 6,860 | 343 75 | 0 049964 | 110,600 | 6,009 65 | 0 054337 | 4,704 | 246.07 | 0 052311 | 7,321 | 367 74 | 0 050231 |
| Apr | 6,274 | 18,819.97 | 2.999676 | 6,336 | 328.22 | 0.051802 | 84,040 | 5,086.86 | 0 060529 | 3,343 | 189 67 | 0 056736 | 7,337 | 378 76 | 0 051623 |
| May | 4,775 | 14,455.44 | 3 027317 | 5,677 | 540.08 | 0.095135 | 181,240 | 7,420 48 | 0 056541 | 3,662 | 351 56 | 0 096002 | 11 586 | 1,097.16 | 0 094697 |
| Jun | 4,794 | 14,380.45 | 2 999677 | 6,017 | 568.32 | 0.094452 | 84,480 | 5,479 98 | 0 064887 | 6,303 | 594 91 | 0 094385 | | | |
| Jul | 4,046 | 12,250.69 | 3.027852 | 5,780 | 570 49 | 0 098690 | 75,980 | 5,127 02 | 0 067486 | 6,045 | 596 18 | 0 098624 | | | |
| Aug | 3,838 | 11,062.72 | 2 882418 | 6,782 | 656 50 | 0 096800 | 75,480 | 5,047.84 | 0 066877 | 6,669 | 645 71 | 0 096823 | | | |
| Sep | 3,276 | 9,492.59 | 2.897616 | 4,865 | 461 57 | 0 094876 | 81,360 | 5,098.35 | 0.062664 | 4,914 | 466 14 | 0 094860 | 4,560 | 580.44 | 0.127289 |
| Oct | 4,320 | 12,543.98 | 2.903699 | 6,106 | 317.69 | 0.052029 | 107,760 | 5,908 07 | 0.054826 | 4,562 | 246.28 | 0 053985 | 5,600 | 538 62 | 0 095271 |
| Nov | 5,998 | 16,717.01 | 2 787097 | 5,382 | 294.61 | 0 054746 | 70,080 | 4,704.64 | 0 067132 | 3,725 | 214 75 | 0 057651 | 6,480 | 606.87 | 0 093653 |
| Dec | 6,033 | 17,233.20 | 2.856489 | 6,685 | 363 09 | 0.054314 | 76,200 | 5,022 83 | 0.065916 | 4,761 | 268 74 | 0 056446 | 5,920 | 517 66 | 0 087443 |
| Dec Accr | 6,502 | 18,573.00 | 2 856506 | 2,588 | 140 55 | 0.054308 | 27,039 | 1,782 28 | 0.065916 | 1,843 | 104.03 | 0 056446 | 2,101 | 183.69 | 0 087430 |
| Total | 58,488 | 171,785.26 | 2.937102 | 74,688 | 5,190.50 | 0 069514 | 1,086,759 | 66,374.66 | 0 061076 | 58,764 | 4,375 99 | 0.074467 | 64,746 | 4,981.12 | 0 076933 |
| Ck | | | | | | | | | | | | | | | |



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| | Perm 42-657-049 | | | Plant 39-131-284 | | | 61-349-019 DCA Plant | | | Total | | | Ofcs 75-767-973 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | KWH | $ | $KWH | KWH | $ | $KWH | KWH | $ | $KWH | KWH | $ | $KWH | KWH | $ | $KWH |
| Dec Rev | -17,120 | -1,155.57 | 0 067498 | -450 | -561.42 | | | | | -21,385 | -1,638 16 | 0 085956 | | | |
| Dec | 17,120 | 1,247 09 | 0 072844 | 555,800 | 29,899.42 | 0.053795 | | | | 649,359 | 35,827.79 | 0 055174 | | | |
| Jan | 21,760 | 1,523.86 | 0.070030 | 371,000 | 21,418 87 | 0 057733 | | | | 516,300 | 29,842 22 | 0.057800 | 12,960 | 1,093 03 | 0 084339 |
| Mar | 16,480 | 1,171 72 | 0 071100 | 617,400 | 31,316.28 | 0 050723 | 120 | 443 58 | 3 696600 | 763,505 | 39,898 79 | 0 052257 | 8,560 | 847 55 | 0 099013 |
| Apr | 22,000 | 1,510 76 | 0 068671 | 407,400 | 23,424 11 | 0.057497 | 1,280 | 439 96 | 0 343719 | 531,736 | 31,368 34 | 0 058974 | 9,040 | 778 22 | 0.086086 |
| May | 19,000 | 1,386.15 | 0 072955 | 670,600 | 33,805.77 | 0 050411 | 480 | 553 89 | 1 153938 | 842,245 | 45,155.09 | 0 053613 | 5,520 | 634 46 | 0 114938 |
| Jun | 23,240 | 1,701 84 | 0.073229 | 487,200 | 30,083 56 | 0.061748 | 1,600 | 549.31 | 0 343319 | 608,840 | 38,977 90 | 0 064020 | 6,640 | 697 31 | 0.105017 |
| Jul | | | | 574,000 | 37,740 87 | 0 065751 | 2,560 | 556 31 | 0.217309 | 664,345 | 44,590.81 | 0 067120 | 14,080 | 1,208 03 | 0 085798 |
| Aug | | | | 642,600 | 38,294 68 | 0 059593 | 2,680 | 551 89 | 0 205929 | 734,211 | 46,196 62 | 0 061558 | 13,520 | 1,189 33 | 0 087968 |
| Sep | | | | 509,600 | 30,544 69 | 0 059939 | 2,440 | 546 26 | 0 223877 | 607,739 | 37,697 45 | 0 062029 | 17,200 | 1,372 95 | 0 079823 |
| Oct | | | | 645,400 | 32,648.52 | 0 050586 | 3,120 | 436 61 | 0 139938 | 772,548 | 40,090.69 | 0 051894 | 13,520 | 1,166 65 | 0 086283 |
| Nov | | | | 462,000 | 26,018.73 | 0 056318 | 3,240 | 442 41 | 0 136546 | 550,907 | 32,282 01 | 0 058598 | 12,080 | 804 59 | 0.066605 |
| Dec | | | | 626,800 | 32,989.91 | 0 052716 | 6,720 | 591.70 | 0 088051 | 726,086 | 39,753 93 | 0 054761 | 5,600 | 479.30 | 0.085589 |
| Dec Accr | | | | 222,058 | 11,706.01 | 0 052716 | 2,835 | 209.96 | 0 074060 | 258,464 | 14,126 52 | 0 054656 | | | |
| Total | 102,480 | 7,386.85 | 0.072071 | 6,790,408 | 379,330.00 | 0 055863 | 27,075 | 5,321 88 | 0.196561 | 8,204,900 | 472,960.00 | 0.057644 | 118,720 | 10,271 32 | 0.086517 |

Cedar - West Helena
Plant Admin Review

| Year To Date > | | Y-T-D DEC, 31 1987 | 1988 | 1989 | 3Yr Avg | 1990 | Incr(Decr) 1990/3YrAvg |
|---|---|---|---|---|---|---|---|
| DESCRIPTION: | A/C No | | | | | | |
| ADMIN | | | | | | | |
| Salary | 1451-6100 | 278,084.48 | 305,519.59 | 284,495.04 | 289,366.37 | 378,340.97 | 88,974.60 |
| Hol & Vac | 1451-6140 | 12,360.54 | 6,327.95 | | 6,229.50 | | (6,229.50) |
| Sick Pay | 1451-6150 | 1,002.37 | | | 334.12 | | (334.12) |
| Other Pay | 1451-6160 | 452.27 | | | 150.76 | | (150.76) |
| P/R Taxes | 1451-6200 | 38,872.58 | 41,916.34 | 41,891.35 | 40,893.42 | 47,607.02 | 6,713.60 |
| Grp Ins | 1451-6210 | 26,859.84 | 38,881.09 | 23,813.69 | 29,851.54 | 34,038.44 | 4,186.90 |
| W/C Ins | 1451-6220 | 2,935.12 | 9,662.32 | 9,573.47 | 7,390.30 | 6,849.66 | (540.64) |
| Pension Plan | 1451-6230 | 23,392.00 | 30,616.00 | 42,319.41 | 32,109.14 | 43,314.68 | 11,205.54 |
| Employ Exp | 1451-6240 | | | | | 16,025.92 | 16,025.92 |
| O/S Labor & Mat'l | 1451-6300 | 24,640.88 | | 19,875.80 | 14,838.89 | 14,200.71 | (638.18) |
| Elect | 1451-6350 | 9,540.89 | 10,430.63 | 8,120.96 | 9,364.16 | 12,257.72 | 2,893.56 |
| Comm | 1451-6370 | 34,628.34 | 37,445.71 | 40,576.58 | 37,550.21 | 38,775.32 | 1,225.11 |
| Auto Exp | 1451-6380 | | 4,049.97 | 2,437.69 | 2,162.55 | -397.38 | (2,559.93) |
| Travel | 1451-6390 | 9,358.59 | 20,418.03 | 21,727.07 | 17,167.90 | 30,372.30 | 13,204.40 |
| Meals & Entertn | 1451-6395 | 1,985.03 | 4,749.13 | 6,112.79 | 4,282.32 | 7,458.01 | 3,175.69 |
| Sup Ord | 1451-6400 | 16,910.32 | 15,554.69 | 32,527.21 | 21,664.07 | 46,567.84 | 24,903.77 |
| Misc | 1451-6460 | 9,172.39 | 11,885.89 | 3,868.87 | 8,309.05 | 17,986.84 | 9,677.79 |
| Dues & Subscript | 1451-6610 | 1,126.17 | 2,050.88 | 999.54 | 1,392.20 | 1,600.97 | 208.77 |
| Fees & Tuitions | 1451-6620 | 815.43 | 4,612.43 | 3,214.23 | 2,880.70 | 5,942.44 | 3,061.74 |
| Consulting Fees | 1451-6630 | | | | | 43,122.30 | 43,122.30 |
| Rental Items | 1451-6650 | | | 2,299.15 | 766.38 | 5,757.04 | 4,990.66 |
| Other Lease Items | 1451-6660 | 10,744.87 | 9,919.36 | 11,075.04 | 10,579.76 | 23,667.66 | 13,087.90 |
| Courier | 1451-6680 | 1,210.46 | 2,786.70 | 612.35 | 1,536.50 | 172.30 | (1,364.20) |
| Sub-Total | | 504,092.57 | 556,826.71 | 555,540.24 | 538,819.84 | 773,660.76 | 234,840.92 |
| R & D | | | | | | | |
| Salary | 2351-6100 | | 8,850.00 | 53,943.84 | 20,931.28 | 53,100.00 | 32,168.72 |
| Hol & Vac | 2351-6140 | | 190.51 | | 63.50 | | (63.50) |
| P/R Taxes | 2351-6200 | | | | | 4,468.88 | 4,468.88 |
| Employ Exp | 2351-6240 | | | 37,735.68 | 12,578.56 | 13,265.64 | 687.08 |
| O/S Labor & Mat'l | 2351-6300 | | | 5,875.40 | 1,958.47 | 754.68 | (1,203.79) |
| Travel | 2351-6390 | | 871.77 | 2,990.55 | 1,287.44 | 4,109.28 | 2,821.84 |
| Meals & Entertn | 2351-6395 | | 104.00 | 728.00 | 277.33 | 482.38 | 205.05 |
| Sup Ord | 2351-6400 | | | 3,435.26 | 1,145.09 | 2,356.86 | 1,211.77 |
| Dues & Subscript | 2351-6610 | | 115.90 | | 38.63 | 5.00 | (33.63) |
| Fees & Tuitions | 2351-6620 | | 861.14 | 109.00 | 323.38 | 99.00 | (224.38) |
| Sub-Total | | 0.00 | 10,993.32 | 104,817.73 | 38,603.68 | 78,641.72 | 40,038.04 |
| TOTAL ADMIN | | 504,092.57 | 567,820.03 | 660,357.97 | 577,423.52 | 852,302.48 | 274,878.96 |
| MONTHLY AVERAGE | | 42,007.71 | 47,318.34 | 55,029.83 | 48,118.63 | 71,025.21 | 22,906.58 |

Cedar - West Helena
Plant Overhead Review

| Year To Date > | | Y-T-D DEC 31, 1987 | 1988 | 1989 | 3 Yr Avg | 1990 | Incr(Decr) 1990/3YrAvg |
|---|---|---|---|---|---|---|---|
| DESCRIPTION: | A/C No | | | | | | |
| PRODUCTION | | | | | | | |
| Salary | 151-6100 | | 13,883.72 | 5,187.03 | 6,356.92 | 9,686.69 | 3,329.77 |
| Wages | 151-6110 | 228.68 | 928.05 | 11,306.88 | 4,154.54 | 29,798.82 | 25,644.28 |
| Hol & Vac | 151-6140 | | 43,557.06 | 39,852.36 | 27,803.14 | 45,474.49 | 17,671.35 |
| Sick Pay | 151-6150 | | 5,662.54 | 3,827.93 | 3,163.49 | 4,515.26 | 1,351.77 |
| Other Pay | 151-6160 | | 3,005.08 | 2,211.84 | 1,738.97 | 1,860.00 | 121.03 |
| O/S Labor & Mat'l | 151-6300 | 50.55 | 2,140.00 | -289.48 | 633.69 | 158.33 | (475.36) |
| Gas | 151-6350 | | 37,675.67 | 9,021.34 | 15,565.67 | 9,481.37 | (6,084.30) |
| Travel | 151-6390 | | | 32.36 | 10.79 | 64.55 | 53.76 |
| Sup Ord | 151-6400 | 8,837.08 | 2,623.19 | 2,439.05 | 4,633.11 | 3,645.15 | (987.96) |
| Maint Sup | 151-6410 | 1,713.77 | -1,145.92 | 15,063.78 | 5,210.54 | 13,524.84 | 8,314.30 |
| Other Chem | 151-6510 | | 16,175.53 | | 5,391.84 | 32,852.60 | 27,460.76 |
| Rental | 151-6650 | 9,536.75 | 19,810.40 | 16,391.11 | 15,246.09 | 16,560.56 | 1,314.47 |
| Power | 151-6900 | 38,582.41 | 36,005.67 | 42,698.26 | 39,095.45 | 70,537.57 | 31,442.12 |
| Fringes | 151-6960 | 95.51 | 638.61 | 6,772.01 | 2,502.04 | 12,141.64 | 9,639.60 |
| Sub-Total | | 59,044.75 | 180,959.60 | 154,514.47 | 131,506.27 | 250,301.87 | 118,795.60 |
| MAINTENANCE | | | | | | | |
| Salary | 251-6100 | 16,191.02 | 20,443.48 | 25,877.88 | 20,837.46 | 23,314.58 | 2,477.12 |
| Wages | 251-6110 | 78,036.13 | 87,843.03 | 69,068.14 | 78,315.77 | 116,718.51 | 38,402.74 |
| Hol & Vac | 251-6140 | 42,392.89 | 29,624.80 | 21,953.88 | 31,323.86 | 26,389.05 | (4,934.81) |
| Sick Pay | 251-6150 | 454.79 | 2,354.40 | 484.40 | 1,097.86 | 2,235.83 | 1,137.97 |
| Other Pay | 251-6160 | 1,174.63 | 2,625.54 | 2,958.23 | 2,252.80 | 805.94 | (1,446.86) |
| O/S Labor & Mat'l | 251-6300 | 10,371.80 | 5,950.48 | 22,226.41 | 12,849.56 | 80,379.38 | 67,529.82 |
| Travel | 251-6390 | | 89.17 | 1,741.71 | 610.29 | 3,848.58 | 3,238.29 |
| Meals & Entertm | 251-6395 | | | 481.08 | 160.36 | 602.94 | 442.58 |
| Sup Ord | 251-6400 | 5,064.61 | -18,424.30 | 2,526.95 | -3,610.91 | 5,452.13 | 9,063.04 |
| Maint Sup | 251-6410 | 116,080.24 | 152,762.67 | 122,646.65 | 130,496.52 | 232,230.50 | 101,733.98 |
| Maint Tools | 251-6420 | 4,285.44 | 133.46 | 3,736.98 | 2,718.63 | 4,592.93 | 1,874.30 |
| Expandible Items | 251-6430 | 15,556.85 | 24,772.40 | 22,815.34 | 21,048.20 | 49,416.11 | 28,367.91 |
| Other Chem | 251-6510 | 470.74 | | 60.00 | 176.91 | | (176.91) |
| Dues & Subscrpt | 251-6610 | | | 213.06 | 71.02 | 110.75 | 39.73 |
| Fees & Tuition | 251-6620 | 310.22 | 1,641.34 | 1,401.99 | 1,117.85 | 3,696.26 | 2,578.41 |
| Rental | 251-6650 | 792.00 | 10,324.24 | 2,906.08 | 4,674.11 | 7,210.30 | 2,536.19 |
| Power | 251-6900 | 5,238.35 | 6,734.38 | 8,491.32 | 6,821.35 | 8,977.98 | 2,156.63 |
| Fringes | 251-6960 | 31,700.80 | 37,895.93 | 38,573.05 | 36,056.59 | 47,562.15 | 11,505.56 |
| Sub-Total | | 328,120.51 | 364,771.02 | 348,163.15 | 347,018.23 | 613,543.92 | 266,525.69 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| STORES | | | | | | | |
| Wages | 551-6110 | 15,280.95 | 17,958.07 | 18,441.79 | 17,226.94 | 40,407.58 | 23,180.64 |
| Hol & Vac | 551-6140 | 1,886.71 | 4,053.42 | 2,271.43 | 2,737.19 | 3,235.89 | 498.70 |
| Sick Pay | 551-6150 | 134.08 | 290.96 | 83.20 | 169.41 | 156.00 | (13.41) |
| Other Pay | 551-6160 | | 757.58 | 4,304.12 | 1,687.23 | 2,454.40 | 767.17 |
| Sup Ord | 551-6400 | | | 130.26 | 43.42 | 2,558.42 | 2,515.00 |
| Maint Sup | 551-6410 | | | | | 2,562.04 | 2,562.04 |
| Freight | 551-6680 | 2,722.14 | 8,666.36 | 8,312.93 | 6,567.14 | 12,415.82 | 5,848.68 |
| Fringes | 551-6960 | 5,270.56 | 7,911.17 | 10,244.32 | 7,808.68 | 17,999.72 | 10,191.04 |
| Sub-Total | | 25,294.44 | 39,637.56 | 43,788.05 | 36,240.02 | 81,789.87 | 45,549.85 |
| SAFETY | | | | | | | |
| Salary | 751-6100 | 23,419.84 | 29,664.47 | 30,144.00 | 27,742.77 | 31,407.30 | 3,664.53 |
| Wages | 751-6110 | 72,880.88 | 77,383.40 | 86,964.11 | 79,076.13 | 83,810.21 | 4,734.08 |
| Hol & Vac | 751-6140 | 11,621.89 | 9,645.23 | 7,679.04 | 9,648.72 | 8,484.04 | (1,164.68) |
| Sick Pay | 751-6150 | 469.28 | 490.88 | 632.16 | 530.77 | 146.40 | (384.37) |
| Medical Exams | 751-6260 | 16,593.81 | 13,907.65 | 7,997.58 | 12,833.01 | 16,073.24 | 3,240.23 |
| Blood Test | 751-6270 | 69.00 | 850.47 | 330.35 | 416.61 | 221.40 | (195.21) |
| Sup Ord | 751-6280 | 55,249.95 | 44,558.26 | 86,937.21 | 62,248.47 | 81,280.04 | 19,031.57 |
| O/S Lab & Matr'l | 751-6300 | 1,300.00 | -613.50 | 322.00 | 336.17 | 3,015.73 | 2,679.56 |
| Travel | 751-6390 | | | 36.00 | 12.00 | 105.75 | 93.75 |
| Sup Ord | 751-6400 | | | -213.61 | -71.20 | 459.05 | 530.25 |
| Fees & Tuition | 751-6620 | 169.00 | 700.00 | 1,000.00 | 623.00 | 120.00 | (503.00) |
| Power | 751-6900 | 7,396.69 | 6,086.05 | 5,306.41 | 6,263.05 | 3,892.87 | (2,370.18) |
| Fringes | 751-6960 | 32,770.68 | 34,754.08 | 48,913.64 | 38,812.80 | 36,758.20 | (2,054.60) |
| Sub-Total | | 221,941.02 | 217,426.99 | 276,048.89 | 238,472.30 | 265,774.23 | 27,301.93 |
| LAB | | | | | | | |
| Salary | 951-6100 | | 1,314.68 | 1,150.87 | 821.85 | 1,620.30 | 798.45 |
| Wages | 951-6110 | 3,157.80 | 2,118.57 | 2,509.09 | 2,595.15 | 2,643.27 | 48.12 |
| Hol & Vac | 951-6140 | 20,619.74 | 13,005.98 | 14,972.21 | 16,199.31 | 15,931.95 | (267.36) |
| Sick Pay | 951-6150 | 1,705.56 | 222.96 | 857.84 | 928.79 | 394.00 | (534.79) |
| Other Pay | 951-6160 | 531.86 | 148.64 | 67.50 | 249.33 | 78.80 | (170.53) |
| O/S Labor & Mat'l | 951-6300 | 204.75 | | | 68.25 | 2,409.00 | 2,340.75 |
| Travel | 951-6390 | 77.91 | 59.01 | | 45.64 | 2,858.37 | 2,812.73 |
| Meals & Entertm | 951-6395 | | | | | 74.38 | 74.38 |
| Sup Ord | 951-6400 | 26,327.40 | 26,852.80 | 43,333.85 | 32,171.35 | 40,334.22 | 8,162.87 |
| Maint Sup | 951-6410 | 3,887.28 | 1,698.84 | 2,021.65 | 2,535.92 | 2,191.46 | (344.46) |
| Fees & Tuition | 951-6620 | 5.00 | 1,448.00 | 275.82 | 576.27 | 500.00 | (76.27) |
| Rental | 951-6650 | 771.75 | 241.50 | | 337.75 | 34.39 | (303.36) |
| Power | 951-6900 | 6,538.03 | 4,228.52 | 4,529.24 | 5,098.60 | 5,414.09 | 315.49 |
| Fringes | 951-6960 | 1,054.43 | 1,614.58 | 1,557.84 | 1,408.95 | 1,479.02 | 70.07 |
| Sub-Total | | 64,881.51 | 52,954.08 | 71,275.91 | 63,037.17 | 75,963.25 | 12,926.08 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PACKAGING | | | | | | | |
| Salary | 1051-6100 | -117.37 | 289.81 | 77.10 | 83.18 | 1,488.36 | 1,405.18 |
| Wages | 1051-6110 | 19.56 | 139.00 | 381.16 | 179.91 | 2,428.05 | 2,248.14 |
| Hol & Vac | 1051-6140 | 8,940.41 | 5,764.74 | 4,345.32 | 6,350.16 | 7,399.83 | 1,049.67 |
| Sick Pay | 1051-6150 | 1,230.80 | 597.84 | 285.04 | 704.56 | 1,783.60 | 1,079.04 |
| Other Pay | 1051-6160 | 252.72 | 1,084.80 | 227.44 | 521.65 | 115.20 | (406.45) |
| Sup Ord | 1051-6400 | 1,309.43 | 586.30 | 1,016.60 | 970.78 | 2,942.76 | 1,971.98 |
| Maint Sup | 1051-6410 | 570.48 | 6,422.68 | 3,840.89 | 3,611.35 | 1,435.38 | (2,175.97) |
| Fringes | 1051-6960 | 9.59 | 67.10 | 151.69 | 76.13 | 996.85 | 920.72 |
| Sub-Total | | 12,215.62 | 14,952.27 | 10,325.24 | 12,497.71 | 18,590.03 | 6,092.32 |
| GEN PLANT | | | | | | | |
| Property Taxes | 2051-6710 | | -18,619.00 | 3,135.12 | -5,161.29 | 1,672.66 | 6,833.95 |
| POND CLOSURE | | | | | | | |
| O/S Labor & Mat'l | 2151-6300 | | | | | 3962.58 | 3,962.58 |
| ENVIRON | | | | | | | |
| Salary | 2251-6100 | | 25,960.42 | 32,436.00 | 19,465.47 | 35,268.32 | 15,802.85 |
| Wages | 2251-6110 | | 45,417.32 | 47,422.54 | 30,946.62 | 55,760.25 | 24,813.63 |
| Hol & Vac | 2251-6140 | | 1,536.55 | | 512.18 | | (512.18) |
| P/R Taxes | 2251-6200 | | | | | 3,005.43 | 3,005.43 |
| O/S Labor & Matr' | 2251-6300 | | 48,130.04 | 21,874.36 | 23,334.80 | 61,528.32 | 38,193.52 |
| Travel | 2251-6390 | | 69.26 | 624.27 | 231.18 | 371.33 | 140.15 |
| Meals & Entertm | 2251-6395 | | | 263.57 | 87.86 | 70.89 | (16.97) |
| Sup Ord | 2251-6400 | | 22,269.89 | 8,185.42 | 10,151.77 | 17,336.69 | 7,184.92 |
| Maint Sup | 2251-6410 | | 4,128.24 | 5,061.34 | 3,063.19 | 5,525.12 | 2,461.93 |
| Fees & Tuition | 2251-6620 | | | 10,800.00 | 3,600.00 | 14,248.50 | 10,648.50 |
| Consulting | 2251-6630 | | | | | 381.80 | 381.80 |
| Rental | 2251-6650 | | 600.00 | 75.00 | 225.00 | 425.00 | 200.00 |
| Properety Taxes | 2251-6710 | | 2,054.00 | | 684.67 | | (684.67) |
| Pond closure | 2251-6730 | | -22,882.11 | | -7,627.37 | -13,079.54 | (5,452.17) |
| Power | 2251-6900 | | 4,727.68 | | 1,575.89 | | (1,575.89) |
| Fringes | 2251-6960 | | 19,348.84 | 27,100.31 | 15,483.05 | 23,902.40 | 8,419.35 |
| Sub-Total | | 0.00 | 151,360.13 | 153,842.81 | 101,734.31 | 204,744.51 | 103,010.20 |
| YARDS & GRDS | | | | | | | |
| Salary | 2451-6100 | 6,256.10 | 669.80 | | 2,308.63 | | (2,308.63) |
| Wages | 2451-6110 | 32,065.13 | 18,541.31 | 25,790.63 | 25,465.69 | 31,533.76 | 6,068.07 |
| Hol & Vac | 2451-6140 | | 413.56 | | 137.85 | | (137.85) |
| O/S Labor & Matr' | 2451-6300 | 5,050.22 | 4,856.50 | 2,675.42 | 4,194.05 | 28,813.65 | 24,619.60 |
| Sup Ord | 2451-6400 | 60.00 | 336.02 | 2,670.96 | 1,022.33 | 250.50 | (771.83) |
| Maint Sup | 2451-6410 | 100.00 | 20.06 | 437.33 | 185.80 | 4,275.03 | 4,089.23 |
| Rental | 2451-6650 | | | | | 1,225.00 | 1,225.00 |
| Fringes | 2451-6960 | 13,107.29 | 7,551.03 | 14,385.70 | 11,681.34 | 13,161.61 | 1,480.27 |
| Sub-Total | | 56,638.74 | 32,388.28 | 45,960.04 | 44,995.69 | 79,259.55 | 34,263.86 |
| TOTAL OVERHEAD | | 768,136.59 | 1,035,830.93 | 1,107,053.68 | 970,340.40 | 1,595,602.47 | 625,262.07 |
| MONTHLY AVERAGE | | 64,011.38 | 86,319.24 | 92,254.47 | 80,861.70 | 132,966.87 | 52,105.17 |

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WEST HELENA PLANT
YEAR END PROJECTED STATEMENT OF INCOME
AS OF 12/31/90

| PRODUCT | | 1990 BUD QTY | BUD UNIT PRICE | BUD TOTAL | BUD % | 1990 REV QTY | REV UNIT PRICE | REV TOTAL | REV % | 1990 ACTUAL QTY | ACTUAL UNIT PRICE | ACTUAL TOTAL | ACTUAL % | 1991 QTY | 1991 UNIT PRICE | 1991 TOTAL | 1991 % | 1992 QTY | 1992 UNIT PRICE | 1992 TOTAL | 1992 % | 1993 QTY | 1993 UNIT PRICE | 1993 TOTAL | 1993 % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PROPANIL - NET SALES** | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3lb | gls | 300.0 | 7.68 | 2,305 | | 300.5 | 8.29 | 2,492 | | 427 | 8.44 | 3,606 | | 300.0 | 8.40 | 2,522 | | 400 | 8.80 | 3,520 | | 400 | 9.00 | 3,600 | |
| 4lb | gls | 500.0 | 12.47 | 6,235 | | 310.0 | 12.50 | 3,906 | | 391 | 13.28 | 5,194 | | 350.0 | 15.49 | 5,422 | | 400 | 16.00 | 6,400 | | 350 | 16.50 | 5,775 | |
| Propanex | gls | | | | | 42.8 | 14.46 | 619 | | 52 | 13.74 | 718 | | 50.0 | 15.81 | 791 | | | | | | | | | |
| Wham | gls | 150.0 | 12.71 | 1,906 | | 148.0 | 13.36 | 1,971 | | 91 | 11.85 | 1,077 | | 150.0 | 14.77 | 2,216 | | 250 | 15.25 | 3,813 | | 300 | 15.75 | 4,725 | |
| DCA | lbs | | | | | | | | | | | | | 900.0 | 1.70 | 1,530 | | 2,500 | 1.90 | 4,750 | | 3,500 | 2.00 | 7,000 | |
| Tech | lbs | | | | | 1,840.2 | 2.21 | 4,059 | | 1,918 | 2.20 | 4,230 | | 2,000.0 | 2.41 | 4,816 | | 2,000 | 2.65 | 5,300 | | 2,000 | 2.90 | 5,800 | |
| Flaked T | lbs | | | | | 132.0 | 1.64 | 217 | | 152 | 1.72 | 262 | | 250.0 | 1.90 | 475 | | 1,000 | 2.25 | 2,250 | | 1,250 | 2.40 | 3,000 | |
| 60 DF | lbs | | | | | 257.5 | 2.10 | 541 | | 258 | 2.10 | 541 | | 750.0 | 2.18 | 1,635 | | 750 | 2.40 | 1,800 | | 750 | 2.65 | 1,988 | |
| 50 wdg | lbs | 200.0 | 1.68 | 336 | | 95.7 | 1.82 | 174 | | 96 | 1.79 | 172 | | 500.0 | 1.99 | 994 | | 750 | 2.05 | 1,538 | | 750 | 2.30 | 1,725 | |
| Stref | gls | 329.4 | 11.10 | 3,656 | | 329.4 | 11.69 | 3,852 | | 329 | 12.03 | 3,964 | | 225.0 | 13.60 | 3,060 | | | | | | | | | |
| TOTAL NET SALES - PROPANIL | | | | 14,439 | 100.0% | | | 17,731 | 100.0% | | | 19,763 | 100.0% | | | 23,459 | 100.0% | | | 29,370 | 100.0% | | | 33,813 | 100.0% |
| COST OF SALES | | | | 12,245 | 84.8% | | | 14,158 | 79.8% | | | 16,144 | 81.7% | | | 18,448 | 78.6% | | | 23,030 | 78.4% | | | 26,706 | 79.5% |
| GROSS MARGIN | | | | 2,194 | 15.2% | | | 3,573 | 20.2% | | | 3,619 | 18.3% | | | 5,011 | 21.4% | | | 6,340 | 21.6% | | | 6,907 | 20.5% |
| **BUTOXONE - NET SALES** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Butox - estc | gls | 20.0 | 19.77 | 395 | | 20.0 | 19.70 | 394 | | 15 | 20.40 | 288 | | 15.0 | 21.32 | 320 | | 20 | 22.00 | 440 | | 20 | 22.50 | 450 | |
| Butox 175 | gls | 100.0 | 15.20 | 1,520 | | 91.0 | 15.20 | 1383 | | 77 | 14.69 | 1,132 | | 98.0 | 15.83 | 1,425 | | 100 | 16.50 | 1,650 | | 100 | 17.00 | 1,700 | |
| Butox 200 | gls | 20.0 | 16.50 | 331 | | 8.2 | 16.55 | 136 | | 8 | 15.06 | 123 | | 20.0 | 16.81 | 336 | | 20 | 18.00 | 360 | | 20 | 18.50 | 370 | |
| TOTAL NET SALES - BUTOXONE | | | | 2,246 | 100.0% | | | 1,913 | 100.0% | | | 1,552 | 100.0% | | | 2,081 | 100.0% | | | 2,450 | 100.0% | | | 2,520 | 100.0% |
| COST OF SALES | | | | 1,850 | 82.4% | | | 1,482 | 77.5% | | | 1,113 | 71.7% | | | 1,624 | 78.0% | | | 1,911 | 78.0% | | | 1,966 | 78.0% |
| GROSS MARGIN - BUTOXONE | | | | 396 | 17.6% | | | 431 | 22.5% | | | 439 | 28.3% | | | 457 | 22.0% | | | 539 | 22.0% | | | 554 | 22.0% |
| **CONTRACT MFG - NET SALES** | | | | | | | | | | | | | | | | | | | | | | | | | |
| ICI | | | | 1,180 | | | | 1,200 | | | | 1,200 | | | | 601 | | | | | | | | | |
| MTPO | | | | 1,095 | | | | 797 | | | | 879 | | | | 500 | | | | | | | | | |
| TCC | | | | | | | | | | | | | | | | | | | | 2,000 | | | | 5,400 | |
| Dupont ent | | | | 270 | | | | 589 | | | | 590 | | | | 795 | | | | 800 | | | | 850 | |
| Ortom | | | | 240 | | | | 229 | | | | 229 | | | | 240 | | | | | | | | | |
| B. F. Goodrich | | | | | | | | 70 | | | | 70 | | | | 592 | | | | 900 | | | | 1,500 | |
| Grace | | | | 2,580 | | | | 2,569 | | | | 2,815 | | | | 2,633 | | | | 2,880 | | | | 3,030 | |
| Sectagon II | | | | 480 | | | | 536 | | | | 537 | | | | 501 | | | | | | | | | |
| MES | | | | 375 | | | | 259 | | | | 259 | | | | | | | | | | | | | |
| Dupont MBC | | | | 810 | | | | 800 | | | | 820 | | | | 270 | | | | | | | | | |
| Xanthates | | | | | | | | | | | | | | | | 1,740 | | | | 3,475 | | | | 4,100 | |
| Other | | | | 1,080 | | | | 7 | | | | 11 | | | | | | | | | | | | | |
| TOTAL NET SALES - CONTR | | | | 7,980 | 100.0% | | | 7,056 | 100.0% | | | 7,216 | 100.0% | | | 7,871 | 100.0% | | | 10,055 | 100.0% | | | 14,880 | 100.0% |
| COST OF SALES-CONTRACTS | | | | 5,419 | 68.9% | | | 5,853 | 83.0% | | | 5,664 | 78.4% | | | 5,340 | 67.8% | | | 7,039 | 70.0% | | | 10,420 | 70.0% |
| IDLE PLANT COST | | | | | 0.0% | | | 300 | 4.3% | | | 205 | 2.8% | | | | 0.0% | | | | 0.0% | | | | 0.0% |
| TOTAL | | | | 5,419 | 68.9% | | | 6,153 | 87.2% | | | 5,868 | 81.3% | | | 5,340 | 67.8% | | | 7,039 | 70.0% | | | 10,420 | 70.0% |
| GROSS MARGIN | | | | 2,441 | 31.1% | | | 903 | 12.8% | | | 1,351 | 18.7% | | | 2,531 | 32.2% | | | 3,016 | 30.0% | | | 4,460 | 30.0% |
| Environmental Cost | | | | | | | | 150 | | | | | | | | 150 | | | | 300 | | | | 300 | |



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| | 1990 BUD TOTAL | | 1990 REV | | 1990 ACTUAL | | 1991 | | 1992 | | 1993 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOTAL NET SALES - W. H. | 24,645 | 100.0% | 26,700 | 100.0% | 28,525 | 100.0% | 33,411 | 100.0% | 41,875 | 100.0% | 51,013 | 100.0% |
| TOTAL W. H. COST OF SALES | 19,514 | 79.6% | 21,951 | 82.2% | 23,116 | 81.0% | 25,562 | 76.5% | 32,280 | 77.1% | 39,392 | 77.2% |
| GROSS MARGIN | 5,031 | 20.5% | 4,749 | 17.8% | 5,409 | 19.0% | 7,849 | 23.5% | 9,595 | 22.9% | 11,621 | 22.8% |
| G & A | 1,260 | 5.1% | 1,420 | 5.3% | | 0.0% | 1,864 | 5.6% | 1,955 | 4.7% | 2,050 | 4.0% |
| Interest | 956 | 3.9% | 1,020 | 3.8% | | 0.0% | 1,167 | 3.5% | 1,135 | 2.7% | 1,026 | 2.0% |
| Total Expenses | 2,216 | 9.0% | 2,440 | 9.1% | 0 | 0.0% | 3,031 | 9.1% | 3,090 | 7.4% | 3,076 | 6.0% |
| INCOME BEFORE TAX | 2,815 | 11.5% | 2,308 | 8.6% | 5,409 | 19.0% | 4,818 | 14.4% | 6,505 | 15.5% | 8,546 | 16.8% |

| People | Salary | Hourly | Total | Salary | Hourly | Total | Salary | Hourly | Total | Salary | Hourly | Total | Salary | Hourly | Total | Salary | Hourly | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 27 | 70 | 97 | 28 | 81 | 109 | 28 | 74 | 102 | 31 | 92 | 123 | 35 | 100 | 135 | 35 | 100 | 135 |
| | Monthly | Total | | Monthly | Total | | Monthly | Total | | Monthly | Total | | | | | | | |
| Adm Exp | 66 | 783 | | 62 | 745 | | 71 | 852 | | 74 | 888 | | | | | | | |
| Pit O&I | 82 | 985 | | 133 | 1,604 | | 133 | 1,596 | | 138 | 1,659 | | | | | | | |
| Pit Cost | 495 | 5,942 | | 579 | 6,951 | | 574 | 6,893 | | 754 | 9,048 | | | | | | | |



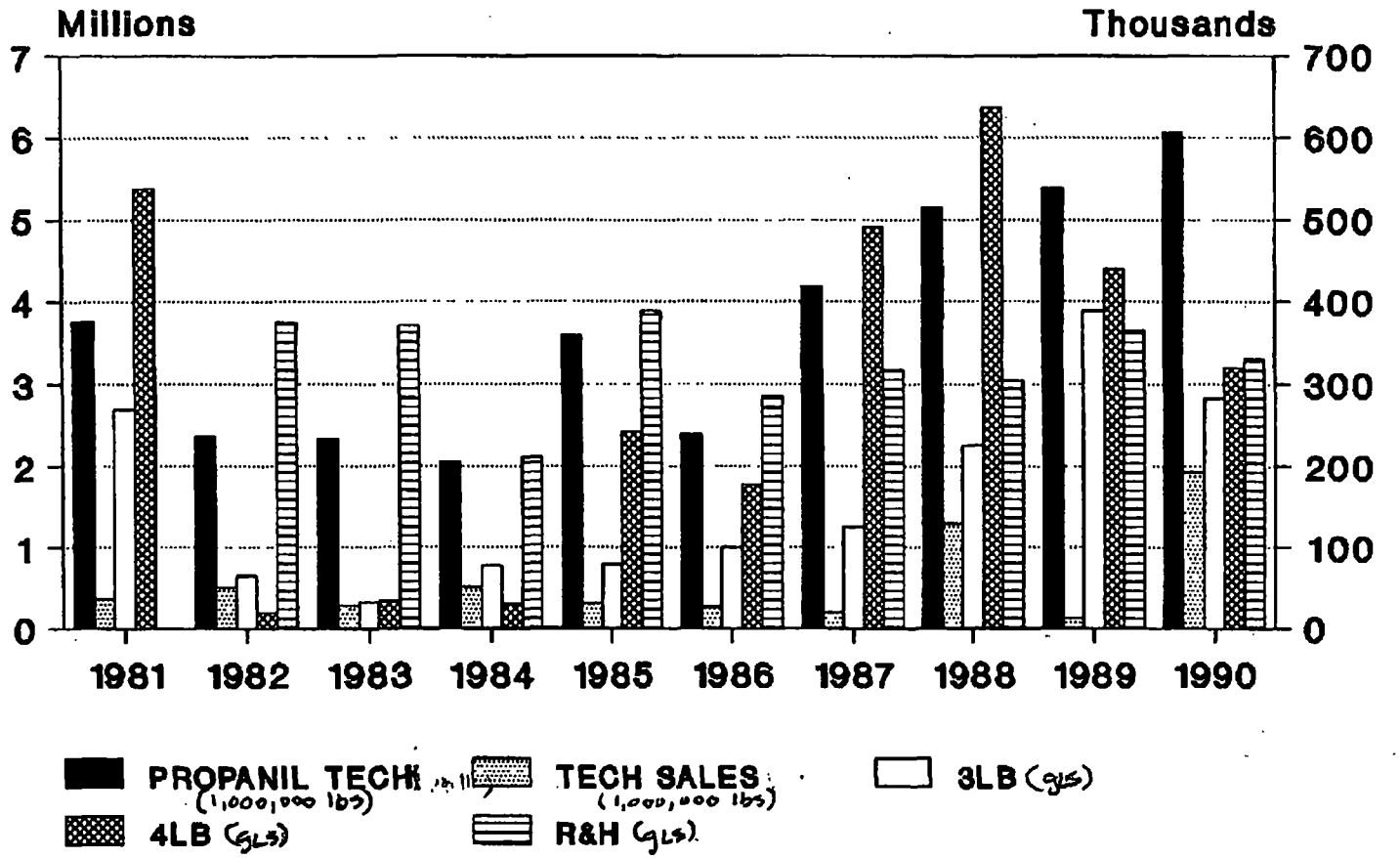
28

CE[redacted]AR -WEST HELENA
QU[redacted]NTITIES SOLD/PRODUCED
AS OF 12/31/90

| PRODUCT | Bud 1990 | Rev Est 1990 | Act 1990 | Est 1991 | Est 1992 | Est 1993 |
|---|---|---|---|---|---|---|
| PROPANEX 4E | | | | | | |
| Gallons Sold | | 42,816 | 52,266 | 50,000 | | |
| Avg Net Selling Price/Gl | | 14.46 | 13.74 | 15.81 | | |
| Gallons Purchased | | 130,281 | 130,281 | | | |
| Purc Price/Gl | | 13.22 | 13.10 | 13.22 | | |
| PROPANIL 4E | | | | | | |
| Gallons Sold | 500,000 | 310,000 | 391,154 | 350,000 | 400,000 | 350,000 |
| Avg Net Selling Price/Gl | 12.47 | 12.60 | 13.28 | 15.49 | 16.00 | 16.50 |
| Gallons Produced | 500,000 | 219,305 | 318,655 | 450,000 | 400,000 | 350,000 |
| Mfg Cost/Gl | 9.34 | 9.07 | 9.23 | 10.49 | 10.49 | 10.49 |
| PROPANIL 3E | | | | | | |
| Gallons Sold | 300,000 | 300,600 | 427,348 | 300,000 | 400,000 | 400,000 |
| Avg Net Selling Price/Gl | 7.69 | 8.29 | 8.44 | 8.40 | 8.80 | 9.00 |
| Gallons Produced | 200,000 | 222,792 | 282,247 | 370,000 | 400,000 | 400,000 |
| Mfg Cost/Gl | 7.77 | 7.67 | 7.67 | 8.44 | 8.44 | 8.44 |
| PROPANIL TECH | | | | | | |
| Pounds Sold | | 1,840,200 | 1,918,404 | 2,000,000 | 2,000,000 | 2,000,000 |
| Avg Net Selling Price/Lb | | 2.21 | 2.20 | 2.41 | 2.65 | 2.90 |
| Pounds Produced | 5,637,600 | 5,634,839 | 6,063,037 | 7,720,000 | 7,822,500 | 8,070,000 |
| Mfg Cost/Lb | 1.44 | 1.50 | 1.52 | 1.66 | 1.66 | 1.66 |
| WHAM | | | | | | |
| Gallons Sold | 150,000 | 140,000 | 90,835 | 150,000 | 250,000 | 300,000 |
| Avg Net Selling Price/Gl | 12.71 | 13.36 | 11.85 | 14.77 | 15.25 | 15.75 |
| Gallons Produced | 200,000 | 106,110 | 106,110 | 150,000 | 250,000 | 300,000 |
| Mfg Cost/Gl | 8.98 | 8.46 | 8.51 | 9.42 | 9.42 | 9.42 |
| STAM/STREL | | | | | | |
| Gallons Sold | 329,406 | 329,400 | 329,420 | 225,000 | | |
| Avg Net Selling Price/Gl | 11.10 | 11.69 | 12.03 | 13.60 | | |
| Gallons Produced | 250,800 | 329,945 | 329,945 | 225,000 | | |
| Mfg Cost/Gl | 9.93 | 9.39 | 9.40 | 10.94 | | |
| DCA | | | | | | |
| Pounds Sold | | | | 900,000 | 2,500,000 | 3,500,000 |
| Avg Net Selling Price/Lb | | | | 1.70 | 1.90 | 2.00 |
| Pounds Produced | | | | 3,000,000 | 7,741,875 | 8,677,500 |
| Mfg Cost/Lb | | | | 1.69 | 1.51 | 1.53 |
| FLAKED TECH | | | | | | |
| Pounds Sold | | 132,000 | 152,258 | 250,000 | 1,000,000 | 1,250,000 |
| Avg Net Selling Price/Lb | | 1.64 | 1.72 | 1.90 | 2.25 | 2.40 |
| Pounds Produced | 1,500,000 | 741,861 | 557,852 | 1,585,000 | 2,862,500 | 3,320,000 |
| Mfg Cost/Lb | 1.66 | 2.13 | 1.86 | 1.74 | 1.74 | 1.74 |
| 50 WDG | | | | | | |
| Pounds Sold | 200,000 | 95,700 | 95,720 | 500,000 | 750,000 | 750,000 |
| Avg Net Selling Price/Lb | 1.68 | 1.82 | 1.79 | 1.99 | 2.05 | 2.30 |
| Pounds Produced | 200,000 | 13,280 | 13,280 | 500,000 | 750,000 | 750,000 |
| Mfg Cost/Lb | 1.48 | 1.41 | 1.41 | 1.51 | 1.51 | 1.51 |

| ODUCT | Bud 1990 | Rev Est 1990 | Act 1990 | Est 1991 | Est 1992 | Est 1993 |
|---|---|---|---|---|---|---|
| 60 DF | | | | | | |
| Pounds Sold | | 257,600 | 257,641 | 750,000 | 750,000 | 750,000 |
| Avg Net Selling Price/Lb | | 2.10 | 2.10 | 2.18 | 2.40 | 2.65 |
| Pounds Produced | | 271,440 | 271,440 | 750,000 | 750,000 | 750,000 |
| Mfg Cost/Lb | | 1.65 | 1.65 | 1.69 | 1.69 | 1.69 |
| BUTOXONE ESTER | | | | | | |
| Gallons Sold | 20,000 | 20,000 | 14,580 | 15,000 | 20,000 | 20,000 |
| Avg Net Selling Price/Gl | 19.77 | 19.70 | 20.40 | 21.32 | 22.00 | 22.50 |
| Gallons Produced | | | | 20,000 | 20,000 | 20,000 |
| Mfg Cost/Gl | 10.36 | 10.36 | 10.36 | 13.19 | 13.19 | 13.19 |
| BUTOXONE 175 | | | | | | |
| Gallons Sold | 100,000 | 91,000 | 77,014 | 90,000 | 100,000 | 100,000 |
| Avg Net Selling Price/Gl | 15.20 | 15.20 | 14.69 | 15.63 | 16.50 | 17.00 |
| Gallons Produced | 80,000 | 70,764 | 70,764 | 90,000 | 100,000 | 100,000 |
| Mfg Cost/Gl | 10.83 | 9.77 | 9.76 | 10.90 | 10.90 | 10.90 |
| BUTOXONE 200 | | | | | | |
| Gallons Sold | 20,000 | 8,200 | 8,154 | 20,000 | 20,000 | 20,000 |
| Avg Net Selling Price/Gl | 16.50 | 16.55 | 15.06 | 16.81 | 18.00 | 18.50 |
| Gallons Produced | 10,000 | 17,444 | 17,444 | 20,000 | 10,000 | 10,000 |
| Mfg Cost/Gl | 12.18 | 8.05 | 8.05 | 12.24 | 12.24 | 12.24 |
| Grace Project | | | | | | |
| Lbs Sold | 2,143,000 | 881,000 | 774,740 | 2,500,000 | 4,000,000 | 4,000,000 |
| Tolling Fee/Lb | 1.20 | 2.92 | 3.37 | 1.05 | 0.76 | 0.76 |
| Other Custom Projects | | | | | | |
| Sales Dollars | 7,860,000 | 7,056,000 | 7,210,960 | 7,871,000 | 10,055,000 | 14,880,000 |
| Propanil Sales | 14,439,000 | 17,731,000 | 19,763,800 | 23,459,000 | 29,370,000 | 33,613,000 |
| Propanil Mfg Cost | 12,245,000 | 13,559,749 | 15,195,820 | 18,037,500 | 22,530,000 | 26,285,500 |
| Task Force | | 442,000 | 552,500 | 500,004 | 500,000 | 500,000 |
| Var/Contgy | | 156,251 | 395,680 | -89,504 | | 500 |
| Total C.O.S | 12,245,000 | 14,158,000 | 16,144,000 | 18,448,000 | 23,030,000 | 26,786,000 |
| Butoxone Sales | 2,246,000 | 1,913,000 | 1,552,800 | 2,081,000 | 2,450,000 | 2,520,000 |
| Butoxone Cost | 1,850,000 | 1,162,280 | 968,345 | 1,423,650 | 1,710,600 | 1,765,680 |
| Task Force | | 160,000 | 105,000 | 200,004 | 200,000 | 200,000 |
| Var/Contgy | | 159,720 | 39,655 | 346 | 400 | 400 |
| Total C.O.S | 1,850,000 | 1,482,000 | 1,113,000 | 1,624,000 | 1,911,000 | 1,966,000 |

# WEST HELENA PRODUCTION



| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| DCA Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | 38,400 | 411,840 | 968,580 | 1,467,900 | 1,965,700 | 1,082,418 | 842,180 | 1,541,897 | 1,500,000 |
| | | | | | | | | | | |
| Gross Sales | | 53,760 | 471,114 | 1,235,735 | 1,481,110 | 2,747,525 | 1,562,279 | 1,374,383 | 2,454,341 | 2,175,000 |
| Per Unit | | 1.40 | 1.14 | 1.28 | 1 01 | 1.40 | 1.44 | 1.63 | 1.59 | 1.45 |
| Less-Freight Out | | | 19,369 | 106,243 | 55,324 | 50,956 | 72,364 | 55,916 | 77,621 | |
| Less-Trns Freight | | | 1,928 | | 2,212 | 4,368 | 4,694 | 5,024 | | |
| Less-Warehouse | | | 400 | | | | | | | |
| Less-Commission | | | | 5,419 | 13,901 | 38,804 | 45,528 | 120,731 | (19,676) | |
| Sub-Total | | | 21,697 | 111,662 | 71,437 | 94,128 | 122,586 | 181,671 | 57,945 | |
| Per Unit | | | 0.05 | 0.12 | 0.05 | 0.05 | 0.11 | 0.22 | 0.04 | |
| Net Sales | | 53,760 | 449,418 | 1,124,073 | 1,409,673 | 2,653,397 | 1,439,693 | 1,192,712 | 2,396,396 | 2,175,000 |
| Per Unit | | 1.40 | 1.09 | 1.16 | 0.96 | 1.35 | 1.33 | 1.42 | 1.55 | 1.45 |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | | (54,862) | 457,110 | 1,148,170 | 1,567,932 | 2,174,099 | 1,095,287 | 983,084 | 1,619,194 | 1,534,612 |
| | | (1.43) | 1.11 | 1.19 | 1.07 | 1.11 | 1.01 | 1.17 | 1.05 | 1.02 |
| Mfg Variance | | | | 179,127 | 16,051 | (786) | 533,574 | (45,701) | (444,633) | (10) |
| | | | | 0.18 | 0.01 | (0.00) | 0.49 | (0.05) | (0.29) | (0.00) |
| Start Up Cost | | (366,318) | 84,535 | 84,535 | 84,535 | 24,738 | 87,975 | | | |
| | | (9.54) | 0.21 | 0.09 | 0.06 | 0.01 | 0.08 | | | |
| Other | | | | 800.00 | | | | | | |
| | | | | 0.00 | | | | | | |
| Total Cost of Sales | | (421,180) | 541,645 | 1,412,632 | 1,668,518 | 2,198,051 | 1,716,836 | 937,383 | 1,174,561 | 1,534,602 |
| | | (10.97) | 1.32 | 1.46 | 1.14 | 1.12 | 1.59 | 1.11 | 0.76 | 1.02 |
| Gross Margin | | 474,940 | (92,228) | (288,559) | (258,845) | 455,346 | (277,143) | 255,329 | 1,221,835 | 640,398 |
| | | 12.37 | (0.22) | (0.30) | (0.18) | 0.23 | (0.26) | 0.30 | 0.79 | 0.43 |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Propanil Tech Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | 1,918,404 | 2,598,720 | 1,862,020 | 1,727,840 | 2,135,500 | 1,881,460 | 2,784,860 | 1,470,240 | 2,109,730 | 2,516,000 |
| | | | | | | | | | | |
| Gross Sales | 4,236,343 | 6,977,927 | 5,116,464 | 4,133,144 | 4,781,125 | 3,946,394 | 6,055,140 | 2,234,667 | 3,006,588 | 3,461,400 |
| Per Unit | 2.21 | 2.69 | 2.75 | 2.39 | 2.24 | 2.10 | 2.17 | 1.52 | 1.43 | 1.38 |
| Less-Rebate | | | | | | | | | | |
| Less-QDC/RC | | | | | | | | | | 242,560 |
| Less-Freight Out | 6,711 | 1,435 | 6,496 | 7,467 | 3,000 | | 3,372 | | 42,373 | |
| Less-Tms Freight | | | | | | | | | | |
| Less-Warehouse | | | | | | | | | | |
| Less-Commission | | | | 7,730 | 16,140 | 20,921 | 13,349 | | | |
| Sub-Total | 6,711 | 1,435 | 6,496 | 15,197 | 19,140 | 20,921 | 16,721 | | 42,373 | 242,560 |
| Per Unit | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | | 0.02 | 0.10 |
| Net Sales | 4,229,632 | 6,976,492 | 5,109,968 | 4,117,947 | 4,761,985 | 3,925,473 | 6,038,419 | 2,234,667 | 2,964,215 | 3,218,840 |
| Per Unit | 2.20 | 2.68 | 2.74 | 2.38 | 2.23 | 2.09 | 2.17 | 1.52 | 1.41 | 1.28 |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | 2,762,502 | 4,330,712 | 2,339,804 | 2,120,605 | 2,230,323 | 2,113,301 | 3,210,758 | 1,705,641 | 2,226,534 | 2,553,397 |
| | 1.44 | 1.67 | 1.26 | 1.23 | 1.04 | 1.12 | 1.15 | 1.16 | 1.06 | 1.01 |
| Mfg Variance | 471,191 | | | 191,743 | 14,609 | (619) | 129,963 | (153) | (2) | 47 |
| | 0.25 | | | 0.11 | 0.01 | (0.00) | 0.05 | (0.00) | (0.00) | 0.00 |
| Task Force | | 146,854 | 176,841 | 98,019 | 70,102 | 22,655 | 52,985 | 13,760 | | |
| | | 0.06 | 0.09 | 0.06 | 0.03 | 0.01 | 0.02 | 0.01 | | |
| Total Cost of Sales | 3,233,693 | 4,477,566 | 2,516,645 | 2,410,367 | 2,315,034 | 2,135,337 | 3,393,706 | 1,719,248 | 2,226,532 | 2,553,444 |
| | 1.69 | 1.72 | 1.35 | 1.40 | 1.08 | 1.13 | 1.22 | 1.17 | 1.06 | 1.01 |
| Gross Margin | 995,939 | 2,498,926 | 2,593,323 | 1,707,580 | 2,446,951 | 1,790,136 | 2,644,713 | 515,419 | 737,683 | 665,396 |
| | 0.52 | 0.96 | 1.39 | 0.99 | 1.15 | 0.95 | 0.95 | 0.35 | 0.35 | 0.26 |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| FlaKe Tech Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | 152,258 | 99,994 | 613,983 | 889,828 | 1,304,101 | 27,779,111 | 1,902,108 | 3,497,692 | 3,078,577 | 3,212,000 |
| | | | | | | | | | | |
| Gross Sales | 274,991 | 206,953 | 1,193,296 | 1,505,347 | 2,116,119 | 4,887,175 | 2,730,116 | 5,985,750 | 4,376,443 | 4,676,105 |
| Per Unit | 1.81 | 2.07 | 1.94 | 1.69 | 1.62 | 0.18 | 1.44 | 1.71 | 1.42 | 1.46 |
| Less-QDC/RC | | | | | | | (115,362) | | (84,162) | 288,900 |
| Less-Rebate | | | | | | | | 39,672 | 45,301 | |
| Less-Freight Out | 7,894 | 2,552 | 9,947 | 27,079 | 87,827 | 120,076 | 35,785 | 69,435 | 202 | |
| Less-Trns Freight | | | 720 | 13,838 | 15,672 | 10,972 | 15,890 | 41,030 | 66,616 | |
| Less-Warehouse | 5,228 | 32,451 | 59,027 | 29,103 | 46,195 | 31,831 | 34,963 | 40,250 | 119,312 | |
| Less-Commission | | | | 16,553 | 292,956 | 381,775 | 223,669 | 370,081 | (92,058) | |
| Sub-Total | 13,122 | 35,003 | 69,694 | 86,573 | 442,650 | 544,654 | 194,925 | 560,468 | 55,211 | 288,900 |
| Per Unit | 0.09 | 0.35 | 0.11 | 0.10 | 0.34 | 0.02 | 0.10 | 0.16 | 0.02 | 0.09 |
| Net Sales | 261,869 | 171,950 | 1,123,602 | 1,418,774 | 1,673,469 | 4,342,521 | 2,535,191 | 5,425,282 | 4,321,232 | 4,387,205 |
| Per Unit | 1.72 | 1.72 | 1.83 | 1.59 | 1.28 | 0.16 | 1.33 | 1.55 | 1.40 | 1.37 |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | 253,412 | 67,015 | 1,127,608 | 1,445,721 | 1,725,278 | 3,351,096 | 2,190,503 | 4,246,036 | 3,583,808 | 3,569,741 |
| | 1.66 | 0.67 | 1.84 | 1.62 | 1.32 | 0.12 | 1.15 | 1.21 | 1.16 | 1.11 |
| Mfg Variance | (4,593) | | | (39,896) | 16,660 | (6,722) | (3,599) | (554) | (34,181) | (24) |
| | (0.03) | | | (0.04) | 0.01 | (0.00) | (0.00) | (0.00) | (0.01) | (0.00) |
| Other | 1,912 | | | 527 | | | | | | |
| | 0.01 | | | 0.00 | | | | | | |
| Task Force | | | 71,692.00 | 30,952.00 | 19,825.00 | 11,513.00 | 50,813.00 | 25,249.00 | | |
| | | | 0.12 | 0.03 | 0.02 | 0.00 | 0.03 | 0.01 | | |
| Total Cost of Sales | 250,731 | 67,015 | 1,199,300 | 1,437,304 | 1,761,763 | 3,355,887 | 2,237,717 | 4,270,731 | 3,549,627 | 3,569,717 |
| | 1.65 | 0.67 | 1.95 | 1.62 | 1.35 | 0.12 | 1.18 | 1.22 | 1.15 | 1.11 |
| Gross Margin | 11,138 | 104,935 | (75,698) | (18,530) | (88,294) | 986,634 | 297,474 | 1,154,551 | 771,605 | 817,488 |
| | 0.07 | 1.05 | (0.12) | (0.02) | (0.07) | 0.04 | 0.16 | 0.33 | 0.25 | 0.25 |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3# Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | 427,348 | 248,463 | 311,477 | 346,690 | 463,707 | 374,966 | 440,809 | 495,378 | 542,153 | 507,328 |
| | | | | | | | | | | |
| Gross Sales | 3,642,877 | 2,224,120 | 2,573,902 | 2,952,965 | 3,982,829 | 3,439,691 | 4,319,310 | 4,473,428 | 4,309,679 | 3,987,091 |
| Per Unit | 8.52 | 8.95 | 8.26 | 8.52 | 8.59 | 9.17 | 9.80 | 9.03 | 7.95 | 7.86 |
| Less-Rebate | | | | | | | | 74,737 | (119,410) | |
| Less-Freight Out | 28,049 | 29,535 | 77,032 | 164,434 | 234,875 | 244,946 | 295,925 | 191,554 | (5,759) | |
| Less-Trns Freight | | 4,680 | | 677 | 25,539 | 13,037 | 2,166 | 2,496 | 827 | |
| Less-Warehouse | 8,470 | | 1,200 | | | 74 | | | | |
| Less-Commission | | | | 214,577 | 373,884 | 312,173 | 504,149 | 206,508 | (47,033) | |
| Sub-Total | 36,519 | 34,215 | 78,232 | 379,688 | 634,298 | 570,230 | 802,240 | 475,295 | (171,375) | |
| Per Unit | 0.09 | 0.14 | 0.25 | 1.10 | 1.37 | 1.52 | 1.82 | 0.96 | (0.32) | |
| Net Sales | 3,606,358 | 2,189,905 | 2,495,670 | 2,573,277 | 3,348,531 | 2,869,461 | 3,517,070 | 3,998,133 | 4,481,054 | 3,987,091 |
| Per Unit | 8.44 | 8.81 | 8.01 | 7.42 | 7.22 | 7.65 | 7.98 | 8.07 | 8.27 | 7.86 |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | 3,403,734 | 1,975,298 | 2,531,174 | 2,426,281 | 3,193,383 | 2,549,077 | 2,896,688 | 3,517,956 | 3,839,239 | 3,444,360 |
| | 7.96 | 7.95 | 8.13 | 7.00 | 6.89 | 6.80 | 6.57 | 7.10 | 7.08 | 6.79 |
| Mfg Variance | (35,161) | | 29,327 | 8,027 | 24,576 | 5,830 | 212,937 | 138,222 | (123,480) | |
| | (0.08) | | 0.09 | 0.02 | 0.05 | 0.02 | 0.48 | 0.28 | (0.23) | |
| Product Complaint | | | | | 13,154 | | | | | |
| | | | | | 0.03 | | | | | |
| Task Force | | | | | | 15,060 | 29,797 | 20,319 | | |
| | | | | | | 0.04 | 0.07 | 0.04 | | |
| Other | | | | 644 | | | | | | |
| | | | | 0.00 | | | | | | |
| Total Cost of Sales | 3,368,573 | 1,975,298 | 2,560,501 | 2,434,952 | 3,231,113 | 2,569,967 | 3,139,422 | 3,676,497 | 3,715,759 | 3,444,360 |
| | 7.88 | 7.95 | 8.22 | 7.02 | 6.97 | 6.85 | 7.12 | 7.42 | 6.85 | 6.79 |
| Gross Margin | 237,785 | 214,607 | (64,831) | 138,325 | 117,418 | 299,494 | 377,648 | 321,636 | 765,295 | 542,731 |
| | 0.56 | 0.86 | (0.21) | 0.40 | 0.25 | 0.80 | 0.86 | 0.65 | 1.41 | 1.07 |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 4# Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | 443,420 | 448,663 | 454,524 | 444,396 | 296,983 | 397,678 | 335,158 | 364,551 | 687,299 | 547,154 |
| | | | | | | | | | | |
| Gross Sales | 6,042,864 | 6,796,191 | 7,133,672 | 7,076,791 | 3,028,002 | 5,559,380 | 4,572,896 | 4,485,821 | 6,310,646 | 4,942,443 |
| Per Unit | 13.63 | 15.15 | 15.69 | 15.92 | 10.20 | 13.98 | 13.64 | 12.31 | 9.18 | 9.03 |
| Less-Rebate | | | | | | | | 234,275 | (13,187) | |
| Less-Freight Out | 35,591 | 45,719 | 56,195 | 60,675 | 117,322 | 136,578 | 127,149 | 116,821 | 854 | |
| Less-Trns Freight | | | 715 | 5,129 | 6,025 | 3,780 | 8,320 | 3,890 | 169 | |
| Less-Warehouse | 95,746 | 25,349 | 35,808 | 15,511 | 16,029 | 14,783 | 39,898 | 15,282 | 38 | |
| Less-Commission | | | | 41,651 | 122,829 | 111,158 | 173,254 | 84,421 | (20,111) | |
| Sub-Total | 131,337 | 71,068 | 92,718 | 122,966 | 262,205 | 266,299 | 348,621 | 454,689 | (32,237) | |
| Per Unit | 0.30 | 0.16 | 0.20 | 0.28 | 0.88 | 0.67 | 1.04 | 1.25 | (0.05) | |
| Net Sales | 5,911,527 | 6,725,123 | 7,040,954 | 6,953,825 | 2,765,797 | 5,293,081 | 4,224,275 | 4,031,132 | 6,342,883 | 4,942,443 |
| Per Unit | 13.33 | 14.99 | 15.49 | 15.65 | 9.31 | 13.31 | 12.60 | 11.06 | 9.23 | 9.03 |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | 4,308,695 | 4,741,732 | 3,989,280 | 3,740,312 | 2,544,772 | 3,199,963 | 2,608,839 | 3,025,181 | 5,641,917 | 4,223,548 |
| | 9.72 | 10.57 | 8.78 | 8.42 | 8.57 | 8.05 | 7.78 | 8.30 | 8.21 | 7.72 |
| Mfg Variance | (31,081) | | | 37,392 | (239,387) | 14,132 | 153,796 | 36,121 | (254,148) | (1) |
| | (0.07) | | | 0.08 | (0.81) | 0.04 | 0.46 | 0.10 | (0.37) | (0.00) |
| Product Complaint | | | 3,462 | 5,429 | 1,236 | 1,769 | 6,442 | 9,800 | 25,080 | |
| | | | 0.01 | 0.01 | 0.00 | 0.00 | 0.02 | 0.03 | 0.04 | |
| Task Force | 552,500 | 145,448 | 86,031 | 68,688 | 55,012 | 19,415 | 48,374 | 19,692 | | |
| | 1.25 | 0.32 | 0.19 | 0.15 | 0.19 | 0.05 | 0.14 | 0.05 | | |
| Other | | | | 48,913 | | | | | | |
| | | | | 0.11 | | | | | | |
| Total Cost of Sales | 4,830,114 | 4,887,180 | 4,078,773 | 3,900,734 | 2,361,633 | 3,235,279 | 2,817,451 | 3,090,794 | 5,412,849 | 4,223,547 |
| | 10.89 | 10.89 | 8.97 | 8.78 | 7.95 | 8.14 | 8.41 | 8.48 | 7.88 | 7.72 |
| Gross Margin | 1,081,413 | 1,837,943 | 2,962,181 | 3,053,091 | 404,164 | 2,057,802 | 1,406,824 | 940,338 | 930,034 | 718,896 |
| | 2.44 | 4.10 | 6.52 | 6.87 | 1.36 | 5.17 | 4.20 | 2.58 | 1.35 | 1.31 |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Stam Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | 329,420 | 317,662 | 1,301,179 | 596,653 | 569,439 | 827,045 | 633,060 | 584,362 | 543,305 | 385,000 |
| | | | | | | | | | | |
| Gross Sales | 3,964,302 | 4,270,526 | 15,582,810 | 7,937,496 | 5,628,982 | 7,638,786 | 6,761,321 | 6,859,342 | 5,306,774 | 3,470,500 |
| Per Unit | 12.03 | 13.44 | 11.98 | 13.30 | 9.89 | 9.24 | 10.68 | 11.74 | 9.77 | 9.01 |
| Less-QDC-RC | | | | | | | | 1,129,142 | 1,657,103 | 173,800 |
| Less-Freight Out | 193 | 1,130 | 3,302 | | | | | | | |
| Less-Trns Freight | | | 280 | 464 | 2,640 | 7,540 | 280 | 4,615 | 2,320 | |
| Less-Warehouse | | 3,380 | 9,659 | | 9,465 | 38,588 | | 13,427 | 9,304 | |
| Less-Cash Discount | | | | | | | | | | |
| Sub-Total | 193 | 4,510 | 13,241 | 464 | 12,105 | 46,128 | 280 | 1,147,184 | 1,668,727 | 173,800 |
| Per Unit | 0.00 | 0.01 | 0.01 | 0.00 | 0.02 | 0.06 | 0.00 | 1.96 | 3.07 | 0.45 |
| Net Sales | 3,964,109 | 4,266,016 | 15,569,569 | 7,937,032 | 5,616,877 | 7,592,658 | 6,761,041 | 5,712,158 | 3,638,047 | 3,296,700 |
| Per Unit | 12.03 | 13.43 | 11.97 | 13.30 | 9.86 | 9.18 | 10.68 | 9.78 | 6.70 | 8.56 |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | 3,271,141 | 3,409,244 | 11,894,616 | 5,163,189 | 4,657,294 | 6,894,564 | 5,100,230 | 5,078,091 | 4,624,435 | 2,944,622 |
| | 9.93 | 10.73 | 9.14 | 8.65 | 8.18 | 8.34 | 8.06 | 8.69 | 8.51 | 7.65 |
| Mfg Variance | (170,750) | | | 41,289 | (252,160) | 140,926 | 552,157 | (84,247) | (270,102) | 21,090 |
| | (0.52) | | | 0.07 | (0.44) | 0.17 | 0.87 | (0.14) | (0.50) | 0.05 |
| Royalties | | | 3,485,258 | 2,160,517 | 404,932 | 462,693 | 1,037,803 | | | |
| | | | 2.68 | 3.62 | 0.71 | 0.56 | 1.64 | | | |
| Total Cost of Sales | 3,100,391 | 3,409,244 | 15,379,874 | 7,364,995 | 4,810,066 | 7,498,183 | 6,690,190 | 4,993,844 | 4,354,333 | 2,965,712 |
| | 9.41 | 10.73 | 11.82 | 12.34 | 8.45 | 9.07 | 10.57 | 8.55 | 8.01 | 7.70 |
| Gross Margin | 863,718 | 856,772 | 189,695 | 572,037 | 806,811 | 94,475 | 70,851 | 718,314 | (716,286) | 330,988 |
| | 2.62 | 2.70 | 0.15 | 0.96 | 1.42 | 0.11 | 0.11 | 1.23 | (1.32) | 0.86 |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 55% Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | | | | | | |
| | | | | | | | | | | |
| Gross Sales | | | | | | | | | | |
| Per Unit | | | | | | | | | | |
| Less-Freight Out | | | | | | | | | | |
| Less-Trns Freight | | | | | | | | | | |
| Less-Warehouse | | | | | | | | | | |
| Less-Commission | | | | | | | | | | |
| Sub-Total | | | | | | | | | | |
| Per Unit | | | | | | | | | | |
| Net Sales | | | | | | | | | | |
| Per Unit | | | | | | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | | | | | | | | | | |
| | | | | | | | | | | |
| Mfg Variance | | | | | | | | | | |
| | | | | | | | | | | |
| Start Up Cost | | | | | | | | | | |
| | | | | | | | | | | |
| Other | | | | | | | | | | |
| | | | | | | | | | | |
| Total Cost of Sales | | | | | | | | | | |
| | | | | | | | | | | |
| Gross Margin | | | | | | | | | | |
| | | | | | | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Stampede Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | 22,602 | 17,527 | | | | | | |
| | | | | | | | | | | |
| Gross Sales | | | 246,148 | 179,652 | | | | | | |
| Per Unit | | | 10.89 | 10.25 | | | | | | |
| Less-Freight Out | | | 975 | | | | | | | |
| Less-Trns Freight | | | | | | | | | | |
| Less-Warehouse | | | | | | | | | | |
| Less-Commission | | | | | | | | | | |
| Sub-Total | | | 975 | | | | | | | |
| Per Unit | | | 0.04 | | | | | | | |
| Net Sales | | | 245,173 | 179,652 | | | | | | |
| Per Unit | | | 10.85 | 10.25 | | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | | | 245,172 | 190,869 | | | | | | |
| | | | 10.85 | 10.89 | | | | | | |
| Mfg Variance | | | | 13,383 | | | | | | |
| | | | | 0.76 | | | | | | |
| Royalties | | | | | | | | | | |
| | | | | | | | | | | |
| Other | | | | | | | | | | |
| | | | | | | | | | | |
| Total Cost of Sales | | | 245,172 | 204,252 | | | | | | |
| | | | 10.85 | 11.65 | | | | | | |
| Gross Margin | | | 1 | (24,600) | | | | | | |
| | | | 0.00 | (1.40) | | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diuron Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | 510,000 | 1,475,437 | 995,942 | 2,438,489 | 2,192,793 | 2,544,389 | 3,000,000 |
| | | | | | | | | | | |
| Gross Sales | | | | 1,356,408 | 3,783,692 | 2,547,235 | 6,616,373 | 5,716,791 | 6,782,346 | 8,040,000 |
| Per Unit | | | | 2.66 | 2.56 | 2.56 | 2.71 | 2.61 | 2.67 | 2.68 |
| Less-Freight Out | | | | | 40 | 2,170 | 8,258 | (109) | (2,995) | 30,000 |
| Less-Trns Freight | | | | 320 | 1,720 | 5,058 | 2,775 | 7,020 | 14,032 | |
| Less-Warehouse | | | | 3,507 | 11,752 | 18,905 | | 41,827 | 131,024 | 210,000 |
| Less-Commission | | | | | | | | | | |
| Sub-Total | | | | 3,827 | 13,512 | 26,133 | 11,033 | 48,738 | 142,061 | 240,000 |
| Per Unit | | | | 0.01 | 0.01 | 0.03 | 0.00 | 0.02 | 0.06 | 0.08 |
| Net Sales | | | | 1,352,581 | 3,770,180 | 2,521,102 | 6,605,340 | 5,668,053 | 6,640,286 | 7,800,000 |
| Per Unit | | | | 2.65 | 2.56 | 2.53 | 2.71 | 2.58 | 2.61 | 2.60 |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | | | | 1,081,200 | 3,494,300 | 2,382,198 | 6,262,231 | 5,840,264 | 6,619,505 | 7,638,083 |
| | | | | 2.12 | 2.37 | 2.39 | 2.57 | 2.66 | 2.60 | 2.55 |
| Mfg Variance | | | | 443,587 | 283,548 | 892,003 | 402,911 | 92,000 | 175,890 | 2 |
| | | | | 0.87 | 0.19 | 0.90 | 0.17 | 0.04 | 0.07 | 0.00 |
| Tolling Cost | | | | 1,658 | | | | | | |
| | | | | 0.00 | | | | | | |
| Start-Up Cost | | | | (273,222) | 94,000 | 94,000 | 85,222 | | | |
| | | | | (0.54) | 0.06 | 0.09 | 0.03 | | | |
| Other | | | | 202.00 | | | | | | |
| | | | | 0.00 | | | | | | |
| Total Cost of Sales | | | | 1,253,425 | 3,871,848 | 3,368,201 | 6,750,364 | 5,932,264 | 6,795,395 | 7,638,085 |
| | | | | 2.46 | 2.62 | 3.38 | 2.77 | 2.71 | 2.67 | 2.55 |
| Gross Margin | | | | 99,156 | (101,668) | (847,099) | (145,024) | (264,211) | (155,109) | 161,915 |
| | | | | 0.19 | (0.07) | (0.85) | (0.06) | (0.12) | (0.06) | 0.05 |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Diuron Col Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | | 333,963 | 234,315 | | | |
| | | | | | | | | | | |
| Gross Sales | | | | | | 621,867 | 510,516 | | | |
| Per Unit | | | | | | 1.86 | 2.18 | | | |
| Less-Freight Out | | | | | | 28,842 | 18,785 | | | |
| Less-Trns Freight | | | | | | | 676 | | | |
| Less-Warehouse | | | | | | | | | | |
| Less-Commission | | | | | | | | | | |
| Sub-Total | | | | | | 28,842 | 19,461 | | | |
| Per Unit | | | | | | 0.09 | 0.08 | | | |
| Net Sales | | | | | | 593,025 | 491,055 | | | |
| Per Unit | | | | | | 1.78 | 2.10 | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | | | | | | 534,341 | 430,334 | | | |
| | | | | | | 1.60 | 1.84 | | | |
| Mfg Variance | | | | | | 78,191 | 23,521 | 46,915 | | |
| | | | | | | 0.23 | 0.10 | | | |
| Total Cost of Sales | | | | | | 612,532 | 453,855 | 46,915 | | |
| | | | | | | 1.83 | 1.94 | | | |
| Gross Margin | | | | | | (19,507) | 37,200 | (46,915) | | |
| | | | | | | (0.06) | 0.16 | | | |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Bandit Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | | | 2,853 | | | |
| | | | | | | | | | | |
| Gross Sales | | | | | | | 51,439 | | | |
| Per Unit | | | | | | | 18.03 | | | |
| Less-Freight Out | | | | | | | 1,307 | | | |
| Less-Trns Freight | | | | | | | 76 | | | |
| Less-Warehouse | | | | | | | | | | |
| Less-Commission | | | | | | | | | | |
| Sub-Total | | | | | | | 1,383 | | | |
| Per Unit | | | | | | | 0.48 | | | |
| Net Sales | | | | | | | 50,056 | | | |
| Per Unit | | | | | | | 17.55 | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | | | | | | | 39,234 | | | |
| | | | | | | | 13.75 | | | |
| Mfg Variance | | | | | | | 6,476 | | | |
| | | | | | | | 2.27 | | | |
| Start Up Cost | | | | | | | | | | |
| | | | | | | | | | | |
| Other | | | | | | | | | | |
| | | | | | | | | | | |
| Total Cost of Sales | | | | | | | 45,710 | | | |
| | | | | | | | 16.02 | | | |
| Gross Margin | | | | | | | 4,346 | | | |
| | | | | | | | 1.52 | | | |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wham/Super Wham Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | 90,835 | 44,035 | 97,580 | 131,050 | 392,520 | 175,180 | 180,020 | 357,829 | 623,502 | 503,800 |
| | | | | | | | | | | |
| Gross Sales | 1,159,863 | 631,767 | 1,542,779 | 2,085,335 | 5,926,463 | 2,607,461 | 2,708,298 | 5,713,621 | 5,450,086 | 4,722,621 |
| Per Unit | 12.77 | 14.35 | 15.81 | 15.91 | 15.10 | 14.88 | 15.04 | 15.97 | 8.74 | 9.37 |
| Less-Rebate | | | | | | | | 483,583 | (222,798) | |
| Less-Freight Out | 46,319 | 29,265 | 36,688 | 37,555 | 105,352 | 42,850 | 126,035 | 107,408 | 11,205 | 20,152 |
| Less-Trns Freight | | | 3,199 | 22,179 | 55,671 | 42,028 | 78,290 | 54,062 | 69,808 | 60,456 |
| Less-Warehouse | 37,010 | 12,024 | 23,516 | 21,439 | 63,747 | 58,909 | 74,570 | 46,184 | 55,139 | 45,342 |
| Less-Commission | | | | | | | 53,797 | 19,149 | (4,549) | |
| Sub-Total | 83,329 | 41,289 | 63,403 | 81,173 | 224,770 | 143,787 | 332,692 | 710,386 | (91,195) | 125,950 |
| Per Unit | 0.92 | 0.94 | 0.65 | 0.62 | 0.57 | 0.82 | 1.85 | 1.99 | (0.15) | 0.26 |
| Net Sales | 1,076,534 | 590,478 | 1,479,376 | 2,004,162 | 5,701,693 | 2,463,674 | 2,375,606 | 5,003,235 | 5,541,281 | 4,596,671 |
| Per Unit | 11.85 | 13.41 | 15.16 | 15.29 | 14.53 | 14.06 | 13.20 | 13.98 | 8.89 | 9.12 |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | 820,099 | 443,739 | 1,058,075 | 1,101,215 | 3,258,793 | 1,418,753 | 1,461,164 | 2,885,734 | 4,877,031 | 3,716,438 |
| | 9.03 | 10.08 | 10.84 | 8.40 | 8.30 | 8.10 | 8.12 | 8.06 | 7.82 | 7.38 |
| Mfg Variance | (27,942) | | 22,029 | (144,885) | (161,528) | 9,276 | 358,398 | 132,112 | (345,531) | 2 |
| | (0.31) | | 0.23 | (1.11) | (0.41) | 0.05 | 1.99 | 0.37 | (0.55) | 0.00 |
| Product Complaint | | 39,480 | 8,315 | 463 | 4,007 | 47,242 | 12,045 | 33,513 | 2,878 | |
| | | 0.90 | 0.09 | 0.00 | 0.01 | 0.27 | 0.07 | 0.09 | 0.00 | |
| Task Force | | 61,243 | 43,015 | 21,803 | 21,475 | 19,462 | 18,035 | 14,476 | | |
| | | 1.39 | 0.44 | 0.17 | 0.05 | 0.11 | 0.10 | 0.04 | | |
| Other | 90 | | | 59,778 | | | | | | |
| | 0.00 | | | 0.46 | | | | | | |
| Total Cost of Sales | 792,247 | 544,462 | 1,131,434 | 1,038,374 | 3,122,747 | 1,494,733 | 1,849,642 | 3,065,835 | 4,534,378 | 3,716,440 |
| | 8.72 | 12.36 | 11.59 | 7.92 | 7.96 | 8.53 | 10.27 | 8.57 | 7.27 | 7.38 |
| Gross Margin | 284,287 | 46,016 | 347,942 | 965,788 | 2,578,946 | 968,941 | 525,964 | 1,937,400 | 1,006,903 | 880,231 |
| | 3.13 | 1.04 | 3.57 | 7.37 | 6.57 | 5 53 | 2.92 | 5.41 | 1.61 | 1.75 |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wham 80% Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | 135,140 | 257,600 | 97,100 | 84,230 | | | | |
| | | | | | | | | | | |
| Gross Sales | | | 430,121 | 758,351 | 159,023 | 168,550 | | | | |
| Per Unit | | | 3.18 | 2.94 | 1.64 | 2.00 | | | | |
| Less-Freight Out | | | 6,548 | 4,640 | 22,638 | | | | | |
| Less-Trns Freight | | | | 2,627 | 650 | | | | | |
| Less-Warehouse | | | 3,639 | 5,380 | 2,609 | 5,197 | | | | |
| Less-Commission | | | | | | | | | | |
| Sub-Total | | | 10,187 | 12,647 | 25,897 | 5,197 | | | | |
| Per Unit | | | 0.08 | 0.05 | 0.27 | 0.06 | | | | |
| Net Sales | | | 419,934 | 745,704 | 133,126 | 163,353 | | | | |
| Per Unit | | | 3.11 | 2.89 | 1.37 | 1.94 | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | | | 130,359 | 518,614 | 163,504 | 204,238 | | | | |
| | | | 0.96 | 2.01 | 1.68 | 2.42 | | | | |
| Mfg Variance | | | | (100,007) | 51,089 | 28,261 | (7) | | | |
| | | | | (0.39) | 0.53 | 0.34 | | | | |
| Task Force | | | 57,354 | 12,764 | 8,474 | 2,289 | | | | |
| | | | 0.42 | 0.05 | 0.09 | 0.03 | | | | |
| Other | | | | 14,838.00 | | | | | | |
| | | | | 0.06 | | | | | | |
| Total Cost of Sales | | | 187,713 | 446,209 | 223,067 | 234,788 | (7) | | | |
| | | | 1.39 | 1.73 | 2.30 | 2.79 | | | | |
| Gross Margin | | | 232,221 | 299,495 | (89,941) | (71,435) | 7 | | | |
| | | | 1.72 | 1.16 | (0.93) | (0.85) | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Duet Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | | | | | | 300,000 |
| | | | | | | | | | | |
| Gross Sales | | | | | | | | | | 2,812,200 |
| Per Unit | | | | | | | | | | 9.37 |
| Less-Freight Out | | | | | | | | | | |
| Less-Tms Freight | | | | | | | | | | |
| Less-Warehouse | | | | | | | | | | |
| Less-Commission | | | | | | | | | | |
| Sub-Total | | | | | | | | | | |
| Per Unit | | | | | | | | | | |
| Net Sales | | | | | | | | | | 2,812,200 |
| Per Unit | | | | | | | | | | 9.37 |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | | | | | | | | | | 2,199,823 |
| | | | | | | | | | | 7.33 |
| Mfg Variance | | | | | | | | | | (1) |
| | | | | | | | | | | (0.00) |
| Start Up Cost | | | | | | | | | | |
| | | | | | | | | | | |
| Other | | | | | | | | | | |
| | | | | | | | | | | |
| Total Cost of Sales | | | | | | | | | | 2,199,822 |
| | | | | | | | | | | 7.33 |
| Gross Margin | | | | | | | | | | 612,378 |
| | | | | | | | | | | 2.04 |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| DF/WDG's Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | 353,361 | 501,690 | 32,800 | | | | | | | |
| | | | | | | | | | | |
| Gross Sales | 714,045 | 1,074,840 | 50,918 | | | | | | | |
| Per Unit | 2.02 | 2.14 | 1.55 | | | | | | | |
| Less-Rebate | | | | | | | | | | |
| Less-Freight Out | 317 | 9,930 | 925 | | | | | | | |
| Less-Trns Freight | | | | | | | | | | |
| Less-Warehouse | 1,126 | 12,193 | 308 | | | | | | | |
| Less-Commission | | | | | | | | | | |
| Sub-Total | 1,443 | 22,123 | 1,233 | | | | | | | |
| Per Unit | 0.00 | 0.04 | 0.04 | | | | | | | |
| Net Sales | 712,602 | 1,052,717 | 49,685 | | | | | | | |
| Per Unit | 2.02 | 2.10 | 1.51 | | | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | 566,775 | 863,378 | 59,250 | | | | | | | |
| | 1.60 | 1.72 | 1.81 | | | | | | | |
| Mfg Variance | 1,200 | | | | | | | | | |
| | 0.00 | | | | | | | | | |
| Other | | | | | | | | | | |
| | | | | | | | | | | |
| Product Complaint | | | | | | | | | | |
| | | | | | | | | | | |
| Task Force | | 221,455 | 43,015 | | | | | | | |
| | | 0.44 | 1.31 | | | | | | | |
| Total Cost of Sales | 567,975 | 1,084,833 | 102,265 | | | | | | | |
| | 1.61 | 2.16 | 3.12 | | | | | | | |
| Gross Margin | 144,627 | (32,116) | (52,580) | | | | | | | |
| | 0.41 | (0.06) | (1.60) | | | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Butoxone 175 Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | 77,014 | 111,350 | 98,321 | 104,060 | 78,194 | 76,417 | 37,307 | 33,884 | 22,248 | 43,000 |
| | | | | | | | | | | |
| Gross Sales | 1,158,498 | 1,996,333 | 1,894,957 | 2,249,016 | 1,474,207 | 1,436,072 | 904,635 | 835,234 | 287,324 | 1,059,952 |
| Per Unit | 15.04 | 17.93 | 19.27 | 21.61 | 18.85 | 18.79 | 24.25 | 24.65 | 12.91 | 24.65 |
| Less-Rebate | | | | | | | | 155,946 | (75,579) | 324,652 |
| Less-Freight Out | 15,215 | 26,017 | 20,618 | 13,368 | 10,388 | 13,347 | 11,019 | 13,341 | 8,675 | 16,340 |
| Less-Trns Freight | | | | 14,459 | 9,770 | 8,730 | 12,981 | 16,034 | 11,997 | 21,500 |
| Less-Warehouse | 11,569 | 18,788 | 20,464 | 50,733 | 31,604 | 32,488 | 19,945 | 11,252 | 24,472 | 30,960 |
| Less-Commission | | | | | | | | | | |
| Sub-Total | 26,784 | 44,805 | 41,082 | 78,560 | 51,762 | 54,565 | 43,945 | 196,573 | (30,435) | 393,452 |
| Per Unit | 0.35 | 0.40 | 0.42 | 0.75 | 0.66 | 0.71 | 1.18 | 5.80 | (1.37) | 9.15 |
| Net Sales | 1,131,714 | 1,951,528 | 1,853,875 | 2,170,456 | 1,422,445 | 1,381,507 | 860,690 | 638,661 | 317,759 | 666,500 |
| Per Unit | 14.69 | 17.53 | 18.86 | 20.86 | 18.19 | 18.08 | 23.07 | 18.85 | 14.28 | 15.50 |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | 835,036 | 1,281,452 | 976,248 | 1,058,389 | 791,773 | 851,061 | 416,530 | 362,278 | 272,311 | 464,434 |
| | 10.84 | 11.51 | 9.93 | 10.17 | 10.13 | 11.14 | 11.16 | 10.69 | 12.24 | 10.80 |
| Mfg Variance | (139,261) | | | (66,161) | (17,375) | 21,631 | 6,051 | (10,724) | (18,944) | (1) |
| | (1.81) | | | (0.64) | (0.22) | 0.28 | 0.16 | (0.32) | (0.85) | (0.00) |
| Other | 910 | | | 5,361 | | | | | | |
| | 0.01 | | | 0.05 | | | | | | |
| Product Complaint | | 21,584 | | 2,169 | | 20,348 | | 784 | | |
| | | 0.19 | | 0.02 | | 0.27 | | 0.02 | | |
| Task Force | 105,000 | 125,573 | 113,129 | 298,650 | 137,806 | 86,903 | 95,575 | 124,108 | 42,314 | 48,600 |
| | 1.36 | 1.13 | 1.15 | 2.87 | 1.76 | 1.14 | 2.56 | 3.66 | 1.90 | 1.13 |
| Total Cost of Sales | 801,685 | 1,428,609 | 1,089,377 | 1,298,408 | 912,204 | 979,943 | 518,156 | 476,446 | 295,681 | 513,033 |
| | 10.41 | 12.83 | 11.08 | 12.48 | 11.67 | 12.82 | 13.89 | 14.06 | 13.29 | 11.93 |
| Gross Margin | 330,029 | 522,919 | 764,498 | 872,048 | 510,241 | 401,564 | 342,534 | 162,215 | 22,078 | 153,467 |
| | 4.29 | 4.70 | 7.78 | 8.38 | 6.53 | 5.25 | 9.18 | 4.79 | 0.99 | 3.57 |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Butoxone 200 Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | 8,154 | 33,212 | 30,024 | 80,620 | 57,128 | 35,132 | 25,787 | 27,087 | 27,519 | 28,280 |
| | | | | | | | | | | |
| Gross Sales | 130,323 | 667,606 | 639,978 | 1,717,020 | 1,065,404 | 766,426 | 599,433 | 696,505 | 507,528 | 777,700 |
| Per Unit | 15.98 | 20.10 | 21.32 | 21.30 | 18.65 | 21.82 | 23.25 | 25.71 | 18.44 | 27.50 |
| Less-Rebate | | | | | | | | 86,445 | (1,149) | 240,097 |
| Less-Freight Out | 2,302 | 14,495 | 13,199 | 42,897 | 31,279 | 15,045 | 5,534 | 10,359 | 11,773 | 14,140 |
| Less-Trns Freight | | | | 15,163 | 9,711 | 15,435 | 19,986 | 23,284 | 22,179 | 33,936 |
| Less-Warehouse | 5,196 | 7,469 | 10,975 | 15,067 | 14,781 | 9,280 | 15,162 | 13,062 | 13,391 | 15,837 |
| Less-Commission | | | | | | | | | | |
| Sub-Total | 7,498 | 21,964 | 24,174 | 73,127 | 55,771 | 39,760 | 40,682 | 133,150 | 46,194 | 304,010 |
| Per Unit | 0.92 | 0.66 | 0.81 | 0.91 | 0.98 | 1.13 | 1.58 | 4.92 | 1.68 | 10.75 |
| Net Sales | 122,825 | 645,642 | 615,804 | 1,643,893 | 1,009,633 | 726,666 | 558,751 | 563,355 | 461,334 | 473,690 |
| Per Unit | 15.06 | 19.44 | 20.51 | 20.39 | 17.67 | 20.68 | 21.67 | 20.80 | 16.76 | 16.75 |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | 98,126 | 374,739 | 432,613 | 984,029 | 693,891 | 406,639 | 297,592 | 313,609 | 394,585 | 347,268 |
| | 12.03 | 11.28 | 14.41 | 12.21 | 12.15 | 11.57 | 11.54 | 11.58 | 14.34 | 12.28 |
| Mfg Variance | 70,390 | | | 4,421 | (27,889) | (5,823) | 23,301 | (11,344) | (29,604) | 2 |
| | 8.63 | | | 0.05 | (0.49) | (0.17) | 0.90 | (0.42) | (1.08) | 0.00 |
| Other | (915) | | | 196 | | | | | | |
| | (0.11) | | | 0.00 | | | | | | |
| Product Complaint | | | | | | | | 2,075 | | |
| | | | | | | | | 0.08 | | |
| Task Force | | 31,645 | 31,423 | 76,350 | 87,194 | 48,097 | 54,425 | 125,269 | 30,843 | 36,396 |
| | | 0.95 | 1.05 | 0.95 | 1.53 | 1.37 | 2.11 | 4.62 | 1.12 | 1.29 |
| Total Cost of Sales | 167,601 | 406,384 | 464,036 | 1,064,996 | 753,196 | 448,913 | 375,318 | 429,609 | 395,824 | 383,666 |
| | 20.55 | 12.24 | 15.46 | 13.21 | 13.18 | 12.78 | 14.55 | 15.86 | 14.38 | 13.57 |
| Gross Margin | (44,776) | 239,258 | 151,768 | 578,897 | 256,437 | 277,753 | 183,433 | 133,746 | 65,510 | 90,024 |
| | (5.49) | 7.20 | 5.05 | 7.18 | 4.49 | 7.91 | 7.11 | 4.94 | 2.38 | 3.18 |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Butoxone 7500 Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | | | 10,350 | 7,886 | 6,980 | |
| | | | | | | | | | | |
| Gross Sales | | | | | | | 219,938 | 120,545 | 97,477 | |
| Per Unit | | | | | | | 21.25 | 15.29 | 13.97 | |
| Less-Rebate | | | | | | | | 1,240 | 5,009 | |
| Less-Freight Out | | | | | | | 1,973 | 2,797 | 3,517 | |
| Less-Trns Freight | | | | | | | 3,873 | 2,758 | 3,220 | |
| Less-Warehouse | | | | | | | 4,614 | 8,421 | 7,540 | |
| Less-Commission | | | | | | | | | | |
| Sub-Total | | | | | | | 10,460 | 15,216 | 19,286 | |
| Per Unit | | | | | | | 1.01 | 1.93 | 2.76 | |
| Net Sales | | | | | | | 209,478 | 105,329 | 78,191 | |
| Per Unit | | | | | | | 20.24 | 13.36 | 11.20 | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | | | | | | | 120,715 | 93,448 | 77,408 | |
| | | | | | | | 11.66 | 11.85 | 11.09 | |
| Mfg Variance | | | | | | | 65,876 | 4,946 | (18,146) | |
| | | | | | | | 6.36 | 0.63 | (2.60) | |
| Other | | | | | | | | | | |
| | | | | | | | | | | |
| Product Complaint | | | | | | | | | | |
| | | | | | | | | | | |
| Task Force | | | | | | | | 31,623 | 10,742 | |
| | | | | | | | | 4.01 | 1.54 | |
| Total Cost of Sales | | | | | | | 186,591 | 130,017 | 70,004 | |
| | | | | | | | 18.03 | 16.49 | 10.03 | |
| Gross Margin | | | | | | | 22,887 | (24,688) | 8,187 | |
| | | | | | | | 2.21 | (3.13) | 1.17 | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Butoxone Ester Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | 14,580 | 8,810 | 14,040 | 6,815 | | | | | | |
| | | | | | | | | | | |
| Gross Sales | 308,273 | 216,304 | 230,356 | 101,360 | | | | | | |
| Per Unit | 21.14 | 24.55 | 16.41 | 14.87 | | | | | | |
| Less-Rebate | | | | | | | | | | |
| Less-Freight Out | 7,050 | 5,318 | 3,403 | 1,025 | | | | | | |
| Less-Trns Freight | | | 373 | 860 | | | | | | |
| Less-Warehouse | 3,722 | 309 | 4,505 | 800 | | | | | | |
| Less-Commission | | | | | | | | | | |
| *Sub-Total* | 10,772 | 5,627 | 8,281 | 2,685 | | | | | | |
| Per Unit | 0.74 | 0.64 | 0.59 | 0.39 | | | | | | |
| Net Sales | 297,501 | 210,677 | 222,075 | 98,675 | | | | | | |
| Per Unit | 20.40 | 23.91 | 15.82 | 14.48 | | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | 151,049 | 114,948 | 186,607 | 76,784 | | | | | | |
| | 10.36 | 13.05 | 13.29 | 11.27 | | | | | | |
| Mfg Variance | (7,388) | | 842 | 5,931 | | | | | | |
| | (0.51) | | 0.06 | 0.87 | | | | | | |
| Other | | | | | | | | | | |
| | | | | | | | | | | |
| Product Complaint | | | | | | | | | | |
| | | | | | | | | | | |
| Task Force | | 23,161 | 12,568 | | | | | | | |
| | | 2.63 | 0.90 | | | | | | | |
| Total Cost of Sales | 143,661 | 138,109 | 200,017 | 82,715 | | | | | | |
| | 9.85 | 15.68 | 14.25 | 12.14 | | | | | | |
| Gross Margin | 153,840 | 72,568 | 22,058 | 15,960 | | | | | | |
| | 10.55 | 8.24 | 1.57 | 2.34 | | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Pluck Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | 12,370 | 58,725 | 95 | | | |
| | | | | | | | | | | |
| Gross Sales | | | | | 537,155 | 2,708,709 | (885,763) | | | |
| Per Unit | | | | | 43.42 | 46.13 | (9,323.82) | | | |
| Less-Rebate | | | | | | | | | | |
| Less-Freight Out | | | | | 6,054 | 18,913 | 4,105 | | | |
| Less-Trns Freight | | | | | 557 | 3,419 | 15 | | | |
| Less-Warehouse | | | | | 222 | 4,215 | 2,348 | | | |
| Less-Commission | | | | | | | | | | |
| Sub-Total | | | | | 6,833 | 26,547 | 6,468 | | | |
| Per Unit | | | | | 0.55 | 0.45 | 68.08 | | | |
| Net Sales | | | | | 530,322 | 2,682,162 | (892,231) | | | |
| Per Unit | | | | | 42.87 | 45.67 | (9,391.91) | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | | | | | 404,696 | 1,703,025 | 2,058 | | | |
| | | | | | 32.72 | 29.00 | 21.66 | | | |
| Mfg Variance | | | | | 19,957 | (360,558) | (3,420) | | | |
| | | | | | 1.61 | (6.14) | (36.00) | | | |
| Other | | | | | | | | | | |
| | | | | | | | | | | |
| Product Complaint | | | | | | | | | | |
| | | | | | | | | | | |
| Task Force | | | | | | | | | | |
| | | | | | | | | | | |
| Total Cost of Sales | | | | | 424,653 | 1,342,467 | (1,362) | | | |
| | | | | | 34.33 | 22.86 | (14.34) | | | |
| Gross Margin | | | | | 105,669 | 1,339,695 | (890,869) | | | |
| | | | | | 8.54 | 22.81 | (9,377.57) | | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tough Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | |
| Qty Sold > | | | | 39,140 | 29,360 | (795) | | | | | |
| | | | | | | | | | | | |
| Gross Sales | | | | 1,827,245 | 749,668 | 7,492 | | | | | |
| Per Unit | | | | 46.68 | 25.53 | (9.42) | | | | | |
| Less-Freight Out | | | | 16,067 | 37,779 | (3,345) | 1,073 | | | | |
| Less-Trns Freight | | | | 8,682 | 1,715 | 6,653 | | | | | |
| Less-Warehouse | | | | 35,739 | 21,196 | 4,234 | | | | | |
| Less-Commission | | | | 3,760 | | | | | | | |
| Sub-Total | | | | 64,248 | 60,690 | 7,542 | 1,073 | | | | |
| Per Unit | | | | 1.64 | 2.07 | (9.49) | | | | | |
| Net Sales | | | | 1,762,997 | 688,978 | (50) | (1,073) | | | | |
| Per Unit | | | | 45.04 | 23.47 | 0.06 | | | | | |
| | | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | | |
| Cost of Sales @ Std | | | | 1,251,811 | 596,859 | 54,026 | | | | | |
| | | | | 31.98 | 20.33 | (67.96) | | | | | |
| Mfg Variance | | | | (337,224) | 55,280 | 189 | | | | | |
| | | | | (8.62) | 1.88 | (0.24) | | | | | |
| Product Complaint | | | | | 136,503 | | | | | | |
| | | | | | 4.65 | | | | | | |
| Other | | | | 74,649.00 | | | | | | | |
| | | | | 1.91 | | | | | | | |
| Total Cost of Sales | | | | 989,236 | 788,642 | 54,215 | | | | | |
| | | | | 25.27 | 26.86 | (68.19) | | | | | |
| Gross Margin | | | | 773,761 | (99,664) | (54,265) | (1,073) | | | | |
| | | | | 19.77 | (3.39) | 68.26 | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tough/Combo Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | 1,823 | (1,320) | | | | | |
| | | | | | | | | | | |
| Gross Sales | | | | 604,871 | (238,755) | | | | | |
| Per Unit | | | | 331.80 | 180.88 | | | | | |
| Less-Freight Out | | | | 2,322 | 483 | | | | | |
| Less-Trns Freight | | | | 3,958 | | | | | | |
| Less-Warehouse | | | | 9,736 | 675 | | | | | |
| Less-Commission | | | | | | | | | | |
| Sub-Total | | | | 16,016 | 1,158 | | | | | |
| Per Unit | | | | 8.79 | (0.88) | | | | | |
| Net Sales | | | | 588,855 | (239,913) | | | | | |
| Per Unit | | | | 323.01 | 181.75 | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | | | | 483,027 | (249,216) | | | | | |
| | | | | 264.96 | 188.80 | | | | | |
| Mfg Variance | | | | | | | | | | |
| | | | | | | | | | | |
| Product Complaint | | | | 495 | | | | | | |
| | | | | 0.27 | | | | | | |
| Other | | | | | | | | | | |
| | | | | | | | | | | |
| Total Cost of Sales | | | | 483,522 | (249,216) | | | | | |
| | | | | 265.23 | 188.80 | | | | | |
| Gross Margin | | | | 105,333 | 9,303 | | | | | |
| | | | | 57.78 | (7.05) | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acid Chloride Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | |
| Qty Sold > | | | | 290,905 | | 117,032 | | | | | |
| | | | | | | | | | | | |
| Gross Sales | | | | 811,136 | | 55,265 | | | | | |
| Per Unit | | | | 2.79 | | 0.47 | | | | | |
| | | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | | |
| Tolling Cost | | | | 243,433 | | 167,624 | | | | | |
| | | | | 0.84 | | 1.43 | | | | | |
| Mfg Variance | | | | | | | 2,367 | | | | |
| | | | | | | | | | | | |
| Total Cost of Sales | | | | 243,433 | | 167,624 | 2,367 | | | | |
| | | | | 0.84 | | 1.43 | | | | | |
| Gross Margin | | | | 567,703 | | (112,359) | (2,367) | | | | |
| | | | | 1.95 | | (0.96) | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Acifluorfen Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | | | 297,913 | 1,693,496 | 1,915,887 | 2,205,000 |
| | | | | | | | | | | |
| Gross Sales | | | | | | | 1,116,100 | 3,469,413 | 3,680,857 | 4,101,300 |
| Per Unit | | | | | | | 3.75 | 2.05 | 1.92 | 1.86 |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | | | | | 990,893 | 3,109,547 | 3,163,591 | 3,614,837 |
| | | | | | | | 3.33 | 1.84 | 1.65 | 1.64 |
| Total Cost of Sales | | | | | | | 990,893 | 3,109,547 | 3,163,591 | 3,614,837 |
| | | | | | | | 3.33 | 1.84 | 1.65 | 1.64 |
| Gross Margin | | | | | | | 125,207 | 359,866 | 517,266 | 486,463 |
| | | | | | | | 0.42 | 0.21 | 0.27 | 0.22 |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ADPA Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | 2,822,913 | 2,050,823 | 1,787,177 | | | | |
| | | | | | | | | | | |
| Gross Sales | | | 64,000 | 559,307 | 329,182 | 289,500 | | | | |
| Per Unit | | | | 0.20 | 0.16 | 0.16 | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | 61,520 | 552,928 | 483,281 | 364,927 | | | | |
| | | | | 0.20 | 0.24 | 0.20 | | | | |
| Total Cost of Sales | | | 61,520 | 552,928 | 483,281 | 364,927 | | | | |
| | | | | 0.20 | 0.24 | 0.20 | | | | |
| Gross Margin | | | 2,480 | 6,379 | (154,099) | (75,427) | | | | |
| | | | | 0.00 | (0.08) | (0.04) | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AKZO Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | | | | | | |
| | | | | | | | | | | |
| Gross Sales | | | | | | | | | | |
| Per Unit | | | | | | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | 958 | | | | | | | |
| | | | | | | | | | | |
| Total Cost of Sales | | | 958 | | | | | | | |
| | | | | | | | | | | |
| Gross Margin | | | (958) | | | | | | | |
| | | | | | | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Angus Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | | | | | | |
| | | | | | | | | | | |
| Gross Sales | | | | | | | | | | |
| Per Unit | | | | | | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | 572 | | | | | | | |
| | | | | | | | | | | |
| Total Cost of Sales | | | 572 | | | | | | | |
| | | | | | | | | | | |
| Gross Margin | | | (572) | | | | | | | |
| | | | | | | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BFG Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | 806,372 | 4,343,341 | 6,971,039 | 4,796,344 | 7,505,877 | 9,432,881 | 10,500,000 |
| | | | | | | | | | | |
| Gross Sales | 70,057 | 458,529 | 659,708 | 618,474 | 1,459,731 | 2,382,777 | 1,396,985 | 2,219,872 | 2,215,040 | 2,352,000 |
| Per Unit | | | | 0.77 | 0.34 | 0.34 | 0.29 | 0.30 | 0.23 | 0.22 |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | 66,158 | 269,652 | 519,149 | 528,689 | 955,077 | 1,217,098 | 646,458 | 1,212,941 | 1,451,034 | 1,566,020 |
| | | | | 0.66 | 0.22 | 0.17 | 0.13 | 0.16 | 0.15 | 0.15 |
| Total Cost of Sales | 66,158 | 269,652 | 519,149 | 528,689 | 955,077 | 1,217,098 | 646,458 | 1,212,941 | 1,451,034 | 1,566,020 |
| | | | | 0.66 | 0.22 | 0.17 | 0.13 | 0.16 | 0.15 | 0.15 |
| Gross Margin | 3,899 | 188,877 | 140,559 | 89,785 | 504,654 | 1,165,679 | 750,527 | 1,006,931 | 764,006 | 785,980 |
| | | | | 0.11 | 0.12 | 0.17 | 0.16 | 0.13 | 0.08 | 0.07 |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Butyl Chloride Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | | | 284,420 | 274,157 | | |
| | | | | | | | | | | |
| Gross Sales | | | | | | | 115,740 | 110,562 | | |
| Per Unit | | | | | | | 0.41 | 0.40 | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | | | | | 216,105 | 197,041 | | |
| | | | | | | | 0.76 | 0.72 | | |
| Total Cost of Sales | | | | | | | 216,105 | 197,041 | | |
| | | | | | | | 0.76 | 0.72 | | |
| Gross Margin | | | | | | | (100,365) | (86,479) | | |
| | | | | | | | (0.35) | (0.32) | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO300 Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | | | | | | |
| | | | | | | | | | | |
| Gross Sales | | | | | | | | | | |
| Per Unit | | | | | | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | | 1,921 | | | | | | |
| | | | | | | | | | | |
| Total Cost of Sales | | | | 1,921 | | | | | | |
| | | | | | | | | | | |
| Gross Margin | | | | (1,921) | | | | | | |
| | | | | | | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cobra Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | 441,370 | 428,580 | | | | |
| | | | | | | | | | | |
| Gross Sales | | | | | 630,000 | 566,916 | | | | |
| Per Unit | | | | | 1.43 | 1.32 | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | | | 243,050 | 198,086 | | | | |
| | | | | | 0.55 | 0.46 | | | | |
| Total Cost of Sales | | | | | 243,050 | 198,086 | | | | |
| | | | | | 0.55 | 0.46 | | | | |
| Gross Margin | | | | | 386,950 | 368,830 | | | | |
| | | | | | 0.88 | 0.86 | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CTBL Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | 203,055 | 515,125 | 514,050 | 46,620 | | | | | |
| | | | | | | | | | | |
| Gross Sales | | 290,500 | 815,215 | 516,054 | 129,478 | | | | | |
| Per Unit | | 1.43 | 1.58 | 1.00 | 2.78 | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | 130,316 | 371,343 | 290,315 | 52,768 | | | | | |
| | | 0.64 | 0.72 | 0.56 | 1.13 | | | | | |
| Total Cost of Sales | | 130,316 | 371,343 | 290,315 | 52,768 | | | | | |
| | | 0.64 | 0.72 | 0.56 | 1.13 | | | | | |
| Gross Margin | | 160,184 | 443,872 | 225,739 | 76,710 | | | | | |
| | | 0.79 | 0.86 | 0.44 | 1.65 | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cypermethrin Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | |
| Qty Sold > | | | | 171,309 | | 162,810 | 178,114 | | | | |
| | | | | | | | | | | | |
| Gross Sales | | | | 539,694 | | 653,796 | 764,129 | | | | |
| Per Unit | | | | 3.15 | | 4.02 | 4.29 | | | | |
| | | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | | |
| Tolling Cost | | | | 166,095 | | 211,962 | 740,866 | | | | |
| | | | | 0.97 | | 1.30 | 4.16 | | | | |
| Total Cost of Sales | | | | 166,095 | | 211,962 | 740,866 | | | | |
| | | | | 0.97 | | 1.30 | 4.16 | | | | |
| Gross Margin | | | | 373,599 | | 441,834 | 23,263 | | | | |
| | | | | 2.18 | | 2.71 | 0.13 | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CYMP Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | | | | | 21,180 | |
| | | | | | | | | | | |
| Gross Sales | | | | | | | | | 261,600 | |
| Per Unit | | | | | | | | | 12.35 | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | | | | | | | 177,362 | |
| | | | | | | | | | 8.37 | |
| Total Cost of Sales | | | | | | | | | 177,362 | |
| | | | | | | | | | 8.37 | |
| Gross Margin | | | | | | | | | 84,238 | |
| | | | | | | | | | 3.98 | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| D8 Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | | | | | | |
| | | | | | | | | | | |
| Gross Sales | | | | 6,730 | | | | | | |
| Per Unit | | | | | | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | | 8,964 | | | | | | |
| | | | | | | | | | | |
| Total Cost of Sales | | | | 8,964 | | | | | | |
| | | | | | | | | | | |
| Gross Margin | | | | (2,234) | | | | | | |
| | | | | | | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depha Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | |
| Qty Sold > | | 1,380,850 | 4,848,210 | 728,950 | 1,334,487 | 2,680,920 | 970,100 | | | | |
| | | | | | | | | | | | |
| Gross Sales | | 1,536,958 | 2,372,765 | 287,492 | 511,649 | 1,023,035 | 408,835 | | | | |
| Per Unit | | 1.11 | 0.49 | 0.39 | 0.38 | 0.38 | 0.42 | | | | |
| | | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | | |
| Tolling Cost | | 741,263 | 1,560,986 | 404,756 | 647,037 | 1,127,666 | 304,145 | | | | |
| | | 0.54 | 0.32 | 0.56 | 0.48 | 0.42 | 0.31 | | | | |
| Total Cost of Sales | | 741,263 | 1,560,986 | 404,756 | 647,037 | 1,127,666 | 304,145 | | | | |
| | | 0.54 | 0.32 | 0.56 | 0.48 | 0.42 | 0.31 | | | | |
| Gross Margin | | 795,695 | 811,779 | (117,264) | (135,388) | (104,631) | 104,690 | | | | |
| | | 0.58 | 0.17 | (0.16) | (0.10) | (0.04) | 0.11 | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dupont-CNT Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | 1,145,200 | | | | | | | | | |
| | | | | | | | | | | |
| Gross Sales | 589,904 | | | | | | | | | |
| Per Unit | 0.52 | | | | | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | 425,710 | 50 | | | | | | | | |
| | 0.37 | | | | | | | | | |
| Total Cost of Sales | 425,710 | 50 | | | | | | | | |
| | 0.37 | | | | | | | | | |
| Gross Margin | 164,194 | (50) | | | | | | | | |
| | 0.14 | | | | | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dupont-MBC Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | 285,340 | 309,650 | | | | | | | | |
| | | | | | | | | | | |
| Gross Sales | 820,044 | 521,986 | | | | | | | | |
| Per Unit | 2.87 | 1.69 | | | | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | 636,371 | 304,356 | | | | | | | | |
| | 2.23 | 0.98 | | | | | | | | |
| Total Cost of Sales | 636,371 | 304,356 | | | | | | | | |
| | 2.23 | 0.98 | | | | | | | | |
| Gross Margin | 183,673 | 217,630 | | | | | | | | |
| | 0.64 | 0.70 | | | | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Ethephon Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | | | 344,244 | 1,283,517 | | |
| | | | | | | | | | | |
| Gross Sales | | | | | | | 1,136,744 | 2,505,587 | 1,800,000 | 1,600,000 |
| Per Unit | | | | | | | 3.30 | 1.95 | | |
| Less-Freight Out | | | | | | | | 22,446 | (4,465) | |
| Less-Trns Freight | | | | | | | | | | |
| Less-Warehouse | | | | | | | 424 | | | |
| Less-Commission | | | | | | | | | | |
| Sub-Total | | | | | | | 424 | 22,446 | (4,465) | |
| Per Unit | | | | | | | 0.00 | 0.02 | | |
| Net Sales | | | | | | | 1,136,320 | 2,483,141 | 1,804,465 | 1,600,000 |
| Per Unit | | | | | | | 3.30 | 1.93 | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | | | | | | | 1,160,102 | 1,026,430 | | |
| | | | | | | | 3.37 | 0.80 | | |
| Tolling Cost | | | | | | | | | | |
| | | | | | | | | | | |
| Mfg Variance | | | | | | | (4,661) | 448,262 | (5,325) | |
| | | | | | | | (0.01) | 0.35 | | |
| Start Up Cost | | | | | | | | | | |
| | | | | | | | | | | |
| Total Cost of Sales | | | | | | | 1,155,441 | 1,474,692 | (5,325) | |
| | | | | | | | 3.36 | 1.15 | | |
| Gross Margin | | | | | | | (19,121) | 1,008,449 | 1,809,790 | 1,600,000 |
| | | | | | | | (0.06) | 0.79 | | |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 5-Nitro Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | | | | | 139,333 | 135,000 |
| | | | | | | | | | | |
| Gross Sales | | | | | | | | | 4,119,000 | 2,913,000 |
| Per Unit | | | | | | | | | 29.56 | 21.68 |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | | | | | | | 2,097,370 | 2,188,102 |
| | | | | | | | | | 15.05 | 16.21 |
| Cost Overrun | | | | | | | | | 644,268 | |
| | | | | | | | | | 4.62 | |
| Total Cost of Sales | | | | | | | | | 2,741,638 | 2,188,102 |
| | | | | | | | | | 19.68 | 16.21 |
| Gross Margin | | | | | | | | | 1,377,362 | 724,898 |
| | | | | | | | | | 9.89 | 5.37 |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Grace Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | 774,740 | 1,999,933 | 2,258,355 | | | | | | | |
| | | | | | | | | | | |
| Gross Sales | 2,614,552 | 2,797,261 | 4,318,167 | | | | | | | |
| Per Unit | 3.37 | 1.40 | 1.91 | | | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | 2,445,661 | 1,970,016 | 1,904,093 | | | | | | | |
| | 3.16 | 0.99 | 0.84 | | | | | | | |
| Start Up Cost | (77,336) | 71,255 | 213,764 | | | | | | | |
| | (0.10) | 0.04 | 0.09 | | | | | | | |
| Total Cost of Sales | 2,368,325 | 2,041,271 | 2,117,857 | | | | | | | |
| | 3.06 | 1.02 | 0.94 | | | | | | | |
| Gross Margin | 246,227 | 755,990 | 2,200,310 | | | | | | | |
| | 0.32 | 0.38 | 0.97 | | | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Graphsize Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | 3,599,310 | 2,725,600 | 2,002,650 | | | |
| | | | | | | | | | | |
| Gross Sales | | | | | 1,029,056 | 652,475 | 1,130,870 | | | |
| Per Unit | | | | | 0.29 | 0.24 | 0.56 | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | | | 736,843 | 502,499 | 983,439 | | | |
| | | | | | 0.20 | 0.18 | 0.49 | | | |
| Start Up Cost | | | | | | | | | | |
| | | | | | | | | | | |
| Total Cost of Sales | | | | | 736,843 | 502,499 | 983,439 | | | |
| | | | | | 0.20 | 0.18 | 0.49 | | | |
| Gross Margin | | | | | 292,213 | 149,976 | 147,431 | | | |
| | | | | | 0.08 | 0.06 | 0.07 | | | |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ICI Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | 1,022,962 | 601,312 | | | | | | | | |
| | | | | | | | | | | |
| Gross Sales | 1,199,567 | 600,000 | | | | | | | | |
| Per Unit | 1.17 | 1.00 | | | | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | 620,153 | 416,406 | | | | | | | | |
| | 0.61 | 0.69 | | | | | | | | |
| Start Up Cost | | | | | | | | | | |
| | | | | | | | | | | |
| Total Cost of Sales | 620,153 | 416,406 | | | | | | | | |
| | 0.61 | 0.69 | | | | | | | | |
| Gross Margin | 579,414 | 183,594 | | | | | | | | |
| | 0.57 | 0.31 | | | | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MES Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | 272,100 | | | | | | | | | |
| | | | | | | | | | | |
| Gross Sales | 258,870 | | | | | | | | | |
| Per Unit | 0.95 | | | | | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | 289,105 | 1,270 | | | | | | | | |
| | 1.06 | | | | | | | | | |
| Start Up Cost | | | | | | | | | | |
| | | | | | | | | | | |
| Total Cost of Sales | 289,105 | 1,270 | | | | | | | | |
| | 1.06 | | | | | | | | | |
| Gross Margin | (30,235) | (1,270) | | | | | | | | |
| | (0.11) | | | | | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| MTPO Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | 148,800 | 42,930 | | 46,910 | 44,394 | | | | | |
| | | | | | | | | | | |
| Gross Sales | 879,120 | 349,880 | | 370,543 | 381,782 | | | | | |
| Per Unit | 5.91 | 8.15 | | 7.90 | 8.60 | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | 403,003 | 282,691 | 7,716 | 280,123 | 321,454 | (427) | | | | |
| | 2.71 | 6.58 | | 5.97 | 7.24 | | | | | |
| Start Up Cost | | | | | | | | | | |
| | | | | | | | | | | |
| Total Cost of Sales | 403,003 | 282,691 | 7,716 | 280,123 | 321,454 | (427) | | | | |
| | 2.71 | 6.58 | | 5.97 | 7.24 | | | | | |
| Gross Margin | 476,117 | 67,189 | (7,716) | 90,420 | 60,328 | 427 | | | | |
| | 3.20 | 1.57 | | 1.93 | 1.36 | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Orfom Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | 793,070 | 116,700 | 1,196,907 | | | | | | | |
| | | | | | | | | | | |
| Gross Sales | 229,457 | 67,608 | 350,694 | | | | | | | |
| Per Unit | 0.29 | 0.58 | 0.29 | | | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | 339,742 | 81,982 | 285,871 | | | | | | | |
| | 0.43 | 0.70 | 0.24 | | | | | | | |
| Start Up Cost | | | | | | | | | | |
| | | | | | | | | | | |
| Total Cost of Sales | 339,742 | 81,982 | 285,871 | | | | | | | |
| | 0.43 | 0.70 | 0.24 | | | | | | | |
| Gross Margin | (110,285) | (14,374) | 64,823 | | | | | | | |
| | (0.14) | (0.12) | 0.05 | | | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Perborate Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | 85,080 | 1,371,860 | 1,234,680 | | | | | |
| | | | | | | | | | | |
| Gross Sales | | | 4,000 | 60,149 | 46,198 | | | | | |
| Per Unit | | | 0.05 | 0.04 | 0.04 | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | 32,284 | 187,828 | 95,311 | | | | | |
| | | | 0.38 | 0.14 | 0.08 | | | | | |
| Start Up Cost | | | | | | | | | | |
| | | | | | | | | | | |
| Total Cost of Sales | | | 32,284 | 187,828 | 95,311 | | | | | |
| | | | 0.38 | 0.14 | 0.08 | | | | | |
| Gross Margin | | | (28,284) | (127,679) | (49,113) | | | | | |
| | | | (0.33) | (0.09) | (0.04) | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Permethrin Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | | | 67,866 | 189,420 | | |
| | | | | | | | | | | |
| Gross Sales | | | | | | | 227,351 | 623,720 | | |
| Per Unit | | | | | | | 3.35 | 3.29 | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | | | | | 138,966 | 327,537 | | |
| | | | | | | | 2.05 | 1.73 | | |
| Total Cost of Sales | | | | | | | 138,966 | 327,537 | | |
| | | | | | | | 2.05 | 1.73 | | |
| Gross Margin | | | | | | | 88,385 | 296,183 | | |
| | | | | | | | 1.30 | 1.56 | | |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sectagon Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | 425,794 | 189,352 | | | | | | | | |
| | | | | | | | | | | |
| Gross Sales | 537,423 | 246,623 | | | | | | | | |
| Per Unit | 1.26 | 1.30 | | | | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | 505,457 | 240,907 | 16,411 | (84,535) | | | | | | |
| | 1.19 | 1.27 | | | | | | | | |
| Total Cost of Sales | 505,457 | 240,907 | 16,411 | (84,535) | | | | | | |
| | 1.19 | 1.27 | | | | | | | | |
| Gross Margin | 31,966 | 5,716 | (16,411) | 84,535 | | | | | | |
| | 0.08 | 0.03 | | | | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Stockhousen Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | | | | | | | |
| | | | | | | | | | | | |
| Gross Sales | | | | | | | | | | | |
| Per Unit | | | | | | | | | | | |
| | | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | | |
| Tolling Cost | | | | 6,310 | | | | | | | |
| | | | | | | | | | | | |
| Total Cost of Sales | | | | 6,310 | | | | | | | |
| | | | | | | | | | | | |
| Gross Margin | | | | (6,310) | | | | | | | |
| | | | | | | | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Suresize Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | 796,150 | | | | | |
| | | | | | | | | | | |
| Gross Sales | | | | | 578,500 | | | | | |
| Per Unit | | | | | 0.73 | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | | 1,354 | 371,913 | | | | | |
| | | | | | 0.47 | | | | | |
| Total Cost of Sales | | | | 1,354 | 371,913 | | | | | |
| | | | | | 0.47 | | | | | |
| Gross Margin | | | | (1,354) | 206,587 | | | | | |
| | | | | | 0.26 | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TA Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | 82,675 | 293,734 | 484,419 | 603,676 | 198,927 | 490,000 |
| | | | | | | | | | | |
| Gross Sales | | | | | 492,806 | 1,725,525 | 2,861,028 | 3,539,137 | 1,202,431 | 3,028,200 |
| Per Unit | | | | | 5.96 | 5.87 | 5.91 | 5.86 | 6.04 | 6.18 |
| Less-Freight Out | | | | | 2,747 | 13,406 | 9,656 | 58,723 | 10,454 | 24,500 |
| Less-Trns Freight | | | | | | 5,600 | 1,250 | 967 | 10,950 | 24,500 |
| Less-Warehouse | | | | | 20,525 | 505 | 5,997 | 4,234 | 29,281 | 39,200 |
| Less-Commission | | | | | | 21,977 | 275,000 | 414,437 | 51,945 | |
| Sub-Total | | | | | 23,272 | 41,488 | 291,903 | 478,361 | 102,630 | 88,200 |
| Per Unit | | | | | 0.28 | 0.14 | 0.60 | 0.79 | 0.52 | 0.18 |
| Net Sales | | | | | 469,534 | 1,684,037 | 2,569,125 | 3,060,776 | 1,099,801 | 2,940,000 |
| Per Unit | | | | | 5.68 | 5.73 | 5.30 | 5.07 | 5.53 | 6.00 |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | | | | | 395,714 | 1,658,361 | 2,303,910 | 2,126,069 | 709,289 | 1,810,216 |
| | | | | | 4.79 | 5.65 | 4.76 | 3.52 | 3.57 | 3.69 |
| Tolling Cost | | | | | 26,776 | | | | | |
| | | | | | 0.32 | | | | | |
| Mfg Variance | | | | | | 58,707 | 237,963 | 571,268 | (343,206) | |
| | | | | | | 0.20 | 0.49 | 0.95 | (1.73) | |
| Start Up Cost | | | | | (250,594) | 55,164 | 55,164 | 55,164 | | |
| | | | | | (3.03) | 0.19 | 0.11 | 0.09 | | |
| Total Cost of Sales | | | | | 171,896 | 1,772,232 | 2,597,037 | 2,752,501 | 366,083 | 1,810,216 |
| | | | | | 2.08 | 6.03 | 5.36 | 4.56 | 1.84 | 3.69 |
| Gross Margin | | | | | 297,638 | (88,195) | (27,912) | 308,275 | 733,718 | 1,129,784 |
| | | | | | 3.60 | (0.30) | (0.06) | 0.51 | 3.69 | 2.31 |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Trometamol Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | | | 441 | 3,197 | | 35,000 |
| | | | | | | | | | | |
| Gross Sales | | | | | | | 4,298 | 19,258 | | 350,000 |
| Per Unit | | | | | | | 9.75 | 6.02 | | 10.00 |
| Less-Freight Out | | | | | | | | | | 3,500 |
| Less-Trns Freight | | | | | | | | | | 3,500 |
| Less-Warehouse | | | | | | | | | | 4,200 |
| Less-Commission | | | | | | | | | | |
| Sub-Total | | | | | | | | | | 11,200 |
| Per Unit | | | | | | | | | | 0.32 |
| Net Sales | | | | | | | 4,298 | 19,258 | | 338,800 |
| Per Unit | | | | | | | 9.75 | 6.02 | | 9.68 |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales @ Std | | | | | | | 6,773 | 26,816 | | 210,000 |
| | | | | | | | 15.36 | 8.39 | | 6.00 |
| Tolling Cost | | | | | | | | | | |
| | | | | | | | | | | |
| Mfg Variance | | | | | | 22,551 | (4,583) | 2,252 | (18,844) | |
| | | | | | | | (10.39) | 0.70 | | |
| Start Up Cost | | | | | | | | | | |
| | | | | | | | | | | |
| Total Cost of Sales | | | | | | 22,551 | 2,190 | 29,068 | (18,844) | 210,000 |
| | | | | | | | 4.97 | 9.09 | | 6.00 |
| Gross Margin | | | | | | (22,551) | 2,108 | (9,810) | 18,844 | 128,800 |
| | | | | | | | 4.78 | (3.07) | | 3.68 |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TTP Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | 158,230 | 484,820 | | | | |
| | | | | | | | | | | |
| Gross Sales | | | | | 28,956 | 166,810 | | | | |
| Per Unit | | | | | 0.18 | 0.34 | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | | | 86,856 | 88,450 | | | | |
| | | | | | 0.55 | 0.18 | | | | |
| Total Cost of Sales | | | | | 86,856 | 88,450 | | | | |
| | | | | | 0.55 | 0.18 | | | | |
| Gross Margin | | | | | (57,900) | 78,360 | | | | |
| | | | | | (0.37) | 0.16 | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unidentified Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Qty Sold > | | | | | | | | | | |
| | | | | | | | | | | |
| Gross Sales | | | | | | | | | | 2,115,000 |
| Per Unit | | | | | | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | | | | | | | | 2,076,973 |
| | | | | | | | | | | |
| Total Cost of Sales | | | | | | | | | | 2,076,973 |
| | | | | | | | | | | |
| Gross Margin | | | | | | | | | | 38,027 |
| | | | | | | | | | | |

