US EPA RECORDS CENTER REGION 5
1000999

Clean Harbors Services, Inc.
11800 S. Stony Island Ave.
Chicago, IL 60617

EPA ID No. ILD000608471

RCRA Part B License
Request for Permit
April 19, 2003

Volume 6
Appendices
Sections D-35 through D-49

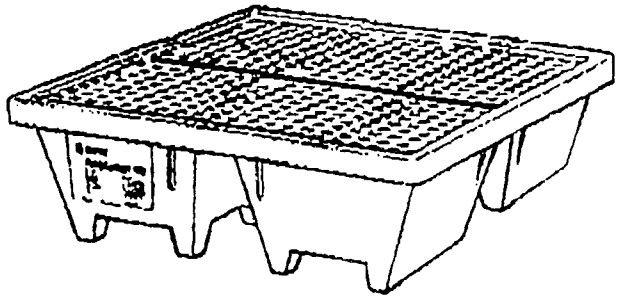
APPENDIX D-35

MANUFACTURER'S LITERATURE: ENPAC CORPORATION "POLY-SPILLPALLET 3000" SELF-CONTAINED PALLETS

ENPAC CORPORATION

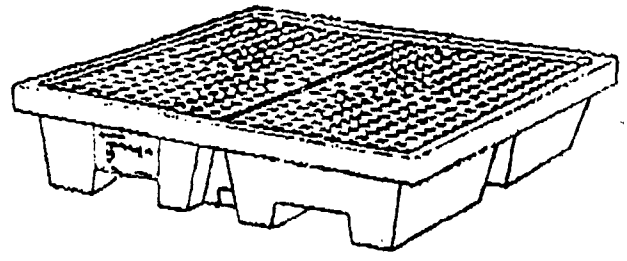
Specifications

POLY-SPILLPALLET™ 6000



Part No.: 5001
Material: Polyethylene with UV inhibitor
Shipping Weight: 94 lbs.
Dimensions: 49½" x 49½" x 17" outside
Secondary Containment Capacity: 94 gallons
Color: Translucent yellow standard with black decking
Maximum Load: 6,000 lbs. uniformly distributed static load
Regulations: EPA Container Storage 40 CFR 264.175

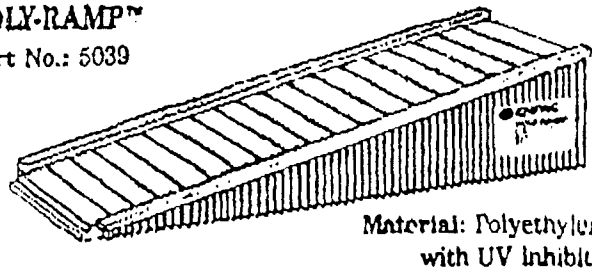
POLY-SPILLPALLET™ 3000



Part No.: 5100
Material: Polyethylene with UV inhibitor
Shipping Weight: 35 to 40 lbs.
Dimensions: 48½" x 49½" x 11¾" outside
Secondary Containment Capacity: 70 gallons
Color: Translucent yellow standard with black decking
Maximum Load: 3,000 lbs. uniformly distributed static load
Regulations: EPA Container Storage 40 CFR 264.175

POLY-RAMP™

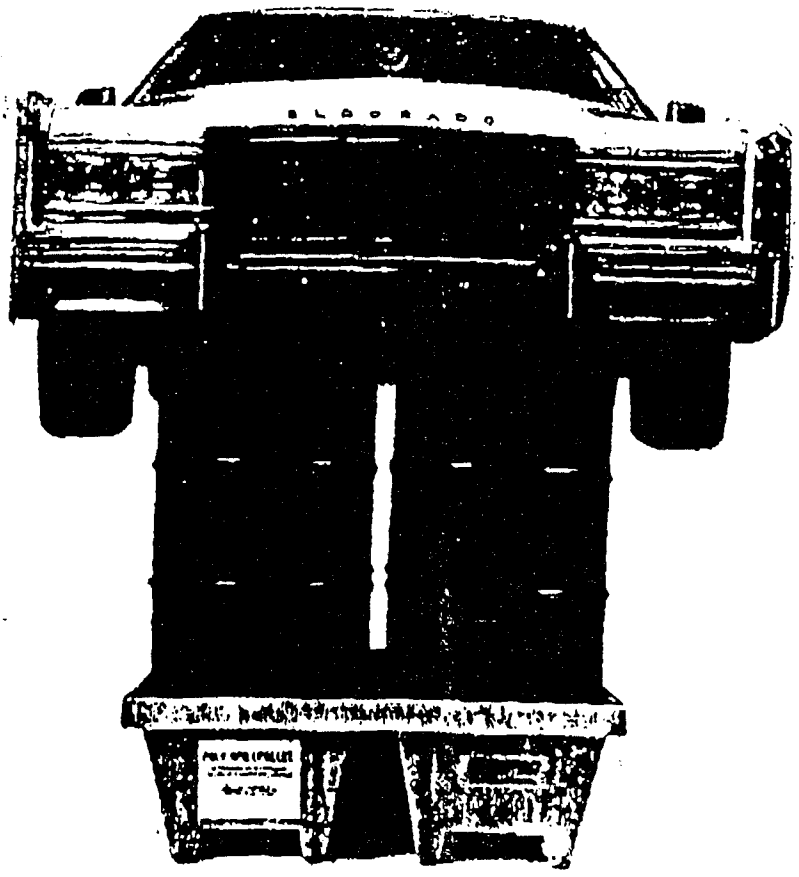
Part No.: 5039

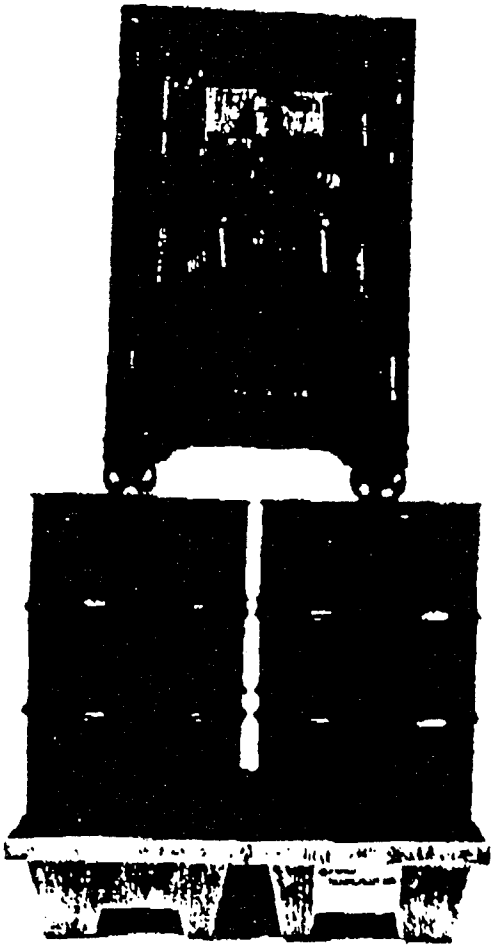


Material: Polyethylene with UV inhibitor
Dimensions: 65" x 31" x 12¾"
Color: Black
Maximum Load: 1,000 lbs.

ENPAC [redacted]

ENPAC now offers you a choice in 4-drum spill pallet protection





Our Classic POLY-SPILLPALLET™

POLY-SPILLPALLET™ 6000 is the one to buy if you need high-performance

- Load rating of 6,000 lbs.
- Huge 73-gallon sump with 94-gallon overflow capacity meets 40 CFR 264.175
- Two heavy-duty, removable, structural foam grates
- Thick wall construction
- Weighs over 94 lbs.
- Forkliftable from all sides

Our Value POLY-SPILLPALLET™

POLY-SPILLPALLET™ 3000 is the one that saves you money

- Load rating of 3,000 lbs
- Large 66-gallon sump with 70-gallon overflow capacity meets 40 CFR 264.175
- Low 11¾-inch profile makes loading easier
- Both grates are removable
- Uni-body base construction provides strength
- Weighs 35 to 40 lbs.
- Forkliftable from two sides
- POLY-RAMP™ accessory available

ENPAC CORPORATION

[redacted]

APPENDIX D-36

ENGNEERING DRAWINGS AND DESIGN SPECIFICATIONS FOR BULK STORAGE TANK FARM (UNIT 16)

LEE F. MOUNT, P.E.
CIVIL ENGINEER
2 BAY VIEW AVENUE HINGHAM, MASSACHUSETTS 02043
(617) 749-5394

CWM TANK FARM

Review and Assessment of Structural Integrity of Existing Tank Nos.

T - 101	T - 106
T - 102	T - 107
T - 103	T - 109
T - 104	T - 110
T - 105	T - 112

January 1995

Prepared For:

Clean Harbors of Chicago, Inc.

(In response to Illinois EPA comments)

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TANK GENERAL DESCRIPTIONS AND HISTORY	2
SPECIFIC TANK DETAILS	3
PROJECTED SERVICE LIFE	3
INSPECTION/TESTING PLAN PRIOR TO REUSE	4-5
SUMMARY DISCUSSION	6
CERTIFICATION	7
APPENDIX A - EXISTING TANK STATUS FORMS	A-1 to A-10
APPENDIX B - ESTIMATED SERVICE LIFE CALS.	B-1 to B-4

INTRODUCTION

This report was prepared in response to the Illinois EPA's request for additional information on the structural condition of the existing hazardous waste storage and/or fuel tanks scheduled for reuse at your CWM Tank Farm.

The work scope involved a technical review of all available tank related documents furnished by Clean Harbors. Pertinent data was then summarized and tabulated for each tank on a "Existing Tank Status Form". The ultrasonic test measurements for thickness, shown on the status forms, were then analyzed in order to make estimates of corrosion rates and projected service life.

Reference documents consulted during the course of this study include:

* RCRA Tank Assessment - Tank Farm System, prepared for CWM Chemical Services Inc. by ALpha Consultants, Ltd. Jan. 1990

* Tank System Inspection, prepared for CWM Chemical Services Inc. by Sirrine Environmental Consultants Nov. 1991

* Straubing, Rubin & Kenes, Inc. Tank Design Drawings

* Imperial Steel Tank Co. Fabrication Drawings

* Supplemental ultrasonic thickness measurements taken on stainless steel Tank No. T-101 on 23 January '95 by MQS Inspection, Inc. (raw data)

TANK GENERAL DESCRIPTIONS AND HISTORY

The ten (10) existing tanks, numbered T-101 to T-107, T-109, T-110, & T-112, are 12 ft. dia. vertical, cone bottomed, leg supported, above ground, insulated tanks.

Tank T-112 has a nominal capacity of 20,000 gals. All other tanks are of 12,000 gal. capacity each.

Tank nos. T-101 and T-107 are of stainless steel construction. All others are of carbon steel.

The four (4) newer tank nos. T-101 to T-104, fabricated by Imperial Steel Tank Co., were placed in service during 1986. The remaining older six (6) tanks date from 1981.

Available records and fabrication drawings for tank nos. T-101 to T-104 indicate they were built to the Underwriters Laboratories, Inc. Standard UL-142 for steel above ground tanks and were to be labeled as such. The published UL-142 Standards "do not cover vertical tanks that are elevated by means of legs" and are not intended for liquids having a specific gravity exceeding that of water. In order to satisfy these exceptions, it was necessary for Imperial Steel to apply for Underwriters Lab review and inspection to obtain the UL Listing for these cone bottomed above ground steel tanks on legs.

The Imperial fabrication drawings list the following tank design parameters:

Design Pressure = hyrdostatic head due to contents

Design Temperature = 250° F

Specific Gravity = 1.5

Corrosion Allowance = 1/16 "

Although no fabrication drawings were found for the six (6) older tanks, the Straubing, Rubin & Kenes design plans indicate the same material thicknesses for the top, shell, and bottom as shown on the Imperial plans. Since these thicknesses have been further verified by ultrasonic test measurements, it seems reasonable to conclude that these older tanks were also built to the design standards of UL-142.

The most recent ultrasonic thickness measurements include those taken by Alpha Consultants in Aug. '89 and by MQS Inspection in Oct. '91 for the Serrine report.

Alpha Consultants conducted visual internal inspections on all tanks (except T-110, which was in service) in early Dec. '89 and an external site inspection on 3 Jan. '90. Serrine Environmental Consultants conducted a visual site inspection, including all tank externals, in Sept. '91.

SPECIFIC TANK DETAILS

For tabulation of existing tank detail design information and summary of latest ultrasonic thickness measurements, refer to the tank status form provided in Appendix A for each of the ten (10) tanks.

PROJECTED SERVICE LIFE

The following table summarizes results of calculations undertaken to establish corrosion rates, based on past service, in order to predict an expected service life for the eight (8) carbon steel tanks. For calculation details, refer to Appendix B.

Surface	Estimated Corrosion Rate	Estimated Retirement Thickness	% of "as built" Thickness Remaining at Retirement	Projected Life as of 1995
Tank Top T-110	2.5 Mils/yr	0.156"	62%	24 yrs.
Side Shell T-105&T-112	3.6 Mils/yr	0.188"	60%	21 yrs.
Cone Bottom T-102	3.0 Mils/yr	0.281"	71%	28 yrs.

NOTE:

The following assumptions were used in the development of this table:

Corrosion rates for the tank top and shell surfaces were arrived at by subtracting the lowest recorded minimum ultrasonic thickness reading to date from the "as built" thickness and then dividing by the tank age at time of thickness reading.

In arriving at an estimated corrosion rate for the bottom cone surface, it was found necessary to develop an adjusted "as built" thickness. This was required since the average recorded bottom thickness measurement for all tanks, and in most cases the minimum value also, exceeded the 0.375" thickness shown on the fabrication drawing. The "as built" thickness was therefore adjusted to 0.392" to more accurately reflect the ultrasonic readings which ten years later were giving averages and minimums greater than 0.375".

INSPECTION/TESTING PLAN PRIOR TO REUSE

In order to assess each tank's internal condition, material thickness, and integrity prior to being placed back in service, it is planned to do the following, once the tank has been found safe for man-entry:

* Conduct an initial visual inspection by a tank experienced technician in company with a registered professional engineer to determine general tank condition. A standard check list, similar to that used by Alpha Consultants for Tank T-109 and shown in Figure 1 will be used as a guide and for recording findings. Suspicious areas will be noted for a more rigorous inspection and scheduled for ultrasonic measurement if deemed necessary.

* Since these tanks are insulated, past ultrasonic readings taken from the tank exterior have been limited to those areas where a removable patch permits direct access to the plate surface beneath. Past surveys have included at each of 4 - 90° quadrants, 1 top point, 3 side points and 1 cone bottom point giving a total of 20 readings/tank. With the tank out of service and clean, it would seem desirable to take additional ultrasonic thickness measurements from within. The cone bottom and tank height will make this difficult and require a tank ladder or other means to reach the underside of the top plate.

* It is recommended that a minimum of 12 readings each be taken in a + pattern on the top and bottom surfaces. For the shell at mid-height, a girth sample of about 20 points around the circumference is desirable. Finally, a vertical row sample, top to bottom, of about 10 points at a location determined from the visual inspection to be most worthy of further exploration, should provide more than enough data to verify the existing surface thicknesses and to form a base for comparison with past and future thickness measurement readings. The ultrasonic test readings are to be taken by personnel qualified and certified as competent to use the test equipment. The test results are to be analyzed by a registered professional engineer experienced in steel tank design and construction.

FIGURE 1

ALPHA CONSULTANTS, Ltd.

CHECKLIST FOR VISUAL INSPECTION OF UNLINED VESSELS

OWNER CWM Chemical Services, Inc.-Chicago Incinerator
TEST SITE 11700 So. Stony Island Ave., Chicago, Il. 60617
DATE OF INSPECTION December 5, 1989
TIME OF INSPECTION 1525
SUPERVISORY ENGINEER Harris E. Dicker, P. E.
PHOTOGRAPHER/TECHNICIAN Robert A. Dicker
TECHNICIAN James L. Eggert

TANK NO. 109 (NO PCB IN TANK)
INTERIOR SHELL MATERIAL CS
CLADDING MATERIAL SST
INSULATION 2' FIBREGLASS SIDES & BOTTOM, 2" COL BLOCK TOP
EQUIPPED WITH MIXER NO

INITIAL ROOF INSPECTION FOR SAFETY
- HAZARDS OF FALLING OBJECTS NONE
- VISIBLE CORROSION NONE

MORE RIGOROUS INSPECTION OF ROOF & STRUCTURAL SUPPORTS
- VISIBLE LOSS OF METAL THICKNESS NONE
- VISIBLE CRACKS OR LEAKS AT WELDS NONE
- VISIBLE CRACKS AT NOZZLE CONNECTIONS NONE
- MALFUNCTIONING OF ROOF SEALS NONE
- VISIBLE DETERIORATION OF WATER DRAIN SYSTEM NONE
- CONDUCT HAMMER TESTING NO

TANK SHELL
- VISIBLE CRACKS AT SEAMS NONE
- VISIBLE CORROSION AT VAPOR SPACE/LIQUID LEVEL LINE NONE
- VISIBLE CRACKING OF PLATE JOINTS NONE
- VISIBLE CRACKING OF NOZZLE CONNECTION JOINTS NONE
- VISIBLE LOSS OF METAL THICKNESS NONE

TANK BOTTOM
- TYPE OF BOTTOM, SLOPED OR FLAT SLOPED
- VISIBLE CORROSION PITS NONE
- VISIBLE CRACKED SEAMS NONE
- TYPE OF CONNECTION TO SIDEWALL, WELDED OR RIVETED WELDED
- VISIBLE TIGHTNESS AT CONNECTION NONE
- VISIBLE DEPRESSIONS IN BOTTOM AREAS AROUND OR UNDER ROOF OR PIPE SUPPORTS NONE
- VISIBLE LOSS OF METAL THICKNESS NONE
- VISIBLE UNEVENESS OF BOTTOM NONE
- CONDUCT HAMMER TEST NO
- VISIBLE BULGES, BLISTERING OR SPALLING NONE
- WAS ULTRASONIC TESTING OF TANK WALLS, ETC. CONDUCTED YES

Source: OSWER Policy Directive No. 9483.00-1
Modified Version of Table 4-7, Page 4-35
"Permit Writer's Guidance for Hazardous Waste Tanks" U. S. EPA Contract 68-01-6515
(undated draft) pp 8-10.

SUMMARY DISCUSSION

Projected Service Life - The projected useful service life for the eight (8) carbon steel tanks is estimated to be on the order of 20 years from today.

- The projected service life for the two (2) stainless steel tanks (T-101 & T-107) is estimated to be more than 20 years as evidenced by the ultrasonic thickness readings which indicate little, if any significant material loss as of '91.

- These projected service life estimates are believed to be conservative in that minimum point readings, rather than average readings, were used to establish the corrosion rates. Furthermore, the projected service life calculations assume that corrosion has continued at the same rate during the past 3 years when the tanks have been out of service.

- These estimated rates can be expected to remain in effect so long as the future stored waste product corrosivity characteristics are compatible with and do not differ significantly from those products stored in the past. Also, the integrity of the external insulation cladding material must be maintained to prevent exterior corrosion from the weather.

- It is anticipated that these tanks, once returned to service, will be ultrasonically tested on an annual basis, at which time these estimated corrosion rates should be reviewed and modified if necessary to suit existing service conditions.

Type of Wastes Stored - The individual tank status forms, Appendix A, list the typical types of waste products stored in past service as well as those planned for future operations. Before any wastes are stored, the facility management is required to assess the compatibility of the waste with (1) the storage unit materials of construction and (2) the wastes being presently stored.

Conclusion - Based on a detailed technical review of the page 1 referenced documents, it is my opinion that the ten (10) existing tanks proposed for reuse at the CWM Tank Farm are structurally sound, free from leaks, and exhibit sufficient material thickness, as determined by ultrasonic measurements. They appear to meet applicable design guidance standards and the past visual inspection reports indicate them to be substantially free from corrosion. Therefore, it is my opinion that the existing reported condition and structural integrity of these storage tanks demonstrate suitability for continued service.

CERTIFICATION

"I certify, under penalty of law, that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including possible fines and imprisonment"

Registered Professional Engineer

Name: Lee F. Mount

Signature Lee F. Mount

Date: 24 JANUARY 1995

Massachusetts Registration No: 21193

COMMONWEALTH OF MASSACHUSETTS
LEE
FORREST
MOUNT
21193
REGISTERED
PROFESSIONAL ENGINEER

APPENDIX A

EXISTING TANK STATUS FORMS

Tank Number	Page
T-101	A-1
T-102	A-2
T-103	A-3
T-104	A-4
T-105	A-5
T-106	A-6
T-107	A-7
T-109	A-8
T-110	A-9
T-112	A-10

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

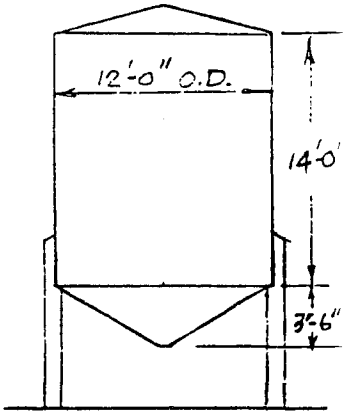
Tank No. T-101

Nominal Capacity 12,000 gals.

Mat'l. of Const. 316 Stainless

Approx. Year of Build 1986

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	NFPA CLASS 2 - AQUEOUS	ACIDIC WATERS, LEAN WATERS
	PCB/FUEL BLEND	AND/OR HAZARDOUS WASTE FUE (NFPA CLASS 1-3 LIQUIDS)

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built A	As Built E	Ultrasonic Test Results 08/89 B Avg.	08/89 B Min.	10/91 C Avg.	10/91 C Min
Top	0.086	0.250	0.313	0.320	0.316	0.316	0.305
Shell	0.115	0.313	0.313	0.323	0.310	0.332	0.320
Bottom	0.158	0.375	0.438	0.437	0.429	0.445	0.416

01/23/95 D		
TOP	0.316	0.303
SHELL	0.339	0.324
BOTTOM	0.439	0.411

NOTES:

A. FROM IMPERIAL STEEL FABRICATION DWG. '86

B. FROM ALPHA CONSULTANTS JAN. '90 RPT.

C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

D. ADD'L. READINGS BY MQS TAKEN 23 JAN. '95

E. ESTIMATED ACTUAL AS BUILT t BASED ON ULTRASONIC RDGS. TO DA

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

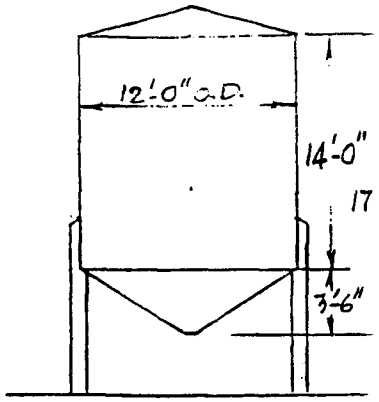
Tank No. T-102

Nominal Capacity 12,000 gals.

Mat'l. of Const. A-285-C STL.

Approx. Year of Build 1986

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	NFPA CLASS 2	PCB's
	PCB / FUEL BLEND	

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built A	Ultrasonic Test Results 08/89 B		10/91 C	
			Avg.	Min.	Avg.	Min.
Top	0.123	0.250	0.253	0.248	0.311	0.300
Shell	0.167	0.313	0.317	0.310	0.307	0.299
Bottom	0.240	0.375	0.380	0.371	0.399	0.389

NOTES:
A. FROM IMPERIAL STEEL TANK CO. FABRICATION DWG. '86
B. FROM ALPHA CONSULTANTS JAN. '90 RPT.
C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

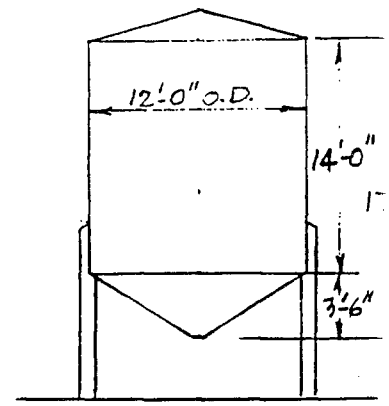
Tank No. T-103

Nominal Capacity 12,000 gals.

Mat'l. of Const. A-285-C STL.

Approx. Year of Build 1986

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	NFPA CLASS 2	HAZARDOUS WASTE FUELS
	PCB / FUEL BLEND	(NFPA CLASS 1-3 LIQUIDS)

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built A	Ultrasonic Test Results 08/89 B Avg.	08/89 B Min.	10/91 C Avg.	10/91 C Min.
Top	0.123	0.250	0.255	0.252	0.254	0.248
Shell	0.167	0.313	0.317	0.310	0.317	0.299
Bottom	0.240	0.375	0.383	0.382	0.388	0.383

NOTES:
A. FROM IMPERIAL STEEL TANK CO. FABRICATION DWG. '86
B. FROM ALPHA CONSULTANTS JAN. '90 RPT.
C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

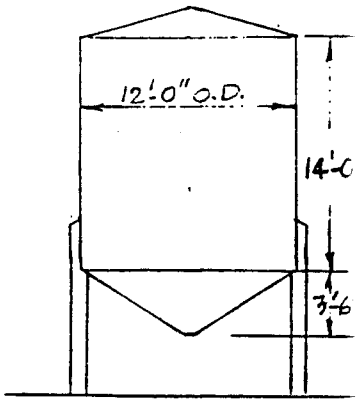
Tank No. T-104

Nominal Capacity 12,000 gals.