| CEDAR - WEST HELENA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit 1 Analysis | | | | | | | | | | | |
| | | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Gross Sales | | | | | | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | | | 15,643 | 131,881 | 615,870 | 581,660 | 209,589 | 347,723 |
| Mfg Variance | | | | | | | | | | |
| Start Up Cost | | | | | | | | | | |
| Total Cost of Sales | | | | | 15,643 | 131,881 | 615,870 | 581,660 | 209,589 | 347,723 |
| Gross Margin | | | | | (15,643) | (131,881) | (615,870) | (581,660) | (209,589) | (347,723) |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Unit 4 Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Gross Sales | | | | | | | | | | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | | | 7,610 | 18,636 | 630,489 | 5,725 | 146,806 | 147,847 |
| Mfg Variance | | | | | | | | | | |
| Start Up Cost | | | | | | | | | | |
| Total Cost of Sales | | | | | 7,610 | 18,636 | 630,489 | 5,725 | 146,806 | 147,847 |
| Gross Margin | | | | | (7,610) | (18,636) | (630,489) | (5,725) | (146,806) | (147,847) |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Unit 5 Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Gross Sales | | | | | | | | | 669,106 | 600,000 |
| Cash Discount | | | | | | | | | 25,000 | |
| Net Sales | | | | | | | | | 644,106 | 600,000 |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Tolling Cost | | | | | (65,926) | 553,481 | 1,109,114 | 490,079 | 1,086,796 | 667,448 |
| Mfg Variance | | | | | | | | | | |
| Start Up Cost | | | | | | | | | | |
| Total Cost of Sales | | | | | (65,926) | 553,481 | 1,109,114 | 490,079 | 1,086,796 | 667,448 |
| Gross Margin | | | | | 65,926 | (553,481) | (1,109,114) | (490,079) | (442,690) | (67,448) |

| CEDAR - WEST HELENA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Other Analysis | | | | | | | | | | |
| | | | | | | | | | | |
| Sales | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| Gross Sales | 11,966 | 25,175 | 19,327 | | (168) | 87,946 | 67,797 | 7,494 | (70,017) | |
| Cash Discount | | | | | | 275,680 | 43,577 | 137,068 | 90,093 | |
| Net Sales | 11,966 | 25,175 | 19,327 | | (168) | (187,734) | 24,220 | (129,574) | (160,110) | |
| | | | | | | | | | | |
| Cost of Sales | | | | | | | | | | |
| Cost of Sales | | 5,637 | | | | | | | | |
| Mfg Variance | | 341,416 | | 3 | | 167,645 | 500,262 | (9,154) | 22,721 | 549,251 |
| Consent Decree | | | 456,841 | 399,157 | 120,260 | 76,624 | 126,252 | 80,453 | 147,612 | |
| Other | 3,626 | | | | | | | | | |
| Total Cost of Sales | 3,626 | 347,053 | 456,841 | 399,160 | 120,260 | 244,269 | 626,514 | 71,299 | 170,333 | 549,251 |
| Gross Margin | 8,340 | (321,878) | (437,514) | (399,160) | (120,428) | (432,003) | (602,294) | (200,873) | (330,443) | (549,251) |

Neil Robbins

CEDAR - WEST HELENA
CAPITAL SPENDING BY YEAR

| YEAR | SPENDING | CUMULATIVE | CUM AVG |
|---|---|---|---|
| 1990 | 3,787,037 | 3,787,037 | 3,787,037 |
| 1991 | 4,028,416 | 7,815,453 | 3,907,727 |
| 1992 | 1,552,274 | 9,367,727 | 3,122,576 |
| 1993 | 2,396,127 | 11,763,854 | 2,940,964 |
| 1994 | 1,687,292 | 13,451,146 | 2,690,229 |
| 1995 | 2,938,321 | 16,389,467 | 2,731,578 |
| 1996 | 3,765,151 | 20,154,618 | 2,879,231 |
| 1997 | 2,976,593 | 23,131,211 | 2,891,401 |
| 1998 | 4,017,305 | 27,148,516 | 3,016,502 |
| 1999 | 5,806,780 | 32,955,296 | 3,295,530 |

| Description | CAR # | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Grace Project | XX-1798 | 197,189 | | | | | | | | | 197,189 |
| Grace Project Int | 8805 | 29 | | | | | | | | | 29 |
| DCA-Engineering | 1-1798 | 372,354 | 238,648 | | | | | | | | 611,002 |
| DCA-Lab Equipment | 2-1799 | 3,405 | 3,428 | | | | | | | | 6,833 |
| DCA-Equipment | 3-1799 | 542,492 | 178,545 | | | | | | | | 721,037 |
| DCA-Office Building | 4-1799 | 324,598 | 23,058 | | | | | | | | 347,656 |
| DCA-Plant Salaries & Wages | 5-1799 | (52) | | | | | | | | | (52) |
| DCA-Site Prep | 6-1799 | 48,805 | 33,079 | | | | | | | | 81,884 |
| DCA-Structural | 7-1799 | 409,086 | 64,043 | | | | | | | | 473,129 |
| DCA-Equipment Installation | 8-1799 | 17,467 | 47,674 | | | | | | | | 65,141 |
| DCA-Piping | 9-1799 | 339,323 | 862,522 | | | | | | | | 1,201,845 |
| DCA-Intr & Controls | 10-1799 | 71,485 | 765,931 | | | | | | | | 837,416 |
| DCA-Elec | 11-1799 | 11,920 | 13,485 | | | | | | | | 25,405 |
| DCA-Painting | 12-1799 | 52,260 | 225,026 | | | | | | | | 277,286 |
| DCA-Concrete | 13-1799 | 138,548 | 4,620 | | | | | | | | 143,168 |
| DCA-Painting | 14-1799 | 16,889 | 53,151 | | | | | | | | 70,040 |
| DCA-Freight | 15-1799 | 25,884 | 7,351 | | | | | | | | 33,235 |
| DCA-Equipment Repair | 16-1799 | 197,861 | | | | | | | | | 197,861 |
| DCA-Crane Rental | 17-1799 | 39,500 | 18,047 | | | | | | | | 57,547 |
| DCA-Waste Handling | 18-1799 | 19,860 | 15,580 | | | | | | | | 35,440 |
| DCA-Equipment Relocation | 19-1799 | 149,157 | | | | | | | | | 149,157 |
| DCA-Storage Tanks | 20-1799 | 59,247 | | | | | | | | | 59,247 |
| DCA-Lab Expansion | 21-1779 | 111,112 | 24,190 | | | | | | | | 135,302 |
| DCA-Warehouse | 22-1779 | 98,809 | 106,053 | | | | | | | | 202,862 |
| DCA-Capitized Interest | 24-1799 | 141,830 | 144,095 | | | | | | | | 285,925 |
| Propane Bld Tank | 9001 | 33,067 | | | | | | | | | 33,067 |
| Gen Plt Phone Sys | 9002 | 4,214 | | | | | | | | | 4,214 |
| Gen Plt Refr Comp | 9003 | 91,837 | 3,573 | | | | | | | | 95,410 |
| U4 Reactor Dph | 9004 | 31,851 | 572 | | | | | | | | 32,423 |
| P Acid Storage | 9005 | 21,534 | 8,839 | | | | | | | | 30,373 |
| Grace Water Trac Sys | 9006 | 16,252 | | | | | | | | | 16,252 |
| Gen Plt Utility Tms | 9007 | | 63,527 | | | | | | | | 63,527 |
| MTPO Plt Mod | 9008 | 201,224 | | | | | | | | | 201,224 |
| Custom Mfg Unit/Ph I | 9009 | | 81,613 | 2,369 | | | | | | | 83,982 |
| Formulation Lab Equip | 9101 | | 12,320 | | | | | | | | 12,320 |
| Grace Metering Pump | 9102 | | 16,031 | | | | | | | | 16,031 |
| Steam Line Inst | 9103 | | 17,765 | | | | | | | | 17,765 |
| Gas Chromatagraph | 9104 | | 25,882 | | | | | | | | 25,882 |
| Benchspace Env Lab | 9105 | | 12,845 | | | | | | | | 12,845 |
| DCA Storage Tank Pump | 9106 | | 8,080 | | | | | | | | 8,080 |
| Agitator | 9107 | | 10,340 | | | | | | | | 10,340 |
| New 4" Gas Main | 9108 | | 8,200 | | | | | | | | 8,200 |
| Centrifuge Speed Controller | 9109 | | 139 | 6,780 | | | | | | | 6,919 |
| Plant Nitrogen Head | 9110 | | 20,914 | | | | | | | | 20,914 |
| Office Site Improvements | 9111 | | 17,690 | 4,793 | | | | | | | 22,483 |
| Bulk Storage Sys | 9112 | | 17,341 | | | | | | | | 17,341 |
| Dehpa Plt Mod | 9113 | | 232,490 | 4,618 | | | | | | | 237,108 |
| Cooling Water Pump | 9114 | | 12,105 | 33,955 | | | | | | | 46,060 |
| Rail Station Platform | 9115 | | 9,414 | | | | | | | | 9,414 |
| IBM Printer | 9116 | | 5,013 | | | | | | | | 5,013 |
| Scrubber Tnk/Gls Reactor | 9117 | | 58,690 | | | | | | | | 58,690 |
| 2 New Mass Flow Meters | 9118 | | 18,900 | 16,551 | | | | | | | 35,451 |
| DCA Wash Vessel Wgt | 9119 | | 5,359 | 17,689 | | | | | | | 23,048 |
| Plant Air Sys | 9120 | | 10,082 | | | | | | | | 10,082 |
| Brinkman Particle Sizer | 9121 | | | 31,655 | | | | | | | 31,655 |
| DCA Nitric Piping | 9122 | | | 19,711 | | | | | | | 19,711 |
| Replace Agitator | 9123 | | 6,101 | 5 | | | | | | | 6,106 |
| Install New Agitator | 9124 | | | 6,691 | | | | | | | 6,691 |
| CTBL Plant Mod | 9125 | | 516,065 | 33,672 | | | | | | | 549,737 |
| U1 Control Room Roof | 9201 | | | 7,834 | | | | | | | 7,834 |
| Lime System | 9202 | | | 14,236 | | | | | | | 14,236 |
| Secoundary Dehydr Condensor | 9203 | | | 9,798 | | | | | | | 9,798 |
| R-PE108 Foundation Replacement | 9204 | | | 12,314 | | | | | | | 12,314 |
| Gas Chromatagraph | 9205 | | | 24,710 | | | | | | | 24,710 |
| RR Spur Culvert | 9206 | | | 13,944 | | | | | | | 13,944 |
| Propane Scrubber Sys | 9207 | | | 34,765 | | | | | | | 34,765 |
| Lime Conveyor Sys DCA | 9208 | | | 9,093 | | | | | | | 9,093 |
| Replc Refrigerator Sys | 9209 | | | 118,424 | 11,083 | | | | | | 129,507 |
| Revamp Boiler Blowdown | 9210 | | | 17,317 | | | | | | | 17,317 |
| DCA V-D316 Repair | 9211 | | | 31,072 | (891) | | | | | | 30,181 |

| Description | CAR # | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TFE Lined Pipe DCA | 9212 | | | 58,764 | 5,537 | | | | | | 64,301 |
| Prop Unit Upgrade Ph I | 9213 | | | 60,048 | | | | | | | 60,048 |
| New Chg Room | 9214 | | | 196,531 | 4,480 | | | | | | 201,011 |
| U3 Sump Repairs | 9215 | | | 7,200 | | | | | | | 7,200 |
| Prop Unit Upgrade | 9216 | | | 255,820 | (3,379) | | | | | | 252,441 |
| Rail Spur Drainage Imprv | 9217 | | | 10,258 | | | | | | | 10,258 |
| DCA Bottoms Drumming | 9218 | | | 24,763 | 6,055 | | | | | | 30,818 |
| Nitric Acid Scrubber | 9219 | | | 8,713 | | | | | | | 8,713 |
| Control Rm Pressurization | 9220 | | | 27,320 | 4,869 | | | | | | 32,189 |
| API Separator Repairs | 9221 | | | 20,523 | 16,015 | | | | | | 36,538 |
| Perborate Proj Ph I | 9222 | | | 89,092 | (8,124) | | | | | | 80,968 |
| Absorption Nitrogen Sy | 9223 | | | 8,703 | 36,930 | | | | | | 45,633 |
| UPS Sys for DCA | 9224 | | | 4,454 | 1,531 | | | | | | 5,985 |
| Alkl Chloride Stg Tk | 9225 | | | 15,997 | | | | | | | 15,997 |
| New Propanil Pkg Facility | 9226 | | | 105,209 | 277,895 | | | | | | 383,104 |
| DCA Scrubber Mod | 9227 | | | 6,838 | 6,140 | | | | | | 12,978 |
| ADPA Proj Mod | 9228 | | | 116,856 | (3,018) | | | | | | 113,838 |
| U4 Control Room Upgrade | 9229 | | | 47,723 | 13,088 | | | | | | 60,811 |
| Drainage Improvement | 9230 | | | 9,368 | (220) | | | | | | 9,146 |
| Envirn Drm Storage Cover | 9231 | | | 8,500 | | | | | | | 8,500 |
| FMC Acid Chloride Mod | 9301 | | | | 226,121 | | | | | | 226,121 |
| U1 Scrubber Rplcm't | 9302 | | | | 62,838 | | | | | | 62,838 |
| Office Improvements | 9303 | | | | 6,460 | | | | | | 6,460 |
| Plant Entrance & Parking Lot | 9304 | | | | 60,595 | 691 | | | | | 61,288 |
| DCA Circulation Line | 9305 | | | | 31,259 | | | | | | 31,259 |
| Spervisors Office | 9306 | | | | 13,088 | | | | | | 13,088 |
| Grading & Pavinf DCA Unit | 9307 | | | | 15,000 | | | | | | 15,000 |
| Emergency Relief Vents Prop | 9308 | | | | 20,081 | 12,831 | | | | | 32,912 |
| Trash Compactor Site | 9309 | | | | 14,532 | | | | | | 14,532 |
| U1 Sump | 9310 | | | | 28,999 | | | | | | 28,999 |
| Spare Vacum Pump | 9311 | | | | 33,400 | | | | | | 33,400 |
| Cypermethrin Mod | 9312 | | | | 188,730 | | | | | | 188,730 |
| Sodium Perborate Mod | 9313 | | | | 107,388 | | | | | | 107,388 |
| Propanil Vacum Pump | 9314 | | | | 60,457 | | | | | | 60,457 |
| U4 Sump & Trenches | 9315 | | | | 8,106 | | | | | | 8,106 |
| Storm Water Treatment Sys | 9316 | | | | 143,544 | | | | | | 143,544 |
| U4 Tanks | 9317 | | | | 9,158 | | | | | | 9,158 |
| Stormwater System Ph I | 9318 | | | | 170,018 | 20,224 | | | | | 190,242 |
| Tank Dike Access | 9319 | | | | 9,224 | 419 | | | | | 9,643 |
| Diuron Mfg Unit 3 | 9320 | | | | 127,002 | 5,268 | | | | | 132,268 |
| DCA Column Packing | 9321 | | | | 95,819 | | | | | | 95,819 |
| U5 Hydrogen Meter Sys | 9322 | | | | 1,599 | 4,914 | | | | | 6,513 |
| DCNB FlowMeter | 9323 | | | | 10,647 | | | | | | 10,647 |
| U4 Reactor | 9324 | | | | 143,361 | 4,250 | | | | | 147,611 |
| Waste Water Piping | 9325 | | | | 45,782 | | | | | | 45,782 |
| U4 Plant Mod | 9326 | | | | 361,681 | 78,892 | | | | | 440,573 |
| U4 Dehpa Mod | 9327 | | | | 22,674 | 73 | | | | | 22,747 |
| U4 Graphsize Mod | 9328 | | | | 34,595 | 135,568 | | | | | 170,163 |
| Nitric Acid Tank-DCA | 9401 | | | | | 92,297 | 232 | | | | 92,529 |
| Unit 4 Vinnings Isma Mod | 9402 | | | | | 177,790 | | | | | 177,790 |
| Propanil Solvent Tank Replcmt | 9403 | | | | | 42,820 | | | | | 42,820 |
| Chromatograph Data Pkg | 9404 | | | | | 6,297 | 397 | | | | 6,694 |
| DCA Tempered Wate Sys | 9405 | | | | | 56,982 | (2,712) | | | | 54,270 |
| Peroxide Treatment Per CAO | 9406 | | | | | 22,885 | | | | | 22,885 |
| UV-Visible Spectrophotometer | 9407 | | | | | 6,314 | | | | | 6,314 |
| Repack Propanil Distillation | 9408 | | | | | 12,727 | | | | | 12,727 |
| U4 PLC Control Room | 9409 | | | | | 12,242 | | | | | 12,242 |
| Diuron Unit 2 Mod | 9410 | | | | | 568,852 | 7,435 | | | | 576,087 |
| U4 Agitator | 9411 | | | | | 19,458 | | | | | 19,458 |
| New Stormwater Transfer Sys | 9412 | | | | | 11,074 | | | | | 11,074 |
| DCA Sulfuric Acid Lo'g Platf | 9413 | | | | | 3,679 | 14,373 | | | | 18,052 |
| Rplc Ag'tor For R-5103 Unit 5 | 9414 | | | | | 34,888 | 13,958 | | | | 48,826 |
| Rplc DCA Nitrtion Circ Loop | 9415 | | | | | 13,703 | 7,927 | | | | 21,630 |
| API Separator Repairs | 9416 | | | | | 6,647 | 6,494 | | | | 13,141 |
| Condensor Repair Unit 4 | 9417 | | | | | 4,941 | | | | | 4,941 |
| A&W-TTP Pit Mod | 9418 | | | | | 134,479 | | | | | 134,479 |
| Unit 2 Control Panel Rplcmt | 9419 | | | | | 37,394 | | | | | 37,394 |
| TA Plant Mod | 9420 | | | | | 117,967 | | | | | 117,967 |
| HPLC Pump & Flash Tester | 9421 | | | | | 5,286 | 3,233 | | | | 8,519 |
| DCNB Crystallization | 9422 | | | | | | 1,555,870 | 901,307 | (207,590) | | 2,249,587 |

| Description | CAR # | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Agitator Drive Unit 1 | 9423 | | | | | | 7,366 | | | | 7,366 |
| Agitator Shaft U | 9424 | | | | | 18,518 | | | | | 18,518 |
| Lactofen Plant Mod-Unit 1 | 9425 | | | | | 16,344 | 4,572 | | | | 20,916 |
| Firewater Booster Pump | 9426 | | | | | | 114,075 | | | | 114,075 |
| Boiler Replacement-Ph I | 9501 | | | | | | 114,951 | | | | 114,951 |
| DCA Computer Sys | 9502 | | | | | | 233,200 | 10,478 | | | 243,678 |
| RR Loading Station Ph I | 9503 | | | | | | 30,669 | | | | 30,669 |
| Reactor R-4101-Unit 4 | 9504 | | | | | | 93,815 | | | | 93,815 |
| Agitator Drive R-1103-Unit 1 | 9505 | | | | | | 7,995 | | | | 7,995 |
| Rplcm't Diuron Duct Collector | 9506 | | | | | | 17,425 | | | | 17,425 |
| Replace Flaker Belt | 9507 | | | | | | 14,003 | | | | 14,003 |
| Lab HPLC | 9508 | | | | | | 6,797 | | | | 6,797 |
| DCA Waste Trmt Tnk Vent Rplcm | 9509 | | | | | | | 3,156 | | | 3,156 |
| Diuron Condensor Improvements | 9510 | | | | | | 60,012 | | | | 60,012 |
| Dryer Repairs Unit 5 | 9511 | | | | | | 31,185 | | | | 31,185 |
| Scrubber Tank-Unit 4 | 9512 | | | | | | 25,562 | | | | 25,562 |
| DCA Distillation Still Pot | 9513 | | | | | | 5,078 | | | | 5,078 |
| DCA Boiler | 9514 | | | | | | 8,041 | | | | 8,041 |
| DCA Hydrogenator | 9515 | | | | | | 19,578 | | | | 19,578 |
| R-4104 Reactor Replcm't | 9516 | | | | | | 82,702 | 20,226 | | | 102,928 |
| DCA Tank Farm Dike | 9517 | | | | | | 11,437 | | | | 11,437 |
| DCA Cooling Water Tower | 9518 | | | | | | 165,764 | (7,084) | | | 158,680 |
| DCA Refrigeration System | 9519 | | | | | | 177,342 | 20,863 | | | 198,206 |
| DCA Vacuum Pump Mod | 9520 | | | | | | 99,544 | 50,092 | | | 149,636 |
| Brine Tank Unit 4 | 9521 | | | | | | | 7,588 | | | 7,588 |
| DCA Utility System Upgrade | 9522 | | | | | | | 23,298 | | | 23,298 |
| Tromethamine Pkg'g Sys Unit 5 | 9523 | | | | | | | 14,775 | | | 14,775 |
| Hgh Pressure Feed Pump Unit 5 | 9524 | | | | | | | 16,260 | | | 16,260 |
| Plant Water Supply Mod | 9601 | | | | | | | 17,868 | | | 17,868 |
| Fire/Process Water Piping Mod | 9602 | | | | | | | 44,073 | | | 44,073 |
| DCA Bottoms Pump Replacm' | 9603 | | | | | | | 7,900 | 985 | | 8,885 |
| Acifluorfen Mod Unit 4 | 9604 | | | | | | | 530,198 | (1,371) | | 528,827 |
| Ethephon Plt Unit 5 Mod | 9605 | | | | | | | 702,732 | 649,909 | | 1,352,641 |
| Ethephon Plt Mod | 9606 | | | | | | | | 6,565 | | 6,565 |
| Replace High Pressure Bol | 9606 | | | | | | | 410,738 | (68,318) | | 342,420 |
| Propanil Flaker Repairs | 9607 | | | | | | | 23,541 | | | 23,541 |
| Railroad Spur Repairs | 9608 | | | | | | | 10,461 | 3,010 | | 13,471 |
| Plant Crane | 9609 | | | | | | | 61,835 | | | 61,835 |
| Reactor Replacement R-2104 | 9610 | | | | | | | 195,881 | | | 195,881 |
| DCPI Bulk Storage | 9611 | | | | | | | 31,701 | | | 31,701 |
| New Vacuum Pump DCNB | 9612 | | | | | | | 61,818 | | | 61,818 |
| Diuron Mod Unit 2a | 9613 | | | | | | | 381,781 | (13,548) | | 368,233 |
| Plant Perimeter Fencing | 9614 | | | | | | | 28,397 | 6,564 | | 34,961 |
| Propanil Column Packing | 9615 | | | | | | | 8,777 | 8,794 | | 17,571 |
| Unit 1 Siding Replacement | 9616 | | | | | | | | 9,150 | | 9,150 |
| Unit 5 Trometm'e Product | 9617 | | | | | | | 7,252 | 3,330 | | 10,582 |
| DCA-Vacuum Pumps | 9618 | | | | | | | 9,747 | | | 9,747 |
| DCA-Secondary Crystallization | 9619 | | | | | | | 18,004 | | | 18,004 |
| DCA-Metanol Tank Bottoms | 9620 | | | | | | | 10,071 | | | 10,071 |
| DCA-Primary Crystalizer | 9621 | | | | | | | 12,002 | | | 12,002 |
| DCA-DCNB Crystallizer Vent | 9622 | | | | | | | 8,503 | | | 8,503 |
| DCA-R6110 Load Cell Inst | 9623 | | | | | | | 9,999 | | | 9,999 |
| DCA-r6106 Coil Repairs | 9624 | | | | | | | 5,502 | | | 5,502 |
| U1-4-5 Refregeration | 9625 | | | | | | | 70,211 | | | 70,211 |
| Unit 5 R-5104 Reactor Rep | 9626 | | | | | | | | 62,013 | | 62,013 |
| DCA-F-6701 Filter Replacement | 9628 | | | | | | | 37,200 | 114,037 | | 151,237 |
| DCA-F-6701 Filter Replacement | 9628 | | | | | | | | 41,577 | | 41,577 |
| DCA-F-6701 Filter Replacement | 9628 | | | | | | | | 13,680 | | 13,680 |
| Diuron P-2104 Pump Replacement | 9701 | | | | | | | | 1,837 | | 1,837 |
| Fire Protection Sys Mod | 9702 | | | | | | | | 197,781 | | 197,781 |
| Unit 5-Liquid HCL Vaporizer | 9703 | | | | | | | | 353,475 | | 353,475 |
| Unit 5-PCL | 9704 | | | | | | | | 76,288 | | 76,288 |
| Lab Ion Chromatograph | 9705 | | | | | | | | 15,000 | | 15,000 |
| Diuron Centrifuge Improvement | 9706 | | | | | | | | 53,814 | | 53,814 |
| Unit 5 EO Scrubber | 9707 | | | | | | | | 85,366 | | 85,366 |
| Unit 5 Reactor Replacement R | 9708 | | | | | | | | 98,258 | | 98,258 |
| Lab-Gas Chromatograph | 9709 | | | | | | | | 24,771 | | 24,771 |
| Ethephon HCL Recirculation | 9711 | | | | | | | | 61,597 | | 61,597 |
| Isomer Seperation Centrif | 9712 | | | | | | | | 6,393 | 2,321 | 8,714 |
| TA Warehouse Roof Repair | 9713 | | | | | | | | 16,518 | | 16,518 |

| Description | CAR # | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit 2a Replacement Load | 9714 | | | | | | | | 4,703 | | 4,703 |
| E-6101 Unit 6 Heat Exc | 9716 | | | | | | | | 49,943 | | 49,943 |
| BFG Telene Improvements | 9717 | | | | | | | | 30,577 | | 30,577 |
| Unit 8 Vessel Replacement | 9718 | | | | | | | | 97,868 | 22,889 | 120,757 |
| Bio Pond Aeration-Rev 1 | 9719 | | | | | | | | 47,526 | | 47,526 |
| Heat Exchanger Unit 4 | 9720 | | | | | | | | 19,167 | 5,415 | 24,582 |
| Unit 6 DCNB Column Imprv | 9721 | | | | | | | | 19,622 | (1,013) | 18,609 |
| Wastewater Trmt Impr-Bio | 9722 | | | | | | | | 18,285 | | 18,285 |
| Ponds Influent Flowmeter | 9724 | | | | | | | | 14,270 | 1,092 | 15,362 |
| T-4201 Replacement Unit 4 | 9727 | | | | | | | | 400 | 22,687 | 23,087 |
| Agitator Replacement Unit | 9728 | | | | | | | | 70,401 | 522 | 70,923 |
| Main Transformer Relocati | 9729 | | | | | | | | 128,930 | 34,796 | 163,726 |
| Diuron Dryer Chute Imprvm | 9730 | | | | | | | | | 23,649 | 23,649 |
| Unit 4 Replace Decantatio | 9732 | | | | | | | | 28,509 | 48,717 | 77,226 |
| Unit 8 R-6105 Replacement | 9733 | | | | | | | | 110,624 | 63 | 110,687 |
| Unit 1 T-1214 Scrubber Ta | 9735 | | | | | | | | 20,000 | | 20,000 |
| Unit 1 Control Rm & Mtr C | 9736 | | | | | | | | 344,400 | | 344,400 |
| Unit 1 R-1102, V-1303, T-12 | 9801 | | | | | | | | 359,482 | (37,278) | 322,204 |
| Quality Lab Expansion | 9804 | | | | | | | | | 283,410 | 283,410 |
| Unit 4 R-4103 Replacement | 9806 | | | | | | | | | 161,896 | 161,896 |
| DCA AutoClave Replacement | 9807 | | | | | | | | | 660,531 | 660,531 |
| Unit 1 Telene Improvement | 9808 | | | | | | | | | 330,712 | 330,712 |
| Propanil Improvements Rev 1 | 9810 | | | | | | | | | 125,992 | 125,992 |
| Unit 4 Solvent Change | 9811 | | | | | | | | | 401,929 | 401,929 |
| Unit 8 Catalyst Recovery | 9812 | | | | | | | | | 38,470 | 38,470 |
| Unit 6 DCA Expansion | 9813 | | | | | | | | | 125,450 | 125,450 |
| Unit 1 Vessel Additions | 9814 | | | | | | | | | 1,150,000 | 1,150,000 |
| Compressed Air Dryer | 9815 | | | | | | | | | 11,246 | 11,246 |
| Boiler Feed Water Economizer | 9816 | | | | | | | | | 2,761 | 2,761 |
| Unit 1 & 2 New Cooling Tower | 9817 | | | | | | | | | 142,991 | 142,991 |
| Unit 8 T-6202, Nitric Storage | 9818 | | | | | | | | | 59,036 | 59,036 |
| R&D Lab & Office Expansion | 9819 | | | | | | | | | 47,269 | 47,269 |
| Unit 2 Propanil Reactor | 9821 | | | | | | | | | 75,578 | 75,578 |
| Propanil Storage & Vent Condensor | 9822 | | | | | | | | | 121,338 | 121,338 |
| Unit 8 V-6302 Agitator Replacement | 9823 | | | | | | | | | 57 | 57 |
| Unit 5 CYMP Process Mod | 9827 | | | | | | | | | 113,585 | 113,585 |
| Dover Phos | 9901 | | | | | | | | | 63,194 | 63,194 |
| | | | | | | | | | | | |
| | | 3,787,037 | 4,028,416 | 1,552,274 | 2,396,127 | 1,687,282 | 2,938,321 | 3,765,151 | 2,976,593 | 4,017,305 | 27,148,516 |
| | | | | | | | | | | | |
| | | | | | | | | | | | 3,016,502 |

[redacted]
SUMMARY OF FIXED ASSETS
COST

DATE 31-Dec-90

LOCATION West Helena

| | BALANCE 1-1-90 | ADDITIONS | RETIREMENTS | TRANSFER TO (FROM) CIP | TRANSFER (TO) FM OTHER PLANTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND | 47,260.00 | | | | | | 47,260.00 |
| LAND IMPROVEMENTS | 802,716.55 | | | | | | 802,716.55 |
| BUILDINGS | 427,595.70 | | | | | | 427,595.70 |
| MACHINERY & EQUIPMENT | 10,010,713.91 | | | 3,101,061.66 | | | 13,111,775.57 |
| TRANSPORTATION EQUIPMENT | | | | | | | |
| OFFICE EQUIPMENT | 77,419.56 | | | 4,214.74 | | | 81,633.80 |
| CIP | 3,376,812.00 | 3,787,036.92 | | 3,607,275.90 | | | 3,456,573.02 |
| TOTAL COST | 14,741,517.72 | 3,787,036.92 | | 0.00 | | | 18,528,554.64 |

CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
ACCUMULATED DEPRECIATION

DATE 31-Dec-90

LOCATION West Helena

| | BALANCE 1-1-90 | CURRENT YEAR DEPRECIATION | RETIREMENTS | | TRANSFER (TO) FM OTHER PLANTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND IMPROVEMENTS | 508,929.03 | 3,895.20 | | | | | 512,824.23 |
| BUILDINGS | 238,998.79 | 40,847.76 | | | | | 279,846.55 |
| MACHINERY & EQUIPMENT | 7,317,044.24 | 643,239.70 | | | | | 7,960,283.94 |
| TRANSPORTATION EQUIPMENT | | | | | | | |
| OFFICE EQUIPMENT | 40,537.22 | 15,229.19 | | | | | 55,766.41 |
| TOTAL ACCUMULATED DEPRECIATION | 8,105,509.28 | 703,211.85 | | | | | 8,808,721.13 |

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AB0000076060/6

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| Project Description | Project Number | Spending Prior to 1/1/90 | Spending Current Year | Spending Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over (Under) Budget |
|---|---|---|---|---|---|---|---|---|
| Gen Plt-Refrig Comp | 9003 | | 91 847 | 91 847 | | 40 000 | | |
| Reactor-Unit 4-Diph | 9004 | | 31 851 | 31 851 | 9 000 | 40 000 | | |
| Steam-Water Sys/Trac | 9005 | | 16 252 | 16 252 | 6 000 | 22 000 | | |
| Gen Plt-Utility Trns | 9007 | | | | 65 000 | 65 000 | | |
| Custom Mfg Unit/Ph I | 9009 | | | | 80 000 | 80 000 | | |
| Sub Total | | | 139 939 | 139 939 | 160 800 | 248 000 | | |
| DCA-Engineering | 1-1799 | | 372 354 | 372 354 | | | | |
| DCA-Lab Equipment | 2-1799 | | 3 485 | 3 485 | | | | |
| DCA-Equipment | 3-1799 | 123 025 | 542 492 | 665 517 | | | | |
| DCA Ofc Bldg | 4-1799 | | 324 598 | 324 598 | | | | |
| DCA-Plt Sal/Wages | 5-1799 | 52 | (52) | | | | | |
| DCA Site Prep | 6-1799 | | 48 885 | 48 885 | | | | |
| DCA-Structural | 7-1799 | | 409 086 | 409 086 | | | | |
| DCA-Equip Installatn | 8-1799 | | 17 467 | 17 467 | | | | |
| DCA-Piping | 9-1799 | | 339 323 | 339 323 | | | | |
| DCA-Inst & Contrls | 10-1799 | | 71 485 | 71 485 | | | | |
| DCA-Elec | 11-1799 | | 11 920 | 11 920 | | | | |
| DCA-Painting | 12-1799 | | 52 260 | 52 260 | | | | |
| DCA-Concrete | 13-1799 | | 138 548 | 138 548 | | | | |
| DCA-Painting | 14-1799 | | 16 889 | 16,889 | | | | |
| DCA-Freight | 15-1799 | | 25 884 | 25 884 | | | | |
| DCA-Equip Repair | 16-1799 | | 197 861 | 197 861 | | | | |
| DCA-Crane Rental | 17-1799 | | 39 500 | 39 500 | | | | |
| DCA Waste Handling | 18-1799 | | 19 860 | 19 860 | | | | |
| DCA-Equipment Reloc | 19-1799 | | 149 157 | 149 157 | | | | |
| DCA-Storage Tanks | 20-1799 | | 59 247 | 59 247 | | | | |
| DCA-Lab Expansion | 21-1799 | 2 715 | 111 112 | 113 827 | | | | |
| DCA-Warehouse | 22-1799 | | 96 809 | 96 809 | | | | |
| DCA- | 23 1799 | | | | | | | |
| DCA-Capitalized Int | 24-1799 | | 141 830 | 141 830 | | | | |
| Sub Total-DCA Plant | | 125 792 | 3 189 842 | 3 315 634 | 2 904 366 | 6 000 000 | | |
| TOTAL | | 125 792 | 3 329 781 | 3 455 573 | 3 145 166 | 6 248 000 | | |

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[redacted] FIN[redacted]ICAL [redacted]ATION [redacted]ATION [redacted]est [redacted] Page [redacted] Fax [redacted]
C[redacted]D PROJECTS DATE 31-Dec-98

| Project Description | Project Number | Spending: Prior to 1/1/90 | Spending: Current Year | Spending: Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over (Under) Budget |
|---|---|---|---|---|---|---|---|---|
| Grace Project (Int) | 8005 | 142 613 | 29 | 142 642 | | | | |
| Grace Project | XX-[illegible] | 3 007 406 | 197 189 | 3 204 595 | | 3 000 000 | | |
| Propanil Bld Tank | 9001 | | 33 067 | 33 067 | | | | |
| Gen Plt-Phone Sys | 9002 | | 4 214 | 4 214 | | | | |
| P acid Storage Tank | 9005 | | 21 534 | 21 534 | | | | |
| NTPO Plant Mod | 9008 | | 201 224 | 201 224 | | | | |
| Sub Total Completed | | 3 150 019 | 457 257 | 3 607 276 | | 3 000 000 | | |
| Total CIP & Completed Proj | | 3 275 811 | 3 787 038 | 7 062 849 | 3 145 166 | 9 240 000 | | |

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CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
COST

DATE: 31-Dec-91

LOCATION: West Helena

| | BALANCE 1/1/91 | ADDITIONS | RETIREMENTS | TRANSFER TO (FROM )CIP | TRANSFER <TO> FM OTHER PLANTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND | 67,260.00 | | | | | | 67,260.00 |
| LAND IMPROVEMENTS | 802,716.55 | | | | | | 802,716.55 |
| BUILDINGS | 327,595.70 | | | 722,188.97 | | | 1,049,784.67 |
| MACHINERY & EQUIPMENT | 13,613,775.57 | | | 5,871,998.59 | | | 19,485,774.16 |
| TRANSPORTATION EQUIPMENT | | | | | | | |
| OFFICE EQUIPMENT | 81,633.80 | | | 12,179.81 | | 9,483.81 | 103,297.42 |
| CIP | 3,455,573.02 | 4,028,417.25 | | -6,606,367.37 | | | 877,622.90 |
| TOTAL COST | 18,348,554.64 | 4,028,417.25 | | | | 9,483.81 | 22,386,455.70 |

CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
ACCUMULATED DEPRECIATION

DATE: 31-Dec-91

LOCATION: West Helena

| | BALANCE 1/1/90 | CURRENT YEAR DEPRECIATION | RETIREMENTS | | TRANSFER <TO> FM OTHER PLANTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| LAND IMPROVEMENTS | 512,824.23 | 4,737.96 | | | | | 517,562.19 |
| BUILDINGS | 279,846.55 | 58,870.47 | | | | | 338,717.02 |
| MACHINERY & EQUIPMENT | 7,960,283.94 | 1,120,658.40 | | | | | 9,080,942.34 |
| TRANSPORTATION EQUIPMENT | | | | | | | |
| OFFICE EQUIPMENT | 55,766.41 | 15,667.19 | | | | | 71,433.60 |
| TOTAL ACCUMULATED DEPRECIATION | 8,808,721.13 | 1,199,934.02 | | | | | 10,008,655.15 |

CEDAR CHEMICAL CORPORATION LOCATION West Helena Page 1 of 2 Fax: Johnny Hanna-Ephs Ofc
CONSTRUCTION IN PROCESS DATE 31-Dec-91

| Project Description | Project Number | <Spending Prior to 1/1/91 | Current Year | Total> | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over <Under> Budget |
|---|---|---|---|---|---|---|---|---|
| Centrifuge Speed Ctr | 9109 | | 139 | 139 | 9,000 | 9,000 | | |
| Ofc Site Imprv | 9111 | | 17,690 | 17,690 | 4,000 | 21,700 | | |
| Dehpa Plt Mod | 9113 | | 232,490 | 232,490 | | N/A | | |
| Cooling Water pump | 9114 | | 12,105 | 12,105 | 19,900 | 32,000 | | |
| Scrubber Tnk/Gls Rea | 9117 | | 58,690 | 58,690 | 15,310 | 74,000 | | |
| 2 New Mass Flow Mete | 9118 | | 18,900 | 18,900 | 6,900 | 12,000 | | |
| DCA Wash Vessel Wgt | 9119 | | 5,359 | 5,359 | 15,000 | 20,300 | | |
| Plant Air Sys | 9120 | | 10,082 | 10,082 | 2,000 | 12,000 | | |
| Brinkmann Particle S | 9121 | | | | 32,000 | 32,000 | | |
| DCA Nitric Piping | 9122 | | | | 35,000 | 35,000 | | |
| Replace Agitator | 9123 | | 6,101 | 6,101 | 3,400 | 9,500 | | |
| Install New Agitator | 9124 | | | | 7,000 | 7,000 | | |
| CTBL Plant Mod | 9125 | | 516,065 | 516,065 | | N/A | | |
| Sub Total | | | 877,623 | 877,623 | 149,510 | 264,500 | | |
| TOTAL C I P | | | 877,623 | 877,623 | 149,510 | 264,500 | | |

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CEDAR CHEMICAL CORPORATION LOCATION West Helena Page 2 of 2 Fax: Johnny Hanna-Mphis Ofc
COMPLETED PROJECTS DATE 31-Dec-91

| Project Description | Project Number | Spending Prior to 1/1/91 | Spending Current Year | Spending Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over <Under> Budget |
|---|---|---|---|---|---|---|---|---|
| Gen Plt-Refrig Comp | 9003 | 91,837 | 3,573 | 95,410 | | 40,000 | | |
| Reactor-Unit 4-Diph | 9004 | 31,851 | 572 | 32,423 | | 40,000 | | |
| P Acid Storage Tank | 9005 | | 8,839 | 8,839 | | | | |
| Grace-Water Sys/Trac | 9006 | 16,252 | 0 | 16,252 | | 23,000 | | |
| Gen Plt-Utility Trns | 9007 | | 63,527 | 63,527 | | 65,000 | | |
| Form Lab Equip | 9101 | | 12,320 | 12,320 | | 30,000 | | |
| Steam Line Inst | 9103 | | 17,765 | 17,765 | | 23,000 | | |
| Gas Chromatograph | 9104 | | 25,882 | 25,882 | | 24,830 | | |
| Benchspace Env Lab | 9105 | | 12,845 | 12,845 | | 11,500 | | |
| DCA Storage Tk Pump | 9106 | | 8,080 | 8,080 | | 10,000 | | |
| Custom Mfg Unit/Ph I | 9009 | | 81,613 | 81,613 | | 80,000 | | |
| Grace Metering Pump | 9102 | | 16,031 | 16,031 | | 15,000 | | |
| Agitator | 9107 | | 10,340 | 10,340 | | Stores-Spare Prts | | |
| New 4" Gas Main | 9108 | | 8,200 | 8,200 | | 8,000 | | |
| Plant Nitrogen Heade | 9110 | | 20,914 | 20,914 | 1,500 | 22,500 | | |
| Bulk Storag Sys | 9112 | | 17,341 | 17,341 | | N/A | | |
| Rail Station Platfor | 9115 | | 9,414 | 9,414 | 7,000 | 16,500 | | |
| IBM Printer | 9116 | | 5,013 | 5,013 | | | | |
| DCA-Engineering | 1-1799 | 372,354 | 238,648 | 611,002 | | | | |
| DCA-Lab Equipment | 2-1799 | 3,405 | 3,428 | 6,833 | | | | |
| DCA-Equipment | 3-1799 | 665,517 | 178,545 | 844,062 | | | | |
| DCA-Ofc Bldg | 4-1799 | 324,598 | 23,058 | 347,656 | | | | |
| DCA-Plt Sal/Wages | 5-1799 | | | | | | | |
| DCA-Site Prep | 6-1799 | 48,805 | 33,079 | 81,884 | | | | |
| DCA-Structural | 7-1799 | 409,086 | 64,043 | 473,129 | | | | |
| DCA-Equip Installati | 8-1799 | 17,467 | 47,674 | 65,141 | | | | |
| DCA-Piping | 9-1799 | 339,323 | 862,522 | 1,201,845 | | | | |
| DCA-Intr & Contrls | 10-1799 | 71,485 | 765,931 | 837,416 | | | | |
| DCA-Elec | 11-1799 | 11,920 | 13,485 | 25,405 | | | | |
| DCA-Painting | 12-1799 | 52,260 | 225,026 | 277,286 | | | | |
| DCA-Concrete | 13-1799 | 138,548 | 4,620 | 143,168 | | | | |
| DCA-Painting | 14-1799 | 16,889 | 53,151 | 70,040 | | | | |
| DCA-Freight | 15-1799 | 25,884 | 7,351 | 33,235 | | | | |
| DCA-Equip Repair | 16-1799 | 197,861 | 0 | 197,861 | | | | |
| DCA-Crane Rental | 17-1799 | 39,500 | 18,047 | 57,547 | | | | |
| DCA-Waste Handling | 18-1799 | 19,860 | 15,580 | 35,440 | | | | |
| DCA-Equipment Reloc | 19-1799 | 149,157 | 0 | 149,157 | | | | |
| DCA-Storage Tanks | 20-1799 | 59,247 | 0 | 59,247 | | | | |
| DCA-Lab Expansion | 21-1799 | 113,827 | 24,190 | 138,017 | | | | |
| DCA-Warehouse | 22-1799 | 96,809 | 106,053 | 202,862 | | | | |
| DCA- | 23-1799 | | | | | | | |
| DCA-Capitalized Int | 24-1799 | 141,830 | 144,095 | 285,925 | | | | |
| Sub Total Completed | | 3,455,572 | 3,150,796 | 6,606,368 | | 409,330 | | |
| Total CIP & Completed Proj | | 3,455,572 | 4,028,418 | 7,483,990 | 149,510 | 673,830 | | |

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CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
REVISED COST

DATE 12/31/92

LOCATION West Helena

| | BALANCE 1/1/92 | ADDITIONS | RETIREMENTS | TRANSFER TO (FROM )CIP | TRANSFER <TO> FM OTHER PLANTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND | 67,260.00 | | | | | | 67,260.00 |
| LAND IMPROVEMENTS | 802,716.55 | | | | 36,426.86 | | 839,143.41 |
| BUILDINGS | 1,049,784.67 | | | | | | 1,049,784.67 |
| MACHINERY & EQUIPMENT | 19,485,774.16 | | | | 1,103,505.71 | | 20,589,279. |
| TRANSPORATION EQUIPMENT | | | | | | | |
| OFFICE EQUIPMENT | 103,297.42 | | | | 45,890.67 | | 149,188.09 |
| CIP | 882,375.98 | 1,552,274.65 | | | -1,185,823.24 | | 1,248,827.39 |
| TOTAL COST | 22,391,208.78 | 1,552,274.65 | | | | | 23,943,483.43 |

CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
ACCUMULATED DEPRECIATION

DATE 12/31/92

LOCATION West Helena

| | BALANCE 1/1/92 | CURRENT YEAR DEPRECIATION | RETIREMENTS | | TRANSFER <TO> FM OTHER PLANTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| LAND IMPROVEMENTS | 517,562.19 | 41,992.14 | | | | | 559,554.33 |
| BUILDINGS | 338,717.02 | 50,917.08 | | | | | 389,634.10 |
| MACHINERY & EQUIPMENT | 9,080,942.34 | 1,392,092.84 | | | | | 10,473,035.18 |
| TRANSPORTATION EQUIPMENT | | | | | | | |
| OFFICE EQUIPMENT | 71,433.60 | 10,176.98 | | | | | 81,610.58 |
| TOTAL ACCUMULATED DEPRECIATION | 10,008,655.15 | 1,495,179.04 | | | | | 11,503,834.19 |

CEDAR CHEMICAL CORPORATION  LOCATION  West Helena  Page 1 of 2
CONSTRUCTION IN PROCESS  DATE  12/31/92
REVISED

| Project Description | Project Number | <----------Spending----------> Prior to 1/1/92 | Current Year | Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over <Under> Budget |
|---|---|---|---|---|---|---|---|---|
| Propanil Scrubber Sys | 9207 | | 34,765 | 34,765 | 1,235 | 36,000 | | |
| Rplc Refrig Sys | 9209 | | 118,424 | 118,424 | 15,576 | 134,000 | | |
| DCA V-D316 Repairs | 9211 | | 31,072 | 31,072 | 312 | 18,110 | | |
| DCA V-D316 Repairs\Sup | 9211 | | | | | 12,650 | | |
| TFE Lined Pipe DCA | 9212 | | 58,764 | 58,764 | 5,966 | 64,730 | | |
| Prop Unit Upgrd-Ph I | 9213 | | 60,048 | 60,048 | | 58,300 | | |
| New Chg Rm | 9214 | | 196,531 | 196,531 | 23,469 | 220,000 | | |
| Prop Unit Upgrd-Ph II | 9216 | | 255,820 | 255,820 | | 248,000 | | |
| Rail Spur Drainage Imprv | 9217 | | 10,258 | 10,258 | 242 | 10,500 | | |
| DCA/Bottoms Drumming | 9218 | | 24,763 | 24,763 | 5,887 | 30,650 | | |
| Control Rm Press | 9220 | | 27,320 | 27,320 | 5,680 | 33,000 | | |
| API Separator | 9221 | | 20,523 | 20,523 | 17,477 | 38,000 | | |
| DuPont Perborate Proj-Ph | 9222 | | 89,092 | 89,092 | | 82,000 | | |
| Absorption Nitrogen Gener | 9223 | | 8,703 | 8,703 | 38,297 | 47,000 | | |
| UPS Sys For DCA | 9224 | | 4,454 | 4,454 | 1,546 | 6,000 | | |
| Allyl Chloride Strg Tk | 9225 | | 15,997 | 15,997 | | 10,000 | | |
| New Propanil Pkg Facility | 9226 | | 105,209 | 105,209 | 275,681 | 380,890 | | |
| DCA Srubber Mod | 9227 | | 6,838 | 6,838 | 5,517 | 12,355 | | |
| A & W - ADPA Proj | 9228 | | 116,656 | 116,656 | | 102,350 | | |
| Unit 4 - Control Room Upg | 9229 | | 47,723 | 47,723 | 11,277 | 59,000 | | |
| Drainage Imprv @ Lab | 9230 | | 9,366 | 9,366 | 134 | 9,500 | | |
| Envirn Drm Storage Cover | 9231 | | 6,500 | 6,500 | | 6,500 | | |
| TOTAL C I P | | | 1,248,826 | 1,248,826 | 408,296 | 1,619,535 | | |

CEDAR CHEMICAL CORPORATION LOCATION West Helena Page 2 of 2
COMPLETED PROJECTS DATE 12/31/92
REVISED

| Project Description | Project Number | <----------Spending----------> Prior to 1/1/92 | Current Year | Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over <Under> Budget |
|---|---|---|---|---|---|---|---|---|
| Custom Mfg Unit | 9009 | | 2,369 | 2,369 | | | | |
| Centrifuge Speed Ctrl | 9109 | 139 | 6,780 | 6,919 | | 9,000 | | |
| Ofc Site Imprv | 9111 | 17,690 | 4,793 | 22,483 | | 21,700 | | |
| Dehpa Plt Mod | 9113 | 232,490 | 4,618 | 237,108 | | N/A | | |
| Cooling Water pump | 9114 | 12,105 | 33,955 | 46,060 | | 32,000 | | |
| Scrubber Tnk/Gls Reactor | 9117 | 58,690 | 0 | 58,690 | | 74,000 | | |
| 2 New Mass Flow Meters | 9118 | 18,900 | 16,551 | 35,451 | | 12,000 | | |
| DCA Wash Vessel Wgt | 9119 | 5,359 | 17,689 | 23,048 | | 20,300 | | |
| Plant Air Sys | 9120 | 10,082 | | 10,082 | | 12,000 | | |
| Brinkmann Particle Sizer | 9121 | | 31,655 | 31,655 | | 32,000 | | |
| DCA Nitric Piping | 9122 | | 19,711 | 19,711 | | 35,000 | | |
| Replace Agitator | 9123 | 6,101 | 5 | 6,106 | | 9,500 | | |
| Install New Agitator | 9124 | | 6,691 | 6,691 | | 7,000 | | |
| CTBL Plant Mod | 9125 | 520,819 | 33,672 | 554,491 | | N/A | | |
| Unit 1-Contrl Rm-Roof | 9201 | | 7,634 | 7,634 | | 7,500 | | |
| Lims System | 9202 | | 14,236 | 14,236 | | 14,000 | | |
| Secondary Dehydr Condenso | 9203 | | 9,798 | 9,798 | | 15,000 | | |
| R-PE108 Foundation Rplc | 9204 | | 12,314 | 12,314 | | 15,450 | | |
| Gas Chromatagraph | 9205 | | 24,710 | 24,710 | | 24,650 | | |
| RR Spur Culvert | 9206 | | 13,944 | 13,944 | | 16,000 | | |
| Lime Conveyor DCA | 9208 | | 9,093 | 9,093 | | 9,735 | | |
| Revamp Boiler Blowdown | 9210 | | 17,317 | 17,317 | | 21,000 | | |
| Unit 3 Sump Repairs | 9215 | | 7,200 | 7,200 | | 7,200 | | |
| Nitric Acid Scrubber | 9219 | | 8,713 | 8,713 | | 6,000 | | |
| Sub Total Completed | | 882,375 | 303,448 | 1,185,823 | | 401,035 | | |
| Total CIP & Completed Proj | | 882,375 | 1,552,275 | 2,434,650 | 408,296 | 2,020,570 | | |

CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
REVISED COST

DATE 12/31/93

LOCATION West Helena

| | BALANCE 1/1/93 | ADDITIONS | RETIREMENTS | TRANSFER TO (FROM )CIP | TRANSFER <TO> FM OTHER PLANTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND | 67,260.00 | | | - | | | 67,260.00 |
| LAND IMPROVEMENTS | 839,143.41 | | | 109,372.15 | | | 948,515.56 |
| BUILDINGS | 1,049,784.67 | | | 220,538.91 | | | 1,270,323.58 |
| MACHINERY & EQUIPMENT | 20,589,279.87 | | | 2,087,284.13 | | | 22,676,564.00 |
| TRANSPORATION EQUIPMENT | | | | | | | |
| OFFICE EQUIPMENT | 149,188.09 | | | | | | 149,188.09 |
| CIP | 1,248,827.39 | 2,396,128.28 | | -2,417,195.19 | | | 1,227,760.48 |
| TOTAL COST | 23,943,483.43 | 2,396,128.28 | | | | | 26,339,611.71 |

CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
ACCUMULATED DEPRECIATION

DATE 12/31/93

LOCATION West Helena

| | BALANCE 1/1/93 | CURRENT YEAR DEPRECIATION | RETIREMENTS | | TRANSFER <TO> FM OTHER PLANTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| LAND IMPROVEMENTS | 559,554.33 | 44,086.93 | | | | | 603,641.26 |
| BUILDINGS | 389,634.10 | 55,314.18 | | | | | 444,948.28 |
| MACHINERY & EQUIPMENT | 10,473,035.18 | 1,289,743.61 | | | | | 11,762,778.79 |
| TRANSPORTATION EQUIPMENT | | | | | | | |
| OFFICE EQUIPMENT | 81,610.58 | 4,590.60 | | | | | 86,201.18 |
| TOTAL ACCUMULATED DEPRECIATION | 11,503,834.19 | 1,393,735.32 | | | | | 12,897,569.51 |

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[redacted] CHEMICAL CORPORATION [redacted] LOCATION West Helena [redacted] Page 1 of 3 Part Johnny Hann[redacted]ns Of
CONSTRUCTION IN PROCESS DATE 12/31/93
REVISED

| Project Description | Project Number | <----------Spending----------> Prior to 1/1/93 | Current Year | Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over <Under> Budget |
|---|---|---|---|---|---|---|---|---|
| New Propanil Pkg Facility | 9226 | | | | | | | |
| Plant Entrance & Parking | 9304 | | 160 | 160 | 5,385 | | | |
| Emergency Relief Vents-Pro | 9308 | | | | 10,080 | | | |
| New Unit One Sump | 9310 | | 1,197 | 1,197 | | | | |
| Vacuum Pump-Propanil | 9314 | | 60,457 | 60,457 | | 60,000 | | |
| Storm Water Treatment Sys | 9316 | | 143,544 | 143,544 | 17,856 | 161,400 | | |
| Stormwater System Plan Ph | 9318 | | 170,018 | 170,018 | 20,272 | 190,290 | | |
| Tank Dike Access | 9319 | | 9,224 | 9,224 | 776 | 10,000 | | |
| Diuron Mfg Unit 5 | 9320 | | 127,002 | 127,002 | 4,998 | 132,000 | | |
| DCA Column Packing | 9321 | | 95,819 | 95,819 | | 110,000 | | |
| Unit 5 Hydrogen Meter Sys | 9322 | | 1,599 | 1,599 | 16,401 | 18,000 | | |
| DCNB Flowmeter | 9323 | | 10,647 | 10,647 | | 11,000 | | |
| Unit 4 Reactor R-4104 | 9324 | | 143,361 | 143,361 | | 142,000 | | |
| Waste Water Piping | 9325 | | 45,782 | 45,782 | | 49,450 | | |
| Unit 4 Mod Stockhausen | 9326 | | 361,681 | 361,681 | 238,319 | 600,000 | | |
| Unit 4 Mod Dehpa | 9327 | | 22,674 | 22,674 | | 21,450 | | |
| Unit 4 Graphsize Mod | 9328 | | 34,595 | 34,595 | 95,405 | 130,000 | | |
| Nitric Acid Tank-DCA | 9401 | | | | | 94,600 | | |
| Unit 4 Vinnings SMA Mod | 9402 | | | | | | | |
| TOTAL C I P | | | 1,227,760 | 1,227,760 | 409,492 | 1,730,190 | | |

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[redacted] CORPORATION LOCATION West Helena Page 2 of 3 FAX Johnny Hann[redacted]hs Of
COMPLETED PROJECTS DATE 12/31/93
REVISED

| Project Description | Project Number | Spending Prior to 1/1/93 | Spending Current Year | Spending Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over <Under> Budget |
|---|---|---|---|---|---|---|---|---|
| Propanil Scrubber Sys | 9207 | 34,765 | | 34,765 | | 36,000 | | |
| Rplc Refrig Sys | 9209 | 118,424 | 11,083 | 129,507 | | 134,000 | | |
| DCA V-D316 Repairs | 9211 | 31,072 | (891) | 30,181 | | 18,110 | | |
| DCA V-D316 Repairs\Sup | 9211 | | | | | 12,650 | | |
| TFE Lined Pipe DCA | 9212 | 58,764 | 5,537 | 64,301 | | 64,730 | | |
| Prop Unit Upgrd-Ph I | 9213 | 60,048 | | 60,048 | | 58,300 | | |
| New Chg Rm | 9214 | 196,531 | 4,480 | 201,011 | | 220,000 | | |
| Prop Unit Upgrd-Ph II | 9216 | 255,820 | (3,379) | 252,441 | | 248,000 | | |
| Rail Spur Drainage Imprv | 9217 | 10,258 | | 10,258 | | 10,500 | | |
| DCA/Bottoms Drumming | 9218 | 24,763 | 6,055 | 30,818 | | 30,650 | | |
| Control Rm Press | 9220 | 27,320 | 4,869 | 32,189 | | 33,000 | | |
| API Separator | 9221 | 20,523 | 16,015 | 36,538 | | 38,000 | | |
| DuPont Perborate Proj-Ph 1 | 9222 | 89,092 | (8,124) | 80,968 | | 82,000 | | |
| Absorption Nitrogen Genera | 9223 | 8,703 | 36,930 | 45,633 | | 47,000 | | |
| UPS Sys For DCA | 9224 | 4,454 | 1,531 | 5,985 | | 6,000 | | |
| Allyl Chloride Strg Tk | 9225 | 15,997 | | 15,997 | | 10,000 | | |
| New Propanil Pkg Facility | 9226 | 105,209 | 277,895 | 383,104 | | 380,890 | | |
| DCA Srubber Mod | 9227 | 6,838 | 6,140 | 12,978 | | 12,355 | | |
| A & W - ADPA Proj | 9228 | 116,656 | (3,018) | 113,638 | | 102,350 | | |
| Unit 4 - Control Room Upgr | 9229 | 47,723 | 13,088 | 60,811 | | 59,000 | | |
| Drainage Imprv @ Lab | 9230 | 9,366 | (220) | 9,146 | | 9,500 | | |
| Envirn Drm Storage Cover | 9231 | 6,500 | | 6,500 | | 6,500 | | |
| FMC Acid Chloride Plt | 9301 | | 226,121 | 226,121 | | 260,000 | | |
| Unit One Scrubber Rplm't | 9302 | | 62,836 | 62,836 | | 60,000 | | |
| Office Improvements | 9303 | | 6,460 | 6,460 | | 6,500 | | |
| Plant Entrance & Parking | 9304 | | 60,435 | 60,435 | | 65,820 | | |
| DCA Circulation Line | 9305 | | 31,259 | 31,259 | | 26,000 | | |
| Supervisors Ofc | 9306 | | 13,068 | 13,068 | | 13,300 | | |
| Grading & Paving DCA Unit | 9307 | | 15,000 | 15,000 | | 15,000 | | |
| Emergency Relief Vents-Pro | 9308 | | 20,081 | 20,081 | | 37,000 | | |
| Trash Compactor Site | 9309 | | 14,532 | 14,532 | | 14,450 | | |
| New Unit One Sump | 9310 | | 25,802 | 25,802 | | 29,100 | | |
| Spare Vacuum Pump | 9311 | | 33,400 | 33,400 | | 29,434 | | |
| Cypermethrin Mod-Unit 1 | 9312 | | 166,730 | 166,730 | | 185,000 | | |
| Sodium Perborate Mod-Unit | 9313 | | 107,388 | 107,388 | | 108,000 | | |
| Unit 4 Sump & Trenches | 9315 | | 8,106 | 8,106 | | 8,000 | | |
| Unit 4 Tanks | 9317 | | 9,158 | 9,158 | | 8,000 | | |

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[redacted] COMPLETED [redacted]OJECTS
REVISED

[redacted]TION West Helena [redacted] Page 3 of 3 Fax: Johnny Hann[redacted]phs Of
DATE 12/31/93

| Project Description | Project Number | <----------Spending----------> Prior to Prior to | Current Year | Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over <Under> Budget |
|---|---|---|---|---|---|---|---|---|
| Sub Total Completed | | 1,248,826 | 1,168,368 | 2,417,194 | | 2,485,139 | | |
| Total CIP & Completed Proj | | 1,248,826 | 2,396,127 | 3,644,953 | 409,492 | 4,215,329 | | |

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CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
REVISED COST

DATE 12/31/94

LOCATION WEST HELENA

| | BALANCE 1/1/94 | ADDITIONS | RETIREMENTS | TRANSFERS TO (FROM) CIP | TRANSFERS TO (FRM) OTHER PLTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND | 67,260.00 | | | | | | 67,260.00 |
| LAND IMPROVEMENTS | 948,515.56 | | | 344,279.34 | | | 1,292,794.90 |
| BUILDINGS | 1,270,323.58 | | | | | | 1,270,323.58 |
| MACHINERY & EQUIPMENT | 22,676,564.00 | | | 1,191,035.08 | | | 23,867,599.08 |
| OFFICE EQUIPMENT | 149,188.09 | | | | | | 149,188.09 |
| CIP | 1,227,760.48 | 1,687,288.88 | | (1,535,314.42) | | | 1,379,734.94 |
| TOTAL COST | 26,339,611.71 | 1,687,288.88 | | 0.00 | | | 28,026,900.59 |

CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
ACCUMULATED DEPRECIATION

DATE 12/31/94

LOCATION WEST HELENA

| | BALANCE 1/1/94 | ADDITIONS | RETIREMENTS | | TRANSFERS TO (FRM) OTHER PLTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND IMPROVEMENTS | 603,641.26 | 52,040.98 | | | | | 655,682.24 |
| BUILDINGS | 444,948.28 | 58,018.92 | | | | | 502,967.20 |
| MACHINERY & EQUIPMENT | 11,762,778.79 | 1,662,758.87 | | | | | 13,425,537.66 |
| OFFICE EQUIPMENT | 86,201.18 | 3,745.92 | | | | | 89,947.10 |
| TOTAL COST | 12,897,569.51 | 1,776,564.69 | | | | | 14,674,134.20 |

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[redacted] CEDAR CHE[redacted]AL CORPORATION LOCATION West Helena [redacted] Page 1 of 2 Fax: Johnny Han[redacted]phs Of

CONSTRUCTION IN PROCESS DATE 12/31/94

REVISED

| Project Description | Project Number | <----------Spending----------> Prior to 1/1/94 | Current Year | Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over <Under> Budget |
|---|---|---|---|---|---|---|---|---|
| Nitric Acid Tank-DCA | 9401 | | 92,297 | 92,297 | 2,303 | 94,600 | | |
| Unit 4 Vinnings SMA Mod | 9402 | | 177,790 | 177,790 | 22,210 | 200,000 | | |
| Propanil Solvent Tank Rplmt | 9403 | | 42,820 | 42,820 | 2,180 | 45,000 | | |
| Chromatograph Data Pkg | 9404 | | 6,297 | 6,297 | | 6,460 | | |
| DCA Tempered Wate Sys | 9405 | | 56,982 | 56,982 | | 55,000 | | |
| Peroxide Treatment per CAO | 9406 | | 22,885 | 22,885 | | 26,000 | | |
| UV-Visible Spectrophotomete | 9407 | | 6,314 | 6,314 | | 6,300 | | |
| Diuron Unit 2 Mod | 9410 | | 568,652 | 568,652 | 557 | 516,000 | | |
| New Stormwater Trnsfer Line | 9412 | | 11,074 | 11,074 | | 15,125 | | |
| DCA Sulfuric Acid Ld'g Plat | 9413 | | 3,679 | 3,679 | 18,821 | 22,500 | | |
| Rplc Ag'tor For R-5103 Unit | 9414 | | 34,668 | 34,668 | 13,332 | 48,000 | | |
| Rplc DCA Nitrtion Circ Loop | 9415 | | 13,703 | 13,703 | 28,297 | 42,000 | | |
| API Separator Repairs | 9416 | | 6,647 | 6,647 | 9,853 | 16,500 | | |
| Conds'r Rep'r R-4102 Unit 4 | 9417 | | 4,941 | 4,941 | 6,059 | 11,000 | | |
| A&W-TTP Plant Mod | 9418 | | 134,479 | 134,479 | | 100,000 | | |
| Unit 2 Control Panel Replcm | 9419 | | 37,394 | 37,394 | 2,606 | 40,000 | | |
| TA Plant Modification | 9420 | | 117,967 | 117,967 | | 135,000 | | |
| HPLC Pump & Flash Tester | 9421 | | 5,286 | 5,286 | 2,709 | 7,995 | | |
| DCNB Crystallization | 9422 | | | | | | | |
| Agitator Drive Unit 1 | 9423 | | | | 9,000 | 9,000 | | |
| Agitator Shift Unit 4 | 9424 | | 19,518 | 19,518 | 4,482 | 24,000 | | |
| Lactofen Plant Mod-Unit 1 | 9425 | | 16,344 | 16,344 | 5,456 | 21,800 | | |
| Firewater Booster Pump | 9426 | | | | 130,000 | 130,000 | | |
| TOTAL C I P | | | 1,379,735 | 1,379,735 | 257,865 | 1,572,280 | | |

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.:DAR CHEM[illegible]L CORPORATION LOCATION West Helena Page 2 of 2 Fax: Johnny Hann[illegible]ns Of
COMPLETED PROJECTS DATE 12/31/94
EVISED

| roject Description | Project Number | <----------Spending----------> Prior to 1/1/94 | Current Year | Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over <Under> Budget |
|---|---|---|---|---|---|---|---|---|
| lant Entrance & Parking | 9304 | 160 | 691 | 850 | | | | |
| mergency Relief Vents-Prop | 9308 | | 12,831 | 12,831 | | | | |
| ew Unit One Sump | 9310 | 1,197 | | 1,197 | | | | |
| acuum Pump-Propanil | 9314 | 60,457 | | 60,457 | | 60,000 | | |
| torm Water Treatment Sys | 9316 | 143,544 | | 143,544 | | 161,400 | | |
| tormwater System Plan Ph I | 9318 | 170,018 | 20,224 | 190,242 | | 190,290 | | |
| ank Dike Access | 9319 | 9,224 | 419 | 9,643 | | 10,000 | | |
| iuron Mfg Unit 5 | 9320 | 127,002 | 5,266 | 132,268 | | 132,000 | | |
| CA Column Packing | 9321 | 95,819 | | 95,819 | | 110,000 | | |
| nit 5 Hydrogen Meter Sys | 9322 | 1,599 | 4,914 | 6,513 | | 18,000 | | |
| CNB Flowmeter | 9323 | 10,647 | | 10,647 | | 11,000 | | |
| nit 4 Reactor R-4104 | 9324 | 143,361 | 4,250 | 147,611 | | 142,000 | | |
| aste Water Piping | 9325 | 45,782 | | 45,782 | | 49,450 | | |
| nit 4 Plant Mod | 9326 | 361,681 | 78,892 | 440,573 | | 600,000 | | |
| nit 4 Mod Dehpa | 9327 | 22,674 | 73 | 22,747 | | 21,450 | | |
| nit 4 Graphsize Mod | 9328 | 34,595 | 135,568 | 170,163 | | 130,000 | | |
| epack Propanil Distillatio | 9408 | | 12,727 | 12,727 | | 12,000 | | |
| LC Unit 4 Control Room | 9409 | | 12,242 | 12,242 | | 10,000 | | |
| eplace Agitator For R-4104 | 9411 | | 19,458 | 19,458 | | 17,000 | | |
| Sub Total Completed | | 1,227,760 | 307,554 | 1,535,314 | | 1,674,590 | | |
| otal CIP & Completed Proj | | 1,227,760 | 1,687,289 | 2,915,049 | 257,865 | 3,246,870 | | |

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AB0000076060/21

CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
REVISED COST

DATE 12/31/95

LOCATION WEST HELENA

| | BALANCE 1/1/95 | ADDITIONS | RETIREMENTS | TRANSFERS TO (FROM) CIP | TRANSFERS TO (FRM) OTHER PLTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND | 67,260.00 | | | | | | 67,260.00 |
| LAND IMPROVEMENTS | 1,292,794.90 | | | 11,073.56 | | | 1,303,868.46 |
| BUILDINGS | 1,270,323.58 | | | | | | 1,270,323.58 |
| MACHINERY & EQUIPMENT | 23,867,599.08 | | | 1,922,129.01 | | | 25,789,728.09 |
| OFFICE EQUIPMENT | 149,188.09 | 861.67 | | 28,323.92 | | | 178,373.68 |
| CIP | 1,379,734.94 | 2,938,321.06 | | (1,961,526.49) | | | 2,356,529.51 |
| TOTAL COST | 28,026,900.59 | 2,939,182.73 | | | | | 30,966,083.32 |

CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
ACCUMULATED DEPRECIATION

DATE 12/31/95

LOCATION WEST HELENA

| | BALANCE 1/1/95 | ADDITIONS | RETIREMENTS | | TRANSFERS TO (FRM) OTHER PLTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND IMPROVEMENTS | 655,682.24 | 56,073.72 | | | | | 711,755.96 |
| BUILDINGS | 502,967.20 | 54,909.36 | | | | | 557,876.56 |
| MACHINERY & EQUIPMENT | 13,425,537.66 | 1,549,237.25 | | | | | 14,974,774.91 |
| OFFICE EQUIPMENT | 89,947.10 | 28,998.92 | | | | | 118,946.02 |
| TOTAL COST | 14,674,134.20 | 1,689,219.25 | | | | | 16,363,353.45 |

CEDAR CHEMICAL [redacted]ORATION
CONSTRUCTION IN PROCESS

LOCATION West Helena[redacted]
DATE 12/31/95



Fax: Johnny Hann[redacted]s Ofc

| Project Description | Proj No | Complet'n Date | Spending Prior to 1/1/95 | Spending Current Year | Spending Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over <Under> Budget |
|---|---|---|---|---|---|---|---|---|---|
| DCNB Crystallization | 9422 | | | 1,555,870 | 1,555,870 | 294,130 | 1,850,000 | | |
| DCA Computor Sys | 9502 | | | 233,200 | 233,200 | | 230,000 | | |
| RR Loading Station Ph I | 9503 | | | 30,669 | 30,669 | 94,331 | 125,000 | | |
| DCA Waste Trmt Tnk Vent Rplcm | 9509 | | | | | 5,800 | 5,800 | | |
| R-4104 Reactor Replcm't | 9516 | | | 82,702 | 82,702 | 17,298 | 100,000 | | |
| DCA Tank Farm Dike | 9517 | | | 11,437 | 11,437 | 1,063 | 12,500 | | |
| DCA Cooling Water Tower | 9518 | | | 165,764 | 165,764 | | 140,000 | | |
| DCA Refrigeration System | 9519 | | | 177,342 | 177,342 | 22,658 | 200,000 | | |
| DCA Vacuum Pump Mod | 9520 | | | 99,544 | 99,544 | 50,456 | 150,000 | | |
| Brine Tank Unit 4 | 9521 | | | | | | | | |
| DCA Utility System Upgrade | 9522 | | | | | | | | |
| Tromethamine Pkg'g Sys Unit 5 | 9523 | | | | | | | | |
| Hgh Pressure Feed Pump Unit 5 | 9524 | | | | | | | | |
| Plant Water Supply Mod | 9601 | | | | | | | | |
| TOTAL C I P | | | | 2,356,530 | 2,356,530 | 485,734 | 2,813,300 | | |

* Closure Statement Received From Engineering/Pending Booking of All Cost

| Project Description | Proj No | Complet'n Date | Spending Prior to 1/1/95 | Spending Current Year | Spending Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over <Under> Budget |
|---|---|---|---|---|---|---|---|---|---|
| Nitric Acid Tank-DCA | 9401 | 3/31/95 | 92,297 | 232 | 92,529 | | 94,600 | | |
| Unit 4 Vinnings SMA Mod | 9402 | 3/31/95 | 177,790 | | 177,790 | | 200,000 | | |
| Propanil Solvent Tank Rplmt | 9403 | 1/31/95 | 42,820 | | 42,820 | | 45,000 | | |
| Chromatograph Data Pkg | 9404 | 2/28/95 | 6,297 | 397 | 6,694 | | 6,460 | | |
| DCA Tempered Wate Sys | 9405 | 3/31/95 | 56,982 | (2,712) | 54,270 | | 55,000 | | |
| Peroxide Treatment per CAO | 9406 | 1/31/95 | 22,885 | | 22,885 | | 26,000 | | |
| UV-Visible Spectrophotometer | 9407 | 2/28/95 | 6,314 | | 6,314 | | 6,300 | | |
| Diuron Unit 2 Mod | 9410 | 3/31/95 | 568,652 | 7,435 | 576,087 | | 516,000 | | |
| New Stormwater Trnsfer Line | 9412 | 1/31/95 | 11,074 | | 11,074 | | 15,125 | | |
| DCA Sulfuric Acid Ld'g Platf | 9413 | 3/31/95 | 3,679 | 14,373 | 18,051 | | 22,500 | | |
| Rplc Ag'tor For R-5103 Unit 5 | 9414 | 11/30/95 | 34,668 | 13,958 | 48,626 | | 48,000 | | |
| Rplc DCA Nitrtion Circ Loop | 9415 | 3/31/95 | 13,703 | 7,927 | 21,630 | | 42,000 | | |
| API Separator Repairs | 9416 | 3/31/95 | 6,647 | 6,494 | 13,141 | | 16,500 | | |
| Conds'r Rep'r R-4102 Unit 4 | 9417 | 1/31/95 | 4,941 | | 4,941 | | 11,000 | | |
| A&W-TTP Plant Mod | 9418 | 3/31/95 | 134,479 | | 134,479 | | 100,000 | | |
| Unit 2 Control Panel Replcm't | 9419 | 3/31/95 | 37,394 | | 37,394 | | 40,000 | | |
| TA Plant Modification | 9420 | 1/31/95 | 117,967 | | 117,967 | | 135,000 | | |
| HPLC Pump & Flash Tester | 9421 | 2/28/95 | 5,286 | 3,233 | 8,520 | | 7,995 | | |
| Agitator Drive Unit 1 | 9423 | 3/31/95 | | 7,366 | 7,366 | | 9,000 | | |
| Agitator Shift Unit 4 | 9424 | 1/31/95 | 19,518 | | 19,518 | | 24,000 | | |
| Lactofen Plant Mod-Unit 1 | 9425 | 2/28/95 | 16,344 | 4,572 | 20,916 | | 21,800 | | |
| Firewater Booster Pump | 9426 | 9/30/95 | | 114,075 | 114,075 | | 130,000 | | |
| Boiler Replacement-Ph 1 | 9501 | 11/30/95 | | 114,951 | 114,951 | | 110,000 | | |
| Reactor R-4101-Unit 4 | 9504 | 11/30/95 | | 93,815 | 93,815 | | 95,000 | | |
| Agitator Drive R-1103-Unit 1 | 9505 | 11/30/95 | | 7,995 | 7,995 | | 9,800 | | |
| Rplcm't Diuron Duct Collector | 9506 | 11/30/95 | | 17,425 | 17,425 | | 15,000 | | |
| Replace Flaker Belt | 9507 | 12/31/95 | | 14,003 | 14,003 | | 19,000 | | |
| Lab HPLC | 9508 | 9/30/95 | | 6,797 | 6,797 | | 7,500 | | |
| Diuron Condensor Improvements | 9510 | 11/30/95 | | 60,012 | 60,012 | | 61,000 | | |
| Dryer Repairs Unit 5 | 9511 | 11/30/95 | | 31,185 | 31,185 | | 29,000 | | |
| Scrubber Tank-Unit 4 | 9512 | 12/31/95 | | 25,562 | 25,562 | | 19,000 | | |
| DCA Distillation Still Pot | 9513 | 11/30/95 | | 5,078 | 5,078 | | 5,100 | | |
| DCA Boiler | 9514 | 11/30/95 | | 8,041 | 8,041 | | 8,000 | | |
| DCA Hydrogenator | 9515 | 11/30/95 | | 19,578 | 19,578 | | 17,000 | | |
| Sub Total Completed | | | 1,379,735 | 581,792 | 1,961,526 | | 1,967,680 | | |
| Total CIP & Completed Proj | | | 1,379,735 | 2,938,321 | 4,318,056 | 485,734 | 4,780,980 | | |

CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
REVISED COST

DATE 12/31/96

LOCATION WEST HELENA

| | BALANCE 1/1/96 | ADDITIONS | RETIREMENTS | TRANSFERS TO (FROM) CIP | TRANSFERS TO (FRM) OTHER PLTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND | 67,260.00 | | | | | | 67,260.00 |
| LAND IMPROVEMENTS | 1,303,868.46 | | | 46,135.23 | | | 1,350,003.69 |
| BUILDINGS | 1,270,323.58 | | (20,512.65) | | | | 1,249,810.93 |
| MACHINERY & EQUIPMENT | 25,789,728.09 | | (5,027,043.90) | 1,614,188.22 | | | 22,376,872.41 |
| OFFICE EQUIPMENT | 178,373.68 | 13,903.94 | (46,084.02) | | | | 146,193.60 |
| CIP | 2,356,629.51 | 3,765,152.76 | | (1,660,323.45) | | | 4,461,358.82 |
| TOTAL COST | 30,966,083.32 | 3,779,056.70 | (5,093,640.57) | 0.00 | 0.00 | 0.00 | 29,651,499.45 |

CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
ACCUMULATED DEPRECIATION

DATE 12/31/96

LOCATION WEST HELENA

| | BALANCE 1/1/96 | ADDITIONS | RETIREMENTS | | TRANSFERS TO (FRM) OTHER PLTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND IMPROVEMENTS | 711,755.96 | 66,566.90 | | | | | 778,322.86 |
| BUILDINGS | 557,876.56 | 40,437.56 | (20,512.65) | | | | 577,801.47 |
| MACHINERY & EQUIPMENT | 14,974,774.91 | 2,000,075.21 | (5,027,043.90) | | | | 11,947,806.22 |
| OFFICE EQUIPMENT | 118,946.02 | 18,897.07 | (46,084.02) | | | | 91,759.07 |
| TOTAL COST | 16,363,353.45 | 2,125,976.74 | (5,093,640.57) | 0.00 | 0.00 | 0.00 | 13,395,689.62 |

CEDAR CHEMICAL CORPORATION
CONSTRUCTION IN PROCESS

LOCATION West Helena
DATE 12/31/96



Fax: Johnny Hanna

| Project Description | Proj No | Complet'n Date | Spending: Prior to 1/1/96 | Spending: Current Year | Spending: Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over(Under) Budget |
|---|---|---|---|---|---|---|---|---|---|
| DCNB Crystallization | 9422 | | 1,555,870 | 901,308 | 2,457,178 | | 1,850,000 | | |
| RR Loading Station Ph I | 9503 | | 30,669 | (0) | 30,669 | 94,331 | 125,000 | | |
| Plant Water Supply Mod | 9601 | | | 17,868 | 17,868 | 1,632 | 19,500 | | |
| Ethephon Plt Unit 5 Mod | 9605 | | | 702,732 | 702,732 | 527,268 | 1,230,000 | | |
| Replace High Pressure Boiler | 9606 | | | 410,738 | 410,738 | | 400,000 | | |
| Railroad Spur Repairs | 9608 | | | 1,500 | 1,500 | | | | |
| Reactor Replacement R-2104 | 9610 | | | 195,881 | 195,881 | | 141,000 | | |
| DCPI Bulk Storage | 9611 | | | 31,701 | 31,701 | 28,299 | 60,000 | | |
| New Vacuum Pump | 9612 | | | 61,818 | 61,818 | 3,182 | 65,000 | | |
| Diuron Mod U2A | 9613 | | | 381,781 | 381,781 | | 350,000 | | |
| DCA-Secoundary Crystalizer | 9619 | | | 16,004 | 16,004 | | 16,000 | | |
| DCA-Methanol Tank Bottoms | 9620 | | | 10,071 | 10,071 | | 10,000 | | |
| DCA-Primary Crystalizer | 9621 | | | 12,002 | 12,002 | | 12,000 | | |
| DCA-DCNB Crystalizer Vent | 9622 | | | 8,503 | 8,503 | | 8,500 | | |
| DCA-6110 Load Cell Inst | 9623 | | | 9,999 | 9,999 | | 10,000 | | |
| DCA-R6106 Coil Repairs | 9624 | | | 5,502 | 5,502 | | 5,500 | | |
| Units 1,4 & 5 Refregeration | 9625 | | | 70,211 | 70,211 | | | | |
| Unit 5 R-5104 Reactor Rplcmnt | 9626 | | | | | | | | |
| Refergeration Motor | 9627 | | | | | | | | |
| DCA-F6701 Filter Replcmnt | 9628 | | | 37,200 | 37,200 | (37,200) | | | |
| TOTAL C I P | | | 1,586,539 | 2,874,819 | 4,461,358 | 617,512 | 4,302,500 | | |

* Closure Statemants Received From Engineering/Pending Booking of All Cost

CEDAR CHEMICAL CORPORATION
COMPLETED PROJECTS

LOCATION West Helena
DATE 12/31/96



Fax: Johnny Hanna-Mphs-Ofc

| Project Description | Proj No | Complet'n Date | <----------Spending----------> Prior to 1/1/96 | Current Year | Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over <Under> Budget |
|---|---|---|---|---|---|---|---|---|---|
| DCA Waste Trmt Tnk Vent Rplcm | 9509 | 4/30/96 | | 3,156 | 3,156 | | 5,800 | | |
| DCA Computor Sys | 9502 | 11/30/96 | 233,200 | 10,478 | 243,678 | | 230,000 | | |
| R-4104 Reactor Replcm't | 9516 | 4/30/96 | 82,702 | 20,226 | 102,928 | | 100,000 | | |
| DCA Tank Farm Dike | 9517 | 4/30/96 | 11,437 | | 11,437 | | 12,500 | | |
| DCA Cooling Water Tower | 9518 | 4/30/96 | 165,764 | (7,084) | 158,680 | | 140,000 | | |
| DCA Refrigeration Syatem | 9519 | 4/30/96 | 177,342 | 20,863 | 198,206 | | 200,000 | | |
| DCA Vacuum Pump Mod | 9520 | 11/30/96 | 99,544 | 50,093 | 149,637 | | 150,000 | | |
| Brine Tank Unit 4 | 9521 | 5/31/96 | | 7,588 | 7,588 | | 7,500 | | |
| DCA Utility System Upgrade | 9522 | 4/30/96 | | 23,298 | 23,298 | | 27,000 | | |
| Tromethamine Pkg'g Sys Unit 5 | 9523 | 5/31/96 | | 14,775 | 14,775 | | 15,000 | | |
| Hgh Pressure Feed Pump Unit 5 | 9524 | 4/30/96 | | 16,260 | 16,260 | | 17,000 | | |
| Fire/Process Water Piping Mod | 9602 | 12/31/96 | | 44,073 | 44,073 | | 42,000 | | |
| DCA Bottoms Pump Replacm't | 9603 | 12/31/96 | | 7,900 | 7,900 | | 9,000 | | |
| Acifluorfen Mod Unit 4 | 9604 | 12/31/96 | | 530,198 | 530,198 | | 512,000 | | |
| Propanil Flaker Repairs | 9607 | 12/31/96 | | 23,541 | 23,541 | | 23,000 | | |
| Railroad Spur Repairs | 9608 | 12/31/96 | | 8,961 | 8,961 | | 9,000 | | |
| Plant Crane | 9609 | 12/31/96 | | 61,835 | 61,835 | | 60,000 | | |
| Plant Perimeter Fencing | 9614 | 12/31/96 | | 28,397 | 28,397 | | 35,000 | | |
| Propanil Column Packing | 9615 | 12/31/96 | | 8,777 | 8,777 | | 18,000 | | |
| Unit 1 Siding Rplmnt | 9616 | 12/31/96 | | 7,252 | 7,252 | | 10,500 | | |
| DCA-Vacuum Pump | 9618 | 12/31/96 | | 9,747 | 9,747 | | 10,000 | | |
| Sub Total Completed | | | 769,990 | 890,334 | 1,660,324 | | 1,633,300 | | |

| | | | | | |
|---|---|---|---|---|---|
| Total CIP & Completed Proj | 2,356,530 | 3,765,152 | 6,121,682 | 617,512 | 5,935,800 |

CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
REVISED COST

DATE 12/31/97

LOCATION WEST HELENA

| | BALANCE 1/1/97 | ADDITIONS | RETIREMENTS | TRANSFERS TO (FROM) CIP | TRANSFERS TO (FRM) OTHER PLTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND | 67,260.00 | | | | | | 67,260.00 |
| LAND IMPROVEMENTS | 1,350,003.69 | | | 19,868.05 | | | 1,369,871.74 |
| BUILDINGS | 1,249,810.93 | | (220,116.75) | 16,518.53 | | | 1,046,212.71 |
| MACHINERY & EQUIPMENT | 22,376,872.41 | | (1,854,734.46) | 6,141,727.82 | | | 26,663,865.77 |
| OFFICE EQUIPMENT | 146,193.60 | 7,510.08 | (23,535.64) | 39,770.95 | | | 169,938.99 |
| CIP | 4,461,358.82 | 2,976,594.20 | | (6,217,885.35) | | | 1,220,067.67 |
| TOTAL COST | 29,651,499.45 | 2,984,104.28 | (2,098,386.85) | 0.00 | 0.00 | 0.00 | 30,537,216.88 |

CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
ACCUMULATED DEPRECIATION

DATE 12/31/97

LOCATION WEST HELENA

| | BALANCE 1/1/97 | ADDITIONS | RETIREMENTS | | TRANSFERS TO (FRM) OTHER PLTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND IMPROVEMENTS | 778,322.86 | 64,754.09 | | | | | 843,076.95 |
| BUILDINGS | 577,801.47 | 39,312.45 | (220,116.75) | | | | 396,997.17 |
| MACHINERY & EQUIPMENT | 11,947,806.22 | 2,358,366.56 | (1,854,734.46) | | | | 12,451,438.32 |
| OFFICE EQUIPMENT | 91,759.07 | 20,372.10 | (23,535.64) | | | | 88,595.53 |
| TOTAL COST | 13,395,689.62 | 2,482,805.20 | (2,098,386.85) | 0.00 | 0.00 | 0.00 | 13,780,107.97 |

CEDAR CHEMICAL CORPORATION
CONSTRUCTION IN PROCESS

LOCATION West Helena
DATE 12/31/97



Fax: Johnny Hanna

| Project Description | Proj No | Complet'n Date | <----------Spending----------> Prior to 1/1/97 | Current Year | Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over(Under) Budget |
|---|---|---|---|---|---|---|---|---|---|
| Refrigeration System Moto | 9627 | * | | | | 20,000 | 20,000 | | |
| Unit 4 Pump 4102 Replacem | 9710 | * | | | | 6,000 | 6,000 | | |
| Isomer Seperation Centrif | 9712 | * | | 6,393 | 6,393 | 27,607 | 34,000 | | |
| Bio Pond Aeriation | 9715 | | | | | | Cancelled | | |
| Unit 6 Vessel Replacement | 9718 | | | 97,868 | 97,868 | 2,132 | Pending | | |
| Heat Exchanger Unit 4 | 9720 | | | 19,167 | 19,167 | 11,833 | Pending | | |
| Unit 6 DCNB Column Imprv | 9721 | | | 19,622 | 19,622 | 17,378 | 37,000 | | |
| Unit 6 R-6105 Agitator Rp | 9723 | | | | | | Voided | | |
| Ponds Influent Flowmeter | 9724 | | | 14,270 | 14,270 | | 13,900 | | |
| FMC 5-Nitro (S 3-1230) | 9725 | | | | | | Pending** | | |
| | 9726 | | | | | | | | |
| T-4201 Replacement Unit 4 | 9727 | | | 400 | 400 | 27,600 | 28,000 | | |
| Agitator Replacement Unit | 9728 | | | 70,401 | 70,401 | | 52,150 | | |
| Main Transformer Relocati | 9729 | | | 128,930 | 128,930 | 41,370 | 170,300 | | |
| Diuron Dryer Chute Imprvm | 9730 | | | | | 24,000 | 24,000 | | |
| | 9731 | | | | | | | | |
| Unit 4 Replace Decantatio | 9732 | | | 28,509 | 28,509 | 56,491 | 85,000 | | |
| Unit 6 R-6105 Replacement | 9733 | | | 110,624 | 110,624 | | 102,000 | | |
| | 9734 | | | | | | | | |
| Unit 1 T-1214 Scrubber Ta | 9735 | | | 20,000 | 20,000 | 12,700 | 32,700 | | |
| Unit 1 Control Rm & Mtr C | 9736 | | | 344,400 | 344,400 | | Pending | | |
| Unit 1 R-1102, V-1303, T-12 | 9801 | | | 359,482 | 359,482 | | Pending | | |
| TOTAL C I P | | | | 1,220,066 | 1,220,066 | 247,111 | 605,050 | | |

* Closure Statements Received From Engineering/Pending Booking of All Cost

** Note Spending Captured in S 3-1230---Request for $6,100,

CEDAR CHEMICAL CORPORATION
COMPLETED PROJECTS

LOCATION West Helena
DATE 12/31/97



Fax: Johnny Hanna-Mphs Of

| Project Description | Proj No | Complet'n Date | <----------Spending----------> Prior to 1/1/97 | Current Year | Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over <Under> Budget |
|---|---|---|---|---|---|---|---|---|---|
| DCNB Crystallization | 9422 | 4/30/97 | 2,457,178 | (207,590) | 2,249,588 | | 1,850,000 | | |
| RR Loading Station Ph I | 9503 | 5/31/97 | 30,669 | | 30,669 | | 125,000 | | |
| Plant Water Supply Mod | 9601 | 2/28/97 | 17,868 | | 17,868 | | 19,500 | | |
| DCA Bottoms Pump Replacm' | 9603 | 2/28/97 | | 985 | 985 | | Closed in 1996 | | |
| Acifluorfen Mod Unit 4 | 9604 | 2/28/97 | | (1,371) | (1,371) | | Closed in 1996 | | |
| Ethephon Plt Unit 5 Mod | 9605 | 7/31/97 | 702,732 | 649,909 | 1,352,641 | | 1,230,000 | | |
| Ethephon Plt Mod | 9605 | 10/31/97 | | 8,565 | 8,565 | | Completed | | |
| Replace High Pressure Boi | 9606 | 5/31/97 | 410,738 | (68,318) | 342,420 | | 400,000 | | |
| Railroad Spur Repairs | 9608 | 5/31/97 | 1,500 | 3,010 | 4,510 | | Closed in 1996 | | |
| Reactor Replacement R-2104 | 9610 | 4/30/97 | 195,881 | | 195,881 | | 141,000 | | |
| DCPI Bulk Storage | 9611 | 4/30/97 | 31,701 | | 31,701 | | 60,000 | | |
| New Vacuum Pump DCNB | 9612 | 4/30/97 | 61,818 | | 61,818 | | 65,000 | | |
| Diuron Mod Unit 2a | 9613 | 4/30/97 | 381,781 | (13,548) | 368,233 | | 350,000 | | |
| Plant Perimeter Fencing | 9614 | 2/28/97 | | 6,564 | 6,564 | | Closed in 1996 | | |
| Propanil Column Packing | 9615 | 2/28/97 | | 8,794 | 8,794 | | Closed in 1996 | | |
| Unit 1 Siding Replacement | 9616 | 7/31/97 | | 9,150 | 9,150 | | 9,000 | | |
| Unit 5 Trometm'e Product | 9617 | 2/28/97 | | 3,330 | 3,330 | | Closed in 1996 | | |
| DCA-Secondary Crystallization | 9619 | 2/28/97 | 16,004 | | 16,004 | | 16,000 | | |
| DCA-Methanol Tank Bottoms | 9620 | 2/28/97 | 10,071 | | 10,071 | | 10,000 | | |
| DCA-Primary Crystallizer | 9621 | 2/28/97 | 12,002 | | 12,002 | | 12,000 | | |
| DCA-DCNB Cryatallizer Ven | 9622 | 2/28/97 | 8,503 | | 8,503 | | 8,500 | | |
| DCA-R-6610 Load Cell Inst | 9623 | 2/28/97 | 9,999 | | 9,999 | | 10,000 | | |
| DCA-R-6106 Coil Repairs | 9624 | 2/28/97 | 5,502 | | 5,502 | | 5,500 | | |
| Units 1/4 & 5 Refrigeration | 9625 | 2/28/97 | 70,211 | | 70,211 | | 80,000 | | |
| Unit 5 R-5104 Reactor Rep | 9626 | 4/30/97 | | 52,013 | 52,013 | | 55,000 | | |
| DCA-F-6701 Filter Replacement | 9628 | 4/30/97 | 37,200 | 114,037 | 151,237 | | 345,000 | | |
| DCA-F-6701 Filter Replacement | 9628 | 7/31/97 | | 41,577 | 41,577 | | | | |
| DCA-F-6701 Filter Replacement | 9628 | 10/31/97 | | 13,880 | 13,880 | | | | |
| Diuron P-2104 Pump Replacement | 9701 | 5/31/97 | | 1,837 | 1,837 | | 6,500 | | |
| Fire Protection Sys Mod | 9702 | 7/31/97 | | 197,781 | 197,781 | | 200,000 | | |
| Unit 5-Liquid HCL Vaporizer | 9703 | 7/31/97 | | 353,475 | 353,475 | | 130,000 | | |
| Unit 5-PCL | 9704 | 5/31/97 | | 76,288 | 76,288 | | 80,000 | | |
| Lab Ion Chromatograph | 9705 | 5/31/97 | | 15,000 | 15,000 | | 15,000 | | |
| Diuron Centrifuge Improvement | 9706 | 5/31/97 | | 53,614 | 53,614 | | | | |
| Unit 5 EO Scrubber | 9707 | 5/31/97 | | 85,366 | 85,366 | | 85,000 | | |
| Unit 5 Reactor Replacement R | 9708 | 5/31/97 | | 98,258 | 98,258 | | 106,000 | | |
| Lab-Gas Chromatograph | 9709 | 5/31/97 | | 21,420 | 21,420 | | 26,000 | | |
| Lab-Gas Chromatograph | 9709 | 7/31/97 | | 3,351 | 3,351 | | | | |
| Ethephon HCL Recirculation | 9711 | 10/31/97 | | 61,597 | 61,597 | | 59,000 | | |
| TA Warehouse Roof Repair | 9713 | 10/31/97 | | 16,519 | 16,519 | | 16,500 | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Unit 2a Replacement Load | 9714 | 10/31/97 | | 4,703 | 4,703 | | 5,500 |
| E-6101 Unit 6 Heat Exc | 9716 | 12/31/97 | | 49,943 | 49,943 | | 62,000 |
| BFG Telene Improvements | 9717 | 12/31/97 | | 30,577 | 30,577 | | 105,700 |
| Bio Pond Aeriation-Rev 1 | 9719 | 12/31/97 | | 47,526 | 47,526 | | 58,300 |
| Wastewater Trmt Impr-Bio | 9722 | 12/31/97 | | 18,285 | 18,285 | | 19,000 |
| Sub Total Completed | | | 4,461,358 | 1,756,527 | 6,217,885 | | 5,766,000 |
| Total CIP & Completed Proj | | | 4,461,358 | 2,976,593 | 7,437,951 | 247,111 | 6,371,050 |

CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
REVISED COST

DATE 12/31/98

LOCATION WEST HELENA

| | BALANCE 1/1/98 | ADDITIONS | RETIREMENTS | TRANSFERS TO (FROM) CIP | TRANSFERS TO (FRM) OTHER PLTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND | 67,260.00 | | | | | | 67,260.00 |
| LAND IMPROVEMENTS | 1,369,871.74 | | | | | | 1,369,871.74 |
| BUILDINGS | 1,046,212.71 | | | 655,082.56 | | | 1,701,295.27 |
| MACHINERY & EQUIPMENT | 26,663,865.77 | | | 2,653,381.65 | | | 29,317,247.42 |
| OFFICE EQUIPMENT | 169,938.99 | 12,659.31 | | | | | 182,598.30 |
| CIP | 1,220,067.67 | 4,017,308.07 | | (3,308,464.21) | | | 1,928,911.53 |
| TOTAL COST | 30,537,216.88 | 4,029,967.38 | 0.00 | 0.00 | 0.00 | 0.00 | 34,567,184.26 |

CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
ACCUMULATED DEPRECIATION

DATE 12/31/98

LOCATION WEST HELENA

| | BALANCE 1/1/98 | ADDITIONS | RETIREMENTS | | TRANSFERS TO (FRM) OTHER PLTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND IMPROVEMENTS | 843,076.95 | 57,510.60 | | | | | 900,587.55 |
| BUILDINGS | 396,997.17 | 56,008.99 | | | | | 453,006.16 |
| MACHINERY & EQUIPMENT | 12,451,438.32 | 2,693,087.82 | | | | | 15,144,526.14 |
| OFFICE EQUIPMENT | 88,595.53 | 21,261.72 | | | | | 109,857.25 |
| TOTAL COST | 13,780,107.97 | 2,827,869.13 | 0.00 | 0.00 | 0.00 | 0.00 | 16,607,977.10 |

CEDAR CHEMICAL CORPORATION
CONSTRUCTION IN PROCESS

LOCATION West Helena
DATE 12/31/98



| Project Description | Proj No | Complet'n Date | Prior to 1/1/98 | Spending Current Year | Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over(Under) Budget |
|---|---|---|---|---|---|---|---|---|---|
| Front Office Expansion | 9805 | | | | | | Cancelled | | |
| DCA AutoClave Replacement | 9807 | * | | 660,531 | 660,531 | 7,469 | 760,000 | | |
| Piping for Refrigeration | 9809 | | | | | | Cancelled | | |
| Propanil Improvements Rev 1 | 9810 | * | | 125,992 | 125,992 | 14,008 | 140,300 | | |
| Unit 4 Solvent Change | 9811 | | | 401,929 | 401,929 | 201,671 | 694,000 | | |
| Unit 6 Catalyst Recovery | 9812 | | | 36,470 | 36,470 | 120,430 | 226,100 | | |
| Unit 6 DCA Expansion | 9813 | | | 125,450 | 125,450 | 3,574,550 | 3,700,000 | | |
| Boiler Feed Water Economizer | 9816 | | | 2,761 | 2,761 | 58,739 | Pending Mphs | | |
| Unit 1 & 2 New Cooling Tower | 9817 | * | | 142,991 | 142,991 | | Pending Mphs | | |
| Unit 6 T-6202, Nitric Storage | 9818 | * | | 59,036 | 59,036 | | 57,000 | | |
| Rail Road Spur Improvements | 9820 | | | | | 230,000 | Pending Mphs | | |
| Unit 2 Propanil Reactor | 9821 | | | 75,578 | 75,578 | 31,422 | Pending Mphs | | |
| Propanil Storage & Vent Condensor | 9822 | | | 121,338 | 121,338 | 44,662 | Pending Mphs | | |
| Unit 6 V-6302 Agitator Replacement | 9823 | * | | 57 | 57 | 24,943 | 25,000 | | |
| Unit 1 Redundant Control System | 9824 | | | | | 60,000 | Pending Mphs | | |
| Unit 6 R-6106 Coil Improvements | 9825 | | | | | 180,000 | Pending Mphs | | |
| Laboratory Printer Installation | 9826 | | | | | 25,000 | Pending Mphs | | |
| Unit 5 CYMP Process Mod | 9827 | * | | 113,585 | 113,585 | 19,415 | Pending Mphs | | |
| Waste Water Pond Improvement | 9828 | | | | | 50,000 | Pending Mphs | | |
| Confined Space Retrieval System | 9829 | | | | | 10,000 | Pending Mphs | | |
| Dover Phos | 9901 | | | 63,194 | 63,194 | 338,806 | Pending Mphs | | |
| TOTAL C I P | | | | 1,928,912 | 1,928,912 | 4,981,116 | 5,602,400 | | |

* Closure Statements Received From Engineering/Pending Booking of All Cost

CEDAR CHEMICAL CORPORATION
COMPLETED PROJECTS

LOCATION West Helena
DATE 12/31/98



| Project Description | Proj No | Complet'n Date | Spending: Prior to 1/1/98 | Spending: Current Year | Total | Estimated Cost To Complete | Amount of Approved AFE | Current Year Budget | Spending Over <Under> Budget |
|---|---|---|---|---|---|---|---|---|---|
| Isomer Seperation Centrif | 9712 | 3/31/98 | 6,393 | 2,321 | 8,714 | | 34,000 | | |
| Unit 6 Vessel Replacement | 9718 | 3/31/98 | 97,868 | 22,889 | 120,757 | | 100,000 | | |
| Heat Exchange Unit 4 | 9720 | 3/31/98 | 19,167 | 5,415 | 24,582 | | 31,000 | | |
| Ponds Influent Flowmeter | 9724 | 3/31/98 | 14,270 | 1,092 | 15,362 | | 13,900 | | |
| T-4201 Replacement Unit 4 | 9727 | 12/31/98 | 400 | 22,687 | 23,087 | | 28,000 | | |
| Agitator Replacement Unit | 9728 | 3/31/98 | 70,401 | 522 | 70,923 | | 52,150 | | |
| Main Transformer Relocati | 9729 | 3/31/98 | 128,930 | 34,796 | 163,726 | | 170,300 | | |
| Unit 6 R-6105 Replacement | 9733 | 3/31/98 | 110,624 | 63 | 110,687 | | 102,000 | | |
| Unit 1 T-12114 Scrubber Ta | 9735 | 3/31/98 | 20,000 | | 20,000 | | 32,700 | | |
| Unit 1 Control Rm & Mtr C | 9736 | 3/31/98 | 344,400 | | 344,400 | | 344,400 | | |
| Unit 6 DCNB Column Imprv | 9721 | 6/30/98 | 19,622 | (1,013) | 18,609 | | Canceled | | |
| Diuron Dryer Chute Imprvm | 9730 | 6/30/98 | | 23,649 | 23,649 | | 24,000 | | |
| Unit 4 Replace Decantatio | 9732 | 6/30/98 | 28,509 | 48,717 | 77,226 | | 85,000 | | |
| Unit 1 R-1102, V-1303, T-12 | 9801 | 6/30/98 | 359,482 | (37,278) | 322,204 | | 266,500 | | |
| Quality Lab Expansion | 9804 | 12/31/98 | | 263,410 | 263,410 | | 263,500 | | |
| Unit 4 R-4103 Replacement | 9806 | 6/30/98 | | 161,896 | 161,896 | | 195,000 | | |
| Unit 1 Telone Improvement | 9808 | 12/31/98 | | 330,712 | 330,712 | | 515,900 | | |
| Unit 1 Vessel Additions | 9814 | 10/31/98 | | 1,150,000 | 1,150,000 | | 1,150,000 | | |
| Compressed Air Dryer | 9815 | 12/31/98 | | 11,246 | 11,246 | | 17,000 | | |
| R&D Lab & Office Expansion | 9819 | 12/31/98 | | 47,269 | 47,269 | | 50,000 | | |
| Sub Total Completed | | | 1,220,066 | 2,088,393 | 3,308,459 | | 3,475,350 | | |
| Total CIP & Completed Proj | | | 1,220,066 | 4,017,306 | 5,237,371 | 4,981,116 | 9,077,750 | | |

CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
REVISED COST

DATE 12/31/1999

LOCATION WEST HELENA

| | BALANCE 1/1/1999 | ADDITIONS | RETIREMENTS | TRANSFERS TO (FROM) CIP | TRANSFERS TO (FRM) OTHER PLTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND | 67,260.00 | | | | | | 67,260.00 |
| LAND IMPROVEMENTS | 1,369,871.74 | | | | | | 1,369,871.74 |
| BUILDINGS | 1,701,295.27 | | | 23,189.82 | | | 1,724,485.09 |
| MACHINERY & EQUIPMENT | 29,317,247.42 | | | 2,986,799.88 | | | 32,304,047.30 |
| OFFICE EQUIPMENT | 182,598.30 | 10,953.03 | | 70,726.08 | | | 264,277.41 |
| CIP | 1,928,911.53 | 5,806,778.08 | | (3,080,715.78) | | | 4,654,973.83 |
| TOTAL COST | 34,567,184.26 | 5,817,731.11 | 0.00 | 0.00 | 0.00 | 0.00 | 40,384,915.37 |

CEDAR CHEMICAL CORPORATION
SUMMARY OF FIXED ASSETS
ACCUMULATED DEPRECIATION

DATE 12/31/1999

LOCATION WEST HELENA

| | BALANCE 1/1/1999 | ADDITIONS | RETIREMENTS | | TRANSFERS TO (FRM) OTHER PLTS | OTHER | ENDING BALANCE |
|---|---|---|---|---|---|---|---|
| LAND IMPROVEMENTS | 900,587.55 | 50,229.36 | | | | | 950,816.91 |
| BUILDINGS | 453,006.16 | 72,458.94 | | | | | 525,465.10 |
| MACHINERY & EQUIPMENT | 15,144,526.14 | 3,067,108.07 | | | | | 18,211,634.21 |
| OFFICE EQUIPMENT | 109,857.25 | 30,866.33 | | | | | 140,723.58 |
| TOTAL COST | 16,607,977.10 | 3,220,662.70 | 0.00 | 0.00 | 0.00 | 0.00 | 19,828,639.80 |

CEDAR CHEMICAL CORPORATION
CONSTRUCTION IN PROCESS

LOCATION West Helena
DATE 12/31/99



| Project Description | Proj No | Complet'n Date | Spending: Prior to 1/1/1999 | Spending: Current Year | Total | Estimated Cost To Complete | Total Estimated Cost | Amount of CAR | Over (Under) CAR | Status |
|---|---|---|---|---|---|---|---|---|---|---|
| Unit 6 Catalyst Recovery | 9812 | * | 38,470 | 147,947 | 184,417 | 45,583 | 230,000 | 226,100 | 3,900 | |
| Unit 6 DCA Expansion | 9813 | | 125,450 | 2,868,400 | 2,893,850 | 239,263 | 3,233,113 | 3,700,000 | (466,887) | February 23, 1999 |
| Rail Road Spur Improvements | 9820 | | | | | | | 230,000 | (230,000) | Cancelled |
| Unit 1 Redundant Control System Rev I | 9824 | * | | 60,333 | 60,333 | | 60,333 | 60,000 | 333 | February 23, 1999 |
| Unit 6 R-6106 Cell Improvements | 9825 | | | 73,548 | 73,548 | 106,452 | 180,000 | 180,000 | | February 23, 1999 |
| Confined Space Retrieval System | 9829 | | | 10,727 | 10,727 | | 10,727 | 10,000 | 727 | Pending Mphs |
| Brine System Improvements | 9907 | | | 1,865 | 1,865 | 66,635 | 68,500 | 68,500 | | September 20, 1999 |
| New Warehouse | 9908 | | | | | | | 420,000 | (420,000) | October 22, 1999 |
| U5 Rotary Vacuum Dryer | 9912 | | | 321,774 | 321,774 | 112,226 | 434,000 | 434,000 | | June 28, 1999 |
| Waste Water Upgrade | 9913 | | | 19,903 | 19,903 | 330,097 | 350,000 | 350,000 | | September 16, 1999 |
| U3 Diuron Powder Flow Imprv | 9914 | | | 5,000 | 5,000 | 95,000 | 100,000 | 100,000 | | September 20, 1999 |
| U5 Stanol Plant Mod | 9915 | * | | 116,833 | 116,833 | 151 | 116,984 | 112,300 | 3,684 | September 20, 1999 |
| Plant Brine Pump Improvements | 9917 | * | | 10,587 | 10,587 | 9,013 | 19,600 | 19,600 | | September 19, 1999 |
| New Office-Replaced with 2004 | 9919 | | | | | | | | | Rpto'd with 2004 |
| Pentabrom Plt Mod | 9920 | | | 476,946 | 476,946 | 75,554 | 552,500 | 552,500 | | November 10, 1999 |
| Stanol Debottleneck | 9921 | | | 67,660 | 67,660 | 47,340 | 115,000 | 115,000 | | Pending Mphs |
| U6-doa Separation Imprv | 9922 | | | 163,714 | 163,714 | 1,286 | 165,000 | 165,000 | | Pending Mphs |
| Plt Boiler & Infra Structure Imprv | 9923 | | | 133,633 | 133,633 | 1,367 | 135,000 | 135,000 | | Pending Mphs |
| Computer Network Installation & Hardware | 2001 | | | | | 93,500 | 93,500 | 93,500 | | Pending Mphs |
| N2 Compressor Electrical | 2002 | | | | | 55,000 | 55,000 | 55,000 | | Pending Mphs |
| Plant Locker Room Expansion | 2003 | | | 15,183 | 15,183 | 44,817 | 60,000 | 60,000 | | Pending WH |
| Plant Office Addition | 2004 | | | | | 175,000 | 175,000 | 175,000 | | Pending WH |
| Process Simulation Software | 2005 | | | | | 40,000 | 40,000 | 40,000 | | Pending WH |
| TOTAL C I P | | | 161,920 | 4,493,053 | 4,654,973 | 1,538,284 | 6,193,257 | 7,301,500 | (1,108,243) | |

* Closure Notice Received From Engineering/Pending Booking of All Cost

CEDAR CHEMICAL CORPORATION
COMPLETED PROJECTS

LOCATION West Helena
DATE 12/31/99



| Project Description | Proj No | Complet'n Date | Spending: Prior to 1/1/1999 | Spending: Current Year | Total | Estimated Cost To Complete | Total Estimated Cost | Amount of Approved AFE | Over (Under) CAR | Status |
|---|---|---|---|---|---|---|---|---|---|---|
| DCA AutoClave Replacement | 9807 | 5/31/99 | 660,531 | 62,297 | 722,828 | | 722,828 | 760,000 | (37,172) | |
| Propanil Improvements Rev 1 | 9810 | 5/31/99 | 125,992 | 11,971 | 137,963 | | 137,963 | 140,300 | (2,337) | |
| Unit 4 Solvent Change | 9811 | 9/30/1999 | 401,929 | 251,256 | 653,185 | | 653,185 | 694,000 | (40,815) | |
| Boiler Feed Water Economizer | 9816 | 9/30/1999 | 2,761 | 48,986 | 51,747 | | 51,747 | 61,500 | (9,753) | February 23, 1999 |
| Unit 1 & 2 New Cooling Tower | 9817 | 5/31/99 | 142,991 | 2,177 | 145,168 | | 145,168 | 148,000 | (2,832) | February 23, 1999 |
| Unit 1 & 2 New Cooling Tower | 9817 | 12/31/1999 | | 13,490 | 13,490 | | 13,490 | | 13,490 | Closed 5/31/99 |
| Unit 6 T-6202, Nitric Storage | 9818 | 5/31/99 | 59,036 | (3,821) | 55,215 | | 55,215 | 57,000 | (1,785) | |
| R&D Lab & Other Office Expansion | 9819 | 5/31/99 | | 3,668 | 3,668 | | 3,668 | | 3,668 | Closed in 1998 |
| Unit 2 Propanil Reactor | 9821 | 9/30/1999 | 75,578 | 46,929 | 122,507 | | 122,507 | 125,000 | (2,493) | February 23, 1999 |
| Propanil Storage & Vent Condensor | 9822 | 9/30/1999 | 121,338 | 54,988 | 176,326 | | 176,326 | 166,000 | 10,326 | February 23, 1999 |
| Unit 6 V-6302 Agitator Replacement | 9823 | 5/31/99 | 57 | 9,518 | 9,576 | | 9,576 | 25,000 | (15,425) | |
| Laboratory Printer Installation | 9826 | 9/30/1999 | | 20,710 | 20,710 | | 20,710 | 25,000 | (4,290) | Pending Mphs |
| Unit 5 CYMP Process Mod | 9827 | 5/31/99 | 113,585 | 11,689 | 125,274 | | 125,274 | 133,000 | (7,726) | February 23, 1999 |
| Waste Water Pond Improvement | 9828 | 9/30/1999 | | 37,388 | 37,388 | | 37,388 | 50,000 | (12,611) | Pending Mphs |
| Dover Phos Rev I | 9901 | 9/30/1999 | 63,194 | 370,299 | 433,493 | | 433,493 | 440,000 | (6,507) | February 23, 1999 |
| U2 Steam Header | 9902 | 12/31/1999 | | 34,886 | 34,886 | | 34,886 | 33,000 | 1,886 | April 8, 1999 |
| GC Mas Spectrometer | 9903 | 12/31/1999 | | 70,726 | 70,726 | | 70,726 | 70,000 | 726 | September 16, 1999 |
| Plant Equipment Storage Site | 9904 | 9/30/1999 | | 29,547 | 29,547 | | 29,547 | 30,000 | (453) | April 7, 1999 |
| Propanil Bagging System | 9905 | 12/31/1999 | | 39,810 | 39,810 | | 39,810 | 42,000 | (2,190) | April 8, 1999 |
| U2 A-2103 Agitator Upgrade | 9906 | 5/31/99 | | 15,979 | 15,979 | | 15,979 | 19,700 | (3,721) | March 30, 1999 |
| U2 A-2103 Agitator Upgrade | 9906 | 12/31/1999 | | 5,340 | 5,340 | | 5,340 | | 5,340 | Closed 5/31/99 |
| U4 V-4302A Replacement | 9909 | 5/31/99 | | 15,922 | 15,922 | | 15,922 | 22,400 | (6,478) | Pending Mphs |
| U3 A-2104 Replacement of Agitator Gear Box | 9910 | 5/31/99 | | 28,202 | 28,202 | | 28,202 | 29,000 | (798) | Pending Mphs |
| U5 Toll Filtering System | 9911 | 12/31/1999 | | 112,447 | 112,447 | | 112,447 | 100,000 | 12,447 | Pending Mphs |
| Formulations Lab Improvements | 9918 | 12/31/1999 | | 19,524 | 19,524 | | 19,524 | 25,000 | (5,476) | September 29, 1999 |
| Sub Total Completed | | | 1,766,992 | 1,313,725 | 3,080,717 | | 3,080,717 | 3,195,900 | (115,183) | |
| Total CIP & Completed Proj | | | 1,928,912 | 5,806,778 | 7,735,690 | 1,538,284 | 9,273,974 | 10,497,400 | (1,223,426) | |

**CEDAR CHEMICAL CORPORATION**
**CAPITAL PROJECTS IN PROCESS**

**LOCATION West Helena**
**DATE December 31, 1999**

| Project Description | CAR # | Date Completed | Spending | | | Est Cost To Complete | Estimated Project Cost | Approved CAR | Estimated Over (Under) CAR | Information Only Current Year Budget | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Prior to 1/1/99 | Current Year | Total | | | | | Year-to-date Budget | Total Current Year Budget |
| **1998 Capital Projects** | | | | | | | | | | | |
| Front Office Expansion | 9805 | | | | | | | | | | |
| DCA Autoclave Replacement | 9807 | 5/31/1999 | 660,531 | 62,297 | 722,828 | | 722,828 | 760,000 | (37,172) | | |
| Propanil Improvements-Rev 1 | 9810 | 5/31/1999 | 125,992 | 11,971 | 137,963 | | 137,963 | 140,300 | (2,337) | 20,000 | 20,000 |
| Unit 4 Solvent Change | 9811 | 9/30/1999 | 401,929 | 251,256 | 653,185 | | 653,185 | 694,000 | (40,815) | 288,000 | 288,000 |
| Unit 6 Catalyst Recovery | 9812 | | 36,470 | 147,947 | 184,417 | 45,583 | 230,000 | 226,100 | 3,900 | | |
| Unit 6 DCA Expansion | 9813 | | 125,450 | 2,868,400 | 2,993,850 | 239,263 | 3,233,113 | 3,700,000 | (466,887) | 3,075,000 | 3,075,000 |
| Boiler Feed Water Economizer | 9816 | 9/30/1999 | 2,761 | 48,986 | 51,747 | | 51,747 | 61,500 | (9,753) | 25,000 | 25,000 |
| Unit 1 & 2 Cooling Tower | 9817 | 12/31/1999 | 142,991 | 15,667 | 158,658 | | 158,658 | 148,000 | 10,658 | | |
| Unit 6 T-6202, Nitric Storage | 9818 | 5/31/1999 | 59,036 | -3,821 | 55,215 | | 55,215 | 57,000 | (1,785) | | |
| R&D Lab Renovation | 9819 | 5/31/1999 | | 3,666 | 3,666 | | 3,666 | | 3,666 | | |
| RR Spur Expansions | 9820 | | | | | | | 230,000 | (230,000) | 220,000 | 220,000 |
| Unit 2 Proapnil Reactor | 9821 | 9/30/1999 | 75,578 | 46,929 | 122,507 | | 122,507 | 125,000 | (2,493) | 105,000 | 105,000 |
| Propanil Storage & Vent Condensor | 9822 | 9/30/1999 | 121,338 | 54,988 | 176,326 | | 176,326 | 166,000 | 10,326 | 40,000 | 40,000 |
| Unit 6 V-6302 Agitator Rplm't | 9823 | 5/31/1999 | 57 | 9,518 | 9,575 | | 9,575 | 25,000 | (15,425) | | |
| Unit 1 Redundant Control Sys Rev I | 9824 | | | 60,333 | 60,333 | | 60,333 | 60,000 | 333 | 50,000 | 50,000 |
| Unit 6 V-6106 Coil Improvements | 9825 | | | 73,548 | 73,548 | 106,452 | 180,000 | 180,000 | | 180,000 | 180,000 |
| Laboratory Printer Installation | 9826 | 9/30/1999 | | 20,710 | 20,710 | | 20,710 | 25,000 | (4,290) | 25,000 | 25,000 |
| Unit 5 CYMP Process Mod | 9827 | 5/31/1999 | 113,585 | 11,689 | 125,274 | | 125,274 | 133,000 | (7,726) | | |
| Waste Water Pond Improvement | 9828 | 9/30/1999 | | 37,389 | 37,389 | | 37,389 | 50,000 | (12,611) | 50,000 | 50,000 |
| Confined Space Retrieval System | 9829 | | | 10,727 | 10,727 | | 10,727 | 10,000 | 727 | | |
| **1999 Capital Projects** | | | | | | | | | | | |
| Safety Equipment Upgrades | | | | | | | | | | 50,000 | 50,000 |
| Change Room Expansion | | | | | | | | | | 100,000 | 100,000 |
| Vessel PSM Compliance | | | | | | | | | | 100,000 | 100,000 |
| Waste Drum Pad | | | | | | | | | | 50,000 | 50,000 |
| Storage Tank Vents | | | | | | | | | | 200,000 | 200,000 |
| Diuron Waste Water Treatment | | | | | | | | | | 100,000 | 100,000 |
| Reactor Replacements | | | | | | | | | | 500,000 | 500,000 |
| T-5401 Scrubber Tank Replacement | | | | | | | | | | 100,000 | 100,000 |
| Propanil/Diuron Storgae Improvements | | | | | | | | | | 75,000 | 75,000 |
| Packaging Upgrade | | | | | | | | | | 25,000 | 25,000 |
| Storage Tank Replacement | | | | | | | | | | 150,000 | 150,000 |
| Scale House Replacement | | | | | | | | | | 75,000 | 75,000 |
| Storeroom | | | | | | | | | | 175,000 | 175,000 |
| HPLC Liquid Chromatograph | | | | | | | | | | 45,000 | 45,000 |
| Storage Tank Replacements | | | | | | | | | | 175,000 | 175,000 |
| Lab Equipment Upgrades | | | | | | | | | | 50,000 | 50,000 |
| Condensate Return, U1, U2, & U6 | | | | | | | | | | 250,000 | 250,000 |
| Plant Air Header | | | | | | | | | | 60,000 | 60,000 |
| Unidentified | | | | | | | | | | 175,000 | 175,000 |
| U2 Control Room | | | | | | | | | | 400,000 | 400,000 |

CEDAR CHEMICAL CORPORATION
CAPITAL PROJECTS IN PROCESS

LOCATION West Helena
DATE December 31, 1999

| Project Description | CAR # | Date Completed | Spending | | | Est Cost To Complete | Estimated Project Cost | Approved CAR | Estimated Over (Under) CAR | Information Only Current Year Budget | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Prior to 1/1/99 | Current Year | Total | | | | | Year-to-date Budget | Total Current Year Budget |
| In House Formulation | | | | | | | | | | 1,000,000 | 1,000,000 |
| Dover Phos | | | | | | | | | | | |
| Dover Phos Rev I | 9901 | 9/30/1999 | 63,194 | 370,299 | 433,493 | | 433,493 | 440,000 | (6,507) | 402,000 | 402,000 |
| U2 Steam Header | 9902 | 12/31/1999 | | 34,886 | 34,886 | | 34,886 | 33,000 | 1,886 | 75,000 | 75,000 |
| GC Mass Pectrometer | 9903 | 12/31/1999 | | 70,726 | 70,726 | | 70,726 | 70,000 | 726 | 65,000 | 65,000 |
| Plant Equipment Storage Site | 9904 | 9/30/1999 | | 29,547 | 29,547 | | 29,547 | 30,000 | (453) | | |
| Propanil Bagging System | 9905 | 12/31/1999 | | 39,610 | 39,610 | | 39,610 | 42,000 | (2,390) | | |
| U2 A-2103 Agitator Upgrade | 9906 | 12/31/1999 | | 21,319 | 21,319 | | 21,319 | 19,700 | 1,619 | | |
| Gen Plt Nitrogen Blanket for Brine Tank | 9907 | | | 1,865 | 1,865 | 66,635 | 68,500 | 68,500 | | | |
| New Warehouse | 9908 | | | | | | | 420,000 | (420,000) | 500,000 | 500,000 |
| U4 V-4302A Replacement | 9909 | 5/31/1999 | | 15,922 | 15,922 | | 15,922 | 22,400 | (6,478) | | |
| U3 A-2104 Reactor Agitator Replacement | 9910 | 5/31/1999 | | 28,202 | 28,202 | | 28,202 | 29,000 | (798) | | |
| U5 Toll Filtering Unit | 9911 | 12/31/1999 | | 112,447 | 112,447 | | 112,447 | 100,000 | 12,447 | | |
| U5 Rotary Vacuum Dryer | 9912 | | | 321,774 | 321,774 | 112,226 | 434,000 | 434,000 | | | |
| Waste Water Upgrade | 9913 | | | 19,903 | 19,903 | 330,097 | 350,000 | 350,000 | | 250,000 | 250,000 |
| U3 Diuron Powder Flow Sys | 9914 | | | 5,000 | 5,000 | 95,000 | 100,000 | 100,000 | | 200,000 | 200,000 |
| U5 Stanol Plant Mod | 9915 | | | 115,833 | 115,833 | 151 | 115,984 | 112,300 | 3,684 | | |
| Plant Brine Pump Improvements | 9917 | | | 10,587 | 10,587 | 9,013 | 19,600 | 19,600 | | | |
| Formulations Lab Improvements | 9918 | 12/31/1999 | | 19,524 | 19,524 | | 19,524 | 25,000 | (5,476) | | |
| New Office | 9919 | | | | | | | | | | |
| Petabrom Plt Mod | 9920 | | | 476,946 | 476,946 | 75,554 | 552,500 | 552,500 | | | |
| Stanol Debottleneck | 9921 | | | 67,660 | 67,660 | 47,340 | 115,000 | 115,000 | | | |
| U6-DCA Separation Imprvmt | 9922 | | | 163,714 | 163,714 | 1,286 | 165,000 | 165,000 | | | |
| Plt Boiler & Infra Structure Imprvmt | 9923 | | | 133,633 | 133,633 | 1,367 | 135,000 | 135,000 | | | |
| 2000 Capital Projects | | | | | | | | | | | |
| Computer Network Installation & Hardware | 2001 | | | | | 93,500 | 93,500 | 93,500 | | | |
| N2 Compressor Electrical | 2002 | | | | | 55,000 | 55,000 | 55,000 | | | |
| Plant Locker Room Expansion | 2003 | | | 15,183 | 15,183 | 44,817 | 60,000 | 60,000 | | | |
| Plant Office Expansion | 2004 | | | | | 175,000 | 175,000 | 175,000 | | | |
| Process Simulation Software | 2005 | | | | | 40,000 | 40,000 | 40,000 | | | |
| | | | | | | | | | | | |
| TOTAL C I P | | | 1,928,912 | 5,806,780 | 7,735,692 | 1,538,284 | 9,273,976 | 10,497,400 | (1,223,424) | 9,425,000 | 9,425,000 |

5/30/72

Notes to CPB

cc: JER
GDY
RJM

SUBJECT: du Pont Methyl Ester Project

Per my 5/26/72 conversation with Newt Thayer of du Pont's Sabine River Works, the following should be noted:

1. I called Newt in regard to his 5/15/72 letter wherein he suggested we contact him on certain technical aspects of the dehydration step in this process. He commented that du P nt had run 2 experiments in an effort to define some of the parameters surrounding this dehydration. In the first experiment, they added 1-2% sulfuric acid based on the weight of DBA and proceeded with the dehydration. Newt felt that most of the water had come over by the time the temperature had reached 127° C.; however, he felt that only approximately 1/6 of the nitric acid had been removed at that time. At the 127° C. temperature, they began to see considerable amounts of $NO_2$ being generated due to the reaction of the nitric acid with the various diabasic acids. Newt feels that the process simply involves the removal of one carbon atom and the subsequent oxidation of the remaining terminal carbon atom so that the by-products of this reaction are simply shorter-chained diabasic acids. Further, he feels that any diabasic acids generated below succinic would probably go to carbon dioxide, thereby leaving the system essentially free of extraneous materials other than the 3 diabasic acids with which we started. Apparently the formation of $NO_2$ continues while the temperature is brought up to 140° C. During this dehydration they continue to bubble a small stream of nitrogen through the product and hold material at 140° C. until all of the $NO_2$ disappears, leaving a clear blue liquid. During this experiment, no exotherm was noted.

2. They ran an additional reaction wherein the material was kept under 50 mm. of mercury vacuum while they brought the temperature up. Again at 127° C. they began to get $NO_2$. Although they had removed more water at this time, Newt felt that the amount of nitric acid remaining was considerably higher. Subsequently, he feels this is why they got a rapid exotherm which took the temperature from 127 up to 148° without additional heat. Apparently this required only about 2 minutes, during which time all of the $NO_2$ was driven off and they had a clear blue liquid remaining. However, he did caution us that this took place fairly vigorously.

3. du Pont does not currently intend to try to remove the water and/or nitric acid from this material, and would still desire Chemform to do so. However, they are of course keeping this option open and want our quotation for this step separate so they can evaluate the economics involved. Currently, he just guessed that it is costing them 1¢ per pound of DBA to ship in the water.

4. Regarding removal of the $NO_2$ gas, Newt felt that a caustic scrubber would be required along with a certain amount of air for oxidation purposes. He did not feel that a simple water scrubber would be

GDY/2

effective in that they produce nitric acid by oxidizing ammonia in the presence of air under pressure to NO which is subsequently oxidized to $NO_2$ and scrubbed under pressure with water to generate nitric acid plus more NO. They apparently find it difficult to contain the NO in the water and therefore have a problem at that point in the process. Apparently the NO comes out of the water, is oxidized to $NO_2$, and becomes a gaseous waste product. Presumably they have worked out some method for recycling this.

5. Newt suggested that we ascertain the minimum amount of sulfuric acid catalyst which could be used effectively since the greater the amount of sulfuric acid present, the greater amount of solid waste products which must be discarded. However, he repeated several times that the presence of the sulfuric acid did enable the removal of much larger quantities of nitric acid, thereby lessening the $NO_2$ problem. However, he could not give any comment as to the corrosive effects of the sulfuric/nitric acid blend with the water-acid solution. Further, he commented that no specific corrosion test had been made on this project, although they are currently handling nitric acid at many different conditions using 316 and 304 stainless steel. He did caution us to beware of possible corrosion which would take place during the 120-140° C. cycles.

6. We discussed the possibility of continuous dehydration of this material, and he was quite optimistic that we could dehydrate up to the 127° C. level. Beyond that, he felt that we were facing a need for actual chemical reaction to remove the nitric acid, and he felt that this could be done much better on a batch scale. Fortunately, he does not feel that any significant quantity of DBA is brought over during the dehydration step.

7. Newt suggested that we review the specifications which he had given us concerning the finished product, particularly as relates to the methyl red test. He could not remember specifically what he had given us on this, but stated that the test should involve 0.01 cc.'s of 1% Methyl Red in methanol per 5 cc.'s of ester. This of course should remain yellow to indicate a lack of acidity.

8. Regarding the addition of calcium hydroxide at the end of the reaction, he suggested that we add a sufficient amount of this material to give an "apparent pH"of 8-9 when a measurement is made directly upon the ester itself. I asked if he did not mean a water dispersion with the ester, and he stated that this was not the case. He did comment that chemists would probably say that it is baloney to try to measure pH on pure ester, but he said to just take it as a relative test, giving a meter reading of 8-9.

9. After the calcium hydroxide is added and the while the material is cooking at 100° C. for one hour, we should follow the evolution of ammonia as an off-gas. Once the ammonia stops coming over, he suggests adding an additional 10% calcium hydroxide based on the original weight of this material added. If this gives additional ammonia, the reaction should be continued until the ammonia ceases to evolve. If all of the ammonia is not removed, certain color impurities apparently come over in the distillation of the ester.

10. I mentioned to Newt that we had been given a general impression from Walter Heldt that there was significantly more activity going on within the du Pont organization as relates to this project than appeared to be existing at the time of his visit to our plant. Newt confirmed that there was a considerable increase in activity and stated that there was a good chance of there being a considerable increase in volume, but quickly backed up and covered himself by saying they were not ready to commit to this fact at this time. I considered his even acknowledging the possibility of expanding business as a particularly encouraging sign since he is frequently so conservative on this type of thing.

11. Newt was extremely helpful and cordial and stated several times that we should call him if we have any technical difficulties whatsoever.

CPB:a

10/9/72

Notes to CPB

cc: RJH
JER
GOY

SUBJECT: The du Pont Co. -- Newt Thayer & Seymour Hochberg Visitation 10/5/72

During the subject visitation the following notes were taken and are summarized in a random order:

1. Thayer commented that the best information which he had regarding the schedule of shipments after commercial production begins is as follows:

   a. During the first 3 months they would consume 10,000 lbs. per month.

   b. Months #4 - #8 would involve a gradual scale-up to a 100,000-lb.-per-month level at 9 months.

   c. Months #10 and #11 would involve a scale-up to a 200,000-lb.-per-month at Month #12.

2. I pointed out that it would not appear the total consumption over this period would equal the one million pounds specified in the letter of intent. Newt stumbled over this to some extend, acting as if it was not understood that there was a firm purchase requirement of one million = pounds during this first 12 months. I indicated that this was the case and he accepted it and said that they might have to store some material toward the end of the year in order to meet the requirement. He did state that after the first plant run they can better judge the rate at which they will consume material and will give us a written forecast at that time.

3. Regarding our response to their production requirements, I indicated that we would gradually scale up both with equipment and personnel as the needs arose. Regarding this, he asked how rapidly we could reach the 200,000-lb.-per-month level should it be required early in the first year. I told him that we would want approximately a minimum of 4 months' notice, should they expect the reach the 200,000-lb. level prior to the first 6-8 months.

4. Regarding the manner in which Chemform manufactures this product, both Thayer and Hochberg were strongly of the impression that Chemform was legally bound to divulge all of the technology surrounding this production. In other words, he wants complete access to our production facility and to the process information involved with this production. However, after the meeting, I reviewed our secrecy agreement and found nothing which indicates a legal requirement on our part to give out such information. I do think that in order to avoid an insurmountable psychological stumbling block, we will have to be fairly open about what we are doing. Nevertheless, fine points of technique should not necessarily have to be disclosed.

AB0000108126/1

5. I discussed with Newt the possibility of using du Pont's cars to haul the DBA solution in lieu of Chemform having to lease such cars on its own. He stated that he could make no comments without having discussions with their transportation department and asked me to write him a letter expressing our interest in this area.

6. We discussed the possibility of the water being removed completely at the Sabine River Works and the product being diluted with methanol prior to shipment to Chemform. Thayer feels that this is a very intelligent approach and expects that they will want to consider it, should the 7 million pound consumption appear to be taking place much more rapidly than is currently expected. However, he reminded us that it takes du Pont a minimum of 18 months to accomplish a "hardware" installation.

7. Newt told us that the drums for shipping the ester would be new mild steel tight-head, top bung drums, These would be our standard CD-5 drums. He is to also furnish us with the freight classification to be used for the shipments, the location and amounts for shipments, stenciling instructions, etc. He suggested that the freight for these shipments be on a collect basis unless they desire otherwise.

8. Regarding storage capacity of the finished product, I indicated our current thinking was to maintain about a 3-wks. supply in inventory at the 3,000,000-lb.-per-year consumption level. This would amount to a 20,000-25,000-gal. storage tank. He was not certain whether this would be adequate or not and said that he would contact the consumers at the other end and determine their storage capacity and analyze the total. Should he feel that this is insufficient storage, he would let us know.

9. Unless otherwise notified, the drums should be filled to a weight of 500 lbs. net.

10. For the pilot batch, Newt will requisition 26,000 lbs. of DME to be placed in 52 drums. For this to make this, they will supply a tank truck of DBA solution to be delivered on the 12th and on the 18th of October. He is to notify us as to the instructions to be given to the carrier prior to entering du Pont's facility.

11. Should du Pont at some time decide that this product must be stored in a lined tank, I told Newt that they would have to be responsible for selecting the lining material.

12. He mentioned that there would be no DBA solution available between October 23 and November 10 due to a major plant shutdown at the Sabine River Works.

13. He asked that we clean 3 of the stainless steel drums which they used to furnish test quantities of DBA solution and fill them with ester from this production batch. These drums should then be returned to the Sabine River Works at his discretion. Further, he would like 50 lbs. of the anhydrous DBA cast into a fiber drum, etc., and forwarded to him.

14. I told him that the minimum amount of DME which we anticipated producing would be approximately .3 lbs. of DME per pound of DBA solution furnished. On the basis of a 44,000-lb. tank truck shipment, this would equate to 26,400 lbs. for the two tank trucks. However, we should expect to get somewhat larger yields than this, in which case we will drum this material in Chemform's own drums and bill it to du Pont on the next order.

15. Thayer feels obligated to participate in this early production by visiting our facility and witnessing part of the operation. We suggested that he be here sometime between the 16th and the 23rd, during which time we would be doing dehydration and esterification. He asked that we confirm to him the best dates for him to spend a couple of days at our plant. Seymour Hochberg made certain technical comments regarding the process which may be summarized as follows:

    a. He feels that using an oil bath or otherwise maintaining a lower pot temperature during distillation will minimize the amount of colored material which is carried over.

    b. He feels that the process ultimately produces certain quantities of dimethyl sulfate, trimethylamine, and tetramethyl ammonium sulfate. He stated that heating the product in the presence of the calcium hydroxide drives off the trimethylamine and slowly decomposes the tetramethyl ammonium sulfate into trimethylamine. He feels this can be accelerated by blowing air through the product.

    c. The origin of the tetrabutyl ammonium hydroxide base test resulted from their evaluations of this material in transesterification processes using a base catalyst. Apparently certain of these impurities when carried over cause severe charring and darkening during transesterification. Therefore, he felt that the use of the TBAH to indicate the yellow color would positively define whether or not such darkening would occur during transesterification. He did admit that this test would be interferred with by the presence of methanol or water in the ester itself.

    d. Regarding the effect of the yellow color on solvency applications, Hochberg did not really believe it was a significant factor, despite his desire to have a maximum allowable color of 2 Gardner on the TBAH test. However, he is awaiting the results of the durability studies to better define this situation. Because of our possible concern over being able to consistently meet the 2 Gardner specification, as well as the probability that this test is insignificant

for the solvency application, I suggested that we review the area once the durability tests were complete and try to establish a meaningful specification for this application. Should at a later date du Pont develop a reasonable business for transesterification processes, etc., they would be welcome to approach us on trying to reduce the specification and we would relate to them whether or not we could do it and if there would be an increase in cost. Thayer was very much concerned about the apparent subjectivity and somewhat insignificance of the TBAH test, and some effort should be made to reconcile this point of difference fairly soon.

e. Hochberg feels that there are numerous bases which may be equally effective in this process, such as potassium carbonate, soda ash, etc.

f. Hochberg cautioned us to be careful about adding methanol before all of the nitric acid is removed so that we do not make nitrated methyl compounds which he felt would be hazardous as heart stimulants, etc.

16. Both Thayer and Hochberg felt that if any of the three carbon chains was to be eliminated, they would prefer to lose the adipic acid and maintain as much glutaric acid as possible. It is their feeling that the glutarate is the most beneficial of all of the components.

17. With regard to the possibility of Chemform's marketing these materials or derivatives thereof, Thayer is much more positive in this direction than was Jerry Uniecke during our visit to Wilmington. Therefore, he asked that we approach him on any outside sales opportunities which we might come across. He made no promises, etc., but did state that he would try to give any proposition a fair evaluation.

18. With the exception of Thayer's apparent concern over the specifications, the rest of the meeting was extremely cordial and all matters seemed to have been handled properly and finalized.

ATTENTION: RJH, JER and GDY:

If after reviewing the above you find that I have left out any information which is pertinent to this topic and should be recorded, please so note and pass along to me your comments so that I may attach them to my copy of the memo.

CPB:a

VERTAC CHEMICAL CORPORATION
24th Floor • 5100 Poplar • Memphis, TN 38137 • 901-767-6851 TELEX 53927

June 10, 1981

Mr. Robert J. DeStefano
Senior Purchasing Agent
Contracting Section
Chemicals, Contracting & Packaging
Energy and Materials Department
E. I. du Pont de Nemours & Company
Wilmington, Delaware 19898

Dear Bob:

Per your request, I am confirming Vertac's current proposal for the manufacture of Hydan L at the annual production levels shown below:

| | 7.5MM lbs(1) | | 10-15MM lbs(2) | |
|---|---|---|---|---|
| | 1981 | 1982 | 1981 | 1982 |
| Monthly Facilities Charge | $105,000 | $114,000 | $105,000 | $114,000 |
| Production Fee | $0.185/lb<br>- | $0.20/lb<br>- | $0.165/lb(3)<br>$0.095/lb(4) | $0.179/lb(3)<br>$0.103/lb(4) |
| Investment Credit(5) | $0.0125/lb | $0.0125/lb | $0.0125/lb | $0.0125/lb |

(1) Estimated Plant Modification Costs = $720,000 (one centrifuge)

(2) Estimated Plant Modification Costs = $855,000 (two centrifuges)

Plant modification costs are to be paid by DuPont as incurred. Upon completion, Vertac will reimburse DuPont for one-third of the plant modification cost, less $70,000. Upon termination of the Agreement, Vertac will take title to all new equipment other than the centrifuges(s) supplied by DuPont.

(3) First 10MM lbs of Hydan produced per year.

(4) Excess of 10MM lbs of Hydan produced per year.

(5) Vertac will allow DuPont a credit of $0.0125/lb of product produced until all of DuPont's plant modification costs having been reimbursed; provided, however, that should

the contract terminate prior to all such costs having been reimbursed, there would be no further obligation for cost reimbursement by Vertac.

Vertac will staff, operate, and maintain the facility, including the centrifuge(s); however, DuPont will supply all spare parts necessary to maintain the centrifuge(s). This proposal assumes that DuPont will furnish or pay for all raw materials, supplies, and offsite waste disposal costs.

The Agreement will be for a minimum of 24 continuous months of production with provisions for evergreen renewal unless terminated on six months notice by either party.

Bob, you are aware of Vertac's extensive technical review of the Hydan L project. Based on this effort and our collaboration with your technical personnel, we feel very confident about our ability to produce Hydan L in a timely and economical manner. I trust that your inspection of our facilities and DuPont's past relationships with our personnel at West Helena give you similar confidence. Assuming a prompt acceptance of our proposal, we estimate a maximum of six months from project approval to plant startup.

We appreciate being given the opportunity to quote on this project and look forward to hearing from you soon. This proposal will remain valid for thirty days and is subject to our reaching mutually acceptable terms and conditions in the final Agreement.

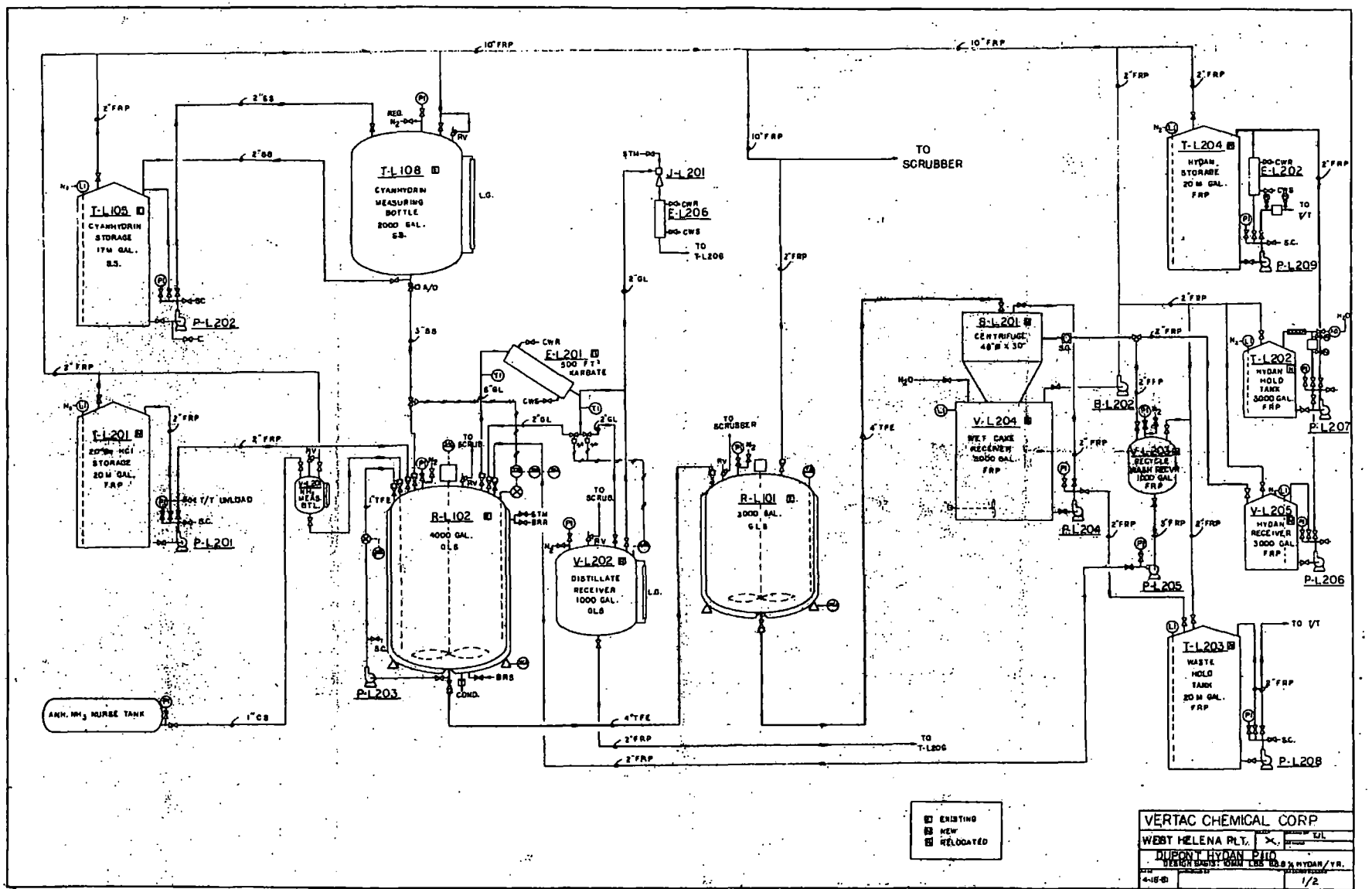
Very truly yours,

C. P. Bomar, Jr.
President

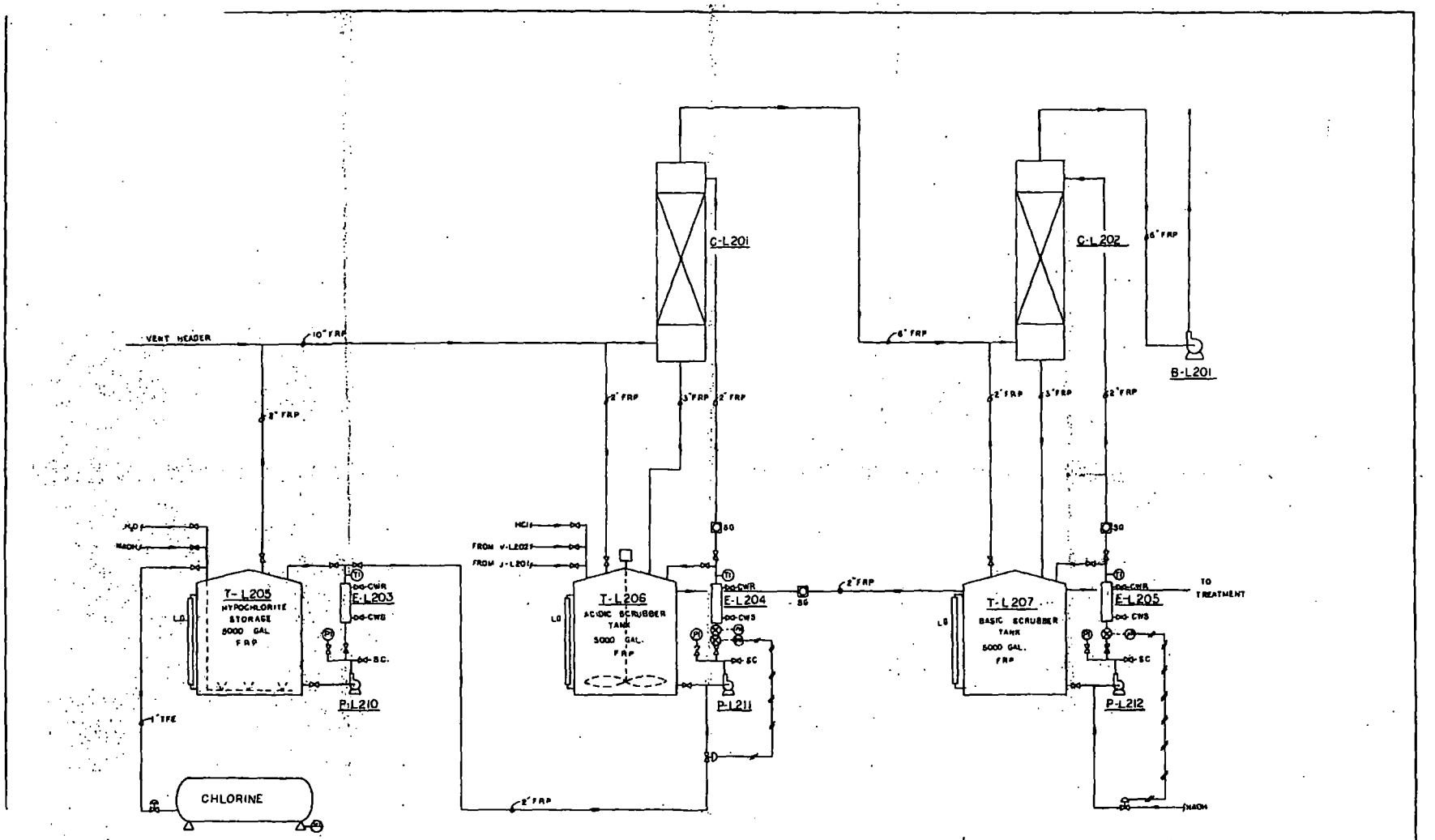
CPB:ap

cc: Mr. N. R. Wallner
Mr. H. V. Kerth
Mr. R. A. Guidi

bcc: J. W. Shackelford
J. Miles
L. J. Reid



T-L105
CYANHYDRIN STORAGE 17M GAL. S.S.
P-L202
T-L108
CYANHYDRIN MEASURING BOTTLE 2000 GAL. S.S.
L.G.
J-L201
E-L206
TO T-L206
TO SCRUBBER
T-L201
20% HCl STORAGE 20M GAL. FRP
P-L201
V-L201
NH3 MEAS. BTL.
E-L201
500 FT² KARBATE
R-L102
4000 GAL. GLS
P-L203
V-L202
DISTILLATE RECEIVER 1000 GAL. GLS
R-L101
3000 GAL. GLS
B-L201
CENTRIFUGE 48"Ø X 30"
V-L204
WET CAKE RECEIVER 2000 GAL. FRP
R-L204
B-L202
V-L203
RECYCLE WASH RECVR 1000 GAL. FRP
P-L205
T-L204
HYDAN STORAGE 20 M GAL. FRP
E-L202
P-L209
T-L202
HYDAN HOLD TANK 3000 GAL. FRP
P-L207
V-L205
HYDAN RECEIVER 3000 GAL. FRP
P-L206
T-L203
WASTE HOLD TANK 20 M GAL. FRP
P-L208
ANH. NH3 NURSE TANK
EXISTING
NEW
RELOCATED
VERTAC CHEMICAL CORP.
WEST HELENA PLT.
DUPONT HYDAN P&ID
1/2




| | |
|---|---|
| VERTAC CHEMICAL CORP | |
| WEST HELENA PLT | X |
| HYDAN SCRUBBER SYSTEM | |
| 5-29-81 | 2/2 |

ARR00011814S/4

VERTAC, INC.

FROM: Tom Ledice

| | |
|---|---|
| | SUITE 2414, 5100 POPLAR, MEMPHIS, TN 38137 |
| | P.O. BOX 3, VICKSBURG, MS 39180 |
| | P.O. BOX 6948, JACKSON, MS 39212 |
| | P.O. BOX 69, JACKSONVILLE, ARK. 72076 |
| X | P.O. BOX 2648, W. HELENA, ARK. 72390 |
| | P.O. BOX 1745, W. MEMPHIS, ARK. 72301 |
| | TECHNICAL CENTER, P.O. BOX 941, W. MEMPHIS, ARK. 72301 |

TO: Pat Bomar

SUBJECT Hydan Pt ID

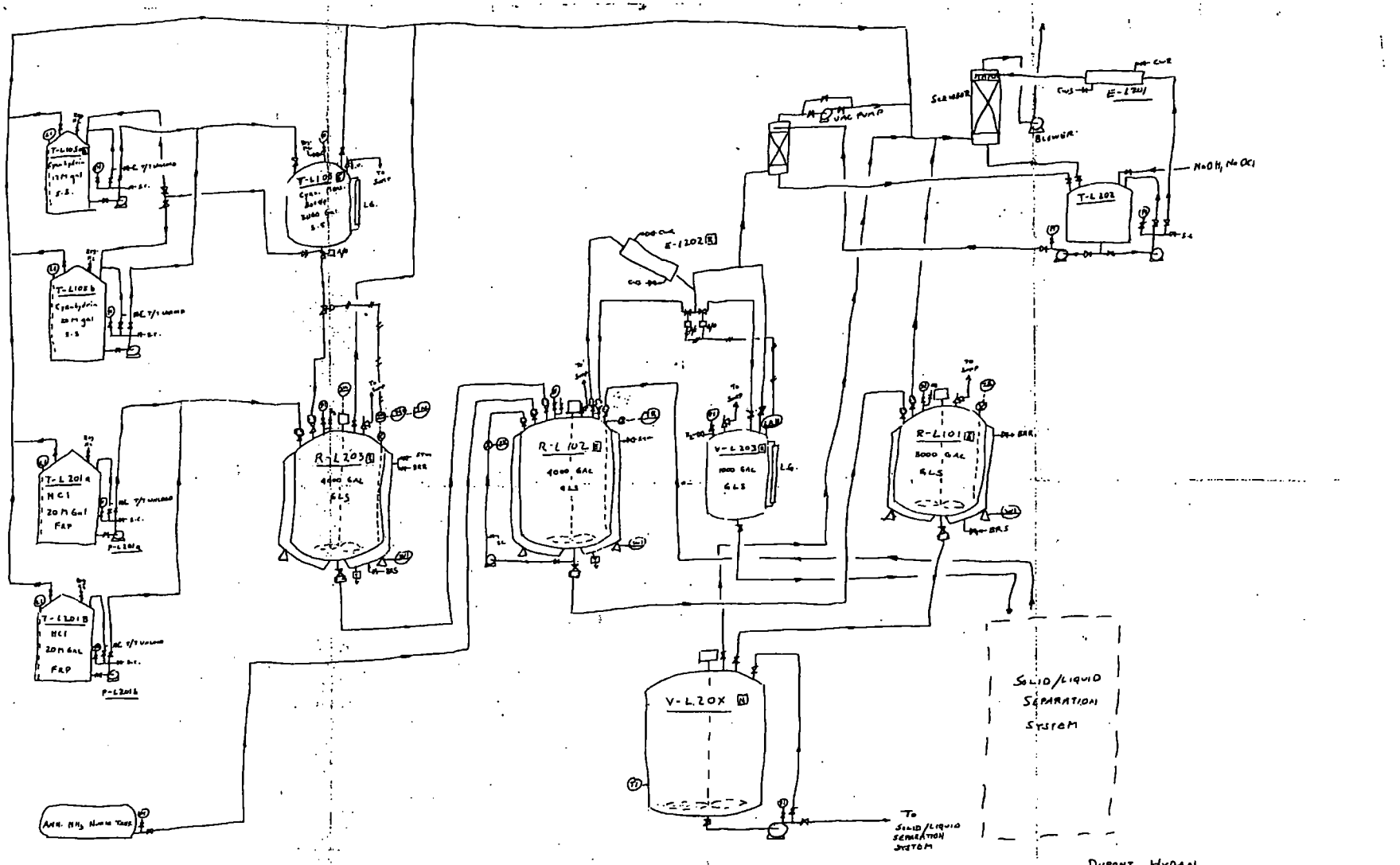
MESSAGE Enclosed are 2 copies of the Hydan Pt ID upon which the cost estimate was based. However, in order to get 10 million lbs/yr., we would need to add a slurry feed tank, another centrifuge and wet cake hopper, and another (or just a larger) recycle wash receiver. With those changes, we should be able to get 12-15 million lbs/yr.

SIGNED Tom Ledice DATE 6/4/81

REPLY

SIGNED DATE

SENDER'S COPY




ARM0011R145/6

INTERNAL CORRESPONDENCE

DATE: May 22, 1980

TO: Distribution

FROM: George Mather

MAY 27 1980

CC: T. Lodice
B. Shackelford
Circulatory Copy
-Technical
-Office
M-304-107
Contract File

SUBJECT: DuPont Hydan

Attached is the Technical Data Package for manufacture of liquid Hydan which could represent an excellent opportunity for the West Helena Lannate Unit. An initial project review is anticipated for mid next week.

:tes

Attachment

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

ENERGY AND MATERIALS DEPARTMENT

May 14, 1980

George F. Mather
Business Manager
Specialty Chemicals and Custom Manufacturing
Vertac Chemical Corporation
5100 Poplar Avenue
Memphis, TN 38137

Dear George:

TECHNICAL DATA PACKAGE

Attached is technical information for the manufacture of liquid Hydan® that you are or will be blending for us. This information includes the composition, processing requirements, handling requirements and other details necessary to process this material successfully for Du Pont. You should take appropriate precautions to operate in a safe manner.

To indicate your receipt and understanding of this technical information, please sign the copy of this letter marked "Wilm. E. & M. Dept. Copy" and return it to me. Inquiries concerning this information should be directed to:

E. I. du Pont de Nemours and Company
Biochemicals Department
Brandywine Building Room 212
Wilmington, DE 19898
Attention: J. W. Stuart

This technical information transmitted to you is accepted by you in accordance with our Confidential Technical Information Agreement dated December 19, 1974.

Very truly yours,

R. J. DE STEFANO
SENIOR PURCHASING AGENT
CONTRACTING SECTION

ACKNOWLEDGED:

VERTAC CHEMICAL CORPORATION

BY George F. Mather

TITLE Business Manager/Custom Manufacturing & Intermediate Chemicals

DATE May 23, 1980

/jtm/ddb/8375B
REV. 1/16/80

There's a world of things we're doing something about

PERSONAL AND CONFIDENTIAL

May 2, 1980

# TECHNICAL DATA PACKAGE

# LIQUID HYDAN® MANUFACTURE

## TABLE OF CONTENTS


I. INTRODUCTION

II. PROCESS DESCRIPTION

III. RAW MATERIAL AND FINISHED PRODUCT PHYSICAL PROPERTIES

IV. ANALYTICAL REQUIREMENTS AND SAMPLE PLAN

V. FINISHED PRODUCT SPECIFICATIONS

VI. INVENTORY RECORDS AND CONTROLS

May 2, 1980

## I. INTRODUCTION

Liquid Hydan® is a nutrient feed supplement for poultry feeds, and is analogous to solid Hydan®, which has been produced by Du Pont since 1954. The liquid product in this document will be referred to as "Liquid Hydan®. The product is categorized as GRAS (Generally Recognized As Safe).

The process is "fairly well-defined". Development work to date has been in glass laboratory equipment. The process is presently being conducted in small-scale commercial type equipment to firm up engineering data and prepare product for experimentation. The data will be transmitted as it becomes available. Analytical methods and raw material and finished product specifications are being developed, and will be transmitted as they become available.

Du Pont's schedule requires start-up of facilities in August, 1980, with product available for sale in September. Estimated production quantities are shown:

| YEAR | MM POUNDS OF 88% LIQUID HYDAN® |
|---|---|
| 1980 | .5 |
| 1981 | 5.0 |
| 1982 | 10.0 |
| 1983 | 15.0 |



AB0000118220/4

## II. PROCESS DESCRIPTION

### A. GENERAL

The batch process consists of a reaction step, vacuum evaporation, neutralization and then centrifugation to remove the byproduct ammonium chloride. The cake is washed with a near-saturated ammonium chloride solution for yield recovery, and the wash recycled to the reaction step. The byproduct will be either land-filled or redissolved for deep well disposal. The finished product will be shipped in bulk and possibly 55 gal. drum. A minor amount of one quart samples will be requested.

All materials in the process are malodorous, and a vapor incineration system must be used.