Mat'l. of Const. A-285-C STL.

Approx. Year of Build 1986

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	NFPA CLASS 2	HAZARDOUS WASTE FUELS
	PCB / FUEL BLEND	(NFPA CLASS 1-3 LIQUIDS

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built	Ultrasonic Test Results			
			08/89 B		10/91 C	
		A	Avg.	Min.	Avg.	Min
Top	0.123	0.250	0.247	0.246	0.241	0.238
Shell	0.167	0.313	0.311	0.306	0.308	0.298
Bottom	0.240	0.375	0.386	0.385	0.387	0.378

NOTES:

A. FROM IMPERIAL STEEL TANK CO. FABRICATION DWG. '86

B. FROM ALPHA CONSULTANTS JAN. '90 RPT.

C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

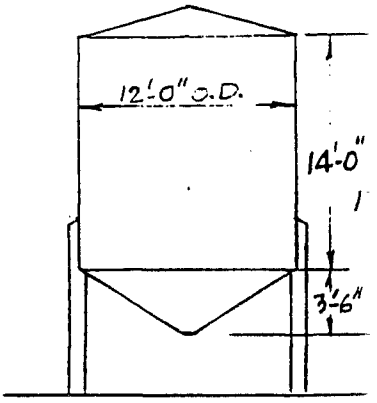
Tank No. T-105

Nominal Capacity 12,000 gals.

Mat'l. of Const. CARBON STEEL

Approx. Year of Build 1981

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	NFPA CLASS 2 FUELS LEAN WATER	HAZARDOUS WASTE FUELS (NFPA CLASS 1-3 LIQUIDS)

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built A	Ultrasonic Test Results 08/89 B Avg.	08/89 B Min.	10/91 C Avg.	10/91 C Min.
Top	0.123	0.250	0.250	0.238	0.254	0.250
Shell	0.167	0.313	0.305	0.303	0.299	0.277
Bottom	0.240	0.375	0.380	0.375	0.398	0.380

NOTES:

A. FROM STRAUBING, RUBIN & KENES DESIGN DWG. 1-Q-001

B. FROM ALPHA CONSULTANTS JAN. '90 RPT.

C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

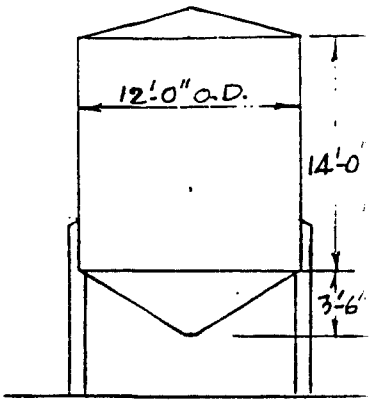
Tank No. T-106

Nominal Capacity 12,000 gals.

Mat'l. of Const. CARBON STEEL

Approx. Year of Build 1981

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	NFPA CLASS 2	HAZARDOUS WASTE FUELS
	LEAN WATER	(NFPA CLASS 1-3 LIQUIDS)

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built	Ultrasonic Test Results			
			08/89 B		10/91 C	
		A	Avg.	Min.	Avg.	Min.
Top	0.123	0.250	0.250	0.247	0.252	0.250
Shell	0.167	0.313	0.304	0.301	0.295	0.278
Bottom	0.240	0.375	0.381	0.378	0.394	0.387

NOTES:

A. FROM STRAUBING, RUBIN & KENES DESIGN DWG. 1-Q-002

B. FROM ALPHA CONSULTANTS JAN. '90 RPT.

C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

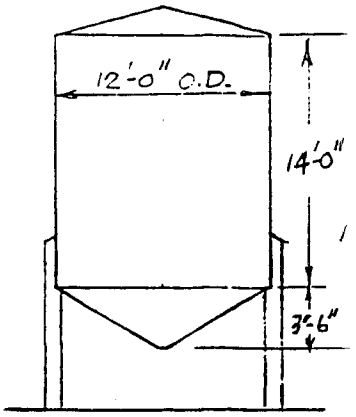
Tank No. T-107

Nominal Capacity 12,000 gals.

Mat'l. of Const. 316 Stainless

Approx. Year of Build

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	NFPA CLASS 2 - AQUEOUS	ACIDIC WATERS, LEAN WATERS,
	RACA FUEL	AND/OR HAZARDOUS WASTE FUELS (NFPA CLASS 1-3 LIQUIDS)

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built A	Ultrasonic Test Results 08/89 B Avg.	08/89 B Min.	10/91 C Avg.	10/91 C Min.
Top	0.086	0.250	0.261	0.252	0.270	0.265
Shell	0.115	0.313	0.322	0.316	0.341	0.318
Bottom	0.158	0.375	0.386	0.386	0.402	0.398

NOTES:

A. FROM STRAUBING, RUBIN, & KENES DESIGN DWG. 1-Q-003

B. FROM ALPHA CONSULTANTS JAN. '90 RPT.

C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

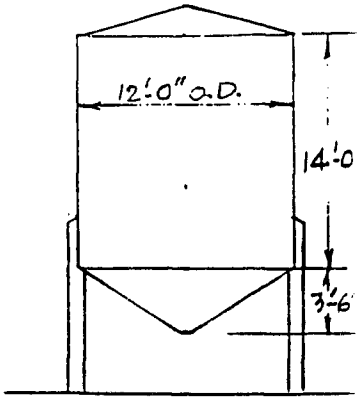
Tank No. T-109

Nominal Capacity 12,000 gals.

Mat'l. of Const. CARBON STEEL

Approx. Year of Build 1981

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	FUEL OIL (HEATED)	HAZARDOUS WASTE FUEL (NFPA CLASS 1-3 LIQUID

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built	Ultrasonic Test Results			
			08/89 B		10/91 C	
		A	Avg.	Min.	Avg.	Min
Top	0.123	0.250	0.254	0.249	0.255	0.246
Shell	0.167	0.313	0.315	0.305	0.318	0.307
Bottom	0.240	0.375	0.385	0.384	0.414	0.397

NOTES:

A. FROM STRAUBING, RUBIN & KENES DESIGN DWG. 1-Q-001

B. FROM ALPHA CONSULTANTS JAN. '90 RPT.

C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

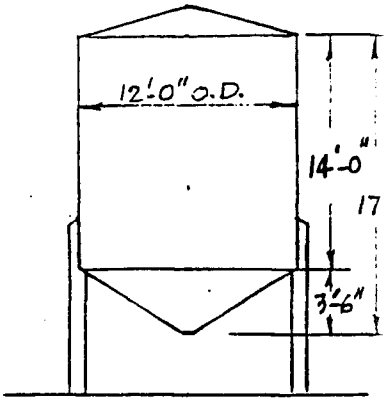
Tank No. T-110

Nominal Capacity 12,000 gals.

Mat'l. of Const. CARBON STEEL

Approx. Year of Build 1981

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	WASTE OILS	PCB's
	FUEL OIL	

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built A	Ultrasonic Test Results 08/89 B Avg.	08/89 B Min.	10/91 C Avg.	10/91 C Min.
Top	0.123	0.250	0.251	0.249	0.230	0.225
Shell	0.167	0.313	0.312	0.303	0.314	0.310
Bottom	0.240	0.375	0.388	0.387	0.428	0.414

NOTES:

A. FROM STRAUBING, RUBIN, & KENES DESIGN DWG. 1-Q-006

B. FROM ALPHA CONSULTANTS JAN. '90 RPT.

C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

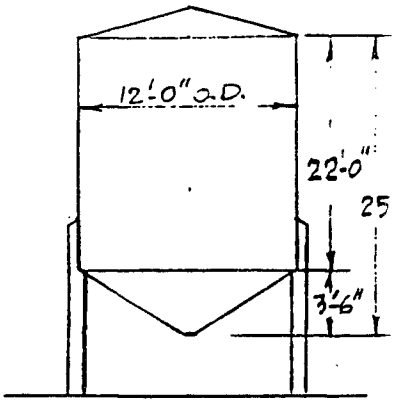
Tank No. T-112

Nominal Capacity 20,000 gals.

Mat'l. of Const. CARBON STEEL

Approx. Year of Build 1981

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	NFPA CLASS 2 (FEED)	NEUTRAL PH WATERS, LEAN WATE
	LEAN WATER	AND/OR HAZARDOUS WASTE FUE
	PCB / FUEL BLEND	(NFPA CLASS 2-3 LIQUIDS ONLY)

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built	Ultrasonic Test Results			
			08/89 B		10/91 C	
		A	Avg.	Min.	Avg.	Min.
Top	0.123	0.250	0.255	0.242	0.254	0.250
Shell	0.167	0.313	0.304	0.301	0.296	0.277
Bottom	0.240	0.375	0.375	0.370	0.401	0.389

NOTES:

A. FROM STRAUBING, RUBIN, & KENES DESIGN DWG 1-Q-008

B. FROM ALPHA CONSULTANTS JAN. '90 RPT.

C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

APPENDIX B

ESTIMATED SERVICE LIFE CALCULATIONS

Surface	Page
Tank Top	B-1
Side Shell	B-2
Cone Bottom	B-3,4

ESTIMATED SERVICE LIFE BASED ON PAST CORROSION RATE OF EXISTING 8 CARBON STL. TANKS

FOR TANK TOP

FIND LOWEST MINIMUM ULTRASONIC RDG. AS OF '91 (CONSERVATIVE)

SEE TANK T-110 MIN. TOP RDG. = 0.225"

AS BUILT t = 0.250 ('81)
− 0.225
0.025" LOSS IN 10 YRS

∴ CORROSION RATE = 0.025/10 = 0.0025"/YR (2.5 MILS/YR) ← USE

ESTABLISH RETIREMENT t @ 1/8" + 1/32" CORR ALLOW = 0.156" ← THIS IS ABT. 62% OF AS BUILT

PROJECTED LIFE:

STARTING t = 0.250 (1981)
LESS − 0.156 RETIREMENT t
0.094 PERMITTED LOSS

∴ YEARS TO REACH RETIREMENT t AT EXISTING CORROSION RATE:

= 0.094" / .0025"/YR ≈ 38 YRS FROM '81
LESS − 14 YRS ('81 TO '95)
24 YRS. FROM TODAY

CHECK MIN. t RDG. = 0.225 ('91)
− 0.156 RETIREMENT t
0.069 / .0025 ≈ 28 YRS FROM '91
LESS − 4 YRS ('91-'95)
24 YRS FROM TODAY

AGREES

ESTIMATED SERVICE LIFE BASED ON PAST CORROSION RATE OF EXISTING 8 CARBON STL. TANKS

FOR TANK SHELL

FIND LOWEST MINIMUM ULTRASONIC RDG. AS OF '91 (CONSERVATIVE)

SEE TANKS T-105 & T-112 MIN. SHELL RDG. = 0.277"

AS BUILT t = 0.313 ('81)
− 0.277
0.036" LOSS IN 10 YRS.

∴ CORROSION RATE = $\frac{0.036''}{10}$ = 0.0036"/YR (3.6 MILS/YR) ← USE

ESTABLISH RETIREMENT t @ 5/32 + 1/32 CORR. ALLOW = 0.1875" ← THIS IS ABT. 60% OF "AS BUILT"

PROJECTED LIFE:

STARTING t = 0.313 (1981)
LESS − .188 RETIREMENT t
0.125 PERMITTED LOSS

∴ YEARS TO REACH RETIREMENT t AT EXISTING CORROSION RATE:

= $\frac{0.125''}{.0036''/YR}$ ≈ 35 YRS. FROM '81
LESS − 14 YRS. ('81 TO '95)
21 YRS. FROM TODAY

CHECK MIN. t RDG. = 0.277 ('91)
− .188 RETIREMENT t
$\frac{0.089''}{.0036}$ ≈ 25 YRS FROM '91
LESS − 4 YRS ('91-'95)
21 YRS FROM TODAY

AGREES

ESTIMATED SERVICE LIFE BASED ON PAST CORROSION RATE OF EXISTING 8 CARBON STEEL TANKS

FOR CONE BOTTOM

	TANK T-102	TANK T-112
FIND LOWEST MINIMUM ULTRASONIC RDG.S:	0.371 ('89)	0.370 ('89)
	0.389 ('91)	0.389 ('91)

DETERMINATION OF ADJUSTED "AS BUILT" THICKNESS:

SINCE THE AVERAGE RECORDED THICKNESS FOR ALL TANKS IN BOTH MEASUREMENT YEARS ('89 & '91) WAS FOUND TO BE EQUAL TO OR GREATER THAN THE LISTED AS BUILT OF 0.375", IT IS BELIEVED A THICKER BOTTOM PLATE WAS USED IN THE CONSTRUCTION OF THESE CARBON STEEL TANKS. USING AN AVERAGE OF THE AVERAGE BOTTOM THICKNESS RECORDED FOR ALL 8 TANKS UP TO '91 YIELDS A VALUE OF 0.392" (THIS 4.5% INCREASE IS WITHIN PERMISSIBLE VARIATIONS IN OVER WEIGHT MILL PRACTICE TOLERANCES FOR ORDERED STEEL PLATE)

THE PROJECTED SERVICE LIFE CALCULATIONS WILL CONSIDER THIS ADJUSTED "AS BUILT" THICKNESS TO HAVE BEEN 0.392" WHEN THE TANK WAS NEW.

ESTIMATED CORROSION RATES:

	TANK T-102 (NEW IN '86)	TANK T-112 (NEW IN '81)
BASED ON 1989 SURVEY	.392 − .371 (MIN) = 0.021"/3 YRS = 0.0070"/YR — LOOKS HIGH	.392 − .370 (MIN) = 0.022"/8 YRS = 0.0028"/YR — LOOKS POSSIBLE
BASED ON 1991 SURVEY	.392 − .389 (MIN) = 0.003"/5 YRS = 0.0006"/YR — LOOKS LOW	.392 − .389 (MIN) = 0.003"/10 YRS = 0.0003"/YR — LOOKS LOW

FOR CORROSION RATE USE TANK T-102

ASSUME RDG. TAKEN IN 1993 WOULD BE AVG. OF '89 & '91 = $\frac{.371 + .389}{2} = 0.380$"

∴ CORROSION RATE = .392 − .380 = 0.012"/4 YRS = 0.0030"/YR (3 MILS/YR.) ← USE

ESTIMATED SERVICE LIFE

CONE BOTTOM (CON'D.)

ESTABLISH RETIREMENT t @ $\frac{1}{4}'' + \frac{1}{32}$ CORR. ALLOW. = 0.281" ← 71% OF ADJUSTED "AS BUILT" t (THIS IS ABT.)

PROJECTED LIFE:

STARTING ADJUSTED t = 0.392" (1986)
LESS − .281" RETIREMENT t
0.111" PERMITTED LOSS

∴ YEARS TO REACH RETIREMENT t AT EXISTING CORROSION RATE:

$= \frac{0.111}{.003''/YR}$ = 37 YRS. FROM '86
LESS − 9 YRS. ('86-'95)
28 YRS. FROM TODAY

CHECK MIN t RDG = 0.380" ASSUMED '90 AVG.
− 0.281 RETIREMENT t
$\frac{0.099}{.003}$ = 33 YRS FROM '90
LESS − 5 YRS ('90-'95)
28 YRS FROM TODAY

AGREES

HOYER-SCHLESINGER-TURNER inc.
ENGINEERS CONSTRUCTORS
300 west adams street chicago illinois 60606 telephone 263-0556 area code 312

July 21, 1999

Mr. Mark A. Schollenberger, P.E.
Illinois Environmental Protection Agency
Bureau of Land - Permit Section
1021 North Grand Avenue East
Post Office Box 19276
Springfield, IL 62794-9276

Dear Mr. Schollenberger:

This letter is to provide documentation to the Illinois Environmental Protection Agency for the Clean Harbors Services, Inc. permit modification dated July 1, 1999 to install a three-foot wide addition to the dock extension on Unit Q and to allow two additional roll-off boxes to be stored in Unit B.

I hereby certify that I, the undersigned am a Professional Engineer, licensed to practice in the State of Illinois.

The certify under penalty of law that the three-foot wide dock extension for the existing Unit Q was designed under my direct supervision and the design incorporates good engineering practices.

The structural design of this dock extension and Unit B are suitable for intended use. Foundations, floors and containment slabs are designed for intended load and will maintain structural integrity without failure.

Engineer Seal

Amos Turner 7/21/99
Amos Turner Date

H.S.T., Inc.
3074 University Avenue
Highland Park, IL 60035

(847)681-0470

AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

EXP. DATE 11/30/99

H-S-T

December 14, 1999

Mr. Mark A. Schollenberger, P.E.
Illinois Environmental Protection Agency
Bureau of Land - Permit Section
1021 North Grand Avenue East
Springfield, IL 62794-9276

Dear Mr. Schollenberger:

This letter is to provide documentation to the Illinois Environmental Protection Agency for the Clean Harbors Services, Inc. permit modification dated July 1, 1999 to install a three-foot wide addition to the dock extension on Unit Q and to allow two additional roll-off boxes to be stored in Unit B.

I hereby certify that I, the undersigned am a Professional Engineer, licensed to practice in the State of Illinois. I further certify that the three-foot wide dock extension for the existing Unit Q was designed under my direct supervision and the design incorporates good engineering practices. The structural design of this dock extension and Unit B are suitable for intended use. Foundations, floors and containment slabs are designed for intended load and will maintain structural integrity without failure.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Engineer Seal

Amos Turner 12/14/99

Amos Turner Date

H.S.T., Inc.
3074 University Avenue
Highland Park, IL 60035
(847)681-0470

AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF
ILLINOIS

MECA

MECA ENGINEERING CORP. OF AMERICA

5539 Indianapolis Blvd. East Chicago, IN 46312 (219) 397-0100 FAX (219) 397-0164 e-mail mecaeng@netnitco.net

October 25, 2002

Illinois Environmental Protection Agency
Bureau of Land #33
Permit Section
1021 North Grand Avenue East
Springfield, IL 62794-9276

RE: 0316000051
Clean Harbor Services, Inc.
ILD000608471
RCRA Permit Log No. 16

Dear Sir:

I hereby certify that I, the undersigned am a Professional Engineer, Licensed to practice in the State of Illinois.

Clean Harbors has submitted an application for a Class 2 Modification to the subject facility Unit Q1. I certify under penalty of law that I have reviewed the modification (fire suppression system for roll off containers in Unit Q1), proposed by Clean Harbors Services. I certify that it has been designed in accordance with good engineering practices.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Respectively submitted,

MECA Engineering Corporation of America

Kenneth D. Spaulding

Kenneth D. Spaulding P. E.
Licensed Professional Engineer
Illinois License No. 62-44249; Expiration Date: 2/28/03

KENNETH D. SPAULDING
62-44249
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

CleanHarbors
ENVIRONMENTAL SERVICES, INC.
2605 EGYPT ROAD, SUITE #204 • TROOPER, PA 19403
(610) 539-6633 • FAX (610) 539-3094

August 6, 1996

Permit Section, RCRA Unit
Division of Land Pollution Control
Illinois Environmental Protection Agency
P.O. Box 19276
Springfield, IL 62794-9276

RE: Clean Harbors Services, Inc.
11800 S. Stony Island Avenue
Chicago, IL 60617
Revised Part B Permit Application

Dear Sir or Madam:

Please refer to: 0316000051 - Cook County
Clean Harbors Services, Inc.
ILD000608471
RCRA Permit Log No. 16
RCRA Permit File

I hereby certify that I, the undersigned am a Professional Engineer, licensed to practice in the State of Illinois.

I certify under penalty of law that the following proposed area:

- Dock Extension for Existing Unloading Area (Unit Q)

was designed under my direct supervision and that the design incorporates good engineering practices.

The structural design of dock extension is suitable for intended use. Foundations, floors and containment slabs are designed for intended load and will maintain structural integrity without failure. Water stops have been incorporated in the design, wherever necessary.

CleanHarbors

After curing, the concrete surfaces of the floors and curbs of all containment areas shall be inspected for cracking and repaired if necessary.

Respectfully submitted,

CLEAN HARBORS ENVIRONMENTAL SERVICES, INC.

Bhupendra Patel

Bhupendra Patel
Licensed Professional Engineer
Illinois No. 062-048690
My license expires on 11/30/96

Appendix D-38

Compressed Gas SOPs for Venting and Downloading, Engineering Certifications

Clean Harbors Services, Inc.
Atmospheric Gases Venting
Plan of Operation

Material Description:

A. Nitrogen, Compressed. (2.2, UN1066)
B. Oxygen, Compressed. (2.2, UN1072)
C. Krypton, Compressed. (2.2, UN1056)
D. Argon, Compressed. (2.2, UN1006)
E. Neon, Compressed. (2.2, UN1065)
F. Helium, Compressed. (2.2, UN1046)
G. Xenon. (2.2, UN2036)
H. Air, Compressed. (2.2, UN1002)

Condition of Material:

Nitrogen is colorless gas which is a simple asphyxiant.

Oxygen is a colorless, odorless, tasteless gas which is necessary for combustion and is an oxidizer.

Krypton is a colorless gas which is an asphyxiant.

Argon is a colorless gas which is a simple asphyxiant.

Neon is a colorless, odorless gas which is an asphyxiant.

Helium is a colorless, odorless, tasteless gas which is a simple asphyxiant.

Xenon is a colorless gas which is a simple asphyxiant.

Air is a colorless, odorless gas which can accelerate combustion.

Basic Equipment:

Building 25 lab pack consolidation hoods in the acid and poison/alkaline bays.

O2/LEL meter

Operational Procedures:

1) Inspect to confirm the compressed gas is one allowed for venting. This includes inspecting the cylinder for labels and the Cylinder Evaluation Form.

2) Confirm no operations are taking place in the flammable bay during inert gas venting.

3) Check oxygen content at lab pack consolidation hood with

O2/LEL meter. Continue to operate until venting is completed. If meter alarms (i.e., oxygen concentration below 19.5%), immediately stop operation.

4) Move cylinder from storage to lab pack consolidation hood in the acid or alkaline/poison bay depending on compatibility. Do not block aisle space or emergency access in bay.

5) Secure cylinder in cylinder clamp to hold while venting. Place CGA fitting to SS Series 250 regulator or into inlet of consolidation hood. Note and verify pressure.

6) Confirm hood is operating.

7) Slowly open valve/regulator letting cylinder contents vent into hood.

8) When venting complete, close cylinder valve and verify pressure to ensure cylinder is empty.

9) Disconnect and tag cylinder.

Clean Harbors Env. Services Inc
Treatable Gases Downloading
Plan Of Operation

Material Description:

A. Hydrogen Chloride, Anhydrous. (2.3 UN1050)
B. Hydrogen Bromide, Anhydrous. (2.3 UN1048)
C. Ammonia, Anhydrous.(2.2 UN1005)
D. Boron Trichloride. (2.3 UN1741)
E. Boron Trifluoride. (2.3 UN1008)
F. Chlorine. (2.3 UN1017)
G. Sulfur Dioxide, Liquefied. (2.3 UN1079)

Condition of Material:

Anhydrous Hydrogen Chloride is a colorless gas which fumes strongly in moist air and has a highly irritating effect on body tissue.

A) Vapor pressure at 70 degrees F (613 psig)
B) CGA outlet number (110/330)
C) Pressure relief device (CG-4)
D) DOT specifications (3A,3AA,3AX,3AAX,3E)
E) Anticipated yearly volumes (152 pounds)

Anhydrous Hydrogen Bromide is a colorless, toxic, and corrosive gas at room temperature and pressure.

A) Vapor pressure at 62 degrees F (294 psia)
B) CGA outlet number (110/330)
C) Pressure relief device (CG-4)
D) DOT specifications (3A,3AA,3AX,3AAX,3E)
E) Anticipated yearly volumes (140 pounds)

Anhydrous Ammonia at room temperature and atmospheric pressure is a pungent, colorless gas.

A) Vapor pressure at 70 degrees F (114.1 psig)
B) CGA outlet number (110/180/660/705)
C) Pressure relief device (CG-2)
D) DOT specifications (3A,3AA,3AL,3E,4A,4AA)
E) Anticipated yearly volumes (2508 pounds)

Boron Trichloride is a colorless, acid gas that fumes in the presence of moist air.

A) Vapor pressure at 70 degrees F (19.1 psia)
B) CGA outlet number (110/660)
C) Pressure relief device (CG-2)
D) DOT specifications (Specification steel or nickel cylinders)
E) Anticipated yearly volumes (84 pounds)

Boron Trifluoride is a colorless gas which has a persistent, irritating, acidic odor and which hydrolyzes in moist air to form dense white fumes.

A) Nonliquefied gas at varying pressures up to 2000 psig.
B) CGA outlet number (180/330)
C) Pressure relief device (CG-4,CG-5)
D) DOT specifications (3A,3AA,3B,3E)
E) Anticipated yearly volumes (24 pounds)

Chlorine is a greenish-yellow, nonflammable gas with a distinctive, pungent odor.

A) Vapor pressure at 80 degrees F (118.16 psia)
B) CGA outlet number (110/180/660)
C) Pressure relief devices (CG-2)
D) DOT specifications (3A,3AA,3E,3BN)
E) Anticipated yearly volumes (172 pounds)

Sulfur Dioxide is a colorless gas with a characteristic pungent odor.