AB0000118220/5

May 2, 1980

## II. PROCESS DESCRIPTION

### B. HYDROLYSIS REACTION

Chemistry

$$CH_3SCH_2CH_2CH(OH)CN + 1.18\ HCl + 2H_2O \xrightarrow{95°C}$$

M.W. 131.2 M.W. 36.5 M.W. 18

"Cyanhydrin M"

$$CH_3SCH_2CH_2CH(OH)COOH + NH_4Cl + .18\ HCl$$

M.W. 150.2 M.W. 53.5 M.W. 36.5

MHA (Methionine Hydroxy Analog-free Acid)

Description

A specified amount of 31% hydrochloric acid (20°Be) is charged to the reactor. The amount will be 1.18 moles per mole of technical Cyanhydrin M. The specified amount of Cyanhydrin M is then added to the reactor within 30-60 minutes. During 60-70% of the Cyanhydrin addition, the reactor temperature should rise from the exothermic reaction. Cooling is used to control the reaction temperature at 95°C. After all the Cyanhydrin has been added, 95-100°C is maintained for about 1-2 hours to complete the hydrolysis reaction. It will be necessary to use heat to maintain temperature during the holding period. A condenser with reflux to the reactor will be necessary.

The byproduct of the reaction, ammonium chloride, is a solid. The solids are easily resuspended, and show no tendency to foul glass laboratory equipment. It is important these solids not undergo severe attrition in the process, since the smaller particles would make the final separation step difficult.

The expected cycle time for addition, hold, and neutralization is ~3.5 hours.



AB0000118220/6

## II. PROCESS DESCRIPTION

### C. VACUUM EVAPORATION - CONCENTRATION

The slurry from the reaction step is transferred to the second glass-lined, agitated vessel. Vacuum is applied slowly, to avoid "bumping", to an operating pressure of ~200-300 torr. Heat is used to maintain a temperature of about 70-85°C.

There should be a means of measuring amount of distillate removed, since this step controls the strength of the finished product. Evaporating excess water makes the slurry more viscous and more difficult to handle. Termination of the evaporation step prior to endpoint will depress the finished product assay, resulting in rework by reblending.

The overheads from this step are malodorous. Vapors should be incinerated and the liquid treated in a waste treatment facility.

After concentration, some excess hydrochloric acid must be reacted with either anhydrous ammonia or ammonium hydroxide to form additional byproduct. This is an exothermic reaction, so cooling is needed.

The concentrated solution must be cooled to ~30°C for the final step, ammonium chloride removal.



AB00000118220/7

May 2, 1980

## II. PROCESS DESCRIPTION

### D. BYPRODUCT REMOVAL

The concentrated slurry is transferred to a glass-lined hold up tank for the isolation step. The vessel must be agitated, and jacketed for cooling the slurry.

Laboratory work has been conducted using a basket centrifuge (~900G's) for separation. The cake must be washed with a small amount (~6% of cake weight) of saturated ammonium chloride solution (prepared by dissolving cake from previous batch) for yield recovery. The wash water is recycled to the concentration step. The cake will contain ~3-4% water, ~1% MHA, and a small amount of other impurities, and is malodorous. Disposal is discussed in the following section.

The filtrate from the separation is the final product. Sufficient storage must be available for analysis prior to shipment via tank trailer directly to our customer. Tankage should be available also for holdup due to shipping delays, etc. Filters must be used prior to loading to remove any suspended solids due to storage conditions. The finished product is malodorous, so storage tanks should be vented to a vapor incineration facility or to vessels with a common vent. The vapor pressure of liquid Hydan∋ is very low; therefore, no yield loss is expected due to storage.

Rework of finished product due to lower than specification assay could be accomplished by two means 1) reconcentrating in the vacuum evaporator or 2) reblending into specification product. The ammonium chloride concentration in the finished product is fixed by the solubility temperature relationship.

A Hastelloy C, 48" diameter basket centrifuge, complete with batch sequencing controls has been purchased by Du Pont for potential use.



AB0000118220/8

## II. PROCESS DESCRIPTION

### E. BYPRODUCT DISPOSAL

The ammonium chloride cake will contain ~3 - 4 % water, ~1% MHA, and a small amount of other impurities, and is malodorous. It should be disposed of in accordance with appropriate environmental regulations.



AB0000118220/9

May 2, 1980

## II. PROCESS DESCRIPTION

### F. EXPECTED PROCESS YIELDS

Semiworks equipment is presently being operated by Du Pont to gather technical data. Lab studies to date have given essentially quantitative yields based on 100% purity Cyanhydrin M.



AR0000118220(10

## II. PROCESS DESCRIPTION

### G. MISCELLANEOUS DATA

- Hydrolysis heat of reaction = ∿28.7 kcal/g mole Cyanhydrin
  ∿52M BTU/lb mole
- Heat capacity of hydrolyzate = ∿1.05 BTU/lb°F



AB0000118220/11

## II. PROCESS DESCRIPTION

### H. MATERIALS OF CONSTRUCTION

Corrosion studies are underway, and results are expected by June 1st. General statements can be made, however, concerning expected materials of construction.

The process involves handling hot acidic slurries initially, and when cool the slurry contains solid ammonium chloride and about 3% in solution. The finished product is also acidic, with a pH of ∿.9. Therefore, the following could be expected:

- Cyanhydrin M storage and handling - S/S
- HCl Storage - FRP
- $NH_4OH$ Storage - C/S
  or
- Anhydrous $NH_3$ - C/S
- Hydrolysis Reactor - G/L
- Hydrolysis Condenser - G/L, teflon-lined
- Vacuum Evaporator - G/L
- Any Process Pumps - Hastelloy C
- Slurry Storage Tank - G/L
- Centrifuge - Hastelloy C
- Product Storage, Tanks* - FRP, Polyethylene, Polypropylene
- Ammonium Chloride Disposal - Polyethylene, FRP
- Centrifuge Wash Water and Receiver tanks - FRP

*Lined steel is currently being tested.



AB0000118220/12

## III. RAW MATERIAL AND FINISHED PRODUCT PHYSICAL PROPERTIES

Safety, toxicity, and physical property information for chemicals used in this process are given on the following pages.

Key to abbreviations:

From National Institute for Occupational Safety and Health "Registry of Toxic Effects of Chemical Substances, 1977"

$LC_{lo}$ = Lowest published lethal concentration [=] $\frac{Conc}{Time}$

$LD_{lo}$ = Lowest published lethal dose [=] weight/body weight

$LD_{50}$ = Lethal dose which will kill 50 percent of the population [=] weight/body

$TC_{lo}$ = Lowest published toxic concentration (lowest concentration which will produce a toxic, but not necessarily lethal effect [=] conc/time

ALD = Approximate lethal dosage (Haskell Laboratory

ACGIH = American Conference of Governmental Industrial Hygienists



AB0000118220/13

SAFETY DATA SHEET May 2, 1980

Material Name: Ammonium Chloride
Molecular Formula: $NH_4Cl$
Molecular Weight: 53.50

I. IDENTIFICATION:

A. Other Names: Sal Ammonia

B. Structural Formula: $NH_4Cl$

II. PHYSICAL PROPERTIES

Liquid ( ) Gas ( ) Solid (X) Polymorphic ( )

| | |
|---|---|
| Melting Point: | 338°C |
| Boiling Point: | 520°C |
| Specific Gravity: | |
| Solubility: | In 100g $H_2O$ =37.2 @ 20°C, 77.3 @ 100°C |
| Appearance: | White crystals |
| Vapor Pressure: | 1mm @ 160.4°C |

III. HAZARD CLASSIFICATION:

IV. TOXICITY DATA:

Oral $LD_{50}$ = 1650 mg/kg
species rat

V. HEALTH EFFECTS:

Do not eat material.
Large doses can cause nausea, vomiting, and acidosis.

VI. FIRST AID:

VII. NECESSARY PRECAUTIONS:

Wear rubber gloves and safety glasses. Ammonium chloride should be stored in cool, dry environment.



AR0000118220/14

MATERIAL NAME: Hydrochloric Acid, 32%
Molecular Formula: HCl
Molecular Weight: 36.47

May 2, 1980

## IDENTIFICATION

Other Name: Muriatic Acid
Hydrochloric Acid, aqueous

Code Numbers: CAS No. 007647010

Structural Formula: HCl

## PHYSICAL PROPERTIES

liquid [x] gas [ ] solid [ ] polymorphic [ ]

Melting Point: -74°C
Boiling Point: 110°C
Specific Gravity: 1.16
Solubility in Water: ∞
Soluble in MeOH
Appearance: Like Water, colorless to slightly yellow
Odor: Pungent
Flash Point: None
Autoignition Temperature: None
Threshold Limit Value: 5 ppm (ACGIH year 1978)

## HAZARD CLASSIFICATION

Corrosive Liquid; Irritating Material
Nonflammable liquid, but reacts with most metals with evolution of hydrogen which when mixed with air may result in fire or explosion if ignited.



AB0000118220/15

Acute Oral $LD_{50}$: 900 mg/kg
Species - Rabbit

Inhalation $LC_{50}$: 3124 ppm/1 hr
Species - Rat

May 2, 1980

HEALTH EFFECTS

Acute Symptoms

Irritation, burning sensation, coughing

FIRST AID

In Case of Contact

Eyes: In case of contact with the eyes, immediately flush eyes with copious amounts of water for at least 15 minutes. Consult physician at once.

Skin: In case of contact with the body, immediately remove contaminated clothing and wash skin with soap and water. Seek medical attention.

NECESSARY PRECAUTIONS

Wear rubber gloves, rubber or plastic apron, face shield and splash-proof goggles. Use spot ventilation. Avoid breathing fumes.



AR000011822016

May 2, 1980

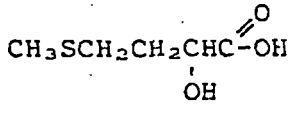
# SAFETY DATA SHEET

MATERIAL NAME: Liquid Hydan©
Molecular Formula: $C_5H_{10}O_3S$
Molecular Weight: 150.24

## I. IDENTIFICATION:

A. Other Names: None at present. Will be given copyrighted name in future.

B. Structural Formula*:



*In concentrated aqueous solutions, this material exists as an equilibrium mixture of linear and cyclic dimers along with smaller amounts of higher polymers.

## II. PHYSICAL PROPERTIES:

| | |
|---|---|
| Liquid | |
| Freezing Point: | Below -22°C |
| Boiling Point: | Above 120°C |
| Specific Gravity: | 1.22 at 25°C (approx. 10 lbs per gal) |
| Solubility: | Completely miscible with water |
| Appearance: | Amber to Dark Brown Liquid |
| Viscosity (CS, Approx.): | 100°F: 35 |
| | 80°F: 70 |
| | 32°F: 500 |
| | 0°F: 3500 |
| pH | Less than 2.0 |

## III. HAZARD CLASSIFICATION:

Combustible, strong acid.

## IV. TOXICITY DATA: GRAS. Status by FDA. Toxic dose level currently unknown.

## V. HEALTH EFFECTS

Specific effects of large doses not known. Probably typical for strong acid. Causes eye burns due to acidity. Material is a feed supplement and is expected to perform like solid Hydan© as a nutrient.



AB0000118220/17

VI. FIRST AID:

In case of contact, immediately flush eyes with water for at least 15 minutes. Call a physician. In case of skin contact, remove any contacted clothing and flush skin area with large quantities of water.

VII. NECESSARY PRECAUTIONS:

Keep away from heat and flame. In case of fire, use water, dry chemical or carbon dioxide. For a spill or leak, flush spill area with large amounts of water.

Avoid breathing vapor or mist. Use with adequate ventilation. Wash thoroughly after handling. Wear rubber gloves and safety glasses when handling.



AB0000118220/18

CYANHYDRIN M

C.A.S. REGISTRY NO. 17773-41-0

| | | |
|---|---|---|
| 1 | SLIGHT HEALTH HAZARD | DATE ISSUED 3/79 |
| 1 | SLIGHTLY COMBUSTIBLE | LATEST REVISION: |
| 1 | SLIGHTLY REACTIVE | |

# MATERIAL SAFETY DATA SHEET

## I PRODUCT IDENTIFICATION

MANUFACTURER'S NAME: E. I. DU PONT DE NEMOURS & CO.
Regular Telephone No.
Emergency Telephone No. 713-727-9268

ADDRESS: P. O. BOX 3269, BEAUMONT, TEXAS 77704

TRADE NAME: CYANHYDRIN M

SYNONYMS: 2-HYDROXY-Y-METHYLTHIOBUTYRONITRILE

## II HAZARDOUS INGREDIENTS

| MATERIAL OR COMPONENT |
|---|
| 2-HYDROXY-Y-METHYLTHIOBUTYRONITRILE |
| HYDROGEN CYANIDE |
| METHYL MERCAPTAN |
| PYRIDINE |
| ACETIC ACID |
| SULFURIC ACID |

## III PHYSICAL DATA

| | | |
|---|---|---|
| Boiling Point, 760 MM HG | 60°C @ 1mm Hg | -62.2°C (-80°F) |
| Specific Gravity ($H_2O$-1) | 1.112 | Vapor Pressure 0.40mm Hg @ 46.1°C |
| Vapor Density (Air-1) | | Solubility in $H_2O$, % by Wt. 11.3 |
| % Volatiles by Vol. | | Evaporation Rate (Butylacetate-1) <1 |
| Appearance and Odor | Colorless to slight yellow color; garlic-like or burnt almond odor. | |
| M. W. 131 | OH | |
| STRUCTURAL FORMULA – (As ) (Applicable ) | $CH_3SCH_2CH_2CHCN$ | |



AB0000118220/19

## IV FIRE AND EXPLOSION DATA

| | | | |
|---|---|---|---|
| FLASH POINT (Test Method) | 135°C (275°F) Tag open cup ASTM D1310 | AUTOIGNITION TEMPERATURE | |
| FLAMMABLE LIMITS IN AIR, % BY VOL.(HCN) | LOWER 5.6 | UPPER 40 | |
| EXTINGUISHING MEDIA | Water. Do not use dry chemical. | | |
| SPECIAL FIRE FIGHTING PROCEDURES | | | |
| UNUSUAL FIRE AND EXPLOSION HAZARD | Cyanhydrin M decomposes with heat liberating HCN. | | |

## V HEALTH HAZARD INFORMATION

HEALTH HAZARD DATA: Class B poison.

ROUTES OF EXPOSURE

| | |
|---|---|
| INHALATION | Lethal due to HCN present. |
| SKIN CONTACT | Skin irritant and mild skin sensitizer. |
| SKIN ABSORPTION | Maybe lethal due to HCN present. |
| EYE CONTACT | Irritant. |
| INGESTION | May cause death due to HCN poisoning. |

EFFECTS OF OVEREXPOSURE

ACUTE OVEREXPOSURE

CHRONIC OVEREXPOSURE

EMERGENCY AND FIRST AID PROCEDURES

| | |
|---|---|
| EYES | Remove to fresh air, wash with soap and water. |
| SKIN | Remove contaminated clothing. Both thoroughly with soap and water. |
| INHALATION | Remove to fresh air. Give antidote for cyanide poisoning. |
| INGESTION | Induce vomiting and treat for cyanide poisoning. |

NOTES TO PHYSICIAN



AB0000118220/20

## VI REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY

Temperatures above 100°C.

INCOMPATIBILITY

HAZARDOUS DECOMPOSITION PRODUCTS

Cyanhydrin decomposes above 100°C (212°F) liberating HCN.

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION:

None.

## VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

Isolate area. Wash away with water.

NEUTRALIZING CHEMICALS

Ferrous sulfate solution made alkaline with caustic soda solution.

WASTE DISPOSAL METHOD

Drain and flush with water.

## VIII SPECIAL PROTECTION INFORMATION

VENTILATION REQUIREMENTS

Provide adequate ventilation. Personnel should avoid breathing vapors or contact with skin.

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY (SPECIFY IN DETAIL)

Wear full face air mask.

EYE

Wear goggles or face mask.

GLOVES

Wear heavy duty surgical or neoprene gloves. Discard after use.

OTHER CLOTHING AND EQUIPMENT

Full faced air mask or self-contained air mask with full acid suit.



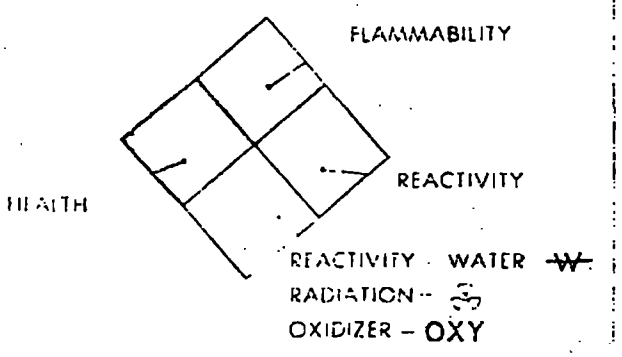
AB0000118220/21

## IX SPECIAL PRECAUTIONS

PRECAUTIONARY STATEMENTS

Cyanhydrin M is a penetrating, highly obnoxiously odorous chemical. It permeates leather and rubber shoe soles and the vapors are absorbed by clothing especially synthetics of acetate nature. Avoid contact, wear coveralls or full acid suit.

NFPA SYMBOL:






AB0000118220/22

May 2, 1980

AMMONIA

C.A.S. REGISTRY NO. 7664417

AMMONIA

| | | |
|---|---|---|
| 3 | HIGH HEALTH HAZARD | DATE ISSUED 3/79 |
| | | LATEST REVISION |
| 2 | MODERATELY COMBUSTIBLE | |

# MATERIAL SAFETY DATA SHEET

## I PRODUCT IDENTIFICATION

| | | | |
|---|---|---|---|
| MANUFACTURER'S NAME | E. I. DU PONT DE NEMOURS & CO. | Regular Telephone No. / Emergency Telephone No. | 800-424-9300 |
| ADDRESS | 1007 MARKET STREET, WILMINGTON, DE 19898 | | |
| TRADE NAME | AMMONIA (ANHYDROUS) | | |
| SYNONYMS | AMMONIA | | |

## II HAZARDOUS INGREDIENTS

| MATERIAL OR COMPONENT | | HAZARD DATA |
|---|---|---|
| AMMONIA | 100% | TLV = 25 ppm |
| | | |
| | | |
| | | |
| | | |
| | | |

## III PHYSICAL DATA

| | | | |
|---|---|---|---|
| Boiling Point, 760 MM HG | (-27.4°F) (-33°C) | Melting Point | (-106.6°F) (-77°C) |
| Specific Gravity ($H_2O$-1) | 1.3 @ 61.7°F (16.5°C) | Vapor Pressure | 10ATM @ 78.3°F (25.7°C) |
| Vapor Density (Air-1) | 0.6 | Solubility in $H_2O$, % by Wt. | 89.9g/100ml (32°F) |
| % Volatiles by Vol. | 100 | Evaporation Rate (Butylacetate-1) | Gas |
| Appearance and Odor | Colorless liquid with pungent odor. Odor threshold: 21.4 ppm | | |
| M. W. 17.03 | | | |
| STRUCTURAL FORMULA – (As) (Applicable) | $NH_3$ | | |



AB0000118220/23

DATE PREPARED 3/79 LAST REVISION

## IV FIRE AND EXPLOSION DATA

| | | | |
|---|---|---|---|
| FLASH POINT (Test Method) | Gas flammable | AUTOIGNITION TEMPERATURE | 1204°F (651°C) |
| FLAMMABLE LIMITS IN AIR, % BY VOL. | LOWER 16 | UPPER | 25 |
| EXTINGUISHING MEDIA | Stop flow of gas. | | |
| SPECIAL FIRE FIGHTING PROCEDURES | Use water to keep surroundings cool, until leak is shut off. | | |
| UNUSUAL FIRE AND EXPLOSION HAZARD | Flammable toxic gas. | | |

## V HEALTH HAZARD INFORMATION

HEALTH HAZARD DATA TWA = 25 ppm Stel = 35 ppm

ROUTES OF EXPOSURE

INHALATION: Causes violent coughing, burning of eyes and throat, swelling of eyelids - pulmonary edema - death.

SKIN CONTACT: Severe burns - irritation.

SKIN ABSORPTION: Not significant.

EYE CONTACT: Severe burns, irritation and superficial corneal lacerations.

INGESTION: Gastric burns - death.

EFFECTS OF OVEREXPOSURE

ACUTE OVEREXPOSURE: Immediate coughing, vomiting and breathing difficulty. Inflammation of respiratory tract. Possible death.

CHRONIC OVEREXPOSURE: Eye, nose and respiratory inflammation.

EMERGENCY AND FIRST AID PROCEDURES Call a physician.

EYE: Flush with water for 15 mins.

SKIN: Flush with water for 15 mins.

INHALATION: Fresh air - oxygen.

INGESTION: Drink large amounts of water to dilute chemical. Do not induce vomiting if in shock, extreme pain or unconscious.

NOTES TO PHYSICIAN

No salve or ointment should be applied to skin during 24-hr. period following injury.



AR000011822024

DATE ISSUED 3/79 LAST REVISION

## VI REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY

None.

INCOMPATIBILITY Reacts exothermically with acids, contact with mercury, chlorine, iodine, bromide, calcium, silver oxide and hypochlorite can form explosive compounds.

HAZARDOUS DECOMPOSITION PRODUCTS

None.

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION

Will not occur.

## VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

Flood with water.

NEUTRALIZING CHEMICALS

Flood with water or use 5% acetic acid if readily available.

WASTE DISPOSAL METHOD

Wash to waste pond. Dilute for discharge.

## VIII SPECIAL PROTECTION INFORMATION

VENTILATION REQUIREMENTS

Keep concentration below 50 ppm.

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY (SPECIFY IN DETAIL)

Airline respirator of self-contained breathing apparatus.

EYE

Goggles and face shield.

GLOVES

Impervious-Neoprene butyl rubber.

OTHER CLOTHING AND EQUIPMENT

Impervious apron, boots, or air supplied acid type suit.



AB0000118220/25

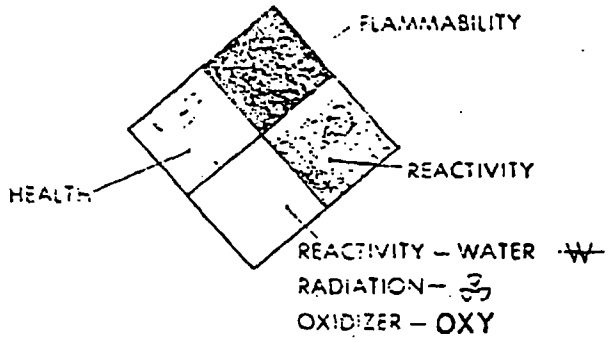
DATE ISSUED: 3/79 LAST REVISION:

## IX SPECIAL PRECAUTIONS

PRECAUTIONARY STATEMENTS

Danger. Hazardous liquid and gas. Do not get in eyes, on skin or clothing.

NFPA SYMBOL:






AB0000118220/26

AQUA AMMONIA

C. A. S. REGISTRY NO. 007486

| | |
|---|---|
| 2 | MODERATE HEALTH HAZARD |
| 2 | MODERATELY HAZARDOUS |
| 2 | MODERATELY COMBUSTIBLE |

DATE ISSUED 3/79

LATEST REVISION:

# MATERIAL SAFETY DATA SHEET

## I PRODUCT IDENTIFICATION

MANUFACTURER'S NAME: E. I. DU PONT DE NEMOURS & CO.
Regular Telephone No. / Emergency Telephone No.: 302-774-7500

ADDRESS: 1007 MARKET STREET, WILMINGTON, DE 19898

TRADE NAME: AQUA AMMONIA

SYNONYMS: AMMONIUM HYDROXIDE

## II HAZARDOUS INGREDIENTS

| MATERIAL OR COMPONENT | % | HAZARD DATA |
|---|---|---|
| AMMONIA | 29 | 350mg/kg LD50-oral-rat |

## III PHYSICAL DATA

| | | | |
|---|---|---|---|
| Boiling Point, 760 MM HG | 183°F (84°C) | Melting Point | (-106.6°F) (-77°C) |
| Specific Gravity ($H_2O$=1) | 0.90 | Vapor Pressure | 570mm Hg @ 70°F (21°C) |
| Vapor Density (Air=1) | 0.6 | Solubility in $H_2O$, % by Wt. | 100% |
| % Volatiles by Vol. | 100% | Evaporation Rate (Butylacetate=1) | ≥1 |
| Appearance and Odor | Clear, colorless liquid with a pungent odor. | | |
| M. W. 35.05 | | | |
| STRUCTURAL FORMULA— (As Applicable) | $NH_4OH$ | | |

DATE ISSUED 3/79 LAST REVISION

## IV FIRE AND EXPLOSION DATA

| | | | |
|---|---|---|---|
| FLASH POINT (Test Method) | Gas-flammable | AUTOIGNITION TEMPERATURE | 1204°F (651°C) |
| FLAMMABLE LIMITS IN AIR, % BY VOL. | LOWER 16 | UPPER | 25 |

EXTINGUISHING MEDIA: Water for area fires.

SPECIAL FIRE FIGHTING PROCEDURES: Cool tank with water if exposed to fire.

UNUSUAL FIRE AND EXPLOSION HAZARD: Releases ammonia gas when heated. Ammonia gas can burn when pre-heated.

## V HEALTH HAZARD INFORMATION

HEALTH HAZARD DATA: TWA = 50 ppm (OSHA): ACGIH TLV = 25 ppm

ROUTES OF EXPOSURE

INHALATION: Irritating vapor.

SKIN CONTACT: Skin burns.

SKIN ABSORPTION: Not significant.

EYE CONTACT: Eye burns.

INGESTION: May cause death or permanent injury after short exposure to small quantities.

EFFECTS OF OVEREXPOSURE

ACUTE OVEREXPOSURE: Alkaline burns Coughing up of blood-tinged sputum. If in eye, possible loss of vision.

CHRONIC OVEREXPOSURE: May involve reversible or irreversible changes; not severe enough to cause death or permanent injury.

EMERGENCY AND FIRST AID PROCEDURES Call a physician.

EYES: Flush with water 15 mins.

SKIN: Flush with water for 15 minutes. Wash clothing before reuse. Remove contaminated clothing and shoes.

INHALATION: Remove to fresh air-oxygen-artificial respiration.

INGESTION: Do not induce vomiting. Dilute chemical by immediately giving milk or water to drink. Call a physician.

NOTES TO PHYSICIAN

Biological effects due to alkali properties.



AB0000118220/28

DATE ISSUED 3/79 LAST REVISION

## VI REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY

Strong mineral acids.

INCOMPATIBILITY

Mercury, dimethyl sulfate, gold, aqua regia, silver nitrate and silver oxide.

HAZARDOUS DECOMPOSITION PRODUCTS

Ammonia.

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION

Will not occur.

## VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

Do not breathe vapor. Wear self-contained breathing apparatus and full protective clothing. Flush area with water spray. Keep upwind of leak. Evacuate until gas has dispersed.

NEUTRALIZING CHEMICALS

WASTE DISPOSAL METHOD

Drain to sewer and then to waste treatment system.

## VIII SPECIAL PROTECTION INFORMATION

VENTILATION REQUIREMENTS

Maintain adequate ventilation.

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY (SPECIFY IN DETAIL)

Self-contained breathing apparatus.

EYE

Chemical safety goggles/face shield.

GLOVES

Long-rubber or plastic.

OTHER CLOTHING AND EQUIPMENT



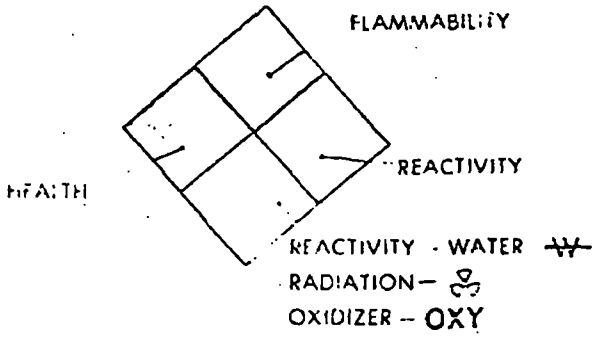
AB0000118220/29

## IX SPECIAL PRECAUTIONS

PRECAUTIONARY STATEMENTS

- Keep away from sun and heat.

NFPA SYMBOL:






AB0000118220/30

## IV. ANALYTICAL REQUIREMENTS AND SAMPLE PLAN

The following analytical equipment will be required along with the usual assorted glassware normally present in a control laboratory:

- Two Liquid Chromatographs with 220 nanometer detectors (dedicated)
- Gas Chromatograph with hot wire detector.
- Oxidation-Reduction titration apparatus.
- pH Meter.

The assay method and impurity profile for the Cyanhydrin M are liquid chromatograph procedures. The impurity profile indicates the amount of sulfur-bearing impurities that will be present in the final product. This method will probably be quantitative by start-up.

The assay method for product is an oxidation-reduction (bromide-bromate) titration. However, it will also be necessary to know the actual content of active ingredient which is determined on the liquid chromatograph after a preliminary acid hydrolysis in standard laboratory equipment.

Water content is determined on a gas chromatograph and pH on a standard pH meter. Chloride ion is determined by a modification of the Volhard method. on some

As usual, start-up will require numerous determinations that will not be required during normal plant operation.

An estimate of the analysis required during start-up are shown in Table I and those which will probably be required during normal operation in Table II.



AB0000118220/31

TABLE I

TENTATIVE STARTUP SAMPLE SCHEDULE

(Assume 2 Months)

| Sample | Analyses | Method | Frequency |
|---|---|---|---|
| *Cyanhydrin M* | Strength<br>Impurities | LC | Each T/C |
| After hydrolysis | Strength | Titration & LC | Batchwise |
| After concentration | Strength | Titration & LC | Batchwise |
| After neutralization | pH | Meter | Batchwise |
| After correction | pH | Meter | |
| Product batch tank (2 samples) | Strength | Titration & LC | Batchwise |
| | $H_2O$ | GC | |
| | $NH_4Cl$ | Titration | |
| Product storage tank (2 samples) | Strength | Titration & LC | Before filling a T/T |
| | $NH_4Cl$ | Titration | |
| | $H_2O$ | GC | |
| | Cross Contam. | to be supplied | |



AB0000118220/32

TABLE II

TENTATIVE ROUTINE SAMPLE PLAN

| | | Method | Frequency |
|---|---|---|---|
| Cyanhydrin M | Strength<br>Impurities | LC | Each tank car |
| After concentration | Strength<br>pH | Titration<br>Meter | Batchwise |
| After neutralization | Strength<br>pH | Titration & LC<br>Meter | Batchwise |
| Product batch tank | Strength | Titration | Daily |
| Product storage tank | Strength<br>$NH_4Cl$<br>$H_2O$ | Titration & LC<br>Titration<br>GC | Before filling a T/T |



AB0000118220/33

May 2, 1980

## V. FINISHED PRODUCT SPECIFICATIONS

The probable specifications that will be placed on the product are shown in the following table:

| | |
|---|---|
| Strength by Titration | 89.5 ± 1.5% |
| Strength by LC | No more than 4% below titration strength |
| $H_2O$ | 10.0 ± 1.0% |
| $Cl^-$ | <1.0% |



AB0000118220/34

May 2, 1980

## VI. INVENTORY RECORDS AND CONTROLS

A physical inventory must be taken monthly. Du Pont will establish the monthly production periods for accounting purposes, and will assist in setting up necessary records.

During the normal business days, there will be daily communication concerning production, shipments, etc.



AB0000118220/35

INTERNAL CORRESPONDENCE

DATE: April 9, 1980

TO: Distribution

FROM: G. F. Mather

CC: P. Bomar
R. Calvert
G. Gammal
R. Guidi
R. Kirk
E. Munoz
B. Shackelford
M-304-12

SUBJECT: DuPont Unit-West Helena Pla

Per telecon of April 9th with Bob De Stefano, Senior Buyer for DuPont

1. An approval telegram was received from DuPont to proceed with one gallon Lannate formulation and packaging. Approximately 200-300M gallons will be processed at a rate of 100M per month at a fee of $0.90/gallon. A formal order GH-623791S will be processed as an appendix to the existing Vertac-DuPont contract.

   DuPont has indicated that for future formulations, Vertac will receive greater pressure to hold down its price ($0.90 per gallon versus $0.75/gallon, 1979).

2. Contract discussions on the extended Vertac-DuPont Lannate agreement are scheduled for April 21st in Wilmington, Delaware.

3. A revised process package for contract manufacture of a new DuPont product in the Lannate Unit is forthcoming. Ray Bergman from DuPont's Beaumont, Texas plant is to contact Vertac and several other candidates in the next several weeks.

:tes

VERTAC CHEMICAL CORPORATION
24th Floor • 5100 Poplar • Memphis, TN 38137 • 901-767-6851 TELEX 53927

copy Rosemary Calvert & file

March 28, 1980

Mr. Robert J. De Stefano
Senior Purchasing Agent
Contracting Section
Chemicals, Contracting & Packaging
Energy and Materials Department
E.I. Du Pont de Nemours & Company, Inc.
Wilmington, Delaware 19898

Dear Bob:

Confirming our discussion of March 27th, Vertac Chemical proposes to formulate 300,000 gallons of Lannate from technical methomyl to be provided by Du Pont in fifty kilo drums, and package this material in one gallon containers. Vertac's fee for the formulating and packaging is to be $0.90 per gallon, FOB West Helena, Arkansas with all raw materials and containers to be provided by Du Pont. Further, Du Pont will reimburse Vertac's direct out of pocket costs for disposing of the empty fifty kilo drums. Vertac is planning to be in operation during the week of April 7th and will produce formulated Lannate at about the rate of 100,000 one gallon containers per month.

It is our understanding that Du Pont has on hand a limited number of fifty five gallon drums of liquid Lannate formulation. Vertac's fee for formulation confirmation and packaging in one gallon containers would be $0.80 per gallon per the same basis as above. As indicated, Vertac will hire and train a number of employees to free up the former Lannate operators and packaging crew for your pressing requirements. Therefore, Du Pont's immediate authorization to proceed would be in our mutual best interests.

We need to be sure what we repackage are for is different.

We are pleased to assist Du Pont on the one gallon formulation. We are also looking forward to reviewing the Lannate contract extension and possible new product venture on April 21st.

Very truly yours,

George F. Mather
Business Manager
Custom Manufacturing and
Intermediate Chemicals

GPM:ts

CC: Mr. M. E. Stevens
Mr. Jess W. Stuart

AB0000065740/1

No typo

Pat

3/31/80

Lannate Liquid
—all principals on vacation regarding this project. Key Houston plant CONTACT, Bill Bringhurst, will be in Wednesday. He is to confirm the following:

1. 300# gals (could go as high as 500# But purchase order may need to be on invoice will be for 300# gal).
2. all TECHNICAL methomyl blending to liquid/about 85% as 1 gal containers & Balance in larger sizes principally (55gal).
3. Making plans right now to have materials to VERTAC.
4. Approval paperwork is in Wilmington from Houston & has general agreement. There are enough principals on vacation that it will be next week before final approval.
5. DuPont would still like VERTAC to start up next week (of course)

Cheryl

cc: Bill Shackelford
M-304-12
Rosemary Calvert

AB0000065740/2

copy to Byron
Dave

INTER-OFFICE CORRESPONDENCE

VERTAC, INC.
SUITE 2414 • 5100 POPLAR
MEMPHIS, TN 38137 • 901-767-6851

DATE: January 11, 1980

TO: Bill Shackelford

FROM: G. F. Mather

REPLY REQUESTED BY (DATE)

SUBJECT: LANNATE CHARGES

Per the terms of the June 1, 1975 Lannate Agreement, Vertac revised its Lannate manufacturing charges effective January 1, 1980 for the period to June 1, 1980. Please note per the attached November 1, 1980 letter from C. P. Bomar to R. S. Seidel of Dupont, that stand-by costs should now be billed at $16,458 starting in January 1980.

GFM

:tes

Attachment

CC: Pat Bomar
Rosemary Calvert
Ray Guidi
Lannate File

VERTAC, INC. SUITE 2414 • 5100 POPLAR • MEMPHIS, TN 38137 • 901-767-6851

November 1, 1979

Mr. R. S. Seidel
Energy and Materials Department
E.I. DuPont de Nemours Company, Inc.
Wilmington, Delaware 19898

Dear Dick:

In accordance with the terms of our June 1, 1975 Lannate Agreement as amended, Vertac will revise its Lannate manufacturing charges effective January 1, 1980 per the attached Exhibit C for the period of January 1, 1980 to June 1, 1980. We are, for the moment, not asking to renegotiate the add-on charge, but as we discussed, we may want to address this in the near future.

Vertac is aggressively reviewing the short term and long term Lannate picture in consideration of our mutual interests discussed at last week's meeting, and I will be contacting you to discuss this further in the near future. Meanwhile, if you have any questions regarding the attached Exhibit C, please let me know.

Very truly yours,

C. P. Bomar, Jr.
Vice President

CPB:ts
Attachment
CC: Mr. J. W. Stuart

Effective January 1, 1980

# EXHIBIT "C"

For the Period: 1/1/80 - 6/1/80

## Manufacturing Cost/Product 10

1,200,000 gallons, year capacity @ 330 day/year operation

| | | USAGE PER GALLON | UNIT COST $ | VARIABLE COST/GALLON $ | FIXED COST PER MONTH $ | (1) STAND- COST/MO |
|---|---|---|---|---|---|---|
| 1. | RAW MATERIAL USAGE | | | | | |
| | Slurry (as 100% MTAAO) | 1.33 | | | | |
| | Methyl Isocyanate | 0.75 | | | | |
| | Methanol | 5.25 | | | | |
| | Methylene Chloride | 0.70 | 0.2575 | 0.18025 | | |
| 2. | UTILITIES | | | | | |
| | Electricity | 1.72 KWH | 0.03405 | 0.05857 | 1,714 | Net Billi |
| | Steam | 13.10 lbs. | 0.00462 | 0.06052 | 886 | |
| | Water | 4.15 gal. | 0.00058 | 0.00241 | 208 | |
| | Nitrogen | 7.55 SCF | 0.00380 | 0.02869 | 450 | 4 |
| | Natural Gas | 876 MSCF (2) | 1.7685 | - | 1,549 | |
| | Sub Total | | | 0.015019 | 4,807 | 4 |
| 3. | OPERATING LABOR | | | | | |
| | Operating | | | | 13,049 | |
| | Packaging | | | 0.0960 | 6,338 | |
| | Sub Total | | | 0.0960 | 19,387 | 3,2 |
| 4. | MAINTENANCE | | | | | |
| | Repair Labor | | | | 5,593 | |
| | Maintenance Mat. | | | | 5,405 | |
| | Maintenance O/H | | | | 2,486 | |
| | Sub Total | | | - | 13,484 | 2,8 |
| 5. | MISCELLANEOUS OPERATING EXPENSE | | | | | |
| | Supervision & Clerical | | | | 3,927 | 2,7 |
| | Operating Materials | | | 0.01725 | 1,207 | - |
| | Laboratory | | | | 6,057 | 2,3 |
| | Shipping & Handling | | | | 1,138 | - |
| | Sub Total | | | 0.01725 | 12,329 | 5,1 |
| 6. | ADMINISTRATIVE O/H | | | | | |
| | Sub Total | | | | 8,082 | 4,7 |
| 7. | WASTE DISPOSAL | | | | | |
| | Sub Total | | | (3) | - | - |
| | TOTAL | | | $ 0.44369 | $ 58,089 | $ 16,4 |

(1) For declared six months (min.) period; charge for shorter periods will be negotiated.
(2) Monthly consumption.
(3) To be billed at costs from mutually acceptable disposal companies, but not to exceed $0.28 per gallon of Product 10, including on-site disposal costs at Vertac, West Helena plant.

## GENERAL

The detailed descriptions of equipment associated with the operations discussed in this standard are provided in the Urea Herbicide area Equipment Description Manual. (See reference (11)).

In general, all equipment and piping associated with phosgenation, dehydrohalogenation, vacuum flash, and off-gas recovery must be fabricated from materials of construction that will not fail catastrophically when occasionally exposed to a hydrous hydrochloric acid environment. The most common materials of construction recommended for such service are Hastelloy C-276®, nickel, glass, TFE (Teflon®), tantalum, and some high nickel alloys (e.g. Inconel® 600). The recommended materials for the HCl recovery system are glass, graphite, Hastelloy B, rubber, Teflon®, and certain other thermoplastics.

Most of these recommended materials have limitations. A metallurgist should be consulted before selecting any material for a particular service.

Besides materials of construction, the only other critical piece of equipment is the phosgenator agitator. This agitator must be equipped with a seal capable of containing the contents of the phosgenator at the operating pressure used. Double mechanical seals, for example, have worked well in this environment.



AB0000117579/1

EM-6481 REV. 9-82

DU PONT

ESTABLISHED 1802

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

MATERIALS AND LOGISTICS DEPARTMENT

Bill Shackelford
cc: Miles
Lodice
Porter
Pace
Satterfield

October 23, 1985

Mr. R. Cheves
Vertac Chemical Corporation
One Greentree Center
Suite 201
Marlton, NJ 08053

Dear Mr. Cheves:

INQUIRY NO.: RJD-13j-1

Please provide a quotation covering tolling services for our Agricultural Products Department. The product covered would be 6MM-7MM lbs./year of 3,4-dichlorophenylisocyanate. The service would begin approximately 3rd or 4th Quarter of 1986. Your quotation should be an estimate (showing range of minimum-maximum) based on the following:

- Du Pont will supply everything.
- Contractor will be responsible for waste disposal; however, Du Pont reserves the right to approve ultimate disposal company and site.
- Need to show cost elements involved in your total and any capital necessary.

This data package is accepted in accordance with our Confidential Information Agreement dated October 21, 1985.

This request for a quotation should not be construed as a commitment to purchase any service.

Your reply by November 25, 1985 would be appreciated. Please refer to our Inquiry No. RJD-13j-1. If you have any questions, please contact me.

Very truly yours,

R. J. DE STEFANO
SENIOR PURCHASING AGENT
CONTRACTING & PACKAGING SECTION

RJD/es
Attachment

cc: T. N. Kirchner-APD-Barley Mill

PRELIMINARY TECHNICAL PACKAGE

# MANUFACTURE OF 3,4 DICHLOROPHENYL ISOCYANATE (DCPI)

E. I. DU PONT DE NEMOURS & CO., INC.
AGRICULTURAL PRODUCTS DEPARTMENT
WILMINGTON, DELAWARE 19898

CONFIDENTIAL SPECIAL CONTROL

Prepared by:

D W Parman
Wilmington
October 1, 1985

AB0000117579/3

## INDEX

I. INTRODUCTION

II. PROCESS DESCRIPTIONS FOR DCPI MANUFACTURE

A. CURRENT PROCESS USING MBC ..... SECTION I
*MONOCHLOROBENZENE SOLVENT*

B. SOLVENT-FREE TECHNOLOGY FOR ..... SECTION II
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SOLVENT, AN ALTERNATE TO SOLVENT
FREE TECHNOLOGY, FOR HIGH PURITY
PRODUCT

III. APPENDICES ..... SECTION IV

A. MATERIAL SAFETY DATA SHEETS

B. RAW MATERIAL SPECIFICATIONS

## NOTE

The required product must be high purity as specified on page 7 of Section II. Section I, the monochlorobenzene technology, which does not produce high purity product, is for your information. Section II & III are alternative processes for high purity product. These processes or any other that can produce specification product will be considered.

## INTRODUCTION

The purpose of this manual for Dichlorophenyl Isocyanate (DCPI) is to document the product formula and process.

For general guidelines concerning Safety and Environment, Quality, Production or Accounting Procedures, refer to your "Guidelines and Instructions for Contractors" manual. If you do not have a copy of this manual, contact your Du Pont Contact Administer.

THE FOLLOWING INFORMATION IS BASED ON TECHNICAL DATA THAT DU PONT BELEIVES ARE RELIABLE. IT IS INTENDED FOR USE BY PERSONS HAVING TECHNICAL SKILL AND AT THEIR OWN DISCRETION AND RISK. SINCE CONDITIONS OF USE ARE OUTSIDE OUR CONTROL, WE MAKE NO WARRANTIES, EXPRESS OR IMPLIED, AND ASSUME NO LIABILITY IN CONNECTION WITH ANY USE OF THIS INFORMATION. THE INFORMATION AND DATA IN THIS MANUAL MAY NOT BE SUFFICIENT FOR EQUIPMENT DESIGN OR SIZING.

The information in this manual is to be considered COFIDENTIAL. The Contractor shall not furnish it to any third party without prior written permission of Du Pont.

# PROCESS DESCRIPTION FOR MANUFACTURE OF

# DCPI VIA LA PORTE PROCESS

## A. PROCESS CHEMISTRY

### 1.0 MAIN PROCESS REACTIONS

3,4 Dichlorophenylisocyanate (DCPI) is manufactured via two main process steps: an exothermic phosgenation reaction step and an endothermic dehydrohalogenation step.

#### 1.10 Phosgenation

In the phosgenation step 3,4 dichloroaniline (DCA) reacts with phosgene (carbonyl chloride) in a monochlorobenzene (MCB) solvent medium and in the presence of trimethylamine (TMA) catalyst to form 3,4 dichlorophenyl carbamoyl chloride (DCPCC). Hydrogen chloride (HCl) is generated as a by-product. The reaction is as shown below:

(1) $DCA + COCl_2 \xrightarrow{TMA} DCPCC + HCl$

The reaction conditions required to achieve high yields and quality are discussed in Section B of this chapter and in Chapter III.

#### 1.20 Dehydrohalogenation

In the dehydrohalogenation step, 3,4 DCPCC formed in the phosgenation step endothermically decomposes to 3,4 DCPI and hydrogen chloride as shown below:

(2) $DCPCC \xrightarrow{Heat} DCPI$



AB0000117579/7

1.0 Main Process Reactions (Cont'd)

1.30 Caustic System

In the caustic system, various chemicals must be neutralized before certain vapor streams can be discharged to the atmosphere. Phosgene is neutralized in the caustic system according to the equation below:

(3) $COCl_2 + 4\ NaOH \longrightarrow 2\ NaCl + Na_2CO_3 + 2\ H_2O$

Hydrogen chloride is neutralized according to this equation:

(4) $HCl + NaOH \longrightarrow NaCl + H_2O$

Chlorine is neutralized according to this equation:

(5) $Cl_2 + 2\ NaOH \longrightarrow NaOCL + NaCl + H_2O$



AB0000117579/8

## 2.0 SIDE PROCESS REACTIONS

### 2.10 Phosgenation

Under the conditions of the phosgenation step, DCPCC can begin to decompose (dehydrohalogenate) to DCPI and HCl as shown in Equation (2). Other possible side reactions which can or will occur in the phosgenation step are:

(6) DCA + HCl $\longrightarrow$ DCA·HCl

(7) TMA + HCl $\longrightarrow$ TMA·HCl

(8) $COCl_2 + H_2O \longrightarrow CO_2 +$ 2 HCl

The hydrolysis of phosgene as shown in Equation (8) is a relatively slow reaction and only occurs when an excessive amount of water is present in the system.

The formation of bis urea in the phosgenation system is an undesirable side reaction which can result from the following reactions:

(9) 3,4 DCA + 3,4 DCPI $\longrightarrow$ BIS UREA

(10) 3,4 DCA + 3,4 DCPCC $\longrightarrow$ BIS UREA + HCl

(11) 2 3,4 DCPI + $H_2O \longrightarrow$ BIS Urea + $CO_2$

If the phosgenation system becomes contaminated with methanol from the brine system, in addition to the formation of bis urea via Equation (11) above, methyl ester will also form according to the following reaction:

(12) 3,4 DCPI + $CH_3OH \longrightarrow$ METHYL ESTER

Certain impurities can enter the phosgenation system with feed materials. The most significant side reaction that occurs in this way is the formation of 2,3 DCPI from 2,3 DCA impurity in the DCA feed.

(13) 2,3 DCA + $COCl_2 \xrightarrow{TMA}$ 2,3 DCPCC + HCl

(14) 2,3 DCPCC $\xrightarrow{Heat}$ 2,3 DCPI + HCl

Any 2,3 DCPI formed can undergo the same side reactions as can 3,4 DCPI. (See Equations 9, 10, 11, and 12).



AB0000117579/9

## 2.0 Side Process Reactions

### 2.10 Phosgenation (Cont'd)

Another side reaction that can occur in the phosgenation system but to a lesser degree than the formation of bis urea is the formation of 1,3,5 (3,4 dichlorophenyl)-biuret according to the reaction equation below:

(15) 3,4 DCPI + BIS UREA $\longrightarrow$ BIURET

Bis urea can undergo a dehydration reaction to form 1,3 (3,4 dichlorophenyl)-carbodiimide according to the reaction equation below:

(16) BIS UREA $\xrightarrow[\text{Heat}]{COCl2}$ CARBODIIMIDE + $H_2O$

Very little carbodiimide has been identified in the process or product streams from the Urea Herbicides area.

TMA can react with phosgene to form dimethylcarbamoyl chloride.

(17) TMA + $COCl_2$ $\longrightarrow$ DMCC + $CH_3Cl$

The solids sometimes found in DCPI manufacture have been postulated (Ref. 9) to include various carbimmonium salts formed by the further reaction of DMCC with phosgene. For example:

(18) DMCC + $COCl_2$ $\longrightarrow$ Carbimmonium Salt

### 2.20 Dehydrohalogenation

The most significant side reactions that should be considered during normal operation for the dehydrohalogenation step are the formation of DCPCC from DCPI and HCl according to the reversible reaction, Equation (2) and the formation of 2,3 DCPI according to Equation (14).

During abnormal conditions when the proper impurities are present, Equations (8), (9), (10), (11), (12), (15), and (16) can take place.

DCPI can also polymerize under certain conditions (high temperature and concentration) to form dimers and trimers of DCPI.



AB0000117579/10

## 2.0 Side Process Reactions

### 2.20 Dehydrohalogenation (Cont'd)

If linuron, diuron, or methyl ester are present in the phosgenation system, they will react with DCPI to form allophanates or similar compounds (see the Linuron and Diuron Technical Standards for more details).

### 2.30 Caustic System

In the caustic system during abnormal conditions (as discussed in Section B of this chapter) certain side reactions can occur. Phosgene can undergo hydrolysis according to Equation (8). Chlorine can also undergo hydrolysis according to the reaction equation below:

(17) $Cl_2 + H_2O \longrightarrow HOCl + HCl$

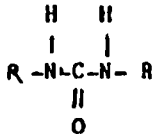
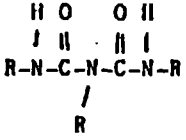
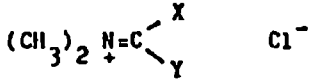
Sodium hypochlorite which is formed from the neutralization of chlorine according to Equation (5) can decompose to sodium chlorate according to the equation below:

(18) $3\ NaOCl \longrightarrow NaClO_3 + 2\ NaCl$



AB0000117579/11

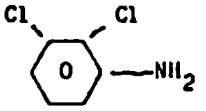
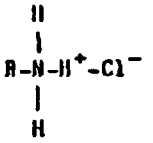
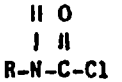
## 3.0 INDEX OF CHEMICALS (R = Cl-C6H4-)

| NAME | STRUCTURE | MOLECULAR WEIGHT |
|---|---|---|
| 1,3 (3,4 Dichlorophenyl)-Bis Urea |  | 350.04 |
| 1,3,5(3,4 Dichlorophenyl)-Biuret |  | 538.06 |
| Carbimmonium Salts |  | - |
| Carbodiimide | | 332.02 |

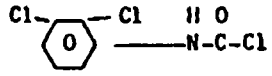
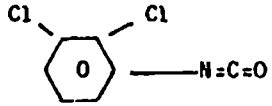
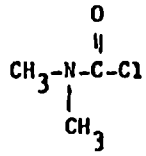


AB0000117579/12

3.0 Index of Chemicals (Cont'd)

| NAME | STRUCTURE | MOLECULAR WEIGHT |
|---|---|---|
| Chlorine | $Cl_2$ | 70.92 |
| Carbon Dioxide | $CO_2$ | 44.02 |
| 3,4 Dichloroaniline | $R\text{-}NH_2$ | 162.02 |
| 2,3 Dichloroaniline |  | 162.02 |
| 3,4 DCA Hydrochloride |  | 198.49 |
| 3,4 Dichlorophenyl Carbamoyl Chloride |  | 224.48 |

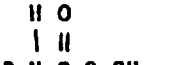
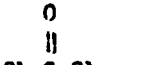
3.0 Index of Chemicals (Cont'd)

| NAME | STRUCTURE | MOLECULAR WEIGHT |
|---|---|---|
| 2,3 Dichlorophenyl Carbamoyl Chloride |  | 224.48 |
| 3,4 Dichlorophenyl Isocyanate | R-N=C=O | 188.02 |
| 2,3 Dichlorophenyl Isocyanate |  | 188.02 |
| Dimethyl Carbamoyl Chloride |  | 107.52 |
| Hydrogen Chloride | HCl | 36.47 |
| Hypochlorous Acid | HOCl | 52.46 |



AB0000117579/14

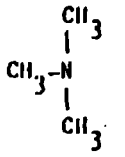
3.0 Index of Chemicals (Cont'd)

| NAME | STRUCTURE | MOLECULAR WEIGHT |
|---|---|---|
| Methanol | $CH_3OH$ | 32.04 |
| Methyl Chloride | $CH_3Cl$ | 50.49 |
| 2-(3,4 Dichlorophenyl)-1 methylester |  | 220.06 |
| Phosgene |  | 98.93 |
| Sodium Carbonate | $Na_2CO_3$ | 106.10 |
| Sodium Chlorate | $NaClO_3$ | 106.44 |
| Sodium Chloride | NaCl | 58.45 |
| Sodium Hydroxide | NaOH | 40.00 |
| Sodium Hypochlorite | NaOCl | 74.44 |



AB0000117579/15

3.0 Index of Chemicals (Cont'd)

| NAME | STRUCTURE | MOLECULAR WEIGHT |
|---|---|---|
| Water | $H_2O$ | 18.02 |
| Trimethyl Amine |  | 59.08 |

## B. CONDENSED PROCESS DESCRIPTION

### 1.0 PHOSGENATION

The purpose of the phosgenation step is to react DCA and phosgene under controlled conditions to form DCPCC. Molten DCA from the DCA weigh tank (W/T) is mixed with fresh MCB and TMA catalyst before it is fed into the phosgenator vessel. Liquified phosgene from the phosgene W/T is fed through a dip pipe into the phosgenator.

Temperature, pressure, phosgene excess, proper mixing, DCA feed concentration TMA concentration, and DCPCC concentration (including any DCPI), are all critical control parameters to insure desired operability, yields, and quality. During the formation of DCPCC, one mole of hydrogen chloride is formed for each mole of DCPCC formed. Under the conditions of the phosgenator, some of the DCPCC decomposes to form DCPI and generate another mole of HCl for each mole of DCPCC that decomposes.

The vapors leaving the phosgenator contain mostly phosgene, HCl, and MCB but also some TMA (or TMA·HCl) and DCPI. These vapors vent to the off gas recovery system. All vapors that are condensed in the off-gas system reflux to the phosgenator. The liquid leaving the phosgenator (hereafter called phosgenate) contains mostly MCB, DCPCC, phosgene, TMA·HCl, and some DCPI. This liquid stream is fed to the dehydrohalogenation step.



AB0000117579/17

## 2.0 DEHYDROHALOGENATION

The purpose of the dehydrohalogenation step is to convert the DCPCC formed in the phosgenation step into DCPI. This conversion takes place in two stages. The phosgenate leaving the phosgenation step is preheated before being fed to the first stage reboiler. More heat is then added to this reboiler to continue the conversion of DCPCC to DCPI. The vapors leaving the first reboiler contain mostly HCl, MCB, phosgene, and some DCPI. The phosgenate liquid leaving the first reboiler is preheated before entering the second stage reboiler. Similarly, more heat is added to this reboiler to essentially complete the conversion of DCPCC to DCPI. The vapors leaving the second reboiler contain about the same materials as those leaving the first reboiler. The vapors from both reboilers combine before venting to the off-gas system. The "stripped" phosgenate liquid leaving the second reboiler consists of mostly MCB, DCPI, TMA·HCl and trace amounts of DCPCC, phosgene and HCl. The stripped phosgenate liquid leaving the second reboiler is fed to the vacuum flash system.



AB0000117579/18

## 3.0 OFF-GAS SYSTEM

The vapors leaving the phosgenator and both reboilers, consisting of mostly MCB, phosgene, HCl, and some DCPI and TMA·HCl, vent to a water-cooled condenser. The vapors that are condensed here (mostly MCB, phosgene, and some DCPI) reflux to the phosgenator through a dip pipe. The uncondensed vapors then vent to a brinecooled condenser. The condensate leaving the brine condenser also refluxes to the phosgenator. The uncondensed vapors leaving the brine condenser flow through the phosgene scrubber, a packed column where they are scrubbed with cold MCB. Any MCB and phosgene that are condensed here reflux to the phosgenator. The uncondensed vapors, now consisting of mostly HCl and phosgene, pass through the MCB absorber, another packed column. Cold phosgene liquid from the -40°F and -100°F condensers is used to absorb the last traces of MCB from the off gas. The vapors leaving the second packed column feed to a Freon®-cooled horizontal condenser. The Freon® on the shell side of this first condenser is supplied at about -40°F. Vapors leaving the first condenser then vent to a second Freon®cooled horizontal condenser which is supplied Freon® at about -100°F. The liquid leaving the two Freon® condensers passes through the packed absorber column and refluxes to the phosgenator through a dip pipe. The vapors leaving the -100°F condenser consist mostly of HCl and vent to the HCl recovery system.



AB0000117579/19

## 4.0 VACUUM FLASH

The purpose of the vacuum flash system is to remove some of the MCB from the stripped phosgenate before it is fed to the amination system. The stripped phosgenate leaving the second reboiler is fed into a flash column operated under vacuum. MCB, phosgene and some traces of DCPI and HCl vapors are partially condensed and collected in a small hold tank. The distillate from the hold tank then is recycled to the phosgenator. The uncondensed vapors vent to the steam jet vacuum system. The steam condensate containing traces of MCB and HCl drain to a seal pot before being discharged to the liquid waste facilities.



AB0000117579/20

## 5.0 HCl RECOVERY

Cold HCl vapors containing traces of phosgene leave the -100°F condenser and vent to a falling film, water-cooled absorber/-cooler. The HCl vapors absorb into a weak acid solution which drains from a packed scrubber. Some of the phosgene fed to the HCl recovery facilities is hydrolyzed to HCl and then also absorbed to form hydrochloric acid. The hydrochloric acid leaving the absorber cooler drains into a tank. From this tank it is recirculated and then transferred either to a storage tank (if it can be sold to an outside customer or used elsewhere on the plant) or to a limestone neutralization pit (from which it is discharged to the waste water treatment facilities).

Vapors from the recirculation tank and the bottom of the absorber cooler vent to the packed scrubber. Fresh water scrubs these vapors before the weak acid drains to the absorber cooler. Vapors from the packed scrubber, consisting mostly of inert gases with traces of HCl and phosgene, vent to the caustic system.



AB0000117579/21

## 6.0 CAUSTIC SYSTEM

The purpose of the caustic system is to neutralize any phosgene, chlorine (unloaded from tank cars at Urea Herbicides only for use in other areas), and HCl that may be present in various vapor streams before they are discharged to the atmosphere. An aqueous caustic solution in the caustic recirculation tank (CRT) is pumped through a cooler to either a packed caustic scrubber or a liquid eductor jet. The liquid from the jet drains back into the CRT. The liquid that passes through the packed scrubber drains back to the CRT also. The mostly inert vapors leaving the caustic scrubber discharge to the atmosphere.

During normal operation, vapors from the packed scrubber in the HCl system, the vacuum flash jet system, the vacuum flash distillate hold tank, the stripped phosgenate hold tanks (SPHT's) and the phosgene weigh tank vent continuously or semi-continuously to the caustic jet. Also during normal operation, vapors from the caustic recirculation tank and the $Cl_2$ storage tank (S/T) vent similarly to the caustic scrubber.

As periodic needs arise, vapors from the $Cl_2$ tank car (T/C) spot, phosgene truck spot, $Cl_2$ S/T, phosgenator vessel, and the phosgene feed line can be vented to the caustic jet. These periodic needs arise during $Cl_2$ T/C or phosgene cylinder unloading operations, maintenance operations associated with $Cl_2$ unloading facilities, phosgene unloading facilities or the phosgenation facilities, and during certain emergency situations.

Another important feature of the caustic system is the emergency caustic system. This system provides the protection needed to prevent toxic vapors from being discharged to the atmosphere during power failures, relief device failures, or when the caustic scrubbing solution becomes inadequate during normal operation. When activated (either automatically or manually), the emergency caustic system is designed to deliver a weak caustic solution (8-10% wt.) to the caustic scrubber for a limited period of time and also provides a limited supply of water to the caustic jet to assist with evacuating certain equipment.

The caustic solution that recirculates through the caustic scrubber and caustic jet during normal operation is prepared batchwise by diluting 50% (weight) sodium hydroxide with water to 10%. When the caustic strength drops to about 3% (weight) the batch is considered "spent". The spent caustic solution during normal operation and also during emergencies is discharged to the liquid waste facilities.



AB0000117579/22

## 2.0 PHOSGENATION

DCA, phosgene (fresh and recycle), MCB (monochlorobenzene) solvent, and TMA (catalyst) are fed to the phosgenator to form DCPCC and some DCPI. (See Chapter I, Section B for details). The key operating variables are temperature, the amount of phosgene in the liquid phase, DCA feed concentration, TMA concentration, DCPCC concentration (including any DCPI) and mixing.

Temperature is controlled by condensing phosgene to remove heat from the system. Temperature must be high enough to prevent DCPCC and DCA hydrochloride from precipitating or plating out on the walls of the equipment. It must not be so high, however, that the desired phosgene excess (inversely proportional to temperature) cannot be maintained.

Phosgene excess is necessary to ensure that DCA reacts to form DCPCC instead of bis urea (see Sections I.A.1.0 and 2.0). Phosgene excess must be in the liquid phase to be beneficial and is directly proportional to phosgenator pressure. In addition to temperature and pressure dependence, phosgene excess is also directly proportional to heat input to the phosgenator. This is because increasing boilup strips HCl from the liquid. This reduces HCl in the vapor also, since it is not condensed in the off-gas system and therefore leaves the phosgenation system. The reduction in HCl partial pressure is accompanied by a corresponding increase in phosgene partial pressure (at constant temperature and total pressure) and therefore by increased phosgene liquid concentration. Heat can be added to the phosgenator via the vessel jacket, heat traced and jacketed piping in the recirculation loop, heat from the exothermic reaction (DCA and $COCl_2$), and as sensible heat from the feeds and recycle streams.

DCA feed concentration in the solvent feed should be maximized to reduce the load on the solvent removal facilities (including the vacuum flash system and the amination system concentrators and stills). However, if the DCA feed concentration gets too high, DCPI quality and thus DCA yield are reduced. These reductions result mostly from the formation of bis urea. (See Chapter I, Section A for details on side reactions).



AB0000117579/23

2.0 Phosgenation (Cont'd)

The presence of TMA in the phosgenator improves the conversion of DCA to DCPI. The catalytic mechanism of TMA is unknown. Its concentration is controlled by ratio feed control with DCA. If TMA concentration gets too high, TMA hydrochloride (TMA·HCl) begins to precipitate from the phosgenate solution and also to carry up to the off-gas system causing pluggage problems.

The concentration of DCPCC plus any DCPI in the phosgenate should be maximized to reduce the load on the solvent removal facilities. If this concentration gets too high, though, more bis urea and other by-products form to reduce DCPI quality. The DCPCC/DCPI concentration is most critical in the phosgenator, since DCA is fed only to the phosgenator and very little DCA leaves the reactor.

To take advantage of efforts to control temperature, phosgene concentration, DCA feed concentration, TMA concentration, and DCPCC/DCPI concentration, the phosgenator contents must be well mixed. By-product side reactions occur in any regions that are poorly mixed, especially in the DCA feed region. Mixing in the phosgenator is enhanced by mechanical agitation, pump recirculation, static mixing, thermal agitation, and feed (or recycle) flow velocities and positioning. Mechanical agitation and pump recirculation are the primary means for assuring that the bulk of the phosgenator contents is well mixed. The velocity of the DCA feed and its point of entry into the phosgenator are critical toward enhancing the probability that DCA will react only with phosgene in the bulk liquid.



AB0000117579/24

## 3.0 DEHYDROHALOGENATION

The conversion of DCPCC to DCPI is an endothermic reaction. The rate of this conversion and its degree of completion are a function of heat input and the removal of HCl from the phosgenate in the reboilers. HCl removal is critical because the conversion of DCPCC to DCPI is a reversible reaction.

Heat input to the two-stage dehydrohalogenation is provided by steam jacketed preheaters, steam jacketed vessels, and bayonets inside the vessels. Heat input to the preheaters must be controlled to prevent "vapor locks" as the phosgenate passes through them. The temperature during dehydrohalogenation must also be kept low enough to prevent thermal decomposition of DCPI to unwanted by-products.



AB0000117579/25

## 4.0 OFF-GAS RECOVERY

The objective of this system is to recover as much DCPI, MCB, and phosgene as possible from the vapors leaving the phosgenator and reboilers. The load on the off-gas system is mostly a function of phosgenation temperature, pressure and heat input. When the off-gas system becomes overloaded, it tends to become restricted more frequently, thus reducing process utility. Off-gas restrictions develop when excessive amounts of DCPI and/or TMA·HCl are present in the vapors leaving the water-cooled condenser. They also develop when excessive amounts of MCB are present in the vapors leaving the -40°F condenser. (MCB freezes at about -45°C.)

Reflux streams from the off-gas system all return to the phosgenator through dip pipes to enhance mixing and dispersion into the phosgenate. Temperature and pressure drops through the off-gas system are controlled to maximize production capacity and operating utility.



AB0000117579/26

## 5.0 VACUUM FLASH

Key operating variables for this system are DCPI concentration leaving the system, temperature, pressure, and the concentration of DCPI in the recycle solvent. Temperature and pressure are used to control the amount of solvent removed from the DCPI feed solution. Any solvent that is removed in this system reduces the load on the solvent removal facilities in the amination system and on the solvent purification facilities (dehydration and refining). If too much solvent is removed (DCPI solution too concentrated) less fresh solvent is available to dilute the DCA feed to the phosgenator. (The solvent used to dilute the DCA feed must contain less than about 100 ppm phosgene and 1000 ppm DCPI to prevent significant DCA yield loss.) During linuron operation, if the DCPI feed to amination becomes too concentrated, more bis urea is formed by the reaction between DCPI and water. During diuron operation, stronger DCPI results in stronger diuron aminate which must be kept above its melting point to prevent pluggage problems.

The temperature of the vacuum flash system must be kept low enough to prevent thermal decomposition of the DCPI. If the concentration of DCPI in the recycle solvent gets too high, its transfer line can become restricted.



AB0000117579/27

## 6.0 HCl RECOVERY

A significant amount of heat is generated from the absorption of HCl gas into water to form hydrochloric acid. Enough water must be added to absorb all the HCl gas leaving the off gas system and enough cooling must be provided to dissipate the generated heat. Any HCl or phosgene that leaves this system increases the load on the caustic system.

The HCl recovery system must also produce good quality HCl. Iron contamination indicates a corrosion problem and also discolors the HCl by-product making it undesirable for off-plant sale. MCB contamination must be minimized to prevent attack on the lining in the storage tank. MCB is removed from the HCl by passing if through carbon adsorbers before it is transferred to the storage tank.



AB0000117579/28

## 7.0 CAUSTIC SYSTEM

The load to the caustic system is variable during normal operation. The strength of the recirculating caustic solution, its temperature, and the amount of vacuum at the caustic jet must be monitored to prevent the release of toxic gases to the atmosphere.

A dip pipe is provided on the discharge of the caustic jet to improve the mixing between the toxic gases and the caustic solution and minimize the corrosivity of the vapors in the caustic recirculation tank. Therefore the liquid level in the caustic recirculation tank needs to be high enough to submerge the dip pipe slightly. If the dip pipe is too deeply submerged, the capacity of the caustic jet is reduced.

Periodically, the emergency caustic facilities are tested to verify that they function properly.



AB0000117579/29

## 1.0 CRUDE UNLOADING

| ITEM | LIMITS UPPER | LIMITS LOWER | BASIS FOR CONTROL LIMITS |
|---|---|---|---|
| **1.10 Phosgene Unloading** | | | |
| a. Nitrogen Supply Pressure | 175 psig | 130 psig | UPPER: Nitrogen header relief valve setting.<br>LOWER: This is the minimum pressure required to overcome the cylinder pressure, transfer line static head, and normal weigh tank pressure. |
| b. Phosgene Weigh Tank Pressure | 250 psig | 40 psig | UPPER: Weigh tank design pressure.<br>LOWER: This is equivalent to the vapor pressure of phosgene inside the weigh tank. |
| **1.20 DCA Unloading** | | | |
| a. Nitrogen Supply Pressure | 75 psig | 15 psig | UPPER: The DCA T/C design pressure is about 100 psig.<br>LOWER: This is the minimum pressure required to overcome the transfer line static head. |
| b. DCA Weigh Tank Temperature | 110°C | 80°C | UPPER: DCA starts to decompose if held above 110°C for more than about one day.<br>LOWER: The melting point of DCA is about 72°C. |
| **1.30 TMA Unloading** | | | |
| a. TMA Cylinder Pressure | 250 psig | 35 psig | UPPER: TMA feed line relief valve setting.<br>LOWER: TMA cylinder pressure must be high enough to overcome the feed line and phosgenator pressure. |

## 2.0 PHOSGENATION

| ITEM | LIMITS UPPER | LIMITS LOWER | BASIS FOR CONTROL LIMITS |
|---|---|---|---|
| a. Phosgenator Temperature | 100°C | 72°C | UPPER: Assuming an equipment design pressure limitation of 50 psig, yields begin to suffer due to insufficient dissolved phosgene in the liquid phase.<br>LOWER: DCPCC, and DCA hydrochloride start to precipitate due to lower solubilities.<br>CHANGES: The phosgenator temperature was increased to 80°C during 1980 to increase capacity. It was then reduced to 76°C to improve DCA yield. |
| b. Phosgenator Pressure | 40 psig | 1 psig | UPPER: Most of the equipment in the phosgenation system is designed for 50 psig maximum.<br>LOWER: A slight positive pressure is required to keep air out of the system since it contains both oxygen and moisture.<br>CHANGES: During 1974 the phosgenation pressure was increased from 5 psig to 10 psig. During 1975 it was increased to 15 psig. During 1979 it was increased to 20 psig. All increases were made to increase operating capacity and utility. (Reduces load on York system.) |



AB0000117579/31

2.0 Phosgenation (Cont'd)

| ITEM | LIMITS UPPER | LIMITS LOWER | BASIS FOR CONTROL LIMITS |
|---|---|---|---|
| c. DCA Feed Concentration | 32% (wt.) | 5% (wt). | UPPER: Unwanted side reactions start to seriously reduce yields.<br>LOWER: Generates an excessive load on solvent removal facilities. |
| d. Phosgene Excess | 100% (molar) | 12% (molar) | UPPER: Significant capacity reductions result due to excessive load on off gas recovery system.<br>LOWER: Unwanted side reactions begin to seriously reduce yields. |
| e. TMA Feed Ratio | 0.30 Lbs. / Cwt. DCA | 0.05 Lbs. / Cwt. DCA | UPPER: TMA hydrochloride starts to precipitate from solution and cause pluggage problems in transfer lines and off gas system.<br>LOWER: Unwanted side reactions begin to seriously reduce yields.<br>CHANGES: During 1980 TMA feed was discontinued to evaluate improvements to the DCPI purification proposal. Diuron quality dropped about 1.5% . TMA feed was resumed to improve product quality. |



AB0000117579/32

2.0 Phosgenation (Cont'd)

| | ITEM | LIMITS UPPER | LIMITS LOWER | BASIS FOR CONTROL LIMITS |
|---|---|---|---|---|
| f. | DCA Feed Point | 3" horizontally and vertically from outside tip of agitator impeller. | 1" horizontally and vertically from outside tip of agitator impeller. | UPPER and LOWER: To introduce DCA feed into the region of the phosgenator that is most thoroughly mixed. Introduction into a poorly mixed zone causes significant DCA yield loss. |
| g. | Phosgenator Residence Time | - | - | LOWER: Reaction kinetics studies (see Section VIII.C.) show the reaction is complete in a few seconds. Mixing of the reactants is the critical variable in practice, and any reduction in residence time must be accomplished without adversely affecting mixing. |

## 3.0 DEHYDROHALOGENATION

| ITEM | LIMITS UPPER | LIMITS LOWER | BASIS FOR CONTROL LIMITS |
|---|---|---|---|
| a. Reboilers Temperature | 170°C | 72°F | UPPER: DCPI starts to decompose or polymerize rapidly with increasing temperature and tars content.<br>LOWER: DCPCC starts to precipitate from the phosgenate solution causing pluggage problems. |
| b. Reboilers Pressure | 40 psig | 1 psig | UPPER and LOWER: Same as phosgenator pressure limits. |
| c. "B" Reboiler Strength | 25% (wt.) | 15% | UPPER: The DCPI/DCPCC concentration in the phosgenator increases proportional to "B" Reboiler strength. High concentrations reduce DCPI quality and DCA yield.<br>LOWER: Low DCPI/DCPCC concentrations cause excessive loads on solvent removal facilities. |
| d. Reboilers Residence Time (Combined Volume Basis) | - | 35 minutes | LOWER: Lower residence times may not allow complete decomposition of DCPCC to DCPI. Chloride content of DCPI solution will increase. |



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## 4.0 OFF-GAS RECOVERY

| ITEM | LIMITS UPPER | LIMITS LOWER | BASIS FOR CONTROL LIMITS |
|---|---|---|---|
| See control limits provided in the UH - General Operating Procedures. | | | The individual temperature, flow rates, and pressure drops in the off-gas system are quite variable and inter-related and depend on the whole phosgenation system's throughput rates and conditions. The limits in the Operating Procedures are aimed at maintaining continuity of operation by balancing the loads on the separate pieces of equipment and minimizing plugging, while condensing phosgene effectively. |



AB0000117579/35

## 5.0 VACUUM FLASH

| ITEM | LIMITS UPPER | LIMITS LOWER | BASIS FOR CONTROL LIMITS |
|---|---|---|---|
| a. DCPI Concentration in Column Bottoms | 40% (wt.) | - | UPPER: High DCPI feed concentrations to amination can cause unwanted side reactions to occur there. (See side reactions section of Chapter I. The exact conditions for these side reactions to occur are not known). High concentrations also reduce the fresh solvent feed available to mix with the DCA. |
| b. Column Bottoms Temperature | 170°C | -- | UPPER: DCPI starts to decompose or polymerize. Pure DCPI will start to polymerize at about 95°C. |



AB0000117579/36

## 6.0 HCl RECOVERY

| ITEM | LIMITS UPPER | LIMITS LOWER | BASIS FOR CONTROL LIMITS |
|---|---|---|---|
| See HCl quality specifications provided in Chapter V. | | | |



AB0000117579/37

## 7.0 CAUSTIC SYSTEM

| | ITEM | LIMITS UPPER | LIMITS LOWER | BASIS FOR CONTROL LIMITS |
|---|---|---|---|---|
| a. | Caustic Scrubbing Strength | 50% (wt.) | 3% (wt.) | UPPER: Higher concentrations, even though system is traced, could freeze in cold weather (freezing point of 50% wt. = 8°C).<br>LOWER: Some safety margin must be maintained for the caustic strength so that toxic gases can still be neutralized when a fresh caustic batch is being prepared. |
| b. | Supply Period for Emergency Caustic | - | 15 min. | LOWER: Emergency caustic must be supplied long enough to safely shut down the phosgenation system. |



AB0000117579/38

## 8.0 REFRIGERATION SYSTEM

| ITEM | LIMITS UPPER | LIMITS LOWER | BASIS FOR CONTROL LIMITS |
|---|---|---|---|
| **8.1 Carrier System** | | | |
| a. Brine Concentration | - | 30% (volume MaOH in $H_2O$) | LOWER: To prevent the brine from freezing before the unit is automatically shut down at -24°C. (The freezing point of 30% (vol.) brine is -28°C.) |
| **8.2 York System** | | | |
| See control limits provided in the UH - General Operating Procedures. | | | The limits are set to ensure good mechanical operation of the York refrigeration system. |



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## B. HANDLING AND STORAGE

### 1.0 PHOSGENE

Phosgene is handled in a closed system and pressure unloaded (with nitrogen) from the supply cylinders, to the phosgene weigh tank (storage) and then to the phosgenator. The phosgene weigh tank will hold a maximum of 14,000 pounds.

Because of its toxicity and volatility, air demand masks must be worn while unloading phosgene cylinders or conducting maintenance work. The unloading facilities and the weigh tank must be vented to the caustic system to accommodate periodic maintenance unloading and emergency requirements. Phosgene leaks can be detected using ammonia gas which forms a white cloud (ammonium chloride) upon contact with phosgene.

Avoid water contact with leaking containers of phosgene to prevent the formation of corrosive hydrochloric acid.



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## 2.0 DICHLOROANILINE

DCA is handled in a closed system and pressure unloaded (with nitrogen) from the supply tank car to the storage tank car, directly to the DCA weigh tank, or both simultaneously. (See Urea Herbicides - General Operating Procedures, Reference (2), for details on DCA unloading.)

The DCA tank cars are equipped with internal steam coils to allow melting the DCA. DCA is normally stored as a liquid in a tank car that holds about 17,000 gallons. The DCA Weigh Tank serves as a pump tank to allow continuous phosgenator operation, and it is too small to provide adequate storage during necessary rail car switchings.

Because of its toxicity, personal contact with DCA (solid, liquid, or vapors) must be avoided. DCA spills must be promptly isolated, neutralized (with sodium bisulfate), and disposed of to prevent personnel exposures.



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## 3.0 TRIMETHYLAMINE

TMA is handled in a closed system and pressure unloaded with nitrogen from the supply cylinder through a vaporizer into the phosgenator.

Steam is used to vaporize the liquefied gas before it is fed into the phosgenator.

Because of its toxicity and irritating effects on the respiratory system or skin, personal contact with TMA must be avoided. TMA leaks can be detected using sulfur dioxide gas, which forms a white cloud (trimethylamine sulfone) upon contact with TMA.



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## 4.0 MONOCHLOROBENZENE

MCB is handled in a closed system. Fresh MCB that is received from the supplier is first analyzed to insure that it meets the specification for maximum water content. If it is too "wet" it is either returned to the supplier or pumped to the wet MCB storage tanks so it can be dehydrated, or, if dry, it is pumped to the dry MCB storage tanks. The total dry MCB storage capacity is 37,500 gallons.

Skin contact with MCB should be avoided. It is considered moderately flammable and its exposure to ignition sources must be prevented.



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## 5.0 CAUSTIC (SODIUM HYDROXIDE)

Caustic is pumped by pipeline to the Urea Herbicides area and is stored in a 600-gallon transfer tank for routine use and in two emergency storage tanks which hold up to 1000 gallons.

Caustic batches are made routinely from the Caustic Transfer Tank. Caustic is mixed with water and supplied to the caustic scrubber during emergencies.

Caustic is corrosive to the skin and eyes and personal contact must be avoided.



AB0000117579/44

## 7.0 LIMESTONE

Limestone is stored in piles west of the Urea Herbicides area. As needed, the limestone is transferred to the limestone pit using a backhoe or front-end loader.



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## A. HANDLING AND STORAGE

The product of the phosgenation process is 3,4-dichlorophenyl isocyanate (DCPI).

DCPI solution from the vacuum flash column bottom is transferred to one or both stripped phosgenate hold tanks (SPHT). It is held there until it is pumped to the aminator. Either or both SPHT's can be used to supply DCPI to the aminator. The tanks are maintained above 80°C by steam coils in the tanks. This temperature is needed to provide adequate feed temperature for the aminator. The SPHT's vent to the caustic system, since the DCPI solution contains phosgene. They are also protected from overpressurizations by rupture discs.



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## B. DCPI QUALITY

No absolute standards exist for DCPI quality, but certain ranges have been found by experience to be compatible with good final product (linuron, diuron) quality.

### 1.0 DCPI STRENGTH

Strength should be in the range 28-32% wt. at normal throughput rates. In practice it is frequently lower than 28%, because during problem periods the phosgenation unit is flushed with MCB to prevent plugged lines. The flush material goes to the stripped phosgenate hold tanks and dilutes the DCPI. Low strength reduces amination production capacity by necessitating excessive boiloff of MCB. Because of the limited capacity of the reboilers and vacuum flash column to remove MCB from the DCPI, excessively high strength of the product DCPI is associated with higher than normal concentrations upstream in the phosgenator, which leads to bis urea formation there. At lower than normal throughput rates, it becomes possible to remove and recycle enough MCB so the DCPI concentration can successfully be increased to about 36% out of the vacuum flash column while maintaining adequate dilution in the phosgenator.



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## 2.0 CHLORIDES CONTENT

Chlorides should be less than 0.20% wt. Chlorides can exist as TMA·HCl, DCPCC, free HCl, or phosgene. During diuron operation, they react in the aminator with dimethylamine (DMA) to form DMA·HCl. This lowers DMA yield and increases water pollution (total oxygen demand, TOD) to the sewer, since hydrochlorides are ultimately purged to the process waste ditch. During linuron operation, where the aminator pH is controlled, chlorides fed to it must be neutralized with NaOH. See the Linuron Technical Standard for details on aminator pH control.



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ENGINEERING DEPARTMENT SKETCH SHEET Sheet No.

Proj. No. Plant Title

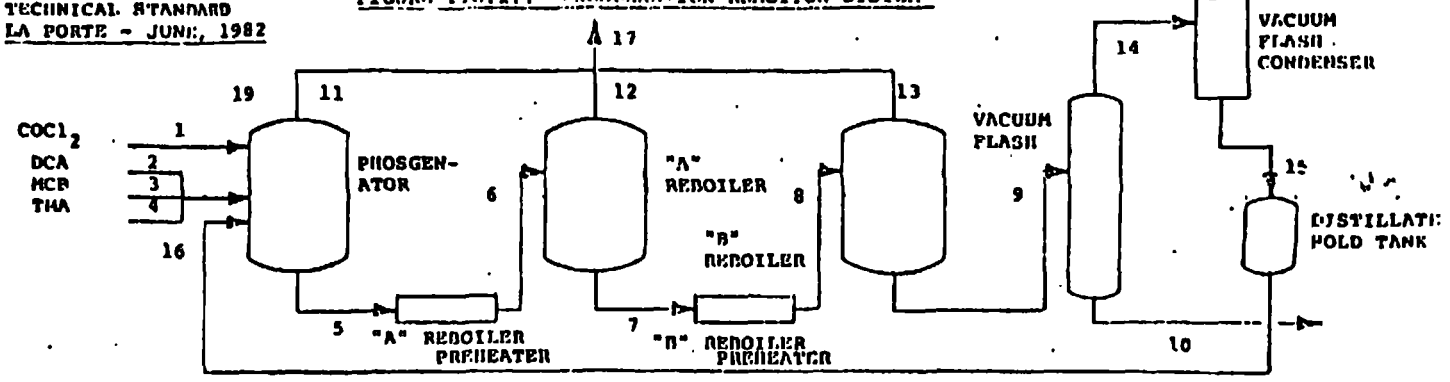
Bldg. or Area Function Subject

Name Date

I. PROCESS DESCRIPTION
E. PROCESS FLOWSHEET

DCPI MANUFACTURE
TECHNICAL STANDARD
LA PORTE - JUNE, 1982

FIGURE I.E.1.1 PHOSGENATION REACTION SYSTEM




| Stream No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stream Name | Phosgene Feed | DCA Feed | MCB Feed | TMA Feed | Phos't'r Btms | A Reb. Feed | A Reb. Btms | B Rrb. Feed | Vac. Flash Feed | Vac. Flash Btms | Phos't'r Vapor | A Reb. Vapor | A Reb. Vapor | Vac. Flash Vapor | Vac. Flash Distillate | Distillate Recycle | Vapor to Off-Gas | Vapor to Act. | Phos't'r Recycle |
| Units (lb/Hr) | | | | | | | | | | | | | | | | | | | |
| DCA | | 1950 | | | | | | | | | | | | | | | | | |
| $COCl_2$ | 1284 | | | | 1344 | 1344 | 377 | 377 | 134 | 8 | 1866 | 966 | 244 | 125 | 60 | 60 | 3019 | 65 | 10[illegible] |
| DCPCC | | | | | 814 | 814 | 73 | 73 | 4 | 4 | | | | | | | 1 | | 1 |
| HCl | | | | | 35 | 35 | 6 | 6 | 1 | | 754 | 150 | 16 | 1 | | | 920 | 1 | 51 |
| DCPI | | | | | 1567 | 1567 | 2181 | 2181 | 2231 | 2211 | 1 | | 9 | 20 | 20 | 20 | 16 | | 16 |
| TMAHCl | | | | | 5 | 5 | 5 | 5 | 5 | 5 | | 7 | | | | | | | |
| $CO_2$ | | | | | | | | | | | 1 | | | | | | 1 | | |
| MCB | | | 4016 | | 8260 | 8260 | 7528 | 7528 | 6908 | 4890 | 223 | 742 | 630 | 2018 | 1995 | 1995 | 1594 | 23 | 2[illegible] |
| $N_2$ | | | | | | | | | | | 21 | 1 | | 1 | | | 25 | 1 | |
| BIS | | | | | 42 | 42 | 42 | 42 | 42 | 41 | | | | | | | | | |
| TMA | | | | 3 | | | | | | | | | | | | | | | |
| TOTAL (lb/Hr) | 1284 | 1950 | 4016 | 3 | 12067 | 12067 | 10212 | 10212 | 9125 | 7159 | 2888 | 1866 | 699 | 2165 | 2075 | 2075 | 5655 | 91 | 5623 |
| Temp. (°C) | 30 | 95 | 76 | 76 | 76 | 125 | 130 | 140 | 155 | 102 | 76 | 130 | 155 | 103 | 40 | 80 | 110 | 40 | 31 |
| Press. (psig) | 30 | 30 | 30 | 30 | 20 | 30 | 20 | 30 | 20 | | 20 | 20 | 20 | | | 30 | 20 | | 19 |
| (mmHg) | | | | | | | | | | 253 | | | | 253 | 100 | | | 100 | |

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ENGINEERING DEPARTMENT [illegible] SKETCH SHEET Sheet No. _____

Proj. No. _____ Plant _____ Title _____

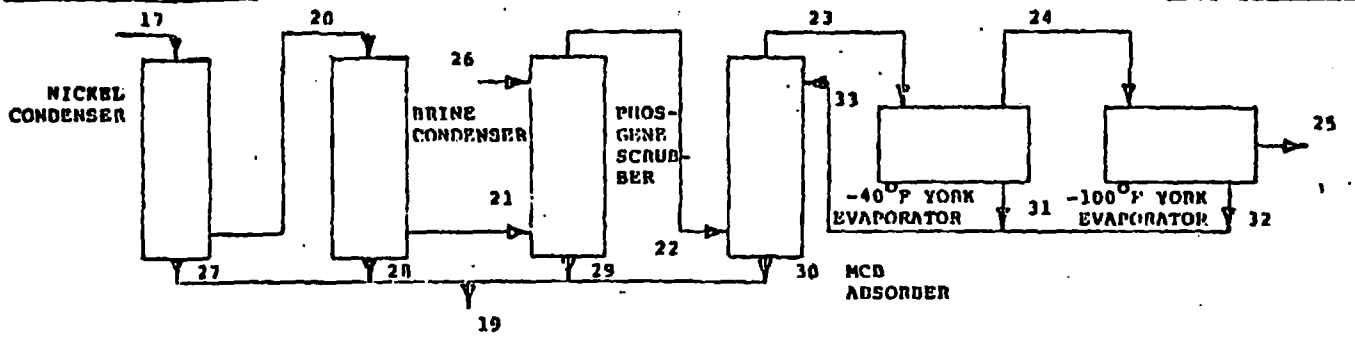
Building Area _____ Function _____ Subject _____

Name _____ Date _____

DCPI MANUFACTURE
TECHNICAL STANDARD
LA PORTE - JUNE, 1982

FIGURE I.E.2.: PHOSGENATION OFF-GAS SYSTEM

I. PROCESS DESCRIPTION
E. PROCESS FLOWSHEET




| Stream No. Stream Name | 20 Nickel Cond. Vap. | 21 Brine Cond. Vap. | 22 Phos. Scr. Vapor | 23 MCB Abs. Vapor | 24 -40 York Vapor | 25 -100 York Vapor | 26 Phos. Scr. MCB | 27 Nickel Cond. Liq. | 28 Brine Cond. Liq. | 29 Phos. Scr. Liquid | 30 MCB Abs. Liquid | 31 -40 York Liquid | 32 -100 York Liquid | 33 Liq. to MCB Abs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units (lb/Hr) | | | | | | | | | | | | | | |
| DCA | | | | | | | | | | | | | | |
| $COCl_2$ | 2268 | 2192 | 1233 | 1603 | 260 | 31 | | 833 | 73 | 459 | 1702 | 1349 | 230 | 1572 |
| DCPCC | | | | | | | | 1 | | | | | | |
| HCl | 904 | 903 | 694 | 1034 | 946 | 869 | | 19 | | 9 | 25 | 97 | 77 | 164 |
| DCPI | | | | | | | | 16 | 1 | | | | | |
| THANCL | | | | | | | | | | | | | | |
| $CO_2$ | 1 | 1 | 1 | 2 | 2 | 1 | | | | | | | | |
| MCB | 45 | 6 | 57 | | | | 900 | 1550 | 37 | 851 | 57 | | | |
| $N_2$ | 25 | 25 | 25 | 25 | 25 | 25 | | | | | | | | |
| BIS | | | | | | | | | | | | | | |
| TIA | | | | | | | | | | | | | | |
| TOTAL | 3240 | 3129 | 2710 | 2664 | 1233 | 926 | 900 | 2415 | 111 | 1319 | 1784 | 1441 | 307 | 1736 |
| Temp. (°C) | 40 | 21 | 44 | 4 | -25 | -53 | 0 | 40 | 21 | 30 | 10 | -25 | -53 | -32 |
| Press. (psig) (mmHg) | 19 | 19 | 19 | 19 | 19 | 19 | 30 | 19 | 19 | 19 | 19 | 19 | 19 | 19 |

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# DCPI MANUFACTURE VIA SOLVENT-FREE TECHNOLOGY

# SOLVENT-FREE DCPI TECHNOLOGY

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## I. SUMMARY AND CONCLUSIONS

This report documents the development of a continuous distillation process as well as a batch distillation process for the manufacture of solvent-free 3,4-dichlorophenyl isocyanate (DCPI) at Houston. DCPI is manufactured at Houston by phosgenation of 3,4-dichloroaniline (DCA) with monochlorobenzene (MCB) as the solvent and trimethylamine (TMA) as the phsogenation catalyst. The "crude DCPI" (DCPI in MCB solvent) is then aminated to form linuron and diuron. Du Pont affiliates in Brazil, Colombia, and Mexico currently purchase crystalline DCPI from Bayer and aminate it to form diuron in a solvent-free "melt" process. The objective of this project was to develop an economical process for the manufacture of solvent-free DCPI from Houston crude for export to Brazil, Colombia, and Mexico.

The continuous distillation has two advantages over the batch distillation:

- Significantly shorter holdup time of DCPI at elevated temperatures, resulting in lower yield loss of DCPI to tars.
- Smaller equipment size, thus lower investment.

Both processes have been demonstrated to be technically feasible and to yield high-quality, solvent-free DCPI.

Although the scope of this study is limited to the manufacture of solvent-free DCPI from Houston crude, other alternatives such as solventless phosgenation in idle Chambers Works facilities have been investigated. High-spot economics show that at present none of these processes are economically attractive versus purchasing Bayer DCPI. This report summarizes the available technology so that should the economics change, the best business decision concerning choice of process can be made.

### RECOMMENDATIONS

- The deutschemark/dollar exchange rate should be monitored and predictions of Bayer DCPI prices should be continually updated to reflect any changes.
- Further investigation of the use of Epoxol oils to remove the problem of TMA-related solids pluggage.
- Further corrosion studies should be undertaken in order to determine whether less costly materials of construction than nickel or Hastelloy-C are appropriate.
- The continuous distillation process should be demonstrated on a semiworks scale.

## II. RAW MATRERIAL, FINISHED PRODUCT, AND BY-PRODUCT QUALITY

### A. Raw Materials

#### 1.0 Specifications and Properties

##### 1.1 Crude DCPI

The crude DCPI fed to the distillation column will contain:

| | |
|---|---|
| monochlorobenzene | 68-72% |
| 3,4-dichlorophenyl isocyanate | 28-32% |
| bis-3,4-dichlorophenyl urea | 0.3-0.5% max |
| phosgene | <0.5% |
| chlorides | <0.1% |
| trimethylamine (added as phosgenation catalyst) | approx. 0.03% (corresponds to <0.5% TMA-related solids in the column)* |

The properties of crude DCPI are listed in Table II-A-1.1.

##### 1.2 Monochlorobenzene (MCB)

The monochlorobenzene added to the column bottoms for storage (batch distillation process) will be obtained from the MCB distilled overhead. The level of DCPI in this MCB should be held to <0.1%, since it will also be mixed with dichloroaniline and recycled to phosgenation. The properties of MCB are listed in Table II-A-1.2.

#### 2.0 Hazards

##### 2.1 Crude DCPI

The fire and explosion data as well as the health data for crude DCPI are listed in Table II-A-2.1. The toxicity of DCPI is not well known. However, other isocyanates such as TDI have a TLV (8 hrs) of 0.02 ppm. It is recommended that DCPI be considered as hazardous as TDI.

##### 2.2 MCB

The fire and explosion data as well as the health data for MCB are listed in Table II-A-2.2.

MCB is reported to be a fairly strong narcotic possessing only slight irritant qualities (Sax, 4th ed., as per BCD 80-11). The TLV (8 hrs) for MCB is 75 ppm.

*TMA reacts with HCl and phosgene to form TMA-HCl, DMCC, and various carbimmonium salts. See reaction scheme presented in Appendix F.



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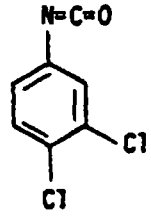
## TABLE II-A-1.1

## PROPERTIES OF CRUDE DCPI

MATERIAL NAME: 30% 3-4-dichlorophenyl isocyanate (DCPI) in monochlorobenzene

Chemical Formula: $C_7H_3Cl_2NO$ in MCB

Chemical Structure:




PHYSICAL PROPERTIES

| | |
|---|---|
| State: | Solution in MCB |
| Color: | Normally dark brown |
| Odor: | Sweet organic in low concentrations |
| Density: | 1.158 g/mL @ 50°C |
| Melting Point: | -19°C |
| Boiling Point: | 60°C at 50 mm Hg (see Appendix A) |
| Specific Heat: | 0.32 PCU/lb°C @ 50°C |
| Viscosity: | 0.6 cps @ 100°C |

CHEMICAL PROPERTIES

| | |
|---|---|
| Molecular Weight: | 188 (DCPI) |
| Corrosive: | Yes |
| Solubility in $H_2O$: | Reacts |
| Solubility in MCB: | Infinite |



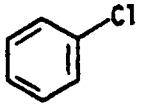
AB0000117579/57

## TABLE II-A-1.2

## PROPERTIES OF MCB

Chemical Formula: $C_6H_5Cl$

Chemical Structure:




### PHYSICAL PROPERTIES

| | |
|---|---|
| State: | Liquid |
| Color: | Water white |
| Odor: | Almond-like |
| Density: | 1.106 g/m @ 20° |
| Melting Point: | -45.2°C |
| Boiling Point: | 131.6°C |
| Specific Gravity: | 1.1058 @ 17°C |
| Viscosity: | 0.844 cps @ 15°C |
| Specific Heat: | 0.35 PCU/lb°C @ 70°C (liquid) |
| | 0.4 PCU/lb°C @ 140°C (liquid) |
| Critical Temperature: | 359°C |
| Critical Pressure: | 44.69 atm. |
| Latent Heat of Vap.: | 81 PCU/lb @ 60°C |
| | 78 PCU/lb @ 100°C |
| Vapor Pressure: | 3 mm Hg 0°C |
| | 26 mm Hg 40°C |
| | 292 mm Hg 100°C |

### CHEMICAL PROPERTIES

| | |
|---|---|
| Molecular Weight: | 112.6 |
| Corrosive: | No |
| Solubility in $H_2O$: | 550 ppm @ 30°C |

### SPECIFICATIONS

| | |
|---|---|
| DCPI: | <0.1% |
| Phosgene: | <0.1% |



AB0000117579/58

TABLE II-A-2.1

HAZARDS OF CRUDE DCPI

FIRE AND EXPLOSION DATA

MCB is a fire hazard.

| | |
|---|---|
| Flash Point: | 29.2°C |
| Autoignition Temperature: | 638°C |

MCB is an explosion hazard.

| | |
|---|---|
| Autodecomposition Temperature: | Not found |
| Lower Explosion Limit: | 1.8% in air, 100°C |
| Upper Explosion Limit: | 9.6% in air, 150°C |
| Minimum Ignition Energy: | Not found |
| $(dP/dT)_{max}$: | Not found |

HEALTH DATA (for DCPI)

| | |
|---|---|
| ALD: | >11,000 mg/kg |
| TLV-TWA: | 0.02 ppm* |
| Inhalation $LC_{50}$: | 2.7 mg/L (4 hrs) |
| $LD_{50}$: | Not found |
| Exposure Symptoms: | Can cause skin burns and severe eye burns. |

*TLV-TWA for TDI. DCPI should be considered as hazardous as TDI.



AB0000117579/59

## TABLE II-A-2.2

## HAZARDS OF MCB

### FIRE AND EXPLOSION DATA

| | |
|---|---|
| Flash Point: | 29.2°C |
| Autoignition Temperature: | 638°C |
| Autodecomposition Temperature: | Not found |
| Lower Explosion Limit: | 1.8% by volume in air |
| Upper Explosion Limit: | 9.6% by volume in air |
| Minimum Ignition Energy: | Not found |
| (dP/dT) max: | Not found |

### HEALTH DATA

| | |
|---|---|
| ALD: | Not found |
| Inhalation $LC_{LO}$: | 15 $g/m^3$ (mouse) |
| $LD_{50}$: | 2.9 g/kg (oral rat) |
| TLV-TWA: | 75 ppm |
| Exposure Symptoms: | Headaches, nausea, dizziness, excitement, hysteria and coma (narcotic symptoms) |



AB0000117579/60

## B. Finished Products

### 1.0 Specifications and Properties

#### 1.1 DCPI

DCPI is a white, crystalline solid (m.p. = 41°C). Specifications for the DCPI product are:

| | |
|---|---|
| DCPI | 99% min |
| MCB | <0.1% |
| TMA solids | <0.1% |

The physical properties of DCPI are listed in Table II-B-1.1.

### 2.0 Hazards

G. B. Bradshaw reported in BCD 80-11 that: DCPI is a powerful irritant to skin and mucous membranes (Sax, 4th ed.). The specific toxicity of DCPI has not been reported, but the Registry of Toxic Effects of Chemical Substances states that 1 ppm of parachlorophenyl isocyanate (a compound similar to DCPI) will cause eye irritation in one minute. Other isocyanates such as toluene diisocyanate (TDI) have a TLV-TWA (8 hrs) of 0.02 ppm. It is recommended that DCPI be considered as hazardous as TDI.

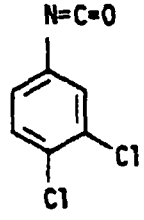


AB0000117579/61

## TABLE II-B-1.1

## PROPERTIES OF DCPI

Structural Formula:




| | |
|---|---|
| Molecular Weight: | 188 |
| Freezing Point, °C: | 41.1 |
| Boiling Point, °C: | 237.2 at 760 mm Hg |
| | 147 at 50 mm Hg (see Appendix A) |
| Specific Gravity: | 1.40 at 50°C |
| | 1.34 at 100°C |
| Heat of Vaporization, PCU/lb: | 67 at 120°C |
| | 63 at 237°C |
| Specific Heat, PCU/lb, °C | 0.25 at 0°C |
| | 0.35 at 100°C |
| Viscosity, cps | 0.98 at 100°C |
| | 0.65 at 140°C |
| | 0.55 at 160°C |



AB0000117579/62

## III. PROCESS STOICHIOMETRY, MATERIAL BALANCE, PROCESS FLOWSHEET

### A. Stoichiometry

#### 1.0 Equations

##### 1.1 Formation of TMA-Related Solids

At Houston, trimethylamine (TMA) is added as a phosgenation catalyst at levels of 0.13 lbs TMA/100 lbs DCA. This translates to a TMA concentration of 0.02-0.03% in the crude DCPI. By means of a special workup procedure (see letter J. S. Ingerman to M. G. Hammond, 2/29/80, included as Appendix F), it was shown that crude DCPI contained derivatives of dimethylamine (DMA) as well as TMA in a DMA:TMA ratio of 3:1. Phosgenation of TMA to dimethyl carbamoyl chloride (DMCC), which is a Du Pont experimental carcinogen as well as a known phosgenation catalyst, is reported in the literature. However, DMCC in turn is likely phosgenated to various carbimmonium salts as shown below, so its concentration should be considerably less than 0.5% of the crude DCPI feed solution.

a. Reactions

1. Formation of Trimethylamine Hydrochloride

$$(CH_3)_3N + HCl \rightleftarrows (CH_3)_3N{\cdot}HCl$$

| trimethylamine | hydrogen chloride | trimethylamine hydrochloride |
|---|---|---|
| (59.11) | (36.47) | (95.58) |

2. Formation of Dimethyl Carbamoyl Chloride

$$(CH_3)_3N{\cdot}HCl + COCl_2 \rightleftarrows [(CH_3)_3\overset{\oplus}{N}COCl\cdot Cl^{\ominus}] + HCl\uparrow \rightleftarrows (CH_3)_2NCOCl + CH_3Cl\uparrow$$

| trimethylamine hydrochloride | phosgene | | hydrogen chloride | dimethyl carbamoyl chloride | methyl chloride |
|---|---|---|---|---|---|
| (95.58) | (98.92) | | (36.47) | (107.54) | (50.49) |

and:

$$(CH_3)_3N + COCl_2 \rightleftarrows [(CH_3)_3\overset{\oplus}{N}COCl\cdot Cl^{\ominus}] \rightarrow (CH_3)_2NCOCl + CH_3Cl\uparrow$$

| trimethylamine | phosgene | | dimethyl carbamoyl chloride | methyl chloride |
|---|---|---|---|---|
| (59.11) | (98.92) | | (107.54) | (50.49) |

3. Formation of Carbimmonium Salts

$$(CH_3)_2NCOCl + COCl_2 \rightleftarrows (CH_3)_2\overset{\oplus}{N}\underset{OCOCl}{CCl}\cdot Cl^{\ominus}$$

| dimethyl carbamoyl chloride | phosgene | carbimmonium salt |
|---|---|---|
| (107.54) | (98.92) | (206.46) |

Carbimmonium salts have low vapor pressures, but since an equilibrium exists between carbimmonium salts and DMCC + $COCl_2$, unlimited mobility is possible.

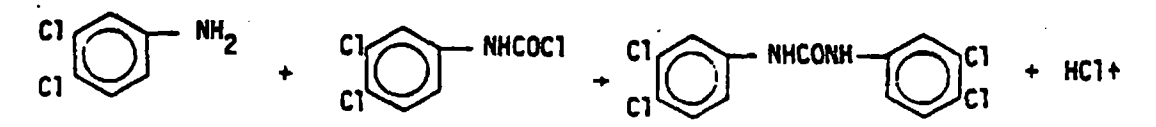


AB0000117579/63

## 1.2 Formation of Tars

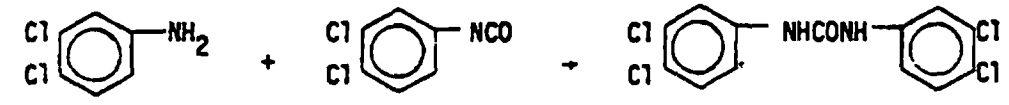
### a. Reactions

#### 1. Formation of bis-3,4-Dichlorophenyl Urea



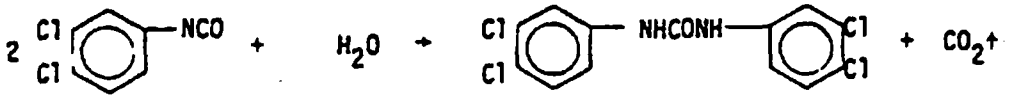
3,4-dichloroaniline (162.02) + 3,4-dichlorophenyl carbamoyl chloride (224.48) → bis-3,4-dichlorophenyl urea (350.03) + hydrogen chloride (36.47)

and:



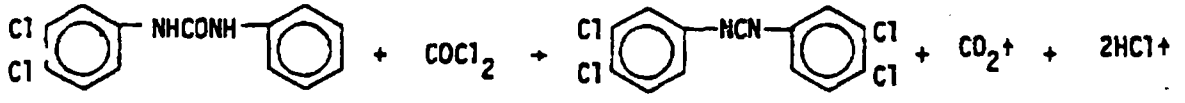
3,4-dichloroaniline (162.02) + 3,4-dichlorophenyl isocyanate (188.01) → bis-3,4-dichlorophenyl urea (350.03)

and:



2 3,4-dichlorophenyl isocyanate (188.01) + water ($H_2O$) (18.02) → bis-3,4-dichlorophenyl urea (350.03) + carbon dioxide ($CO_2$) (44.01)

#### 2. Formation of 3,4-Dichlorophenyl Carbodiimide

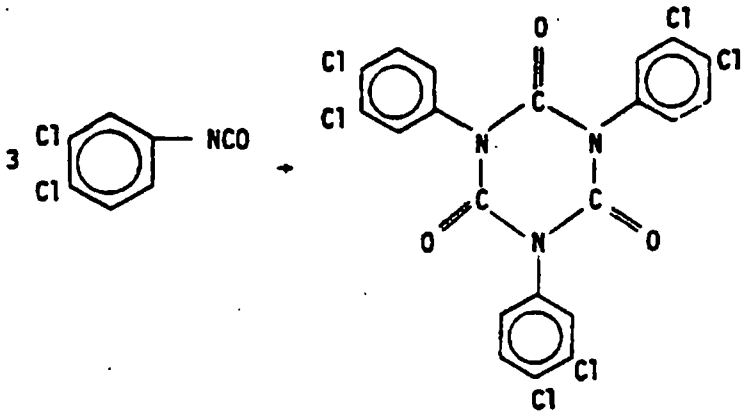


bis-3,4-dichlorophenyl urea (350.03) + phosgene ($COCl_2$) (98.92) → bis-3,4-dichlorophenyl carbodiimide (332.01) + carbon dioxide ($CO_2$) (44.01) + hydrogen chloride ($2HCl$) (36.47)



AB0000117579/64

### 3. Formation of DCPI Polymers



3,4-dichlorophenyl isocyanate (188.01)

DCPI trimer (564.03)

#### b. Process Conditions

Bis-3,4-dichlorophenyl urea and bis-3,4-dichlorophenyl carbodiimide are formed during the phosgenation reaction, as well as during the distillation step whenever phosgene or moisture are present. Polymers are formed when DCPI is heated above approximately 100°C. The relative amounts of urea, carbodiimide, and polymers comprising the tars varies with phosgenation conditions, length of storage of the crude DCPI, exposure to moisture, etc.



AB0000117579/65

## IV. EXPERIMENTAL DETAILS

### A. Equipment

The laboratory distillation unit consisted of a 1-inch diameter, 15-plate Oldershaw column (vacuum-jacketed, and silver-plated), a distillation head with manual reflux control, a tempered-water condenser, a thermosiphon reboiler, a dry ice/acetone cold trap, receiving flasks, an FMI pump, and a vacuum system consisting of a vacuum pump, manometer, and manostat. An equipment diagram is presented as Figure IV-A.

### B. Procedure

Distillations were run at 50 mm Hg head pressure (bottom pressure = 54-55 mm Hg). Prior to the introduction of the initial pot charge (bottoms from the previous run plus some MCB), all receiving flasks were evacuated. The initial charge was preheated to approximately 120°C and fed to the column. MCB was removed overhead while DCPI and tars remained in the lower portion of the column. When the material in the pot reached its boiling point, feed solution preheated to 60°C via an electrical heating tape was entered on the tenth plate (from the bottom) at the rate of 10-20 mL/min. As the column reached steady state operation (indicated by the temperature profile shown in Figure IV-B), the removal of DCPI product from the vapor stream above the fifth plate and the removal of the TMA-related solids purge stream from the ninth plate were begun. Five runs were performed. The column was operated for as long as 7 hours with no pluggage problems observed.

### C. Observations

When the column was operating at steady state conditions:

- The majority of the TMA-related solids collected on plate No. 9 were easily removed in a continuous stream containing 25-30% DCPI. GC analysis of the purge stream indicated that a ten to twenty-fold concentration of the TMA-related solids was achieved. The purge rate was only about 1/10 the DCPI product takeoff rate (approximately 0.5 mL/min).
- No column pluggage occurred.
- High quality DCPI was removed as a vapor stream from above plate No. 5. IR analysis (G. S. Walser) indicated that the DCPI was 99.7% pure.
- The MCB removed overhead contained no detectable DCPI (by GC).
- 95.5% DCPI yield (calculated by GC) was obtained in the distillation step (an overall DCPI yield from DCA of 93.6%). This included the extended holdup time of material in the reboiler pot. Allowing for DCPI losses to maintain fluidity of the tars, a DCPI yield in the distillation step of 93-94% was achieved (an overall DCPI yield from DCA of 91-93%). It is expected that the shorter holdup time possible in a plant-scale system will result in significantly less tar formation and therefore higher DCPI yields.



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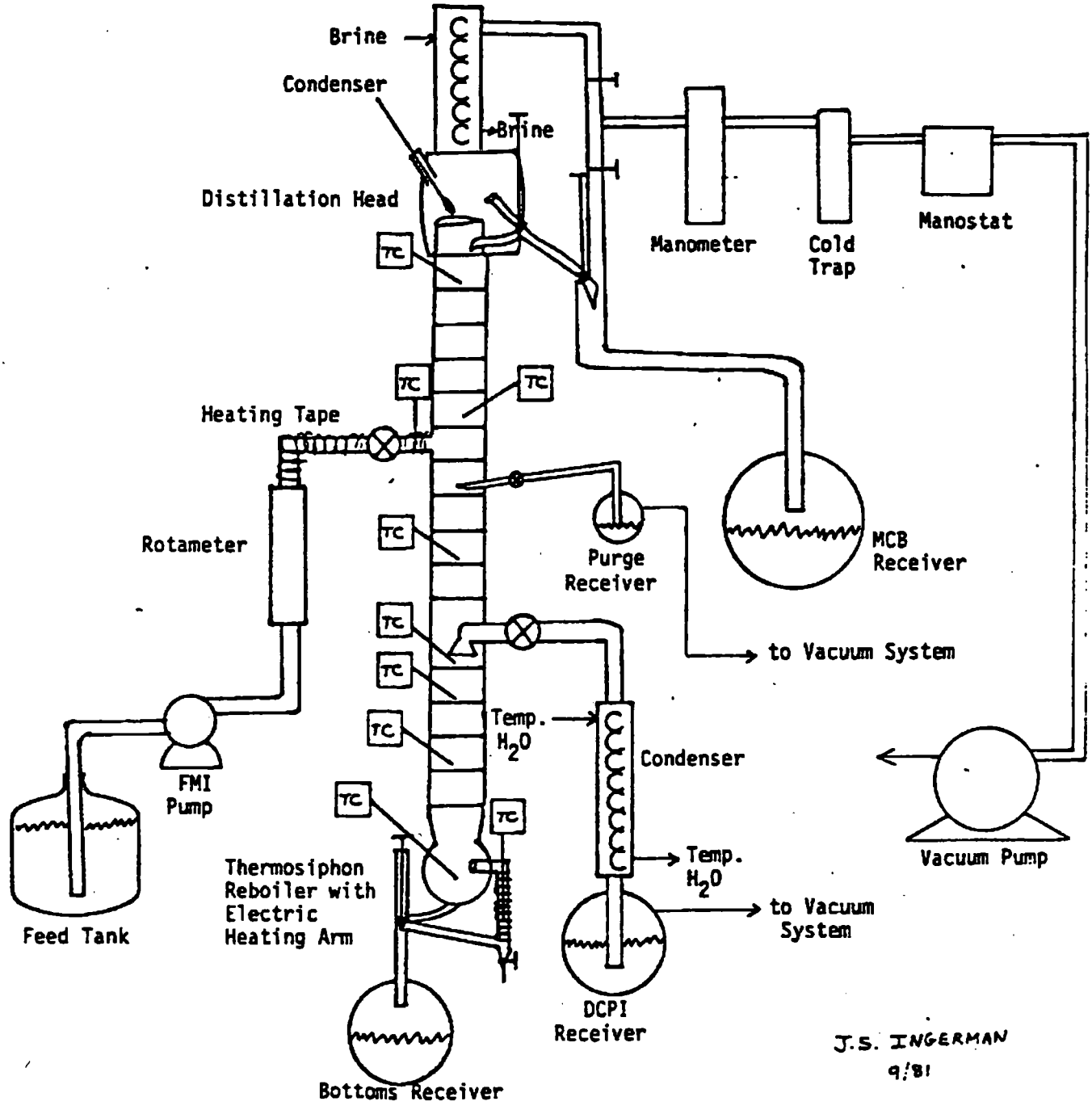
FIGURE IV-A: SCHEMATIC DIAGRAM OF LABORATORY EQUIPMENT

CONTINUOUS DISTILLATION PROCESS



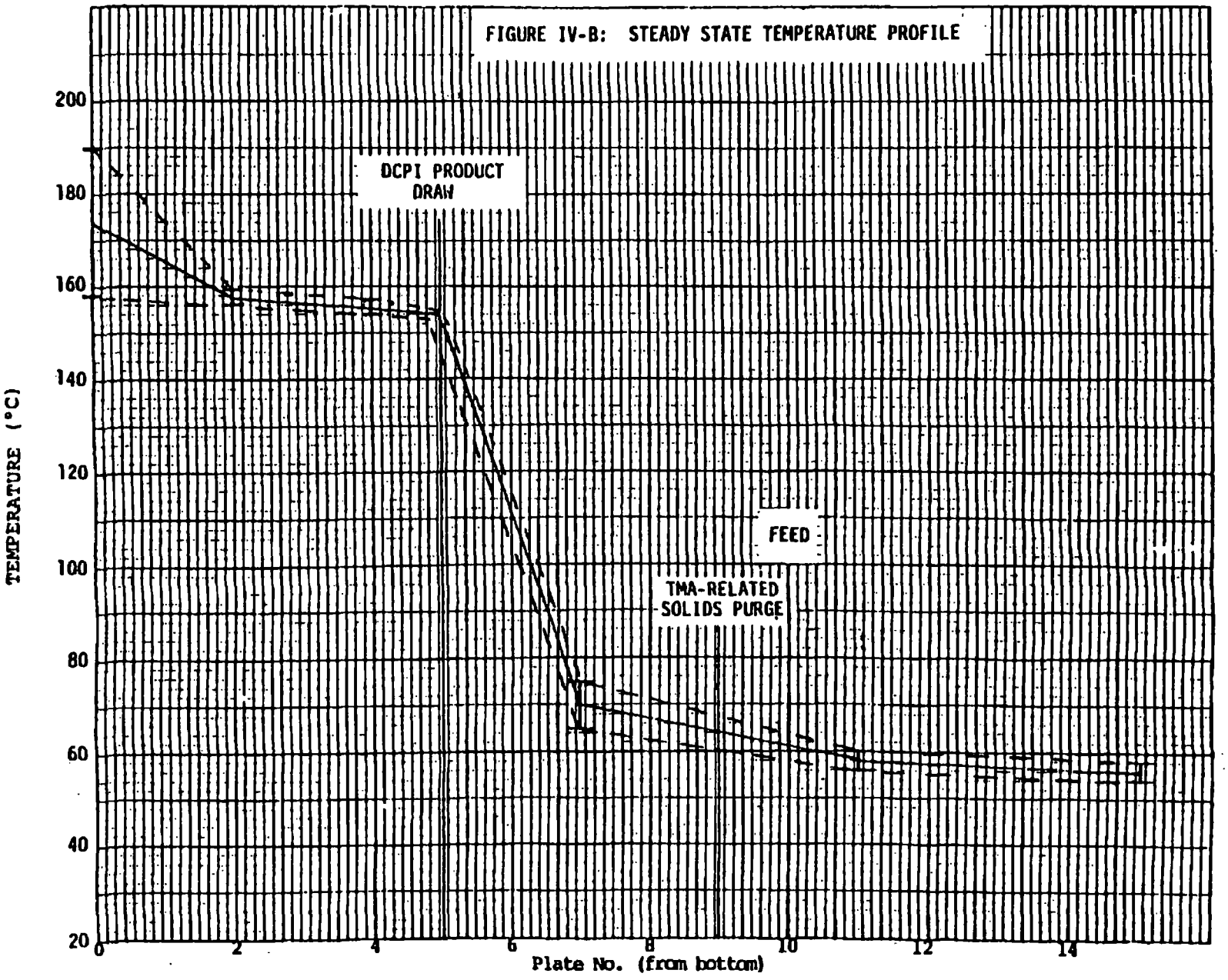


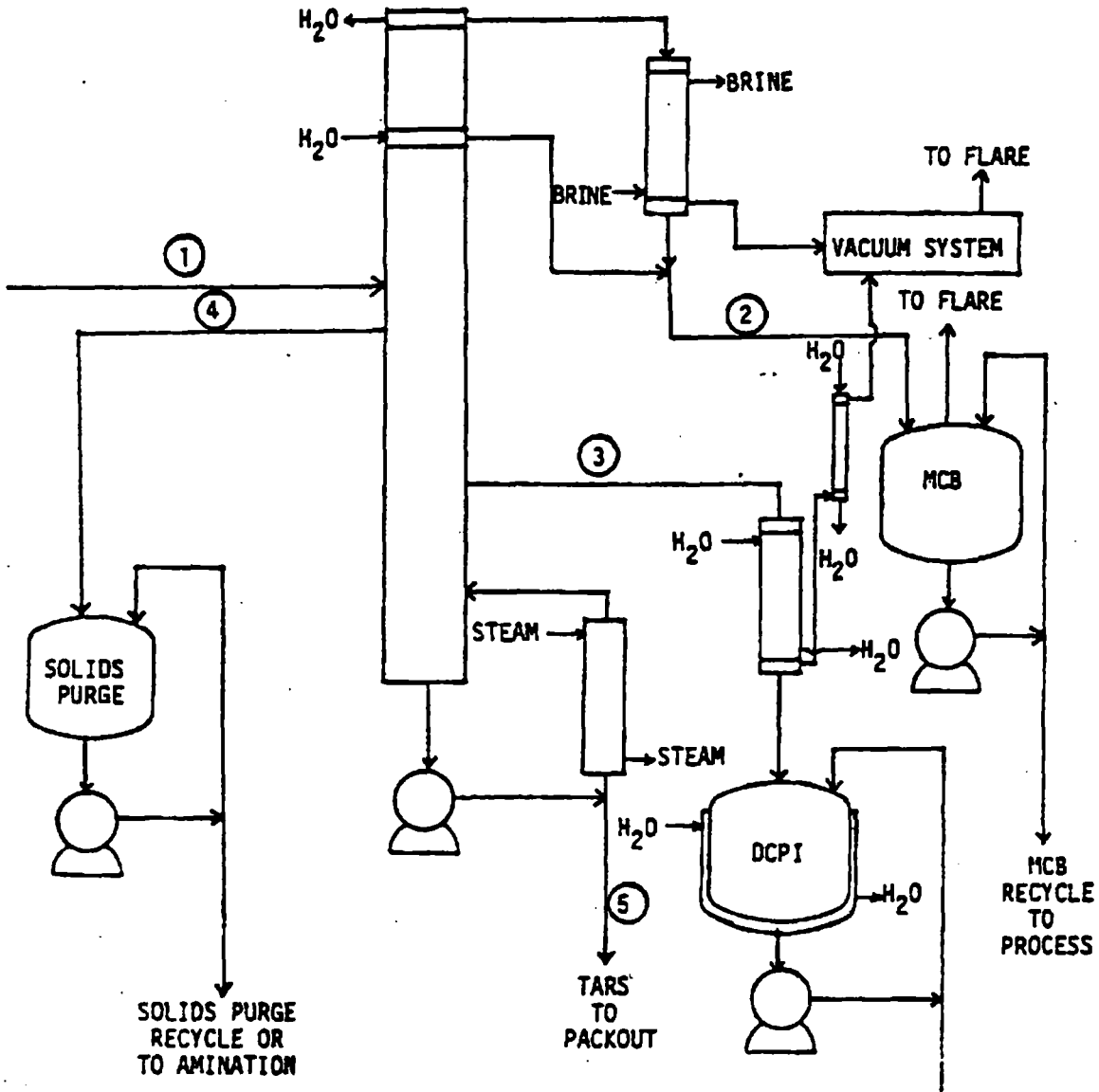
FIGURE IV-B: STEADY STATE TEMPERATURE PROFILE
DCPI PRODUCT DRAW
FEED
TMA-RELATED SOLIDS PURGE
TEMPERATURE (°C)
200
180
160
140
120
100
80
60
40
20
0
2
4
6
8
10
12
14
Plate No. (from bottom)

The column did not consistently operate at steady state. Due to the small scale of equipment, slight changes in the manual control system often resulted in major upsets in the temperature profile (and thus in the concentration profile) and in the liquid levels on the plates. It is therefore recommended that the process be demonstrated on a semiworks scale with an automatic control system.

## D. CONCLUSIONS

- The feasibility of a continuous DCPI distillation was demonstrated in laboratory glassware. The column operated without solids pluggage.
- Removing DCPI as a vapor stream from the lower section of the column was effective in separating the DCPI from its high-boiling tars.
- It was demonstrated that the TMA-related solids could be concentrated in a 3-4 plate region of the column with the majority of the solids located just below the feed plate. Further, it was demonstrated that the TMA-related solids, dissolved in MCB/DCPI solution, could be removed from the column in a liquid purge stream.
- The DCPI product was of high purity (99.7% DCPI by IR).
- Although process feasibility was demonstrated in the laboratory, a semiworks demonstration is recommended. Laboratory benchwork was limited by the physical constraints of a manual control system.

## V. CONTINUOUS DISTILLATION PROCESS FLOWSHEET




Basis: 4MM ppy DCPI (80% Utility)

| Stream No. | Description | MCB (pph) | DCPI (pph) | TARS (pph) | TMA Solids (pph) | $COCl_2$ (pph) |
|---|---|---|---|---|---|---|
| 1 | Feed | 1495 | 650 | 14 | 6 | 2 |
| 2 | MCB Overhead | 1459 | - | - | - | 2 |
| 3 | DCPI Product | - | 600 | - | 1 | - |
| 4 | TMA Solids Purge | 36 | 18 | - | 5 | - |
| 5 | Tars | - | 18 | 28 | - | - |



AB0000117579/70

## VI. BATCH DISTILLATION PROCESS

### A. Process Engineering Description

#### 1.0 Distillation of Crude DCPI

##### 1.1 Objective and Description

The objectives of this step are to remove the monochlorobenzene (MCB) solvent in which 3,4-dichlorophenyl isocyanate (DCPI) is produced and to distill high-purity DCPI overhead from its high-boiling tars. The process operates batchwise in four steps: 1) MCB removal; 2) Purging of TMA-related solids (herein referred to as "solids"); 3) DCPI Purification; and 4) Tar dilution and pumpout. Step 1 consists of removing MCB from a solution of MCB and DCPI by vacuum distillation. Step 2 consists of removing the solids deposited in he column either by using a hot nitrogen purge (170-200°C, or by allowing the DCPI to dissolve the solids and removing an intermediate DCPI/MCB/TMA cut overhead. The third step involves vacuum distilling the DCPI overhead from the tars, leaving behind a bottoms composition of 60% tars, 40% DCPI. Step 4 involves addition of an equal volume of MCB to the column bottoms to reduce DCPI decomposition to tars (which would greatly increase the viscosity of the bottoms - see Figure VII-B-3.1) and to enable the bottoms to be stored as a liquid at ambient temperature.

##### 1.2 Equipment

Based upon corrosion coupon tests reported in IBD 62-22, nickel or Hastelloy-C are suitable materials of construction for the column, reboiler, and condenser. Further information regarding materials of construction can be found in Manufacturing Division's report.

Engineering Department (J. B. Jones, C. J. Noelke) has recommended that the distillation column be designed with valve trays to provide maximum possible efficiency in spite of solids deposition.

It has also been recommended by Engineering Department (H. F. Hublein) that the reboiler be an external, forced-circulation type to ensure adequate heat transfer even when the liquid level in the pot is low. No fouling of heat exchange surfaces is expected, due to the high velocity of the liquid passing through the reboiler. This will be confirmed in the semiworks scale unit at the Engineering Test Center (W. Shamlin) where the pot is heated via a hot oil system. Any fouling that takes place will be noticeable on the walls of the pot, which are 30-50°C hotter than the contents.

Further information regarding equipment design and specifications can be found in the Manufacturing Division report.



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### 1.3 Thermodynamics and Energy Requirements

The heat of vaporization of MCB is:

81 PCU/lb at 60°C
78 PCU/lb at 100°C

The specific heat of MCB (liquid) is:

0.35 PCU/lb°C at 70°C
0.40 PCU/lb°C at 140°C

(See Figure VI-1.31)

The heat of vaporization of DCPI is:

67 PCU/lb°C at 120°C
63 PCU/lb°C at 237

The specific heat of DCPI is:

0.35 PCU/lb°C at 100°C
0.40 PCU/lb°C at 150°C

(See Figure VI-A-1.32)

### 1.4 Process Control

The laboratory batch distillation process was controlled by monitoring pot temperature and overhead temperature, and manually adjusting reflux ratios. Column $\Delta P$ was measured between the top and bottom plates. An increase in $\Delta P$ of more than 5 mm Hg indicated pluggage. (Without pluggage, column $\Delta P$ was approximately .0 mm Hg.)

Further information regarding process control can be found in Manufacturing Division's Basic Data Report and Engineering Department's report on operation of the Semiworks-scale unit.

### 1.5 Hazards

The hazards of handling MCB, DCPI, and phosgene are detailed in Section II.

## 2.0 Removing the TMA-Related Solids

### 2.1 Objective and Description

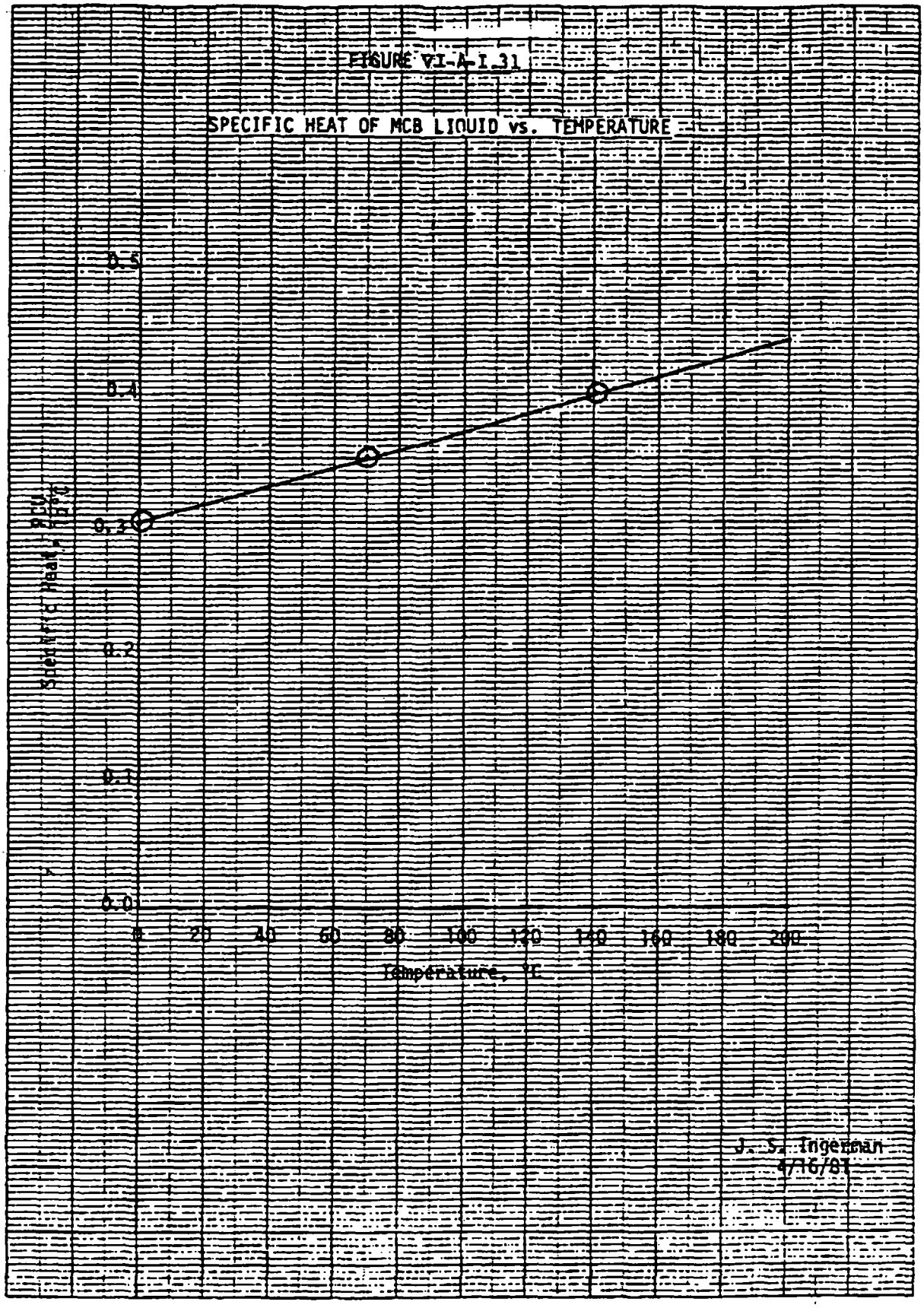
The objective of this step is to remove the solids from the column either by using a hot, inert carrier gas ($N_2$) or by taking an intermediate MCB/DCPI/TMA cut.



AB0000117579/72

FIGURE VI-A-I.31

SPECIFIC HEAT OF MCB LIQUID vs. TEMPERATURE




J. S. Ingeman
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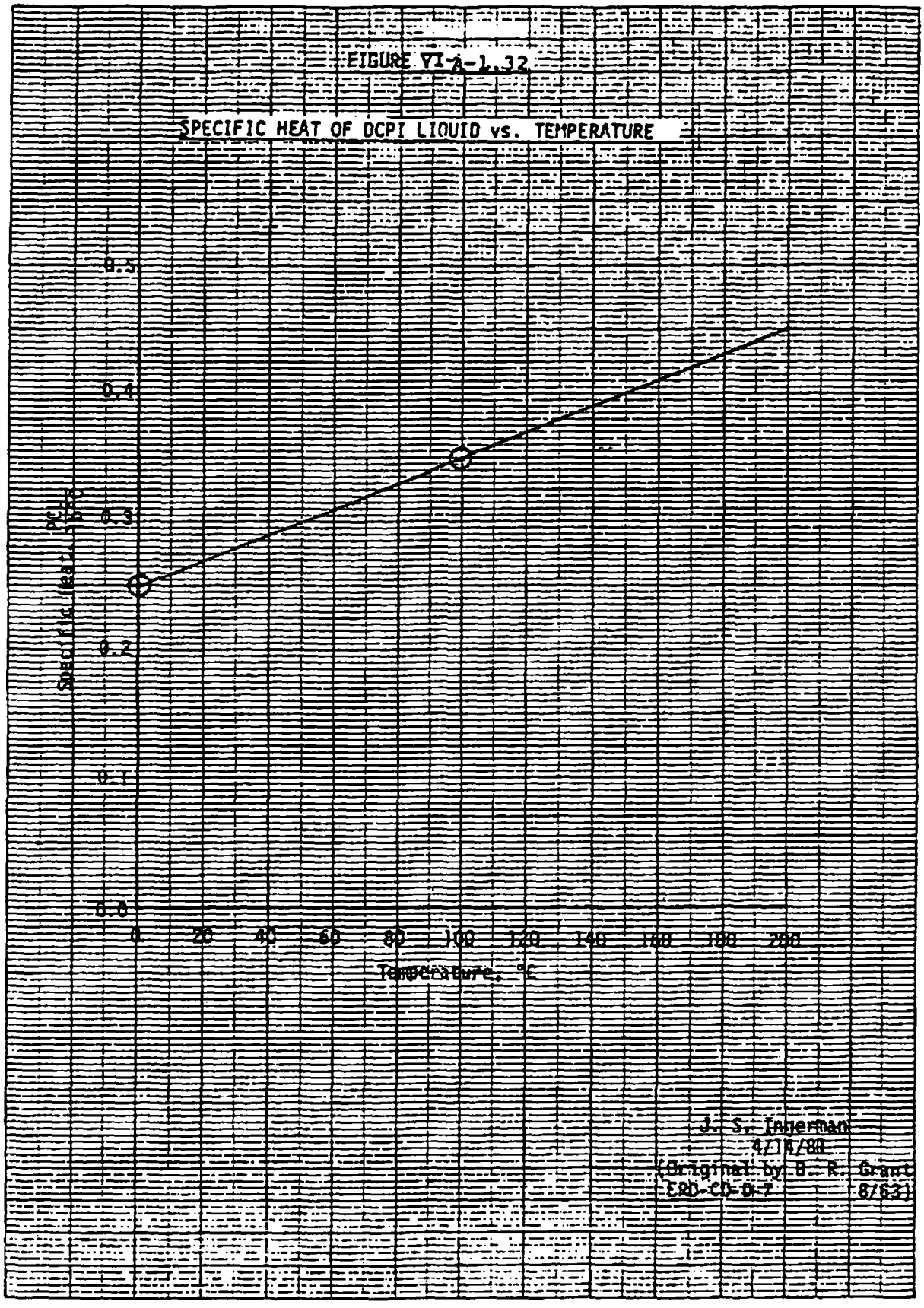
FIGURE VI-A-1.32

SPECIFIC HEAT OF DCPI LIQUID vs. TEMPERATURE




J. S. Innerman
4/18/68
(Original by D. R. Grant
ERD-CD-D-7 8/63)



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### 2.2 Equipment

The additional equipment necessary for purging the solids via the nitrogen route includes a nitrogen preheater and a water scrubber to remove the amine compounds from the carrier gas.

## B. Experimental Details

### 1.0 MCB Removal

A 1-inch diameter, vacuum-jacketed, glass column was used for laboratory demonstration of the MCB removal step (see Figure VI-B-1 Ω). Experiments were performed on Oldershaw (sieve plate) columns as well as packed columns, at head pressures ranging from 30 mm Hg to 400 mm Hg. Several runs were performed using a 10-plate Oldershaw column but a 5-plate column was found to give adequate separation.

In all laboratory runs, the MCB removal step was begun at a minimum reflux ratio (L/V = 0.1-0.2, including internal reflux). The amount of reflux was increased to L/V = 0.2-0.25, including internal reflux, when the pot temperature reached 80°C (50 mm Hg head pressure). At this point, approximately 90% of the MCB had been removed overhead (and essentially 0% of the DCPI). As the pot temperature increased to 130-135°C, solids began to build up in the column and L/V was increased to 0.3 (including internal reflux) in order to improve the MCB/DCPI separation. By the time the pot temperature reached 140-145°C, approximately 99% of the MCB had been removed as "pure" MCB (containing substantially less DCPI than the proposed 0.1% spec). As the overhead temperature began to rise above 60°C, indicating the presence of DCPI on the upper plates, the reflux ratio was increased until it reached total reflux (overhead temperature 140-145°C). Boilup was cut to maintain a liquid level of approximately 7-9 mm on each plate. Typical experimental data are presented in Table VI-B-1.1.



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FIGURE VI-B-1.0

LABORATORY EQUIPMENT SETUP-BATCH DISTILLATION PROCESS

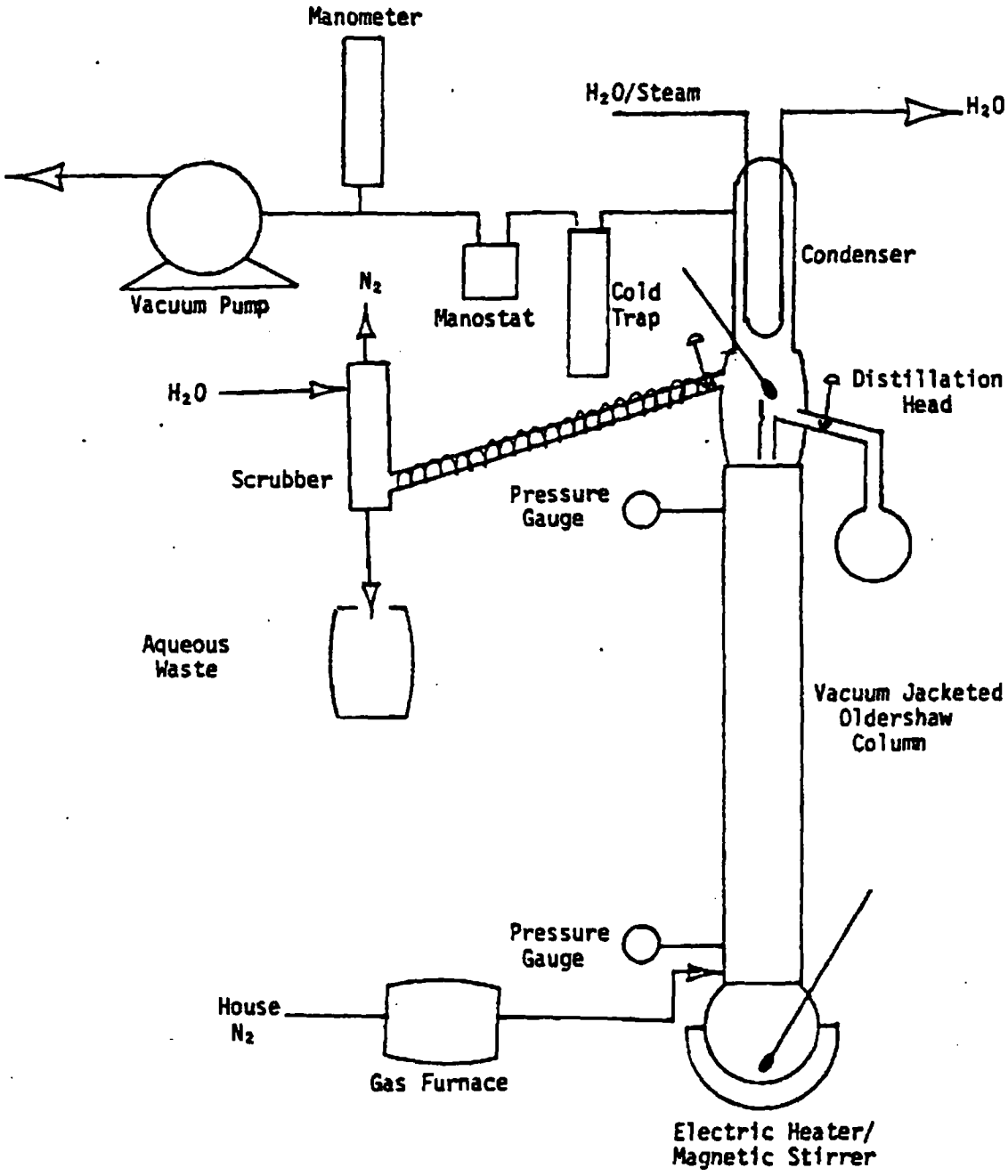




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TABLE VI-B-1.1

MCB REMOVAL STEP (5-PLATE OLDERSHAW COLUMN)

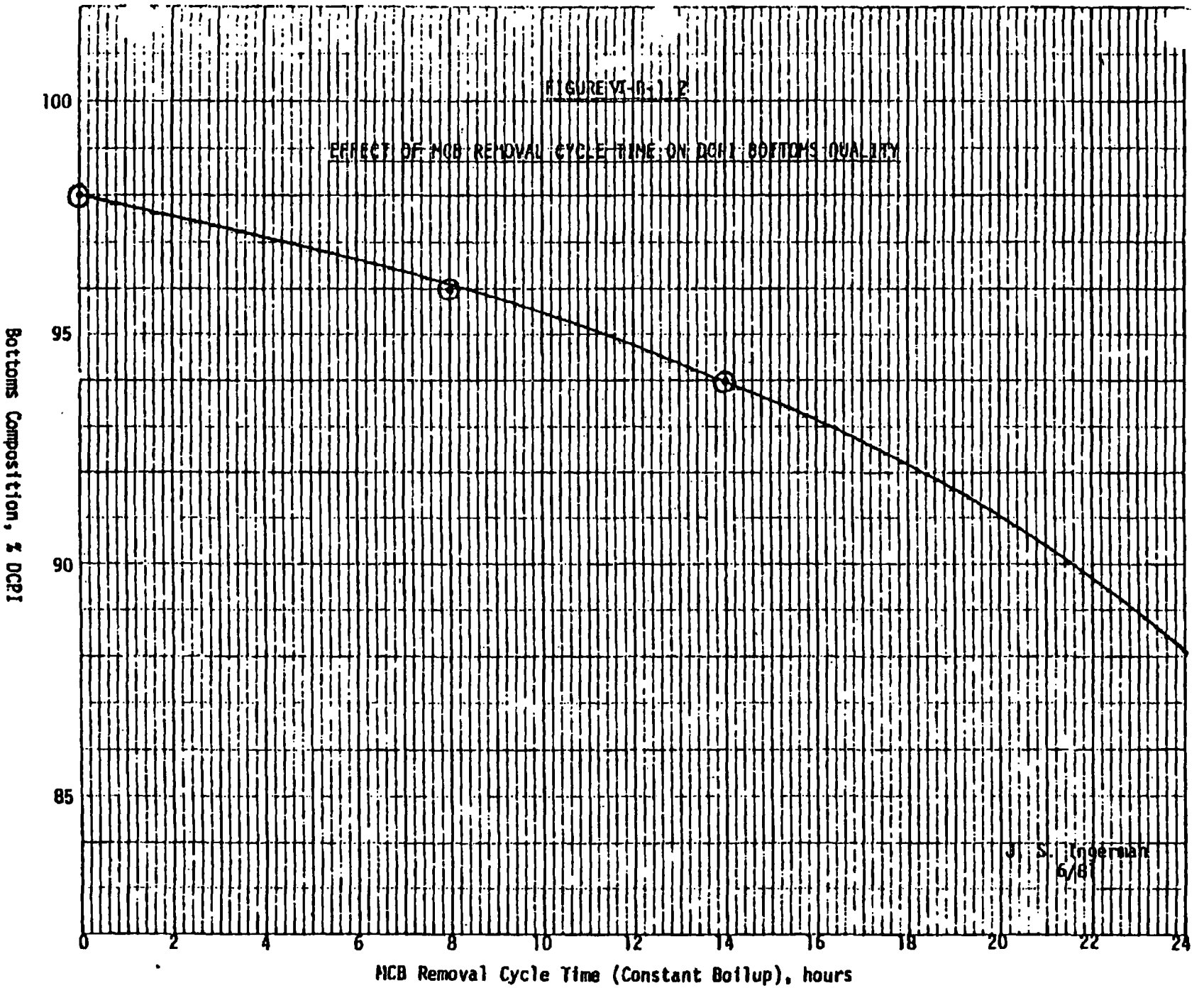
| Run No. | Head Pressure (mm Hg) | Pot Temp. (°C) | Overhead Temp. (°C) | L/V Including Internal Reflux (Estimate) | MCB Removed (% of Total (MCB) | Quality* of each MCB Cut |
|---|---|---|---|---|---|---|
| 1 | 50 | 58-60 | 51 | 0.2 | 26% | <.01% DCPI |
| | | 60-61 | 51-52 | 0.2 | 53% | <.01% DCPI |
| | | 61-67 | 52 | 0.2 | 79% | <.01% DCPI |
| | | 67-80 | 52 | 0.2 | 91% | <.01% DCPI |
| | | 80-130 | 52 | 0.25 | 98% | <.01% DCPI |
| | | 130-140 | 52 | 0.3 | 99% | <.01% DCPI |
| 2 | 50 | 63-64 | 52 | 0.1 | 26% | <.01% DCPI |
| | | 64-65 | 52 | 0.1 | 53% | <.01% DCPI |
| | | 65-72 | 52 | 0.1 | 79% | <.01% DCPI |
| | | 73-80 | 52-53 | 0.1 | 90% | <.01% DCPI |
| | | 80-135 | 52-53 | 0.25 | 98% | <.01% DCPI |
| | | 135-145 | 52 | 0.3 | 99% | <.01% DCPI |

*By IR (G. S. Walser)

The effect of MCB removal cycle time on the quality of the column bottoms is shown in Figure VI-B-1.2.



AB0000117579/77



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## 2.0 Removing the TMA-Related Solids

The TMA-related solids volatilized and plated out on the wetted and nonwetted surfaces of the column, causing localized flooding and an increase in column ΔP. Regardless of head pressure, the solids volatilized in a distinct pressure-temperature region between MCB and DCPI. Therefore, it is evident that the vapor pressure of the solids mixture lies between the vapor pressures of MCB and DCPI for all feasible column conditions (i.e., 30-200 mm Hg. Head pressures higher than 200 mm Hg would result in unacceptable yield losses of DCPI to tars due to thermal decomposition). Fig.VI-B-2.1 shows an estimate of the vapor pressure of the solids mixture based upon laboratory observations and mathematical techniques for vapor pressure estimation (see Reference 6).

Two options exist for removing the solids from the column:

1) Purging the solids from the column with a hot carrier gas ($N_2$)

   or

2) allowing the solids to be dissolved by DCPI and removed overhead.

### 2.1 Nitrogen Purge

Laboratory experiments have shown that the solids can be purged from the column using a hot, inert carrier gas such as nitrogen. House nitrogen (5 psi) was heated to 175°C in a gas furnace and blown upwards through the column. When the temperature within the column reached 175°C, the TMA-related solids volatilized and were carried overhead. It is estimated that once the temperature within the column reaches 175°C, it requires 10 lbs of nitrogen to volatilize 1 lb of solids, assuming that the nitrogen enters at 200°C and exits at 160°C (see Appendix E for calculation). The nitrogen containing the TMA-related compounds was passed through a water scrubber consisting of a 1-ft section of 1-inch diamter glass Vigreaux column through which cold water (10-15°C) was flowing at the rate of approximately 10 mL/min. An aqueous amine waste having no characteristic amine" odor was produced. The nitrogen stream leaving the scrubber was not analyzed for residual organics. If this alternative proves to be the most economical way to remove the solids from the column, the nitrogen purge process will have to be developed more fully (i.e., investigated on a larger scale).

### 2.2 Dissolving in DCPI

The TMA-related solids are soluble in DCPI. It has been demonstrated in the laboratory that an intermediate cut containing all of the solids, approximately 70% DCPI, and the remainder of the MCB can be removed overhead as indicated in Table VI-B-2.2. This intermediate would contain approximately 10% of the DCPI charged. It could be sent to the amination process at Houston, where the TMA-related solids would be removed in the water-wash step. Preliminary results from work done at the Engineering Test Center show that the intermediate cut may contain as much as 25% of the DCPI. This is thought to be a result of poor reflux control in the column.



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FIGURE VI-B-2-1

VAPOR PRESSURE OF TMA-RELATED SOLIDS

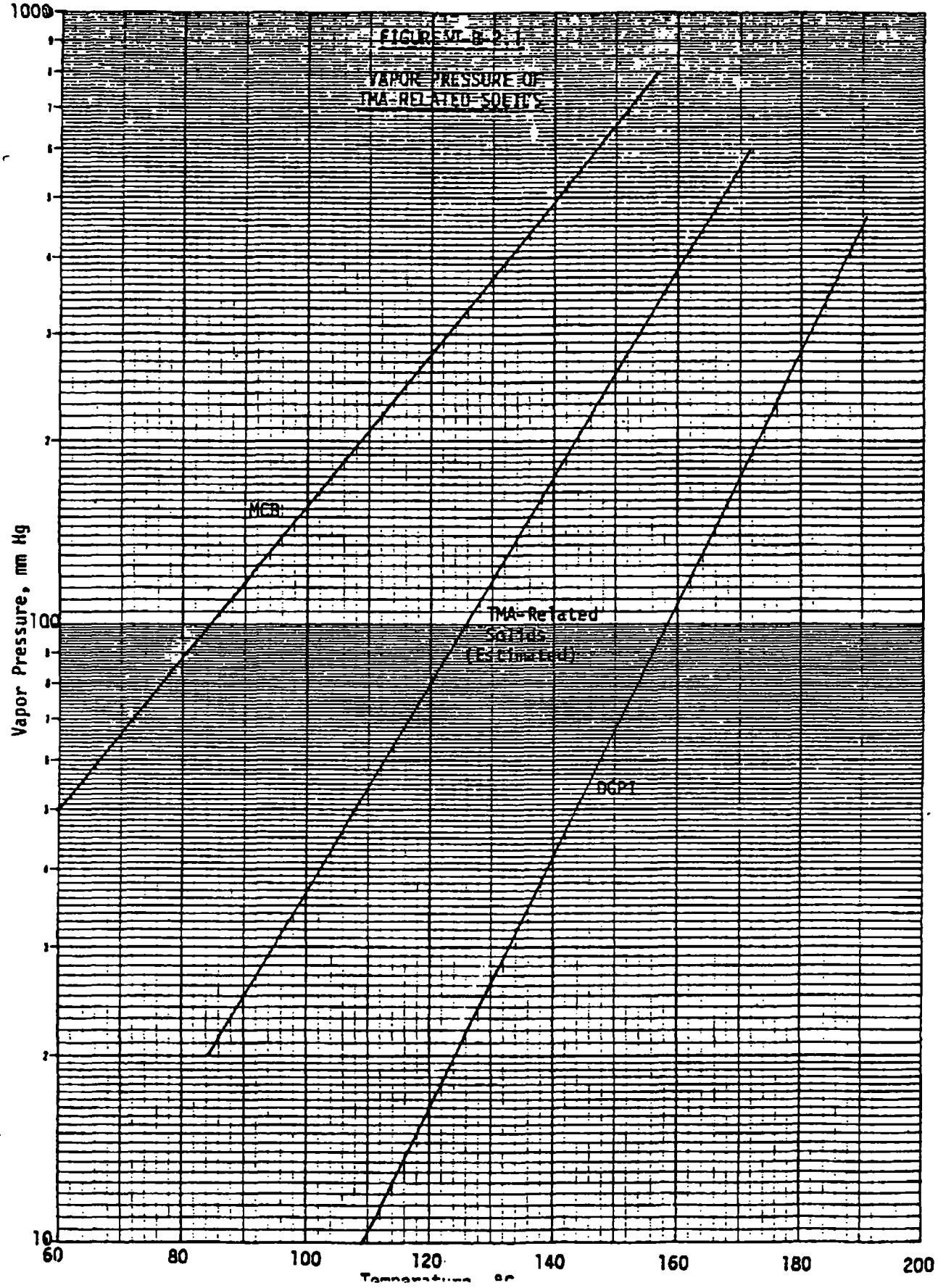

TABLE VI-B-2.2

REMOVING THE TMA-RELATED SOLIDS
IN AN INTERMEDIATE DCPI CUT

| Run # | Head Pressure (mm Hg) | Pot Temp. (°C) | Overhead Temp. (°C) | L/V Including Internal Reflux (Estimate) | Composition of Intermediate Cut* | DCPI in Intermediate Cut (% of Total DCPI) |
|---|---|---|---|---|---|---|
| 1 | 50 | 141-154 | 52-75 | 0.4 | 72% DCPI<br>24% MCB<br>4% bis-urea | ~10 |
| 2 | 50 | 147-154 | 54-145 | 0.35-0.4 | 71% DCPI<br>26% MCB<br>3% bis-urea | ~10 |

*by IR (G. S. Walser) and LC (P. K. Tseng)



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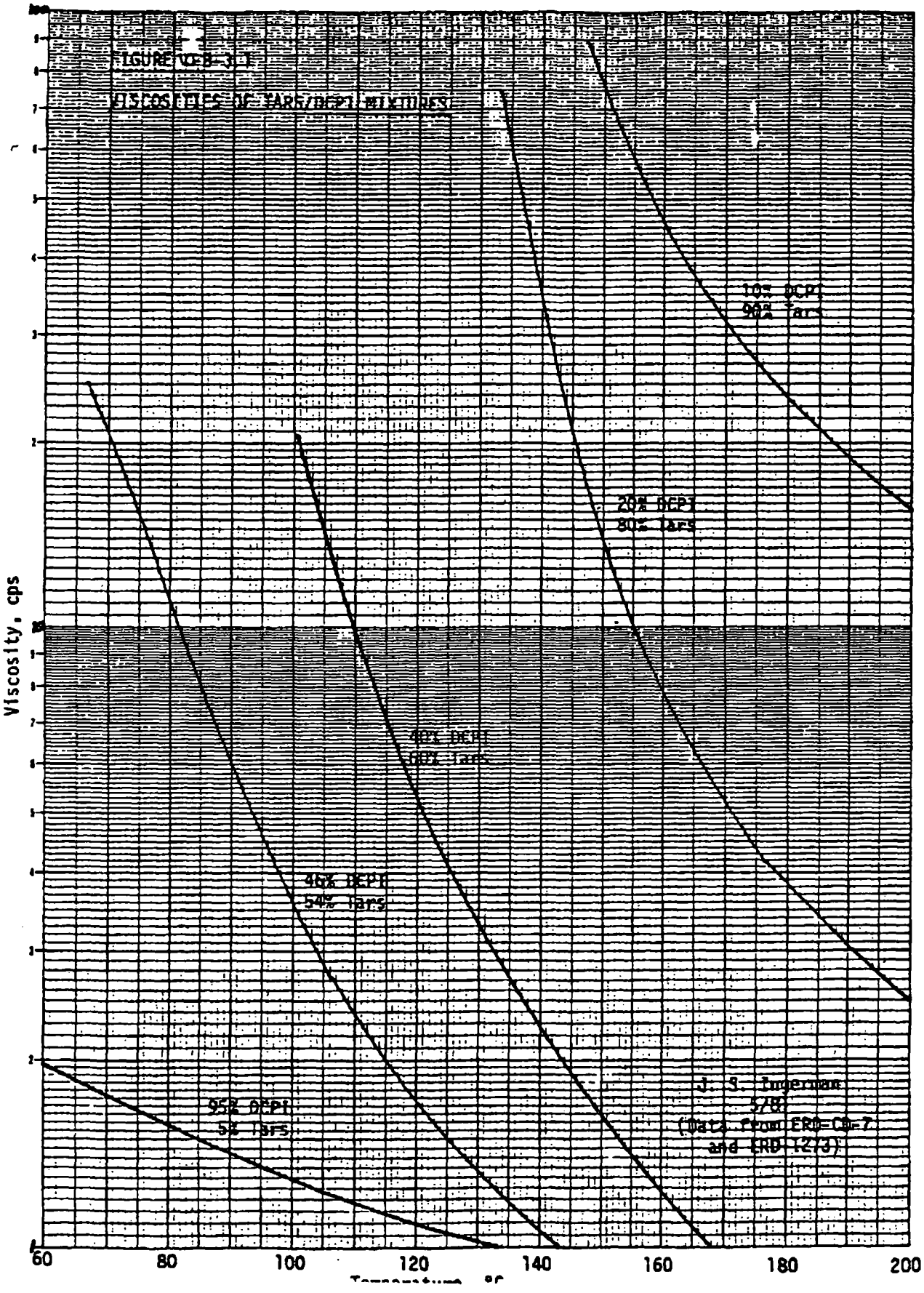
FIGURE G-B-3-1

VISCOSITIES OF TARS/DCPI MIXTURES



On several occasions, the laboratory distillation column plugged enough to become inoperable before the DCPI was able to dissolve the solids (batch sizes: 1-2 liters of Houston crude DCPI containing 30% DCPI). Thus, it is important to design the plant-scale column to handle solids if this option is chosen. Furthermore, the batch size will have to be sufficiently large to compensate for the intermediate cut and still produce enough material for export.

## 3.0 DCPI Purification Step

Once the solids were removed from the column, either via a nitrogen purge or in an intermediate DCPI cut, separation of the DCPI from its high-boiling tar residue proceeded smoothly. Varying the reflux ratio (including internal reflux) from L/V = 0.35-0.4 while the pot temperature remained below 160°C (50 mm Hg head pressure) up to L/V = 0.5 for pot temperatures above 160°C was effective in keeping any volatile tar-related impurities from being taken overhead. Such a high L/V was necessary in lab-scale equipment in order to keep liquid on all the plates. L/V = 0.3 should be adequate in a larger column. Laboratory distillations were run in 1-inch diameter Oldershaw columns and packed columns at head pressures of 30-200 mm Hg. The condenser water was tempered (50°C) to prevent DCPI from freezing on the heat transfer surfaces.

If the solids are removed from the column via a nitrogen purge, a small pre-cut containing approximately 2% of the DCPI may be necessary in order to remove the final 1% of the MCB. However, if the solids are removed in an intermediate DCPI cut, no pre-cut is needed.

The majority of the degradation of DCPI to tars takes place during the DCPI purification step. Information on the decomposition of DCPI to tars is presented in Appendix G of this report.

In order to keep the pot residue fluid, it is necessary to stop the distillation when the pot composition reaches 40% DCPI, 60% tars (pot temperature = 190-200°C for head pressure = 50 mm Hg). Data concerning the viscosities of various mixtures of tars and DCPI have been presented in earlier Elastomer Department reports (ERD-CD-D-7 and ERD-1273) and are redrawn here as Figure VI-B-3.1. (Spindle-type viscometers were used.) The data show that the viscosity of the column bottoms will not exceed 5 cps if the dilution step is performed as indicated in Section VI-B-4.0. If the bottoms are allowed to cool below 120°C (viscosity = 5 cps), they become sticky and difficult to handle.

## 4.0 Tar Dilution and Pumpout

Addition of equal volumes of MCB to the pot while the temperature of the 40% DCPI, 60% tars mixture is above 140°C (atmospheric pressure) is effective in producing a solution that can be stored as a liquid at room temperature. (Freeze point: below -20°C) It is recommended that the MCB be added when the temperature of the bottoms has cooled to 140-150°C, in order to minimize MCB flashing while keeping the viscosity of the tars/DCPI mixture below 2 cps. For pot temperatures between 120 and 140°C, the tars/DCPI mixture thickened (viscosity approximately 5 cps) and a small amount of crystallization



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occurred at the walls, but MCB addition resulted in a liquid capable of being stored at room temperature without solidifying. However, if the tars/DCPI mixture cooled below 120°C, it became a sticky solid, and the MCB added formed a separate layer (i.e., the MCB did not mix with the tars/DCPI). Heating the 2-phase system served only to vaporize the MCB. Thus, in the event that the pot temperature drops below 120°C, it is recommended that the tars/MCB mixture be re-heated to 150°C prior to MCB addition. Adding less than equal volumes of MCB did not always form a mixture that remained liquid at room temperature. For example, a mixture of 30% MCB, 42% tars, and 28% DCPI solidified during storage (approximately 25°C).

Adding MCB to the bottoms and storing the mixture at room temperature essentially quenches the decomposition of DCPI to tars. (See Section V-B-3.0.) Samples containing 50% MCB, 30% tars, and 20% DCPI have been stored at room temperature for 1-4 months with no significant change in DCPI assay (<2%). It is recommended that an agitated tank be used for MCB/tars/DCPI storage since the mixture contains a small amount (1-2%) of insolubles, mainly bis-urea. Exposure to moisture should be avoided in order to prevent further bis-urea formation.

Materials of construction for the storage tank and pumps are discussed in Manufacturing Division's Basic Data Report.

## 5.0 Waste Disposal

The column bottoms containing MCB, tars, and DCPI will be incinerated off-plant. We are studying possible routes for recovering DCPI or other useful materials (such as 3,4-dichloroaniline, one of the starting materials for DCPI manufacture) from the bottoms.

Further information on waste disposal can be found in Manufacturing Division's Basic Data Report.



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C. Process Flowsheet

Figure VI-C is a schematic equipment diagram of the solvent-free DCPI process. Major pieces of equipment include the reboiler, distillation column, condenser, water scrubber, and nitrogen preheater (optional).

Specific flowsheet information is presented in Manufacturing Division's report.



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FIGURE VI-C

SOLVENT-FREE DCPI PROCESS

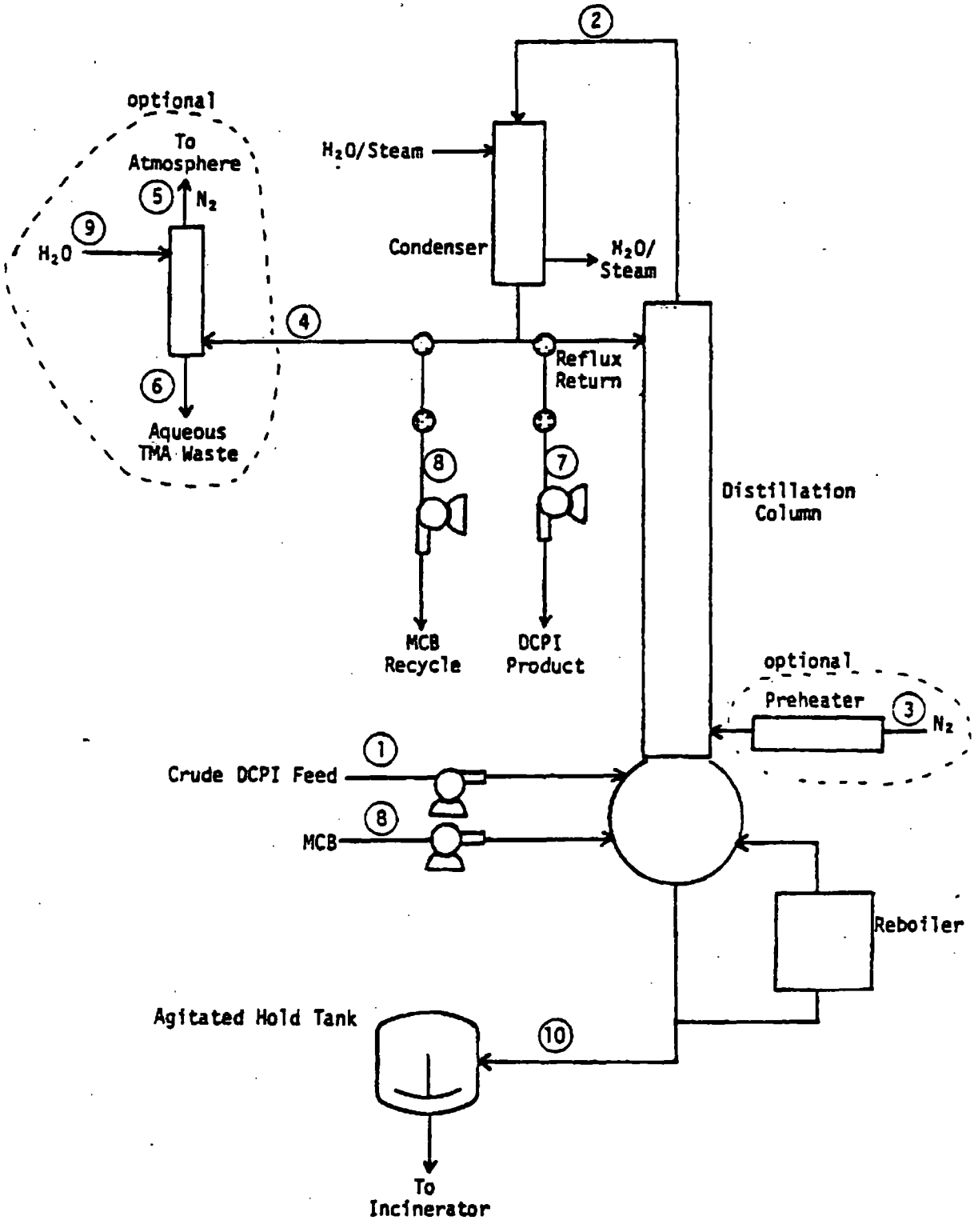

TABLE VI-C

BATCH DISTILLATION PROCESS FLOWSHEET

| Stream No. | Stream Composition |
|---|---|
| 1 | Feed Stream - Crude DCPI |
| 2 | MCB Overhead |
| 3 | Nitrogen Purge |
| 4 | TMA-Related Solids |
| 5 | Scrubbed $N_2$ |
| 6 | Aqueous TMA Waste |
| 7 | DCPI Product |
| 8 | MCB |
| 9 | $H_2O$ to Scrubber |
| 10 | Column Bottoms |

Compositions, temperatures and pressures of streams are detailed in Manufacturing Division's report.



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## VII. ALTERNATE PROCESSES INVESTIGATED

### A. Alternate Catalysts for DCA Phosgenation

Scouting experiments were run in an effort to find a phosgenation catalyst to replace TMA. By eliminating TMA addition, the TMA-related solids problems could be avoided.

#### 1.0 Anisole

The use of anisole as a catalytic solvent for DCA phosgenation is reported in BCD-80-29. No solids problems were encountered in the DCPI/anisole distillation step. However, switching to anisole solvent would mean major modifications of the existing Houston process, not economically justified at this time. Anisole was also considered as a catalyst in MCB solvent, but results of phosgenation studies using anisole in xylene (GCD-51-148) were unsuccessful because of excessive levels of bis-urea (4-6%) in the product. Significantly better results were not expected with anisole in MCB.

#### 2.0 Dimethyl Formamide (DMF)

DMF showed catalytic activity in laboratory phosgenations of DCA (addition rate: 1.2 g DMF/100 g DCA). It was rejected as an alternate catalyst because it reacted with DCA to form amidate solids. Column pluggage problems could be expected. Also, unless the DMF addition rate could be brought down below 0.06 g/100 g DCA, the amidate concentration in linuron could potentially exceed 0.1%, possibly requiring re-registration.

#### 3.0 Tributylamine (TBA)

Laboratory phosgenations of DCA were conducted using TBA as a catalyst (addition rate: 3.1 g TBA/100 g DCA). Although TBA showed catalytic activity, it was rejected as an alternate catalyst because of its high reactivity (due to its α-hydrogens). It was felt that numerous compounds would be formed in the phosgenator, some of which would probably end up in the linuron and diuron products. At TBA addition rates as low as 0.1 g TBA/100 g DCA, TBA-related impurities would likely be present in linuron and diuron at levels above 0.1%. Toxicological testing and re-registration of linuron and diuron might be needed.

#### 4.0 Tertiary Amine Resin

Use of a weak anion resin (Amberlite IRA-94, Rohm and Haas Co.) as a catalyst for DCA phosgenation was attempted in the laboratory. An excessive amount of solids (approximately 250 g/L), presumably DCA·HCl and bis-urea, formed during the phosgenation reaction. Use of a heterogeneous catalyst was not investigated further.

### B. Pretreatment of Houston Crude DCPI

The following methods of removing the solids prior to distillation were attempted in the laboratory.



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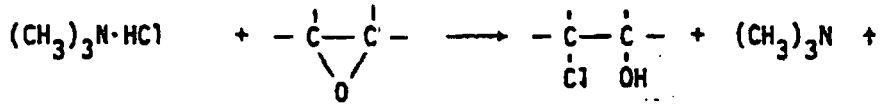
## 1.0 Epoxol Oils

1 weight percent Epoxol 9-5 (epoxidized linseed oil) was added to Houston Crude DCPI. The mixture was agitated and heated to reflux. Even at room temperature, TMA evolution was observed. The rate of TMA evolution increased as the temperature of the mixture increased. After approximately 1 hour, gas evolution ceased. The treated material was then distilled under vacuum (P = 50 mm Hg). No TMA-related solids were observed in the column. The Epoxol oil formed a homogeneous liquid mixture with the DCPI/tars bottoms, suitable for disposal by incineration.

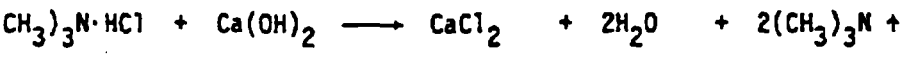
Epoxol oil treatment had no adverse effect on the quality of the solvent-free DCPI product distilled overhead. No trace of any Epoxol-related impurities was found in the DCPI product by GC/MS (R. W. Reiser). However, treating the crude DCPI with Epoxol oil increased the rate of DCPI decomposition to tars by 30% at 200°C (from ~8% DCPI lost per hour to ~11% DCPI lost per hour).



TMA hydrochloride — epoxy group — chlorohydrin group — TMA

## 2.0 Calcium Hydroxide

3 weight percent calcium hydroxide was added to Houston crude DCPI, agitated, and heated to reflux evolving TMA. The treated material was distilled at P = 50 mm Hg. No TMA-related solids were observed in the column. Calcium chloride solids remained in the bottoms along with the high-boiling tars.



TMA hydrochloride — calcium hydroxide — calcium chloride — water — TMA

## 3.0 Molecular Sieves

A sample of crude DCPI (room temperature) was passed through a 1-ft length of 1-inch diameter bed packed with 10A molecular sieves. Subsequent distillation of the treated crude indicated that the majority of the solids had not been removed.



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4.0 Ion Exchange Resin

Crude DCPI (room temperature) was treated by passing through a 1-ft length of 1-inch diameter resin bed containing Dowex® cation exchange resin MSC-1-H in the H+ form (Dow Chemical Co.), recommended by B. W. Page of Engineering Department. The crude solidified in the column (and shortly after exiting the column). The acidity of the resin catalyzed polymerization of DCPI. It was impossible to distill the treated crude.

5.0 Activated Carbon

Pretreating crude DCPI with activated carbon did not remove the solids. A yield loss of approximately 3% resulted from adsorption of DCPI onto the activated carbon.

6.0 Addition of Sulfuric Acid

In an attempt to tie up the volatile TMA-related compounds as non-volatile sulfate salts, concentrated sulfuric acid (98%) was added to a sample of crude DCPI at the level of approximately 0.04% by weight. Solids were observed in the column during distillation of the treated crude. Furthermore, addition of sulfuric acid increased the rate of DCPI polymerization in the pot.

C. Vacuum Flash Process

It was observed that when approximately 70% of the MCB present in the crude was flashed overhead, the remaining DCPI was free of TMA-related solids and could be distilled without column pluggage. The Vacuum Flash Process was designed as two vacuum flash tanks followed by a product purification (distillation) column. See Figure VII-C-1.1. Two flash tanks are necessary to produce a bottoms stream containing 98% DCPI and 2% tars. Flash tank (1)(P = 100 mm Hg, T = 98°C) splits the crude DCPI into an overhead stream containing 6% DCPI and a bottoms stream containing 78% DCPI. The bottoms stream is fed to flash tank (2) (P = 50 mm Hg, T = 130°C) where it is split into an overhead stream containing 63% DCPI and all of the TMA solids, and a bottoms stream containing approximately 98% DCPI. Pure DCPI is separated from high-boiling tars and any residual MCB via distillation. The overhead streams from both flash tanks could be sent to Houston's amination process or returned to the phosgenator.

A laboratory batch simulation of the continuous vacuum flash process showed that the TMA-related solids were, as predicted, removed in the second flash. No solids problems were encountered in the product column distillation. High quality DCPI (>99% DCPI by IR, G. S. Walser) was obtained overhead.

The major advantages of the Vacuum Flash Process are:

1) low holdup time; therefore tar formation is minimized.

2) process is continuous.

However, the investment requirements may be substantial.

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D. Solventless Phosgenation

The possibility of using existing ICL/TCL facilities at Chambers Works to run a solventless phosgenation of DCA to DCPI was investigated. The two major advantages of this process are:

- low investment
- phosgene and DCA are manufactured at Chambers Works

The solventless phosgenation route was not demonstrated in the laboratory. There is considerable uncertainty regarding DCA and phosgene yield to DCPI. For a description of the process and high-spot economics, see Appendix H.



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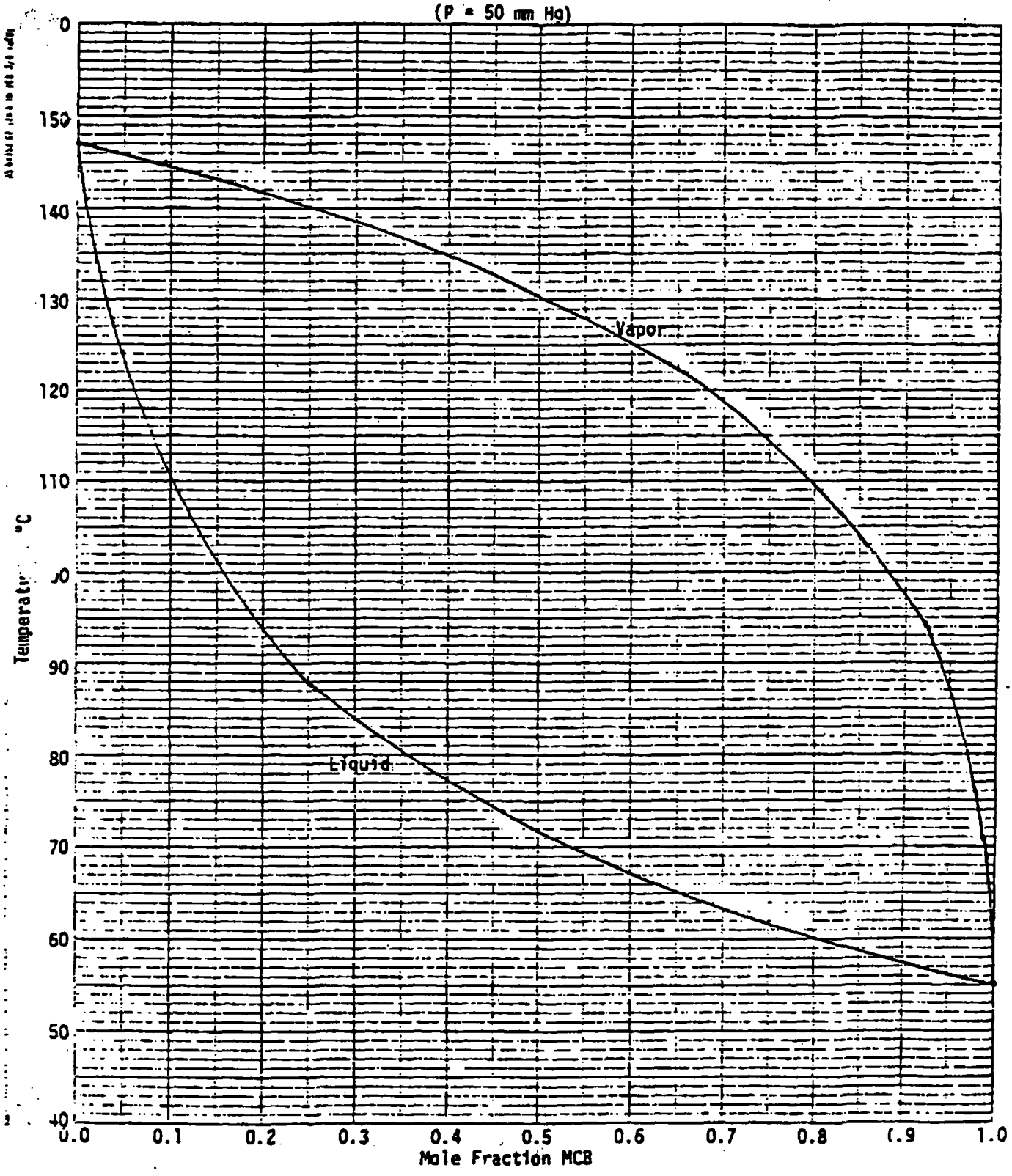
# APPENDICES

## APPENDIX A

## VAPOR-LIQUID EQUILIBRIA OF MCB/DCPI

(P = 50 mm Hg)



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## APPENDIX B

## BOILING POINTS OF DCPI/TARS AT 50 mm Hg

| % DCPI | % Tars | Boiling Point, °C (Approximate) |
|---|---|---|
| 100 | 0 | 147 |
| 96 | 4 | 153-154 |
| 70 | 30 | 173-175 |
| 50 | 50 | 185-190 |
| 40 | 60 | 195-200 |
| 30 | 70 | 208-212 |



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## APPENDIX C

### PRESSURE DIFFERENTIAL SCANNING CALORIMETRY (PDSC) ANALYSIS OF DCPI

Three samples obtained from the Engineering Test Center semiworks-scale column (nickel valve trays) were submitted to J. R. Kosak of C&P Department for PDSC analysis to check thermal stability:

(1) Column bottoms containing MCB, tars, and DCPI
(2) DCPI product (overhead)
(3) Feed solution: DCPI in MCB

All samples showed excellent thermal stability up to 400°C.



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8-11846 REV. 13-71

DU PONT

I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

BIOCHEMICALS DEPARTMENT
EXPERIMENTAL STATION

APPENDIX D

cc: W. J. Cordes/R. J. Bassett
V. A. Engelhardt/B. G. Julin
D. D. Schlueter
324 File R-2

January 9, 1980

T. A. Rensi
Building 335

Vapor Pressure of
Bis 3,4-dichlorophenylurea and
Bis 3,4-dichlorophenylcarbodiimide

The vapor pressures of bis 3,4-dichlorophenylurea and bis 3,4-dichlorophenylcarbodiimide were measured using the Du Pont Model 916 Thermal Evolution Analyzer. The data are attached.

It should be noted that the diimide sample used was of questionable purity as was verified by TLC using silica gel plates and a methylene chloride/cyclohexane (1:4) developing solvent. At least three components were detected. This may result in an unacceptable degree of error in the measurement.

DR Keeler
D. R. Keeler

DRK/mhs

Att.



THERE'S A WORLD OF THINGS WE ARE DOING SOMETHING ABOUT

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## Vapor Pressure

| Bis 3,4-dichlorophenylurea | | Bis 3,4-dichlorophenylcarbodiimide | |
|---|---|---|---|
| T(°C) | Vp (mm Hg) | T (°C) | Vp (mm Hg) |
| 54 | $1.02 \times 10^{-3}$ | 36 | $4.66 \times 10^{-4}$ |
| 61 | $1.83 \times 10^{-3}$ | 39 | $6.80 \times 10^{-4}$ |
| 69 | $1.84 \times 10^{-3}$ | 46 | $1.20 \times 10^{-3}$ |
| 73 | $3.11 \times 10^{-3}$ | 54 | $1.59 \times 10^{-3}$ |
| 85 | $4.48 \times 10^{-3}$ | 68 | $2.17 \times 10^{-3}$ |
| 98 | $6.87 \times 10^{-3}$ | 81 | $7.55 \times 10^{-3}$ |
| 104 | 0.012 | 97 | 0.015 |
| 110 | 0.011 | 105 | 0.033 |
| 124 | 0.024 | 114 | 0.056 |
| 134 | 0.027 | 124 | 0.107 |
| 136 | 0.053 | 134 | 0.150 |
| 147 | 0.053 | | |



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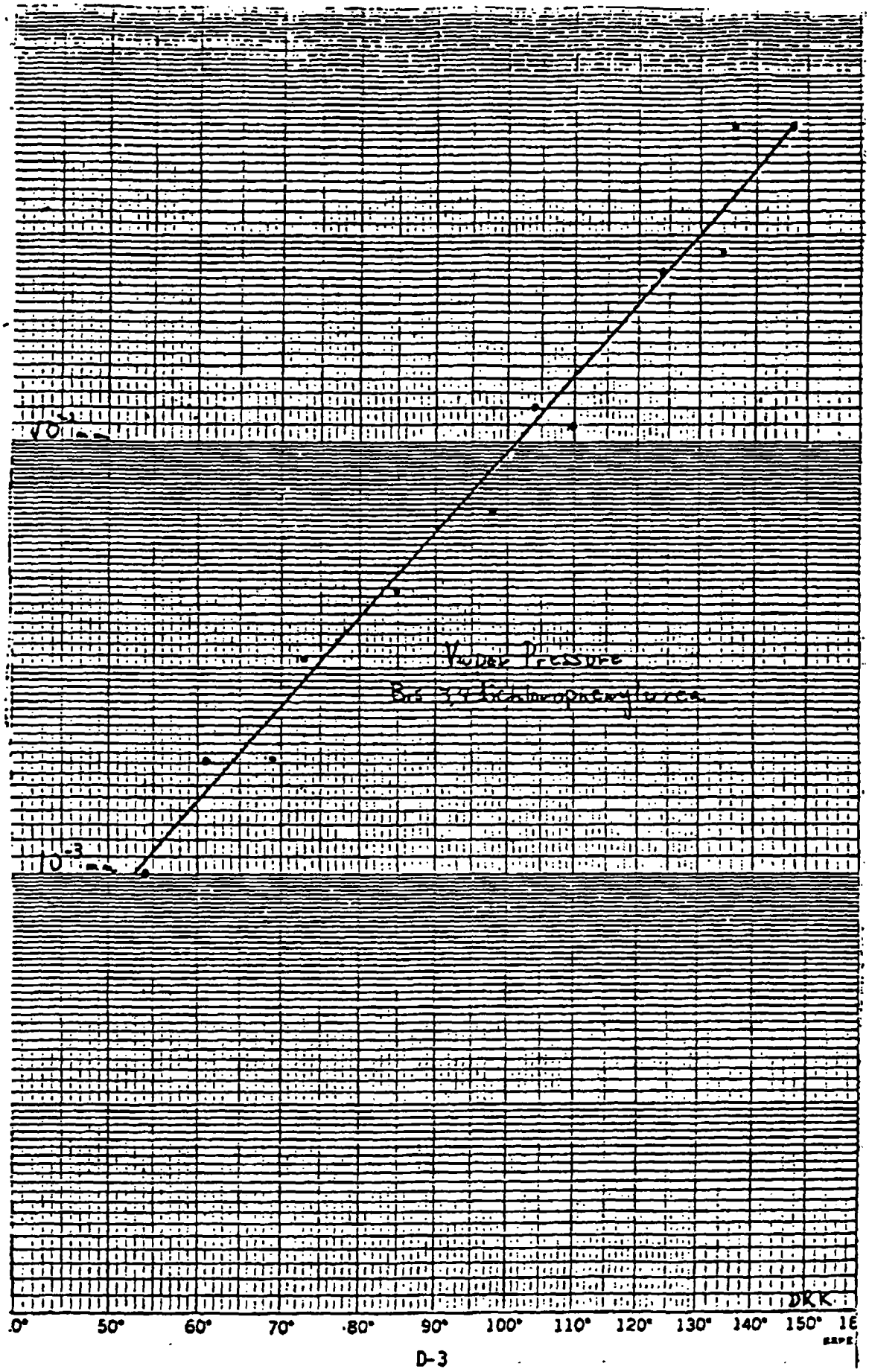


D-3

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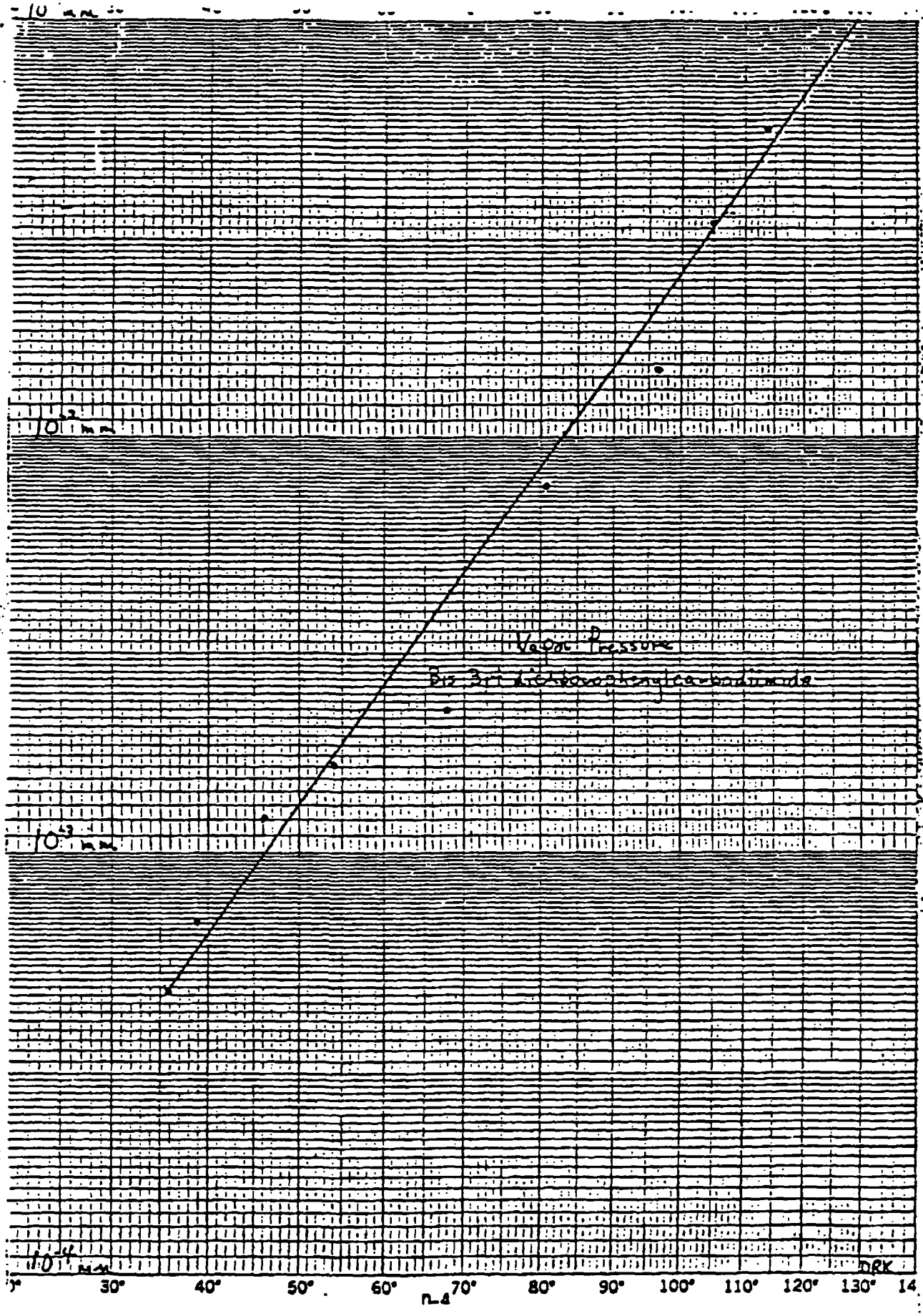


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## APPENDIX E

## CALCULATION OF NITROGEN NEEDED TO VOLATILIZE SOLIDS

(1) Calculation of $\Delta H_{vap}$ of TMA-related solids:

- Clausius-Clapeyron Equation:

$$\ln\left(\frac{p(T_2)}{p(T_1)}\right) = \frac{-\Delta H_{vap}}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

where:

$p(T_1)$ = vapor pressure of solids at temperature $T_1$, mm Hg
$p(T_2)$ = vapor pressure of solids at temperature $T_2$, mm Hg
$\Delta H_{vap}$ = heat of vaporization of solids, cal/g-mole
$R$ = ideal gas constant
$T_1$ = temperature 1, °K
$T_2$ = temperature 2, °K

- $\Delta H_{vap}$ of solids $= (1.987)\left[\frac{-\ln\left(\frac{700}{460}\right)}{\frac{1}{448} - \frac{1}{438}}\right] = 16{,}369$ cal/g-mole

where:

$T_1 = 165°C$ $\quad p(T_1) = 460$ mm Hg

$T_2 = 175°C$ $\quad p(T_2) = 700$ mm Hg

from Figure V-B-2.1.

- Assumed molecular weight of solids, based upon observation that ratio of dimethyl to trimethyl compounds is approximately 3:1 = 170 g/g-mole

$\therefore \Delta H_{vap} = 96.3$ cal/g = 173.3 BTU/lb

(2) Heat capacity of $N_2$ at 175°C = 6.95 cal/g-mole

- Molecular weight of $N_2$ = 28.01 g/g-mole

$\therefore$ Heat Capacity of $N_2$ at 175°C = 0.25 $\frac{cal}{g}$ = 0.45 $\frac{BTU}{lb}$



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(3) Amount of $N_2$ needed to volatilize solids, assuming that the $N_2$ enters at 200°C and leaves at 160°C:

$$\left[\frac{96.3 \text{ calories to volatilize 1 g solids}}{(0.25 \frac{\text{cal}}{\text{g}})(200°\text{C} - 160°\text{C})}\right] = \frac{9.63 \text{ lbs } N_2}{\text{lb solids}}$$

∴ For a 40°C $\Delta T$, need approximately 10 lbs of nitrogen to volatilize 1 lb of solids.



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B-11044 REV. 12-71

APPENDIX F

E. I. DU PONT DE NEMOURS & COMPANY
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T. A. Rensi, E335
D. R. Keeler/G. S. Walser, E324

February 29, 1980

To: M. G. Hammond

From: J. S. Ingerman JSI

SOLVENT REMOVAL STUDIES: DCPI/MCB CONTAINING TMA CATALYST
(Ref: Letter, GBB to GLB, 11/8/79)

In our urea herbicides process at Houston, dichloroaniline (DCA) is dissolved in monochlorobenzene (MCB) and phosgenated to dichlorophenyl-isocyanate (DCPI) using trimethylamine (TMA) as a catalyst. MCB is not removed prior to conversion of the DCPI to linuron and diuron. Successful removal of the solvent might yield DCPI that could be used in our foreign melt process diuron plants at a savings versus purchased DCPI. This letter is a progress report on our efforts to remove the solvent by distillation.

Summary

A. Distillation of synthetic DCPI/MCB solutions containing no TMA was a smooth operation. Good fractionation was achieved in a 15-plate Oldershaw column. Feed solutions containing approximately 30% DCPI were distilled to produce a 95% DCPI bottoms stream and a DCPI-free (<0.01%) overhead stream.

B. Distillation of actual Houston DCPI/MCB solutions containing TMA catalyst (addition rate 0.13 lbs TMA/100 lbs DCA) presented major operating problems as a result of solids formation in the column, causing pluggage of sieve plates and downcomers. Build-up was noted on both wetted and non-wetted surfaces and occurred throughout the column. Solids continued to accumulate until the column finally became inoperable.



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C. Use of a packed column smoothed the operation and extended the running time, but the plating out of solids on the column walls and packing made shutdown inevitable. However, 99% pure DCPI was recovered in the column bottoms.

D. By means of a special work-up procedure it was shown that the crude DCPI/MCB samples from Houston contained derivatives of not only TMA but DMA as well, in a 0.3:1 ratio. Phosgenation of TMA to dimethyl carbamyl chloride (DMCC), which is a Du Pont experimental carcinogen as well as a known phosgenation catalyst, is reported in the literature. However, DMCC in turn is likely phosgenated to various carbimmonium salts, so its concentration should be considerably less than that of the TMA charged, 0.02%.

E. Although it is difficult to translate these laboratory observations to commercial-scale operation, the problem of solids build-up and resulting shutdown seems inevitable regardless of the equipment size or TMA level. Only by eliminating the TMA can satisfactory column operation be assured.