A) Vapor pressure at 70 degrees F (49.1 psia)
B) CGA outlet number (110/180/660)
C) Pressure relief devices (CG-2)
D) DOT specifications (3A,3AA,3E,3BN)
E) Anticipated yearly volumes (104 pounds)

Caustic Scrubber:
A) Hydrogen Chloride
B) Hydrogen Bromide
C) Boron Trichloride
D) Boron Trifluoride
E) Chlorine
F) Sulfur Dioxide

Acid Scrubber:
A) Ammonia

Basic Equipment Overview:

A) Pressure regulator (Stainless Steel) model 250 or equivalent
B) Appropriate CGA valve with T-purge
C) 3 foot stainless steel hose.
D) Bacharach-EIT Series 4600 GasPlus or equivalent gas monitor
E) Glove box and dispersion components.
F) Existing Reactor system

During cylinder downloading, the gas monitor must be operating. If the monitor detects a release of one of the compressed gases, all operations in the area will cease. If a reportable quantity of a compressed gas is released, the facility Contingency Plan must be enacted. No lab pack pour-off operations can take place during cylinder downloading.

1. **Operational Procedures:** (NORMAL CYLINDERS)

A) Secure cylinder in cylinder clamp to hold while downloading. Place CGA fitting to SS Series 250 regulator. **Note and verify pressure.**

B) 125% of the theoretical amount of solvent (note** reference calculations below) will be used to neutralize the cylinder content. A minimum of 1000 gallons of aqueous mixture along with mixing will aid in the diffusion of the gas in the reactor. The pH of the solvent will be tested each time 4 cylinders are downloaded..

C) Open cylinder valve/regulator, let contents download into reactor. (Note: The solubility data for chlorine is .562g chlorine gas /100g water) Chlorine gas has the **lowest** solubility in water. 70.30 lb's of chlorine gas can be absorbed in 1500 gallons of water. Using a safety factor of 2, and a flow rate of .4 LB's a minute cylinders can be downloaded for 87 minutes. The slow flow rate of .4lb's per minute will ensure adequate mixing and residence time.

D) Close the cylinder valve and open the nitrogen T-purge. Purge regulator of any remaining gas. Turn the regulator outflow control valve to the left to shut off nitrogen flow. Open the cylinder valve and pressurize the cylinder to 40psi. Close Nitrogen T-purge and open cylinder regulator by turning outflow valve to the left 1/4 turn. Allow nitroge to vent into the scrubber. Disconnect, and tag cylinder.

2. <u>Operational Procedures:</u> (LECTURE CYLINDERS ONLY)

A) Secure cylinder in cylinder clamp to hold while downloading. Place cylinder into dry ice/alcohol bath to reduce temperature and pressure. Place CGA fitting to SS Series 250 regulator or equivalent. **Note and verify pressure** Attach a 3ft SS hose to the flow control valve on the left side or outflow port on the regulator.

B) Open cylinder valve/valve stem (1/4 open), let contents download into cold water in the collection container (5 gallon pail) located inside glove box to control fuming.

Note: This procedure will protect process equipment from becoming corroded due to excessive fuming of corrosive gases and prolong the life of the service equipment. The collection container will also be utilized for rinsing of the residual gas from the Lecture Cylinder while in containment to eliminate any fuming prior to the Lecture cylinder being removed from the glovebox. This procedure is not adequate nor intended to absorb process gas prior to entering the caustic reactor as no chemical reactant will be utilized.

Exhaust vapors through reactor system containing appropriate scrubber solution to insure absorption of gases. The operation will be conducted inside a glove box to provide containment of vapors as they proceed into the reactor for treatment/absorption.

C) Close the cylinder valve and open the nitrogen T-purge. Purge regulator of any remaining gas. Turn the regulator outflow control valve to the left to shut off nitrogen flow. Open the cylinder valve and pressurize the cylinder to 40psi. Close Nitrogen T-purge and open cylinder regulator by turning outflow valve to the left 1/4 turn. Allow nitrogen to vent into the scrubber.

D) Remove valve assembly from the downloaded cylinder and thoroughly rinse the cylinder in the container of cold water located in the glove box. This will eliminate any fuming as the cylinder is removed from the glove box. Dispose of the empty, nitrogen purged, and triple rinsed cylinder as scrap metal.

Absorption/Emission Calculations:

1.1 lbs. Anhydrous Hydrogen Chloride/per pound Sodium Hydroxide will yield Sodium Chloride and water.

$HCL+NaOH------NaCl+H2O$

0.49 lbs. Anhydrous Hydrogen Bromide/per pound Sodium Hydroxide will yield Sodium Bromide and water.

$HBr+NaOH------NaBr+H2O$

2.88 pounds of Ammonia/per pound of sulfuric acid will yield ammonium sulfate.

$2NH3 + H2SO4 ----- [NH4]2\ SO4$

0.46 lbs. Boron Trichloride/per pound water will yield Boric Acid and Hydrochloric Acid

$BCl3+3H2O-----H3BO3+3HCl$

1.63 lbs. Boron Trifluoride/per pound Calcium Hydroxide will yield Calcium Fluoride and Boric Oxide.

$2BF3+3Ca[OH]2---------3CaF2+2H2O$

1.13 lbs. Chlorine/per pound Sodium Hydroxide will yield Sodium Hypochlorite and Sodium Chloride.

$Cl2+2NaOH------NaOCl+NaCl+H2O$

1.25 lbs. Sulfur Dioxide/per pound Sodium Hydroxide will yield Sodium Sulfite and water.

$SO2+H2O-----H2SO3$
$H2SO3+2NaOH-----Na2SO3+2H2O$

H-S-T

HOYER-SCHLESINGER-TURNER,Inc.
CONSULTING ENGINEERS
3074 University Ave.
Highland Park, IL 60035
Phone: 847/461-0470 Fax: 847/266-9829

I hereby certify that I, the undersigned am a Professional Engineer, licensed to practice in the State of Illinois. I further certify that the proposed modification of the procedures and equipment for the downloading of cylinders of compressed gases into the existing reactor was designed under my direct supervision and the design incorporates good engineering practices. The equipment is suitable for intended use. There are no changes in types of compressed gases to be downloaded, location, ventilation or monitoring.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Engineer Seal

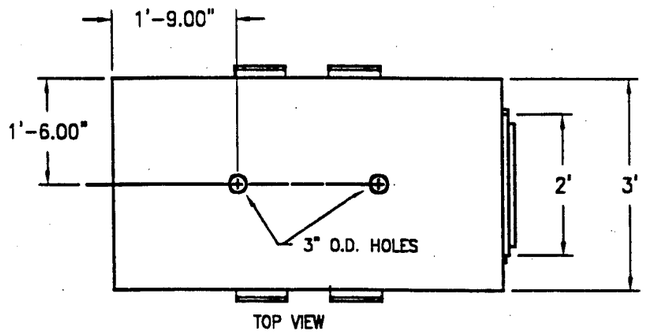
Amos Turner 4-14-2000

Amos Turner Date

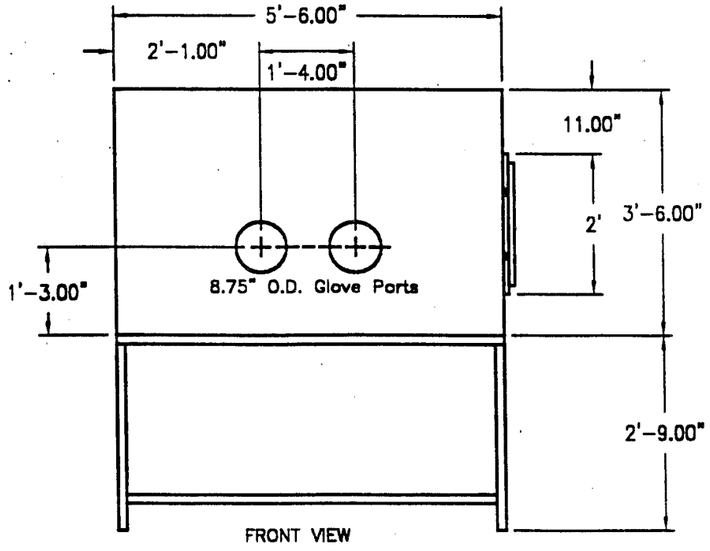
Hoyer-Schlesinger-Turner, Inc.
3074 University Avenue
Highland Park, IL 60035
(847)681-0470

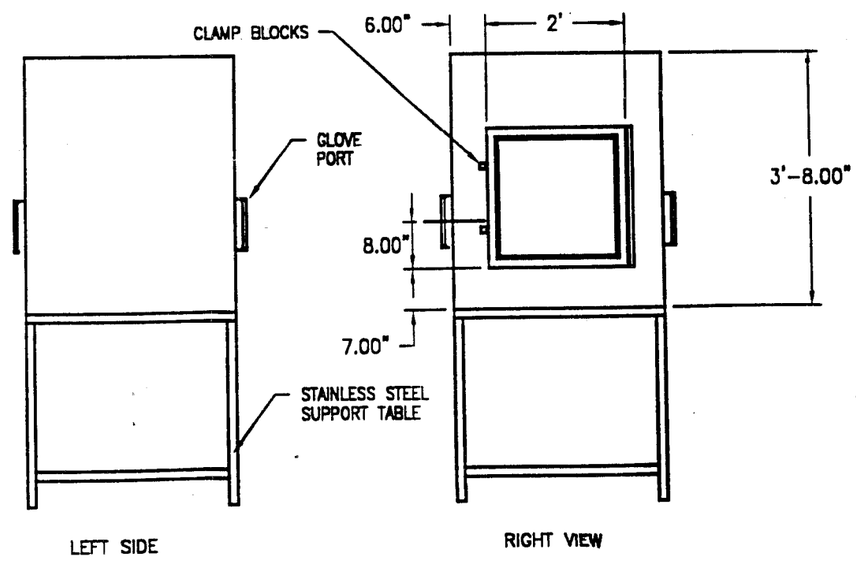
AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF
ILLINOIS

EXPIRATION DATE 11-30-2000



NOTES:
1. MATERIAL OF CONSTRUCTION TO BE OF 1/2" THICK CLEAR ACRYLIC WITH 3/8" THICK WHITE BOTTOM.
2. ALL JOINTS TO BE CHEMICALLY BONDED AND REINFORCED WITH STAINLESS STEEL FASTENERS.
3. GAS PURGING VALVES NOT SHOWN
4. LEVELING FEET NOT SHOWN





AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

EXP. DATE 11-30-2001

THESE DRAWINGS AND/OR SPECIFICATIONS ARE THE PROPERTY OF PLAS LABS, INC. AND UNLESS WRITTEN APPROVAL IS GRANTED SHALL NOT BE USED, DISCLOSED, REPRODUCED OR COPIED IN WHOLE OR IN PART AS THE BASIS FOR MANUFACTURE OF SALE OF EQUIPMENT OR FOR ANY PURPOSE OTHER THAN TO EVALUATE THE RELATED PROPOSAL.

REVISIONS	PLAS LABS, INC. 917 E. Chilson St. Lansing, Michigan USA	
	TITLE CLEAN HARBOR GLOVE BOX	
	SCALE 1/2" = 1'	DRAWING NO.
	DATE 01 APR 00	DR. BY MDR

CONSTRUCTION CERTIFICATION

This statement is to be completed by both the responsible officer and the registered professional engineer upon completion of construction in accordance with 35 IAC Section 702.126. Submit one copy of the certification with original signatures and two additional copies (four additional copies for UIC wells). Forward these certification statements and any information required by the permit to the following address:

Illinois Environmental Protection Agency
Bureau of Land - #33
Permit Section
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

FACILITY NAME: Clean Harbors Services, Inc.

IEPA SITE CODE: 0 3 1 6 0 0 0 0 5 1

U.S. EPA ID NO.: IL D 0 0 0 6 0 8 4 7 1

PART B PERMIT LOG #/UIC PERMIT #: B-16

PERMIT (OR MODIFICATION) ISSUANCE DATE: 09/30/93 (08/06/97)

PERMIT CONDITION NO. REQUIRING CERTIFICATION: II D.1.a

The Additional Pumping Station - Unit 61 has been constructed in accordance with the specifications in the Part B/UIC Permit. Documentation that the construction was in accordance with the permit is contained in the enclosed report. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Michael Petrovich — MICHAEL PETROVICH, GENERAL MANAGER
Signature of Owner/Operator — Name and Title

Kenneth D. Spaulding — KENNETH SPAULDING
Signature of Registered P.E. — Name of Registered P.E. and Illinois Registration Number

Oct 29, 2002
Date

(P.E. SEAL)

KENNETH D. SPAULDING
62-44249
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

This Agency is authorized to require this information under Illinois Revised Statutes, 1979, Chapter 111 2, Section 1039. Disclosure of this information is required under that Section. Failure to do so may prevent this form from being processed and could result in your application being denied. This form has been approved by the Forms Management Center.

MECA

MECA ENGINEERING CORP. OF AMERICA

5539 Indianapolis Blvd. East Chicago, IN 46312 (219) 397-0100 FAX (219) 397-0164 e-mail mecaeng@netnitco.net

October 25, 2002

Illinois Environmental Protection Agency
Bureau of Land #33
Permit Section
1021 North Grand Avenue East
Springfield, IL 62794-9276

RE: 0316000051
Clean Harbor Services, Inc.
ILD000608471
RCRA Permit Log No. 16

Dear Sir:

I hereby certify that I, the undersigned am a Professional Engineer, Licensed to practice in the State of Illinois.

Clean Harbors has submitted an application for a Class 2 Modification to the subject facility Unit 61. I have inspected the piping installed for the modification (additional pump system). I certify under penalty of law that the piping installation was designed and installed in a manner that is properly supported and protected against physical damage and excessive stress due to settlement, vibration, expansion or contraction. I further certify that the pressure test of the piping system was performed in a proper and acceptable manner.

Respectively submitted,
MECA Engineering Corporation of America

Kenneth D. Spaulding P. E.
Licensed Professional Engineer
Illinois License No. 62-44249; Expiration Date: 2/28/03

KENNETH D. SPAULDING
62-44249
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

Appendix D-40

Unit 25 Lab Pack Pour-off Emission Calculations, Engineering Certification

FLAMMABLE LAB PACK POUR-OFF OPERATION CALCULATION FOR POTENTIAL PROCESS EMISSIONS

Lab pack pour off operation will involve various flammable organic chemicals in small quantities, consolidated based on mutual compatibility. During the pour-off operation, some emissions will occur due to the displacement of vapors occupied by the head space during filling and natural vaporization into the head space of chemical being poured. In order to compute the maximum potential emissions, a worst case scenario has been considered, as described below.

Assumption is made that the potential for emission is proportional to the potential of the chemical to volatilize, which in turn is proportional to the vapor pressure of that compound. Among the compounds of interest, Methylene Chloride is considered to be the one that would have higher probability of being present in lab packs(more commonly found in lab packs and expected to be received in fairly large quantity) and that has a highest Vapor Pressure than the other large quantity VOCs such as Acetone.

Again in order to estimate potentially maximum emission rate, it is assumed that 100% of the material poured off will be Methylene Chloride.

The emissions would occur due to filling losses caused by the displacement of vapors from the container being filled in pour-off operation. It is further assumed that the displaced volume of air would be saturated with the compound under consideration.

For the filling losses estimates, A.P.I. formula 28-145 is used. The formula is taken from "Hydrocarbon Emissions From Fixed Roof Tanks", Modern Pollution Control Technology, Volume I, Research and Education Association, NY, 1978.

Equation for filling losses estimates:

$$F = 3 * N(t) * K(t) * P(v) * V * r/10,000$$

Where,

F	=	Process Emission, lbs/hr
N(t)	=	No. of Drums filled/hr
K(t)	=	Empirical drum turnover factor
P(v)	=	Average solvent vapor pressure in psia
V	=	Volume of solvent emptied, gallons/drum
r	=	Average solvent density, lbs/gallon

Compound & Physical Data:

Constituent	:	Methylene Chloride
CAS Number	:	75-09-2
Molecular Weight	:	84.93
Vapor Pressure at 68 deg.F, P(v)	:	6.5760 psia
Average density, r	:	11.12 lbs/gallon
Concentration in liquid	:	100%

Emissions Estimate:

For the pour-off process,

N(t) = 1/2 drum/hr, the assumed maximum throughput is 2,500 drums/yr. (1/2 drum/hr X 20 hrs/day X 250 days/yr.). OR = 137,500 gallons/year.

K(t) = 1. When the drum head space is assumed to be saturated vapors(worst case).

V = 55 gallons/drum, Assumed drum filled completely.

Therefore,

F = 3 * (1/2) * (1) * (6.576) * (55) * 11.12/10,000

= 0.6033 lbs/hr.

The pour-off operation will be carried out under a specially designed enclosure which will be maintained under negative pressure by exhausting 2,000 SCFM from the enclosure. The emission of vapors from the pour-off operation will be captured via adsorption through a Granular Activated Carbon(GAC) adsorber system.

The GAC adsorption system will consist of two sets of carbon beds operated in parallel, each set having two beds. The two beds in each set will be connected in series.

The vapors from the hood will be exhausted by two-1,000 SCFM capacity blowers, one for each set of carbon beds.

The minimum control efficiency of two carbon beds connected in series is assumed to be 95%.

Therefore, the potential emissions after the control device

= F * 0.05

= 0.6033 * 0.05

= 0.03 lb/hr

Life Expectancy of Carbon beds:

Based on the manufacturer's data, the loading capacity of the GAC for Methylene Chloride is 39.8%.

Also, assuming that the all adsorption occurs in the first bed of each set;

the total quantity of carbon available = 2 setx1800 lbs/bed/set
= 3,600 lbs.

Therefore,

The total adsorption capacity of carbon = 3,600 x 0.398

= 1,432 lbs. of methylene Chloride.

Then the estimated time before breakthrough

= 1,432 lbs/(0.6033 x 24) lbs/day of methylene chloride

= 99 days.

Using a factor of safety = 2,

The minimum break through time = 49.5 working days.

FLAMMABLE LAB PACK POUR-OFF

Clean Harbors
Chicago Plant

Analysis For Candidate Compound Selection
To Determine Maximum Potential Emissions

Compound in lab pack	Volume Gallons	% Volume of Total	Compounds in higher volume than Methylene Chloride
Cyclopentane	1	0.11%	
Formalin/Formaldehyde	18	2.06%	
Isopropanol	16	1.83%	
Oil	75	8.58%	*
Acetone	12	1.37%	
Ethanol	87	9.95%	*
Butyl Acetate	0.5	0.06%	
Methanol	73	8.35%	*
Butanol	6.5	0.74%	
Xylene	21.5	2.46%	
Toluene	25	2.86%	
Pentane	1	0.11%	
Trichloroethane	14	1.60%	
Methylene Chloride	**67**	**7.66%**	**Selected Comp.**
Phenol	57	6.52%	
Propylene Glycol	23	2.63%	
Pyridine	20	2.29%	
Ethylene Glycol	15	1.72%	
Freon	10	1.14%	
Carbon Tetrachloride	7	0.80%	
Propanol	10	1.14%	
Ethyl Acetate	10	1.14%	
Chlorobenzene	2	0.23%	
Cyclohexane	3	0.34%	
Benzene	13	1.49%	
Naptha	30	3.43%	
Acetonitrile	23	2.63%	
Chloroform	45	5.15%	
Trichloroethylene	4	0.46%	
Hexane	12	1.37%	
Aniline	8	0.91%	
MEK	15	1.72%	
Diesel Fuel	24	2.74%	
Dichloroethane	5	0.57%	
acetaldehyde	1	0.11%	
Methyl Methacrylate	2	0.23%	
Perchloroethylene	8	0.91%	
Pentanol	1	0.11%	
Octanol	1	0.11%	
Bromohexane	1	0.11%	
Chloroacetone	6	0.69%	

FLAMMABLE LAB PACK POUR-OFF

Clean Harbors
Chicago Plant

Analysis For Candidate Compound Selection
To Determine Maximum Potential Emissions

Compound in lab pack	Volume Gallons	% Volume of Total	Compounds in higher volume than Methylene Chloride
Cyclohexanone	2	0.23%	
Dichlorobenzene	5	0.57%	
Pentachlorophenol	20	2.29%	
(D037 or no code only)			
Bromoform	1	0.11%	
Nitrobenzene	2	0.23%	
Cresols (o,m,p)	1	0.11%	
Acrylamide (l.)	13	1.49%	
Dimethyl Sulfoxide	5	0.57%	
DAB	6	0.69%	
DDT	1	0.11%	
Creosote	1	0.11%	
Nitrophenol	1	0.11%	
Furfural	1	0.11%	
Ethidium Bromide	3	0.34%	
2,4-D (l.)	1	0.11%	
Acrylonitrile	1	0.11%	
1,Bromo-3,Chloropropane	1	0.11%	
Benzyl alcohol	1	0.11%	
Bromopropane	1	0.11%	
THF	12	1.37%	
Acetophenone	2	0.23%	
2-Methyl-1-propanol	1	0.11%	
Amyl alcohol	2	0.23%	
Toluidine (o,m,p)	1	0.11%	
Diaminobenzene	3	0.34%	
Dibromoethane	1	0.11%	
Dibromomethane	1	0.11%	
Benzaldehyde	1	0.11%	
Tetrachloroethane	1	0.11%	
Benzoquinone	2	0.23%	
Methyl Chloride	1	0.11%	
Nitrotoluene	1	0.11%	
dichlorobenzene	2	0.23%	
p-dimethyl amino azo-	1	0.11%	
benzene			
Ethylene bromide	1	0.11%	
Hexachlorobutadiene	1	0.11%	
Sample Total	874.5	100.00%	

POWDERED LAB PACK POUR-OFF

Clean Harbors
Chicago Plant

Compound in lab pack	Volume Gallons	% Volume of Total
Thioacetamide	12	1.19%
Phthalic anhydride	26	2.58%
Maleic anhydride	7	0.70%
Oxalic acid	4	0.40%
Lead Acetate	35	3.48%
Barium Acetate	10	0.99%
Silver Acetate	6	0.60%
Phenol (s.)	53	5.27%
Lindane	1	0.10%
Cresol (s)	5	0.50%
Acrylamide	44	4.37%
Camphene	1	0.10%
Saccharin	2	0.20%
Lead Carbonate	4	0.40%
Lead Citrate	1	0.10%
Lead Tetraacetate	2	0.20%
2,4-D (s.)	2	0.20%
DDT	1	0.10%
Phenacetin	2	0.20%
Trypan blue	50	4.97%
acetamide	11	1.09%
chromium acetate	2	0.20%
Thiourea	17	1.69%
chlorobenzaldehyde	2	0.20%
aminophenol	2	0.20%
lead stearate	5	0.50%
(o,m,p)-Toluidine (s.)	15	1.49%
cadmium acetate	5	0.50%
dichlorophenol	2	0.20%
Ethidium bromide	10	0.99%
Paraformaldehyde	86	8.55%
Napthalene	104	10.34%
Sulfur	257	25.55%
Camphor	20	1.99%
Dichlorobenzene	49	4.87%
Lycopodium	10	0.99%
Resorcinol	21	2.09%
Paradichlorobenzene	64	6.36%
Fluoranthene	1	0.10%
Pentachloronitrobenzene	50	4.97%
Toluidine	5	0.50%
Total	1006	100.00%

ACIDS LAB PACK POUR-OFF

Clean Harbors
Chicago Plant

Compound in lab pack	Volume Gallons	% Volume of Total
Methane sulfonic acid	14	3.67%
Formic acid	83	21.76%
Lactic acid	1	0.26%
Trifluoroacetic acid	1	0.26%
Glacial Acetic acid	66	17.30%
Trichloroacetic acid	20	5.24%
Acetic acid solution	89	23.33%
Formaldehyde	20	5.24%
Butyric acid	3	0.79%
Phenylacetic acid	1	0.26%
Propionic acid	8	2.10%
Acetic anhydride	19.5	5.11%
Glycolic acid	7	1.83%
(hydroxyacetic acid)		
Hydrochloric acid	10	2.62%
Valeric acid	2	0.52%
Pyruvic acid	1	0.26%
Toluene Sulfonic acid	1	0.26%
Phosphoric acid	8	2.10%
Nitric acid	3	0.79%
Sulfamic acid	2	0.52%
Octanoic acid	1	0.26%
Hexanoic acid	1	0.26%
Proprionic anhydride	1	0.26%
Boric acid	4	1.05%
Sulfuric acid	15	3.93%
	381.5	100.00%

ALKALINE LAB PACK POUR-OFF

Clean Harbors
Chicago Plant

Compound in lab pack	Volume Gallons	% Volume of Total
Ammonium Hydroxide	203	53.14%
Ammonia Solution	100	26.18%
Diethylamine	8	2.09%
Diemethylformamide	4	1.05%
Triethanolamine	10	2.62%
Ethanolamine	10	2.62%
Cyclohexylamine	1	0.26%
Diethanolamine	10	2.62%
Tribuylamine	1	0.26%
Dimethyloctylamine	1	0.26%
Diethylenetriamine	1	0.26%
Ethylenediamine	5	1.31%
Triethylenediamine	1	0.26%
Butylamine	1	0.26%
Diphenylamine	1	0.26%
Dibutylamine	1	0.26%
Dimethylamine	3	0.79%
Triethylamine	8	2.09%
Benzylamine	1	0.26%
Triethanolamine	2	0.52%
Potassium Hydroxide	5	1.31%
Sodium Hydroxide	5	1.31%
	382	100.00%

ACID/ALKALINE SCRUBBER SYSTEM DESCRIPTION

The acidic and alkaline lab-pack pour-off hoods will be connected to their respective packed tower scrubbers to remove any gases and/or mists emanating from the pour-off operation.