Details

I. Experimental Conditions

A. Pressure

Vacuum distillations were carried out at 50, 100, and 200 mm Hg.

B. Reflux Ratios

0.2:1; 0.5:1; 1:1

C. Feed Rates

3-15 g/min. The feed solutions were pre-heated so that they entered the column near their boiling points.

D. Feed Origin

Houston Plant, 12/7/79 and 1/18/80 (T. M. Kohler).

E. Temperature Profiles

For P = 50 mm Hg: 50-110°C
For P = 100 mm Hg: 68-172°C
For P = 200 mm Hg: 87-200°C



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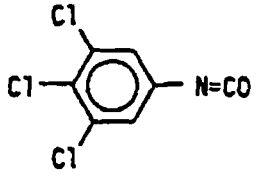
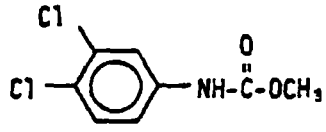
F. Feed Composition

IR analysis (G. S. Walser) showed that the feed solution (Houston crude DCPI) contained 28.0% DCPI, 0.27% phosgene, and 0.53% DCPCC. (No phosgene or DCPCC was detected in the MCB overhead or in the DCPI product.) GC/MS analysis (R. W. Reiser) showed the presence of acetone*, MCB, DCPI, linuron, bis 3,4-dichlorophenyl carbodiimide, and compounds with the following structures:




The bis-urea, if present, would not have been detected by either method.

II. Equipment

A. The equipment consisted of:

1. 20-plate Oldershaw column, 1-inch diameter, vacuum jacketed and silvered, sampling ports above every other plate (Synthetic solutions were distilled in a 15-plate column.)
2. Thermosiphon reboiler with sidearm heater
3. Magnetically operated "swinging-funnel" type reflux dividing head, vacuum jacketed
4. Condensing head, vacuum jacketed, cold water condenser
5. Thermowatch controller
6. Vacuum pump
7. Manometer
8. Manostat
9. Athena controller
10. Flex-o-pulse timer

A schematic diagram of the equipment setup is presented in the appendix.

*According to T. M. Kohler, acetone was used to rinse the jugs in which the samples were shipped.



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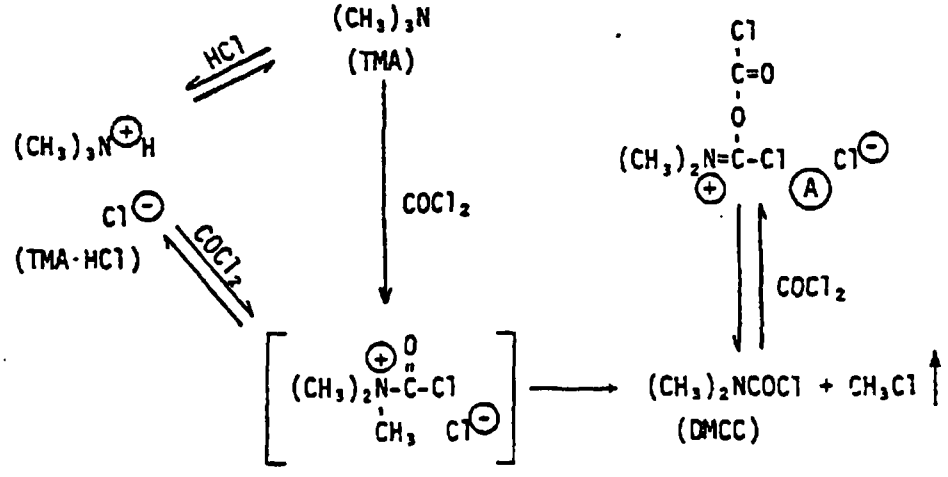
B. Packed Column: One distillation was performed in a packed column consisting of two 1-ft long, 19 mm I.D. sections of vacuum-jacketed column, each packed with 10.5 inches of 3/16-inch glass helices. Operation was somewhat smoother than with the Oldershaw column, but solids still plated out onto the glass helices as well as the column walls.

## III. Observations

Solids were not confined to any specific location in the column nor did they appear at any characteristic temperature. F. R. Haglid suggested the following hypothesis regarding the identity of the solids:

Scheme 1:




A sample of the Houston feed (sampled 1/18/80) was analyzed for TMA and DMA according to the procedure detailed in the appendix. Much of the TMA reportedly used (0.13 lbs TMA/100 lbs DCA) was accounted for as TMA plus DMA, which were present in 0.3:1 ratio. This suggests that a mechanism like the one proposed is indeed taking place since it is the most likely way that TMA can be converted to DMA. Thus the solids present in the column are probably a complex mixture of TMA·HCl and various carbimmonium salts such as (A). However, it was not possible to detect these salts in the solids collected from the column (by IR in Nujol mull) because of their unavoidable exposure to moisture and subsequent hydrolysis to methylammonium hydrochlorides during sample preparation. This hydrolysis probably occurs as follows:



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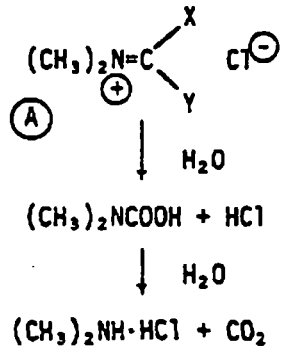
Scheme 2:




The fact that the solids did not seem to collect in any special zone in the column but were randomly distributed seems to reinforce the Scheme 1 hypothesis. Compounds like (A) should have low vapor pressure, but if an equilibrium exists between (A) and DMCC + $COCl_2$, unlimited mobility is possible.

## IV. Conclusions

Distillation of Houston DCPI/MCB solutions containing "TMA catalyst" presented major operating problems as a result of solids formation in the column. Although it is difficult to translate these results to plant-size equipment, it is felt that equipment pluggage would be inevitable. Thus it is recommended that plans for distilling Houston DCPI/MCB solutions containing "TMA catalyst" be discontinued.

JSI/slh



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## APPENDIX

### ANALYSIS OF TMA AND DMA IN HOUSTON FEED

The basic strategy used for the TMA/DMA analysis was: The crude Houston DCPI reaction mixture contains a number of acylating species, primarily DCPI, which can be reacted with methanol to form the corresponding methyl esters. Subsequent aqueous caustic hydrolysis will then recover the free amines from their derivatives. The amines can be distilled overhead into water titrated with dilute HCl, using phenolphthalein as an indicator. This indicator will discriminate between the strongly basic alkyl amines and the weaker DCA.*

In practice, to 50 mℓ of crude Houston DCPI reaction mixture, under controlled conditions, were added 50 mℓ of methanol. After completed exotherm, 50 mℓ of water and 50 mℓ of 50% caustic were added. The mixture was agitated and boiled (b.p. ~80°C) for 1/2 hour under a dry ice condenser and subsequently sparged with $N_2$. The distillate was trapped in water titrated with dilute HCl using phenolphthalein as indicator. 0.1 mℓ 1N HCl was consumed. This converts to an initial charge of approximately 0.01% TMA. The amine hydrochloride solution obtained was washed with $CH_2Cl_2$ and stripped to a small volume. This concentrate, after caustic addition, was analyzed by GC identifying TMA and DMA in a 0.3:1 ratio (D. R. Keeler).

*Direct hydrolysis without prior methanol addition would have liberated free DMA which would have immediately reacted with DCPI to form diuron, and could not have been distilled overhead.



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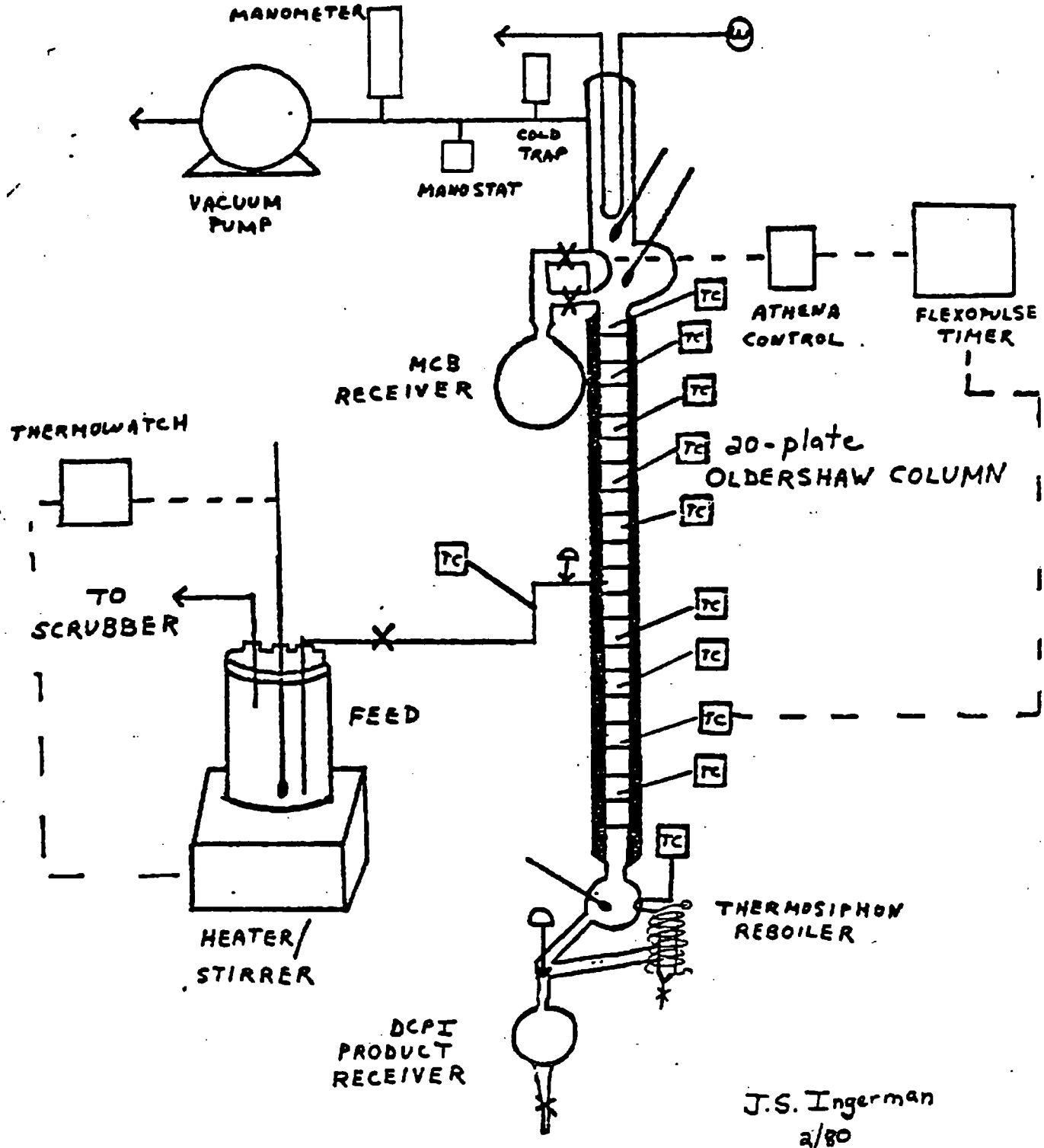
# MCB RECOVERY COLUMN




J.S. Ingerman
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N.B. 8011



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## APPENDIX G

## DECOMPOSITION OF DCPI TO TARS

The major yield loss of DCPI during distillation is the decomposition of DCPI to high-boiling "tars" in the pot. In order to predict DCP yield losses and to design hold time and pot composition for the continuous distillation process, samples of DCPI/tar mixtures were placed in sealed, evacuated glass polymer tubes and stored in an oil bath of constant temperature for a specified period of time.

The rate of DCPI decomposition was determined to be first order with respect to DCPI concentration when tars were present. DCPI that had been distilled overhead from the tars decomposed at a rate independent of DCPI concentration (zero order). This implies that the decumposition is catalyzed by the presence of tars, or of some intermediate decomposition product of DCPI. In call cases, the rate of DCPI decomposition showed an Arrhenius temperature dependence. Using the data presented in Table G-1, the following rate expression was calculated for DCPI containing tars:

$$-r_{DCPI} = 7.75 \times 10^{7} \, C_{DCPI} \, e^{-\left[\frac{(9.69 \times 10^{3})}{T}\right]}$$

where:

$-r_{DCPI}$ = rate of decomposition of DCPI, g moles/l hr

$C_{DCPI}$ = DCPI concentration, g moles/l

T = temperature, °K

DCPI distilled overhead from the tars decomposed at a much slower rate - approximately 0.02%/hr at 185°C (as reported in BCD 80-29).

The rate expression above should not be used to extrapolate decomposition rates for temperatures below 100°C or above 220°C. In addition, it should be noted that these decomposotopm tests were run in glass tubes. Possible catalytic effects of glass surfaces on DCPI polymerization have been seen.

Table G-1: DCPI Decomposition Studies

| Temperature (°C) | Time (hrs) | $C_{DCPI}$ (g moles/l) |
|---|---|---|
| 160 | 0 | 4.65 |
| | 1 | 4.48 |
| | 3 | 4.40 |
| | 6 | 4.09 |
| 200 | 0 | 4.65 |
| | 1 | 4.10 |
| | 3 | 3.50 |
| | 6 | 2.47 |



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FIGURE G-2

$\ln \frac{C_{DCPI}}{C_{DCPI,0}}$ vs. TIME

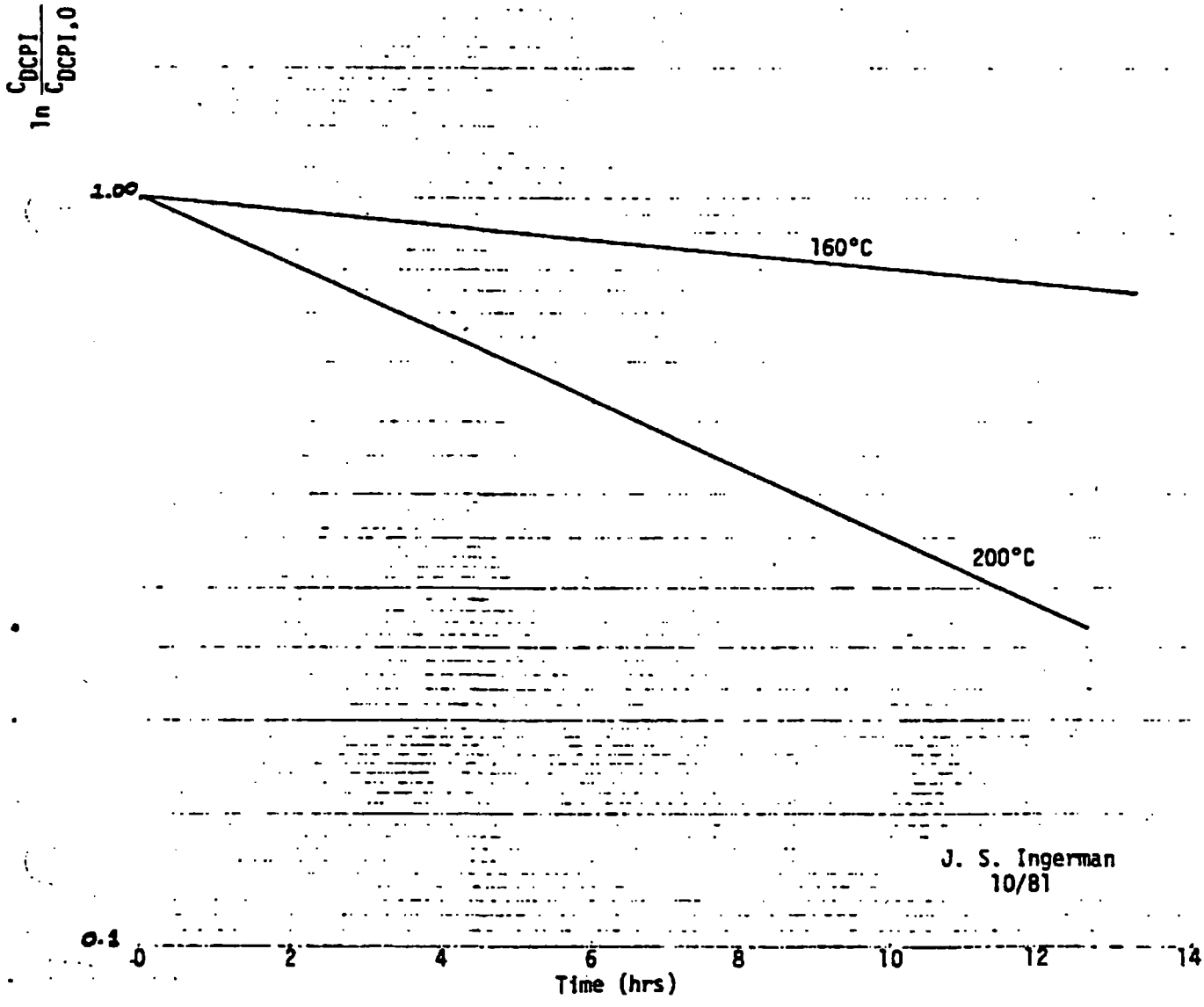


FIGURE 1

PROPOSED HOUSTON PROCESS

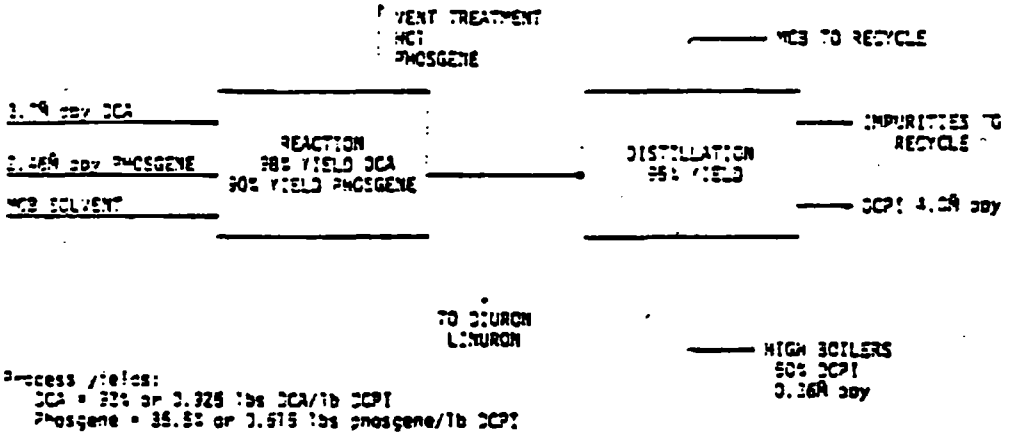
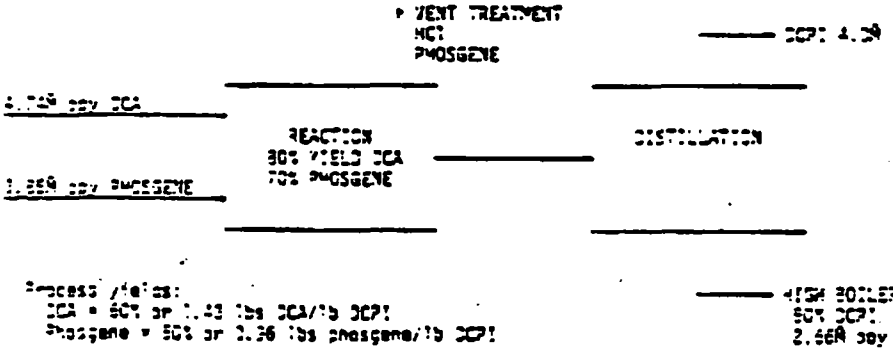



FIGURE 2

CHAMBERS WORKS SOLVENTLESS PROCESS



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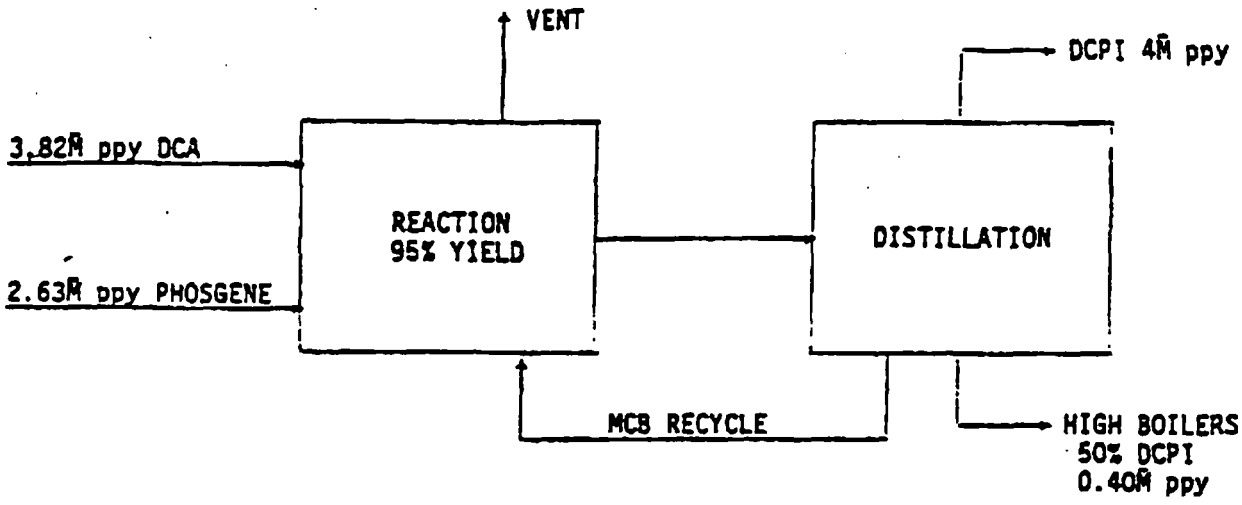
## CHAMBERS WORKS SOLVENT PROCESS




Process yields:
DCA = 90% or 0.95 lbs DCA/lb DCPI
Phosgene = 80% or 0.65 lbs phosgene/lb DCPI



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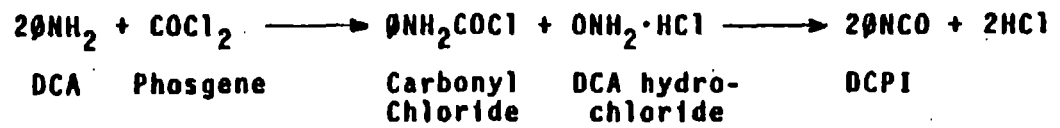
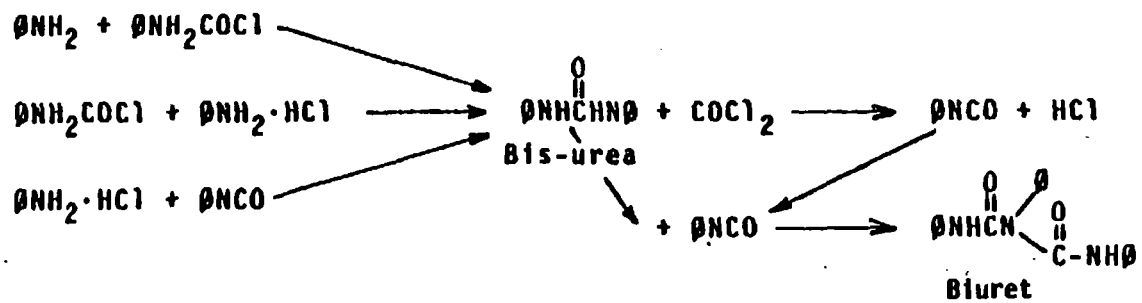
## CHEMISTRY

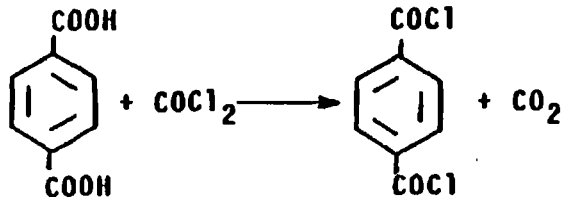
### DESIRED REACTION

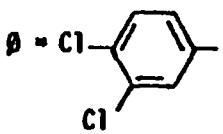



### BY-PRODUCT REACTIONS




### TCL CHEMISTRY



# DCPI PROCESS USING ANISOLE AS CATALYTIC SOLVENT

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## 1. INTRODUCTION

This report documents the development of a continuous process for making 3,4-dichlorophenyl isocyanate (DCPI) by the phosgenation of 3,4-dichloroaniline (DCA) using anisole as a solvent. DCPI is an intermediate in the manufacture of diuron and linuron herbicides at the Houston Plant and diuron at foreign affiliate plants. The Houston Plant makes DCPI for direct conversion to linuron/diuron without prior isolation from the monochlorobenzene (MCB) solvent. Solvent-free DCPI is presently purchased from Bayer for use in the foreign plants to produce diuron via the melt amination process. Full DCPI demand by the foreign affiliate is approximately 4.0MM ppy.

The Houston DCPI process currently uses monochlorobenzene (MCB) as the solvent and trimethylamine (TMA) as the phosgenation catalyst. An initial objective of this work was to eliminate the use of TMA, for two reasons: First, plant experience indicated that TMA·HCl sublimes and plugs off-gas lines. This problem would probably make the final two distillation steps of a CHI-type process impossible. Secondly, TMA itself will phosgenate to form dimethyl carbamoyl chloride (DMCC), which is classified by the American Conference of Governmental Industrial Hygienists (ACGIH) as an "industrial substance suspect of carcinogenic potential for man".

As an alternative to the MCB/TMA system, anisole by itself was tried and found to be an effective catalytic solvent for the phosgenation step. Subsequently, recovery of DCPI from the anisole by distillation was studied. This report is a summary of the process development work done using anisole as the solvent.



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## II. RECOMMENDATIONS

We recommend that:

- Development work should be shifted toward expanding the current DCPI process at Houston to allow for the production of solvent-free DCPI for sale to our foreign affiliates. Cases to be evaluated include eliminating TMA catalyst, using alternate catalysts, and use of anisole solvent.



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## III. SUMMARY AND CONCLUSIONS

A.

All process steps were demonstrated to be feasible. However, additional work is needed on the final product distillation step to demonstrate column operation over extended periods of time. The rather rapid rate of DCPI loss in the column reboiler raised concern about possible residue handling problems during extended runs.

B. Anisole was demonstrated to be a catalytic solvent for the phosgenation of 3,4-DCA.

C. The dehydrohalogenation and phosgene stripping of the phosgenation product was demonstrated using a packed column.

D. The separation of anisole and DCPI by continuous distillation was demonstrated. However, this step will require vacuum operation

E. The continuous, vacuum distillation of crude DCPI was demonstrated in short runs. In these runs the high boiling residues were concentrated in the reboiler and pure DCPI was obtained overhead. In order to be sure of the handling characteristics, e.g. viscosity, of the residues, longer runs must be made.

Note: Elimination of this step is possible if the quality of the DCPI from the solvent removal step is satisfactory.

F. DCPI was found to be relatively unstable in the presence of concentrated process residues at 190°C. Therefore, the holdup time in the product column reboiler must be kept short in order to minimize yield loss. Additional work is needed to better understand and possibly reduce the instability of DCPI in the residues.



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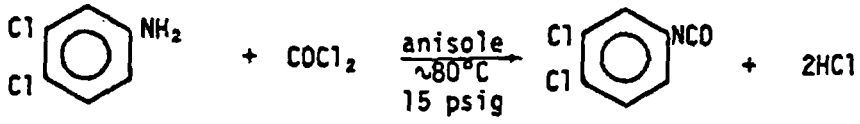
## V. EXPERIMENTAL DETAILS

### A. Reactions

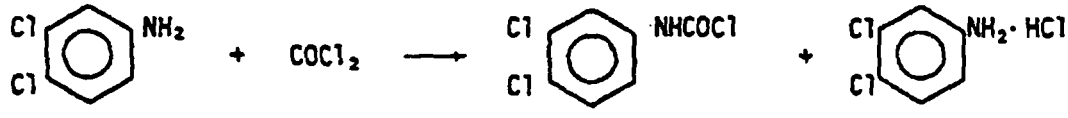
1. Main reactions involved in the formation of 3,4-dichlorophenyl isocyanate are:

The overall reaction for DCPI formation is

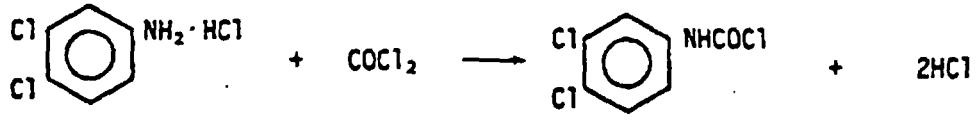



| 3,4-dichloro-aniline (162.02) | phosgene (98.92) | 3,4-dichloro-phenyl isocyanate (188.01) | hydrogen chloride (36.47) |
|---|---|---|---|

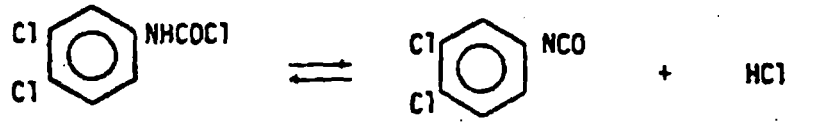
The intermediate reactions are




| 3,4-dichloro-aniline (162.02) | phosgene (98.92) | 3,4-dichloro-phenyl carbamoyl chloride (224.48) | 3,4-dichloro-aniline hydrochloride (198.49) |
|---|---|---|---|




| 3,4-dichloro-aniline hydrochloride (198.49) | phosgene (98.92) | 3,4-dichloro-phenyl carbamoyl chloride (224.48) | hydrogen chloride (36.47) |
|---|---|---|---|




| 3,4-dichloro-phenyl carbamoyl chloride (224.48) | 3,4-dichloro-phenyl isocyanate (188.01) | hydrogen chloride (36.47) |
|---|---|---|



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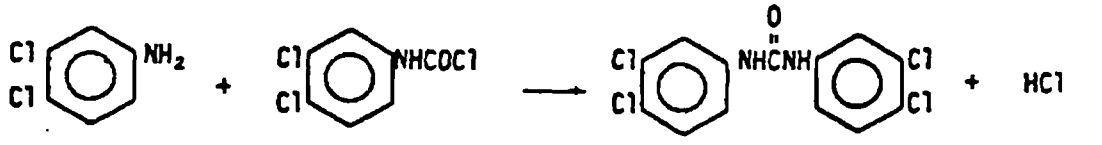
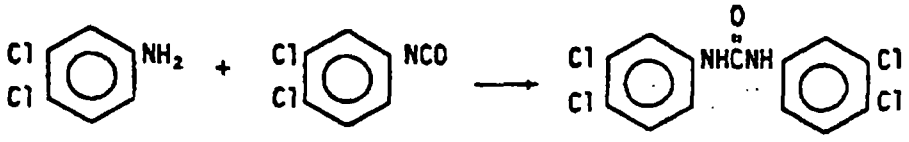
2. The known side reactions are:

The formation of bis-3,4-dichlorophenyl urea (primary side reaction)



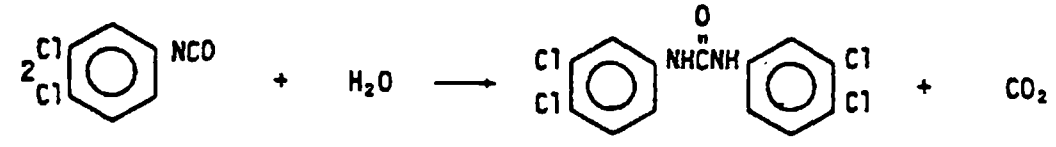
3,4-dichloro-aniline (162.02) + 3,4-dichlorophenyl carbamoyl chloride (224.48) → bis-3,4-dichlorophenyl urea (350.03) + hydrogen chloride (36.47)

or



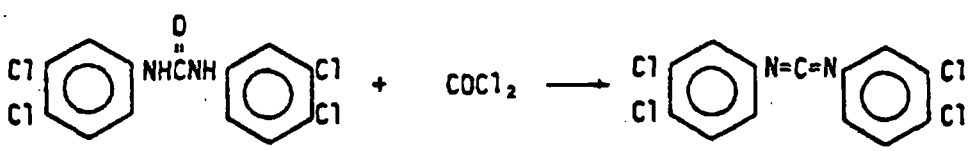
3,4-dichloro-aniline (162.02) + 3,4-dichlorophenyl isocyanate (188.01) → bis-3,4-dichlorophenyl urea (350.03)

or



3,4-dichlorophenyl isocyanate (180.01) + water (18.02) → bis-3,4-dichlorophenyl urea (350.03) + carbon dioxide (44.01)

The formation of 3,4-dichlorophenyl carbodiimide



bis-3,4-dichlorophenyl urea (350.03) + phosgene (98.92) → 3,4-dichlorophenyl-carbodiimide (332.01)

+ $CO_2$ + 2HCl

carbon dioxide (44.01) hydrogen chloride (36.47)



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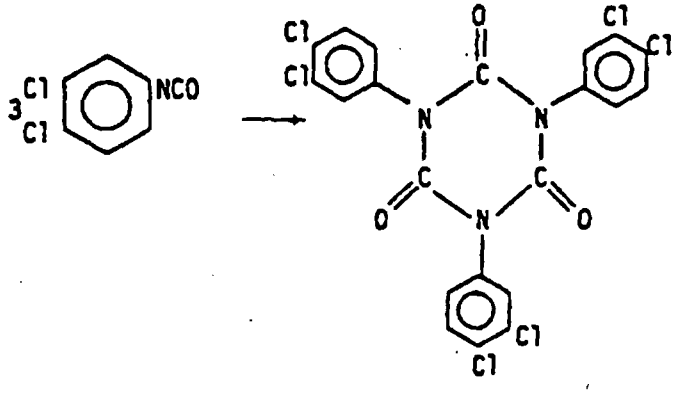
The formation of DCPI trimer



3,4-dichloro-phenyl isocyanate (188.01)

DCPI trimer (564.03)

B. Phosgenation Step

1. Objectives and Description

The objective of the phosgenation step study was to investigate the catalytic effect of anisole when used as the reaction solvent. The degree of catalytic effect of the anisole was determined by comparing results using it with runs made in monochlorobenzene (MCB) solvent with and without trimethylamine (TMA) catalyst. TMA is the current phosgenation catalyst used at the Houston Plant. Based on results obtained in our isocyanate pilot plant facility, anisole was found to be as effective as MCB plus TMA using comparable reactor conditions.

Phosgenation conditions similar to those of the Houston process were used. The continuous, stirred-pot reactor was equipped with an electrical heater, a recirculation loop, and two off-gas condensers in series (Fig. V-B-1). A 50% phosgene/MCB solution was fed to the reactor beneath the liquid surface. The DCA was fed as a 20% solution in MCB. This stream was fed into the periphery of a centrifugal pump in order to provide rapid and intimate mixing of the DCA with the reactor contents. The feed rates were set to give an approximate reactor holdup time of 1 1/2 hours. The phosgene feed rate was ratioed to the DCA feed rate to give the desired reactor phosgene concentration (between 5-15% phosgene). The reactor level was maintained by removing a product stream from the recirculation loop before the mixing pump. The vapors escaping the reactor (primarily HCl and phosgene) were passed through two brine-cooled (-10 to -20°C) condensers in series. Any liquid reflux was returned to the reactor through a rotameter. The uncondensed HCl and phosgene exited through the pressure control valve to a caustic scrubber.



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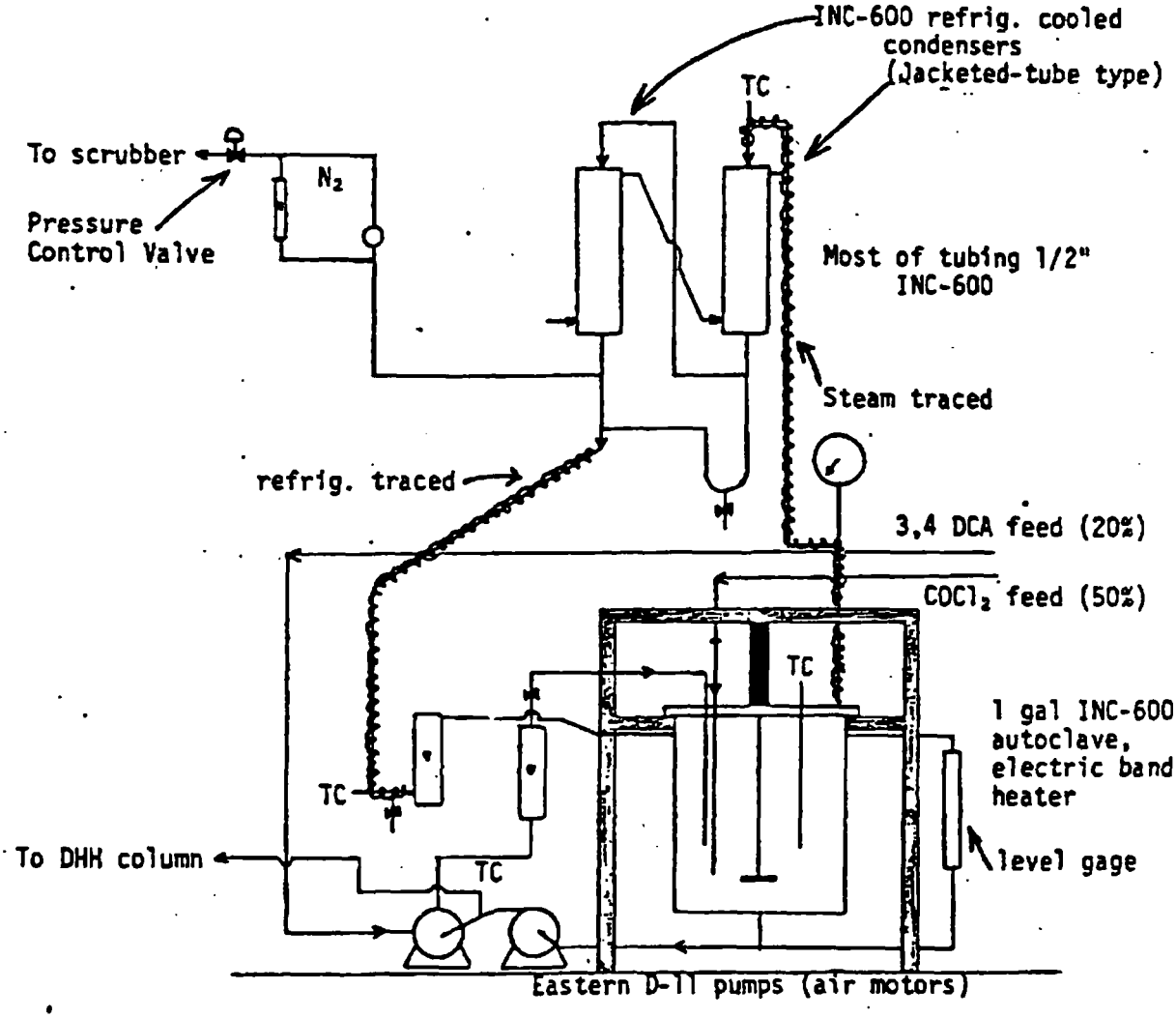
FIGURE V-B-1

DCPI REACTOR



The reactor was run at a temperature and pressure of 82°C and 15 psig, respectively. These conditions were chosen to approximate the temperature and pressure used in the Houston process. The temperature was held constant by adjusting the heat input to the reactor. The boilup rate was determined by the reactor phosgene concentration at a given temperature and pressure.

## 2. Discussion of Results

Two methods were used to measure the effectiveness of anisole as a catalytic solvent. The first method was to compare the yields obtained in anisole with those in MCB, both with and without TMA catalyst. The yield was determined by taking the steady state product and distilling it under reduced pressure until all the volatile material was gone. The remaining material was analyzed for DCPI to determine the residue weight. The distillation cuts were also analyzed for DCPI. The yield was then calculated as

$$Y = \frac{\text{DCPI}}{\text{DCPI + residue}}$$

In using this procedure the assumption was made that all the yield loss was to non-volatile impurities. This assumption was proven to be correct in the cyclohexyl isocyanate process development and in work done on DCPI by the Elastomers Department.

The second method was based on an analysis done by J. L. Fitzjohn (ETL) (Ref. 14 and 15). It assumed that the liquid phase phosgenation of DCA involved two competing reactions:

$$\text{DCA} + \text{COCl} \xrightarrow{k_1} \text{DCPI} \qquad \text{I.}$$

$$\text{DCA} + \text{DCPCC} \xrightarrow{k_2} \text{urea} \qquad \text{II.}$$

Assuming perfect mixing of the DCA in the phosgenator, the DCPI yield is determined by the ratio of the rate constants $k_1$ and $k_2$ and the molar ratio of phosgene and DCPCC. Thus DCPI yield can be maximized by running under conditions which result in high values for $k_1/k_2$ and $[COCl_2]/[DCPCC]$. Fitzjohn derived an expression for calculating $k_1/k_2$ knowing the yield and the concentration of phosgene and DCPCC in the reactor. This expression is

$$k_1/k_2 = \frac{Y + 1}{\{[COCl_2]/[DCPCC]\}(1-Y)}$$

where $Y$ = DCPI yield
$[\ ]$ = molar concentration

The ratio $k_1/k_2$ was calculated for runs using anisole as solvent and compared to the $k_1/k_2$ values obtained in MCB and in MCB + TMA. This comparison was used to evaluate the catalytic effect of anisole and TMA.

To illustrate the catalytic effect of TMA and anisole, a summary of the results for phosgenation runs in MCB, in MCB + TMA, and in anisole is given in Table V-B-1. The TMA concentration in the 20% DCA feed was



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Table V-B-1

REACTOR CONDITIONS AND RESULTS IN
MCB, MCB + TMA, AND ANISOLE

| Run#/Solvent | Temp. °C | Pressure psig | Boilup[1] g/g DCA | $COCl_2$/DCPCC Ratio | % $COCl_2$ | % DHH | $k_1/k_2$ | % DCPI Yield |
|---|---|---|---|---|---|---|---|---|
| #2/MCB | 82 | 15 | 0.5 | 2.8 | 8.0 | 61 | 3.5 | 80 |
| #3/MCB + TMA | 82 | 15 | 0.5 | 2.8 | 5.6 | 49 | 8.5 | 92 |
| #6/Anisole | 81 | 15 | 0.4 | 0.98 | 5.7 | 8 | 25 | 92 |

[1]Reflux plus vented vapors. Houston process boilup ~ 3.5 lb/lb DCA (~ 15% $COCl_2$ in phosgenator)

TABLE V-B-2

REACTOR CONDITIONS AND RESULTS IN ANISOLE

| Run #/Solvent | Temp. °C | Pressure psig | Boilup g/g DCA | $COCl_2$/DCPCC Ratio | % $COCl_2$ | % DHH | $k_1/k_2$ | DCPI % Yield |
|---|---|---|---|---|---|---|---|---|
| #1/Anisole | 81 | 15 | 3.4 | 3.3 | 14.9 | 23 | 11 | 95 |
| #2/Anisole | 81 | 15 | 3.2 | 2.8 | 13.8 | 25 | 35 | 98 |
| #3/Anisole | 80 | 15 | 1.2 | 1.7 | 10.9 | 9 | 19 | 94 |
| #4/Anisole | 90 | 20 | 1.4 | 1.5 | 10.8 | 10 | 18 | 93 |
| #5/Anisole | 81 | 15 | 0.4 | 0.93 | 7.0 | 7 | 30 | 93 |
| #6/Anisole | 81 | 15 | 0.4 | 0.98 | 5.7 | 8 | 25 | 92 |

2.8 g TMA/100 g DCA. (This level is much higher than that used in the Houston process - 0.17 g/100 g DCA.) The yield results in Table V-B-1 show that under nearly identical conditions anisole is as effective as TMA in catalyzing the phosgenation reaction. The yields in MCB + TMA and in anisole were significantly greater than in MCB alone. The results in Table V-B-1 were obtained at reactor phosgene concentrations of <8%. At higher concentrations such as used in the Houston process (~12% phosgene), the effect of the TMA catalyst would not be as readily seen.

Further evidence of the catalytic effect of TMA and anisole can be seen by comparing their $k_1/k_2$ values in Table V-B-1. The very high value of $k_1/k_2$ obtained for anisole indicates that it has a stronger catalytic effect than does TMA. (Anisole may be decreasing $k_2$ as well as increasing $k_1$; therefore, strictly speaking its catalytic effect may not be stronger than TMA's.) However, anisole has greater HCl solubility than does MCB. This results in less dehydrohalogenation of the DCPCC in the reactor (compare % DHH values in Table V-B-1). Therefore, some of the superior catalytic effect of anisole is negated by the lower $[COCl_2]/[DCPCC]$ ratio which results from its use.

A total of six reactor runs were made using anisole as the solvent/catalyst. A summary of the results using anisole is given in Table V-B-2. These results show that in order to obtain yields greater than 95% a $[COCl_2]:[DCPCC]$ ratio of approximately 3 is needed. Since the DCPCC is not readily dehydrohalogenated in anisole, reactor phosgene concentrations of greater than 12% will probably be needed to obtain high yields. An alternative to running at high phosgene concentrations in the reactor would be to reduce the DCPCC concentration. This can be accomplished by increasing the reactor boilup rate in order to more effectively strip HCl from the solution. Additional work would be necessary to determine the combination of reactor phosgene concentration and boilup rate needed to produce a $[COCl_2]/[DCPCC]$ ratio of $\geq 3$.

The values of $k_1/k_2$ shown in Table V-B-2 vary from 11 to 35. At constant temperature, $k_1/k_2$ should be constant for a given solvent/catalyst system. The variation seen in the anisole results is probably caused by the error introduced by dividing by (1-yield) when $k_1/k_2$ was calculated. However, in all the anisole cases $k_1/k_2$ was greater than that obtained for MCB + TMA.

Additional operating data and the reactor product compositions for the anisole runs and for two MCB runs are given in Table V-B-3. In all runs a reactor holdup time (HUT) of ~1 1/2 hours was used. This HUT was chosen because it was found to be sufficient for the CHI process. The Houston process has a HUT of ~35 minutes in the phosgenator. However, they get additional phosgenation in their dehydrohalogenation reboilers. No attempt was made to determine minimum HUT requirements for the phosgenation reaction in anisole.

In all the anisole runs, the reaction solution appeared clear (solid free) when viewed through the rotameter tube. The reactor product was a clear, brown colored liquid, but upon cooling solids would precipitate.



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TABLE V-B-3

REACTOR OPERATING DATA FOR ANISOLE AND MCB RUNS

| | Anisole | | | | | | MCB | |
|---|---|---|---|---|---|---|---|---|
| | #1 | #2 | #3 | #4 | #5 | #6 | #2 | #3 (+ TMA) |
| Temp. exit mixing pump, °C | 80 | 80 | 79 | 88 | 80 | 80 | 82 | 82 |
| Vapor temp. before 1st condenser, °C | 80 | 87 | 75 | 75 | 72 | 78 | 71 | 75 |
| Reflux temp., °C | 9 | 7 | 11 | 11 | - | - | - | - |
| 20% DCA feed rate, g/min | 8.4 | 8.9 | 11.6 | 11.6 | 17.0 | 17.9 | 8.1 | 11.9 |
| 50% $COCl_2$ feed rate, g/min | 10.2 | 8.6 | 9.4 | 9.4 | 9.7 | 9.7 | 9.6 | 9.2 |
| Product rate, g/min | 17.7 | 15.3 | - | - | - | - | 20.2 | 18.7 |
| Recirculation rate, mℓ/min* | 700 | 700 | 750 | 750 | 900 | 650 | 750 | 750 |
| Reflux rate, g/min | 5 | 5 | 2 | 2-3 | 0 | 0 | 0 | 0 |
| Vent rate, g/min | 0.7 | 0.7 | 0.7 | 0.7 | 1.5 | 1.5 | 0.8 | 0.8 |
| Mixing pump rpm* | 1400 | 1400 | 1400 | 1400 | 1400 | 1400 | 1400 | 1400 |
| Agitator rpm* | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| Product composition | | | | | | | | |
| % DCPI | 2.6 | 3.2 | 1.2 | 1.4 | 1.1 | 1.0 | 4.2 | 5.5 |
| % DCPCC | 10.2 | 11.3 | 14.4 | 16.1 | 17.2 | 13.2 | 6.5 | 4.5 |
| % $COCl_2$ | 14.9 | 13.8 | 10.9 | 10.8 | 7.0 | 5.7 | 8.0 | 5.6 |

*These variables changed as much as ±25% during runs.

These solids were identified by IR to be DCPCC. In Run #3/MCB, which used TMA catalyst, the reactor product was clear and solid free until it cooled. However, Run #2/MCB (without TMA) produced a solution which appeared cloudy through the recirculation rotameter. The reactor product contained fine solids which were identified by IR to be a mixture of DCPCC and urea.

No corrosion tests were conducted during the anisole runs. However, materials found to be acceptable for the MCB solvent process should be acceptable with anisole. Hastelloy C-276 would be a conservative choice for metal equipment.

C. Dehydrohalogenation/Phosgene Stripping Step

1. Objectives and Description

There are two objectives in the dehydrohalogenation (DHH)/phosgene stripping step. The first is to thermally split DCPCC to DCPI and HCl and then separate the HCl from the DCPI. The second is to remove the phosgene from the reactor product. In the cyclohexyl isocyanate (CHI) process development, it was found that both these objectives could be accomplished by feeding the product to a packed column equipped with a reboiler and an overhead condenser. The stripping action of the column together with the temperature profile allowed for efficient dehydrohalogenation and phosgene removal. As discussed below, this method also proved to be very effective for dehydrohalogenating and removing phosgene from the reactor product of the DCPI process.

The DHH/phosgene stripping step was demonstrated using the equipment setup shown in Figure V-C-1. The reaction product (5-15% phosgene, 10-17% DCPCC, 1-3% DCPI) was continuously fed to the column. The column boilup was provided by a steam heated thermosiphon-type reboiler (shell and tube). The overhead condenser was cooled with warm water to allow phosgene and HCl to vent to the scrubber while retaining the anisole. The column operated smoothly except for the normal, large fluctuations in pressure drop. The column was operated at atmospheric pressure which differed from the CHI DHH column which operated at the same pressure as the reactor. Running the DCPI DHH column under pressure was not possible because the available steam was not hot enough to boil the DCPI/anisole solution above atmospheric pressure. Operating at atmospheric pressure also has the advantage of reducing any yield loss due to high reboiler temperatures (see Section D for details). Some flashing occurred in the column feed when the pressure was let down from 15 psig to atmospheric. However, the flashing was moderate due to the cooling of the stream which occurred before the let-down valve.

Operating under pressure should have little effect on the process other than raising the operating temperature. The DHH equilibrium will be shifted toward DCPCC, but this should be more than compensated for by the shift toward DCPI caused by the higher temperature.

2. Discussion of Results

A summary of column operating conditions and results is given in Table V-C-1. The column proved to be very effective both in removing phosgene and in dehydrohalogenating. This is shown in the low chloride



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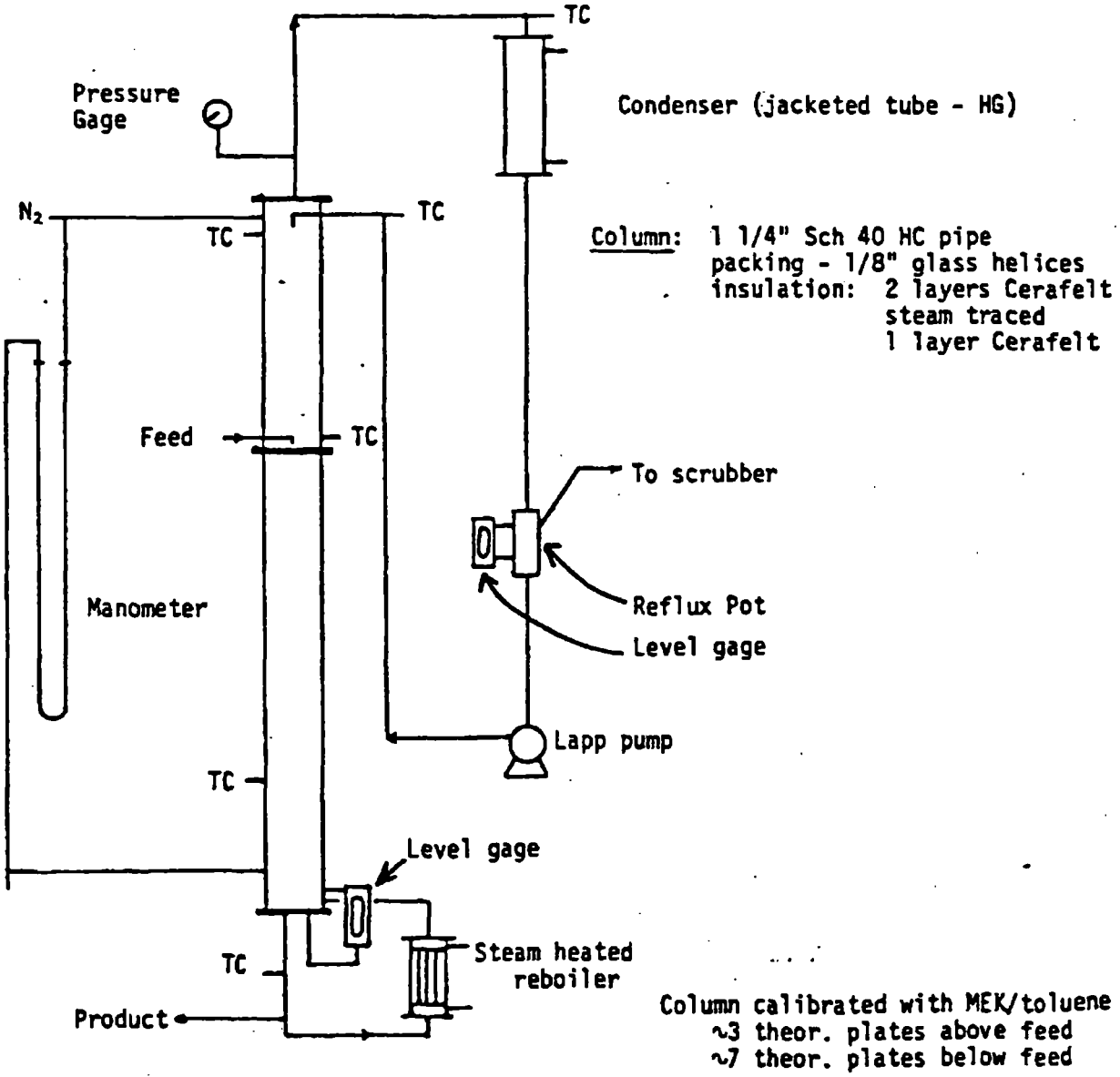
FIGURE V-C-1

DHH/PHOSGENE STRIPPING COLUMN



level (~100 ppm) of the column product. Thus, even though anisole has a relatively high HCl solubility as evidenced by the low degree of dehydrohalogenation product, the stripping action and thermal profile of the column readily dehydrohalogenated the DCPCC.

No corrosion tests were run on the DHH/phosgene removal column. However, as mentioned earlier, materials found to be acceptable for the MCB solvent process should be acceptable. A conservative choice for metal equipment would be Hastelloy C-276.



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TABLE V-C-1

DHH/PHOSGENE STRIPPING COLUMN DATA

| | Anisole Runs | | | |
|---|---|---|---|---|
| | Run #3 | Run #4 | Run #5 | Run #6 |
| Pressure, atm. | 1 | 1 | 1 | 1 |
| Temp., °C | | | | |
| Above reboiler | 156 | 155 | 157 | 156 |
| Feed section | 150-154 | 153 | 152 | 130-150 |
| Top of column | 100-140 | 100-150 | 90-130 | 90-140 |
| Water to condenser | 54 | ~55 | 57 | 57 |
| ΔP, inches anisole | 1-20 | 0.5-10 | 6-20 | 2-20 |
| Rates | | | | |
| Reflux, mℓ/min | 17 | 20 | 22 | 22 |
| Product, g/min | 18.4 | 16.4 | 22.9 | 23.0 |
| Compositions | | | | |
| Feed % DCPI | 1.3 | 1.4 | 1.1 | 1.0 |
| % DCPCC | 14.4 | 16.1 | 17.2 | 13.2 |
| % $COCl_2$ | 10.9 | 10.8 | 7.0 | 5.7 |
| Reflux % $COCl_2$ | 8 | 4.5 | 5.7 | 5 |
| Product % DCPI | 13.2 | 14.8 | 15.9 | 16.2 |
| %$COCl_2$* | <0.2 | <0.2 | <0.2 | <0.2 |
| % chloride | 0.011 | 0.01 | 0.005 | 0.005 |

*$COCl_2$ less than limit of detection

## D. Solvent Recovery Step

### 1. Objectives and Process Description

The objective of this study was to demonstrate the feasibility of removing anisole from DCPI by distillation. Only a limited amount of starting material was available which circumscribed the extent of the study. Due to the high boiling point of DCPI, the distillation was run at a reduced pressure of 100 mm Hg (head pressure). This differed from the analogous step in the CHI process which operated at atmospheric pressure. As in the CHI process, the column was designed with a sidestream takeoff of purified solvent for recycle to the DCA feed stream and a "pasteurization" section to concentrate and remove any residual phosgene or HCl. Anisole containing 1% DCPI was withdrawn from the tenth plate above the reboiler. DCPI would have been reduced to non-detectable levels (<0.01% by IR) by drawing off from the fourteenth plate. No phosgene was detected (<0.01% by IR) in the overhead stream from the pasteurization section ("purge stream"); HCl was not analyzed for. DCPI and any high-boiling impurities were concentrated in the reboiler pot. In our work, anisole levels as low as 0.05% were found in the DCPI product.

The investigation of the solvent recovery step was carried out in the laboratory setup shown in Figure V-D-1. The feed solution was preheated and fed through a line heated with electrical tapes to the sixth plate above the reboiler of a 15-plate, 28 mm ID Oldershaw column. A thermosiphon reboiler with a sidearm electrical heater provided the necessary boilup. An electrical tape wrapped around the reboiler flask provided a secondary heat source. The heat input to the system was varied between 650 and 2300 cal/min to provide the desired boilup. A magnetic reflux divider activated by a Flexopulse timer enabled a sidestream of purified anisole to be taken off the tenth plate. The upper section of the column was designed as a pasteurization section and was operated at a high reflux ratio (L/V between 0.61 and 0.83) to concentrate and remove any residual phosgene or HCl fed to the system. Head pressure was maintained using a manostat. A dry ice/acetone cold trap and a Drierite drying tube were connected to the off-gas line.

The temperature of the liquid on the second plate above the reboiler was used to control the concentration profile in the column. A setpoint temperature of 155°C was chosen because it represented a liquid composition of approximately 85% DCPI. If the temperature of the liquid on the second plate rose above the setpoint temperature (indicating that DCPI was beginning to move up the column), the Athena controller was used to override the Flexopulse timer and provide more reflux below plate ten.

A thermowatch was used to monitor the reboiler pot temperature. Feed entered the column continuously at a preset rate as long as the reboiler pot temperature did not drop below the setpoint temperature (boiling point of pure DCPI). If it did, a warning light flashed and the feed line valve was manually turned off until the setpoint was regained.



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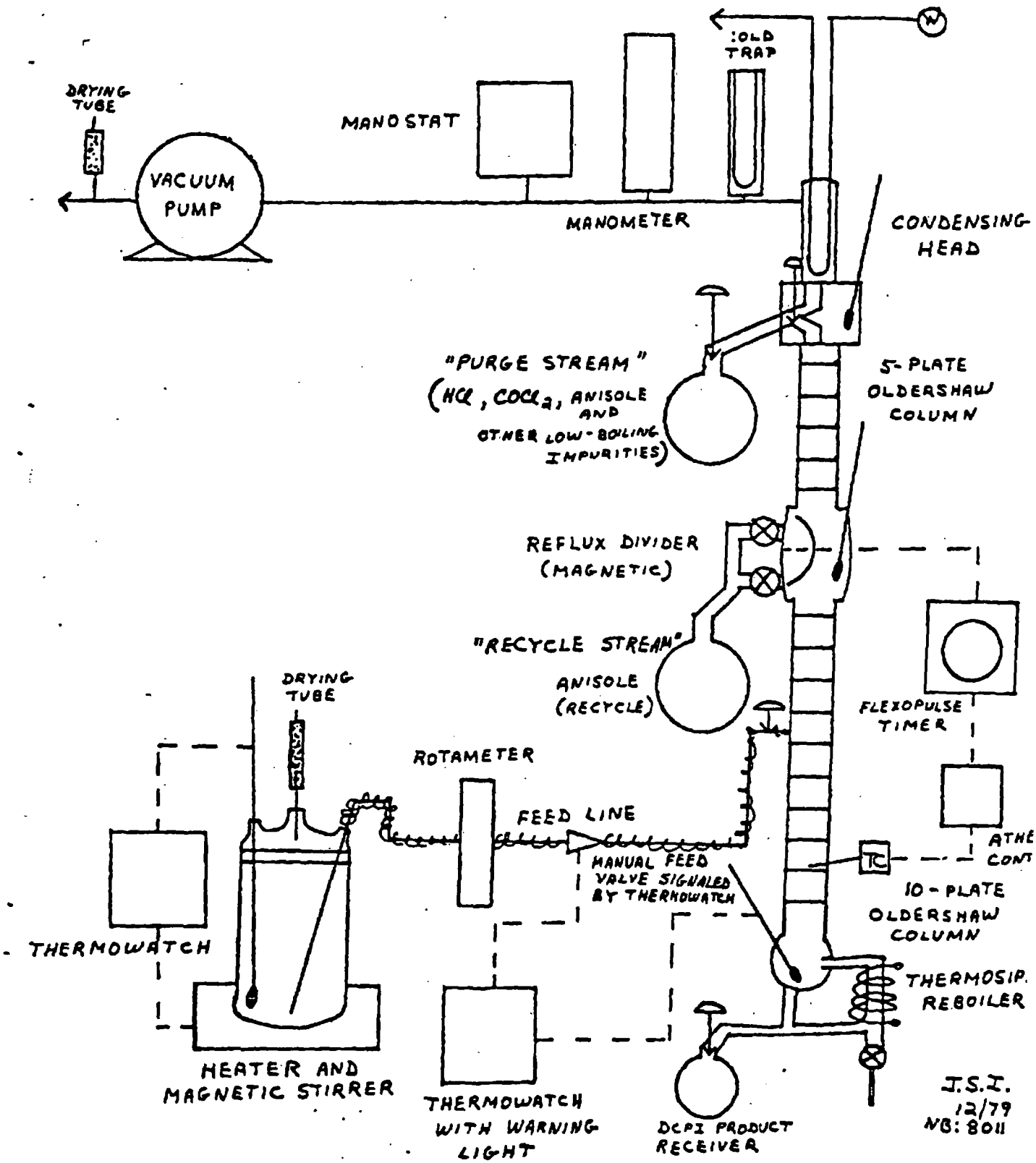
FIGURE V. D-1

# ANISOLE RECOVERY COLUMN

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## 2. Discussion of Results

Product from the dehydrohalogenation (DHH) column runs as well as synthetic DCPI/anisole solutions were used as feeds. The synthetic feed contained approximately 15% DCPI by weight; that obtained from the DHH column, from 12.0-14.6% DCPI. At the operating pressure (100 mm Hg) a 15% solution of DCPI in anisole boiled at approximately 103°C. It was found that feed temperatures between 90°C and 100°C gave the best column operation in terms of lack of flashing or flooding. The feed rate was varied from 10-20 g/min. At feed rates above 20 g/min the column flooded. 15-17 g/min gave smooth column operation with reasonably high throughput. Anisole boilup rate was adjusted to maintain a liquid holdup volume of 2-5 mℓ on each plate.

Table V-D-1 shows the relationship between the ratio of boilup to feed rate and product composition. It is evident that a higher boilup to feed rate ratio results in a DCPI product containing less anisole. (Why the product from the runs using synthetic feed assayed only 90% DCPI is unexplained at this time.)

From preliminary equilibrium calculations two feed plate locations were considered: the fourth plate above the reboiler and the sixth plate above the reboiler. (The equipment was not designed to handle feed entering on the fifth plate above the reboiler). The sixth plate was chosen as the feed plate because it gave a DCPI product containing less anisole than did the fourth plate. The reflux ratio (L'/V) measured at the magnetic reflux divider was varied between 0.06 and 0.33. Variation over this range did not significantly affect product quality. Column conditions for each run are presented in Table V-D-2.

Liquid samples were taken from several plates while the column was in operation. Three runs were performed at nearly identical column conditions (Boilup/Feed Rate = 0.95) using feed from the DHH column in order to obtain the typical composition profiles presented in Table V-D-3. Given these consistent results it is possible to predict the number of actual plates needed for effective column operation at a boilup to feed rate ratio of 0.95. Six actual plates including the feed plate are needed to produce a DCPI product containing less than 0.2% anisole. Eight actual plates are needed to provide an effective rectifying section resulting in an anisole recycle stream that is free of any detectable DCPI (<0.01% by IR). Our column was designed with a sidestream drawoff from the tenth plate and produced an anisole "recycle" stream containing approximately 1% DCPI. The figures in Table V-D-3 indicate that a sidestream drawoff above the fourteenth plate would produce an anisole recycle stream free of any detectable DCPI (<0.01% by IR). No phosgene was detected in the feed solutions from the DHH column (<0.22% by IR), nor was any phosgene detected in the overhead purge stream (<0.01% by IR). However, the concept of a pasteurization section for concentration and removal of phosgene and HCl should not be abandoned. The presence of a pasteurization section will protect the anisole recycle stream from contamination by phosgene and HCl through an upset in the DHH column.

The DCPI distillation product (from DHH column feed) contained approximately 90% DCPI, 2-8% 1,3-bis-3,4-dichlorophenyl urea ("bis-urea")*, and 0.15% anisole. Other high-boiling impurities detected by GC/MS included:

*Bis-urea probably formed in the phosgenation step.



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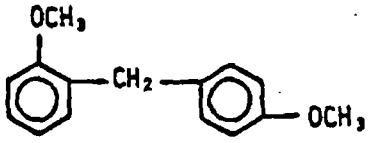
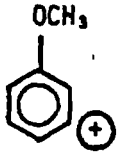
(a) 1-methoxy-2-(4-methoxyphenyl)methyl benzene: approximately 0.2%. This is a compound (MW 228) having the structure:




or isomers thereof.

(b) A compound with MW 200, which is 28 ($C_2H_4$ or CO) less than the above compound and has




as part of its structure. This compound was present at levels of approximately 0.2% by weight.

(c) Four unidentified impurities, eluted after DCPI. Each was present at a level of approximately 0.2% by weight.

The thermal stability of the DCPI distillation product from the DHH column feed was found to be significantly less stable than the DCPI distillation product from synthetic feed. A sample of 90% DCPI in anisole (synthetic) was kept at 165°C. No loss of DCPI was detected (by IR) after six hours. Table V-D-4 shows the decomposition rate of the DCPI distillation product from the DHH column feed at approximately 170°C (Initial DCPI concentration: 89.0%). In a repeat test at 45°C, about 5% of the DCPI was lost over a period of seven hours. However, it may be necessary to store the DCPI distillation product at approximately 60°C. Although the freezing point of pure DCPI is 41°C, solids were occasionally visible at temperatures as high as 55°C.



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Table V-D-1

| | Run # | Boilup Feed Rate | Product Composition % DCPI (IR) | % Anisole (GC) | % Bis-Urea (HPLC) |
|---|---|---|---|---|---|
| Synthetic Feed | 1 | 0.30 | 89.4 | 0.80 | - |
| | 3 | 0.93 | 92.9 | - | 0.72 |
| | 4 | 0.85 | 88.5 | - | 0.76 |
| | 7 | 0.95 | ~90 | 0.05 | - |
| DHH Column Feed | 8 | 1.0 | 93.9 | - | - |
| | 9 | 0.95 | 91.4 | - | 7.60 |
| | 10 | 0.95 | 89.0 | 0.13 | 4.92 |
| | 11 | 0.95 | 87.2 | - | 2.37 |

Table V-D-2

| | Run # | Feed Composition (% DCPI) | Feed Rate (g/min) | Feed Temp. (°C) | Boilup Feed | Purge Feed | Reflux Ratios L/V | Reflux Ratios L'/V | Product Composition (% DCPI) |
|---|---|---|---|---|---|---|---|---|---|
| Synthetic Feed | 1 | 15 | 10 | 60 | 0.30 | 0.10 | 0.67 | 0.07 | 89.4 |
| | 3 | 15 | 17 | 95 | 0.93 | 0.35 | 0.62 | 0.14 | 92.9 |
| | 4 | 15 | 20 | 90-95 | 0.85 | 0.33 | 0.61 | 0.06 | 88.5 |
| | 7 | 15 | 12 | 97-98 | 0.95 | 0.36 | 0.62 | 0.21 | ~90 |
| OHH Column Feed | 8 | 12.0 | 15 | 90-100 | 1.0 | 0.30 | 0.70 | 0.24 | 93.9 |
| | 9 | 14.6 | 10 | 90-98 | 0.95 | 0.16 | 0.83 | 0.30 | 91.4 |
| | 10 | 14.6 | 10 | 95-98 | 0.95 | 0.18 | 0.81 | 0.33 | 89.0 |
| | 11 | 14.4 | 10 | 90-95 | 0.95 | 0.27 | 0.72 | 0.28 | 87.2 |

TABLE V-D-3

| Run # | Feed % DCPI | Plate 4 % DCPI | Plate 8 % DCPI | Plate 10 % DCPI | Plate 12 % DCPI | Plate 14 % DCPI | Purge Stream % DCPI | Product % DCPI | Product % Anisole |
|---|---|---|---|---|---|---|---|---|---|
| 9 | 14.6 | 48.8 | 5.34 | 1.07 | 0.07 | <0.01 | <0.01 | 91.4 | - |
| 10 | 14.6 | 47.8 | 5.25 | 1.07 | <0.01 | <0.01 | <0.01 | 89.0 | 0.13 |
| 11 | 14.4 | 49.9 | 5.66 | 1.08 | 0.09 | <0.01 | <0.01 | 87.2 | - |

## E. Product Distillation Step

### 1.0 Objective and Description

The objective of this study was to demonstrate the production of pure DCPI by distillation of crude DCPI obtained from the solvent removal step. The distillation was carried out in a continuous fashion by feeding the crude DCPI to a column operating under reduced pressures of 50 or 100 mm Hg. Vacuum operation was used to reduce the operating temperatures and thereby minimize DCPI decomposition. The high boiling impurities present in the feed were concentrated in the column reboiler, and pure DCPI was obtained as the overhead product. In practice the concentrated residues would be removed from the column reboiler and either incinerated or further processed to recover additional DCPI.

In our work, residue containing as low as 30-35% DCPI was demonstrated to be fluid and free-flowing in the thermosiphon-type reboiler at 180-200°C. Overall column operability was demonstrated to be good. However, studies on DCPI stability in the reboiler residues indicated that decomposition of DCPI was relatively rapid. Thus, the reboiler hold-up time must be kept short to prevent high yield losses. Much additional work (hold-up time requirements, causes for DCPI decomposition, handling characteristics of residues, etc.) would be needed on this step before its feasibility could be established. The areas where further work is needed are discussed below.

The investigation of the product distillation step was carried out in the laboratory set-up shown in Figure V-E-1. Since the crude DCPI is a solid at room temperature, it was necessary to melt the feed and keep it hot in the feed lines. This was accomplished using the steam jacketed addition funnel and the "hot box" shown in the figure. The feed was introduced to the third plate above the reboiler of a 10 plate, one-inch diameter Oldershaw column. The boilup was provided by an electrically heated thermosiphon-type reboiler. The overhead reflux split was done using a standard distillation head. A vacuum pump was used to provide vacuum.

The crude DCPI feed for this step was not produced by the continuous distillation step of Section D. Rather a batch distillation was conducted to remove the solvent from DCPI/anisole solutions produced in DHH column runs. These distillations were carried out at 50 mm Hg to a final pot temperature of 144°C. The anisole content of the crude DCPI produced was reduced to between 0.1-1.0%.

### 2.0 Discussion of Results

Four product column runs were made. The primary objectives of the runs were to determine the general operability of the column and to determine the characteristics of the reboiler residue solution. Of particular interest were the minimum DCPI concentration needed to keep the reboiler solution fluid and the relationship between reboiler temperature and DCPI concentration. Although increasing DCPI reduces the boiling temperature, it is desirable to run with low concentrations to minimize DCPI loss in the residue purge.



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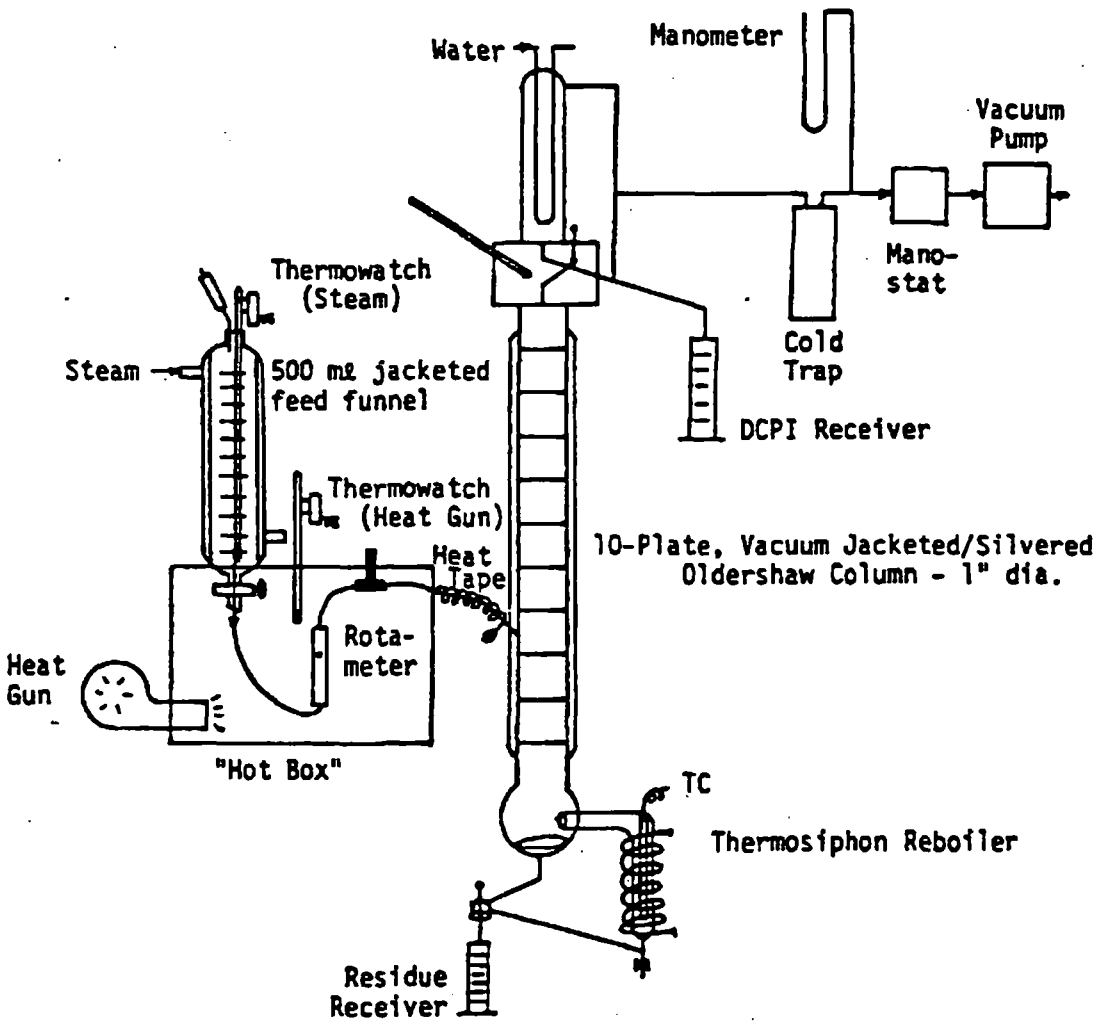
Table V-D-4

| Elapsed Time (hrs) | Temperature (°C) | % DCPI Lost (Analysis by IR) |
|---|---|---|
| 0.00 | 174 | 0.0 |
| 4.00 | 168 | 6.3 |
| 6.08 | 170 | 11.8 |
| 21.92 | 168 | 20.0 |
| 24.00 | 170 | 19.4 |
| 30.00 | 170 | 27.6 |

FIGURE V-E-1

PRODUCT DISTILLATION COLUMN



The data for the four runs are given in Table V-E-1. The first two were made at 100 mm Hg. However, the results indicated that this would require distillation temperatures well above 200°C in order to minimize DCPI losses in the residue purge. This can be seen in Run #1 where the DCPI concentration in the reboiler was 40% at a temperature of 199°C. Before proceeding to lower pressures, J. B. Jones (ESD Distillation Consultant) was consulted about the feasibility of operating at pressures below 100 mm Hg. Jones said 50 mm Hg was about the lower limit. Thus, Run #3 and #4 were operated at 50 mm Hg in order to reduce the column temperatures.

As can be seen in Table V-E-1, the lowest DCPI concentration reached was ~30% which corresponded to a reboiler temperature of 185°C at 50 mm Hg. Under these conditions, the residue was very fluid and free-flowing and the reboiler operated smoothly. Even lower DCPI concentrations undoubtedly would be operable. Overall, the column operated very well at 50 mm Hg, and satisfactory DCPI product was produced in Run #3. The high urea concentration in Run #4 product suggests that the sample may have picked up moisture before it was analyzed.

In all cases the DCPI product was a water-white liquid which cooled to a white solid. After sitting for several days, the products developed a yellow color. The DCPI feed, after melting, was a dark brown liquid. Likewise, the liquid in the column below the feed point was brown in color; while above the feed point it was water-white. The reboiler residues were a very dark brown, opaque liquid that had a viscosity similar to motor oil.

Once running, the column operation was very steady. However, start-ups using reboiler residues from the preceding runs were very difficult. The problem was melting the residues and establishing circulation in the thermo-siphon reboiler. During startup, two heat guns were used to partially melt the residues. Then the reboiler was turned on to try to establish circulation and boilup. The problem arose when the residues, which now had a tar-like quality, would partially solidify in the recirculation line preventing circulation. In an attempt to eliminate the problem, anisole was added to the reboiler at the end of the run to prevent the residues from solidifying. This technique made subsequent startups easier, but did not altogether eliminate the problem. When the residue/anisole solution cooled, solids (probably urea) precipitated. During startup, these solids tended to plug the small recirculation lines. The solids persisted until nearly all the anisole was distilled off. Then the solids dissolved in the residue solution. A better approach to solving this problem might have been to use DCPI instead of anisole to dilute the residues. Additional work would be needed to determine startup and shutdown procedures.

As was mentioned earlier, the DCPI was found to be unstable in the residues. The experimental data obtained on DCPI stability is discussed in Section V-F. Although pure DCPI was found to be very stable when held at 190°C, DCPI in the residue solution (initially 30-40% DCPI) decomposed at a rate of 6-7% (absolute)/hour. Thus, reboiler holdup times must be kept low in order to avoid significant yield loss. For example, it is estimated that with a 1 hour holdup time a column feed containing 10% residues would lose 1% yield.

TABLE V-E-1

PRODUCT COLUMN DATA

| | Run #1 | Run #2[3] | Run #3 | Run #4 |
|---|---|---|---|---|
| Pressure, mm Hg | 100 | 100 | 50 | 46 |
| Rates[1], g/min | | | | |
| Feed | 2.0 | - | 2.5 | 2.8 |
| Reflux[4] | 5-10 | - | 3-4 | 1-2 |
| Product | 2.5 | - | 2.7 | 2.8 |
| Total Feed Time, min | 108 | - | 196 | 172 |
| Temp.[2], °C | | | | |
| Feed | 87 | 92 | 87 | 85 |
| Overhead | 165 | 165 | 146 | 144 |
| Reboiler | 199 | 190-210 | 180 | 185 |
| Reflux Ratio (R/D)[4] | 1-2 | 1-2 | 1-2 | ~0.5 |
| Feed Comp. | | | | |
| % DCPI | 89 | 86 | 89 | 92 |
| % Carbodiimide | - | N.D. | N.D. | 1.0 |
| % Urea | 1.5 | 0.6 | 1.9 | 11.7 |
| % Chlorides | 0.04 | 0.03 | 0.04 | - |
| Product Comp. | | | | |
| % DCPI | 97.8 | 98.6 | 98.3 | 95.5 |
| % $COCl_2$ | 3.3[5] | N.D. | N.D. | N.D. |
| % Chlorides | 0.002 | 0.003 | 0.009 | - |
| % Urea | 0.5 | 0.9 | 0.6 | 6.6 |
| % Carbodiimide | - | N.D. | N.D. | N.D. |
| Residue Comp. | | | | |
| % DCPI | 41 | - | 34.3 | 30.9 |
| % Chlorides | 0.1 | - | - | 0.25 |
| % Urea | 1.6 | - | 10.4 | 27.6 |
| % Carbodiimide | - | - | N.D. | 1.6 |

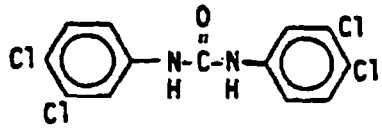
[1]Rates averaged over entire run. In some cases product rate higher than feed rate to concentrate residues in reboiler.
[2]Temperatures at end of run when samples taken.
[3]Run stopped early. Data incomplete.
[4]Estimated by visually comparing reflux rate with take-off rate.
[5]Phosgene believed to come from decomposition of phosgene containing adduct. Discussed later.

Instability of the DCPI residues has been noted before. In the 1960's a few DCPI production campaigns were conducted at Chambers Works in Hylene® process equipment. The initial campaign had a very low yield due to DCPI loss (reaction and/or decomposition) in the concentrated residues. They later determined that the morpholine in the DCA improved the stability of the residues (see U.S. Patent 3,449,397). For additional details refer to Elastomers Department report ERD-1882. Other ERD reports of interest are ERD-1315, -1874, -1881, and -1208. The DCA used in our phosgenation runs contained morpholine, but probably below the 0.35-0.85% level recommended in ERD-1882.

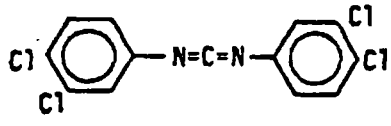
The DCPI decomposition products were not identified. However, during the residue stability tests it was noted that when held at high temperatures, the residues became more viscous with time. Thus, the DCPI may be reacting to form high molecular weight tar-like residues. Since the four product column runs were relatively short (<4 hours), a true "steady state" residue was probably never obtained. Therefore, in order to be sure that actual "steady state" residues have acceptable handling characteristics, long product column runs would be needed.

In an attempt to identify the major components of the DCPI residues, gas chromatography/mass spectrometry (GC/MS) analysis was used. Only three DCPI derived impurities were identified. They were:

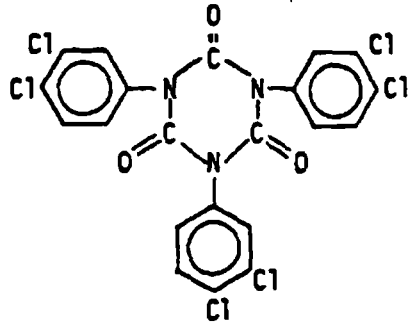
1) urea



2) carbodiimide



3) trimer



Liquid chromatography (LC) methods were developed for the urea and carbodiimide. Although the data are somewhat inconsistent, the LC results indicate that urea is a major component of the residues while the carbodiimide is a relatively minor component. The following table showing % urea in the non-DCPI portion of the column feeds and residues demonstrate the inconsistency of the urea data.



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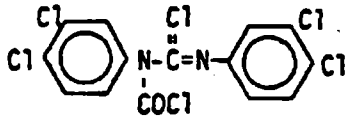
TABLE V-E-2

UREA DATA

| | % Urea in Non-DCPI Portion | |
|---|---|---|
| | Feed | Residue |
| Run #1 | 14 | 3 |
| Run #2 | 4 | - |
| Run #3 | 17 | 16 |
| Run #4 | >100 | 40 |

As shown in Table V-E-1, the DCPI product from Run #1 contained ~3% phosgene (by IR). The presence of phosgene in this product was confirmed by checking with Aromil phosgene detector strips which turned pink when placed in the vapor space above the sample. Any residual phosgene should have been removed from the DCPI feed during the distillation to remove the anisole. Thus, it appears that the feed in Run #1 contained an impurity which, when exposed to the higher temperatures in the product column, decomposed and released phosgene. Such an impurity was found to form in the CHI process by the phosgenation of the carbodiimide. If the DCPI process impurity is analogous to the CHI process impurity, it's structure would be




N-chlorocarbamoyl-(3,4-dichloro)-diphenylchloroformamidine (CCPPCF)

We do not understand the absence of phosgene in the DCPI products from Run #2, #3, or #4. Additional work is needed to determine whether CCPPCF is normally produced in the DCPI process and whether it will persist to the product distillation step if subjected to higher temperatures earlier in the process.

Additional work will be needed to determine acceptable materials of construction for the product column. The high temperatures and unknown characteristics of the chemicals present make the reboiler an area of particular concern.

## F. Miscellaneous Information

### 1.0 DCPI Thermal Stability

Due to the relatively high temperatures (150-200°C) which exist in the solvent removal and product distillation steps, the thermal stability of DCPI is important. Several experiments were run to determine the stability of pure DCPI and DCPI in the presence of concentrated residues. Pure DCPI was found to be very stable even at the highest temperature tested, 185°C. However, the presence of residues made it relatively unstable. Details of the experiments are discussed below.



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a. Pure DCPI

Two experiments were run on pure DCPI - one at 95°C and one at 185°C. DCPI obtained from Tridon Chemicals was used in the 95°C run, DCPI distilled in our laboratory in the other. In both experiments the DCPI was placed in polymer tubes. These were evacuated before sealing and were then placed in a constant temperature bath for specified periods of time. The DCPI assay (IR) and chloride analysis (titration) of the starting materials are given in Table V-F-1.

TABLE V-F-1

ANALYSIS OF STARTING MATERIAL

| | % DCPI | % Chlorides | % Urea |
|---|---|---|---|
| Tridon DCPI, 95°C Run | 94.4 | 0.0006 | 0.3 |
| Distilled DCPI, 185°C Run | 100.6 | 0.005 | 0.4 |

A plot of % DCPI (analyzed by IR) versus time for the two experiments is given in Figure V-F-1. Using the straight line portions of the curves, these rates of DCPI decomposition were calculated:

Tridon DCPI at 95°C = 0.07%/hr

Distilled DCPI at 185°C = 0.02%/hr

As can be seen, the rates of decomposition were low for both cases. However, the distilled DCPI was found to decompose more slowly even though the temperature of the experiment was 90°C higher. Apparently an impurity or impurities present in the DCPI tends to accelerate its thermal decomposition. The effect of impurities on DCPI stability is much more evident in the following data which were determined in the presence of concentrated process residues.

b. DCPI Residues

Two experiments were run using DCPI residues obtained in product column runs. In the first experiment, the material (initially 51.7% DCPI) was heated to 185°C in the sealed polymer tubes described for the pure DCPI experiments. In the second, the DCPI residue (initially 31.7% DCPI) was placed in a flask which was vented to the atmosphere. The residue was held at 190°C, and sampled with time. Figure V-F-2 shows a plot of % DCPI versus time for the two experiments. The rate of DCPI decomposition was significantly increased by the presence of concentrated process residues. The rates of DCPI decomposition for the two cases were:

DCPI residue at 185°C = 4.6%/hr

DCPI residue at 190°C = 6.7%/hr



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FIGURE V. F-1.
STABILITY OF PURE DCPI

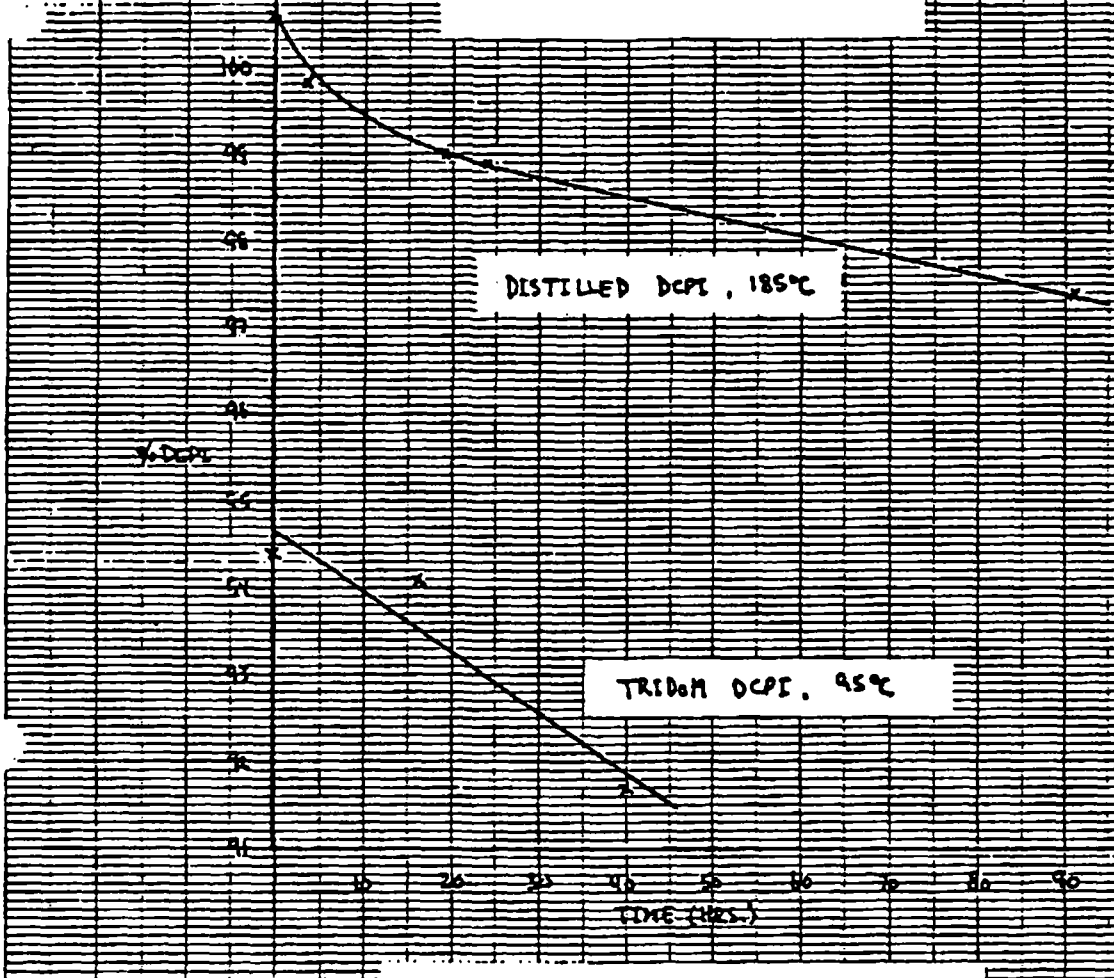
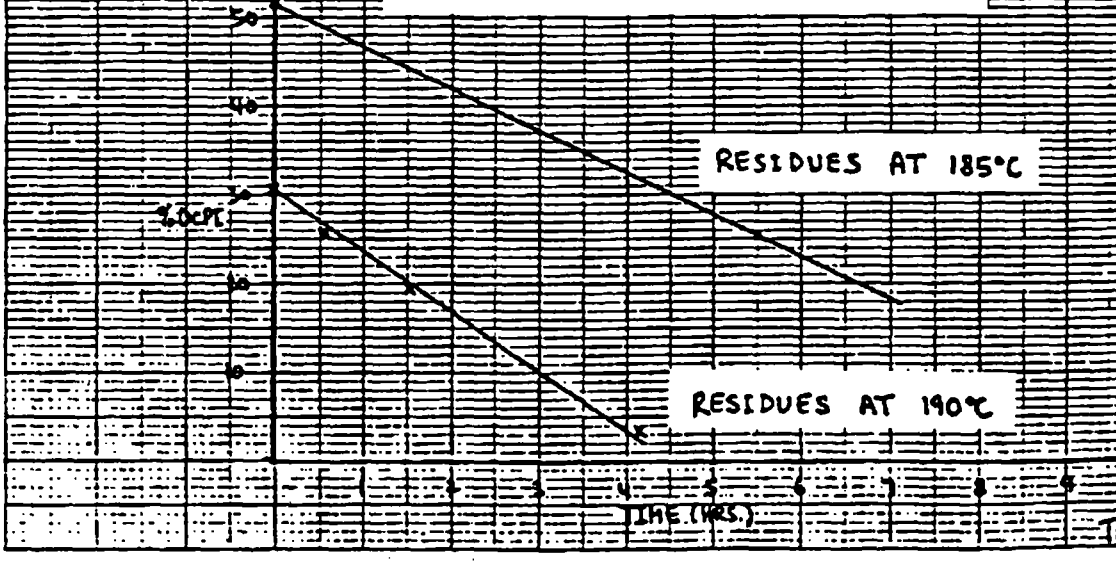



FIGURE V. F-2.
DCPI STABILITY IN RESIDUES

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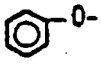
The straight line found for the 190°C case indicates that the decomposition is zero order (independent of DCPI concentration) down to DCPI concentrations of ~5%. The higher rate observed at 190°C could be due to a temperature effect, or it could be due to differences in the starting material used in the two runs. Assuming a temperature effect caused the increased rate, the following Arrhenius-type equation was obtained:

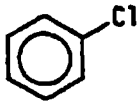
$$r = 2.97 \times 10^{16} \, e^{-1.90 \times 10^{4}/T}$$

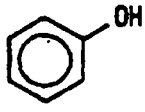
r = rate DCPI decomposition, gmoles/mℓ hrs
T = temp., °K

Unfortunately, the data used in deriving the rate equation are rather sparse. Thus, additional experiments are needed to demonstrate the validity of the equation. Since the difference between the rates in the two experiments might be due to differences in the impurities present, the rate equation must be used with caution.

## 2.0 Anisole Stability in the Presence of HCl

Under the proper conditions (e.g. high temperature), anhydrous HCl can split ethers. For the case of anisole,  , the products would be

 and $CH_3OH$

or  and $CH_3Cl$

In order to determine if anisole has a tendency to split under the conditions present in the DCA phosgenator, an experiment was run. In this experiment, anisole was held at 100°C, and anhydrous HCl was continuously purged through the liquid for 7 hours. Anisole samples were taken at 1, 4, and 7 hours. Titration analyses showed the HCl concentration to be 0.7%. GC analysis did not reveal any new impurity peaks over the course of the experiment, which indicated that the anisole was stable under the conditions tested.

The stability of anisole in the presence of phosgene was not directly checked. However, GC/MS analysis of phosgenator product showed no evidence of significant reaction between anisole and phosgene.

## 3.0 Densities and Freezing Points of DCPI/Anisole and DCA/Anisole

The density and freezing point for various concentrations of DCPI/anisole and DCA/anisole solutions were measured. The relationship between density and temperature is linear for a given concentration of DCPI



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or DCA. The relationship between freezing point and concentration was found to be smooth and linear for the DCPI/anisole system and smooth and slightly non-linear for the DCA/anisole system. Experimental procedure and specific results are detailed in a letter (J. S. Ingerman to R. J. Bassett , August 7, 1979) that is included in the Appendix.

## 4.0 Vapor Pressure Data for Urea and Carbodiimide

The vapor pressures of bis-3,4-dichlorophenylurea and bis-3,4-dichlorophenyl carbodiimide were measured using the Du Pont Model 916 Thermal Evolution Analyzer. The data are presented in the Appendix. The urea data apply to the vapor pressure of the solid and should not be extrapolated above the melting point of 273-274°C. The carbodiimide data were obtained above and below the melting point of 95-99°C. Above the melting point, the slope of the vapor pressure curve is related to the heat of vaporization while below the melting point it is related to the heat of sublimation. Thus there should be a break in the vapor pressure curve at the melting point (smaller slope above the melting point). However, the scatter in the data obscure the expected break.