Each of the two systems will consist of a vertical packed tower scrubber with an integral sump, recirculation pump, recirculation piping, exhaust fan, interconnecting ductwork, chemical feed system, control panel and instrumentation such as pH sensor/controller and level controller. The proposed vertical packed scrubbers will be Ceilcote model SPT-30-120 or equivalent). Each scrubber is 30 inches in diameter with 120 inch packing bed height and Tellerettes #2-K packing media.

Material of construction for the packed towers will be vinyl ester resin reinforced with glass. The packing will be polypropylene.

The chemical feed system for the addition of caustic or acid solution consists of a pH probe which is inserted into the scrubber sump for continuous sensing of the solution pH. The pH sensor is connected to an on/off pH analyzer mounted in the control panel. The signal from the pH sensor will activate the on/off metering pump to maintain the pH range with in the pre-set range. The metering pump can also be controlled for manual feed of chemical on a pre-set interval.

The city water supply will be regulated into the scrubber to maintain the liquid level of the sump. The sump is provided with an overflow piped to an overflow collection tank. The liquid accumulated into the overflow tank will be pumped into a 500 gallon scrubbing solution collection tank.

Each scrubber will have a gas flow of 2000 SCFM at ambient inlet temperature and scrubbant flow rate of 50 GPM.

ACID POUR-OFF SCRUBBER

The scrubbing media will be a 10% caustic solution maintained at a pH of 9.5.

Based on a representative sample of lab packs, Acetic Acid was found to be 40%. Due to its vapor pressure, the potential emissions are calculated on the basis that 100% of pour-off chemicals are Acetic Acid.

To determine the potential emissions of Acetic Acid from the pour-off operation, it is assumed that during the pour-off the head space in the drum is saturated and is being displaced to cause the emissions.

For the filling losses estimates, A.P.I. formula 28-145 is used.

The formula is taken from "Hydrocarbon Emissions From Fixed Roof Tanks", Modern Pollution Control Technology, Volume I, Research and Education Association, NY, 1978.

Equation for filling losses estimates:

$$F = 3 * N(t) * K(t) * P(v) * V * r/10,000$$

Where,

F	=	Process Emission, lbs/hr
N(t)	=	No. of Drums filled/hr
K(t)	=	Empirical drum turnover factor
P(v)	=	Average solvent vapor pressure in psia
V	=	Volume of solvent emptied, gallons/drum
r	=	Average solvent density, lbs/gallon

Compound & Physical Data:

Constituent	:	Acetic Acid
CAS Number	:	64-19-07
Molecular Weight	:	60.05
Vapor Pressure at 68 deg.F, P(v)	:	0.2765 psia

Emissions Estimate:

For the pour-off process,

N(t)	=	1/2 drum/hr, the assumed maximum throughput is 2,500 drums/yr. (1/2 drum/hr X 20 hrs/day X 250 days/yr.). OR = 137,500 gallons/year.
K(t)	=	1. When the drum head space is assumed to be saturated vapors(worst case).
V	=	55 gallons/drum, Assumed drum filled completely.
r	=	8.79 lbs/gal

Therefore,

$$F = 3 * (1/2) * (1) * (0.2765) * (55) * 8.79/10,000$$

$$= 0.02 \text{ lbs/hr.}$$

After going through the wet scrubber with a 95% removal efficiency, the potential emission to atmosphere will be 0.001 lb/hr.

ALKALINE POUR-OFF

Based on the assessment of a representative sample of alkaline pour-offs it has been determined that about 80% of the lab packs in this category contain Ammonia.

With an assumption that 10% of the ammonia will be released in the gaseous form during the pour-off, potential emissions from this operation can be computed as follows:

Assume 100 % of pour-off is Ammonia, as a worst case.

Total volume of poured chemicals		= 25 gals/hr.
Average Density of ammonia solutions		= 10 lbs/gal
Estimated potential emissions	=	25 x 10 x 0.1
	=	25 lbs/hr.

The acid scrubber will have sulfuric acid solution maintained at a pH of 0.2 to capture ammonia.

With the capture efficiency of 95%, the potential emissions to atmosphere = 25 x 0.05 = 1.25 lb/hr.

========

DUST COLLECTOR FOR POWDERS/SOLIDS POUR-OFF

The lab pack pour-off hood for powders/solids will be positively vented through a dust collector to capture airborne particulates during the pour-off process.

The proposed dust collector unit is a Torit model 2DF4 or equivalent. The unit is a cartridge filter with a downflow design and 904 sq.ft. filtration area. This unit will operate under vacuum and has been provided with automatic valves for pulse cleaning controlled by an adjustable pulse timer and photohelic gauge tied to an audible alarm. The pulsing will occur for two cartridges at a time.

The unit contains four replaceable filter cartridges, an exhaust fan with a damper, and control panel. The unit is designed for an outdoor operation.

Capacity	:	2000 SCFM
Filtration area	:	904 sq. ft.
Efficiency	:	99.99 % on particles 1/2 microns and higher

POTENTIAL PARTICULATE EMISSION CALCULATIONS

The pour-off activity will be carried out at a filling rate of 1/2 drum per hour.

Volume of solids collected	:	4 cu. ft./hour
Assumed Average bulk density	:	60 lbs/cu.ft.
Weight of solids collected	:	240 lbs/hour
Maximum % airborne solids	:	5%
Potential to emit w/o controls	:	12 lbs/hr of particulates
Control efficiency	:	99.99%
Potential maximum emission	:	0.0012 lb/hr.

==========

HOYER-SCHLESINGER-TURNER inc.
ENGINEERS - CONSTRUCTORS
300 west adams street chicago illinois 60606 telephone 263-0556 area code 312

August 26, 1999

Illinois Environmental Protection Agency
Bureau of Land #33
Permit Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

RE: 0316000051 -- Cook County
Clean Harbors Services, Inc.
ILD000608471
RCRA Permit Log No. 16
RCRA Permit File

Dear Sir:

I hereby certify that I, the undersigned am a Professional Engineer, licensed to practice in the State of Illinois.

I certify under penalty of law that the following proposed area:

-Unit 25 -modification to allow flammable and reactive container storage, pour-off of lab pack containers and addition of a truck loading/ unloading pad for one truck

was designed in accordance with good engineering practices.

The structural integrity of the secondary containment system and the design of the modifications to Unit 25 are suitable for the intended use. Foundations, floors and containment slabs are designed for the intended loads and will maintain structural integrity without failure. The Protecto-Crete 900 and Protecto-Coat 900 vinyl ester coatings, as manufactured by Dudick, Inc. or equivalent, for the drum storage bays and ramps, and for the truck pad respectively are suitable for its intended use.

Respectively submitted,
Hoyer-Schlesinger-Turner, Inc.

Amos Turner

Amos Turner
Licensed Professional Engineer
Illinois License No. 19471; expiration date 11/30/99

AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF
ILLINOIS

HOYER-SCHLESINGER-TURNER inc.
ENGINEERS - CONSTRUCTORS
300 west adams street chicago illinois 60606 telephone 263-0556 area code 312

CONTAINMENT CAPACITY CALCULATIONS FOR UNIT 25 TRUCK PAD

REQUIRED CAPACITY

(A) Volume of 88-55 Gal. drums= 88x55= 4840 gallons
10% of total volume = 484 gallons

(B) Precipitation allowance for maximum rainfall of 4.7 inches
(4.7/12)'x45'x13.34'x7.481 = 1,759 gallons

TOTAL REQUIRED CAPACITY = 2,243

AVAILABLE CAPACITY

(A) Volume of the sump
=2'x2'x2'x7.481 = 59 gallons

(B) Volume of large sloped section
=1/2x12'x43'x2.67'x7.481 = 5,153 gallons

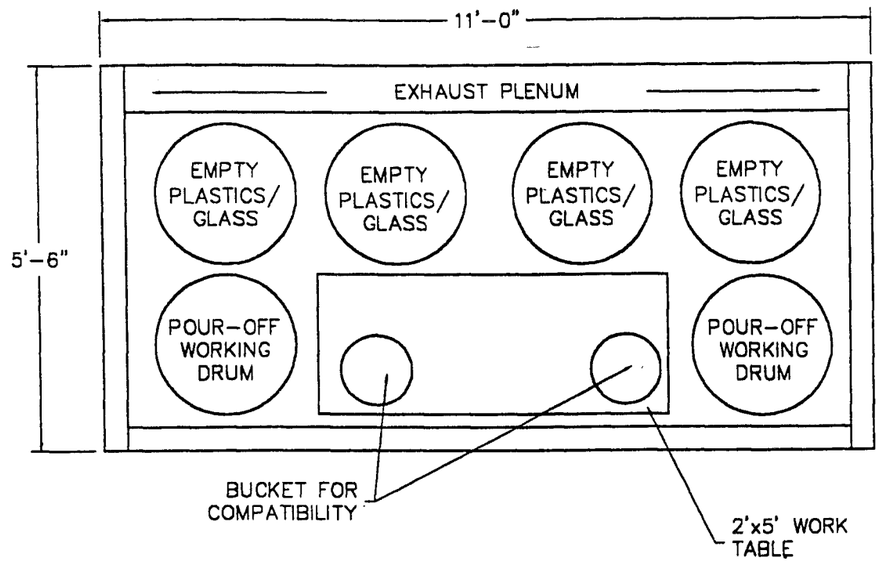
(C) Volume of small sloped section
=1/2x12'x2'x2.62'x7.481 = 235 gallons

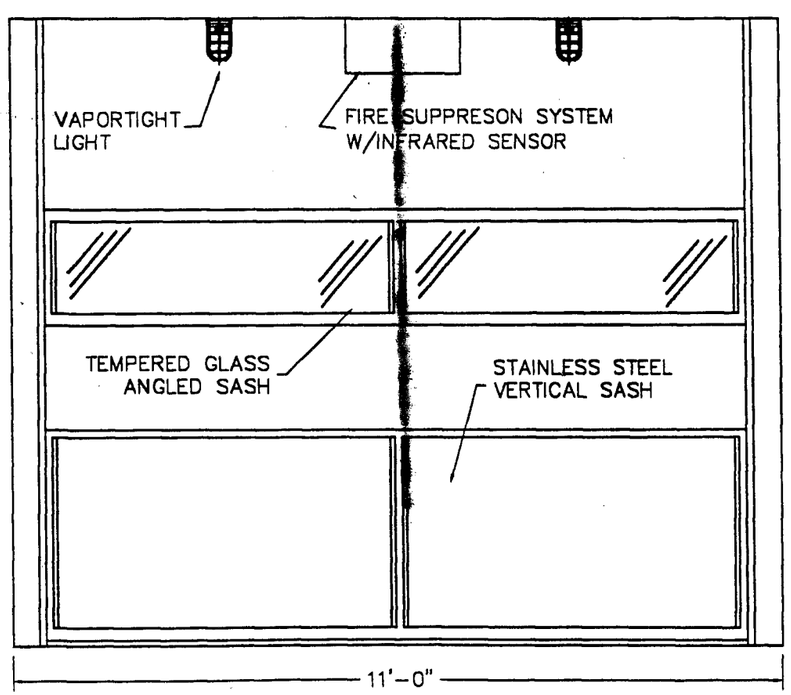
TOTAL AVAILABLE CONTAINMENT CAPACITY = 5,447 gallons

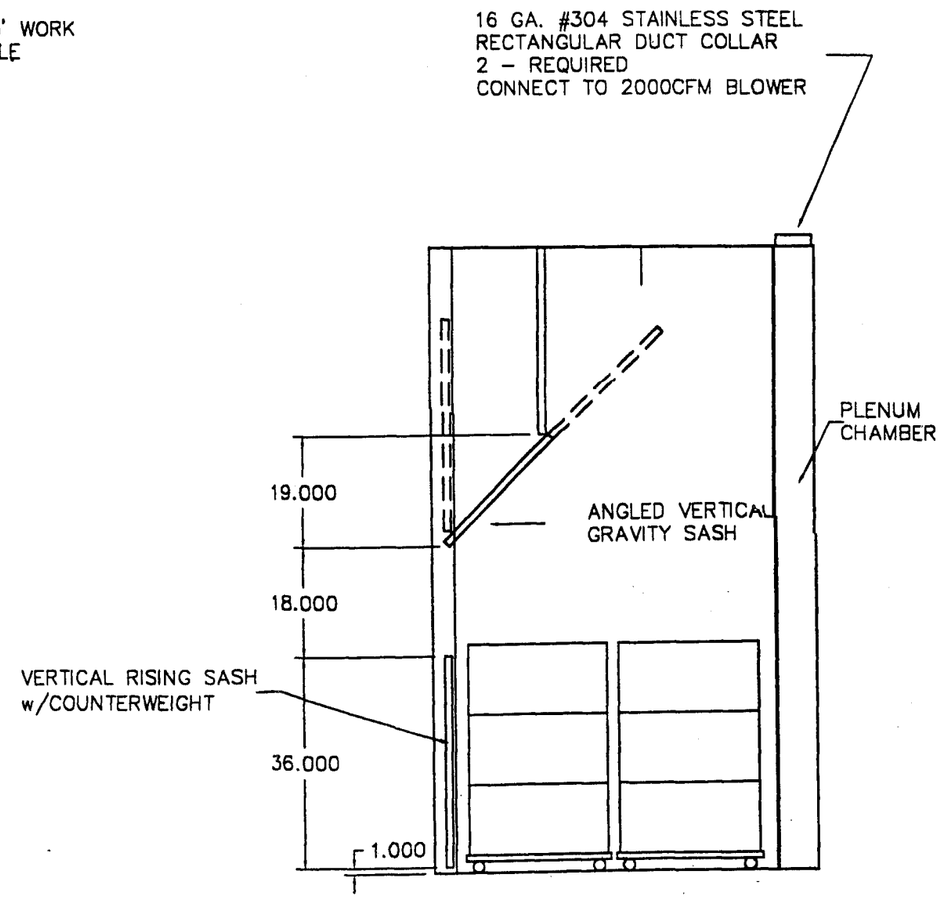
Amos Turner
08-26-99

Amos Turner
Licensed Professional Engineer
Illinois License No. 19471; expiration date 11/30/99

AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF
ILLINOIS







AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

EXP. DATE 11-30-2001

6/28/00

B	CHANGE PLENUM CONFIGURATION	A.A.A.	A.M.L.	A.M.L.	6/28/00
A	PART "B" PERMIT MODIFICATION	K.M.L.	A.M.L.	A.M.L.	6/28/00
REV.	DESCRIPTION	DRWN.	CHKD.	APPR.	DATE

CleanHarbors
ENVIRONMENTAL SERVICES, INC.
1501 Washington Street
Braintree, Massachusetts 02185
Telephone (781) 848-1500

TITLE
CLEAN HARBORS SERVICES, INC.
11800 S. STONY ISLAND AVE.
CHICAGO, ILLINOIS 60617

LAB PACK POUR-OFF HOOD

PROJECT NO. CH11-483?

SCALE DO NOT

Appendix D-41

Building 42 Subpart BB/CC Emission Calculations, Engineering Certification, Potential Pathways to Humans or Environmental Receptors

CleanHarbors
ENVIRONMENTAL SERVICES, INC.
11800 SOUTH STONY ISLAND AVENUE • CHICAGO, IL 60617
(773) 646-6202 • FAX (773) 646-6381
Visit our Website at www.cleanharbors.com

Certified Mail #P475353703

January 12, 1999

Mr. Mark A. Schollenberger, P.E.
Bureau of Land - Permit Section
Illinois Environmental Protection Agency
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Dear Mr. Schollenberger:

Clean Harbors Services, Inc. (CHSI) is submitting additional information concerning the can and glass crusher application. Specifically, to demonstrate this operation meets the requirements of 40 CFR 264 Subpart CC. The Standards covered by the operation include containers, closed vent systems and control devices.

Containers to be processed through the can and glass crusher are 5 gallons or less in capacity. These containers are less than the capacity required to subject them to Subpart CC. After processing, the liquids are collected in 55 gallon drums meeting applicable US DOT regulations on packaging hazardous materials for transportation (49 CFR 178). The cover and closure device will be secured promptly upon conclusion of the filling operation. If intermittent filling occurs, the cover and closure device will be reclosed/ resecured when:

a) the final volume is reached
b) completion of the batch with no material additions within 15 minutes
c) person loading the container leaves the building
d) can and glass crusher is shutdown

After the cover and closure device have been secured, a visual inspection looking for cracks, holes, gaps or open spaces into the interior of the container will be performed. Any container in storage for more than one year will be visually reinspected.

The can and glass crusher operates under a hood connected to a closed vent system to route gases, vapors and fumes from the hazardous waste to control device designed and operated to

reduce the total organic content of the inlet vapor stream by at least 95% by weight. The closed vent system is designed and will be operated with no detectable emissions, as indicated by an instrument reading of less than 500 ppmv above background as determined by the procedure in 40 CFR 264.1034 (b) and by visual inspections. The design certification indicating the unit will operate with no detectable emissions is included as attachment 1. The initial leak detection monitoring using the procedures specified in 40 CFR 264.1034(b) will be conducted on or before the unit becomes operational for all closed-vent system joints, seams or other connections that are permanently or semi-permanently sealed. After initial leak detection monitoring, the unit will be inspected and monitored as follows:

> Closed-vent system joints, seams or other connections that are permanently or semi-permanently sealed shall be visually inspected annually for defects which could result in air emissions. Defects include, but are not limited to, visible cracks, holes, gaps or loose connections. If any component is repaired or replaced or the connection is unsealed, the component or connection will be monitored using the procedures specified in 40 CFR 264.1034(b) to demonstrate that it operates with no detectable emissions.

Detectable emissions, as indicated by visual inspection, or by an instrument reading greater than 500 ppmv above background, will be controlled as soon as practicable, but no later than 15 calendar days after the emission is detected. A first attempt at repair shall be made no later than 5 calendar days after the emission is detected.

The closed vent system and carbon adsorption system will be operated at all times when emissions are vented to them.

Included as Attachment 2, is design analysis which demonstrates the carbon beds will reduce the total organic content of the inlet vapor stream by 95%. The operating parameters in this analysis represent operating conditions at the highest load or capacity level expected to occur.

A flow indicator sensor will be installed to provide a record of the vent stream flow in the closed vent system at least once each hour. A pressure measurement device will be installed in a readily accessible location to verify that negative pressure is being maintained in the closed vent system when operating.

The closed vent system will not include any bypass devices that could be used to divert the gas or vapor stream to the atmosphere before entering the control device. Low leg drains, high point bleeds, analyzer vents, open-ended valves or lines, spring loaded pressure relief valves and other fittings used for safety purposes are not considered bypass devices.

A carbon adsorption system will be used as the control device for the can and glass crusher. During periods of planned routine maintenance or a control device system malfunction, the control device is not required to reduce the total organic content of the inlet vapor stream by 95%. Periods of planned routine maintenance will not exceed 240 hours annually. This will be recorded on a semiannual basis describing the type of preventive maintenance necessary for the next six months, planned frequency of maintenance, and lengths of maintenance periods. The report will also describe planned routine maintenance during the previous six months including type of maintenance performed and total number of hours during the six months the control device did not reduce the total organic content of the inlet vapor stream by 95% during planned routine maintenance. Control device system malfunctions will be corrected as soon as practicable after occurrence in order to minimize excess air pollutant emissions. Gases, vapors and fumes will not be actively vented to the control device during periods of planned routine maintenance or control device system malfunction except when necessary to vent the gases, vapors and/or fumes to avoid an unsafe condition or to implement malfunction corrective actions or planned maintenance actions.

After initial start-up of the carbon adsorption system, all activated carbon will be replaced with new carbon within 24 hours of when monitoring indicates the control device did not reduce the total organic content of the inlet vapor stream by 95%. Monitoring will be conducted each day the can and glass crusher operates.

Manifests for all shipments spent carbon will be maintained at the facility. No spent carbon will be regenerated or disposed on-site. All carbon removed from the control devices will be managed per the requirements of 40 CFR264.1034 below:

1) regenerated/reactivated in a Subpart X unit

2) incinerated as a hazardous waste

3) burned in an industrial furnace or boiler

Records will be maintained at the facility including design documentation, monitoring, operating, and inspection information for the closed-vent system and carbon adsorption system. This will include:

1) description and date of each modification

2) identification of operating parameters, description of monitoring device and diagram of monitoring location, and daily inspection for flow indication sensor

3) monitoring inspections of carbon adsorption system including date and time of monitoring and reading, carbon system startup and shutdowns, records of management of carbon including carbon changes, off-site shipments

4) monitoring inspections of closed vent system including visual and instrument for initial and continued operation, and negative pressure indicators

5) records of defects or leaks found, repairs made of the closed vent system including instrument identification number, component identification number, operator's identification, dates of leak detection, first repair attempt, and successful repair, successful repair reading, repair delays and justifications

6) date, time and duration of each period the carbon system is operating below 95% reduction of total organic content of the inlet vapor stream

A semiannual report will be submitted to the regional administrator detailing dates the carbon adsorption system operated below 95% reduction of total organic content of the inlet vapor stream and the carbon bed was not replaced within 24 hours. If the carbon beds are replaced within 24 hours during the six month period, no report is necessary.

If you have any further questions regarding this additional information, please contact me at (773)646-6202.

Sincerely,

James R. Laubsted
Facility Compliance Manager

I hereby certify as Facility Owner/Operator that the carbon adsorption bed system control device is designed to operate at an efficiency of 95% or greater reduction of total organic concentration from the closed vent system associated with the can and glass crusher as demonstrated by the attached design analysis. This design analysis considers vent stream composition, constituent concentrations, flow rate, relative humidity and temperature. This design analysis establishes the design outlet organic concentration level, capacity of the carbon bed, type and operating capacity of the activated carbon and design carbon replacement interval based on the total carbon working capacity and can and glass crusher operating schedule. I also certify that the operating parameters used in this design analysis reasonably represent the conditions that exist when the can and glass crusher would be operating at the highest load or capacity level reasonably expected to occur.

Signature _____ Date 1-8-99

Stephen E. Dovell, Vice-President of Disposal Services
Clean Harbors Inc.

POTENTIAL PATHWAYS OF EXPOSURE TO HUMANS OR ENVIRONMENTAL RECEPTORS

CHSI believes that operating the can compactor will present the same minimal level of potential exposure to humans and the environment as other operations at the facility (e.g., waste consolidation, waste stabilization, fuels blending, lab pack pour off, etc.). A number of factors significantly minimize any potential exposure of on-site and off-site personnel or the environment to paint and paint-related materials processed by the unit. These factors and the types of materials to be managed and the potential exposure pathways, environmental receptors and magnitude and nature of exposures are discussed below.

(1) WASTES TO BE MANAGED

CHSI will use the Paint Can Compactor to manage hazardous waste paints and other hazardous wastes contained in small metal cans or glass containers. CHSI receives paint and paint-related materials such as latex paint, oil-based paint, marine paint, turpentine, non-solvent thinners, lacquers, shellacs, and other paint-related materials. These materials will contain a variety of organic and inorganic compounds. The types of chemical constituents and their concentrations will vary based on the type of paint and paint-related material that is managed.

Because of the wide variability in the types of chemicals to be managed and their concentrations, for the purposes of this document, CHSI assumed a "worst case" scenario. The assumptions that were made include:

* Paint and paint-related materials to be managed in the unit would be similar to those wastes already being managed in CHSI's ongoing fuels blending operations;

* Paint and paint-related materials to be managed would consist primarily of volatile organic compounds (VOCs). In general, VOCs would be more likely volatilize than other organic or inorganic constituents thereby presenting a worst case scenario when considering the potential impacts associated with inhalation;

* CHSI used the results of an analysis performed by Carlson Environmental, Inc. (Evaluation of Potential Hazardous Material Emergencies through Atmospheric Transport from the Current and Proposed Clean Harbors Facility, Chicago, Illinois) as part of its assessment of potential off-site air impacts. As part of Carlson's assessment, it assumed a number of organic compounds present in typical on-site

operations. CHSI used the list of organic compounds developed by Carlson as the representative worst case of the type of compounds that could likely be found in paint and paint-related material. The list of chemical compounds is provided in **Table 7-1**; and

* Potential pathways and impacts considered normal operation of the unit and spill events.

(2) POTENTIAL PATHWAYS OF HUMAN EXPOSURE

CHSI considered three (3) different scenarios when assessing potential human exposures: (1) on-site worker operating/working at the can compactor; (2) on-site worker working immediately outside Building 42; and (3) person located off-site.

The typical potential pathways of human exposure for this activity could include:

* Adsorption of paint/paint-related material through direct contact with the skin, eyes, etc. (direct adsorption) or adsorption by contact with soil, groundwater or surface water contaminated with paint/paint-related material (indirect adsorption)

* Ingestion of paint/paint-related material (direct ingestion) or ingestion of soil, groundwater or surface water contaminated with paint/paint-related material (indirect ingestion)

* Inhalation of vapors associated with the management of paint/paint-related materials

These human exposure pathways were evaluated for each of three (3) scenarios. The results of this assessment are provided below.

(A) On-site Worker at the Can Compactor

<u>Adsorption</u>

Like the waste management activities already taking place at CHSI, all employees working at the paint can compactor will wear the appropriate personnel protective equipment (PPE) for the materials being managed and the operations to be performed. For the compactor, this equipment will include: hard hat; safety glasses; steel toed shoes; Tyvek suit; and full face, cartridge respirator or self contained breathing apparatus (SCBA). The selection of the appropriate respirator cartridge will be based on the types of waste being managed (e.g., volatile organic compounds).

Table 7-1
Chemical Constituents

Acrolein
Acrylyl chloride
Benzene
Carbon tetrachloride
Chlordane
Chlorobenzene
Chloroform
Cresols
Cyanuric fluoride
1,4-Dichlorobenzene
1,2-Dichloroethane
1,1-Dichloroethylene
Dimethyl sulfide
2,4-Dinitrotoluene
Ethyl benzene
Ethylene fluorhydrin
Ethyleneamine
Gasoline
Heptachlor
Hexachlorobenzene
Hexachlorobutadiene
Hexachloroethane
Isopropyl formate
Methacryloyl chloride
Methylcryloyloxyethyl isocyanate
Methyl chloroformate
Methyl disulfide
Methyl ethyl ketone
Methyl hydrazine
Methyl isocyanate
Methyltrichlorosilane
Methyl vinyl ketone
Methylene chloride
Naphthalene
Nickel carbonyl
Nitrobenzene
Pentaborane
Pentachlorophenol
Phenol
Propargyl bromide
Pyridine
Sulfur trioxide
Tetrachloroethylene
Toluene
1,1,1-Trichloroethylene
1,1,1-Trichloroethane
1,1,2-Trichloro-1,2,2-trifluoroethane
Vinyl chloride
Xylene

All moving parts of the compactor will be enclosed, making the unit safe to operate. When crushing cans containing liquid, a hinged cover located at the discharge end of the crusher will be lowered to protect workers against splashing.

Using the appropriate PPE, following CHSI's existing standard operation procedures for donning and doffing PPE and personal and equipment decontamination, and using the hinged cover when appropriate will prevent or significantly minimize any worker exposure to or contact with paint and paint-related materials to be managed in the compactor via adsorption pathways. In the unlikely event paint or paint-related materials came into contact with an employees skin, eyes, etc. the employee would immediately wash/flush the affected area with water and/or an appropriate cleaner (e.g., soap). The employee would then be directed to seek proper medical attention off-site, if appropriate.

In addition to contact with paint and paint-related material during normal, routine activities associated with operating the can compactor (e.g., removing and staging cans, placing the cans on a conveyor, unit maintenance, etc.), contact during non-routine activities (i.e., spills) must also be considered. In the event of a spill of paint/paint related material within the building, the spill will be cleaned up by personnel wearing the appropriate PPE to minimize the potential for contact with contaminants.

Ingestion

All workers involved with hazardous waste management activities have been trained in hazardous waste operations, the appropriate use of PPE, the proper means of PPE, equipment and personal decontamination. Because of this, the chance for exposure either through direct ingestion of paint or paint-related materials is extremely unlikely to non-existant.

Since the can compactor will be located within an enclosed building, the possibility of a worker ingesting an environmental media (e.g., soil, groundwater, surface water) contaminated with paint or paint-related material is non-existant. In addition to wearing the appropriate PPE and personal decontamination, eating, chewing gum or tobacco, and smoking cigarettes is restricted to designated areas on-site thereby significantly reducing any possibility for a worker to indirectly ingest contaminants.

Inhalation

A full face respirator equipped with cartridges specifically selected for the types of materials being managed or a SCBA will protect compactor workers from potential inhalation exposure. In addition to PPE, CHSI will also use institutional controls to limit the accumulation of paint and paint-related material vapors in the immediate area surrounding the paint compactor.

The building in which the can compactor is located (Building 42) will be continuously ventilated. Any fugitive emissions from operation of the compactor will be vented via a closed vent system to two (2) carbon adsorption units connected in series. Each unit will contain 700 to 1,000 pounds of carbon. According to the carbon manufacturer, these units will remove nearly 100% of the volatile organics from the vented air prior to discharge to the atmosphere through a stack located outside Building 42 until breakthrough occurs (see discussion on carbon units in (2)(B), below).

The combination of wearing the appropriate respirator, using the appropriate respirator cartridges and ventilating the room in which the can compactor will be operated will prevent and/or significantly minimize worker exposure to paint and paint-related materials vapors.

(B) On-site worker outside Building 42

Adsorption/Ingestion

Because can compactor activities will take place within Building 42, the only means for personnel working outside Building 42 to come into contact with paint or paint-related material would be in the event of a spill or release that exited the building. The Building will provide approximately 2,790 gallons of secondary containment. As a result of the potential for a spill of paint or paint-related material to escape the building is minimal.

In the unlikely event of a spill of paint/paint-related material that migrates from the building, the spilled material will be captured and contained by outdoor, bermed concrete areas abutting Building 42 on the east and west. Spill clean up personnel would wear PPE appropriate to the material spilled to minimize the potential for contact with spilled material and clean up debris.

Inhalation

Personnel working outside Building 42 could potentially come into contact with paint or paint-related materials by inhalation. As previously discussed, the area in which can compacting activities will occur is ventilated and vapors from the operation vented via a closed vent to two (2) carbon units in series.

Removal of volatile organic constituents in air using carbon is a recognized air pollution control technology that is utilized in many industrial and commercial applications. CHSI currently operates several carbon units to control emissions from a number of on-site operations. These units have been permitted by the Illinois Environmental Protection Agency.

According to the carbon vendor, the carbon will continue to remove 100% of the organic vapors from the ventilated air until breakthrough occurs. Once breakthrough of the carbon occurs, the removal efficiency of the carbon for certain volatile constituents will decrease.

Carbon breakthrough will be determined by monitoring the volatile organic concentrations in air at the inlet and outlet points of the first carbon unit in the series using an HNu monitoring device. Breakthrough will be determined when the first carbon unit approaches an 85% volatile organic removal efficiency.

In the event breakthrough of the first carbon canister in the series, the canister will be removed and either: (1) replaced with a 700 to 1,000-pound canister of fresh carbon; or (2) the second canister in the series will be connected to the can compactor so that it becomes the first unit in the series and a fresh carbon unit will be placed as the second unit in the series. The carbon canisters will be replaced within 24 hours of detecting breakthrough. During this 24-hour period the first and second canisters will continue to remove approximately 95% of the volatile organics in the air stream.

CHSI believes that operating the air pollution control units will prevent any exposure to workers outside Building 42 to volatile organics from the paint and paint-related material emitted from can compacting activities.

(C) Potential Exposure Pathways to Off-site Personnel

Adsorption/Ingestion

Because the CHSI facility is a secure facility (e.g., fences and gates estricting access), the potential for direct or indirect exposure of off-site personnel to paint and paint-related materials through adsorption is extremely unlikely to non-existent.

The potential for ingestion of paint/paint-related material by off-site personnel is also extremely unlikely. The unit will be located within the secure facility within an area equipped with impervious secondary containment. The area surrounding the unit will be inspected daily for spills and releases. All spills will be cleaned up immediately upon detection. As a result, the potential for spills of paint and paint-related material to exit the building is very unlikely. In the unlikely event paint/paint-related material escaped secondary containment, CHSI personnel would immediately cleanup any spilled material thereby minimizing the impact, if any, to the environment. Impervious secondary containment and immediate cleanup of spills would make the significantly limit the potential for groundwater contamination caused by operating the unit. Since the nearest drinking water well is located approximately three (3) miles from the facility, the potential for someone to drink water contaminated by a release from the unit is extremely unlikely to non-existant.

Inhalation

As discussed in Section (B), above, emissions from can compactor operations will be vented through carbon prior discharge to the atmosphere. The units are designed and will be operated to remove up

to 100% of the volatile organics from the air in Building 42 prior to its discharge to the atmosphere. The carbon units will be monitored and replaced when breakthrough occurs.

As part of CHSI's RCRA Part B permit application, Carlson Environmental, Inc. performed an analysis titled "Evaluation of Potential Hazardous Material Emergencies through Atmospheric Transport from the Current and Proposed Clean Harbors Facility, Chicago, Illinois" (see **Appendix 7-A**). According to that analysis, the land use in the immediate vicinity of the CHSI facility is heavy industrial. Land surrounding use the facility and some potential receptors are listed below:

* 0.5 miles from the CHSI facility
  North - Undeveloped recreational areas
  South - EmEs Company, Lake Calumet Slip #2
  East - Land and Lake Landfill
  West - Lake Calumet

* 1.0 miles from the CHSI facility
  North - North turning basin of Lake Calumet, undeveloped recreational areas
  South - Lake Calumet, bulk terminal plant
  East - Land and Lake Landfill, Norfolk & Western Railway
  West - Calumet Expressway

* 1.5 miles from the CHSI facility
  North - Undeveloped recreational areas
  South - 130th Street, rail yard
  East - Rail yard
  West - Arcade Park residential area, rail yard

* 2.0 miles from the CHSI facility
  North - Stony Island Expressway, 103rd Street
  South - Beaubien Woods Forest Preserve, Carver Area High School
  East - Calumet River, Buffalo Street
  West - Palmer Park residential areas, St. Martin de Porres High School

The predominant wind direction is to the south. The nearest sensitive receptors (e.g., schools, hospitals) to the CHSI facility are located approximately two (2) miles away. Due to the nature of the materials managed and the air pollution control system that will be in place, the potential adverse impact to a person off-site from compacting activities within Building 42 is non-existant. The potential off-site inhalation impact to humans associated with a "worst case" spill (i.e., spill which exits Building 42 and is captured by east or west containment) is extremely unlikely to non-existant.

(3) POTENTIAL ENVIRONMENTAL RECEPTORS

There are four (4) potential contaminant migration pathways: soils, groundwater, surface water, and air. Environmental receptors would include aquatic life in Lake Calumet and birds.

Because can compacting activities will occur within an area equipped with impervious secondary containment and because this area will be inspected on a weekly basis for spills/released, the potential for spills/releases of paint/paint-related material to enter the soil and groundwater is extremely minimal. As a result, any impact to aquatic life in Lake Calumet from groundwater impacts from can compacting activities would also be extremely unlikely to non-existent.

The potential for direct contamination of Lake Calumet from spills or releases of paint/paint-related material is non-existant due to the containment provided by the Building and the proximity of Building 42 in relation to the Lake.

Emissions from compacting activities would be treated prior to discharge through a stack. As previously discussed, due to the removal efficiency of the carbon units, impacts to on-site birds (including sea gulls) are also considered extremely unlikely to non-existent. CHSI believes that operation of the can compactor poses no greater risk than other activities currently permitted and taking place on-site.

Appendix 7-B contains a document titled "Environemntal Assessment Report" prepared by Carlson Environmental, Inc. as part of CHSI's RCRA Part B permit application. This report contains an assessment of potential off-site environmental impacts associated with operation of the CHSI facility.

(4) POTENTIAL MAGNITUDE AND NATURE OF EXPOSURES

Workers in Building 42 stationed at the can compactor have the greatest potential for exposure to the paint and paint-related materials to be managed in the unit. The proper use of PPE and in place engineering controls (e.g., splash protection, ventilation and treatment of fugitive emissions associated with the unit) will significantly minimize any risk for potential exposure to the chemicals being managed.

In the event a worker is exposed to paint or paint-related materials, either through dermal contact, inhalation, or ingestion, CHSI will follow the procedures currently in place for responding to worker exposure to chemicals. These procedures include, but are not limited to: (1) flushing the affected areas as may be appropriate using on-site showers/eyes washes; (2) providing any other first aid that might be appropriate; and (3) sending the worker to a local hospital for examination and/or treatment.

Impacts associated with other on-site and off-site personnel and impacts to the environment are considered extremely minimal and would have no more impact than other waste management activities currently taking place at the facility.

HOYER-SCHLESINGER-TURNER inc.
ENGINEERS - CONSTRUCTORS
300 west adams street chicago illinois 60606 telephone 263-0556 area code 312

July 30, 1998

Illinois Environmental Protection Agency
Bureau of Land #33
Permit Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

RE: 0316000051 -- Cook County
Clean Harbors Services, Inc.
ILD000608471
RCRA Permit Log No. 16-M-26
RCRA Permit File

Dear Sir:

I hereby certify that I, the undersigned am a Professional Engineer, licensed to practice in the State of Illinois.

I certify under penalty of law that the following proposed area:

- Unit 42- operation to compact cans with paint and paint related materials was designed in accordance with good engineering practices.

The structural integrity of the secondary containment system and the design of the modifications to Building #42 are suitable for the intended use. Foundations, floors and containment slabs are designed for intended loads and will maintain structural integrity without failure.

The Protecto-Crete 900 vinyl ester coating, as manufactured by Dudick, Inc. or equivalent, for the west end concrete pad and the floor in Building #42 is suitable for its intended use.

Respectively submitted,
Hoyer-Schlesinger-Turner, Inc.

Amos Turner
Licensed Professional Engineer
Illinois License No. 19471 ; expiration date 11/30/1999

AMOS TURNER
19471
LICENSED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

CLEAN HARBORS ENVIRONMENTAL SERVICES, INC
CHICAGO FACILITY

Can Crusher Operation - Estimated Emissions
Table - 1

Jul-98

CAS Number	Constituent	Mol. Wt.	Vapor Pressure Psia 68 F	Chemical Conc. mole fraction	Estimated Process Emissions lbs/hr	Conc. Of Chemical before Carbon lb/lb. Of Air	Conc. Of Chemical After Carbon lb/lb of Air	Conc. Of Chemical After Carbon ppm
1	2	3	4	5	6	7	8	9
67-64-1	ACETONE	58.08	3.4810	0.5000	0.4790204	0.00015207	7.6035E-06	7.603
107-02-8	ACROLEIN	56.1	5.5370	0.0025	0.0038097	1.20944E-06	6.0472E-08	0.060
71-43-2	BENZENE	78.11	1.4430	0.1000	0.0397142	1.26077E-05	6.30385E-07	0.630
56-23-5	CARBON TETRACHLORIDE	153.84	1.7600	0.5000	0.2421936	7.68869E-05	3.84434E-06	3.844
57-74-9	CHLORDANE	409.76	0.0000	0.5000	2.656E-08	8.43134E-12	4.21567E-13	0.000
108-90-7	CHLOROBENZENE	112.6	0.2280	0.5000	0.0313751	9.96034E-06	4.98017E-07	0.498
67-66-3	CHLOROFORM	119.39	3.0630	0.5000	0.4214994	0.000133809	6.69047E-06	6.690
1319-77-3	CRESOL	108.13	0.0080	0.5000	0.0011009	3.49486E-07	1.74743E-08	0.017
	1,4-DICHLOROBENZENE	147	0.0077	0.5000	0.0010596	3.3638E-07	1.6819E-08	0.017
107-06-2	1,2 DICHLOROETHANE	98.97	1.6830	0.5000	0.2315976	7.35231E-05	3.67615E-06	3.676
540-59-0	1,1 DICHLOROETHYLENE	96.95	2.6680	0.0500	0.0367143	1.16553E-05	5.82767E-07	0.583
77-78-1	DIMETHYL SULFIDE	126	0.0100	0.5000	0.0013761	4.36857E-07	2.18429E-08	0.022
121-14-2	2,4 DINITROTOLUENE	182.13	0.0193	0.5000	0.0026559	8.43134E-07	4.21567E-08	0.042
606-20-2	2,6 DINITROTOLUENE	182.13	0.0003	0.5000	4.128E-05	1.31057E-08	6.55286E-10	0.001
100-41-4	ETHYL BENZENE	106.16	0.1930	0.5000	0.0265587	8.43134E-06	4.21567E-07	0.422
151-58-4	ETHYLENEAMINE	60.12	0.1934	0.5000	0.0266138	8.44882E-06	4.22441E-07	0.422
76-44-8	HEPTACHLOR	375.3	0.0000	0.5000	1.376E-06	4.36857E-10	2.18429E-11	0.000
118-74-1	HEXACHLOROBENZENE	284.8	0.0000	0.5000	2.89E-08	9.174E-12	4.587E-13	0.000
87-68-3	HEXACHLOROBUTADIENE	260.74	0.0029	0.5000	0.0003991	1.26689E-07	6.33443E-09	0.006
67-72-1	HEXACHLOROETHANE	236.72	0.0190	0.5000	0.0026146	8.30029E-07	4.15014E-08	0.042
78-93-3	METHYL ETHYL KETONE	72.12	1.3930	0.5000	0.1916907	6.08542E-05	3.04271E-06	3.043
60-34-4	METHYL HYDRAZINE	46.1	0.6950	0.0500	0.0095639	3.03616E-06	1.51808E-07	0.152
75-09-2	METHYLENE CHLORIDE	84.93	6.5760	0.5000	0.9049234	0.000287277	1.43639E-05	14.364
91-20-3	NAPHTALENE	128.16	0.0015	0.5000	0.0002126	6.74931E-08	3.37466E-09	0.003
98-95-3	NITROBENZENE	123.1	0.0029	0.5000	0.0003991	1.26689E-07	6.33443E-09	0.006

CLEAN HARBORS ENVIRONMENTAL SERVICES, INC
CHICAGO FACILITY

Can Crusher Operation - Estimated Emissions
Table - 1

Jul-98

CAS Number	Constituent	Mol. Wt.	Vapor Pressure Psia 68 F	Chemical Conc. mole fraction	Estimated Process Emissions lbs/hr	Conc. Of Chemical before Carbon lb/lb. Of Air	Conc. Of Chemical After Carbon lb/lb of Air	Conc. Of Chemical After Carbon ppm
1	2	3	4	5	6	7	8	9
87-86-5	PENTACHLOROPHENOL	266.35	0.0000	0.5000	4.516E-07	1.43377E-10	7.16883E-12	0.000
108-95-2	PHENOL	94.11	0.0120	0.5000	0.0016513	5.24229E-07	2.62114E-08	0.026
110-86-1	PYRIDINE	79.1	0.2703	0.5000	0.0372005	1.18097E-05	5.90485E-07	0.590
127-18-4	TETRACHLOROETHYLENE	165.83	0.2071	0.5000	0.0284953	9.04613E-06	4.52307E-07	0.452
108-88-3	TOLUENE	92.13	0.3870	0.5000	0.0532551	1.69064E-05	8.45319E-07	0.845
79-01-6	TRICHLOROETHYLENE	131.4	1.1190	0.5000	0.1539856	4.88843E-05	2.44422E-06	2.444
71-55-6	1,1,1 TRICHLOROETHANE	133.42	1.5860	0.5000	0.2182495	6.92855E-05	3.46428E-06	3.464
76-13-1	1,1,2 TRICHLORO -	187.38	4.3761	0.5000	0.6021888	0.000191171	9.55855E-06	9.559
	1,2,2 TRIFLUOROETHANE							
75-01-4	VINYL CHLORIDE	62.5	14.6900	0.0100	0.0404298	1.28349E-05	6.41743E-07	0.642
1330-20-7	XYLENES	106.17	0.1741	0.5000	0.0239579	7.60568E-06	3.80284E-07	0.380
108-10-1	MIBK	100.18	0.3095	0.5000	0.0425903	1.35207E-05	6.76036E-07	0.676
67-56-1	METHNOL	32.04	1.7795	0.5000	0.244877	7.77387E-05	3.88694E-06	3.887
	1-BUTANOL		0.2901	0.5000	0.0399207	1.26732E-05	6.33661E-07	0.634
	2-PROPANOL		0.6383	0.5000	0.0878365	2.78846E-05	1.39423E-06	1.394
	TURPENTINE	136	0.9700	0.5000	0.1334817	4.23751E-05	2.11876E-06	2.119
	MINERAL SPIRITS		0.0967	0.5000	0.0133069	4.22441E-06	2.1122E-07	0.211

PROCESS EMISSION CALCULATIONS

API formula 28-145 from "Hydrocarbon Emissions From Fixed Roof Tanks"

Filling losses are estimated by the following equation.

$F = 3 * N(t) * K(t) * P(v) * V * r / 10{,}000$

Where,

F = Process emissions lbs/hr
N(t) = Drums/hr
K(t) = Empirical Drum turnover factor
P(v) = Average solvent vapor pressure in Psia
= P'(v) x (Xc)
P'(v) = Vapor presure of pure compound
Xc = Concentration of chemical, mole fraction
V = Volume of solvent emptied in to drum, gallons
r = Average solvent liquid density lbs/gallon

For Can Crusher Process:

N(t) = 2 drums/hr. with the assumed maximum throughput of 10,000 drums/yr
2drums/hr x 20 hrs/day x 250 days/yr.
K(t) = 1, Assumed drum head space is saturated with vapors, worst case.
V = 55 gallons/drum
r = Average liquid density, ASSUME 8.34 lbs/gallon

Therefore,

F = (3) (2) (1) (55) (8.34) P'(v) (Xc)/10,000
= 0.27522 P'(v)(Xc) *USED FOR COLUMN 6 CALCULATIONS*

Clean Harbors-Trooper 610 539 3094 P.04

Clean Harbors-Trooper 610 539 3094 P.05

VAPOR CONCENTRATION IN EXHAUST AIR

Induced exhaust flow = 700 SCFM
= 52.5 lbm/min, where density of air = 0.075 lb/cubic ft.
Wa = 3150 lbs/hr

The concentration of Chemical in the exhaust air to carbon bed
X1 = Process Emission Rate/Exhaust Air flow rate
= F/Wa
= F/3150 lbs/hr *USED FOR COLUMN 7 CALCULATIONS*

Assuming worst case removal efficiency of carbon to be 95%. This would occur when carbon bed is reaching saturation.

The concentration of Chemical after the carbon bed, worst case

X2 = 0.05 * (X1) *USED FOR COLUMN 8 CALCULATIONS*

CLEAN HARBORS ENVIRONMENTAL SERVICES, INC
CHICAGO FACILITY

Can Crusher Operation - Estimated Life of Carbon Beds
Table - 2

Dec. 98

CAS Numbe	Constituent	Conc. Of Chemical before Carbon lb/lb. Of Air	Conc. Of Chemical Before Carbon lb/cu. ft. of Air	Total Loading to Carbon per day	Adsorption Cap. by wt. at 100 F in %	Carbon per Vessel lbs	Capacity of Carbon Vessel lb chem	Estimated Time Before Breakthrough in days
1	2	3	4	5	6	7	8	9
67-64-1	ACETONE	0.00015207	1.14276E-05	9.599182	38.70	1800	696.60	72.57
107-02-8	ACROLEIN	1.20944E-06	9.08857E-08	0.076344	20.00	1800	360.00	4715.50
71-43-2	BENZENE	1.26077E-05	9.4743E-07	0.795841	35.30	1800	635.40	798.40
56-23-5	CARBON TETRACHLORIDE	7.68869E-05	5.77781E-06	4.853364	56.10	1800	1009.80	208.06
57-74-9	CHLORDANE	8.43134E-12	6.3359E-13	5.32E-07	20.00	1800	360.00	676417732.26
108-90-7	CHLOROBENZENE	9.96034E-06	7.4849E-07	0.628731	55.30	1800	995.40	1583.19
67-66-3	CHLOROFORM	0.000133809	1.00554E-05	8.446508	53.00	1800	954.00	112.95
1319-77-3	CRESOL	3.49486E-07	2.62628E-08	0.022061	48.70	1800	876.60	39735.74
	1,4-DICHLOROBENZENE	3.3638E-07	2.52779E-08	0.021233	45.90	1800	826.20	38910.27
107-06-2	1,2 DICHLOROETHANE	7.35231E-05	5.52504E-06	4.641029	45.90	1800	826.20	178.02
540-59-0	1,1 DICHLOROETHYLENE	1.16553E-05	8.75864E-07	0.735726	36.70	1800	660.60	897.89
77-78-1	DIMETHYL SULFIDE	4.36857E-07	3.28285E-08	0.027576	20.00	1800	360.00	13054.86
121-14-2	2,4 DINITROTOLUENE	8.43134E-07	6.3359E-08	0.053222	20.00	1800	360.00	6764.18
606-20-2	2,6 DINITROTOLUENE	1.31057E-08	9.84855E-10	0.000827	20.00	1800	360.00	435162.07
100-41-4	ETHYL BENZENE	8.43134E-06	6.3359E-07	0.532215	43.70	1800	786.60	1477.97
151-58-4	ETHYLENEAMINE	8.44882E-06	6.34903E-07	0.533319	20.00	1800	360.00	675.02
76-44-8	HEPTACHLOR	4.36857E-10	3.28285E-11	2.76E-05	20.00	1800	360.00	13054862.23
118-74-1	HEXACHLOROBENZENE	9.174E-12	6.89398E-13	5.79E-07	20.00	1800	360.00	621660106.32
87-68-3	HEXACHLOROBUTADIENE	1.26689E-07	9.52026E-09	0.007997	20.00	1800	360.00	45016.77
67-72-1	HEXACHLOROETHANE	8.30029E-07	6.23741E-08	0.052394	47.20	1800	849.60	16215.51
78-93-3	METHYL ETHYL KETONE	6.08542E-05	4.57301E-06	3.841327	20.00	1800	360.00	93.72
60-34-4	METHYL HYDRAZINE	3.03616E-06	2.28158E-07	0.191653	20.00	1800	360.00	1878.40
75-09-2	METHYLENE CHLORIDE	0.000287277	2.1588E-05	18.13393	39.80	1800	716.40	39.51
91-20-3	NAPHTALENE	6.74931E-08	5.0719E-09	0.00426	20.00	1800	360.00	84499.13
98-95-3	NITROBENZENE	1.26689E-07	9.52026E-09	0.007997	48.60	1800	874.80	109390.74

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CLEAN HARBORS ENVIRONMENTAL SERVICES, INC
CHICAGO FACILITY

Can Crusher Operation - Estimated Life of Carbon Beds
Table - 2

Dec. 98

CAS Numbe	Constituent	Conc. Of Chemical before Carbon lb/lb. Of Air	Conc. Of Chemical Before Carbon lb/cu. ft. of Air	Total Loading to Carbon per day	Adsorption Cap. by wt. at 100 F in %	Carbon per Vessel lbs	Capacity of Carbon Vessel lb chem	Estimated Time Before Breakthrough in hrs
1	2	3	4	5	6	7	8	9
87-86-5	PENTACHLOROPHENOL	1.43377E-10	1.07743E-11	9.05E-06	20.00	1800	360.00	39777154.88
108-95-2	PHENOL	5.24229E-07	3.93942E-08	0.033091	48.10	1800	865.80	26164.12
110-86-1	PYRIDINE	1.18097E-05	8.87462E-07	0.745468	20.00	1800	360.00	482.92
127-18-4	TETRACHLOROETHYLENE	9.04613E-06	6.79789E-07	0.571023	62.90	1800	1132.20	1982.76
108-88-3	TOLUENE	1.69064E-05	1.27046E-06	1.067189	43.30	1800	779.40	730.33
79-01-6	TRICHLOROETHYLENE	4.88843E-05	3.67351E-06	3.085747	54.80	1800	986.40	319.66
71-55-6	1,1,1 TRICHLOROETHANE	6.92855E-05	5.2066E-06	4.373543	49.90	1800	898.20	205.37
76-13-1	1,1,2 TRICHLORO -	0.000191171	1.43659E-05	12.06738	56.80	1800	1022.40	84.72
	1,2,2 TRIFLUOROETHANE							
75-01-4	VINYL CHLORIDE	1.28349E-05	9.64501E-07	0.810181	20.00	1800	360.00	444.35
1330-20-7	XYLENES	7.60568E-06	5.71544E-07	0.480097	43.70	1800	786.60	1638.42
108-10-1	MIBK	1.35207E-05	1.01604E-06	0.853475	20.00	1800	360.00	421.80
67-56-1	METHNOL	7.77387E-05	5.84183E-06	4.907137	38.90	1800	700.20	142.69
	1-BUTANOL	1.26732E-05	9.52355E-07	0.799978	20.00	1800	360.00	450.01
	2-PROPANOL	2.78846E-05	2.09544E-06	1.760172	20.00	1800	360.00	204.53
	TURPENTINE	4.23751E-05	3.18436E-06	2.674865	36.40	1800	655.20	244.95
	MINERAL SPIRITS	4.22441E-06	3.17452E-07	0.266659	20.00	1800	360.00	1350.04

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NOTES FOR THE TABLE - 2 - VERIFICATION OF CONTROL SYSTEM DESIGN

1 Two Vapor phase carbon beds connected in series, each with 1800 lbs. of regenerated carbon, VPR 4x10, as manufacturd by Calgon Carbon, or equivalent, will be used as a control system.