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BIOCHEMICALS DEPARTMENT
EXPERIMENTAL STATION

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August 7, 1979

To: R. J. Bassett

From: J. S. Ingerman J.S.I.

# DENSITIES AND FREEZING POINTS OF DCPI/ANISOLE AND DCA/ANISOLE SOLUTIONS

As part of our DCPI process development program, we have determined the density and freezing point for various concentrations of DCPI/anisole and DCA/anisole solutions. This report presents the experimental data and summarizes observations made regarding the DCPI/anisole and the DCA/anisole systems.

## Summary

a. Storage problems were encountered with the DCPI/anisole samples. 1,3-bis-3,4-dichlorophenyl urea formed from the reaction of DCPI with water. No storage problems were encountered with the DCA/anisole samples.

b. The relationship between density and temperature is linear for a given concentration of DCPI or DCA.

c. The relationship between freezing point temperature and concentration is smooth and linear for the DCPI/anisole system.

d. The relationship between freezing point temperature and concentration is smooth and slightly non-linear for the DCA/anisole system.

## Experimental Details

### I. Preparation of Samples

#### A. DCPI/Anisole

Nine DCPI/anisole samples ranging in concentration from 10-90 weight percent DCPI were prepared. At concentrations of up to 40 weight percent DCPI dissolved easily and completely in anisole at room temperature. The solutions



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were clear and colorless. DCPI dissolved in anisole slowly (15-30 minutes) at room temperature at concentrations of 50 and 60 weight percent. The solutions formed were cloudy white. Samples containing more than 60 weight percent DCPI were heated with a hot air gun to melt the solid DCPI forming cloudy white solutions.

B. DCA/Anisole

Nine DCA/anisole samples ranging in concentration from 10-90 weight percent DCA were prepared. At concentrations of up to 20 weight percent DCA dissolved easily and completely in anisole at room temperature. The solutions formed were clear and amber-colored. Samples containing more than 20 weight percent DCA were heated with a hot air gun to melt the solid DCA, forming clear amber-colored solutions.

## II. Storage of Samples

After several hours a white precipitate was observed in the DCPI/anisole sample flasks. This precipitate was identified (IR) as 1,3-bis-3,4-dichlorophenyl urea, formed from the reaction of DCPI with water. Water may have come in contact with the DCPI from moisture in the air or from trace amounts of water contained in the anisole. The IR spectra of the anisole used showed no trace of water (<0.5 percent water). It was concluded that the anisole used in preparing the samples would be dried with molecular sieve pellets and that samples would be prepared immediately prior to use, minimizing the problem of urea formation. No storage problems were encountered with the DCA/anisole samples.

## III. Density Experiments

### A. Apparatus

a. 25-ml volumetric flasks with ground glass stoppers

b. An electrically heated water bath with thermostatic control (from here on referred to as "constant temperature bath")

c. 2 Celsius thermometers

d. A hot air gun

e. An analytical balance

f. A 150-ml erlenmeyer flask (test flask)

### B. Procedure

Samples were prepared by placing a weighed amount of DCPI or DCA in a 25-ml volumetric flask, melting the solids with a hot air gun, and adding

anisole that had been dried with molecular sieve pellets. When the solution cooled to room temperature its volume was adjusted to exactly 25 ml and the sample was weighed. The density of each solution at room temperature was determined from:

(Equation 1) $$\text{density} = \frac{(\text{wt. of solution + flask}) - (\text{tare wt. of flask})}{25} \; [=] \; \frac{g}{ml}$$

The flasks were placed in a constant temperature water bath along with a test flask containing water and a thermometer. The test flask gave a general indication of when the solutions in the flasks reached the temperature of the bath. The temperature variation in the bath was observed to be ± 1°C. The flasks remained in the bath for at least an hour after the test flask reached the temperature of the bath. At each temperature the volume of each solution was adjusted to exactly 25 ml. This could not be done while the flasks were in the bath, as the refractive properties of water made it impossible to adjust the volume accurately. The flasks were removed from the bath one at a time and the volumes adjusted as quickly as possible. They were then returned to the bath for 5-10 minutes, removed, and the volumes rechecked. The samples were then weighed and their densities computed from Equation 1.

C. Results

The experimental results obtained are presented in Table 1 and Table 2, as well as in Figure 1 and Figure 2.

Table 1

Densities of DCPI/Anisole Solutions

| Wt. % DCPI | Density at Room Temp. (25-30°C), g/ml | Density at 50°C, g/ml | Density at 80°C, g/ml | Density at 95°C, g/ml |
|---|---|---|---|---|
| 15 | 1.032 | 1.011 | 0.984 | 0.968 |
| 28 | 1.080 | 1.059 | 1.033 | 1.018 |
| 41 | 1.128 | 1.106 | 1.079 | 1.059 |
| 53 | 1.172 | 1.151 | 1.124 | 1.106 |

Table 2

Densities of DCA/Anisole Solutions

| Wt. % DCA | Density at Room Temp. (25-30°C), g/ml | Density at 70°C, g/ml | Density at 90°C, g/ml | Density at 95°C, g/ml |
|---|---|---|---|---|
| 15 | 1.031 | - | - | 0.967 |
| 29 | 1.077 | - | - | 1.012 |
| 29 | - | 1.037 | 1.017 | - |
| 41 | 1.119 | - | - | 1.059 |
| 53 | 1.162 | - | - | 1.107 |
| 57 | - | 1.142 | 1.122 | - |

D. Conclusions

a. The relationship between density and temperature is linear for a given concentration of DCPI or DCA.

b. In the laboratory DCPI/anisole samples should be prepared immediately prior to use and with anisole that has been dried with molecular sieve pellets to minimize the formation of urea.

c. If storage becomes necessary, DCPI/anisole samples should be stored in a moisture-free environment.

## IV. Freezing Point Experiments

### A. Apparatus

a. A 100-ml round bottom flask with thermometer arm (a 200-ml round bottom flask was used for the DCA experiments).

b. Magnetic stirrer and stir bar

c. Hot air gun

d. Ice-acetone bath

### B. Procedure

#### 1. DCPI/Anisole

A weighed amount of DCPI was placed in a 100-ml round bottom flask with a thermometer arm. The DCPI was melted using a hot air gun. A measured amount of anisole was added and the solution cooled in an ice-acetone bath while being stirred with a magnetic stirrer. When frozen solids were observed the flask was removed from the bath. The temperature of the solution was watched closely, and when a plateau (equilibrium) temperature was reached this was determined to be the freezing point of the solution. Then an additional measured amount of anisole was added (changing the concentration of DCPI in the solution while the amount of DCPI remained constant) and the procedure repeated.

#### 2. DCA/Anisole

A weighed amount of DCA was placed in a 200-ml round bottom flask with a thermometer arm. The procedure was identical to that described in Section IV-B-1.

### C. Results

The experimental results obtained are presented in Tables 3 and 4 and in Figures 3 and 4.

Table 3

Freezing Points of DCPI/Anisole Solutions

| Wt. % DCPI | Freezing Pt. °C |
|---|---|
| 90.1 | 34.5 |
| 82.0 | 28 |
| 75.2 | 23 |
| 64.6 | 14 |
| 56.6 | 8.5 |

Table 4

Freezing Points of DCA/Anisole Solutions

| Wt. % DCA | Freezing Pt. °C |
|---|---|
| 89.5 | 59 |
| 76.2 | 50 |
| 71.9 | 42 |
| 63.1 | 38 |
| 56.1 | 30.5 |
| 53.8 | 29 |
| 50.6 | 25.5 |
| 46.0 | 14.5 |
| 33.9 | 1 |

D. Conclusions

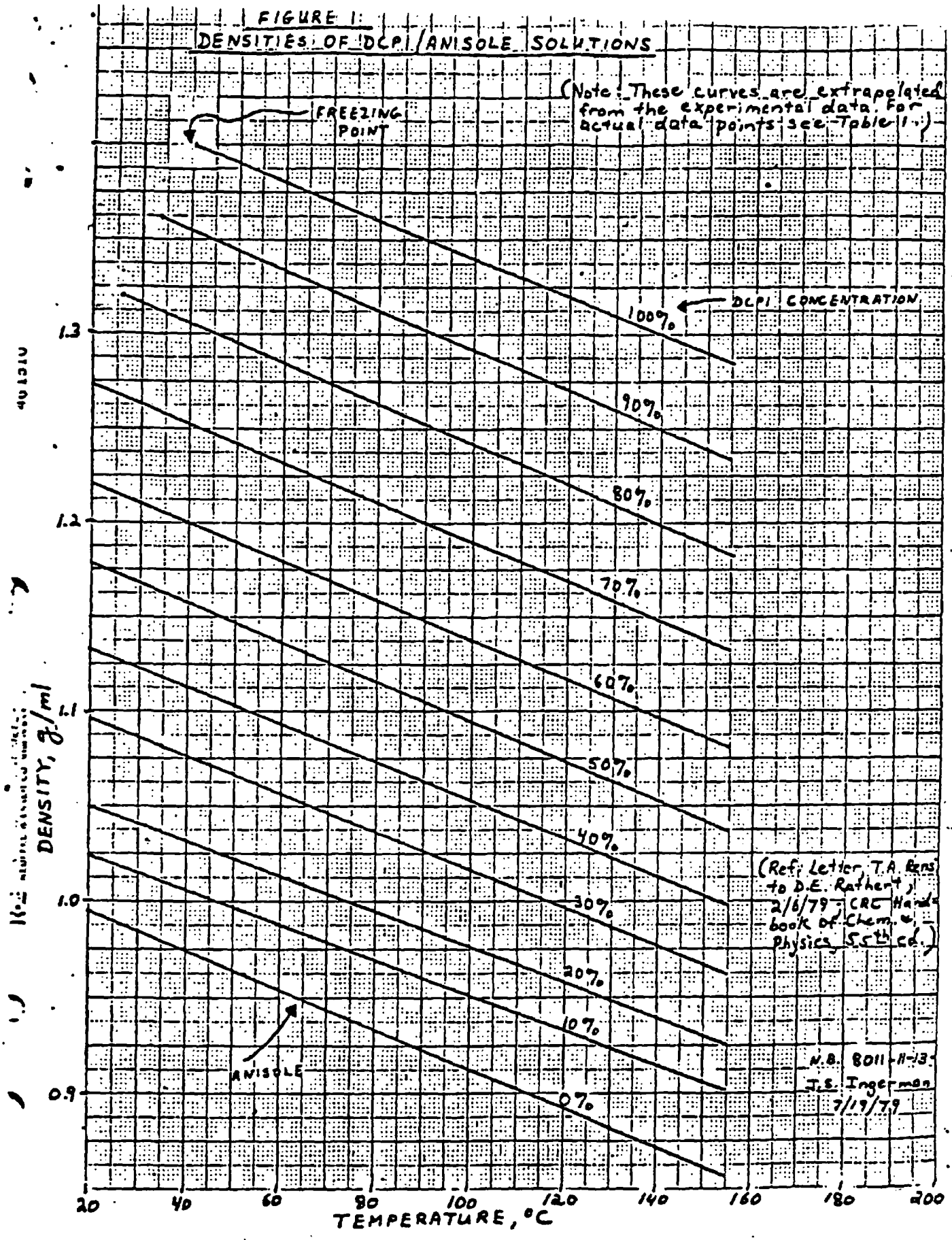
a. The relationship between freezing point temperature and concentration is smooth and linear for the DCPI/anisole system.

b. The relationship between freezing point temperature and concentration is smooth and slightly non-linear for the DCA/anisole system.

JSI/slh

FIGURE 1:

DENSITIES OF DCPI/ANISOLE SOLUTIONS




(Ref: Letter, T.A. Reno to D.E. Rathert 2/6/79 - CRC Handbook of Chem. & Physics, 55th Ed.)

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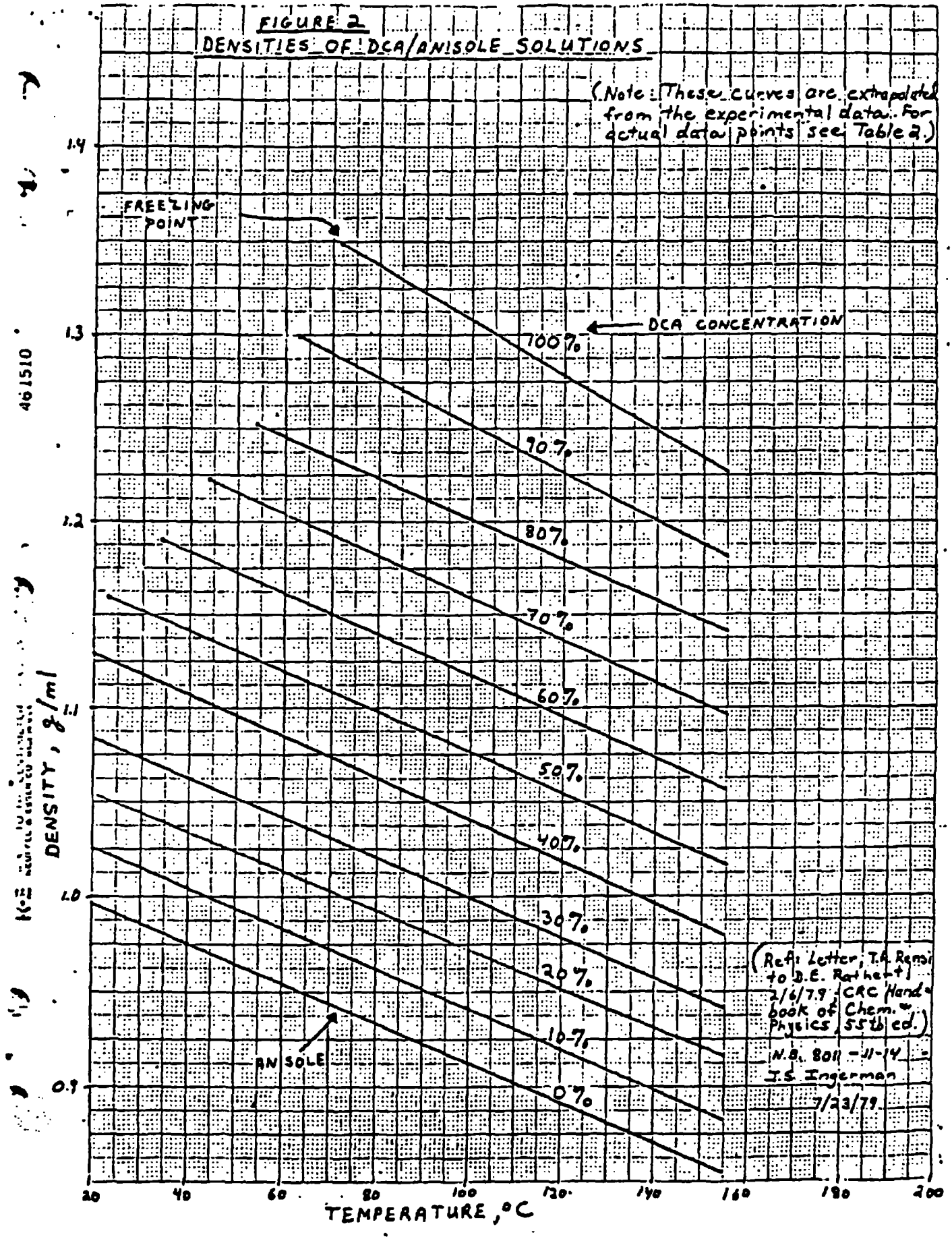
FIGURE 2
DENSITIES OF DCA/ANISOLE SOLUTIONS
(Note: These curves are extrapolated from the experimental data. For actual data points see Table 2.)
FREEZING POINT
DCA CONCENTRATION
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
ANISOLE
DENSITY, g/ml
TEMPERATURE, °C
1.4
1.3
1.2
1.1
1.0
0.9
20
40
60
80
100
120
140
160
180
200
(Ref: Letter, T.A. Remsi to D.E. Rathert 2/6/79; CRC Handbook of Chem. & Physics, 55th ed.)
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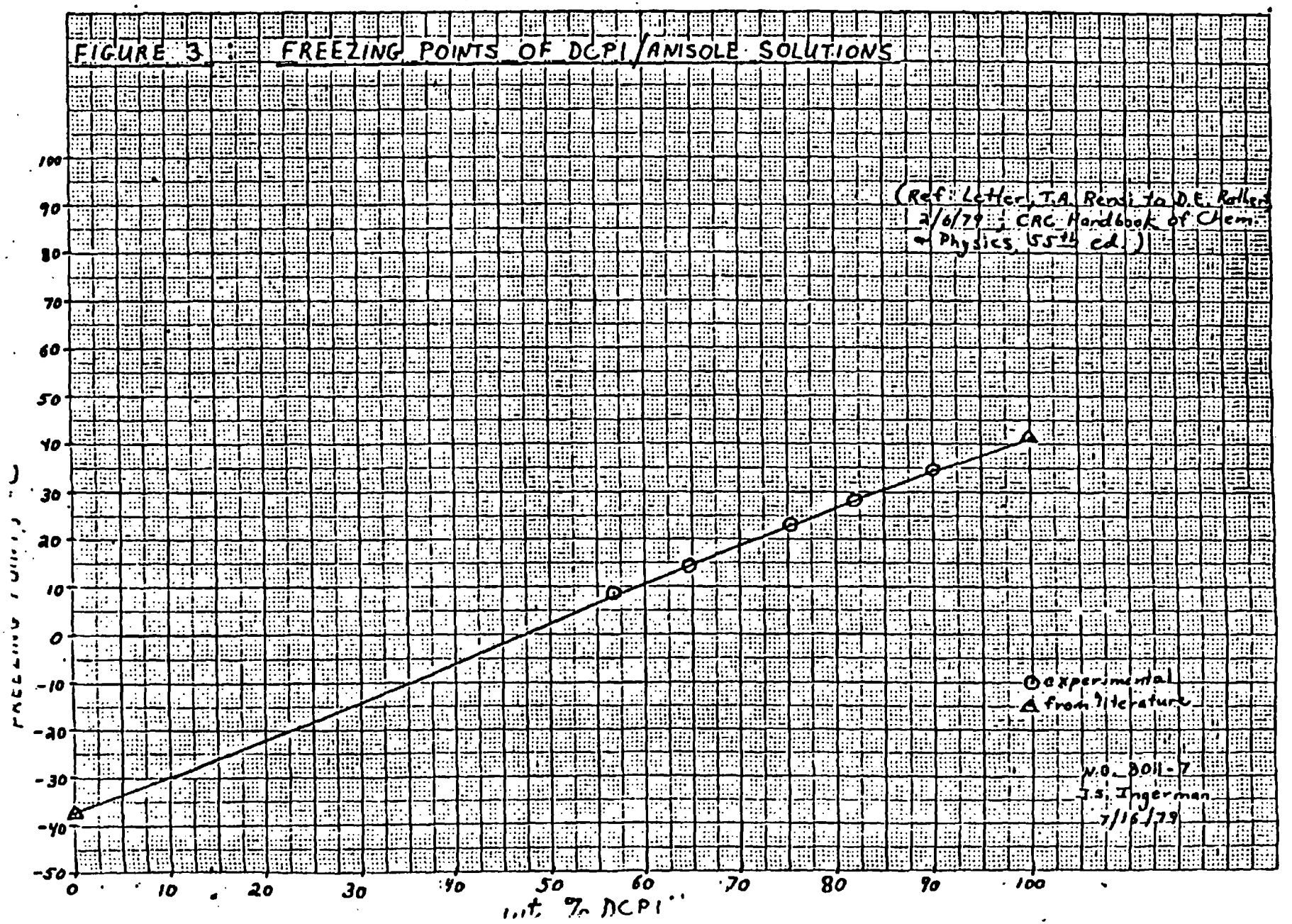
FIGURE 3 : FREEZING POINTS OF DCPI/ANISOLE SOLUTIONS
(Ref: Letter, T.A. Rensi to D.E. Rollers 2/6/79 ; CRC Handbook of Chem. & Physics, 55th ed.)
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
10
20
30
40
50
60
70
80
90
100
wt. % DCPI
experimental
from literature
N.O. 3011-7
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7/16/79

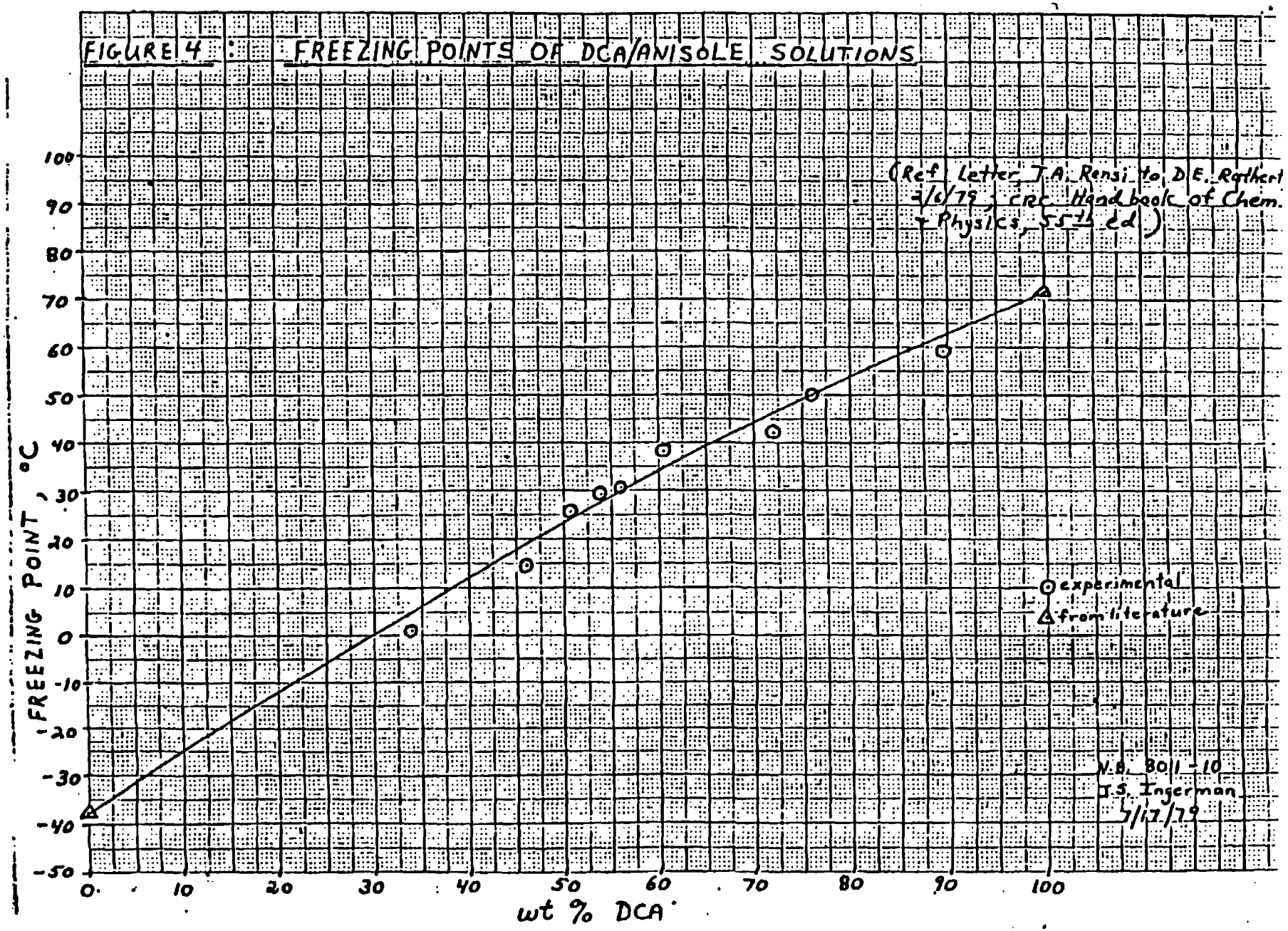
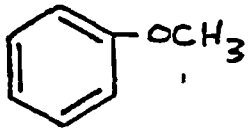


FIGURE 4 : FREEZING POINTS OF DCA/ANISOLE SOLUTIONS
(Ref Letter, J.A. Rensi to D.E. Rathert 2/6/79; CRC Handbook of Chem. & Physics, 55th ed.)
FREEZING POINT, °C
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
10
20
30
40
50
60
70
80
90
100
wt % DCA
experimental
from literature
N.B. 8011-10
J.S. Ingerman
7/17/79

DUPONT

HASKELL LABORATORY

Common Name: Anisole
Chemical Name: Benzene, methoxy- (9CI)
CAS Registry No: 100-66-3
Chemical Structure:




TOXICITY

A. Acute

1. Oral

$LD_{50}$ (rats) = 3700 mg/kg (1).
$LD_{50}$ (mice) = 2800 mg/kg (2).
ALD (rats) = 5000 mg/kg (3).

2. Skin

- No deaths occurred at doses up to 8000 mg/kg when applied to the shaved skin of rabbits. The 8000 mg/kg dose produced marked incoordination lasting two hours, inflammation of the eyes lasting two hours, and irritation of the skin at the site of application for 24 hours. No gross or micropathology was found when the rabbit was sacrificed two weeks after treatment (3).

- When tested according to the regulations of the Federal Hazardous Substances Act (FHSA), anisole is not considered a primary skin irritant (4).

- When tested according to the regulations of the Department of Transportation (DOT), anisole is not considered a corrosive material (5).

3. Eyes

Inflammation of the eyes lasting two hours was seen in the skin absorption test. This inflammation was probably due to vapors of the material (3).

4. Inhalation

Two rats at a time were exposed in a small gas chamber to air bubbled through anisole. The nominal concentration of anisole for each exposure was calculated from the amount of material volatilized and the flow rate of the air into the chamber. The results of the various exposures were as follows:

| Time of Exposure | Concentration | Results |
|---|---|---|
| 160 min | 4,300 ppm | Unconscious after two hours. Both survived. |
| 210 min | 4,100 ppm | Same as above. |
| 210 min | 4,800 ppm | One dead at 175 min. One survived. |
| 60 min | 18,000 ppm | One dead after 43 min. One dead 15 min after end of exposure. |
| 17 min | 30,500 ppm | Both unconscious at end of exposure, but recovered. |

All exposures resulted in loss of consciousness. Animals which died showed congestion of the lungs and brain. (3)

B. Subacute

1. Oral

- 1/6 rats fed 1230 mg/kg/day for 4 days died. None of the rats had evidence of liver injury (2).
- 1/6 rats fed 1000 mg/kg/day died after the sixth treatment. The remaining 5 rats survived 10 treatments. No toxic signs were seen except for slight discomfort after each treatment. No gross or micropathology was seen in the survivors when sacrificed 12 days after the tenth treatment. The rat which died showed congestion of the lungs and liver (3).

C. Carcinogenic, Mutagenic or Teratogenic Potential

No specific information was found on the carcinogenic, mutagenic or teratogenic potential. Anisole like phenol has been shown to be capable of promoting the appearance of skin tumors in mice following a single initiating dose of dimethylbenzanthracene (6).

D. Aquatic Studies

Based on taste and smell, the maximum permissible concentration of anisole in bodies of water has been established as 0.05 mg/l. A minimum increase in B.O.D. was shown to occur at 1 mg/l (7).

References

1. Taylor, J. M., et al., Tox. Appl. Pharm., 6, 378-87 (1964).

2. Von Oettingen, W. F., J. Pharm. Exp. Ther., 88, 400-413 (1946).

3. Haskell Data, MR-0048-011, HL-0008-52.

References Cont'd

4. Haskell Data, MR-0581-041, HL-0036-73.

5. Haskell Data, MR-1698-001, HL-0420-73.

6. Boutwell, R. K., and D. K. Bosch, Cancer Research, 19, 413-24 (1959).

7. Naishtein, S. Y., et al., Sanit. Okhr. Vodoemov Zagryaz Prom. Stochnymi Vodami, No. 7, 143-51 (1965) (CA66:22031).

Richard C Graham

Richard C. Graham:nn
3/31/76

B-11844 REV. 12-71

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

BIOCHEMICALS DEPARTMENT
EXPERIMENTAL STATION

cc: W. J. Cordes/T. J. Bassett
V. A. Engelhardt/B. G. Julin
D. D. Schlueter
324 File R-2

January 9, 1980

T. A. Rensi
Building 335

Vapor Pressure of
Bis 3,4-dichlorophenylurea and
Bis 3,4-dichlorophenylcarbodiimide

The vapor pressures of bis 3,4-dichlorophenylurea and bis 3,4-dichlorophenylcarbodiimide were measured using the Du Pont Model 916 Thermal Evolution Analyzer. The data are attached.

It should be noted that the diimide sample used was of questionable purity as was verified by TLC using silica gel plates and a methylene chloride/cyclohexane (1:4) developing solvent. At least three components were detected. This may result in an unacceptable degree of error in the measurement.

DRK Keeler
D. R. Keeler

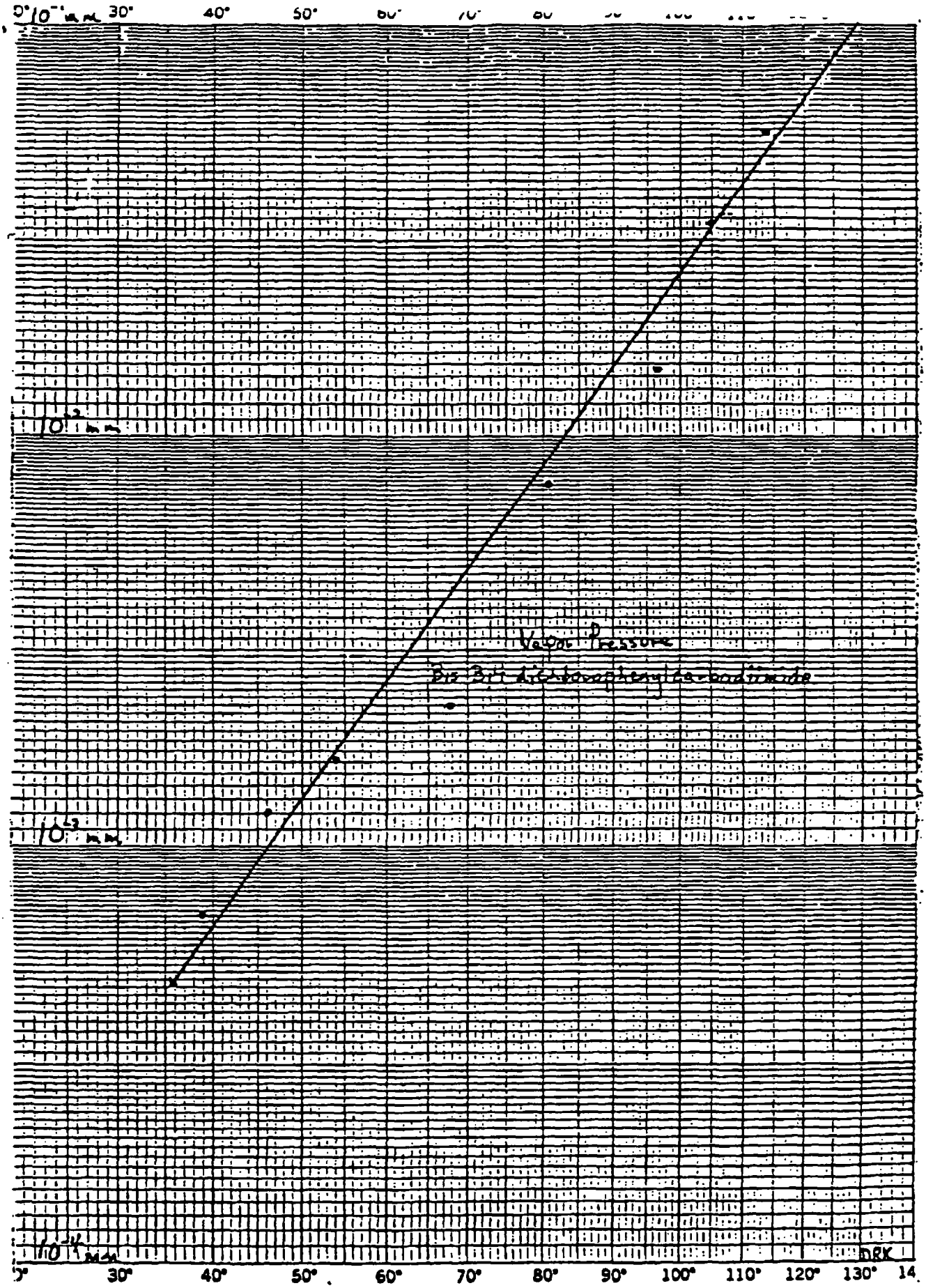
DRK/mhs

Att.

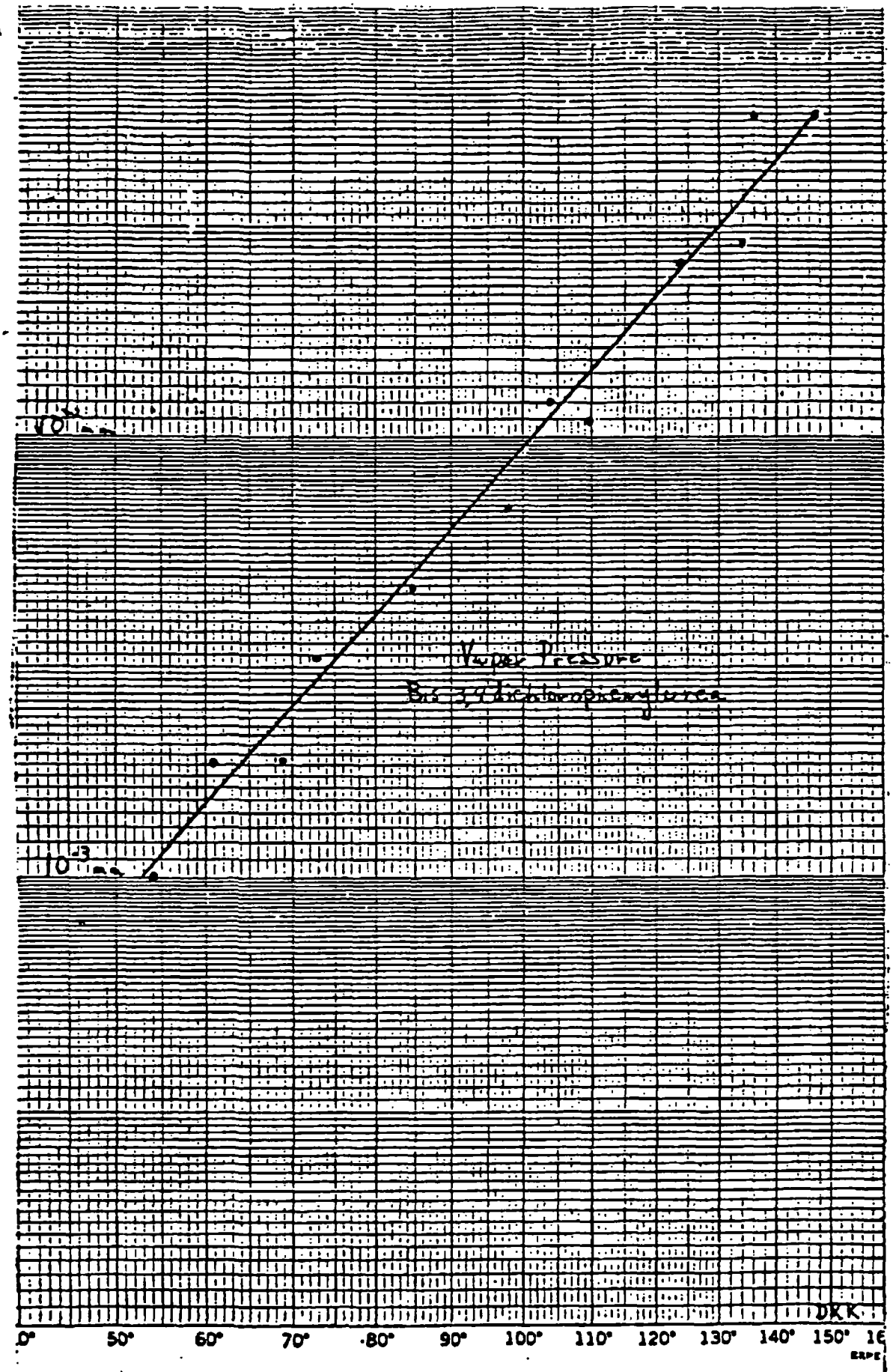
THERE'S A WORLD OF THINGS WE ARE DOING SOMETHING ABOUT

## Vapor Pressure

| Bis 3,4-dichlorophenylurea | | Bis 3,4-dichlorophenylcarbodiimide | |
|---|---|---|---|
| T(°C) | Vp (mm Hg) | T (°C) | Vp (mm Hg) |
| 54 | $1.02 \times 10^{-3}$ | 36 | $4.66 \times 10^{-4}$ |
| 61 | $1.83 \times 10^{-3}$ | 39 | $6.80 \times 10^{-4}$ |
| 69 | $1.84 \times 10^{-3}$ | 46 | $1.20 \times 10^{-3}$ |
| 73 | $3.11 \times 10^{-3}$ | 54 | $1.59 \times 10^{-3}$ |
| 85 | $4.48 \times 10^{-3}$ | 68 | $2.17 \times 10^{-3}$ |
| 98 | $6.87 \times 10^{-3}$ | 81 | $7.55 \times 10^{-3}$ |
| 104 | 0.012 | 97 | 0.015 |
| 110 | 0.011 | 105 | 0.033 |
| 124 | 0.024 | 114 | 0.056 |
| 134 | 0.027 | 124 | 0.107 |
| 136 | 0.053 | 134 | 0.150 |
| 147 | 0.053 | | |



Vapor Pressure
Bis Bit dichlorophenylcarbodiimide
$10^{-2}$ mm
$10^{-3}$ mm
$10^{-4}$ mm
30°
40°
50°
60°
70°
80°
90°
100°
110°
120°
130°
DRK


Vapor Pressure
Bis 3,4 dichlorophenylurea
$10^{-3}$ mm
DRK
0°
50°
60°
70°
80°
90°
100°
110°
120°
130°
140°
150°

## APPENDIX

MSDS

RMS

DUPONT

# MATERIAL SAFETY DATA SHEET



RECEIVED
OCT 7
AGRICHEMICALS DIV.
ENVIRONMENTAL AFFAIRS

## IDENTIFICATION

*Name* 3,4-Dichloroaniline, Technical; ~~3,4-Dichloroaniline 88, Technical; 3,4-Dichloroaniline 93, Technical~~

*Synonyms*
1-Amino-3,4-Dichlorobenzene 3,4-DCA

*Chemical Family*
Aromatic Amine

*CAS Name* Benzeneamine, 3,4-Dichloro-

*CAS Registry No.*
95-76-1

I.D.Nos./Codes: Du Pont Codes:
3,4-Dichloroaniline, Tech = 208466; ~~93 Tech = 208465; 88 Tech = 208456~~
NIOSH Access No. = BX 26250 Wiswesser Line Notation = 2R CG DG

*Manufacturer/Distributor*
E. I. du Pont de Nemours & Co., (Inc.)

*Product Information and Emergency Phone*
(302) 774-2421

*Address*
Wilmington, DE 19898

*Transportation Emergency Phone*
(800) 424-9300

## HAZARDOUS COMPONENTS

| *Material(s)* | Approximate%: ~~88 Tech~~ ~~87%~~ | ~~93 Tech~~ ~~93%~~ | Tech ~~96%~~ 99% |
|---|---|---|---|
| 3,4-Dichloroaniline | | | |
| Other chloroanilines and aniline | ~~<13~~ | ~~<7~~ | < 1 |
| Compound that may cause chloracne | Trace | Trace | Trace |

## PHYSICAL DATA

*Boiling Point, 760 mm Hg*
~~282~~ 272°C (486-522°F)

*Melting Point*
~~62~~ 72°C (~~126~~ 162°F)

*Specific Gravity*
1.36 @ 50°C (122°F)

*Vapor Pressure*
3.8-4.8 mm Hg @ 43°C (110°F)

*Vapor Density*
5.6 (Air = 1)

*Solubility in $H_2O$*
Insoluble

*% Volatiles by Vol.*

*Evaporation Rate (Butyl Acetate = 1)*

| *Form* | *Appearance* | *Color* | *Odor* |
|---|---|---|---|
| Solid | Chrystalline | Gray-brown | Mothballs |

*pH Information*
~9 (Water extract)

*Octanol/Water Partition Coefficient*
Log P = 1.44

## FIRE AND EXPLOSION DATA

*Flash Point* *Method* TOC
164-166°C (327-331°F)

*Autoignition Temperature*
265°C (509°F)

*Flammable Limits in Air, % by Vol.*

| *Lower* | *Upper* |
|---|---|
| 2.8% @ 153°C (307°F) | 7.2% @ 179°C (354°F) |

*Fire and Explosion Hazards*
Will burn, but usually will go out if flame is extinguished or other combustibles are removed. Heat releases toxic and acidic fumes.

*Extinguishing Media*
Foam, dry chemical, carbon dioxide ($CO_2$), water spray.

*Special Fire Fighting Instructions* Use water spray to cool containers. Evacuate area. Stay upwind. Avoid smoke and fumes; where contact cannot be avoided, wear chemical-proof suit with hood and breathing air supply. Use care in approaching advanced or massive fires. Product may decompose from heat and rupture container.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process. The information set forth herein is furnished free of charge and is based on technical data that Du Pont believes to be reliable. It is intended for use by persons having technical skill and at their own discretion and risk. Since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information. Nothing herein is to be taken as a license to operate under or a recommendation to infringe any patents.

## HAZARDOUS REACTIVITY

*Instability*
Decomposes above 150°C (302°F) releasing toxic fumes. Dechlorinates at low pH.

*Incompatibility*
Oxidizing agents

*Decomposition*
Releases $NO_x$ and HCl fumes.

*Polymerization*
Will not occur

## HEALTH HAZARD INFORMATION

*Exposure Limits*

*Routes of Exposure and Effects*
May be fatal if inhaled.
Harmful if absorbed through skin.
Causes cyanosis; symptoms may be delayed.
Causes eye injury.
A trace impurity may cause chloracne; repeated contact of 3,4-Dichloroaniline with the skin may cause allergic skin reactions.

First Aid: See attached page 3.

## PROTECTION INFORMATION

*Ventilation*
Use only with adequate ventilation.

*Personal Protective Equipment* Chemical splash goggles or safety spectacles (side shields preferred), butyl rubber gloves boots and apron, chemical-proof suit, hard hat, face shield, and appropriate respiratory protection. (See references.) Where direct contact with liquid or vapor can not be avoided, wear chemical-proof suit with hood and breathing air supply.

## DISPOSAL PROCEDURES

Spill, Leak or Release: Dike spill and soak up with sand, earth or other nonflammable absorbent (rags OK for small spills). Shovel absorbent into covered steel drums for disposal.

Waste Disposal: Comply with Federal, State and local regulations. If approved, may be incinerated in proper facilities or removed to hazardous material landfill.

## SHIPPING PRECAUTIONS

Transportation: DOT Proper Shipping Name: Poisonous Solid, N.O.S. (in drums). Poisonous Liquid, N.O.S. (T/T; T/C). DOT Hazard Classification: ~~Poison~~ B. UN No. 1590. IMCO Class 6.1.
Shipping Containers: Railroad tank cars, tank trucks, drums.
Storage Conditions: Keep in ventilated area away from heat, sparks, and flame. Keep container upright and tightly closed.

## REFERENCES AND ADDITIONAL INFORMATION

Do not breathe vapor.
Do not get in eyes, on skin, or clothing.
Wash thoroughly after handling.
3,4-Dichloroaniline should be handled only by trained personnel.
For more information refer to: Du Pont 3,4-Dichloroaniline Data Sheet.
See also DHEW (NIOSH) Publication No. 76-189, "A Guide To Industrial Respiratory Protection: available from Dept. HHS (NIOSH), 4676 Columbia Parkway, Cincinnati, OH 45226, Phone (513) 684-4287.

DATE: 12/80



AB0000117579/168

# 3,4-DICHLOROANILINE MSDS ATTACHMENT

FIRST AID:

If inhaled, remove to fresh air. If not breathing give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing before reuse and destroy contaminated shoes.

If swallowed, induce vomiting immediately by giving 2 glasses of water and sticking finger down throat. Never give anything by mouth to an unconscious person. Call a physician.

NOTE TO PHYSICIAN:

Absorption of the product into the body leads to the formation of methemoglobin which, in sufficient concentration, causes cyanosis. In cases of skin absorption symptoms may be delayed 2-4 hours. Since reversion of methemoglobin to hemoglobin occurs spontaneously after termination of exposure, moderate degrees of cyanosis need be treated only by supportive measures such as bed rest and oxygen inhalation. Thorough cleansing of the entire contaminated area of the body including scalp and nails is of utmost importance. If cyanosis is severe, intravenous injection of methylene blue, 1 mg/kg of body weight, may be of value. Cyanocobalamin (Vitamin B-12), 1 mg intramuscularly, will speed recovery. Intravenous fluids and blood transfusions may be indicated in very severe exposures.

DATE: 12/80

E-38325

MSDS 600

# Material Safety Data Sheet

| | |
|---|---|
| Date: March, 1980 | Edition: Second |
| Chemical Name and Synonyms: Carbonyl Chloride, Phosgene<br>CAS No.: 75-44-5 | Trade Name and Synonyms: Phosgene |
| Chemical Family: Acid Chloride | Formula: $COCl_2$ |
| DOT Shipping Name: Phosgene | DOT Hazard Class: POISON A |

## SECTION 1 · PHYSICAL DATA

| Boiling Point @ 760 mm Hg: | Vapor Density (Air=1): | Specific Gravity ($H_2O$=1): | pH of Solutions: |
|---|---|---|---|
| 7.5°C (45.5°F) | @20°C = 3.4 | @20°C = 1.388 | Unknown |
| **Freezing/Melting Point:** | **Solubility (Weight % in Water):** | **Bulk Density:** | **Volume % Volatile:** |
| Not Applicable | Slowly decomposes | Unknown | 100 |
| **Vapor Pressure:** | **Evaporation Rate** | **Heat of Solution:** | **Appearance and Odor:** |
| psia @20°C = 23.44 | (_____=1): Unknown | Unknown | Clear, colorless liquid and gas under pressure with mild, sweet odor |

## SECTION 2 · HAZARDOUS INGREDIENTS

| | % | Hazard Data |
|---|---|---|
| Phosgene (min.) | 99 | Poison - INHAL. |
| (Chlorine (max.) | 0.1 | Poison - INHAL. |
| Hydrogen Chloride (max.) | 0.2 | Irritant/Corrosive |
| | | |

## SECTION 3 · FIRE AND EXPLOSION HAZARD DATA

| Flash Point °F (Method Used) | Flammable Limits in Air (% by Volume) | Extinguishing Media: |
|---|---|---|
| None | Not Applicable<br>LEL: UEL: | Not Applicable |

Special Fire Fighting Procedures:

See Addendum

Unusual Fire and Explosion Hazards: Attempts should be made to keep water away from phosgene leaks and liquid pools. Such a practice could increase phosgene vaporization and release. However, containers must be sprayed with water to keep them cool if they are left in fire area.

## SECTION 4 · HEALTH HAZARD DATA

Permissible Exposure Limits (TLV): Phosgene--0.1ppm, 8-hr. TWA--OSHA 29CFR 1910.1000; Chlorine--1.0ppm, ceiling; hydrogen chloride 5.0ppm, ceiling. NOTE: NIOSH recommends for phosgene 0.1ppm time-weight average and 0.2ppm as a ceiling concentration for any 15-min. period(2).

| Toxicity Data | Classification (Poison, Irritant, Etc.) |
|---|---|
| $LC_{50}$ Inhalation- rats (LCLo) - 50ppm/30 min.(1) | Inhalation: Poison |
| $LD_{50}$ Dermal - not available | Skin/Eye: liquid may be irritating |
| $LD_{50}$ Ingestion - not available | Ingestion: unknown |
| $C_{50}$ (Lethal Concentration) - not available | Aquatic: unknown |

Human Exposure Information/Data: There are documented cases of delayed pulmonary edema and fatalities due to phosgene overexposure.

**24-HOUR EMERGENCY ASSISTANCE: (304) 843-1300**

## SECTION 5 · EFFECTS OF OVEREXPOSURE

This section covers effects of overexposure for inhalation, eye/skin contact, ingestion and other types of overexposure in the order of the most hazardous and the most likely route of overexposure.

### Acute Effects

Inhalation: Phosgene is a highly toxic gas and is classified by the U. S. Department of Transportation as a CLASS "A" POISON. The principal action of inhalation overexposure is delayed pulmonary edema. However, this effect is not immediately apparent in a relatively mild exposure. An exposed person may accidentally breathe the gas deeply into the lungs without being aware of the hazard. Inhalation of small amounts may cause coughing, respiratory tract irritation and delayed pulmonary edema. The onset of pulmonary edema may be delayed for as long as 24 hours after exposure, but depending upon the extent of exposure, it usually occurs within 8 hours.

Eye/Skin Contact: Liquid phosgene may cause severe chemical burns. If there has been liquid exposure with respect to the skin, inhalation of vapors must also be suspected.[2]

Ingestion: Should be considered toxic if ingested. However, this route of exposure is not the primary occupational concern.

Chronic Effects: According to NIOSH[2] there are no pertinent data in the scientific literature concerned with long-term effects on humans exposed to phosgene at low concentrations.

## EMERGENCY AND FIRST AID PROCEDURES:

NOTE: Prior to attempting a rescue of persons exposed to phosgene, all rescue/first aid personnel must be equipped with NIOSH/MSHA-approved, self-contained breathing apparatus until rescue/first aid operations are complete, phosgene vapors have been eliminated, and all contaminated clothing has been removed and disposed.

INHALATION: Remove to fresh air and immediately remove all contaminated clothing and shoes. Do not allow person to walk. If breathing stops, give artificial respiration, preferably mouth-to-mouth. Otherwise, give oxygen. Take immediately to a local medical facility or hospital.

EYE/SKIN CONTACT: Immediately provide exposed person with approved respiratory protection and remove from area of exposure into fresh air. Then thoroughly flush eyes and skin with plenty of water (soap and water for skin) for at least 15 minutes while removing contaminated clothing and shoes. (DO NOT remove respiratory protection during this procedure). Then, transport person to a hospital or local medical facility and observe for possible inhalation overexposure. Place contaminated clothing into an airtight container until it can be decontaminated. Decontaminate clothing by placing in a 20% soda ash solution overnight. Then discard contaminated clothing.

SWALLOWING: If conscious, drink a quart of water. Then, induce vomiting by placing a finger far back in the throat. Call a physician. If vomiting cannot be induced, take immediately to a hospital or physician. Do not induce vomiting or give anything by mouth to an unconscious person. Be aware of possible inhalation overexposure.
NOTES TO PHYSICIAN: IMPORTANT! The attached letter dated February 28, 1980, entitled, "TO: EMERGENCY ROOM PHYSICIAN" should be given to any physician attending anyone suspected of overexposure to phosgene.

## SECTION 6 - REACTIVITY DATA

| Stability: | Conditions to Avoid: Excessive heat, moisture and contamination with materials listed below. |
|---|---|
| Stable | |
| Hazardous Polymerization: | Conditions to Avoid: |
| Will not occur | |

Incompatibility (Materials to Avoid): Azides, reactive metals (such as powdered aluminum, potassium or sodium) and alcohols.

Hazardous Decomposition Products:

See Addendum

## SECTION 7 - SPILL OR LEAK PROCEDURES

Steps to be Taken if Material is Spilled or Released:

See Addendum

Disposal Method:

See Addendum

## SECTION 8 · SPECIAL PROTECTION INFORMATION

P[illegible]atory Protection: NIOSH/MSHA-approved, self-contained or supplied air breathing apparatus. R[illegible]atory protection program meeting requirements of 29CFR 1910.134 must be established.

Ventilation (Type): Local Exhaust/Mechanical General - Sufficient to maintain employee exposure to phosgene below OSHA permissible limit. All local exhaust ventilation must be exhausted through caustic scrubber.

| Eye Protection: | Gloves: |
|---|---|
| Chemical Safety Goggles | Neoprene or other impervious rubber |

Other Protective Equipment 1) Chemically impervious suit tight at the wrist and ankles w/hood, impervious boots and gloves (for high risk exposure or emergency work); 2) Safety shower and eye-wash fountain in immediate area.

## SECTION 9 · SPECIAL PRECAUTIONS

Precautions to be Taken During Handling and Storing:

- Do not apply heat to cylinder or ton tank.
- Do not use tank or cylinder as a vaporizer.
  Phosgene should be unloaded as a liquid using nitrogen pad.
- Use only appropriate wrench as provided by manufacturer for opening and closing container valves. Failure to do so may result in valve stem damage and possible phosgene release.
- Store in well-ventilated, fireproof area away from other containers.
- KEEP AWAY FROM HEAT AND MOISUTRE--Excessive heat can cause pressure buildup and may result in container rupture. Moisture can cause decomposition to carbon dioxide and hydrogen chloride.
- AVOID CONTAMINATION with other chemicals—phosgene is a reactive chemical; contamination may result in violent decomposition, fire, or explosion.
- [illegible]ver place a leaking container in water.
- [illegible]ake sure piping is dry and free of contamination of any type before admitting phosgene.
- Use only dry air (-40°F dew point min.) or oil-free nitrogen for purging, testing for leaks, or padding.

Other Precautions

- Avoid breathing gas.
- Use with adequate ventilation--ventilation must be sufficient to limit employee exposure to phosgene at or below OSHA permissible limit.
  Avoid contact with eyes, skin, and clothing.
- Do not take internally.
- For additional product information, contact PPG Industries, Inc.

## References:


1. NIOSH Registry of Toxic Effects, 1978
2. Criteria for a recommended standard...occupational exposure to PHOSGENE, U. S. Department of Health, Education and Welfare, National Institute for Occupational Safety and Health, 1976
3. Industrial Hygiene and Toxicology, Second Edition, Volume II, Frank A. Patty, 1962
4. Industrial Toxicology, Third Edition, Hamilton and Hardy, 1974


## [illegible]ments:

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B. L. Finocchio
Mgr., Product Safety

ADDENDUM TO MATERIAL SAFETY DATA SHEET ON PHOSGENE

(MARCH, 1980)

SECTION 3--FIRE AND EXPLOSION HAZARD DATA

Special Fire Fighting Procedures

In the event of fire and in the absence of leaks, phosgene-containing vessels and cylinders should be removed from the fire area and/or cooled with water spray. This is imperative because boiling of the phosgene and subsequent rupture of vessel could create an extremely hazardous situation. All unnecessary personnel should be evacuated from the fire area to a safe place far upwind of the phosgene area. Fire fighting personnel should use NIOSH/MSHA-approved, self-contained breathing apparatus with full face piece, as well as other protective equipment as outlined under Section 8.

SECTION 6--REACTIVITY DATA

Hazardous Decomposition Products

Phosgene can react with some azides to form explosive compounds; contact with reactive metals can also cause explosion or fire. Phosgene is reactive with all alcohols; however, the reaction with isopropyl alcohol in the presence of iron salts can cause explosive decomposition. Also, phosgene can react with certain diols to form shock-sensitive explosive compounds.

SECTION 7--SPILL OR LEAK PROCEDURES

Steps to be Taken in Case Material is Released or Spilled

Evacuate all personnel immediately. Only trained personnel wearing NIOSH/MSHA-approved, self-contained breathing apparatus should be permitted to reenter area. Treat all exposed personnel as outlined in Section 5, Emergency and First Aid Procedures. Never put water on a phosgene leak. To locate leak use commercial ammonia (26° Be') in a squeeze bottle or a cloth tied to a stick and dipped in ammonia water. When ammonia water is held near (but not on) a phosgene leak, or is sprayed into the air near a phosgene leak, the ammonia forms a white cloud in the presence of phosgene. Care should be taken to avoid spraying ammonia water on copper fittings. Personnel wearing full face, self-contained breathing apparatus, should position themselves upwind so escaping phosgene moves away from them. For leaks in cylinders and ton containers, rotate so gas escapes instead of liquid. If possible, remove to an

# MATERIAL SAFETY DATA SHEET

DATA SHEET NO 4013
DIVISION O&RC
ISSUE DATE 10-27-82
ISSUED BY CDS
SUPERSEDES ISSUE OF 10-3-78

MANUFACTURING DIV ADDRESS

Mobay Chemical Corporation
Organic & Rubber Chemicals Division
Penn-Lincoln Parkway West
Pittsburgh, PA 15205

| CHEMTREC CHEMICAL TRANSPORTATION EMERGENCY TELEPHONE NO 800-424-9300; DISTRICT OF COLUMBIA 202-483-7616 | MOBAY NON-TRANSPORTATION EMERGENCY NO.: (412) 923-1800 |
|---|---|
| PRODUCT NAME: 3,4-Dichlorophenyl Isocyanate | PRODUCT CODE NUMBER: F-116 |
| CHEMICAL FAMILY: Aromatic Monoisocyanate | CHEMICAL NAME & SYNONYMS: CAS NO. 102-36-3 |
| CHEMICAL FORMULA: $C_7H_3ONCl_2$ | TRADE NAME & SYNONYMS: 3,4-Dichlorophenyl isocyanate |

## HAZARDOUS INGREDIENTS

| HAZARDOUS MIXTURES OF OTHER LIQUIDS SOLIDS OR GASES | % | CURRENT TLV |
|---|---|---|
| 3,4-Dichlorophenyl isocyanate | 100 | N.E. * |
| | | |
| * The ACGIH has established a TLV of 0.02 ppm (0.14 mg/m³) TWA/ceiling for | | |
| toluene diisocyanate. This value can be used as a guideline for this product. | | |

## PHYSICAL DATA

| APPEARANCE (SOLID LIQUID, GAS) | MOLECULAR WEIGHT | MELT POINT | SPECIFIC GRAVITY |
|---|---|---|---|
| Solid (crystals) | 188.02 | > 106°F (> 41°C) | 1.393 @ 50°C |
| VAPOR DENSITY (AIR = 1) | COLOR | BULK DENSITY | BOILING POINT |
| N.E. | White to Yellow | N.E. | 460°F (238°C) |
| VAP PRESSURE | SOLUBILITY (WATER) | ODOR | % VOLATILE BY VOLUME |
| 10 mm Hg @ 108°C | Reacts with water | Sharp pungent | N.E. |

## FIRE & EXPLOSION DATA

| FLASH POINT °F (METHOD USED) | FLAMMABLE LIMIT | EXTINGUISHING MEDIA |
|---|---|---|
| 253°F (123°C) P.M.C.C. | Lel N.E. Uel N.E. | Water Fog, $CO_2$, Dry Chemica |

SPECIAL FIRE FIGHTING PROCEDURES, UNUSUAL FIRE OR EXPLOSION HAZARDS

People who are fighting isocyanate fires must be protected against isocyanate and nitrogen dioxide vapors and should wear self-contained breathing apparatus and full protective clothing. Avoid water contamination in closed containers or confined spaces, $CO_2$ evolved.

## TOXICITY DATA

| LD50 ORAL (INGESTION) | LD50, DERMAL (SKIN CONTACT) | INHALATION (LC50) |
|---|---|---|
| N.E. | N.E. | N.E. |
| FISH LC50 (LETHAL CONCENTRATION) | TLV (UNITS) (THRESHOLD LIMIT VALUE) | SKIN IRRITATION |
| N.E. | N.E. | Severe Irritant |
| EFFECTS TO EYE: Causes immediate irritation upon contact | EFFECTS TO RESPIRATORY SYSTEM: Irritation to upper and lower respiratory tract | Potential allergic sensitizer from skin contact or inhalation |

EMERGENCY AND FIRST AID PROCEDURES, EFFECTS OF OVER EXPOSURE

Overexposure: Exposures cause irritation of respiratory tract (dry throat, cough shortness of breath, chest tightness) resulting in sinusitis, bronchitis and asthma-like symptoms. Cause sensitization in some individuals resulting in asthma-like symptoms on subsequent exposures below TLV. FIRST AID: EYES-Promptly flush eyes with water for 15 minutes and get medical attention. SKIN-Wash with soap and tincture of green soap. For severe exposure, get under safety shower, remove clothing, get medical attention. INHALATION-Remove to uncontaminated area, administer oxygen if needed. INGESTION-Drink large amounts of water to reduce corrosivity and get medical help.



N.E. = NOT ESTABLISHED N.A. = NOT APPLICABLE A.I. = ACTIVE INGREDIENT

AB0000117579/175

## REACTIVITY DATA

| STABILITY | CONDITIONS TO AVOID |
|---|---|
| Stable | |
| POLYMERIZATION<br>Will not occur | CONDITIONS TO AVOID Contact with moisture and other material which react with isocyanates (e.g. bases, tertiary amines). Avoid heating over 200°F. |
| INCOMPATABILITY (MATERIALS TO AVOID)<br>Water, alcohols, strong bases, carboxylic acids, metal compounds | |
| HAZARDOUS DECOMPOSITION PRODUCTS<br>Oxides of nitrogen, carbon monoxide, traces of hydrogen cyanide | |

## SPILL OR LEAK PROCEDURE

| |
|---|
| STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED Cover the spill with sawdust, vermiculite, Fuller's earth or other absorbent materials; pour liquid decontaminant over spillage. Allow to react at least 10 min. Collect material in open containers, add further amounts of decontamination solution. Remove containers to safe place, cover loosely. Wash down area with liquid decontaminant. Decontamination solutions: Solution surfactant (Tergitol-20% & Water-80% or solution of ammonium hydroxide 4-8%, water 90-94% and detergent 2%). |
| WASTE DISPOSAL METHOD<br>Waste material may be incinerated or disposed of in accordance with RCRA. Keep waste polyol and waste isocyanate separated. Do not dispose of in sewer system. |

## SPECIAL PROTECTION DATA

| RESPIRATOR TYPE | |
|---|---|
| Use a respirator that is approved or recommended for use in isocyanate containing environments (air purifying or fresh air supplied). Consider the type of application, the environment and airborne concentrations to ensure proper selection of appropriate respirator. | |
| EYE PROTECTION<br>Goggles or Full Face Shield | GLOVES<br>Plastic or Rubber Safety Gloves |
| OTHER PROTECTIVE EQUIPMENT<br>Local exhaust ventilation is required to maintain air concentrations below TLV. Safety showers and eye-wash stations should be available. Educate and train employees in safe use use of product. | |

## SPECIAL PRECAUTIONS & STORAGE DATA

| STORAGE TEMPERATURE (OPTIMUM) | AVERAGE SHELF LIFE |
|---|---|
| Min. Ambient Max. 104°F (40°C) | One Year |
| SPECIAL SENSITIVITY (HEAT, LIGHT, MOISTURE)<br>Storage in tightly closed containers to protect from moisture. | |
| PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING<br>This product reacts with water and other substances to provide carbon dioxide gas which can cause sealed containers to expand, and possible rupture. Containers should not be resealed if contamination is suspected. | |

## SHIPPING DATA

| D.O.T. SHIPPING NAME | | TECHNICAL SHIPPING NAME | |
|---|---|---|---|
| Poisonous Solid N.O.S. | | 3,4-Dichlorophenyl isocyanate | |
| D.O.T. HAZARD CLASSIFICATION<br>Poison B | UN/NA NO.<br>UN 2811 | R.Q.<br>N.A. | |
| D.O.T. LABELS REQUIRED<br>Poison | LABEL Dated 10-15-82 | T.S.C.A STATUS<br>On Inventory | F-116 |
| REASON FOR ISSUE<br>Revision | FRT CLASS BULK:<br>FRT. CLASS PKG. Chemicals, NOI (Isocyanate) NMFC 60000 | | |
| INITIATED BY: TITLE:<br>C. A. Cooper, Product Manager | | APPROVED BY: TITLE:<br>J. J. Gerulis, Regulatory Affairs Specialist | |
| DATE INITIATED<br>10/6/82 | | DATE APPROVED<br>10/6/82 | |

N.E. = NOT ESTABLISHED N.A. = NOT APPLICABLE A.I. = ACTIVE INGREDIENT

This information is furnished without warranty, expressed or implied, except that it is accurate to the best knowledge of Mobay Chemical Corporation. The data on this sheet relates only to the specific material designated herein. Mobay Chemical Corporation assumes no legal responsibility for use or reliance upon these data.

DU PONT

# MATERIAL SAFETY DATA SHEET

## IDENTIFICATION

*Name*
Methylamine Solutions

*Grade* Monomethylamine-40%; Dimethylamine-40% and 60%; Trimethylamine-25%

*Synonyms* Monomethylamine=Methylamine, MMA; Dimethylamine=DMA; Trimethylamine=TMA

*Chemical Family*
Amine

*Formula*
See Table, page 4

*CAS Name*
See Table, page 4

*CAS Registry No.*
See Table, page 4

*I.D. Nos./Codes*

*Du Pont Registry No.*

*Manufacturer/Distributor*
E. I. du Pont de Nemours & Co. (Inc.)

*Product Information and Emergency Phone*
(302) 774-2421

*Address*
Wilmington, DE 19898

*Transportation Emergency Phone*
(800) 424-9300

## PHYSICAL DATA

*Boiling Point, 760 mm Hg* 36 to 54°C (97 to 129°F)
See Table, page 4

*Freezing Point* -75 to 6°C (-103 to 43°F)
See Table, page 4

*Specific Gravity* 0.83 to 0.93
See Table, page 4

*Vapor Pressure* 215 to 500 mmHg at 25°C
See Table, page 4

*Vapor Density* 1.1 to 2.0 (Air = 1)
See Table, page 4

*Solubility in $H_2O$* Very soluble.

*% Volatiles by Vol.*
100%

*Evaporation Rate (Butyl Acetate = 1)*

| *Form* | *Appearance* | *Color* | *Odor* |
|---|---|---|---|
| Liquid | Clear | Colorless | Ammoniacal, fishy |

*pH Information*
Alkaline

*Octanol/Water Partition Coefficient*

## HAZARDOUS COMPONENTS

| *Material(s)* | *Approximate %* |
|---|---|
| Monomethylamine | 40% |
| or Dimethylamine | 40% or 60% |
| or Trimethylamine | 25% |

## HAZARDOUS REACTIVITY

*Instability*
Stable

*Incompatibility* May react explosively with mercury. DMA or TMA may react with nitrosating agents, such as sodium nitrite, to form N-nitrosodimethylamine, an OSHA regulated carcinogen.

*Decomposition*
By reaction with mercury

*Polymerization*
Will not occur

E- 52971 **Date:** 2/83

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process. The information set forth herein is furnished free of charge and is based on technical data that Du Pont believes to be reliable. It is intended for use by persons having technical skill and at their own discretion and risk. Since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information. Nothing herein is to be taken as a license to operate under or a recommendation to infringe any patents.

## FIRE AND EXPLOSION DATA

*Flash Point* *Method* *Autoignition Temperature*

-52 to 6°C; See Table, page 4 190 to 430°C; See Table, page 4

*Flammable Limits in Air, % by Vol.*

*Lower* 2.0 to 4.9

*Upper* 11.6 to 20.7 See Table, page 4

*Fire and Explosion Hazards*

MMA and DMA are extremely flammable.
TMA is flammable.

*Extinguishing Media*

Water spray, "Alcohol" foam, $CO_2$, Dry chemical.

*Special Fire Fighting Instructions*

Use water spray to cool containers.
Methylamine solutions will burn unless very dilute; thoroughly dilute using water spray.

## HEALTH HAZARD INFORMATION

*Exposure Limits*

OSHA 8-hour Time Weighted Average (TWA) and ACGIH TLV® are: MMA = 10 ppm or 12 $mg/m^3$, DMA = 10 ppm or 18 $mg/m^3$, TMA is not regulated but Du Pont observes an exposure limit of 5 ppm.

*Significant Routes and Effects of Exposure*

Cause burns.

*Safety Precautions*

Do not get in eyes, on skin or clothing.
Do not breathe gas or vapors.
Wash thoroughly after handling.

*First Aid*

IN CASE OF CONTACT: Immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing and shoes before re-use.

IF VAPORS ARE INHALED: Remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficulty, give oxygen.

IF SOLUTIONS ARE SWALLOWED: Immediately dilute by giving large amount of water. Call a physician. Do not induce vomiting. Never give anything by mouth to an unconscious person.

## PROTECTION INFORMATION

*Ventilation* Good general ventilation should be provided to keep vapor concentrations below exposure limits.

*Personal Protective Equipment*

Have available and wear as appropriate: hard hat with brim, safety spectacles (side shields preferred), chemical splash goggles, full length face shield, rubber gauntlet gloves, rubber apron, rubber safety shoes or rubber boots over leather shoes, self-contained breathing apparatus or full face air-line respirator, complete rubber suit with hood and breathing air supply.

*Other*

## DISPOSAL INFORMATION

*Aquatic Toxicity*

TLm 96 = 100-10 ppm

*Spill, Leak or Release* Evacuate area and keep upwind of leak. Use water spray to reduce vapors. Do not flush into sewers. Dike spill. Flush spill area with plenty of water. Dilute solutions may be neutralized with 5% sulfuric acid. Comply with federal, state and local regulations on reporting releases.

*Waste Disposal*

Comply with federal, state and local regulations. If approved, may be incinerated in specially designed equipment. Do not flush to public sewer. Very dilute water solutions are biodegradable by acclimated bacteria.

## SHIPPING INFORMATION

*Transportation*

*DOT Hazard Class.*:*
Flammable Liquid

*IMCO Class.:* MMA = 3.1
DMA & TMA = 3.2

*DOT Shipping Name*:* Monomethylamine, aqueous solution
Dimethylamine, aqueous solution
Trimethylamine, aqueous solution

*UN No.:* MMA = UN 1235
DMA = UN 1160
TMA = UN 1297

*RQ Quantity*:*
RQ 1000 lb/454 kg

**49 CFR 172.101*

*Shipping Containers*

Railroad Tank cars, Tank trucks, 55-Gallon steel drums.

*Storage Conditions*

Keep away from heat, sparks and flame. Keep container tightly closed. Do not store with oxidizing materials. Water scrubber and water sprinkler or deluge system recommended for storage area.

## ADDITIONAL INFORMATION AND REFERENCES

from pages 1 and 2

| Identification: | Product MMA | DMA | | TMA |
|---|---|---|---|---|
| CAS Name | Methanamine | Methanamine, N-Methyl | | Methanamine, N,N-Dimethyl |
| CAS Registry No. | 74-89-5 | 124-40-3 | | 75-50-3 |
| NIOSH Registry No. | PF6300000 | IP8750000 | | YH2285000 |
| Chemical Formula | $CH_3NH_2$ | $(CH_3)_2NH$ | | $(CH_3)_2N$ |
| **Properties:** | | | | |
| Concentration | 40% | 40% | 60% | 25% |
| Boiling Point °C | 48 | 54 | 36 | 43 |
| °F | 118 | 129 | 97 | 109 |
| Freezing Point °C | -38 | -37 | -75 | 6 |
| °F | -36 | -35 | -103 | 43 |
| Specific Gravity ($H_2O$=1) | 0.90 | 0.89 | 0.83 | 0.93 |
| Vapor pressure at 25°C; mmHg | 300 | 215 | 500 | 340 |
| Vapor Density (Air=1)* | 1.1 | 1.6 | 1.6 | 2.0 |
| **Fire And Explosion Data:** | | | | |
| Flash Point °C | -12 | -18 | -52 | 6 |
| °F | 10 | - 1 | -61 | 42 |
| Autoignition C | 430 | 400 | | 190 |
| Temperature F | 806 | 752 | | 374 |
| Flammable Limits in Air - % by Vol. | | | | |
| Lower* | 4.9 | 2.8 | | 2.0 |
| Upper* | 20.7 | 14.4 | | 11.6 |

* For pure methylamine vapors without effects of water vapor.

For further information, see Du Pont Data Sheet, "Methylamines", and Du Pont Storage and Handling bulletin, "Methylamines".



AB0000117579/180

E. I. DU PONT DE NEMOURS & COMPANY
AGRICULTURAL CHEMICALS DEPARTMENT

January 20, 1984
ISSUE NO. 8
SUPERSEDES: 4/10/81

GROUP: PHOSGENE TECHNICAL

P 2-0-1

## RAW MATERIAL SPECIFICATION

## PHOSGENE, TECHNICAL
$COCl_2$

### REQUIREMENTS

| ITEM | SPECIFICATION | STD. METHOD* OF ANALYSIS |
|---|---|---|
| Assay, $COCl_2$, % | 99.5 Min. | |
| Acidity as HCl, % | 0.20 Max. | |
| Free chlorine, % | 0.10 Max. | |
| Non-volatile matter, % | 0.20 Max. | |
| Carbon Tetrachloride, $CCl_4$, % | 0.005 Max. | |

### PHYSICAL PROPERTIES

The color of the phosgene, as received in the shipping package, shall be colorless to yellow and it shall be substantially free of sediment or suspended insoluble matter.

* Vendor analysis certificate accepted

E. I. DU PONT DE NEMOURS & COMPANY
AGRICULTURAL CHEMICALS DEPARTMENT

August 23, 1984
ISSUE NO. 7
SUPERSEDES: 11/1/78

GROUP: MONOCHLOROBENZENE

M 13-0-1

## RAW MATERIAL SPECIFICATION

## MONOCHLOROBENZENE - TECHNICAL
$C_6H_5Cl$

REQUIREMENTS

| ITEM | SPECIFICATION | STD. METHOD OF ANALYSIS |
|---|---|---|
| Monochlorobenzene, % | 99.7 Min. | H920.485 |
| Benzene, % | 0.1 Max. | * |
| Dichlorobenzenes and Trichlorobenzenes, % | 0.1 Max. | * |
| Acidity (HCl), % | 0.015 Max. | * |
| $H_2O$ Content, % | 0.015 Max. | U870.900 |
| Physical Property | | |
| Boiling Point, °C | 131.6 | |

* Vendor's analysis accepted

E. I. DU PONT DE NEMOURS & COMPANY
AGRICULTURAL CHEMICALS DEPARTMENT

February 13, 1984
ISSUE NO. 5
SUPERSEDES: 3/28/66

GROUP: ISOCYANATES

I 1-2-1

## RAW MATERIAL SPECIFICATION

## 3,4-DICHLOROPHENYLISOCYANATE

### REQUIREMENTS

| ITEM | SPECIFICATION | METHOD OF ANALYSES |
|---|---|---|
| Assay (gas chromatography), % | 98.0 Min. | 22 81/1810 222/01* |
| Other isocyanates, % | 2.0 Max. | 22 81/1810 222/01* |
| Organic solvents, % | 1.0 Max. | 22 81/1810 222/01* |
| Hydrolyzable chlorine, % | 0.3 Max. | 2283/1221155/00* |
| Color, APHA | 20.0 Max. | C370.100 |
| Set point, °C | 40.8 Max. | C370.701 |

### CHARACTERISTICS

| | |
|---|---|
| Vapor pressure (50°C) | approx. 0.6 mbar |
| Boiling point, °C | approx. 240.0 |
| Density (50°C), g/mL | approx. 1.393 |
| Flash point, °C | approx. 123.0 |

NOTE:

* Method of Analysis from Bayer - La Porte has a check method.

E. I. DU PONT DE NEMOURS & COMPANY
AGRICULTURAL CHEMICALS DEPARTMENT

August 23, 1984
ISSUE NO. 5
SUPERSEDES: 11/30/77

GROUP: ANILINES

A 11-0-1

## RAW MATERIAL SPECIFICATION

## 3,4-DICHLOROANILINE

REQUIREMENTS

| ITEM | SPECIFICATION | STD METHOD OF ANALYSIS |
|---|---|---|
| 3,4-Dichloroaniline, % | 98.0 Min. | C500.328 |
| Water Content, % | 0.1 Max. | C500.849 |
| Morpholine and its salts, % | 0.5 Max. | C500.328 |
| Morpholine, % | 0.2 Min. | C500.328 |
| Aniline and monochloranilines, % | 0.4 Max. | C500.328 |
| Isomeric dichloroanilines, % | 1.3 Max. | C500.328 |
| Nitro Compounds as 3-4-dichloronitrobenzene, % | 0.1 Max. | * |
| Hydrazo tars, % | 0.4 Max. | D305.739(H) |

*Vendor's analysis accepted

E. I. DU PONT DE NEMOURS & COMPANY
AGRICULTURAL CHEMICALS DEPARTMENT

February 4, 1985
ISSUE NO. 7
SUPERSEDES: 8/23/84

GROUP: AMINES

A 8-9-1

# RAW MATERIAL SPECIFICATION

## TRIMETHYLAMINE-ANHYDROUS

REQUIREMENTS

| ITEM | SPECIFICATIONS | STD. METHOD OF ANALYSIS* |
|---|---|---|
| Trimethylamine, % | 98.62 Min. | |
| Dimethylamine, % | 0.10 Max. | |
| Monomethylamine, % | 0.10 Max. | |
| Ammonia ($HN_3$), % | 0.01 Max. | |
| Water, % | 0.30 Max. | |

* Vendor's analysis accepted

CEDAR CHEMICAL CORP

FOR PERIOD ENDED

9-30-88

| STATE | PAYROLL | QTR TOTAL WAGES | QTR FICA WAGES | QTR FICA W/H | QTR FIT W/H | QTR SIT W/H | Y-T-D TOTAL WAGES | Y-T-D FICA WAGES | Y-T-D FICA W/H | Y-T-D FIT W/H | Y-T-D SIT W/H | WAGES EXCESS $15,000 LA. ONLY | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ARK | EXEC | 52152.00 | 52151.00 | 3914.62 | | 1914.49 | 1639350 | | 116203 | 17241.00 | 5174.47 | SEPT PAYMENT | 5 |
| | PLANT | 2953379.94 | 2071692.88 | 30617.48 | 48232.57 | 15993.18 | 12466039 | | 951104.44 | 151070.42 | 50275.57 | | |
| | TOTAL | 4471491.94 | | | | 17907.67 | | | | | | | |
| FLA | EXEC | N/C | 14125.00 | 849.89 | — | — | 3256700 | | 21941.31 | 3249.30 | — | | |
| LA | EXEC | 57034.98 | 17034.99 | 1277.32 | | 7857.67 | 1991383 | | 71527.78 | 44207.00 | 28/732 | | |
| MISS | EXEC | 1338104.47 | 174850.00 | 9514.99 | | 31558.87 | 3954073 | | 270100.02 | 58603.19 | 35874.61 | SEPT PAYMENT | 5 |
| | PLANT | 7095018.98 | 960788.03 | 72153.07 | 112980.93 | 240977.71 | 25113972.59 | | 1387630.11 | 275146.93 | 62952.49 | $899 | |
| | TOTAL | | | | | 272536.58 | | | | | | | |
| NC | EXEC | 1400001 | 140000.01 | 10574.91 | | 27449.49 | 4094185 | | 30226.23 | 5776.30 | 2023.49 | | |
| NJ | EXEC | — | — | — | — | — | 717457 | | 33785.80 | 1777.46 | 532.72 | | |
| NY | EXEC | 138750.00 | 13875.00 | 1049.02 | | 804.19 | 405650.00 | | 30417.91 | 6242.18 | 2241.65 | SEPT PAYMENT | |
| | | | | | | | | | | | | $ 12. | |
| OKLA | EXEC | 23025.00 | 23625.00 | 1777.28 | | 2480.60 | 152750.00 | | 5200.45 | 1462.52 | 760.46 | SEPT PAYMENT | 6 |
| | | | | | | | | | | | | $ 19 | |
| TENN | EXEC | 1518486.26 | 89111760 | 6692.71 | | — | 4555385.25 | | 270341.04 | 17434.52 | — | | |
| | | | | | | | | | | | | NEW ACCT | |
| IND. | EXEC | 93750.00 | 93750.00 | 7042.02 | | 2742.74 | 93750.00 | | 7042.02 | 1962.25 | 2742.74 | AUG PAYMENT | 5 |
| | | | | | | | | | | | | SEPT PAYMENT | 15 |

FUTA NEW MEXICO

FUTA CEDAR

10-21-88 9:00 AM

TOLD JEAN BUMGARNER OF LATE PAYMENTS

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EXEC | 4422892.24 | 895777.96 | 26833.70 | 7837.94 | 8782.12 | 19986891 | | 733.1992 | 2420678 | 2403928 | |
| PLANT | 13044941.72 | 1764980.91 | 102770.53 | 161141.50 | 400857.71 | 37779926.78 | | 2385073.65 | 446171.15 | 113225.06 | |
| TOTAL | 17467833.96 | 2660758.87 | 129604.23 | 168979.44 | 409639.83 | 57766818.78 | | 3118.1892 | 2866849.15 | 2517153.06 | |

270.13

254.9/10.29

AB0000080961/1

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

REPLY TO: P. O. BOX 2749
WEST HELENA, AR 72390
(501) 572-3701

November 22, 1988

TRUMBO, INC.
SIM AMBROSE, EXECUTIVE VICE PRESIDENT
P.O. BOX 2239
MEMPHIS, TN 38101

Dear Mr. Ambrose;

The only time we have used Trumbo's services is when we were building on capital projects consisting of equipment to produce a product for sale. Therefore, all of the invoices of which you ask for clarification fall into the exempt classification that states "Property is machinery or equipment for direct use in manufacturing a product" as labor to construct said machinery or equipment is considered part of the machinery or equipment.

A Sales Tax Exemption Certificate and a notification of changes in invoice amount were sent to Trumbo on each of these invoices, even as far back as 1985. A copy of each of the standard forms is attached.

The invoice B00247 is in question as the West Helena Plant has no knowledge of Vennis Emslander nor do we have any record of the invoice.

Sincerely,

Barbara Tucker

Barbara Tucker
Accountign/Accounts Payable

Date 11/21/88

To: John Miles, Charlie Parker, Janice Spakes, Richard Johns, Tom Lodice, Robert Ray, Joe Forthman, Floy Estes, Joel Walker, Shift Supervisors

From: Neil Robbins

Subject: New Products:
Flaked Tech
Grace
Dupont MBC

The new product numbers assigned to each of the new products are as follows:

| | |
|---|---|
| Flaked Tech | 55 |
| Grace | 87 |
| Dupont MBC | 89 |

We will use the start-up cost number 5250 for Flaked Tech and Dupont MBC, but will use a Capital number 8805 for the Grace project.

If you have any questions please see me.

Thanks

Neil

Neil Robbins

Date 11/21/88

From Neil Robbins

To John Miles
Charlie Parker
Janice Spakes
Barbara Tucker

Subject Research & Development Department

In an effort to tract the cost of Bill Gastrock I have sent up a new Department for R & D.
All these cost will use the following:

| Department | Product No | Cost Center |
|---|---|---|
| 23 | 51 | 8XXX |

If you have any questions please see me.

Thanks

Neil

Neil Robbins

Gil Blackford

VERTAC CHEMICAL CORPORATION
24th Floor • 5100 Poplar • Memphis, TN 38137 • 901-767-6851 TELEX 53927

pls. copy for John Tom

December 2, 1985

Mr. R. J. De Stefano
Senior Purchasing Agent
Contracting & Packaging Section
E. I. DuPont de Nemours & Company
Wilmington, DE 19898

Dear Mr. De Stefano:

Reference your inquiry No. RJD-13j-1

We have studied your data package concerning production of 6 - 7MM lbs. per year of 3,4-dichlorophenylisocyanate (DCPI) beginning in the third or fourth quarter of 1986. We would offer the following preliminary response based upon our interest in manufacturing the product for you at our West Helena, Arkansas plant.

Although we have had some experience in chemistry related to the production of DCPI, we do not feel that the technology is sufficiently current to offer a process to DuPont and would therefore propose to practice of one of the processes proposed by DuPont. We selected the anisole process contained in Section III of your preliminary technical package for our study. Within the limits of accuracy of this response, our comments could apply to the other methods of production listed in the technical package. Since the equipment is highly specialized, we elected to study the installation of new equipment in an existing building which currently has all the utilities necessary for the process. Our preliminary study carried us to a capital requirement of greater than $2.5MM with a monthly toll conversion fee of $250M. In view of the amount of capital involved, we feel it is appropriate to obtain your response to this preliminary scope estimate before proceeding with a more detailed study.

We hope that these initial figures will be helpful to you in reaching a decision on the project and would be pleased to continue work with DuPont to consider the project in more detail.

If clarification or amplification of these comments are needed, please contact me. Thank you for considering Vertac for this project.

Very truly yours,

Geoffrey L. Pratt
Director of Custom Manufacturing Projects

GLP/bh

cc: J. W. Shackelford
R. Cheves
R. A. Guidi

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

MATERIALS AND LOGISTICS DEPARTMENT

October 23, 1985

Mr. R. Cheves
Vertac Chemical Corporation
One Greentree Center
Suite 201
Marlton, NJ 08053

Dear Mr. Cheves:

INQUIRY NO.: RJD-13j-1

Please provide a quotation covering tolling services for our Agricultural Products Department. The product covered would be 6MM-7MM lbs./year of 3,4-dichlorophenylisocyanate. The service would begin approximately 3rd or 4th Quarter of 1986. Your quotation should be an estimate (showing range of minimum-maximum) based on the following:

- Du Pont will supply everything.
- Contractor will be responsible for waste disposal; however, Du Pont reserves the right to approve ultimate disposal company and site.
- Need to show cost elements involved in your total and any capital necessary.

This data package is accepted in accordance with our Confidential Information Agreement dated October 21, 1985.

This request for a quotation should not be construed as a commitment to purchase any service.

Your reply by November 25, 1985 would be appreciated. Please refer to our Inquiry No. RJD-13j-1. If you have any questions, please contact me.

Very truly yours,

R. J. DE STEFANO
SENIOR PURCHASING AGENT
CONTRACTING & PACKAGING SECTION

RJD/es
Attachment

cc: T. N. Kirchner-APD-Barley Mill

1986

R+H/DuPont 699,413 lbs

| | Date | DuPont Order ID | | B/L Weight | | Analysis | 100% Basis | Total 100% Received | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1/23 | BXPM | 84406 | 41900 | ✓ | 94.87% | 39751 | 39751 | 1 |
| 2 | 1/24 | BXPM | 84533 | 42360 | ✓ | 94.59 | 40068 | 79819 | 2 |
| 3 | 1/31 | BXPM | 84769 A02 | * 45000 | | 95.11 | 42800 | 122619 | 3 |
| 4 | 2/4 | BXPM | 84769 A04 | 42160 | ✓ | 95.12 | 40103 | 162722 | 4 |
| 5 | 2/10 | BXPM | 84769 A01 | 40340 | ✓ | 95.11 | 38367 | 201089 | 5 |
| 6 | 2/14 | BXPM | 84769 A03 | 42240 | ✓ | 95.21 | 40217 | 241306 | 6 |
| 7 | 2/17 | BXPM | 84769 A05 | 41380 | ✓ | 95.55 | 39539 | 280845 | 7 |
| 8 | 2/19 | BXPM | 84769 A06 | 35600 | ✓ | 95.55 | 34016 | 314861 | 8 |
| 9 | 2/22 | BXPM | 84769 A07 | 38080 | ✓ | 93.17 | 35479 | 350340 | 9 |
| 10 | 2/25 | BXPM | 84769 A08 | 41200 | ✓ | 92.97 | 38716 | 389056 | 10 |
| 11 | 2/27 | BXPM | 86233 | 40040 | ✓ | 94.59 | 37874 | 426930 | 11 |
| 12 | 3/3 | BXPM | 84769 A09 | 39640 | ✓ | 93.03 | 36877 | 463807 | 12 |
| 13 | 3/8 | BXPM | 84769 A11 | 45120 | | 96.67 | 43618 | 507,425 | 13 |
| 14 | 3/9 | BXPM | 84769 A12 | 32420 | ✓ | 96.67 | 31340 | 538,765 | 14 |
| 15 | 3/21 | BXPM | 84769 A13 | 41920 | ✓ | 94.38 | 39564 | 578,329 | 15 |
| 16 | 3/25 | BXPM | 84769 A14 | 39880 | ✓ | 94.17 | 37555 | 615,884 | 16 |
| 17 | 3/27 | BXPM | 84769 A15 | 40940 | ✓ | 93.98 | 38475 | 654,359 | 17 |
| 18 | 3/29 | BXPM | 84769 A16 | 36900 | ✓ | 93.98 | 34679 | 689,038 | 18 |
| 19 | | | | | | | | | 19 |
| 20 | | | | | | | | | 20 |
| 21 | | | | | | | | | 21 |

321,895 GALS SHIPPED Less first 100,000 GALS = 221,895 GAL x 3.152 = 699,413 # REQUIRED

Booked at Gross lbs * 728,620 x 1.123 = 818,240.26 CREDIT 50002-1320

Have R&H Credit as follows:

221,895 GALS x 3.54¢ = 785,508.30 DEDIT 50002-1320

(1.123 ¢ per lb DCA x 3.152 # DCA per gal of Steam = 3.54¢)

Balance in 50002-1320 $ 32,731.96 CR

* BOOKED 46,500 lbs -- should have been 46,000 lbs

© WILSON JONES COMPANY G7204 GREEN 7204 RUFF MADE IN U.S.A.

| | CONTAINERS | UNITS |
|---|---|---|
| JAN | 3000 DRMS | 105000 GALS |
| FEB | 3125 DRMS | 109375 GALS |
| MARCH | 1500 DRMS | 52500 GALS |
| APRIL | 1572 DRMS | 55020 GALS |
| | 9197 DRMS | 321895 GALS |

321,895 x 12.984 x .85% = 3,552561.98
321,895 x 12.984 x .80% = <3,343,587.74>
DIFF 208,974.24

321,895 GALS - 100,000 GALS = 221,895 x 3.152 = 699413 #DCM NEED

PURCHASE
50002-1320 CR

| | | | |
|---|---|---|---|
| JAN | 130,760 | x 1.123 | = $146,843.48 |
| FEB | 321,040 | x 1.123 | = 360,527.92 |
| MAR | 276,820 | x 1.123 | = 310,868.86 |
| | | | $318,240.26 |

SALES DR

| | |
|---|---|
| JAN | $17,700.00 |
| FEB | 387,187.50 |
| MAR | 185,850.00 |
| APR | 194,770.80 |
| | 785,508.30 |
| | $32,731.96 CR |

745000 ROHM & AAASS SHIP TO 001

STATE CODE 40

CUST P.O. # 4-25337
S/M # 20
PAY TERMS NET 30
FRT TERMS PPD & ADD
F.O.B SHIPPING POINT
SHIP FROM 04

SHIP TO 001

ITEM # 3420 STAM 11.036 gal
ITEM # 3422 FREIGHT ~~283.56~~ 280.31 PER TL
CMD2 MISC Item # Field Plus DCA Credit <15,487.50>
SHIP VIA
B/L #
WT

S-0002-1320 <is credit>

# PIPING AND EQUIPMENT

BATON ROUGE LA 504/275-6560
DECATUR AL 205/355-6510
EL DORADO, ARK 501/725-2020
FREEPORT, TEX 713/265-4286
GREENVILLE, S C 803/277-0970
HOUSTON, TEX 713/644-6481
JACKSON MISS 601/932-4890
LITHONIA GA 404/482-8761
MOBILE AL 205/666-6770
PAW CREEK, N.C 704/394-8200
PELHAM, ALA 205/663-1113
PENSACOLA, FL 904/432-9966
SAVANNAH, GA 912/964-6360

CUSTOMER # 745000
S/M ST CODE 40

Rohm + HAAS P.O. # 4-25337

11 036/GAL

321,895 gal

Shipped by Swain + Sons .65/cwt

125 drums per shipment 349 LB Gross/EA
43625 X .0065 =
283 56/per TL
Freight

ITEM # 3420

C 1472 - 4600 FRT OUT STAM

AB0000066357/4

PRINT DATE 1/31/85 TIME 9:38:36

VERTAC CHEMICAL CORP.
WEST HELENA, ARK.

| ORDER DATE | ORDER NUMBER |
|---|---|
| 1/31/85 | 20839 |

*****SHIPPING ORDER*****

INVOICE TO
ROHM & HAAS TENNESSEE
ATTN: ERIC ENGE
P.O. BOX 591
KNOXVILLE, TN 37901

SHIP TO
ROHM & HAAS COMPANY 1
C/O UNITED WAREHOUSE
137 WEST ILLINOIS AVE.
MEMPHIS, TN 38106

| REQUESTED | CUST. NO. | CUST. ORDER NO. | SALESMAN | FRT.PPD/ |
|---|---|---|---|---|
| 1/31/85 | 7450-00 | CONTRACT | P. BOMAR | PPD & A |

| SHIPPED FROM | FOB POINT | SHIP VIA | TERMS |
|---|---|---|---|
| WEST HELENA PLANT | SHIPPING POINT | | NET 30 |

| QTY ORDERED | CONTAINER SIZE | ITEM NUMBER | DESCRIPTION |
|---|---|---|---|
| | DRUM | 3420 | STAM M-4 HF (PROPANIL) |
| | | | 35 GAL DRUM |
| | | 3422 | FREIGHT |

DCA CREDIT @ 3.533/G

I BLANKET ORDER FOR SALES OF STAM FOR 1985--TOTAL CONTRACT
I REQUIREMENTS IS 388,000 GALLONS TO BE SHIPPED 2/1-5/31/85

1. 125 × 35

× 11.036

PROGRAM: VOENT VERTAC CHEMICAL CORPORATION DATE: 1/08/86
CUSTOMER ORDER ENTRY

ORDER NUMBER: 27942

CUSTOMER NO: 745000 SHIP TO: 1

| | BILLING ADDRESS | SHIPPING ADDRESS |
|---|---|---|
| NAME : | ROHM & HAAS TENNESSEE | ROHM & HAAS COMPANY |
| ADDRESS : | P.O. BOX 591 | C/O UNITED WAREHOUSE |
| | KNOXVILLE,TN | 650 SOUTH MAIN |
| | | MEMPHIS, TN 38106 |
| ZIP CODE: | 37901 | |

ORDER TYPE: CUSTOMER ORDER NO.: 4-25537 REQUESTED DATE: 000000
SALESMAN : 20 F. BOMAR PAYMENT TERMS: NET 30
FREIGHT TERMS: PPD & ADD
F.O.B.: SHIPPING POINT
SHIP FROM WAREHOUSE: 4 WEST HELENA PLANT ORDER STATUS:
DROP SHIP: BOOKING ORDER NO.: DUE DATE: 000000
INVOICE NO.: SHIP DATE: 000000

#1

CMD KEY - 2 TO RETURN

National 35-106 Made in USA

1986 DCA

R & H WILL SUPPLY ALL DCA AFTER 100,000 gallons PRODUCED.

1st 100,000 gallons we furnish DCA
REMAINING gallons they furnish DCA

We debit Inv @ 1.123 ¢ lb and credit
S0002-1320 Payable To RGH for DCA

We credit R & H on invoice when the
shipments are made at 3.54 ¢ per gal
Debit S0002-1320.

( 1.123 ¢ per lb DCA x 3.152 *DCA per gal Stam = 3.54¢ )

Keep up w Gross lbs received & Purity
(Based on pure lbs)

| NAME<br>SALES ORDER # | COUNTRY<br>MATERIAL | LB/GALLON | FACTOR | LBS DCA USED |
|---|---|---|---|---|
| SOUTHERN CROSS<br>1027 | PANAMA<br>4# | 3905 GAL | 3.35 | 13082 |
| BIESTERFELD<br>1553 | GERMANY/SRI LANKA<br>3# | 3816 GAL | 2.6 | 9922 |
| PRODUCTOS QUIMICOS<br>159# | PANAMA<br>55% | 35640 LB | .464 | 16537 |
| ICD GROUP<br>1829 | JAMAICA<br>3# | 2640 GAL | 2.6 | 6864 |
| BIESTERFELD<br>1790 | COLOMBO<br>3# | 22896 GAL | 2.6 | 59530 |
| STAUFFER<br>1900 thru 1909 | TECH | 179740 LB | .76 | 136602 |
| PRODUCTOS QUIMICOS<br>1911 | PANAMA<br>55% | 35640 | .464 | 16537 |
| | | | TOTAL | 259074 |

MONSANTO - PURCHASED 167,020 LB
INVOICE PRICE 1.00
EXPORT PRICE .85
REBATE .25
167,020 × .25 = $41,755

DUPONT - REMAINDER 92,054
INVOICE PRICE 1.00
EXPORT PRICE 1.05
REBATE .05
92,054 × .05 = $4,602.70
$46,357.70

10/3/86

| | | | |
|---|---|---|---|
| TECH | 136,602 | × .18 = | $24,588.36 |
| 55% | 33,074 | × .18 = | 5,953.32 |
| 3# | 76,316 | × .18 = | 13,736.88 |
| 4# | 13,082 | × .18 = | 2,354.76 |
| | 259,074 | × .18 = | $46,633.32 |

P O BOX 591
KNOXVILLE, TENNESSEE 37901
(615) 521-8200

ROHM AND HAAS TENNESSEE INCORPORATED
SUBSIDIARY OF ROHM AND HAAS COMPANY

June 7, 1985

Ms. Jackie Bierlein
E. I. Dupont De Nemours & Co.
Chemicals & Pigments Dept.
Brandywine Bldg. - Room B 15305
Wilmington, DE 19898

Subject: DUPONT DETENTION INVOICES

Dear Jackie:

This letter will confirm our telephone conversation of June 4 concerning the two enclosed Dupont Detention Invoices (L33 0580178, dated 5/24/85 for $450.00 and L33 0581558, dated 5/29/85 for $150.00). Although we did issue a purchase order to cover the shipment of 93% DCA to Vertac, invoices covering detention charges on shipments to Vertac should be invoiced directly to Vertac. Please cancel these two invoices and forward invoices to Vertac as follows:

Mr. John Miles
Vertac Chemical Corporation
P. O. Box 2648
West Helena, AR 72390

0154-6400

Sincerely,

E. B. Maupin, III, C.P.M.
Chemical Area Purchasing Manager

EBM/sd

cc: Mr. R. Broadbent - H. O. Purchasing
Mrs. A. H. Drinnen
Ms. S. K. Dufrasne - H. O. Ag. Chemical

cc: Bill Hackelbrad
John Miles

Vertac made the proper moves!

R

8 THE WALL STREET JOURNAL
Wednesday, November 3, 1982

# Rohm & Haas Patent Violated, Court Finds

PHILADELPHIA — Rohm & Haas Co. said a federal district court in Houston ruled that the company's patent covering use of a herbicide called propanil was infringed.

The chemicals maker said the court found Crystal Chemical Co., the American Rice Growers Exchange of Lake Charles, La., and Joseph C. Eller of Houston guilty of infringement.

Propanil is used to control weeds. Farmers who buy the herbicide from Rohm & Haas obtain the right to use the company's patented application method, the company said.

William P. Ambrogi, business director for the company's agricultural chemicals group, said the court decision requires Crystal Chemical and Mr. Eller jointly to pay the company more than $4 million in damages and the exchange to pay more than $2.7 million in damages. He said the court also ordered the defendants to stop production and shipment of propanil. Rohm & Haas said Mr. Eller has a businss involvement with both Crystal Chemical and the exchange.

None of the defendants could be reached for comment.

AB0000066770/3

INTERNAL CORRESPONDENCE

D. Stroud

DATE: OCTOBER 18, 1982

TO: JOHN MILES

FROM: GREG SATTERFIELD

CC: BILL SHACKELFORD
CHARLES IVEY

SUBJECT: SOLVENT RATIO FOR STAM M
4HF FOR 1983

AFTER TALKING TO DELMAS PENNINGTON OF ROHM AND HAAS, IT WAS MADE A LITTLE CLEARER AS TO WHAT THEIR REQUIREMENTS WILL BE FOR THE 1983 STAM PRODUCTION. THEIR RESEARCH STAFF HAS DETERMINED THAT THE RATIO OF ISOPHORONE TO MESITYL OXIDE MUST BE A MINIMUM .85 TO 1.15. THIS WAS NOT SO MUCH TO DO WITH FLASH POINT PROBLEMS AS IT WAS WITH RECRYSTALLIZATION OF PROPANIL AT HIGHER MESITYL OXIDE CONCENTRATIONS. EVIDENTLY IF YOU TAKE STAM WITH A HIGH MESITYL OXIDE CONCENTRATION, MIX IT WITH COLD WELL WATER AND DON'T SPRAY RIGHT AWAY, THERE WILL BE RECRYSTALLIZATION. THIS, OF COURSE, PLUGS NOZZLES, FILTERS, AND GIVES LESS KILL OF THE GRASSES. IT DOES APPEAR THAT WE WILL BE EXPECTED TO MEET THIS MINIMUM SPECIFICATION OF .85/1.15, ISOPHORONE TO MESITYL OXIDE.

SINCERELY,

Greg Satterfield

GREG SATTERFIELD

| 4lb STAM | STANDARD USE LB/GAL / 1 | |
|---|---|---|
| PROP TECH | 4.467 | 44.5% 3,4 4.02 LB/GAL 90% TECH |
| EMUL. | .900 | |
| M.O. | 2.065 | 0.86/1.14 SOLVENT RATIO |
| ISOPHORONE | 1.557 | |
| | 8.989 | |

10/19/82

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

July 23, 1987

Ms. Lynn A. Barnhart
E. I. Dupont
Chemicals & Pigments Dept.
Customer Service Center
Wilmington, DE 19898

Dear Lynn:

As agreed with Tom Bartolec, Cedar Chemical will receive a rebate on all DCA purchased and used for propanil export sales. Quantities purchased and rebate amounts are as follows:

| | | | | |
|---|---|---|---|---|
| 4th Qtr. | 1986 | 76,307 lbs. @ $ .20 | | $15,261.40 |
| 1st Qtr. | 1987 | 188,033 lbs. @ $ .15 | | $28,204.95 |
| 2nd Qtr. | 1987 | 147,669 lbs. @ $ .10 | | $14,766.90 |
| | | Total rebate due Cedar | | $58,233.25 |

Supporting detail is attached and the rebate checks should be sent to Mr. John C. Whitsitt, Jr., Treasurer.

Your efforts in helping Cedar be competitive in the export market is greatly appreciated.

Sincerely,

Lloyd E. Harcrow
Director of Purchasing

LEH:nm
Enclosure

cc: Mr. T. Bartolec - Dupont
bcc: J. Miles
C. Parker
G. Pratt
J. Whitsitt

| 4th Qtr. 1986 | | 1st Qtr. 1987 | | 2nd Qtr. 1987 | |
|---|---|---|---|---|---|
| Sales Order No. | Lbs. of DCA Used | Sales Order No. | Lbs. of DCA Used | Sales Order No. | Lbs. of DCA Used |
| 1830 | 10296 | 3346 | 19843 | 4374 | 13082 |
| 2034 | 3445 | 3349 | 29765 | 4803 | 4004 |
| 2361 | 20592 | 3411 | 6890 | 5039 | 33740 |
| 2517 | 39686 | 3482 | 13780 | 5154 | 19843 |
| 2671 | 1144 | 3499 | 13082 | 5223 | 10653 |
| 2750 | 1144 | 3558 | 9922 | 5224 | 10653 |
| | | 3656 | 16537 | 5225 | 10653 |
| | | 3883 | 41184 | 5226 | 10653 |
| | | 3936 | 9922 | 5227 | 10653 |
| | | 4014 | 6890 | 5267 | 10653 |
| | | 4045 | 10296 | 5370 | 13082 |
| | | 4129 | 6477 | | |
| | | 4130 | 3445 | | |
| TOTALS | 76307 | | 188033 | | 147669 |

7/1/87

Lloyd,

Here are calculations for Export DCA usage during the 1st & 2nd quarters of this year. I also included the 4th quarter of 1986, as I don't have any record of receiving a Credit for that material.

Chuck

When you get the amount of the Credit due, would you please send me a copy so Neil can access that amount.

AB0000066754/3

| | Initials | Date |
|---|---|---|
| Prepared by | | |
| Approved by | | |

## 4th Quarter 1986

| Date Shipped | Customer Sales Order # | Country Material | LB/Gallon | Factor | LB DCA Used |
|---|---|---|---|---|---|
| 10-8-86 | Biesterfeld 2034 | Sri Lanka 3# | 1305 Gal | 2.6 | 3445 |
| 10-16-86 | Biesterfeld 2361 | Sri Lanka 3# | 7920 Gal | 2.6 | 20592 |
| 11-5-86 | Hoechst Dominikana 2517 | Santo Domingo 3# | 15264 Gal | 2.6 | 39686 |
| 10-30 86 | Gilmore Int'l 2671 | — 3# | 440 Gal | 2.6 | 1144 |
| 11-13-86 | Grain Technology 2750 | Jamaica 3# | 440 Gal | 2.6 | 1144 |
| 12-18-86 | ICD Group 1830 | — 3# | 3960 Gal | 2.6 | 10296 |
| | | | | | 76307 |
| | | | | | Total 4th Quarter 1986 |

## 1st Quarter 1987

| Date Shipped | Customer Sales Order # | Country Material | LB/Gallon | Factor | LB DCA Used |
|---|---|---|---|---|---|
| 1-22-87 | Hoechst 3346 | Santo Domingo 3# | 7632 Gal | 2.6 | 19843 |
| 2-5+10 87 | Biesterfeld 3482 | Sri Lanka 3# | 5300 Gal | 2.6 | 13780 |
| 2-10 87 | Biesterfeld 3411 | Sri Lanka 3# | 2650 Gal | 2.6 | 6890 |
| 2-11 87 | Marman 3349 | Equador 3# | 11448 Gal | 2.6 | 29765 |
| 2-12 87 | Hoechst 3558 | Santo Domingo 3# | 3816 Gal | 2.6 | 9922 |
| 2-17 87 | Productos Quimicos 3656 | Panama 55% | 35640 Gal | .464 | 16537 |
| 3-5+6 87 | Biesterfeld 3883 | Sri Lanka 3# | 15840 Gal | 2.6 | 41184 |
| 3-4 87 | Biesterfeld 3936 | Sri Lanka 3# | 3816 Gal | 2.6 | 9922 |
| 3-13 87 | Southern Cross 3499 | Panama 4# | 3905 Gal | 3.35 | 13082 |
| 3-17 87 | Agro Quimicos 4045 | Santo Domingo 3# | 3960 Gal | 2.6 | 10296 |

| | Initials | Date |
|---|---|---|
| Prepared by | | |
| Approved by | | |

| | | | | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| 3-18 87 | MARMAN 4014 | — 3# | | 2650 GAL | 2.6 | 6890 |
| 3-26 87 | BIESTERFELD 4129 | THAILAND 3# | | 2491 GAL | 2.6 | 6477 |
| 3-26 87 | BIESTERFELD 4130 | THAILAND 3# | | 1325 GAL | 2.6 | 3445 |
| | | | | | | 188033 |
| | | | | | | Total 1st Quarter 1987 |
| | 2ND QUARTER 1987 | | | | | |
| 5-5 87 | SOUTHERN CROSS 4374 | PANAMA 4# | | 3905 GAL | 3.35 | 13082 |
| 5-21 87 | MARMAN 4803 | JAMAICA 3# | | 1540 GAL | 2.6 | 4004 |
| 5-26 87 | PRODUCTOS QUIMICOS 5039 | PANAMA 55% | | 72720 LBS | .464 | 33742 |
| 6-8 thru 18 87 | 5223 thru 5227 + 5267 Staubter | TECH | | 84100 LBS | .76 | 63916 |
| 6-10 87 | SOUTHERN CROSS ~~PANAMA~~ 5370 | PANAMA 4# | | 3905 | 3.35 | 13082 |
| 6-24 87 | BIESTERFELD 5754 | SRI LANKA 3# | | 7632 | 2.6 | 19843 |
| | | | | | | 147669 |
| | | | | | | Total 2ND Quarter 1987 |

DuPont Diisocyanate Budget Capital Cost Estimate 2/23/89

| ITEM | ITEM COST | TOTAL COST |
|---|---|---|
| 1 ODCB - t/c | | |
| A. Piping | 2,000 | |
| | | 2,000 |
| 2 Phosgene - cyl. | | |
| A. Piping | 10,000 | |
| B. Instrumentation | 12,000 | |
| | | 22,000 |
| 3 Cold Phos. Reactor R-B101 | | |
| A. Dip Pipe | 8,000 | |
| B. Overhead Cond. | 15,000 | |
| C. Overhead Piping | 15,000 | |
| D. Instrumentation | 5,000 | |
| | | 43,000 |
| 4 CHDA Tank | | |
| A. Installation | 20,000 | |
| B. Inlet Piping - T&I | 10,000 | |
| C. Steam Piping | 15,000 | |
| D. Utilities | 5,000 | |
| E. Electrical | 5,000 | |
| F. Piping to Reactor | 15,000 | |
| G. Instrumentation | 7,000 | |
| H. Insulation | 12,000 | |
| | | 89,000 |
| 5 Hot Phos. Reactor - R-B102 | | |
| A. Overhead Piping | 20,000 | |
| B. Inlet Piping | 10,000 | |
| C. Condensers | 40,000 | |
| D. Receiver & piping | 15,000 | |
| E. Piping to Dist Vessel | 15,000 | |
| F. Replacement | 40,000 | |
| G. Hot Oil Piping | 25,000 | |
| | | 165,000 |
| 6 Refrig. System | | |
| A. Installation | 15,000 | |
| B. Piping | 20,000 | |
| C. Tank | 30,000 | |
| | | 65,000 |
| 7 Scrubber | | |
| A. Piping | 15,000 | |
| B. Instrumentation | 10,000 | |
| C. Exchanger | 12,000 | |
| | | 37,000 |
| | | 423,000 |
| Contingency (15%) | | 63,450 |
| TOTAL FOR REACTION | | $486,450 |



AB0000117766/1

| ITEM | ITEM COST | TOTAL COST |
|---|---|---|
| 8 Distillation Vessel - R-PR103 | | |
| A. Column - existing | 10,000 | |
| B. Receiver | 15,000 | |
| C. Piping - T&I | 7,000 | |
| D. Condenser & Piping | 5,000 | |
| E. Outlet Piping | 10,000 | |
| | | 47,000 |
| 9 Evaporator | | |
| A. Repair & Install. | 25,000 | |
| B. Receiver & piping | 35,000 | |
| C. Tempered Water | 12,000 | |
| | | 72,000 |
| | | 119,000 |
| Contingency(15%) | | 17,850 |
| TOTAL FOR DISTILLATION | | 136,850 |
| TOTAL FOR REACTION | | 486,450 |
| GRAND TOTAL | | $623,300 |



AB0000117766/2

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

July 27, 1989

Mr. Robert Blackhall
E.I. DuPont and Company
Material and Logistics Department
Brandywine Building, Room 7373
Wilmington, Delaware 19898

Dear Bob:

This is to confirm our recent conversation regarding the production of sodium n-nonaoyloxyacetate p-phenylsulfonate (NOGPS). Cedar has estimated a cost of 3 to 4 million dollars to modify an existing processing unit at its West Helena plant to produce 1 - 1.5 million pounds per year of NOGPS. We estimate the daily processing fee to be $12,000 to include all services and materials, except raw materials and waste treatment. Any raw materials supplied by Cedar would be invoiced to DuPont at Cedar's cost plus 5 percent. We consider nitrogen a raw material.

At present, it appears that production could begin in the first half of 1990, subject of course to other uses developing for the processing unit we have in mind, and the speed with which an agreement to proceed could be reached. If we do proceed, it will be necessary to refine the plant modification estimate. It is sufficiently accurate for a go/no-go decision, but since it was developed in roughly ten days, it is not of sufficient accuracy for a "not to exceed" figure to be developed. Cedar is usually willing to propose a "not to exceed" plant modification fee to be paid by the client once the project scope has been well defined. Plant modifications are billed as incurred, and thus if the plant can be modified for less than the estimate, the cost reduction is passed on to the client. Cedar is willing also to operate using a fixed fee per unit of product, once the process has been sufficiently demonstrated on a commercial scale. We assume that in keeping with normal DuPont practice, the waste would be returned to a DuPont facility for disposal. However, once commercial production is established, we have been quite successful at treating at least some of the waste from DuPont projects through our biological treatment system and we have shared the cost savings when this occurs.

We have enjoyed working with DuPont on two projects this year and hope that we can reach an agreement for a three year relationship on NOGPS. We do not plan to study the project further until we hear from you that the preliminary economics are within the acceptable range. Please call if clarification or further information would be helpful.

Sincerely,

Geoffrey Pratt
Director Operations
Custom Manufacturing

/kt

cc: Brown
Eissler
Miles

**CEDAR INTERNAL CORRESPONDENCE**

DATE: November 17, 1989

TO: John Miles

FROM: Bill Gastrock WHG

CC:

SUBJECT:

The processes currently running in the plant were reviewed with regard to hazards due to thermal instability of raw materials or products. All operations were found to be well below any known decomposition temperatures.

Propanil Unit

1) Propanil
No information is available on the decomposition temperature of propanil. The stripping step is run at 350 deg.F using hot oil and no problems have been encountered.

2) 3,4-DCA
Monsanto has reported a DCA tank car eruption after heating for 3 weeks @ 338 deg.F. Subsequent work by Monsanto showed only slight decomposition of DCA after 63 days at 302 deg.F. Cedar Chemical stores DCA at approximately 200 deg.F utilizing 10 psig steam (240 deg.F) with an automatic control valve.

3) Propionic acid and anhydride
Both the acid and anhydride are thermally stable.



AB0000124050/1

DuPont CNT Unit

1) 2-Chloro-4-nitrotoluene
Decomposes above 500 deg.F. Product washes are performed at 165-175 deg.F.

2) p-Nitrotoluene
Slow decomposition at 392 deg.F while rapid exothermic decomposition occurs above 428 deg.F. Railcar is heated to 185 deg.F for transfer and chlorination is run at a maximum temperature of 176 deg.F.

3) Chlorine, thionyl chloride, ferric chloride, iodine
These raw materials and catalysts are stored at ambient temperature and present no hazards due to thermal decomposition.

To: Bill Eissler Date: 7/25/89

From: John Miles

## ROUGH COST ESTIMATE
## DUPONT DCA

1.Ø RAW MATERIALS

| | | |
|---|---|---|
| Assume ODCB @ $Ø.35/lb. = | .385 | |
| Assume catalyst @ .ØØ1lb/lb = | .Ø57 | |
| Assume all others = Cedar | .22Ø | |
| | .662 | Ø.662 |

2.Ø WASTE

| | |
|---|---|
| All waste is handled on-site. Assume cost is 7Ø% of off-site. Assume same quantities. | Ø.21Ø |

THE ABOVE COSTS DO NOT VARY WITH RATE Sub Ø.872

3.Ø PLANT COSTS

| | |
|---|---|
| Labor incl supv.&burden | $16ØØM/yr |
| Maint & op supplies | 14ØØ |
| Utilities | 4ØØ |
| T & I @ 5% of capital($2ØMM) | 1ØØØ |
| Plant OH @ 2Ø% of labor | 3ØØ |
| Depreciation (on improvements) | 3ØØ |
| Sub | $5ØØØ/yr |

4.Ø CORPORATE G&A

| | |
|---|---|
| Estimate @ 8Ø% of plant labor = | $13ØØ/yr |

This will give a range of estimated production cost depending on the amount produced.

For 2Ø MM lbs/yr $1.187/ lb

For 3Ø MM lbs/yr $1.Ø82/ lb

Based on DuPont's comments that they would like to raise the selling price of DCA to $1.6Ø/lb to meet their corporate gross margin goal, we can also estimate their cost to be $1.Ø7 at 5Ø% gross margin.

4. PLANT LABOR

| | | |
|---|---|---|
| OPS | DCNB 2/SHIFT | 8 |
| | DCA 2/SHIFT | 8 |
| | Misc/relief | 2 |
| | Pkg/Ship | 2 |
| | | 20 |
| MAINT | | 10 |
| LAB | | 2 |
| SUPV | 4 SHIFT<br>1 AREA<br>1 MAINT | 6 |

$\underbrace{38 \times 2080\ MH/yr}_{79040\ MH} \times \underbrace{\$20/MH}_{\text{INCLUDES LABOR BURDEN}} = \$1.58\ MM/yr$ Say 1.6

2. MAINT MTRL ≒ 6% CAPITAL = $1.2MM/yr

3. UTILITIES $360M/yr

4. OPERATING SUPPLIES @ 15% OF MAINT MTRL = $180M/yr

5. LAB - INCLUDED ABOVE

6. TAXES & INSURANCE - EST 5% OF CAPITAL = $1MM/yr

7. PLANT OH - EST @ 20% LABOR = $300M/yr

TOTAL PLANT COST $4.64MM - Say $5MM ≒ 25¢/LB

AB0000115525/2

ESTIMATE DUPONT COST OF DCA

1.0 RAW MTRLS

| | |
|---|---|
| ASSUME ODCB @ 35¢ × 1.1 #/# | 0.385 |
| ASSUME CATALYST @ $57 × 0.001 | 0.057 |
| ASSUME ALL OTHERS EQUIV TO CEDAR | 0.220 |
| | 0.662 |

2.0 WASTE 0.210

ALL WASTE HANDLED ON SITE

ASSUME COST IS 70% OFF SITE

ASSUME SAME QUANTITIES

3.0 PLANT COST 0.250

DETAIL ATTACHED

4.0 CORPORATE G&A 0.063

ADMIN & MKTG @ 80% OF OP. LABOR =

5.0 TOTAL $1.185/LB

AB0000115525/3

To: John Miles July 25, 1989

From: W. H. Gastrock

Subject: DCA Process - Waste Generation

Copies: Willard Brown, Bill Eissler, Ken Howard, Tom Lodice, Joe Porter, Geoff Pratt, Greg Satterfield

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## RECOMMENDATION

The estimated quantity of waste that will be produced in the production of DCA by the Cedar Process is summarized. The potential for reducing waste is greatest in the organics from the distillation, especially in the heads cut. Ken Howard has done some preliminary work aimed at dechlorination which would produce aniline which would reduce the volume of waste plus provide aniline as an additional product. Further research on this approach is recommended.

## DISCUSSION

A current estimate of the waste that will be generated in the proposed production of DCA by the Cedar Process has been made and is compared to that for the Monsanto Process in the following table. The reduction and distillation wastes are based on the Monsanto DCA technical data, and differences noted in the following table are a reflection of the higher 3,4 content in the DCNB produced in the Cedar Process. The waste generated in the DCNB production by the Monsanto Process is based on information obtained from Monsanto by G. Pratt in a telephone conversation on 7/26/88. The DCNB waste by the Cedar Process is based on our current research which is consistently producing DCNB which can be readily hydrogenated with low catalyst usage.

SUMMARY OF DCA WASTE GENERATION
(lbs. generated/lb of 98% DCA)

| Waste Stream | Monsanto Process | Cedar Process |
|---|---|---|
| 1 - Nitration spent acid | 1.73 | 1.05 |
| 2 - Aqueous wash | 3.36 | 0.22 |
| 3 - Reduction/dehydration aqueous | 0.37 | 0.37 |
| 4 - Distillation | | |
| a - Heads cut | 0.15 | 0.11 |
| b - Vacuum jet losses | 0.03 | 0.02 |
| c - Bottoms | 0.11 | 0.10 |

W. H. Gastrock WHG

WHG/ld
Enc.

2/24/84 BG

# CEDAR NITRATION - REDUCTION - DISTILLATION

| RAW MATERIAL | USAGE (lb/lb DCA) | PRICE ($/lb) | COST CONTRIB ($/lb DCA) |
|---|---|---|---|
| ODCB | 1.099 | 0.40 | 0.440 |
| 30% OLEUM | 0.793 | 0.083 | 0.066 |
| 98% $HNO_3$ | 0.486 | 0.144 | 0.070 |
| 1% Pt/C | 0.000557 | 57.55 | 0.032 |
| $H_2$ | 0.0449 | 1.78 | 0.080 |
| $Na_2CO_3$ | 0.0185 | 0.20 | 0.004 |
| LIME | 0.026 | 0.05 | 0.001 |
| | | TOTAL (minus ODCB) | ~~0.253~~ 0.693 |

| WASTE | PRODUCED (lb/lb DCA) | PRICE ($/lb) | COST ($/lb DCA) |
|---|---|---|---|
| 1- SPENT ACID RETURN FOR INCINERATION | 1.009 | 0.05 +0.04 FRT | 0.091 |
| CREDIT FOR $SO_3$ CONTENT AS 30% OLEUM | (0.759) | 0.043 | (0.033) |
| | | | 0.058 |
| 2- AQUEOUS FOR DISPOSAL | | | |
| a- NITRATION WASHES | 0.096 | | |
| b- REDN AQUEOUS | 0.335 | | |
| c- DEHYDRATION | 0.019 | | |
| | 0.450 | 0.05 | 0.023 |
| 3. ORGANICS FOR INCINERATION | | | |
| a- HEADS CUT | 0.107 | | |
| b- JET LOSSES | 0.016 | | |
| c- BOTTOMS | 0.095 | | |
| | .218 | 1.00 | 0.218 |
| | | Total waste | 0.299 |

2/28/89 BG

CEDAR: NITRATION - SULFONATION - CEDAR REDUCTION

| RAW MATERIAL | USAGE (#/#ODCB) | PRICE ($/#) | COST CONTRIB ($/#ODCB) |
|---|---|---|---|
| ODCB | 1.108 | | |
| 30% OLEUM | 1.629 | 0.083 | 0.135 |
| 98% $HNO_3$ | 0.490 | 0.144 | 0.071 |
| 1% Pt/C | 0.00528 | 57.55 | 0.304 |
| $H_2$ | 0.041 | 1.78 | 0.073 |
| MORPHOLINE | 0.0018 | 1.00 | 0.002 |
| $NaHCO_3$ | 0.012 | 0.18 | 0.002 |
| | | TOTAL (minus ODCB) | 0.587 |

| WASTE | PRODUCED (#/#ODCB) | PRICE ($/#) | COST ($/#ODCB) |
|---|---|---|---|
| 1- SPENT ACID | | | |
| a- NITRATION | | | |
| INCINERATION | 1.017 | 0.05 + 0.04 FRT | 0.092 |
| CREDIT FOR $SO_3$ | (0.765) | 0.043 | (0.033) |
| b- SULFONATION | | | |
| INCINERATION | 1.310 | 0.05 + 0.04 FRT | 0.118 |
| CREDIT FOR $SO_3$ | (0.782) | 0.043 | (0.034) |
| | | | 0.143 |
| 2- AQUEOUS FOR DISPOSAL | | | |
| a- SULFONATION WASH | 0.026 | | |
| b- RED'N AQUEOUS | 0.337 | | |
| c- DEHYDRATION | 0.018 | | |
| | 0.381 | 0.05 | 0.019 |
| | | TOTAL WASTE | 0.162 |

**CEDAR INTERNAL CORRESPONDENCE**

DATE: November 17, 1989

TO: John Miles

FROM: Bill Gastrock WHG

CC:

SUBJECT:

The processes currently running in the plant were reviewed with regard to hazards due to thermal instability of raw materials or products. All operations were found to be well below any known decomposition temperatures.

Propanil Unit

1) Propanil
No information is available on the decomposition temperature of propanil. The stripping step is run at 350 deg.F using hot oil and no problems have been encountered.

2) 3,4-DCA
Monsanto has reported a DCA tank car eruption after heating for 3 weeks @ 338 deg.F. Subsequent work by Monsanto showed only slight decomposition of DCA after 63 days at 302 deg.F. Cedar Chemical stores DCA at approximately 200 deg.F utilizing 10 psig steam (240 deg.F) with an automatic control valve.

3) Propionic acid and anhydride
Both the acid and anhydride are thermally stable.

DuPont CNT Unit

1) 2-Chloro-4-nitrotoluene
Decomposes above 500 deg.F. Product washes are performed at 165-175 deg.F.

2) p-Nitrotoluene
Slow decomposition at 392 deg.F while rapid exothermic decomposition occurs above 428 deg.F. Railcar is heated to 185 deg.F for transfer and chlorination is run at a maximum temperature of 176 deg.F.

3) Chlorine, thionyl chloride, ferric chloride, iodine
These raw materials and catalysts are stored at ambient temperature and present no hazards due to thermal decomposition.

Cedar Internal Correspondence

To: Mr. D. Hoppel July 31, 1992

Subject: DCA Operations

Copies: Bill Gastrock Neil Robbins Tom Lodice
M. J. Pocrass Greg Satterfield Pat Schweikert

From: K. J. Howard

**SUMMARY**

Waste disposal is a very large portion of the cost of producing DCA. This is exactly what was expected going into the project. The following report attempts to sort out what causes the wastes to be generated and their affect on the performance of the department.

Lights or low boilers are generated throughout the process starting with the raw materials and ending in the distillation step. A table detailing the sources of the lights, Table 1, is attached. By far the largest source is the nitration step where 2,3-DCNB is generated which accounts for almost 70% of the total lights. This obviously results in a large yield loss and because of the difficulty in separating the 2,3-DCA from the product it also directly affects the distillation capacity. If no 2,3-DCNB were produced, the distillation capacity would be on the order of 23 million pounds of DCA per year.

Taking Direct Operating Expenses, Indirects, and Overheads as fixed costs ($254,331 for June 1992) results in change of $305,100 per year for every 1 MM #/yr. So a change of +/- 1 % 2,3-DCNB in the nitrator product would result in a change of 1.2 MM #/yr of distillation capacity which would result in a difference of $366,120 in fixed costs. It would also change the costs for disposal, raw materials, product losses, and steam by $137,700. So reducing 2,3-DCNB in the nitrator from 10% to 9% would reduce the total costs by $503,820 and increase capacity by 1.2 MM #/yr.

Distillation bottoms are produced mainly in the hydrogenation step. But, not all. Every pound of trichlorobenzene in the ODCB which is nitrated ends up in the product and in the bottoms. And, some heavies can be produced during the distillation itself, else, why add the lime to the distillation. Intuition says that the quantity of catalyst used in the hydrogenation step has the largest affect on the quantity of heavies produced. Lime, being a solid, is obviously going to come out of the distillation step as bottoms.

LIGHTS

The cost of each of the sources of lights can be developed adding together raw materials, disposal, steam, rate variance, and affects on DCA losses in the distillation, as follows.

| SOURCE | RAW MTL | DISP. | STEAM | RATE VAR | DCA LOSS | TOTAL |
|---|---|---|---|---|---|---|
| PDCB | 0.48 | 0.38 | 0.14 | 1.81 | 0.02 | 2.83 $/CWT DCA |
| 2,3-DCNB | 7.14 | 6.04 | 0.23 | 17.25 | 0.37 | 31.03 |
| UNRXTD ODCB | 0.14 | 0.51 | 0 | 0 | 0 | 0.65 |
| DECLRS | 0.94 | 0.80 | 0.03 | 1.00 | 0.05 | 2.82 |

Elimination of all of the para-Dichlorobenzene from the incoming ODCB would result in 2.83 $/CWT of DCA on a production capacity of 800,000 lbs per year above present 10 MM lbs/yr. Since the pDCB presently averages 0.6 %, this means that each 0.1 % of pDCB is costing us about 133,000 lbs/yr in production and about $50,900. From this it is possible to evaluate various qualities of ODCB from the suppliers.

Similarly, evaluation of the affect of various catalysts upon dechlorination is possible.

Total elimination of all of the 2,3-DCNB from the nitrator product would theoretically allow the distillation capacity to approach 23 MM lbs/yr. But, the rest of the department could not possibly support that rate.

A rate of possibly 14 MM lbs/yr is attainable by the nitrator and hydrogenator. This would require 6 & 2/3 hydrogenator batches per day and 3 & 1/3 nitrator batches per day. Both of these have been demonstrated, but some minor modifications to the department may be necessary for long term reliability.

Reducing the amount of unreacted ODCB in the nitrator product is possible. The problem appears to be caused by slight variations in the weight of ODCB charged to each batch. Either considerable work to correct the weigh scale fluctuations or the use of a mass flow meter on the ODCB would allow some reduction in the excess ODCB in each batch.

BOTTOMS

| Material in bottoms | LBS/CWT DCA | % |
|---|---|---|
| 3,4-DCA at end of Dist. | 1.61 | 13.5 |
| Trichloroanilines | 0.10 | 0.8 |
| TCAB | 3.05 | 25.6 |
| All other Org. Heavies | 2.43 | 20.4 |
| Lime | 2.59 | 21.8 |
| DILUENT (Lights) | 2.13 | 17.9 |
| TOTAL | 11.90 | |

This table represents the materials being drummed out of V-318 to be sent for disposal. If, there is a significant weight of trash, samples, contaminated insulation, and other items, the actual weight of materials presently being identified as bottoms would be more than 11.9 lbs/CWT DCA.

Approximately 15 to 20 % of the 3,4-DCA left in the bottoms is a result of column drainback when the distillation is stopped. The remainder is left in the bottoms due to loss of heat transfer and boilup. It gets to be really a mess trying to figure out how much could be recovered if the percent heavies in the hydrogenation were less and how much is due to the solids which must be fluidized by something.

The TCAB and all other heavies stand out as the biggest loss. Together they account for 5.48 lbs/CWT of DCA produced. The laboratory and the plant results both indicate some correlation between the quantity of catalyst used in the hydrogenator and the amount of TCAB and heavies produced. A higher usage of catalyst tends to reduce these materials. If these materials could be reduced from 5.48 to 3.5 lbs/CWT by increasing the catalyst usage by another 0.5 KG, it would result in annual net savings of $150,000 per year for increased DCA yield and reduced bottoms disposal cost.

Trichlors are sneaky. They do not account for much of the bottoms quantity. The reason for this is that 90 % of the trichlors are removed from the distillation system with the product, unless we are trying to produce 99 % DCA when only 50 % are removed with the product. Producing a 98 % DCA requires a reflux to forward flow ratio of 1:3, whereas 99 % DCA requires a 3:1 ratio. About 1/3 of the trichlors are due to the trichlors in the ODCB and the remainder come from "thermal dechlorination" reactions in the hydrogenator.

Lime is a quandary. It works! Monsanto had one distillation decomposition during their long production history. They were reasonably certain that lime was not added to that batch. Their research personnel suggested using ammonia for the stabilization, but their production personnel would not even try it once! We had a decomposition using ammonia. DuPont does not use lime, but their distillation is continuous and they do have organic high boiling amines present from the hydrogenation. Lime obviously adds solids to our distillation bottoms which must be suspended and agitated vigorously enough to maintain good heat transfer. Lime ends up in our distillation bottoms.

A diluent is necessary to allow removal of the bottoms from the distillation pot and to allow drumming. It is possible that a more volatile diluent could be used, which might later be recovered immediately before drumming. Reduce the amount of lime and it should be possible to reduce the amount of diluent.

**SUGGESTIONS**

1. Use the best ODCB available. Both pDCB and trichlors should be minimized.

2. Increase the reliability of the ODCB charge to the nitrator. Mass flow meter and improvement of the recycled ODCB from V-303.

3. Increase the nitrator cooling capability. The location of the existing cooler is poor, more heat transfer area is needed, and the refrigeration system is not kept at highest efficiency at all times.

4. Investigate catalyst optimization. Type, usage, and activity.

5. Replace the hydrogenation fin tube cooler with a cooling tower.

6. Continue efforts to improve the 3,4 to 2,3 ratio in the nitrator.

7. Investigate means to reduce lime usage SAFELY, such as replace the lime with a cheap high boiling alkaline diluent.

8. Use a valve on the bottom of the distillation column to prevent packing runback while emptying bottoms out of the distillation pot.

| Where do all the DCA Lights come from ? | | | |
|---|---|---|---|
| Source | Description | # Lights/ # DCA | % of Total Gen. |
| Raw Mtls. | p-DiClBenzene | 0.0068 | 4.14 |
| | Tri-ClBenzenes | 0.0008 | 0.49 |
| | Total from Raw Mtls | 0.0076 | 4.62 |
| Nitration | * 2,3-DCNB | 0.112 | 68.13 |
| | Un-reacted ODCB | 0.01 | 6.08 |
| | Others | 0.0017 | 1.03 |
| | Total from Nitration | 0.1237 | 75.24 |
| Hydrogenation | Hydro-Dechlorination | 0.0098 | 5.96 |
| | Thermal-Dechlorination | 0.005 | 3.04 |
| | Unconverted DCNB | 0.002 | 1.22 |
| | Total from Hydrogenation | 0.0168 | 10.22 |
| Distillation | * 3,4-DCA (Imperfect Sep.) | 0.0108 | 6.57 |
| | Water and Others | 0.0055 | 3.35 |
| | Total from Distillation | 0.0163 | 9.91 |
| | Total Lights Generated | 0.1644 | 100.00 |
| | Dilution of Bottoms | -0.0213 | -12.96 |
| | Total Lights to Disposal | 0.1431 | 87.04 |

JAN 1 8 1993

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JOHN B MAXWELL, JR
ALLEN T MALONE
PHILIP G KAMINSKY
ROBERT L DINKELSPIEL
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January 18, 1993

Mr. Joseph M. Hoover
Manager
Enforcement Branch
Arkansas Department of Pollution
Control & Ecology
Hazardous Waste Division
8001 National Drive
P. O. Box 8913
Little Rock, Arkansas 72219-8913

VIA FEDERAL EXPRESS

Re: Cedar Chemical Corporation CAO LIS No. 91-118

Dear Mr. Hoover:

With regard to your letter of December 15, 1992 and your meeting with John Wagner and Jeff Bennett on January 5, 1993, this is to confirm that I will be happy to review with you or your counsel the transcripts of depositions which have been taken in Cedar Chemical Corporation's pending suit against Wormald U.S., Inc., as successor to The Ansul Company, in the Chancery Court of Phillips County. There are only a few deposition exhibits which are under seal pursuant to a Protective Order that was entered in the case; however, I have obtained permission from Wormald's counsel to give ADPC&E's attorneys access to these exhibits. I will be happy to meet with Pat Crossley or if she is on maternity leave, any other member of ADPC&E's legal staff to review these depositions in your offices at any convenient time.

This letter is also intended to clarify Cedar's intent in including my memorandum of August 26, 1992 at Tab A in the Preliminary Report; to provide additional information which was developed in subsequent discovery in the Wormald suit; and to confirm the understandings reached in the meeting on January 5, 1993 concerning your letter of December 15, 1992.

First of all, it should be understood that Table 2-1 in the Preliminary Report reflects only products which Cedar has produced at the West Helena Plant since it acquired the Plant in

1986. The information concerning these products was derived from Cedar's own records. Of course, some of these products (such as propanil, permethrin and cypermethrin) were also produced by former owners or operators at the Plant. Little documentation exists, or if it does exist, is not readily available, regarding production activities at the Plant which were carried out by Eagle River Chemical Corporation or by Vertac, the former owners in the 1970's - at least as to products which were produced by these companies but never produced by Cedar. Thus, for example, although Section 2.2.1 of the Preliminary Report reflects that dinoseb was produced at the Plant in 1972, dinoseb is not among the products listed in Schedule 2-1.

My report at Tab A in the Preliminary Report was intended to help fill this data gap by disclosing information developed in the course of Cedar's suit against Wormald with regard to dinoseb production and any other activities which occurred on the Plant site prior to Cedar's acquisition of the Plant, particularly when Ansul controlled the Plant. (As you probably know, we have asserted in the suit against Wormald, and the Court has determined, that Wormald is responsible for the clean up costs associated with certain wastes which were deposited on the site as a result of the production of dinoseb when the site was controlled by Ansul in 1972.)

In addition to the depositions referred to in my memorandum of August 26, 1992, additional depositions were subsequently taken by counsel for Wormald in September 1992. These later depositions provided information about other products which were produced on the Plant site by former owner/operators during the 1970's which are not identified in Table 2-1. While I do not think that the CAO actually contemplated that Cedar would carry out investigations and report on activities prior to its acquisition of the Plant unless documented in records available to Cedar, I am nevertheless supplementing Table 2-1 by enclosing a list of these additional products and related information in the attachment to this letter. I understand from the deposition testimony in the Wormald case and from my subsequent investigation that production of methoxychlor and DCA by former owners or operators on the plant site in 1974-1975 and the production of propanil from 1974 to 1977 involved disposal of aqueous wastes into the ponds which were closed in 1978. None of the other products listed in the enclosure would have involved such waste disposal.

I am satisfied that the attached list, together with Table 2-1 in the Current Conditions Report, is a complete list of all products manufactured at the West Helena Plant in commercial

quantities since it was first operated by Helena Chemical Company in 1970. If there is any information in ADPC&E files indicating that products other than those on these lists were ever produced on the site, please let me know.

Other than the waste streams referred to above with respect to propanil, DCA and methoxychlor production in the early 1970's, the only other wastes which were disposed of in the ponds which were closed in 1978 were wastes which were transported from Helena Chemical Company's West Helena formulating facility during the period beginning either in 1974 or 1975 and ending in 1977. These wastes are believed to have resulted from the clean out of formulating vessels and would be expected to have contained a variety of pesticide contaminants - which seems to be borne out by the 1986 soil sampling results which are included in the Current Conditions Report. Helena Chemical Company has been named third-party defendant by Wormald in the pending suit and discovery in that case may identify more specifically, if possible, these waste constituents.

Your letter (Paragraph 5) indicates that ADPC&E files disclose additional wastes which were placed in these ponds about which Cedar has no information. Obviously, for purposes of cost recovery actions under the Arkansas Remedial Action Trust Fund, we would be interested in learning everything possible about wastes which were placed in these closed ponds and persons who were involved in such disposal activities, including, of course, any information known concerning Helena Chemical Company's use of the ponds in the early 1970's. Accordingly, I would like to meet with you in your offices to review the files which are referred to in your letter.

Finally, it is my understanding that the thirteen numbered paragraphs of your NOD letter of December 15, 1992 were resolved (to the extent a resolution was required) as follows:

1. The word "wetland" will be added at the appropriate place in Figure 2-1. It is understood that no Flood Plain Map for the site is available from FEMA. It was agreed that Cedar would furnish a narrative of the 100 year flood plain and the elevations at the facility in lieu of a map. Since the meeting, however, John Wagner was able to obtain a flood plain map from the Department of Housing and Urban Development which includes the site, and this map will be included in an appendix to the FIWP. In addition, as agreed, a map showing the location of Outfall 002 at the

Mississippi River, including the line connecting the Outfall to the Plant will be provided in the appendix.

2. Cedar will provide process flow diagrams for each of those processes listed in Table 2-1 for which the biological treatment system has been used for aqueous waste disposal.

3. Table 2-3 is deemed sufficient.

4. It is understood that the comment in Paragraph 4 of your letter is being addressed pursuant to the CAO entered in LIS No. 92-198. Table 2-1 will be revised to delete waste streams which were permitted for handling through the biological treatment system, but which in fact were not so handled and were sent off site for disposal in permitted facilities.

5. The comments in Paragraph 5 are addressed above. After we have an opportunity to review the files referred to in Paragraph 5 of your letter, we may be able to shed some additional light on the subject.

6. The unavailability of a map from FEMA is addressed in Paragraph 1 above.

7. Cedar agrees that characterization of the hydrogeologic setting will be better defined as a result of implementation of the FIWP.

8. There are four documented occurrences of accidental breaks in piping lines:

a. Trestle by Kelly's -release into a ditch; no information as concerning when this occurred or how much released.

b. Trestle on Harry Stephens' property June 1985 - release into a ditch; not known how much released.

c. Release caused by break in line caused by Hill & Hill Construction in April 1989 - release into a ditch - the quantity unknown.

d. Break in line in connection with utility pole installation on other side of levee in 1992 - no release.

It is understood that the FIWP will address and justify Cedar's position that no further remedial action is required with respect to these spill locations.

9. Cedar's removal of the piping which presently transfers process waste water to the treatment system will proceed in accordance with a general construction permit issued pursuant to the CAO in LIS No. 92-198. Cedar will inspect for leaks in the course of the removal and submit an inspection report to ADPC&E pursuant to implementation of the FIWP under the referenced CAO.

10. It is understood that Cedar has not collected any sludge out of the old separator, and sludge from the new separator will be disposed of off-site - not into the biological treatment system. The FIWP will provide for soil sampling where spills occurred on the dike.

11. It is understood that the areas indicated in Exhibit C to the Memorandum which is included at Tab A of the Report will be addressed in the FIWP. (In that regard, I am enclosing a copy of a memo from ADPC&E files which was obtained during discovery in the Wormald case indicating the presence of a "temporary holding pond" on the site in July 1972, which was apparently used for dinoseb waste water. This may be identical to the partially closed impoundments which were referred to in the Holcomb deposition testimony.)

12. The owner of the property northwest of the Site, across the railroad tracks, has been determined to be Alan Hargraves, who resides at 125 Neil Road, Helena, Arkansas.

13. Cedar understands that it is obligated to submit quarterly progress reports to ADPC&E as required by the CAO in LIS No. 92-198.

It was also agreed that Cedar will have a two week extension, to February 4, 1993, in which to submit the second draft of its FIWP.

Let me know if you have any addition or correction to the above understandings. Also, if you are of the opinion that more information concerning the additional products identified in the enclosure is critical to development of a sound FIWP, please let me know promptly. In discussing the subject with Cedar's

consulting firm, ENSAFE, they are of the opinion that information contained in the Current Conditions Report is more than sufficient for development of a FIWP.

I will contact you in the near future to set up an appointment to review ADP&CE's files referred to above.

Sincerely yours,

Allen T. Malone

ATM:jw

Enclosures

cc: Ms. Pat Crossley
Mr. John Wagner
Mr. Jeff Bennett

PRODUCTS BELIEVED TO BE PRODUCED IN COMMERCIAL QUANTITIES
AT WEST HELENA SITE FROM 1970-1986
WHICH ARE NOT IDENTIFIED IN TABLE 2-1

1. Products Produced By Cedar Chemical Corporation Which Were Inadvertently Omitted From Schedule 2-1:

Diphone C for Yorkshire Chemicals plc - produced in 1988 pursuant to an unsuccessful production run which resulted in early termination of the contract.

RP15 (intermediate for production of the pesticide Tackle) - produced in relative short runs in 1986 as well as RP10 (Tackle) also produced for Rhone-Poulenc. Products and process were substantially identical to CTBL (Cobra) which was produced for another contract customer, as identified in Schedule 2-1.

ADPA-60 - This is a new product which is currently being produced for Albright & Wilson; start up occurred subsequent to preparation of the Preliminary Report.

Perborate - This is also a new product which is currently being produced for DuPont; start up occurred subsequent to preparation of the Preliminary Report.

2. Products Produced Prior To Cedar's Ownership Of The Site:

Dinoseb - in 1972

Methoxychlor (produced 1974-1975) allegedly by a joint venture comprised of Eagle River Chemical Corporation and Chemform Corporation located in West Virginia.

DCA - experimental runs from 1974-1975.

Lannate (for DuPont) 1975-1979

NBE (for Mobil Chemical) from approximately 1975 to 1979

Thiofanox (for Diamond Shamrock) from approximately 1976 to 1978

BSC (Benzene Sulphonyl Chloride) - produced from approximately 1979-1980

DRA (also known as FLO) produced for Arco from 1980-1984

2,4 DTBP (another alkylated phenol) produced for Schenectady Chemical in 1984-1985 similar to Isonox 132, as identified Schedule 2-1

OLOA 378 - An oil lube additive produced for Chevron in 1984

STATE OF ARKANSAS
DEPARTMENT OF POLLUTION CONTROL AND ECOLOGY
8001 National Drive
Little Rock, Arkansas 72209

Air 5

July 6, 1972

MEMORANDUM TO: Mr. S. Ladd Davies, Director
Mr. Jarrell Southall, Chief-Air Division

## Synopsis

Eagle River Chemical Company, West Helena, Arkansas has been manufacturing chemical herbicides since September 15, 1971. Investigations conducted by Department personnel have determined that present process methods used by this company cause the release of air and water contaminants.

Eagle River Chemical Company has not requested permit to operate equipment capable of causing air and water contaminants. Such operation is in violation of this Department's permit requirements.

## Report

Process methods at Eagle River Chemical Company, West Helena, Arkansas were inspected June 23, 1972 by the undersigned in response to an air pollution complaint received by this Department. This company is owned by Ansul Company, Marinette, Wisconsin, and has been operating at this location since September 15, 1971.

Eagle River Chemical Company manufactures technical grade DNBP (Dinitrobutylphenol), a soybean pre-emergence and Propanil a rice herbicide. Both are produced in batch type processes. DNBP is the claimed product of a liquid phase separation process resulting from a series of exothermic (heat yielding) chemical reactions whose reactants are ortho-sec-Butylphenol, sulfuric acid, sodium nitrate, methyl alcohol, and water. The resulting unclaimed product consists of sodium nitrate, dissolved phenols, sodium bisulfate, nitric acid, and water. Unclaimed product called "waste water" is collected by Great Lakes Chemical Company, El Dorado, Arkansas. This Department has granted permit to Great Lakes Chemical Company for disposal of collected "waste water" by deep injection.

While producting DNBP gasses are emitted to the atmosphere through a 6" diameter stack connected with the reaction vessel. Mr. Bruce Davey - Plant Manager, has submitted that these gasses are the product of nitrating reactions and are almost 100% Nox. Eagle River Chemical Company has not applied for permit from this Department to operate equipment capable of emitting contaminants to the atmosphere.

oduct and "waste water" spillage has saturated the soil around spective holding tanks. Mechanical agitation of this saturated ea by mobile machinery has dispersed and mixed the spillage with oil throughout company grounds. During the time of this investigation, company grounds other than those around holding tanks were covered with finely divided orange dust (dried product and "waste water" spillage ingredients mixed thoroughly with soil) that easily became airborne with minor mechanical agitation. This dust produced a burning sensation in the nasal area when breathed. Spillage from holding tanks and a recent reaction vessel rupture was ditched openly across company grounds. Most of the spillage was lifted into a temporary holding pond. However, some spillage was excaping into a local drainage ditch. Freshwater used to cool exothermic reaction vessels also entered this drainage ditch and combined with spillage. Combination produced an orange liquid effluent observed leaving company property via drainage ditch.

A saturating rainfall would have caused accumulated product and "waste water" ingredients contained in dusts on plant grounds to be carried into the same drainage ditch. No permit to operate equipment capable of releasing water contaminants has been requested by this company.

Calvin Ed White
Ecologist II

John Gardner
Sanitarian I

EW/msd
cc: Mr. John A. Mitchell
Mr. Jim Shell

Date: March 11, 1993

To: D. Hoppel

CC: T. Lodice

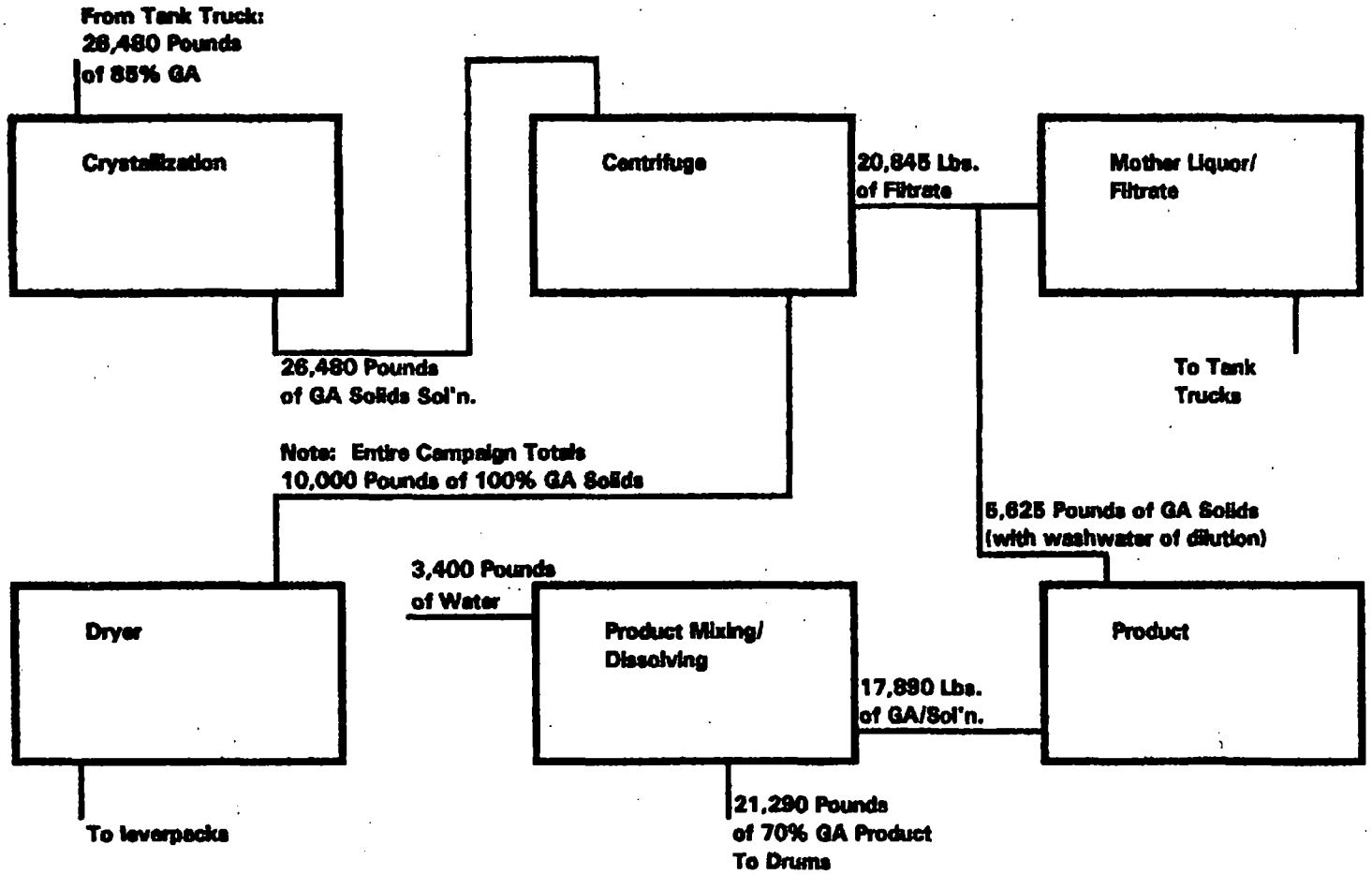
From: P. Schweikert

Subject: Glycolic Acid Project for Dupont

An initial assessment of the glycolic acid project for Dupont has been completed and submitted to the project engineering department for further detailed evaluation. The assessment includes a process flow sheet, process description, required modfications, process concerns and production estimates. The assessment was created with the desire to maintain most of the process within the proximity of the solids handling section of Unit 5.

The project appears to be relatively simple and would fit in Unit with only minor modifications. 70% glycolic acid can be produced at a rate of 26,700 pounds per day with maximum cool down during the crystallization. If a controlled cool down with a 10 F delta T is used, the production rate decreases considerably to 9,140 pounds per day.

PS




GLYCOLIC ACID PROJECT

Glycolic Acid Project:

A. Description of Flow Scheme:

1. 85% Glycolic acid at 120 F is received via tank truck. Using existing unloading lines and transfer lines at T-201, 26,480 pounds of 85% GA are pumped or pressured to the crystallizer, R-203.

2. The material is cooled to 30 F and held for 2 hours in R-203.

3. R-203 is transferred to the centrifuge feed tank, T-212.

4. The material is fed to the centrifuge and spun dry. All mother liquor drains to T-209.

5. Hot DI water is then fed through the wash nozzles to dissolve the cake with centrifuge drainage now directed to T-208.

6. When the basket is empty or near empty, the next load is fed.

7. T-209 is transferred to T-213 and then loaded back onto tank trucks.

8. T-208 is fed to R-204 where additional water is added, the material is kept at 100 F and agitated for a specified period of time. It is then drummed out.

9. A total of 5% of the product produced for the campaign will be solids run through the dryer and into 100 pounds leverpacks.

B. Required Modifications:

1. A heated (100 F) DI water supply to the centrifuge nozzles, supply is piped up but temperature control will be needed.

2. Liquor discharge piping from the centrifuge to T-208. Air-actuated valves interlocked into the centrifuge controls would also be helpful. This would allow liquor to drain to T-209 during the feed and spin cycles and liquor to drain to T-208 during the dissolving/wash cycle.

3. Transfer line from T-209 to T-213.

4. Transfer line from T-208 to R-204.

5. Either load cells on R-104 or charge metering so that the correct amount of centrifuged GA solution and DI water can be fed to the dissolving/mixing reactor.

6. Packout line from R-204.

C. Concerns:

1. If a controlled cool down is desired with only a 10 F temperature difference between brine and reactor contents, the cycle time increases from 6.5 hours to 18.9 hours. The additional equipment and instrumentation required to do this will also be costly.

2. Is the centrifuge capable of handling a rate of close to 20,000 pounds per day? Bulk density of the product is not given in the information.

3. Dissolving product in the centrifuge will increase cycle times. There is also the possibility that wet impurities that would have been removed by drying will be retained in the cake and washed out with the product.

4. The specified equipment list includes a vacuum dryer which is not what the unit possesses. A determination of whether the hollow-flite dryer is sufficient must be made.

D. Production Estimates:

The crystallizer, R-203, is a 3,000 gallon glass-lined vessel.

At 85% capacity, it will hold 26,470 pounds of 85% glycolic acid.

Yield is 25%, or 0.25 * 0.85 * 26,470 = 5,625 lbs of 100% GA

Cycle time for the crystallizer:

Cooling 85% GA solution from 120 to 30 F and then holding for two hours at that temperature.

Transfer in time = 15 minutes.

Cool down $\ln(T1-t1)/(T2-t1) = UA(time)/MC$

T1 = Start temperature or 120 F, T2 = Final temperature or 30 F
t1 = Brine temperature or 20 F
U = 40 BTU/hr*sq.ft*F
A = 235 sq. ft.
M = 26,470 pounds
C = 0.59 BTU/lb*F

Time = 2.30/0.6 = 3.82 hours

Hold period is 2 hours

Transfer out is 15 minutes

Total cycle time is approximately 6.5 hours

At 90% on stream a total of 3.32 batches can be completed per day.

Total production is 5,625 lbs/bx * 3.32 bx/day = 18,692 pounds

At 70% dilution production rate is 26,700 pounds per day.

Refrigeration required:

100 BTU/lb of GA for both heat of crystallization and cooling.

This is 2.25 MM BTU over 3.82 hours or 49 tons.

December 9, 1993

**MEMORANDUM**

Fm: John Wagner

To: M.J. Pocrass

Re: Sump Inspection

Sumps in units 2, 5, and 6 were inspected today by Ensafe as a part of the Facility Investigation. The recommendations resulting from the inspection follow:

1. Unit 2 - Reline with concrete similar to what we did for the unit 3 sump. After the concrete has cured, coat it with an acid resistant epoxy similar to what we used on the pad 3 waste drum shelter. Guinn ordered this epoxy before. Put a rush on the order so we can coat it immediately after the concrete dries.

2. Unit 5 - Clean and coat the existing concrete with an epoxy liner resistant to whatever waste will most commonly be collected there. The sump is clean now, but you need to decide the timing on the coating.

3. Unit 6 - Do the same as in unit 5.

JW

Guinn
Note comments 2 and 3 above.
Confer with Tom as soon as you can and let's order what would be appropriate for each unit.

MJP 12/10/93

XC TL
JW

ND denotes that the compound is not detected at or above the indicated detection limit.

Data was reported with qualifiers as follows:

Organic Qualifiers

A - Tentatively identified compound is a suspected aldol condensation.

U - Compound analyzed but not detected

E - Compound exceeded calibration range

D - Compound analyzed at a secondary dilution factor

J - Compound detected but below the contract required quantitation limit (the value given is an estimate)

N - Identification of tentatively identified compound is based on a mass spectral library search.

S - Spiked compound

B - Compound was found in the method blank

X - Data has been manually integrated

Inorganic Qualifiers

B - The reported value is less than the Contract Required Detection limit (CRDL) but greater than the Instrument Detection Limit (IDL).

E - The reported value is estimated because of the presence of interference.

M - Duplicate injection precision is not met.

N - Spiked sample recovery is not within control limits.

S - The reported value was determined by the Method of Standard Additions (MSA).

U - The analyte was analyzed but not detected.

W - Post digestion spike for furnace AA analysis is out of control limits (85 to 115 percent) while sample absorbance is less than 50 percent of spike absorbance.

* - Duplicate analysis is not within control limits.

+ - Correlation coefficient for the MSA is less than 0.995.

QA/QC information can be found immediately following the analytical data.

| Health Based Action Levels and MCLs for Metals | | |
|---|---|---|
| Analyte | Soil<br>Health Based Action Level<br>mg/kg | Water<br>MCLs and Other<br>$\mu$g/kg |
| Arsenic | 0.6+ | 50.0 |
| Barium | 4,000.0<br>140.0+ | 2,000.0 |
| Cadmium | 1.0+ | 5.0 |
| Calcium | -- | -- |
| Chromium | 80,000.0 | 100.0 |
| Iron | -- | 300.0 SMCL |
| Lead | -- | 50.0<br>15.0 (action level) |
| Magnesium | -- | -- |
| Mercury | -- | 2.0 |
| Selenium | 10.0+ | 50.0 |
| Silver | 200.0<br>10.0+ | 100 SMCL |
| Sodium | -- | -- |

* - Health Based Criteria
\+ - Based on Oral RfD for Pica Child
x - Based on Oral RfD for Adult

| Health Based Action Levels and MCLs for Semi-Volatile Organic Compounds | | |
|---|---|---|
| Compound | Soil Health Based Action Levels mg/kg (ppm) | Water MCLs and Other µg/l (ppb) |
| Di-n-Butylphthalate | 8,000<br>200+<br>70,000x | 4.0* |
| 3,4-Dichloroaniline | -- | -- |
| Dinoseb | 80<br>2.0+<br>700x | 7.0 |
| 1,4-Dichlorobenzene | -- | 75.0 |
| 2-Fluorophenol | -- | -- |
| 2-Fluorobiphenyl | -- | -- |
| 4-Methylphenol | -- | -- |
| Nitrobenzene-d5 | 40<br>1.0+<br>350x | 20.0 |
| Phenol-d5 | 3,000<br>1,200+<br>420,000x | 1,000* |
| Propanil | 10.0+<br>3,500x | -- |
| Pyrene | 60.0+ | -- |
| Terphenyl-d14 | -- | -- |
| 2,4,6-Tribromophenol | -- | -- |

* - Health Based Criteria
\+ - Based on RfD for Pica Child
x - Based on RfD for Adult

| Health Based Action Levels and MCLs for Volatile Organic Compounds | | |
|---|---|---|
| Volatile Organic Compounds | Soil Health Based Action Levels mg/kg | Water MCLs and Other µg/l |
| Acetone | 8,000.0<br>200+ | 4,000.0* |
| 2-Butanone | -- | -- |
| Benzene | -- | 5.0 |
| Chlorobenzene | 2,000.0 | 1,000* |
| Chloroform | 800 | 100 |
| Carbon Tetrachloride | 60 | 5.0 |
| 1,2-Dichloroethane | 40+ | 5.0 |
| 1,2-Dichloropropane | -- | 5.0 |
| Ethylbenzene | 8,000<br>200+ | 700.0 |
| 2-Hexanone | -- | -- |
| 4-Methyl-2-Pentanone | -- | -- |
| Methylene Chloride | 120+ | -- |
| Tetrachloroethene | 20.0 | 5.0 |
| Toluene | 200 | 100.0 |
| Xylenes | 200 | 10,000.0 |

* - Health Based Criteria
\+ - Based on Oral RfD for Pica Child
x - Based on Oral RfD for Adult

| Health Based Action Levels and MCLs for Pesticides | | |
|---|---|---|
| Compound | Soil Health Based Action Level mg/kg | MCLs and Other µg/kg |
| Aldrin | 2.0<br>0.06+ | 1.0*<br>0.002 |
| BHC Isomers (Lindane) | 20.0 | 0.2 |
| Γ-Chlordane | 0.12+ | 2.0 |
| DDT Isomers | 40.0 | 20.0* |
| Dieldrin | 4.0<br>0.1+ | 2.0* |
| Endosulfan Sulfate | 0.1+ | -- |
| Heptachlor | 40.0<br>1.0+ | 0.4 |
| Methoxychlor | 10.0+<br>3,500.0x | 40.0 |

* - Health Based Criteria
\+ - Based on Oral RfD for Pica Child
x - Based on Oral RfD for Adult

## FACILITY INVESTIGATION

## METHYLENE CHLORIDE AND 1, 2 - DICHLOROETHANE IN SAMPLES

1. Methylene chloride was used in the DuPont and CTBL processes as a diluent in the reaction and was distilled and then recycled through the process. 1,2-dichloroethane served the same purpose in the Mobil and RP(Tackle) processes.

175 ↗ (NCC) ↘ 86

2. Methylene chloride would have been most common around unit 4 and dichloroethane around unit 3.

3. Methyl chloride was used in the manufacture of methoxychlor.

November 30, 1993

**MEMORANDUM**

Fm: John Wagner

To: Dave Hoppel

cc: M.J. Pocrass

Re: Facility Investigation Preliminary Results

Enclosed is information on the three sites where we had unexpected groundwater contamination.

Two wells were drilled south of the tank farm and north of the drum storage area. Both exceed removal limits for various substances. Well 1 (west) is the "gas" well and well 2 had the yellow-stained water.

Two wells (3 & 5) exceed limits at the biotreatment system. All of the wells around the impoundments exceed various limits.

This is some of the information that will be submitted to ADPC&E on December 17, and these are the areas that will require Phase II followup.

Tank Farm

| Detected VOCs | CED4GWMW-1 | CED4GWMW-2 | CED4GWMW-2D | MCL |
|---|---|---|---|---|
| 1,2-Dichloroethane | 5,800 | 310 | 240 | 5 |
| Toluene | 110,000 | 60 | 62 | 1000 |
| Chlorobenzene | U | 30.0 J | 30.0 J | 100 |
| Total Xylenes | 1,400 J | 38.0 J | 44.0 J | 10000 |
| Chloroform | U | 1,400 | 1,900 | 100 |
| Benzene | U | 46.0 J | 43.0 J | 5 |
| Methylene Chloride | 1,200 J | 1,300 | 1,500 | 5 |
| Detected SVOCs | | | | |
| 1,4-Dichlorobenzene | U | U | 2.0 J | |
| 4-Methylphenol | 23 | U | U | |
| 4-Chloroaniline | 29 | 5.0 J | 5.0 J | |
| bis-(2-Ethylhexyl)phthalate | U | U | U | |
| 2,4-Dinitrophenol | U | 110 | 109 | |
| Benzoic Acid | 57 | U | U | |
| Phenol | 45 | U | U | |
| Isophorone | 17 | 2.0 J | 2.0 J | |
| Diethyl Phthalate | U | U | U | |
| Dinoseb | U | 41,000 | 47,000 | 7 |
| Napthalene | 2.0 J | U | U | |
| 2-Methylphenol | 35 | U | U | |
| 1,2-Dichlorobenzene | 960 | 33 | 35 | |
| 3,4-Dichloroaniline | 68 | 22 | 28 | |
| Detected Analyte | | | | |
| Iron | 22,000 E | 122,000 E | 108,000 E | |
| Lead | 89.2 | 134 | 118 | 30 |
| Magnesium | 59,000 | 201,000 | 169,000 | - |
| Mercury | U | U | U | |
| Sodium | 57,200 | 27,000 | 29,700 | - |
| Arsenic | 21.8 | 24.8 | 25.8 | 50 |
| Barium | 1,460 | 1,530 | 1,370 | 2000 |
| Cadmium | U | 2.2 N | U | |
| Chromium | 41 | 120 | 107 | 100 |
| Calcium | 166,000 E | 382,000 E | 322,000 | - |
| Selenium | U | U | U | |

Removal Action Level (ppb)

Organic Qualifiers

U - Compound analyzed but not detected

J - Compound detected but below the contract required quantitation limit (estimated value)

Inorganic Qualifiers

U - The analyte was analyzed but not detected

E - The reported value is estimated because of the presence of interference

Biotreatment System

| Detected VOCs | CED1GWMW-1 | CED1GWMW-2 | CED1GWMW-3 | CEDGWMW-3D | CED1GWMW-4 | CED1GWMW-5 | CEDGWMW-6 | |
|---|---|---|---|---|---|---|---|---|
| 1,2-Dichloroethane | 19.0 | U | 2,700.0 | 2,500.0 | U | U | U | 5 |
| Chloroform | 2.0 J | U | U | U | 2.0 J | U | U | 100 |
| Trichloroethene | U | U | U | U | 28.0 J | U | U | |
| Detected SVOCs | | | | | | | | |
| bis-(2-Ethylhexyl)phthalate | 2.0 J | U | U | U | U | U | U | |
| 1,4-Dichlorobenzene | U | U | 4.0 J | 4.0 J | U | U | U | 75 |
| 4-Chloroaniline | U | U | 76.0 J | 160 J | 1.0 J | U | U | |
| 1,3-Dichlorobenzene | U | U | 4.0 J | 3.0 J | U | U | U | 600 |
| Di-n-butyl phthalate | U | U | U | U | U | U | U | |
| 1,2-Dichlorobenzene | U | U | 31.0 | 30.0 | U | U | U | 600 |
| 3,4-Dichloroaniline | U | U | 55.0 | 60.0 | 12.0 | 13.0 | U | – |
| 2,6-Dinitrotoluene | U | U | U | U | U | 320 J | U | 5? |
| Benzoic Acid | U | U | U | U | U | U | 11.0 J | |
| Detected Analyte | | | | | | | | |
| Iron | 109,000 | 53,600 | 107,000 | 160,000 | 22,500 | 42,300 | 18,300 E | |
| Lead | 41.1 | 25.9 | 38.0 | 48.9 | 10.8 | 16.1 | 15.9 | |
| Magnesium | 174,000 | 65,100 | 261,000 | 383,000 | 240,000 | 157,000 | 72,800 | |
| Sodium | 62,100 | 67,700 | 625,000 | 556,000 | 379,000 | 905,000 | 72,300 | |
| Arsenic | 38.5 N | 21.8 N | 44.8 N | 49.3 N | 13.5 N | 20.1 N | 23.6 | 50 |
| Barium | 923.0 | 513.0 | 639.0 | 955.0 | 441.0 | 324.0 | 583.0 | 2000 |
| Chromium | 81.4 | 47.1 | 80.5 | 113.0 | 21.2 | 47.5 | 12.7 | 100 |
| Calcium | 304,000 | 74,100 | 284,000 | 456,000 | 286,000 | 350,000 | 314,000 E | |
| Selenium | U | U | U | U | U | U | U | |

Organic Qualifiers

J - Compound detected below contract required quantitation limit (estimated value)

U - Compound analyzed for but not detected

Inorganic Qualifiers

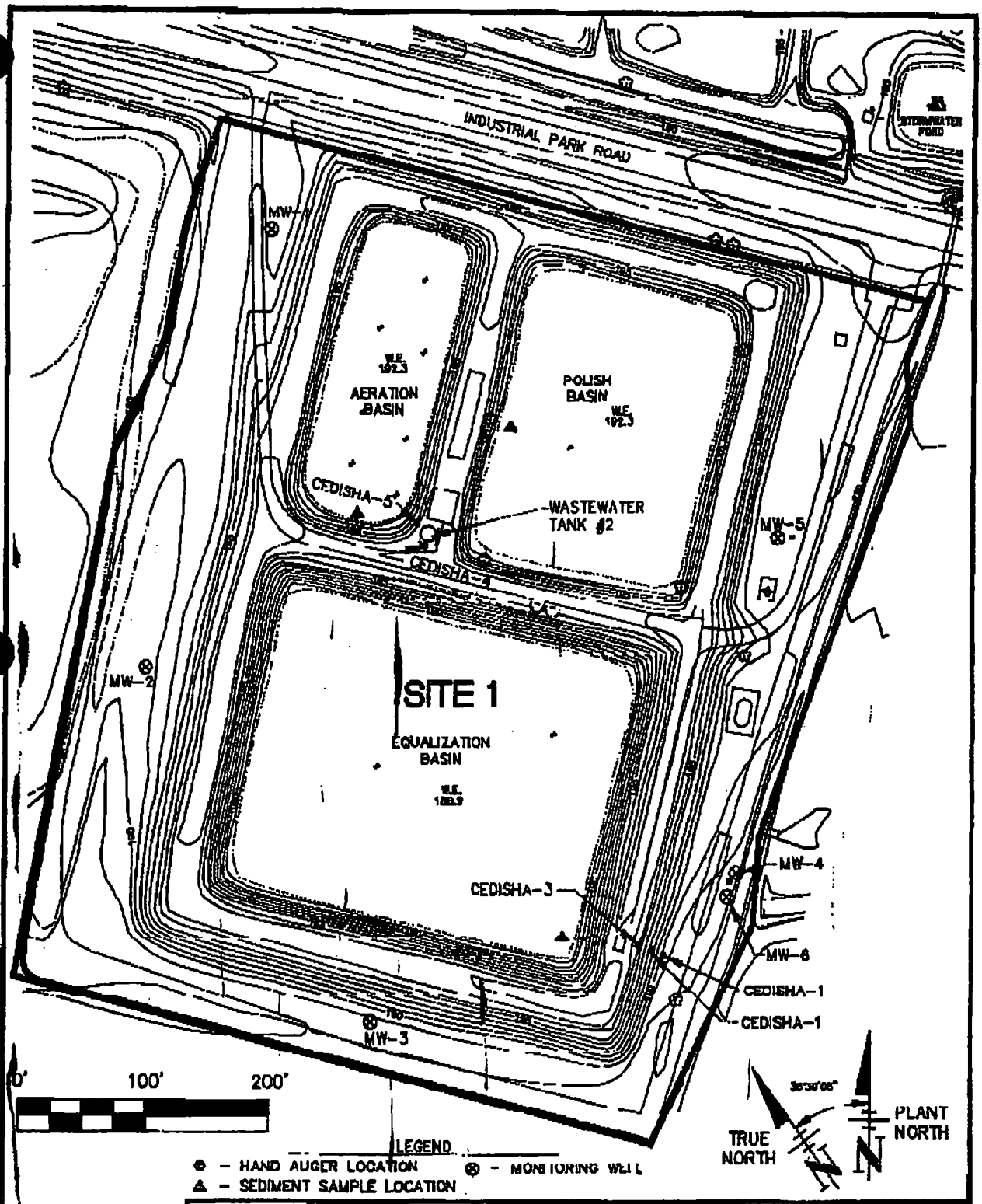
U - The analyte was analyzed for but not detected

N - Spiked sample recovery is not within control limits

E - The reported value is estimated because of the presence of interference



ADEQ0023303/10




Environmental and Safety Designs, Inc.

EnSafe

3724 SUMMER TREES DR. MEMPHIS, TN 38134 901/372-7962
NASHVILLE, TN, PENSACOLA, FL, AND RALEIGH, NC.

FIGURE 4-1
SITE 1
MONITORING WELL, HAND AUGER & SEDIMENT SAMPLE LOCATIONS

DWG DATE: 11/17/93 | DWG NAME: CEDAR2A

IMPOUNDMENTS

| Detected VOCs | CED2GWMW-1 | CED2GWMW-1DL | CED2GWMW-2 | CED2GWMW-3 | CED2GWMW-4 | CED2GWMW-5 | |
|---|---|---|---|---|---|---|---|
| 1,2-Dichloroethane | 29,000 | 29,000 J | U | 120 | 500 | U | 5 |
| 4-Methyl-2-Pentanone | 2,200 J | U | U | 520 | U | U | ? |
| Toluene | 940 J | 4,700 | U | 160 | U | U | 1000 |
| Chlorobenzene | U | 13,000 J | U | U | 470 | U | 100 |
| Total Xylenes | 1,100 J | U | U | 4.0 J | U | U | 10000 |
| Acetone | 4,600 J | 3,400 J | U | 430 | U | U | 3500 |
| Chloroform | 700 | U | U | 340 | U | 3.0 J | 100 |
| Benzene | U | U | U | U | 7.0 J | U | |
| Methylene Chloride | 470,000 R | 600,000 | U | 480 | 720 | U | 5 |
| Detected SVOCs | | | | | | | |
| bis-(2-Ethylhexyl) phthalate | N/A | N/A | 7.0 J | U | U | U | |
| 1,2-Dichlorobenzene | N/A | N/A | 58 | U | U | U | 600 |
| 3,4-Dichloroaniline | N/A | N/A | 220 | U | U | U | - |
| Metals Detected | | | | | | | |
| Iron | N/A | N/A | 127,000 E | 42,400 E | 51,000 E | 211,000 E | |
| Lead | N/A | N/A | 60.2 | 30.6 N | 39.1 N | 20.5 N | 30 |
| Magnesium | N.A | N.A | 82,500 | 66,500 | 205,000 | 44,600 | |
| Mercury | N/A | N/A | 0.25 | U | U | U | |
| Sodium | N/A | N/A | 268,000 | 93,300 | 82,500 | 38,800 | |
| Arsenic | N/A | N/A | 60.4 | 58.2 N | 32.0 N | U | 50 |
| Barium | N/A | N/A | 576 | 1,570 | 1,160 | 217,000 | 2000 |
| Cadmium | N.A | N.A | 4.0 N | U | 2.8 | U | |
| Chromium | N/A | N/A | 102 | 28.5 N | 61.7 N | U | 100 |
| Calcium | N/A | N/A | 187,000 E | 166,000 | 452,000 | U | |
| Selenium | N/A | N/A | U | U | 6.0 N | U | |

N/A - Not analyzed
R - Value is unusable (see DL value)
U - Undetected
DL - Diluted sample (value corrected for dilution)
X - Data has been manually integrated
J - Compound detected but below contract required detection limit (estimated value)
E - Estimated
N - Identification of tentatively identified compound is based on mass spectral library search

SITE 2
APPROXIMATE LOCATION OF
INACTIVE PONDS
SWMUs # 69,70 & 71
INACTIVE POND
#3
INACTIVE POND
#2
INACTIVE POND
#1
11-N
NEW OFFICE
PARKING
6-E
SCALES
TRUE
NORTH
38°30'05"
LEGEND
195

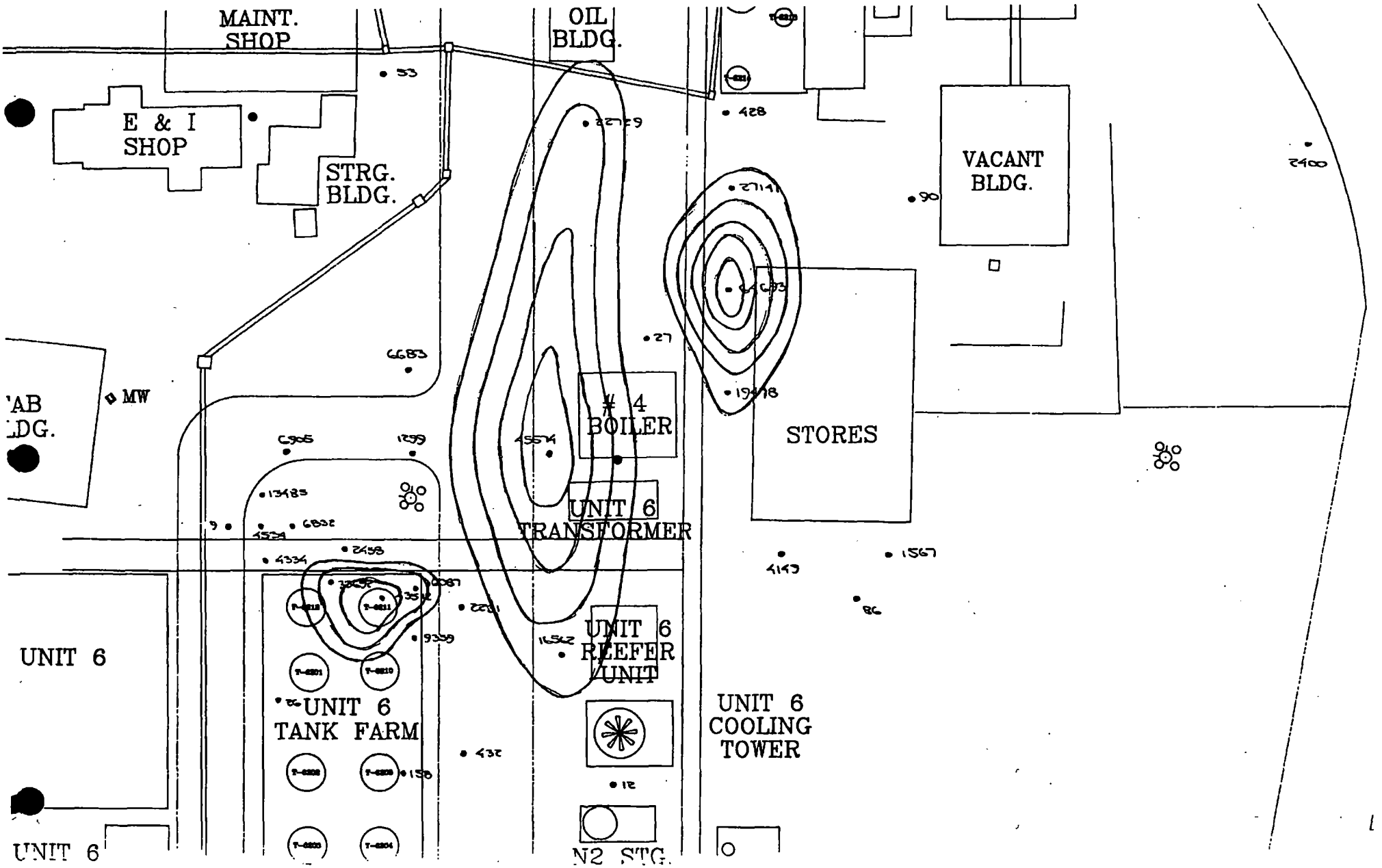
# CEDAR CHEMICAL COMPANY
# MONITORING WELL ELEVATIONS
# OCTOBER 8, 1993

| MONITORING WELL DESCRIPTION | *ELEVATION |
|---|---|
| Site 1 Well #1 | 195.43 |
| Site 1 Well #2 | 194.40 |
| Site 1 Well #3 | 191.49 |
| Site 1 Well #4 | 191.90 |
| Site 1 Well #5 | 194.16 |
| Site 1 Well #6 | 191.97 |
| Site 2 Well #1 | 201.17 |
| Site 2 Well #2 | 199.88 |
| Site 2 Well #3 | 198.76 |
| Site 2 Well #4 | 201.19 |
| Site 2 Well #5 | 199.99 |
| Site 4 Well #1 | 197.69 |
| Site 4 Well #2 | 198.01 |
| Existing Well #1 | 198.23 |
| Existing Well #2 | 199.87 |
| Existing Well #3 | 199.31 |
| Existing Well #4 | 198.13 |
| Existing Well 16' East of Ex. Well #3 | 199.00 |
| Existing Well #6 | 199.56 |
| Existing Well #6A | 198.54 |
| Existing Well #6B | 198.09 |
| Existing Well #6C | 198.17 |
| Existing Well #7 | 198.47 |

*ELEVATIONS ARE TOP OF WELL CASING PIPE WITH CAP REMOVED

Prepared By:

Cline-Frazier, Inc.
Consulting Engineers
Helena, Arkansas
Job No. 93-210




ADEQ0023303/15

DIRT SAMPLES

| DATE | SAMPLE NUMBER | DINOSEB (ppm) | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| 9/8/93 | CED95B1-1 | 86.2 | | | | |
| 9/8/93 | CED95B1-2 | 17.5 | | | | |
| 9/8/93 | CED95B2-1 | 4149 | | | | |
| 9/8/93 | CED95B2-2 | 10.6 | | | | |
| 9/8/93 | CED95B3-1 | 1567 | | | | |
| 9/8/93 | CED95B3-2 | 0.83 | | | | |
| 9/9/93 | CED95B4-2 | 12637 | | | | |
| 9/9/93 | CED95B5-1 | 64693 | | | | |
| 9/9/93 | CED95B6-1 | 432 | | | | |
| 9/10/93 | CED95B7-1 | 16562 | | | | |
| " | CED95B8-1 | 2231 | | | | |
| " | CED95B9-2 | 29 | | | | |
| " | CED95B7-3 | 495 | | | | |
| " | CED95B4-1 | 19478 | | | | |
| " | CED95B5-3 | 4377 | | | | |
| " | CED95B8-2 | 73 | | | | |
| " | CED95B5-2 | 5183 | | | | |
| " | CED95B6-2 | 108 | | | | |
| " | CED95B14-2 | 184 | | | | |
| " | CED95B11-2 | 60 | | | | |
| " | CED95B9-1 | 45514 | | | | |
| " | CED95B11-1 | 6905 | | | | |
| " | CED95B7-2 | 5377 | | | | |
| " | CED95B10-2 | 37 | | | | |
| " | CED95B13-2 | 468 | | | | |
| " | CED95B10-1 | 1299 | | | | |
| " | CED95B12-2 | 32942 | | | | |
| " | CED95B12-1 | 27141 | | | | |
| " | CED95B4-3 | 176 | | | | |
| " | CED95B15-2 | 82 | | | | |
| " | CED95B13-1 | 428 | | | | |
| " | CED95B14-1 | 90 | | | | |
| " | CED95B15-1 | 12 | | | | |
| 9/14/93 | CED95B16-1 | 6683 | | | | |
| " | CED95B16-2 | 6.3 | | | | |
| " | CED95B17-1 | 22729 | | | | |
| " | CED95B17-2 | 65 | | | | |
| " | CED95B18-1 | 27 | | | | |
| " | CED95B18-2 | 79 | | | | |
| 9/16/93 | CED25MW3-7 | <1.0 | | | | |
| 9/17/93 | CED95B19-1 | 53 | | | | |
| " | CED95B19-2 | 95 | | | | |
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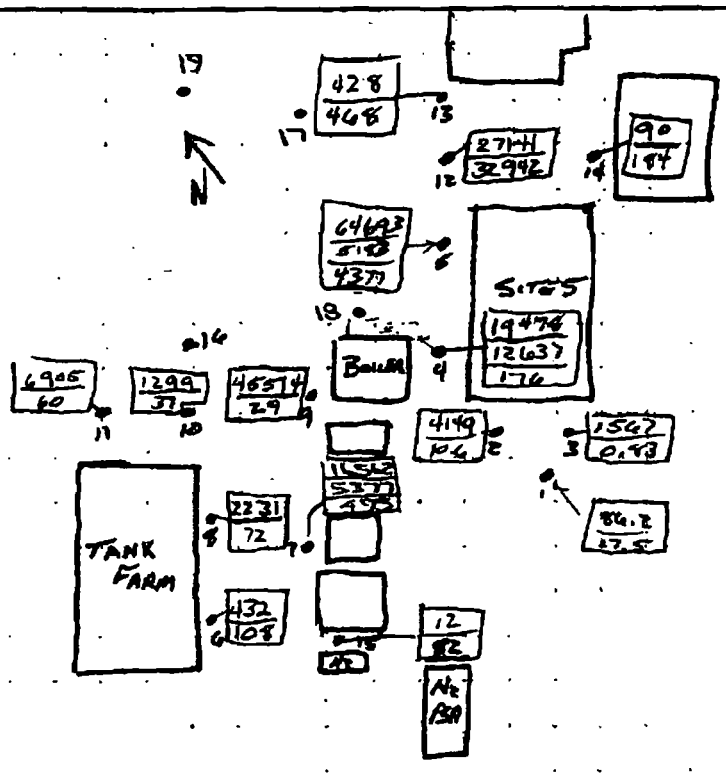
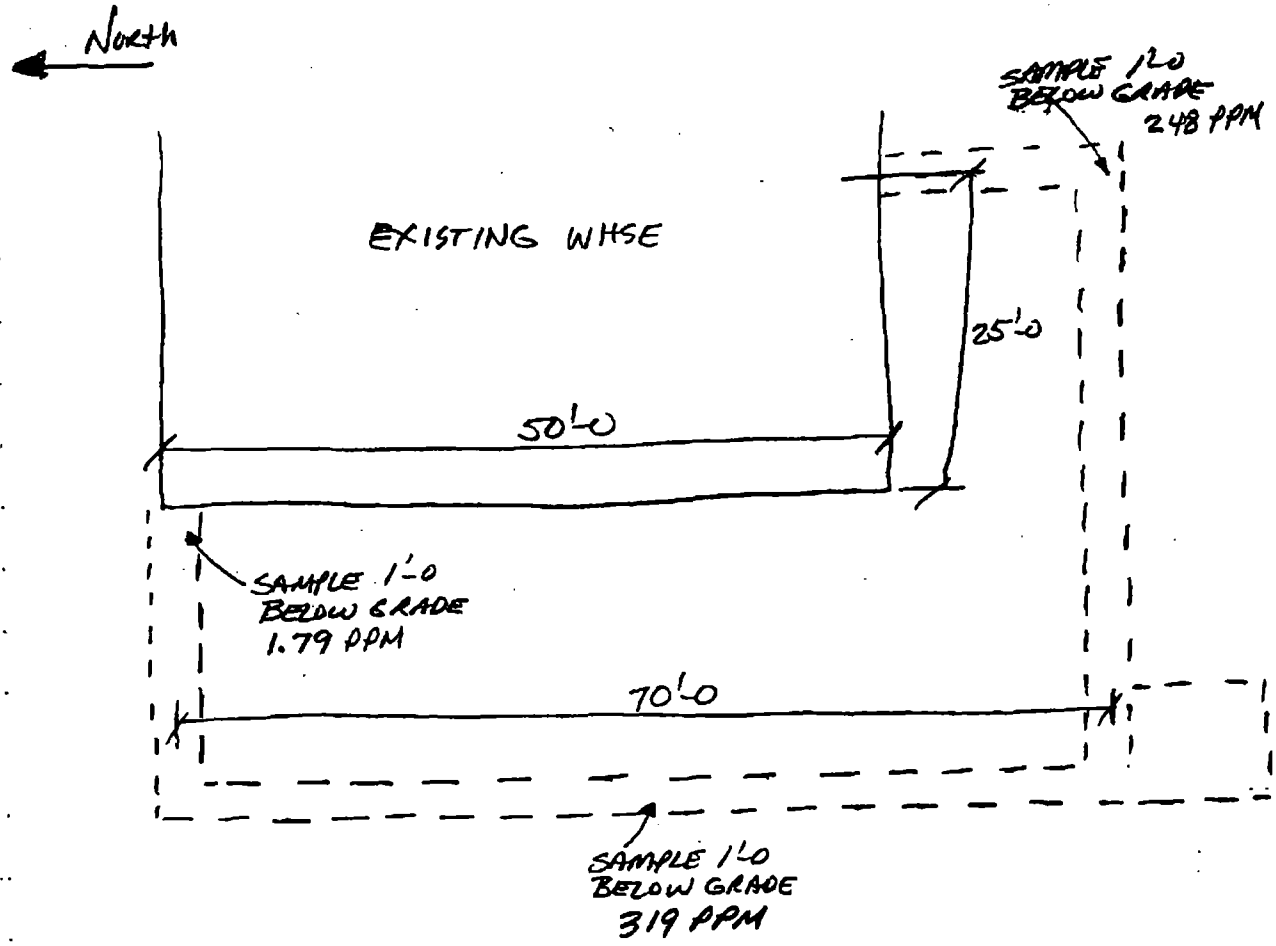
ENSAFE
Environmental and Safety Designs, Inc.
P.O. BOX 341315, MEMPHIS, TN 38184-1315
(901) 372-7962

JOB _____
SHEET NO. _____ TO _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____




Dinoseb Levels (ppm) — SITE 9
- samples collected at 5 foot intervals


North
SAMPLE 1'-0 BELOW GRADE 248 PPM
EXISTING WHSE
25'-0
50'-0
SAMPLE 1'-0 BELOW GRADE 1.79 PPM
70'-0
SAMPLE 1'-0 BELOW GRADE 319 PPM

CEDAR
CHEMICAL CORPORATION

*INTER-OFFICE CORRESPONDANCE*
*West Helena Plant*

# OPERATIONS MONTHLY REPORT - August

To: Jim Rone

From: Kevin Payne

Date: 9/15/00

CC: Randal Tomblin, Ron Fowler, Process Engineers, Supervisors, Geoff Pratt, Don Malcolm, Tony Dinculescu, Plant SLT, Joe Mancini, Chris McGee, Superintendents

## UNIT 1

Telene production began on August 1. Also, the unit continued to distill methanol in support of Unit 5 and TA.

| | AUGUST | Campaign to Date |
|---|---|---|
| Pentabrom (Lbs.) | 0 | 131,265 |
| TELENE (Lbs.) | 640,700 | 640,700 |

## UNIT 2

The Propanil unit was down for 9 days due to the DCA turnaround. This resulted in much lower asset effectiveness at 49.2%, bringing the YTD number to 78%.

We are still waiting for results from DuPont regarding our DOE on the flaker run in July.

| | AUGUST | YTD |
|---|---|---|
| Propanil Tech (Lbs.) | 1,058,050 | 12,615,263 |
| Flaked Tech (Lbs.) | 858,750 | 6,477,431 |
| 3# Bulk (Gals.) | 0 | 301,880 |
| 4# Bulk (Gals.) | 0 | 264,865 |
| 4# X Bulk (Gals.) | 0 | 148,722 |
| RiceSolo (Gals.) | 37,867 | 238,650 |
| Stam Bulk (Gals.) | 0 | 460,514 |
| 6# Molinate (Gals.) | 0 | 1,426 |

## UNIT 3

The unit is ready to begin MACE production, but material is now not expected until the end of September or beginning of October. The campaign is expected to last 60 to 90 days.

| | AUGUST | YTD |
|---|---|---|
| MACE | 0 | 0 |
| Drummed DCPI | 0 | 188,386 |
| Diuron | 0 | 0 |

## UNIT 4

Unit 4 again experienced increased cycle times by allowing TA to take precedence on brine usage. The unit also had 118 hours of downtime due to a brine pump failure.

Lack of raw material resulted in 233 hours of downtime. The asset effectiveness for August was 34.5%, bringing the YTD to 63.2%.

| | AUGUST | YTD |
|---|---|---|
| Acifluorfen (Lbs.) | 97,209 | 1,285,542 |

## UNIT 5

The unit ran much better in August. We experienced some problems with the centrifuge and dryer, resulting in some product with yellow specs. This is excellent material in all other ways, and should be usable at least as Tham.

The campaign is projected to be completed at the end of September.

| | AUGUST | YTD |
|---|---|---|
| PPS – Ticona | 0 | 16,568 |
| CK Witco | 0 | 5,108 |
| TA production (Lbs.) | 170,006 | 286,547 |

## UNIT 6

DCA production was down in August due to a scheduled turnaround. We performed PSM inspections of all vessels, patched R6103, replaced T6210 and T0123, and repaired the cooling tower.

The asset effectiveness was 69.7% (84.1% equivalent if all normal assay was produced), bringing the YTD to 70.7% (79.3%).

| | AUGUST | YTD |
|---|---|---|
| DCA (Lbs.) | 631,758 | 10,378,700 |

## UNIT 7

Seven batches of TA were blended in August. There were several maintenance issues with the dryer, which resulted in a total of 10 days of downtime.

| | AUGUST | YTD |
|---|---|---|
| TA Blending | 73,574 | 114,844 |
| PPG | 0 | 4,119 |
| PPS – Ticona (drying) | 0 | 16,568 |