2 The induced air flow through the control system will be 700 SCFM.

3 The values in column 3 are same as calculated values in column 7 of the Table - 1, Emissions Estimates.

4 Values of Column 4 are obtained by simple conversion of values from column 3, using the following formula:

Val. Col. 4 = Val. Col. 3/(53.35*(460=68)/(14.7*144))

5 Value of column 5 = value of column 4 * 700 CFM * 60 min/hr * 20 hrs/day

6 Values in column 6 are obtained from Calgon Carbon. Wherever the data was not available, the adsorption capacity of carbon has been assumed to 20%.

7 Column 7 represents the amount of carbon available from the first bed.

8 Column 9 shows the estimated breakthrough time in days at the emission rate and adsorption capacity for the given compound, when emitted by itself for the system operation of 20 hrs/day.

In actual situation, multiple compounds may be present. However, the concentration of compounds would be much lower than what has been estimated here and used in the calculations.

The minimum life expectancy of a carbon bed is 39 days, as computed for Methylene Chloride.

Clean Harbors-Trooper 610 539 3094 P.08

HOYER-SCHLESINGER-TURNER inc.
ENGINEERS - CONSTRUCTORS
300 west adams street chicago illinois 60606 telephone 263-0556 area code 312

January 11, 1999

Illinois Environmental Protection Agency
Bureau of Land #33
Permit Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

RE: 0316000051 -- Cook County
Clean Harbors Services, Inc.
ILD000608471
RCRA Permit Log No. 16-M-26

Dear Sir:

I hereby certify that I, the undersigned am a Professional Engineer, licensed to practice in the State of Illinois.

I certify under penalty of law that the closed vent system for the can and glass crusher is designed to operate with no detectable emissions, as indicated by an instrument reading of less than 500 ppmv above background as determined in the procedure in 40 CFR 264.1034(b) and by visual inspections.

I certify that the carbon adsorption bed system control device is designed to operate at an efficiency of 95% or greater reduction of total organic concentration from the closed vent system associated with the can and glass crusher as demonstrated by the attached design analysis. I also certify that the operating parameters used in this design analysis reasonably represent the conditions that exist when the can and glass crusher would be operating at the highest load or capacity level reasonably expected to occur.

AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

Respectively submitted,
Hoyer-Schlesinger-Turner, Inc.

Amos Turner

Amos Turner
Licensed Professional Engineer
Illinois License No. 19471; expiration date 11/30/1999

CHSI has recalculated the air emissions from the compactor in Building 42 for five constituents. The emissions utilize a percent concentration mole fraction of less than the 50% mole fraction used for calculation of all other constituents.

	Percent Concentration Mole Fraction	Concentration After Carbon (ppm)	OSHA PEL (ppm)
Acrylin	0.25	0.060	0.1
Benzene	10.0	0.630	1.0
1,1-Dichloroethylene	5.0	0.583	1.0
Methyl Hydrazine	5.0	0.152	0.2
Vinyl Chloride	1.0	0.642	1.0

The percent mole fractions can be justified from MSDSs for paint.

Appendix D-42

Shredding System Engineering Calculations
(Units 22,24,68,69)

I hereby certify that I, the undersigned am a Professional Engineer, licensed to practice in the State of Illinois. I have reviewed the minimum tank thickness calculations for Tanks 414, 415, 416, 417, 418, 424 and 427 and the containment calculations for Unit 42 and the containment pan below the drum feed roller conveyor and drum lift. I find that the calculations incorporate good engineering practices.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Engineer Seal

Amos Turner 11.7.2000

Amos Turner Date

Hoyer-Schlesinger-Turner, Inc.
3074 University Avenue
Highland Park, IL 60035
(847) 681-0470

AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF
ILLINOIS

EXP. DATE 11-30-2001

LEE F. MOUNT, P.E.
CIVIL ENGINEER
2 BAY VIEW AVENUE HINGHAM, MASSACHUSETTS 02043
(781) 749-5394

20 September 2000

Mr. Agustin Ayon
Clean Harbors Services, Inc.
11800 S. Stony Island Ave.
Chicago, Illinois 60617

Subject: Metal Wash Tank - 424
Structural Arrangement

Enclosures: 1) Marked up print your dwg. no. 4630-M-14
2) Supporting Calculations (12 shts.)

Dear Mr. Ayon,

Enclosures 1) & 2) are forwarded herewith for your review and comment. You will note the empty vessel weight as shown is more than twice your original estimate. The high specific gravity of 2.0 plus the 2.5 psi design pressure require significant stiffening. The plate thicknesses shown include 1/8" corrosion allowance.

I have tried to maintain basic dimensions and avoid interference with shell attachments although some rearrangement may be required. The three bolted top plate sections shown are of a different size than your proposed four.

I have followed a somewhat conservative approach in this design due to the intended use of this tank which requires support of rotating machinery (augers) and a product containing metal pieces. Additional local plate support may be required in way of shell nozzel attachments.

As mentioned on the phone, I will be away until 2 Oct. and will await your comments on this tank design before proceeding with a similar analysis of Tank 427.

Yours truly,

Lee F. Mount

Lee F. Mount

LEE F. MOUNT, P.E.
Civil Engineer/Naval Architect
2 Bay View Avenue
HINGHAM, MASSACHUSETTS 02043
(~~617~~) 749-5394
781

JOB CH CHICAGO METAL WASH TANK TK-424
SHEET NO. 1 OF 12
CALCULATED BY L F MOUNT DATE 11 SEPT. '00
CHECKED BY _____ DATE _____
SCALE _____

REF. PLAN 4630-M-13

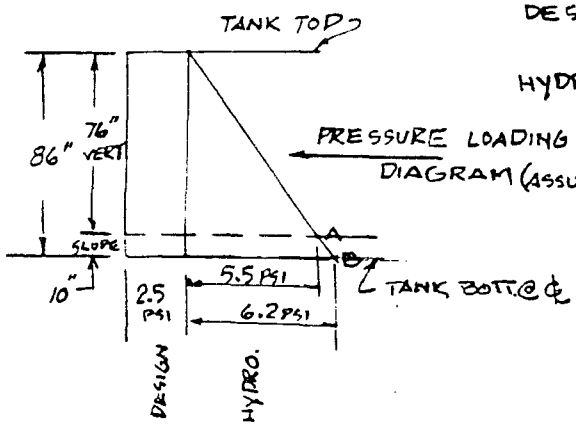
PLATE SIZE CALS.

ASSUME ALLOW. STRESS FOR A36 STEEL; = 23,200 PSI (PER API 650)

FOR SIDE SHELL

S.G. = 2.0

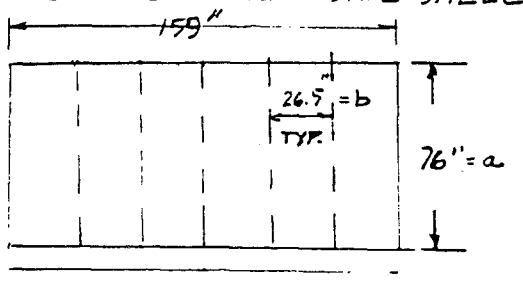
DESIGN PRESS. = 2.5 PSI



HYDRO PRESS. @ A $= \dfrac{\frac{76''}{12} \times 62.4 \times 2.0}{144} = 5.5$ PSI

@ B $= \dfrac{\frac{86''}{12} \times 62.4 \times 2.0}{144} = 6.2$ PSI

DETERMINE PLT. t FOR VERT SIDE SHELL



ELEV.

TRY 26.5" WIDE × 76" HIGH PANEL

$\therefore a/b = \dfrac{76}{26.5} = 2.87$

FIND PLT. t FIRST FOR UNIFORM PRESS THEN FOR TRIANGULAR HYDRO LOAD AND SUPERIMPOSE

FOR 2.5 PSI UNIFORM PRESS.

REFS. 1) LINCOLN ARC WELDING DESIGN OF WELDED STRUCTURES, BLODGETT SECT 6.5
2) ROARK FORMULAS FOR STRESS & STRAIN
3) AISC MANUAL 8TH ED.

CASE 36 (EDGES SUPPORTED) REF. 2)

$t^2 = \dfrac{\beta p b^2}{23{,}200} = \dfrac{0.70(2.5)(26.5)^2}{23{,}200}$

$t^2 = 0.0530$

$t = 0.23''$

FOR 5.5 PSI TRIANGULAR HYDRO

CASE 39 (EDGES SUPPORTED) REF. 2)

$t^2 = \dfrac{\beta p b^2}{23{,}200} = \dfrac{0.42(5.5)(26.5)^2}{23{,}200}$

$t = 0.26''$

$\therefore$ REQ'D. $t = 0.23'' + 0.26'' = 0.49''$

CORROSION ALLOW. (1/8")

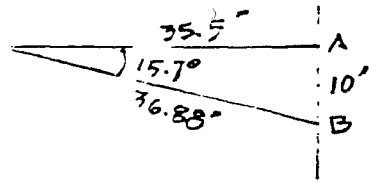
SAY $0.50'' + 0.125'' = 0.625$

USE 5/8" PLT.

LEE F. MOUNT, P.E.
Civil Engineer/Naval Architect
2 Bay View Avenue
HINGHAM, MASSACHUSETTS 02043
(617) 749-5394

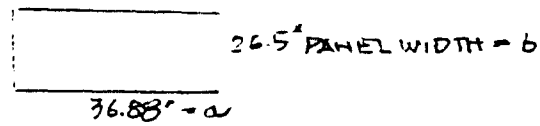
PLATE SIZE CALS (CON'D)

FOR SLOPED BOTTOM PLATES



CONSIDER AS HORIZ. FLAT PL WITH
UNIFORM LOAD = 2.5 PSI (DESIGN PRESS.)
+ 6.2 ← (HYDRO HEAD TO LOWEST POINT @ ℄)
8.7 PSI

SEE LOADING DIA. SHT. 1



CASE 36 (EDGES SUPPORTED, REF 2.)
UNIFORM LOAD

$a/b = \frac{36.88}{26.5} = 1.4$

$t^2 = \frac{\beta P b^2}{23,200} = \frac{0.4530(8.7)(26.5)^2}{23,200}$

$t^2 = 0.1193$

$t = 0.345''$

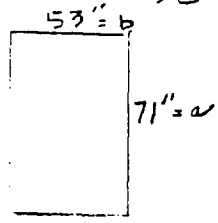
TO KEEP SAME AS SIDE SHELL

SAY 0.50" + 0.125 = USE 5/8" PT.

CORROSION ALLOW.

FOR TOP PLATE

3 SECTIONS @ 53" = b



$a/b = \frac{71}{53} = 1.3$

P = 2.5 PSI DESIGN PRESS.

CASE 36

$t^2 = \frac{\beta P b^2}{23,200} = \frac{0.4146(2.5)(53)^2}{23,200}$

$t = 0.354$ SAY 0.375 + 0.125 = USE 1/2" PT.

CORR ALLOW

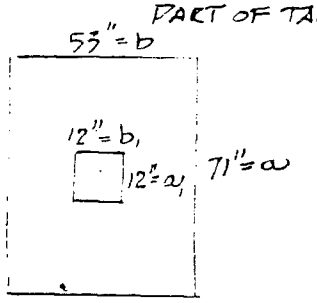
LEE F. MOUNT, P.E.
Civil Engineer/Naval Architect
2 Bay View Avenue
HINGHAM, MASSACHUSETTS 02043
(617) 749-5394

JOB TK-424
SHEET NO. 3 OF 12
CALCULATED BY L F. MOUNT DATE 12 SEPT. '00
CHECKED BY DATE
SCALE

PLATE SIZE CALC (CON'D)

TOP PLATE (CON'D) CHECK THICKNESS CHOSEN FOR TOPLOAD TEST PER UL-142 SECT. 41.1

1000# LOAD OVER 1 FT² AREA AT WEAKEST PART OF TANK TOP

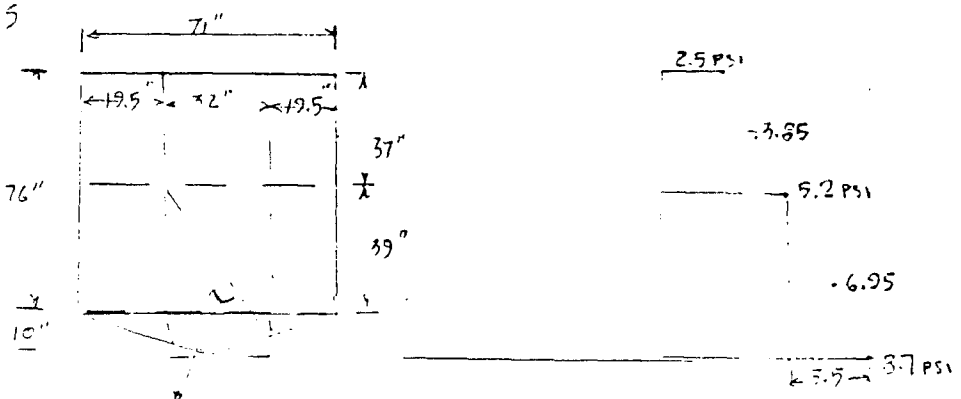


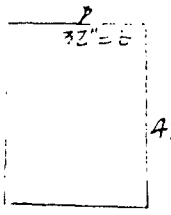
CASE 38 REF. 2

$$t^2 = \frac{\beta W}{23{,}200} = \frac{1.43(1000)}{23{,}200}$$

$t = 0.248''$ vs $0.375''$ AVAIL. O.K.

FOR END PLATES





SAY WIDEST PANEL

$a/b = 1.53$

FOR 5.2 PSI UNIFORM PRESS

CASE 36, REF. 2

$$t^2 = \frac{\beta p b^2}{23{,}200} = \frac{.4947(5.2)(32)^2}{23{,}200}$$

$t = 0.31''$

FOR 3.5 TRIANGULAR HYDRO LOAD CASE 39, REF. 2

$$t^2 = \frac{\beta p b^2}{23{,}200} = \frac{.2648(3.5)(32)^2}{23{,}200}$$

$t = .20''$

∴ TOTAL REQ'D $t = .31 + .20 = 0.51$

CLOSE ENOUGH DUE TO CONSERVATIVE LOADING → SAY $0.5'' + 0.125 = 0.625$ USE $5/8''$ PLT

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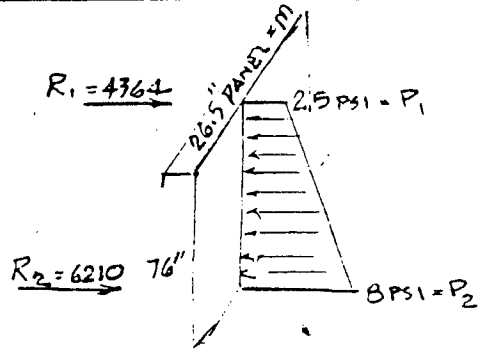
STIFFENER SIZE CALS.

FOR VERTICAL SIDE SHELL STIFF. CASE $3D_c$ REF: 1)



$$M_{OM} = \frac{h^2 m (P_1 + P_2)}{16}$$

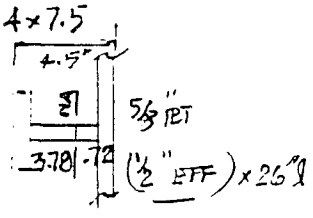
$$= \frac{76^2 (26.5)(10.5)}{16}$$

$$= 100{,}448 \text{ IN-LBS}$$

$\therefore$ REQ'D SECT. MOD. $= \frac{100448}{23{,}200} = 4.3 \text{ IN}^3$

TRY WT 4×7.5

$A = 2.22 \text{ IN}^2$



PIECE	AREA	d	Ad	Ad^2	I_o
T	2.22	3.5	7.77	27.20	3.28
PET 1/2×26	13.00	0.25	3.25	0.81	.27
	15.22	0.72·d	11.02	31.56	

$- Ad^2 - 7.89$

23.67 IN^4

$SM_{LESSER} = \frac{23.67}{3.78} = 6.26 > 4.3$ O.K.

FIND REACTIONS @ R_1 & R_2

DUE TO 2.5 PSI UNIFORM LOAD $R_1 = R_2 = \frac{2.5 \times 76 \times 26.5}{2} = 2517.5^{\#}$

DUE TO TRIANGULAR LOAD $R_1 = \frac{5.5(76)26.5}{6} = 1846.2^{\#}$

$R_2 = \frac{5.5(76)26.5}{3} = 3692.3^{\#}$

$\therefore R_1 = 2517.5 + 1846.2 = 4363.7$

$R_2 = 2517.5 + 3692.3 = 6209.8$

10573.5

CK TOTAL LOAD ON PANEL

$\left(\frac{2.5+8}{2}\right) \times 76 \times 26.5 = 10573.5^{\#}$

FOR BOTT. SLOPE STIFF. SPAN = 36.88"

TREAT AS UNIFORM LOADED BEAM (SEE SHT. 2)

$M_{OM} = \frac{wl^2}{8}$ WHERE $w = 8.7 \text{ PSI} \times 26.5 = 230.55 \text{ \#/"}$

$= \frac{230.55(36.88)^2}{8} = 39197 \text{ IN-LBS}$

REQ'D S.M. $= 39197 / 23200 = 1.69 \text{ IN}^3$

TRY 3×3×1/4 ∠ ON 1/2" PET

↳ CAL SM $= 3.0 \text{ IN}^3 > 1.69 \text{ IN}^3$ O.K.

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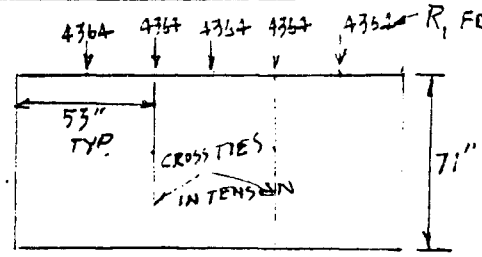
STIFFENER SIZE CALS. (CON'D)

FOR TOP EDGE BOUNDING ANGLE

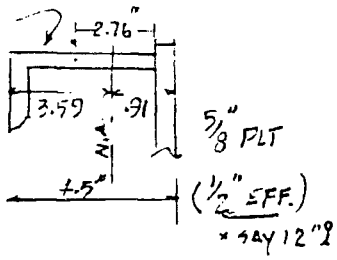


PLAN AT TOP

$M_{OM} = \frac{Pl}{4} = \frac{4364(53)}{4} = 57823$ IN-LBS

$\therefore$ SECT MOD. REQ'D $= \frac{57823}{23200} = 2.5\ IN^3$

TRY 4×3×1/4 L



PIECE	AREA	d	Ad	Ad^2	I_o
L	1.69	3.26	5.51	17.96	2.77
PLT	6.00	.25	1.50	.38	.13
	7.69	0.91	7.01	$I = 21.24\ IN^4$	
				$-Ad^2$	-6.37
				$I = 14.87\ IN^4$	

$SM_{LEFFER} = \frac{14.87}{3.59} = 4.14\ IN^3 > 2.5\ IN^3$ O.K.

FOR TOP CROSS TIES SPAN = 71"

MOM. DUE TO 2.5 PSI PRESS

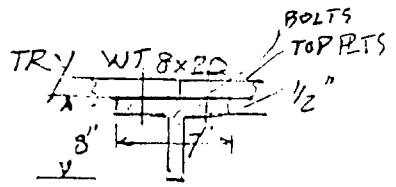
UNIFORM LOAD = 2.5 PSI × 53" = 132.5 #/" = w

$M = \frac{wl^2}{8} = \frac{132.5(71)^2}{8} = 83492$ IN-LBS

S.M. REQ'D (BENDING) $= \frac{83492}{23,200} = 3.6\ IN^3$

TENSILE LOAD $= 4364 + \frac{2 \times 4364}{2} = 8728$ #

TRY WT 8×20



T AREA = 5.89 IN²
− .75 LESS BOLT HOLES (2×.75×.5) SAY Φ
5.14 IN²

S.M. T ONLY = 5.35 IN³

$\therefore f_a = \frac{8728}{5.14} = 1698$ PSI

$f_b = \frac{83492}{5.35} = 15606$ PSI

PER REF 3 FOR COMBINED STRESSES:

$\frac{f_a}{.6F_y} + \frac{f_b}{23,200} \leq 1.0$

$\frac{1698}{21600} + \frac{15606}{23,200} = 0.75 < 1.0$ O.K.

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JOB TK-421
SHEET NO. 6 OF 12
CALCULATED BY LFMOUNT DATE 13 SEPT. 00
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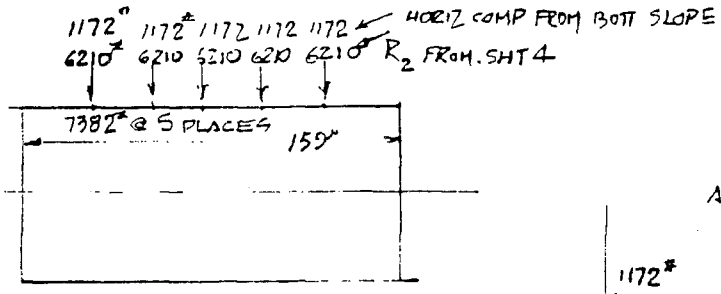
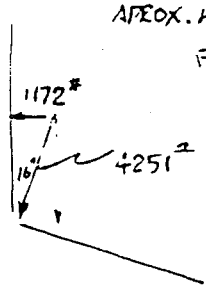
SCALE

STIFF SIZE CALS. (CON'D)
SIDE
FOR LONG'L. STIFF @ BEND



PLAN AT BOTT. BEND



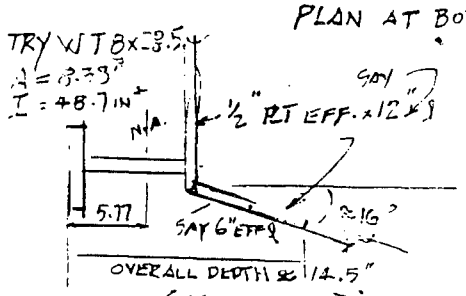
APROX. HORIZ COMPONET OF REACTION FROM LOAD ON SLOPED BOTT PLT.

SEE SHT 4

REACTION = $\frac{230.55\#/\text{in} \times 36.88''}{2}$ = 4251#

SIN 16° = $\frac{\text{HORIZ COMP.}}{4251\#}$

HORIZ COMP = 4251(.2756) = 1172#

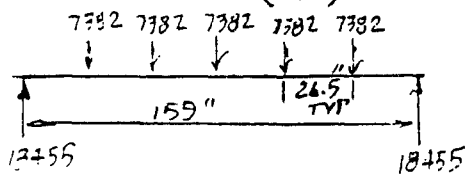


FIND S.M. PROVIDED:

PIECE	AREA	d	Ad	Ad^2	I_o
TEE	8.38	1.94	16.26	31.54	48.7
▯ .5(12)	6.00	8.25	49.5	408.38	—
◇ .5(6)	3.00	11.5	34.5	396.75	—
	17.38	5.77=d	100.26		885.37
				$-Ad^2$	−578.63
					306.74 IN⁴

GREATER C = 14.5 − 5.77 = 8.73"

∴ S.M. PROVIDED = $\frac{306.74}{8.73}$ = 35.1 IN³



M_{MAX} @ CTR

↳ 18455(79.5) − 7382(53) − 7382(26.5)

= 880,304 IN-LBS

REQ'D S.M. = $\frac{880304}{23200}$

= 38 IN³

THIS IS O.K SINCE THIS CONSIDERS FULL LENGTH TANK SPAN (159"). IN FACT SUPPORT WILL BE PROVIDED BY I SUPPORT LEG COLUMN AT MID LENGTH.

∴ USE WT 8x28.5

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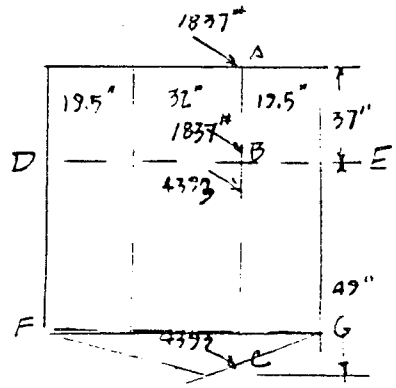
STIFF SIZE. (CON'D)

FOR ENDS



FOR MEMBER A-B PANEL WIDTH $= \frac{32+19.5}{2} = 25.8''$

AVG LOAD = 3.85 PSI (SEE SHT 3 ?)

$w = 3.85(25.8) = 99.3\ \#/''$

$M_{OM} = \frac{wl^2}{8} = \frac{99.3(37)^2}{8} = 16993$ IN-LBS

I/c REQ'D $= \frac{16993}{23{,}200} = 0.73\ IN^3$

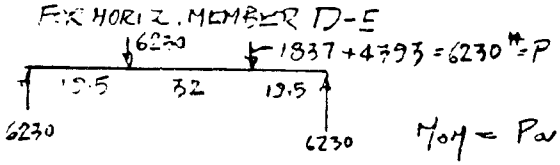
FOR MEMBER B-C (SEE SHT 3 ?)

AVG LOAD = 6.95 PSI $w = 6.95(25.8) = 179.3\ \#/''$

$M = \frac{wl^2}{8} = \frac{179.3(49)^2}{8} = 53012$ IN-LBS

I/c REQ'D $= \frac{53012}{23200} = 2.32\ IN^3$

FOR HORIZ. MEMBER D-E



$M_{OM} = Pa = 6230(19.5) = 121485$ IN-LBS

I/c REQ'D $= \frac{121485}{23{,}200} = 5.24\ IN^3$

FOR HORIZ MEMBER F-G

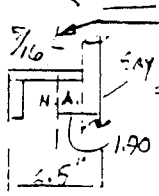
$M_{OM} = 4393(19.5) = 85664$ IN-LBS

I/c REQ'D $= \frac{85664}{23{,}200} = 3.69\ IN^3$

USE ∠ STIFFENERS SO OUTSTANDING LEGS MINIMIZE INTERFERENCES WITH NOZZLES ETC.

FOR MEMBER D-E I/c REQ'D = 5.24

TRY 6 x 3½ x 5/16 ∠ — USE FOR D-E & F-G



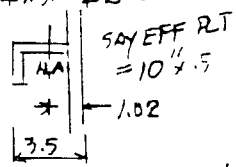
PIECE	AREA	d	Ad	Ad^2	I_o
⌐	2.37	4.5	12.92	58.1	10.9
▯	4.5	.25	1.13	0.3	.1
	7.37	1.90 = d	14.05	69.4	

$-Ad^2 - 26.6$ / $42.8 = I$

S.M. $= 42.8/4.6 = 9.30\ IN^3 > 5.24$ O.K.

FOR MEMBER B-C I/c REQ'D $= 2.32\ IN^3$

TRY 4 x 3 x ¼ ∠ — USE FOR A-B & B-C



PIECE	AREA	d	Ad	Ad^2	I_o
⌐	1.69	3.3	5.58	18.4	2.77
▯	5.00	.25	1.25	.3	.1
	6.69	1.02	6.83	21.57	

$-Ad^2 - 6.96$ / $14.61 = I$

SM $= 14.61/2.48 = 5.89 > 2.32$ O.K.

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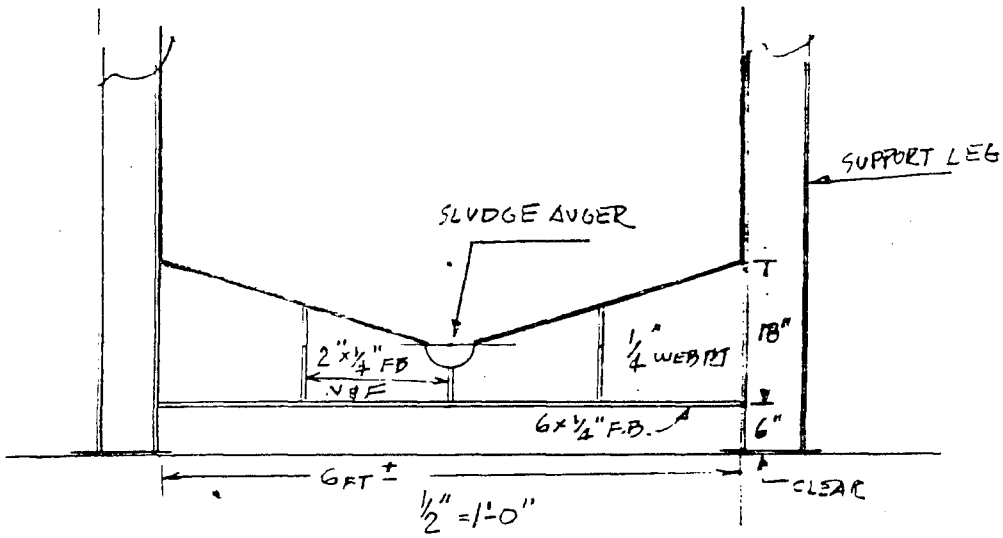
JOB TK-424

SHEET NO. 8 OF 12

CALCULATED BY LFMOUNT DATE 18 SEPT. 00

CHECKED BY _____ DATE _____

SCALE _____



BOTT. SUPPORT @ TANK MID LENGTH

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JOB TK-424
SHEET NO. 9 OF 12
CALCULATED BY L F MOUNT DATE 18 SEPT. 00
CHECKED BY DATE
SCALE

CAPACITY & STEEL WT. ESTIMATE

VOLUME @ 100% FULL:

$13.17' \times 5.92' \times 6.33' = 493.5\ FT^3$

$\frac{.33 \times 5.92}{2} \times 13.17 = 32.4$

$525.9\ FT^3 \times 62.4\ \#/FT^3 \times 2.0 = 65632$ LBS (WT. OF CONTENTS @ 100% FULL)

3934 GALS

EST. STEEL WT:

			LBS.
TOP PLT 1/2"	13.33' × 6.58' × 20.4 #/FT²	=	1856
TOP CROSS TIES WT8×20	5.92' × 20 × 2	=	237
TOP BOUNDING L 4×3×1/4	(13.17×2)+(5.92×2) = 38.2' × 5.8 #/'	=	222
VERT. SIDE PLT (5/8")	13.17' × 6.33 × 25.5 × 2 SIDES	=	4252
SLOPED BOTT PLT (5/8")	13.17' × 3.07' × 25.5 × 2 SIDES	=	2062
VERT. SIDE STIFF. WT 4×7.5	6.33' × 7.5 #/' × 8 REQ'D	=	350
SLOPED BOTT STIFF. 3×3×1/4	4' × 4.9 #/' × 8 REQ'D	=	157
BOTT SIDE LONG'L WT 3×28.5	13.17' × 28.5 × 2 SIDES	=	751
END PLT (5/8")	6.33' × 5.92' = 37.5 □'		
	$\frac{5.92' \times .33'}{2} = 2.5$		
	40.0 × 25.5 × 2 ENDS	=	2010
END VERT STIFF L 4×3×1/4	6.5' × 9.8 #/' × 4 REQ'D	=	151
END HORIZ STIFF L 6×3 1/2×5/16	6.0' × 9.8 #/' × 4 REQ'D	=	235
BOTT. SUPPORT @ MID LENGTH (SEE SHT. 8)	1/4" WEB PLT. 1' × 6' × 10.2 #/FT²		61
	6"×1/4" FB 6' × 5.1 #/'	=	31
	2×1/4 FB 5' × 1.7 #/'	=	8
SLUDGE AUGER PIPE	SAY 6" ϕ SCH 80 16' × 28.57 #/'	=	457
METAL AUGER TROUGH	SAY 24" ϕ " 13' × 125	=	1625
	STEEL SUB TOTAL THIS SHT.		14525 LBS

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JOB TK-424
SHEET NO. 10 OF 12
CALCULATED BY LFMOUNT DATE 18 SEPT. 00
CHECKED BY DATE
SCALE

WEIGHT EST. (CON'D)

		LBS.
SUB TOTAL FROM SHEET 9	=	14525
SUPPORT LEGS SAY W8×31. 6 × 8' × 31#/'	=	1488
METAL AUGER SCREW:		
6"φ SOLID SHAFT 13' × 96.21#/'	=	1251
140 PADDLES @ 15# EA	=	2100
SLUDGE AUGER SCREW ROUGH EST.	≈	1500
		20364 LBS.
ADD 5% FOR MISC. NOZZLES, NUTS/BOLTS, WELD.		36
USE FOR EMPTY TANK WT. ⇒		22,000 LBS
+		
CONTENTS @ 100% FULL		65600 LBS (FROM SHT. 9)
EST. TOTAL WEIGHT FLOODED ⟹		87,600 LBS

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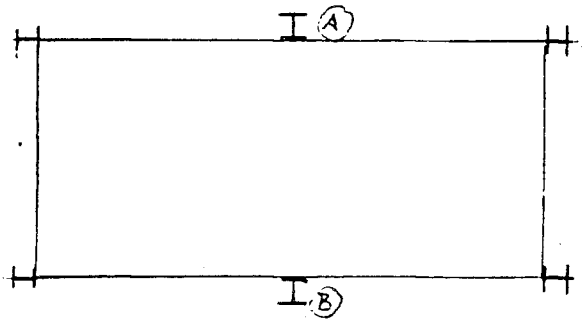
SUPPORT LEG DESIGN



TRY W8x31 (GREED)
$A = 9.13 \text{ IN}^2$
$S_x = 27.5 \text{ IN}^3$
$S_y = 9.27 \text{ IN}^3$
$r_x = 3.47 \text{ IN}$
$r_y = 2.02 \text{ IN}$

TOTAL WEIGHT FLOODED = 87600 LBS (FROM SHT. 10)

EST. LOAD TO SUPPORT (A) = $\frac{87600^{\#}}{2} \times .5 = 21900^{\#}$
" " " " (B)

EST. LOAD TO EACH CORNER SUPPORT = $\frac{87600^{\#}}{2} \times .25 = 10950^{\#}$

SEISMIC LOAD CONSIDERATIONS

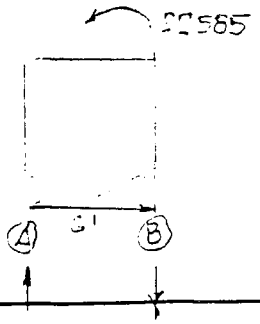
HORIZ LOAD $V = \frac{ZIC}{R_w} \times W$ WHERE $Z = 0.075$ (ASSUME ZONE 1)
$I = 1.0$ FOR TANK
$C = 2.75$
$R_w = 4$ FOR TANKS

$= \frac{0.075(1.0)(2.75)}{4} \times 87600^{\#}$

$= 4517$ LBS

TAKE C.G. OF TANK @ 5' ABV. BASE PLT.

∴ O.T. MOMENT = 4517 (5) = 22585 FT-LBS



ASSUME O.T. MOMENT IS RESISTED BY COLS (A) & (B) ONLY

∴ AXIAL LOAD DUE TO O.T. MOMENT = $\frac{22585}{6} = 3764^{\#}$

TOTAL AXIAL (COMPRESSION) IN MEMBER (A) = 3764
+ 21900 DWT + CONTENTS
25664 = P

$f_a = \frac{P}{A} = \frac{25664}{9.13} = 2811 \text{ PSI}$

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SUPPORT LEG DESIGN (CON'D)

BENDING OF COL. $MOM = \frac{4517 \times 2'}{2\ COL.} = 4517\ FT\text{-}LBS$

$f_b = \frac{4517(12)}{9.27\ IN^3} = 5847\ PSI$

WEAK AXIS
CONSERVATIVE

$Kl/r = \frac{2(24")}{2.92} = 20.76$

WHERE $F_a = \frac{\left[1 - \frac{(Kl/r)^2}{2C_c^2}\right] F_y}{\frac{5}{3} + \frac{3(Kl/r)}{8C_c} - \frac{(Kl/r)^3}{8C_c^3}}$

$C_c = 126.10$

$= \frac{\left[1 - \frac{.532}{.2018}\right] 36000}{1.67 - .07 - 0}$

$F_a = 25317\ PSI$

$\frac{f_a}{F_a} + \frac{f_b}{F_b} \leq 1.0$

$\frac{2811}{20317} + \frac{5847}{23,200}$

$.14 + .25 = .39 \leq 1.0$ O.K.

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6 October 2000

Mr. Agustin Ayon
Clean Harbors Services, Inc.
11800 S. Stony Island Ave.
Chicago, Illinois 60617

Subject: Metal Wash Rinse Tank - 427
Structural Arrangement

Enclosures: 1) Marked up print your dwg. no. 4630-M-16
2) Supporting Calculations (9 shts.)
3) Cardboard plating model

Dear Mr. Ayon,

Enclosures 1),2), & 3) are forwarded herewith for your review and comment. The plate thicknesses shown include 1/8" corrosion allowance.

I had trouble visualizing the intended shape of this tank, thus the model which I hope incorporates the desired features and can be constructed using flat plates. I believe this tank will be difficult to fabricate given the various intersecting surfaces.

I have again followed a somewhat conservative approach in this design due to the intended use which requires support of the bottom auger and a product containing metal pieces. Additional local plate support may be required in way of shell nozzel attachments.

Regarding your preference for angle stiff's in lieu of T's on the Tank 424 design, the WT 4x7.5 vert. side members could be made of 4x4x1/4 angles and the WT 8x28.5 lower horizontal member at the bottom bend could be made of 8x6x1/2 angle with 6" leg pointing down.

Yours truly,

Lee F. Mount

Lee F. Mount

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781

JOB CH CHICAGO METAL RINSE TANK - A27
SHEET NO. 1 OF 9
CALCULATED BY LFMOUNT DATE 4 OCT '00
CHECKED BY _____ DATE _____
SCALE _____

REF PLAN 4630-M-15

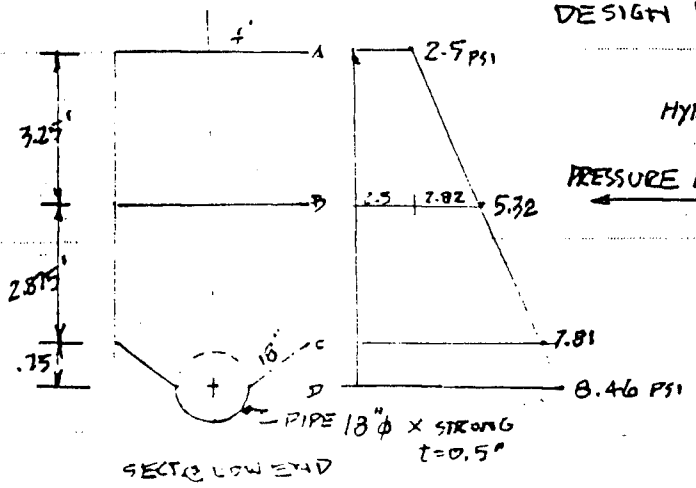
PLATE SIZE CALS.

REFS. 1) LINCOLN ARC WELDING DESIGN OF WELDED STRUCTURES, BLODGETT SECT. 6.5
2) ROARK FORMULAS FOR STRESS & STRAIN
3) AISC MANUAL 8TH ED.

ASSUME ALLOW. STRESS FOR A36 STEEL = 23,200 (PER API 650)

S.G. = 2.0

DESIGN PRESS. = 2.5 PSI



SECT @ LOW END

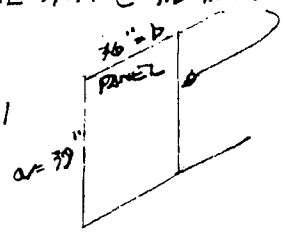
HYDRO PRESS @ B = $\frac{3.25 \times 62.4 \times 2}{144}$ = 2.82 + 2.5 (DESIGN) = 5.32 PSI

PRESSURE LOADING

@ C = $\frac{6.125 \times 62.4 \times 2}{144}$ = 5.31 + 2.5 = 7.81 PSI

@ D = $\frac{6.875 \times 62.4 \times 2}{144}$ = 5.96 + 2.5 = 8.46 PSI

FOR VERT SIDE PLATE A-B ASSUME STIFF @ MID TANK LENGTH



$a/b = \frac{39}{36} = 1.1$

FOR 2.5 PSI UNIFORM PRESS.

CASE 36, REF. 2

$t^2 = \frac{Bpb^2}{23{,}200} = \frac{0.3718 (2.5)(36)^2}{23{,}200}$

$t = 0.22''$

FOR 2.82 TRIANGULAR LOAD

CASE 39, REF. 2

$t^2 = \frac{Bpb^2}{23{,}200} = 0.15 \frac{(2.82)(36)^2}{23{,}200}$

$t = 0.17''$ 0.22 + 0.17 = 0.39"

SAY 0.50" + 0.125 (CORR. ALLOW) = USE 5/8" PLT.

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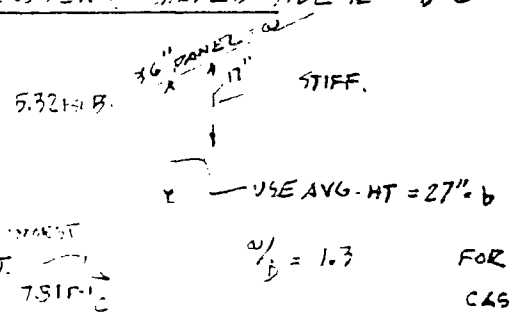
PLATE SIZE CALS (CONT'D)

FOR VERT. TRIANGULAR SHAPED SIDE PLT. B-C (APPROX.)

EST LOAD @ 17" STIFF SAY $\frac{5.32+7.81}{2} \times 36 \times 17 \approx 4000$#

SAY 2000 REACTION @ EA END



FOR 5.32 PSI UNIFORM = P

CASE 36, REF 2

$$t^2 = \frac{\beta P b^2}{23{,}200} = \frac{4146(5.32)(27)^2}{23{,}200}$$

$t = 0.26"$

FOR 2.49 TRIANG. HYDRO = P

CASE 40, REF 2

$$t^2 = \frac{\beta P b^2}{23{,}200} = \frac{0.22(2.49)(27)^2}{23{,}200}$$

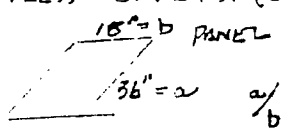
$t = 0.13"$

∴ REQ'D $t = .26 + .13 = 0.39"$

SAY 0.5" + 0.125" = USE 5/8" PLT.
CORR. ALL.

FOR BOTT SLOPED PLATE C-D (APPROX.)

ASSUME TO BE [illegible] LOADED WITH PRESS = 8.46 PSI (CONSERVATIVE)



a/b = 2

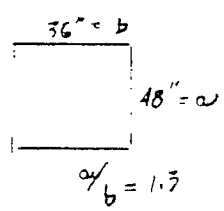
CASE 36, REF 2

$$t^2 = \frac{\beta P b^2}{23{,}200} = \frac{[illegible](8.46)(18^2)}{23{,}200}$$

$t = 0.27"$ [illegible] + .125" = USE 1/2" PLT.
CORR. ALL.

FOR TOP PLATE [illegible] 2 BOLTED SECTIONS

P = 2.5 PSI [illegible] (UNIFORM)



CASE 36, REF 2

$$t^2 = \frac{\beta P b^2}{23{,}200} = [illegible]$$

$t = 0.24"$ [illegible] .125" + .125" = USE 3/8" PLT.
CORR.

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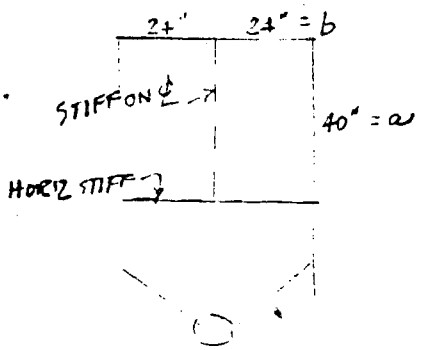
PLATE SIZE CALS. (CON'D)

FOR END PLATES



$a/b = \frac{40}{24} = 1.7$

FOR 2.5 PSI UNIFORM PRESS.
CASE 36, REF 2

$$t^2 = \frac{\beta p b^2}{23{,}200} = \frac{.543(2.5)(24^2)}{23{,}200}$$

$$t = 0.18''$$

FOR 2.82 TRIANGULAR HYDRO
CASE 39, REF 2

$$t^2 = \frac{\beta p b^2}{23{,}200} = \frac{0.29(2.82)(24)^2}{23{,}200}$$

$$t = 0.14''$$

$\therefore$ REQ'D $t = 0.18 + .14 = 0.32''$

→ USE $0.5'' + 0.125 = 5/8''$ RT. TO KEEP SAME AS VERT. SIDES

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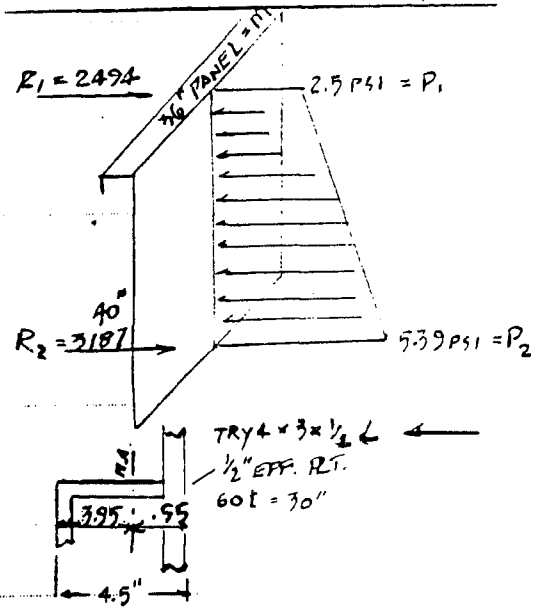
FOR VERTICAL SIDE SHELL STIFF. CASE $3D_c$, REF. 1)



$$M_{OM} = \frac{h^2 m}{16}(P_1 + P_2)$$

$$= \frac{40^2(36)(7.87)}{16} = 28404 \text{ IN-LBS.}$$

$$\therefore \text{REQ'D. SECT. } M_{OM} = \frac{28404}{23{,}200} = 1.22 \text{ IN}^3$$

FIND REACTIONS @ R_1 & R_2

DUE TO 2.5 PSI UNIFORM LOAD $R_1 = R_2 = 1800^{\#}$

DUE TO TRIANGULAR LOAD $R_1 = \frac{2.89 \times 40 \times 36}{6} = 694^{\#}$

$R_2 = \frac{2.89 \times 40 \times 36}{3} = 1387^{\#}$

$\therefore R_1 = 1800 + 694 = 2494^{\#}$

$R_2 = 1800 + 1387 = 3187^{\#}$

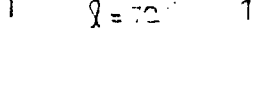
5681

CK TOTAL LOAD ON PANEL $= \frac{2.5 + 5.39}{2} \times 40 \times 36 = 5681^{\#}$

PIECE	AREA	d	Ad	Ad^2	I_o
L	1.69	3.26	5.51	17.96	2.77
PLT	15.0	.25	3.75	.94	.3
	16.69	.55	9.26	21.97	
				$-Ad^2$	5.05
					16.92 IN⁴

$$SM_{LESSER} = \frac{16.92}{3.95} = 4.28 \text{ IN}^3 > 1.22 \text{ REQ'D} \quad \text{O.K.}$$

FOR TOP EDGE BOUNDING ANGLE



$$M_{OM} = \frac{Pl}{4} = \frac{2494(72)}{4} = 44892 \text{ IN LBS}$$

$$SM_{REQ'D} = \frac{44892}{23{,}200} = 1.94 \text{ IN}^3$$

→ TRY 4 × 3 × ½ L on [illegible]

S.M. PROVIDED = 4.14 IN³ > 1.94 O.K.

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FOR LWR SIDE LONG'L. STIFF

R_2 FROM SHT 4 = 3187#

R FROM TRI. PLT STIFF SAY 2000# (FROM SHT 2 CONSERVATIVE)

$l = 72''$

$\therefore P = 3187 + 2000 = 5187\#$

$$MOM = \frac{Pl}{4} = \frac{5187(72)}{4} = 93366 \text{ IN LBS}$$

$$\text{REQ'D S.M.} = \frac{93366}{23{,}200} = 4.02 \text{ IN}^3$$

USE $4 \times 3 \times \frac{1}{2}''$ L S.M. = 7.6 IN³ > 4.02 IN³ O.K.

FOR TOP CROSS TIE @ MID TANK LENGTH SPAN = 48"

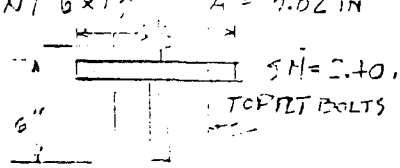
MOM DUE TO 2.5 PSI PRESS

UNIFORM LOAD = 2.5 PSI × 36" = 90 #/IN = w

$$MOM = \frac{wl^2}{8} = \frac{90(48)^2}{8} = 25920 \text{ IN-LBS}$$ $\text{REQ'D SM}_{BENDING} = \frac{25920}{23{,}200} = 1.1 \text{ IN}^3$

TENSILE LOAD = 2494# (FROM SHT 4)

→ TRY WT 6×17 A = 3.82 IN²



SM = 2.40 IN³ T ONLY

FOR T AREA USE 3.82 − [2 × .75 × .375] (LESS BOLT HOLES Φ)

= 3.25 IN²

$$\therefore f_a = \frac{2494}{3.25} = 767 \text{ PSI}$$

$$f_b = \frac{25920}{2.40} = 10800 \text{ PSI}$$

PER REF 3 FOR [illegible]

$$\frac{f_a}{.6F_y} + \frac{f_b}{[illegible]} \leq 1.0$$

$$\frac{767}{21600} + \frac{[illegible]}{[illegible]} \leq 1.0 \text{ O.K.}$$

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CAPACITY & STEEL WT. ESTIMATE

VOLUME @ 100% FULL:

TOP RECTANGLE $3.92' \times 5.92' \times 3.32' = 77.0\ FT^3$

END AREA @ LOW END

		FT^2
$\frac{4'+1.5'}{2} \times .75'$ HT.	=	2.06
4×2.875	=	11.50
$+ \frac{\pi r^2}{2} = \frac{\pi(.75')^2}{2}$	=	0.88
		14.44 ☐

AREA @ MID LENGTH

$\frac{4+1.5}{2} \times .75'$ HT.	=	2.06
4×1.42	=	5.68
	+	0.88
		8.62 ☐

CLOSE

AVG AREA $= \frac{14.44 + 2.94}{2} = 8.69$ ☐

AREA @ HIGH END

$\frac{4+1.5}{2} \times 0.75'$ HT.	=	2.06
	+	.88
		2.94 ☐

∴ VOL. BELOW TOP RECTANGLE
$= 8.69\ FT^2 \times 5.92' = 51.2\ FT^3$

TOTAL VOLUME $= 77.0 + 51.2 = 128.2\ FT^3$

$128.2\ FT^3 \times 62.4\ \#/FT^3 \times 2.0$ (S.G.) $= 15999$ LBS.

WT. OF CONTENTS @ 100% FULL

959 GALS

USE 16,000 LBS

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EST. STEEL WT.

		LBS.
TOP PLT. (3/8")	6.67' × 4.67' × 15.3 #/FT² =	477
TOP CROSS TIE	4' × 13 #/' WTG × 13 =	52
TOP BOUNDING ∠ 4×3×1/4	(6'×2)+(4'×2) = 20' × 5.8 #/' =	116
VERT. SIDE PLT (5/8") TRAPAZOID	4.75' × 6.0' × 25.5 #/FT² × 2 SIDES = (AVG. HT)	1454
SLOPED BOTT PLT (1/2")	1.5' WIDTH × 6.5' L × 20.4 × 2 SIDES =	398
BOTT. AUGER TROUGH	SAY 18" ⌀ × STRONG 1/2" t 93 #/' / 2 × 6.5' = (HALF SECT)	302
LWR. BOUNDING ∠ 4×3×1/2	20' × 11.1 #/' =	222
VERT SIDE STIFF @ MID LENGTH	4×3×1/4 ∠ 5' × 5.8 #/' × 2 SIDES =	58
SLOPED BOTT " " " "	" 2' × 5.8 #/' × 2 SIDES =	23
END PLTG (5/8") LOW END	4'×6' = 24 + 1.5×.75/2 × 2 = 1	
	25 □' × 25.5 #/FT² =	638
HIGH END	3.3 × 4 = 13 + 1	
	14 □' × 25.5 #/FT² =	357
END VERT STIFF ON ⌀	4×3×1/4 ∠ 3.5' × 5.8 #/' × 2 ENDS =	41
SUPPORT LEGS	×15 8.75' × 15 #/' × 4 =	525
AUGER ASS'Y (ROUGH ESTIMATE)	SAY	2000±
		6663 LBS
ADD 5% FOR MISC. FITTINGS, STIFF. WELD	+	337
		7,000 # ⟸ USE FOR EMPTY TANK
+ CONTENTS @ 100% FULL		16,000 (FROM SHT. 6)
EST. TOTAL WEIGHT FLOODED	⟹	23,000 LBS

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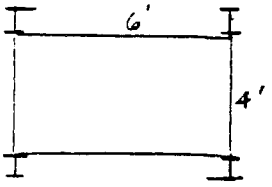
SUPPORT LEG DESIGN



TRY W6x15 $A = 4.43 \text{ in}^2$

$S_x = 9.72 \text{ in}^3$

$S_y = 3.11 \text{ in}^3$

$r_x = 2.56 \text{ in}$

$r_y = 1.46 \text{ in}$

TOTAL WEIGHT FLOODED = 23,000 LBS = W FROM SHT. 7

∴ SAY EA. LEG = $\frac{23,000}{4}$ = 5750#

SEISMIC LOAD CONSIDERATIONS

HORIZ. LOAD Y = $\frac{Z\,I\,C}{R_w} \times W$

WHERE Z = 0.075 (ASSUME ZONE 1)

I = 1.0 FOR TANKS

C = 2.75

R_w = 4 FOR TANKS

$= \frac{0.075(1)(2.75)}{4} \times 23000^{\#}$

= 1186 LBS

EST C.G. OF TANK @ 6' ABV. BASE PLT.

∴ O.T. MOMENT = 1186 (6) = 7116 FT-LBS

ASSUME O.T. MOMENT IS RESISTED BY 4' COUPLE

∴ AXIAL LOAD DUE TO O.T. MOM. = $\frac{7116}{4 \times 2 \text{ SETS LEGS}}$ = 890#

TOTAL AXIAL (COMPRESSION) = 890#

+5750 DUE TO DWT + CONTENTS

6640#

$f_a = \frac{6640}{4.43}$ = 1500 PSI

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CALCULATED BY LFMOUNT DATE 5 OCT. 00
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SUPPORT LEG DESIGN (CON'D)

HIGHEST LEGS

FOR COLUMN BENDING $M_{OM} = 1186^{*} \times \text{SAY } 5.5' = \frac{6523 \text{ FT-LBS}}{4 \text{ LEGS}} = 1631 \text{ FT-LBS/LEG}$

$K\ell/r = \frac{2(66)}{1.46} = 90.4$

$\therefore f_b = \frac{1631(12)}{3.11 \text{ IN}^3} = 6293 \text{ PSI}$

WEAK AXIS (CONSERVATIVE)

$\frac{f_a}{F_a} + \frac{f_b}{F_b} \leq 1.0$

PER REF. 3)

WHERE $F_a = \frac{\left[1 - \frac{(K\ell/r)^2}{2C_c^2}\right] F_y}{5/3 + 3\frac{(K\ell/r)}{8C_c} - \frac{(K\ell/r)^3}{8C_c^3}}$

$C_c = 126.10$ FOR A36 STL

$= \frac{\left[1 - .26\right] 36000}{1.67 + .27 - .05}$

$F_a = 14095 \text{ PSI}$

FROM SHT. 9

$\frac{1500}{14095} + \frac{6293}{23,200}$

$0.11 + 0.27 = 0.38 \leq 1.0$ O.K.

CONCLUDE USE W6×15 FOR LEGS

Minimum Thickness Required for Tanks
ASME Section VIII - Div. 1 Appendix 1

Tanks T - 415 and T - 416 (Assume S.G. = 2.0)

Material of Construction to be Carbon Steel

Maximum Pressure on Tank

$$\frac{62.4 \times 2.0 \times 17.125}{144} = 14.84 \text{ psi}$$

Plus 1 psig Vapor Pressure 1 psi

P = 15.84 psi

Use P= 16.00 psi

Minimum thickness required for shell

$$t = \frac{(P)(Ro)}{(S)(E)+0,4(P)} \qquad \frac{1016}{9666.4} = \boxed{0.105"}$$

Where
P=16 psi
Ro=10.583/2 (12)
S=13,800
E=0.7

Minmum thickness required for shell = 0.105"

Tank shell thickness to be 0.5" (0.5">0.105") therefore o.k.

Minimum thickness required ellipsoidal bottom

$$t = \frac{(P)(D)(K)}{2(S)(E)+0,2(P)} \qquad \frac{3689.28}{19323.2} = \boxed{0.191"}$$

Where
P=16 psi
D=126
S=13,800
E=0.7
K=1.83

Minmum thickness required for bottom = 0.191"

Tank bottom thickness to be 0.5" (0.5">0.191") therefore o.k.

Tank T - 414 (Assume S.G. = 2.0)

Material of Construction to be Carbon Steel

Maximum Pressure on Tank

$$\frac{62.4 \times 2.0 \times 9.17}{144} = 7.95 \text{ psi}$$

Plus 1 psig Vapor Pressure 1 psi

P = 8.95 psi

Use P= 9.00 psi

Minimum thickness required for shell

$$t = \frac{(P)(Ro)}{(S)(E)+0,4(P)} \qquad \frac{486}{9663.6} = \boxed{0.050"}$$

Where P= 9 psi
Ro=9/2 (12)
S=13,800
E=0.70

Minmum thickness required for shell = 0.05"

Tank shell thickness to be 0.25" (0.25">0.05") therefore o.k.

Minimum thickness required ellipsoidal bottom

$$t = \frac{(P)(D)(K)}{2(S)(E)+0,2(P)} \qquad \frac{1778.76}{19321.8} = \boxed{0.092"}$$

Where P=9 psi
D=108
S=13,800
E=0.7
K=1.83

Minmum thickness required for bottom = 0.092"

Tank bottom thickness to be 0.50" (0.50">0.097") therefore o.k.

Tank T - 418 (Assume S.G. = 2.0)

Material of Construction to be 316 Stainless Steel

Minimum Pressure on Tank

$$\frac{62.4 \times 2.0 \times 21.75}{144} = 18.85 \text{ psi}$$

Plus 1 psig Vapor Pressure 1 psi

P = 19.85 psi

Use P= 20.00 psi

Minimum thickness required for shell

$$t = \frac{(P)(Ro)}{(S)(E)+0,4(P)} \qquad \frac{845}{15758} = \boxed{0.054"}$$

Where P=20 psi
Ro=7.041667/2 (12)
S=22,500
E=0.70

Minmum thickness required for shell = 0.054"

Tank shell thickness to be 0.25" (0.25">0.054") therefore o.k.

Minimum thickness requiered ellipsoidal bottom

$$t = \frac{(P)(D)(K)}{2(S)(E)+0,2(P)} \qquad \frac{3074.4}{31504} = \boxed{0.097"}$$

Where P=20 psi
D=84
S=22,500
E=0.7
K=1.83

Minmum thickness required for bottom = 0.097"

Tank bottom thickness to be 0.25" (0.25">0.097") therefore o.k.

Tanks T - 417 (Assume S.G. = 2.0)
Material of Construction to be Carbon Steel

Maximum Pressure on Tank

$$\frac{62.4 \times 2.0 \times 24}{144} = 20.80 \text{ psi}$$

Plus 1 psig Vapor Pressure 1 psi

P = 21.80 psi
Use P= 22.00 psi

Minimum thickness requierd for shell

$$t = \frac{(P)(Ro)}{(S)(E)+0.4(P)} \qquad \frac{1386}{9668.8} = \boxed{0.143"}$$

Where
P=22 psi
Ro=10.5/2 (12)
S=13,800
E=0.7

Minmum thickness required for shell = 0.143"

Tank shell thickness = 0.375" (0.375">0.143") therefore o.k.

The secondary containment calculations for Unit 42 are included on CHSI Dwg. No. 4287. Ten percent of the total storage capacity of 2035 gallons is 204 gallons. This is less than the largest container of 478 gallons. The net containment of 5,239 gallons exceeds the total storage capacity.

The drum feed roller conveyor and drum lift to the shredder have a carbon steel containment pan below them. The pan is 22 feet long, 5 feet wide and 8 inches high. The drum lift and most of the roller conveyor are located in Unit 24 which is an enclosed building. A portion of the conveyor is located outside of the building, but in Unit 70 which is a contained area. The portion of the conveyor in Unit 70 will be covered by a canopy.

Total waste volume: (18)(55) = 990 gallons
10% = 99 gallons
largest container 478 gallons

Volume of containment: (22)(5)(0.67)(7.48) = 549 gallons

Amos Turner, P.E.
AMOS TURNER, P.E.
November 7, 2000

AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF
ILLINOIS

EXP. DATE 11-30-2001

HOYER-SCHLESINGER-TURNER, INC.

SHEET 1 OF 5
PROJECT NO. 1785-1
DATE 9.10.95
BY C.K.

PROJECT CLEAN HARBORS - CHICAGO, IL.
SUBJECT SHREDDER FACILITIES - BLDG. #43

FOR CERTIFICATION

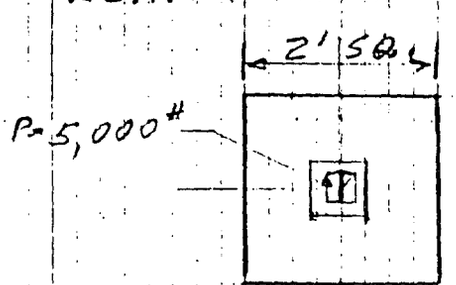
REF. DWGS: CLEAN HARBORS - STRUCTURAL SUPPORTS DWG. NO. 2916-S-15 (SHEET #2)

1. CONTAINMENT CALCULATIONS:
FOR SECONDARY CONTAINMENT CALCULATIONS SEE DWG. 2916-M-07 BY CLEAN HARBORS
REQUIRED = 1,800 GALS < 4,127 GALS PROVIDED O.K.

2. STRUCTURAL ANALYSIS OF EXIST. 6" CONC. SLAB REINF. WITH #5 @ 12" EACH WAY IS EQUIVALENT TO 7" CONC. SLAB REINFORCED WITH 2 LAYERS OF #4 @ 12" C/C EACH WAY TOP & BOTTOM WHICH IS CLASSIFIED AS INDUSTRIAL SLAB LOADED WITH 1500 PSF.

3. COLUMN LOADS AND PAD SIZES ARE TAKEN FROM CLEAN HARBORS DWG. 2916-S-15 AND RECHECKED. (PLAN ATTACHED SHT. #2)

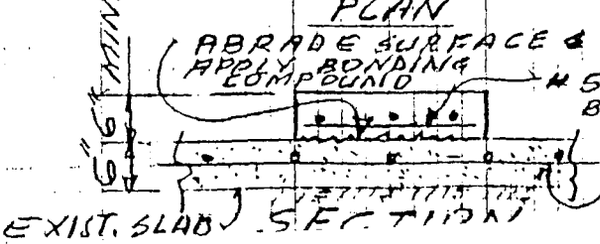
4. DRUM LIFT ASSEMBLE SUPPORTED ON 4 COLS WITH LOAD OF 5000 LBS. EACH AND HAVE ADDITIONAL 2' x 2' x 6" HIGH REINF. PADS ON TOP OF EXIST. 6" CONC. SLAB REINF. WITH #5 @ 12" EACH WAY



PLAN

P = 5000#
AREA = 4 F.S.
ALL = 1,500 x 4
= 6,000# > 5000#
O.K.

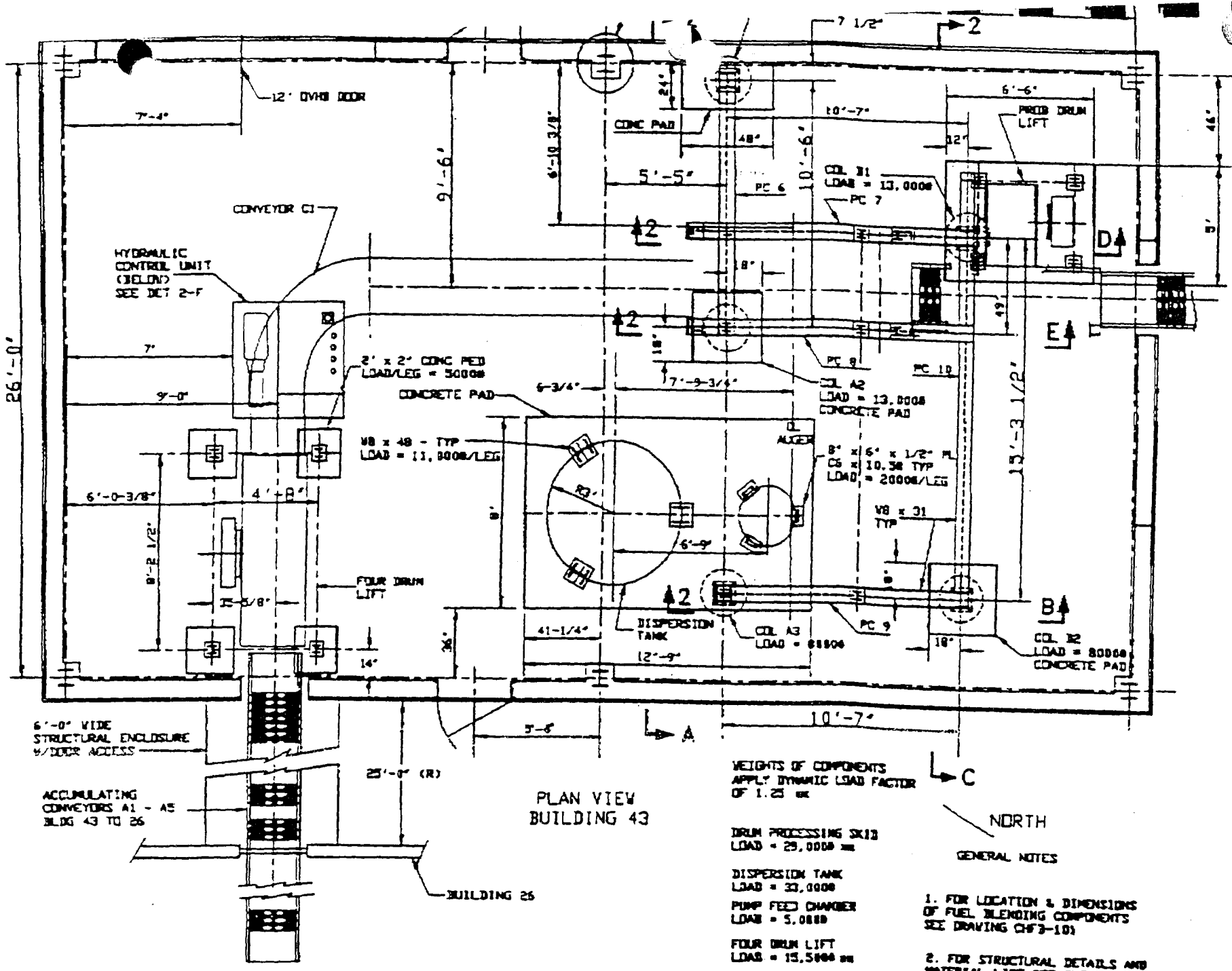
REINFORCE NEW PAD WITH #5 @ 9" c/c EACH WAY BOTT.



SECTION

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes
PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11-30-96



WEIGHTS OF COMPONENTS APPLY DYNAMIC LOAD FACTOR OF 1.25 ea

DRUM PROCESSING SKID LOAD = 29,000# ea

DISPERSION TANK LOAD = 33,000#

PUMP FEED CHANGER LOAD = 5,000#

FOUR DRUM LIFT LOAD = 15,500# ea

PROBLIN DRUM LIFT LOAD = 9,500# ea

HYDRAULIC CONTROL UNIT LOAD = 3,000#

GENERAL NOTES

1. FOR LOCATION & DIMENSIONS OF FUEL BLENDING COMPONENTS SEE DRAWING CHF3-101

2. FOR STRUCTURAL DETAILS AND MATERIAL LIST SEE SHT 2 OF THIS DRAWING. CHF3-103

3. CONCRETE PADS REINFORCED WITH A SINGLE LAYER OF #4 REBAR. (2' ON CTR EACH WAY

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, ILL.

SUBJECT SHREDDER FACILITIES - BLDG. #43

SHEET 2 OF

PROJECT NO. 17885-1

DATE 9.10.93

BY C.K.

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, IL.

SUBJECT SHREDDER FACILITIES - BLDG. # 43

SHEET 3 OF

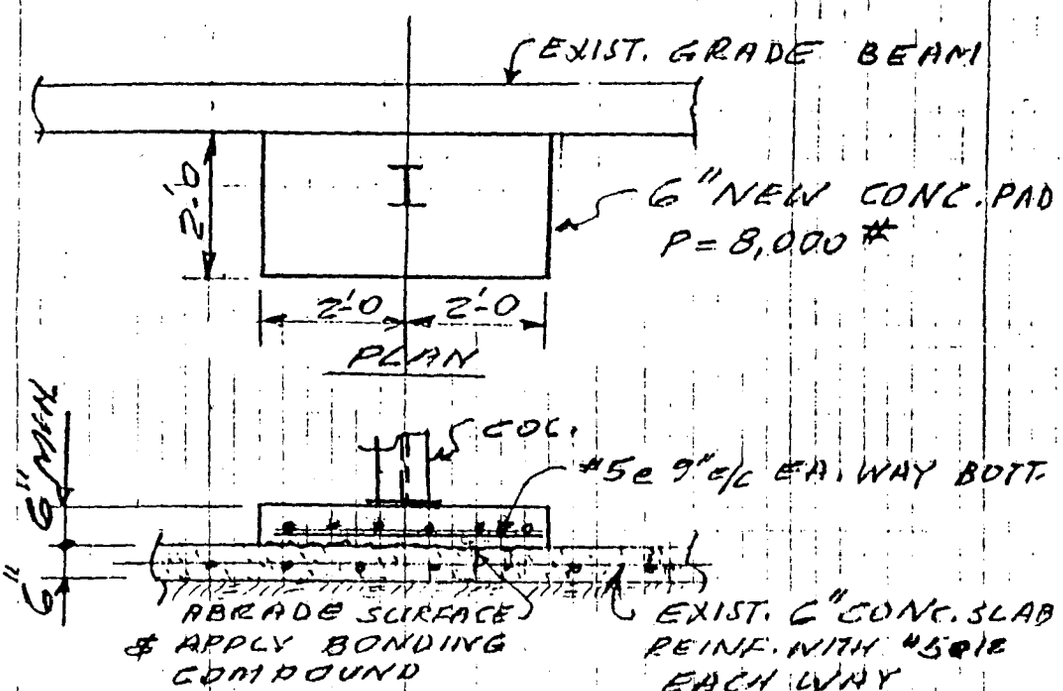
PROJECT NO. 1985-1

DATE 9.10.95

BY C.K.

FOR CERTIFICATION

5. COLUMN A1 LOAD ON COL. 8,000 LBS.
CONC. PAD 2'x4'x6" HIGH REINFORCED WITH
#5 @ 9" c/c EACH WAY BOTTOM. COL. LOAD = 8,000#



AREA: 4'x2' = 8 S.F. 8x1500 = 12,000# > 8,000#
O.K.

6. COL. B2.

COL. LOAD = 8,000#; NEW CONC. PAD
3'-0 SQUARE x 6" HIGH

AREA 3'x3' = 9 S.F.

ALLOWABLE LOAD = 1,500 x 9 = 13,500# > 8,000#
O.K.

REINF. IN NEW CONC.
PAD #5 @ 9" c/c EACH WAY BOTT.

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, IL.

SUBJECT SHREDDER FACILITIES - BLDG. #43

SHEET 4 OF

PROJECT NO. 1785-1

DATE 9.10.95

BY C.K.

FOR CERTIFICATION

7. COL. A2

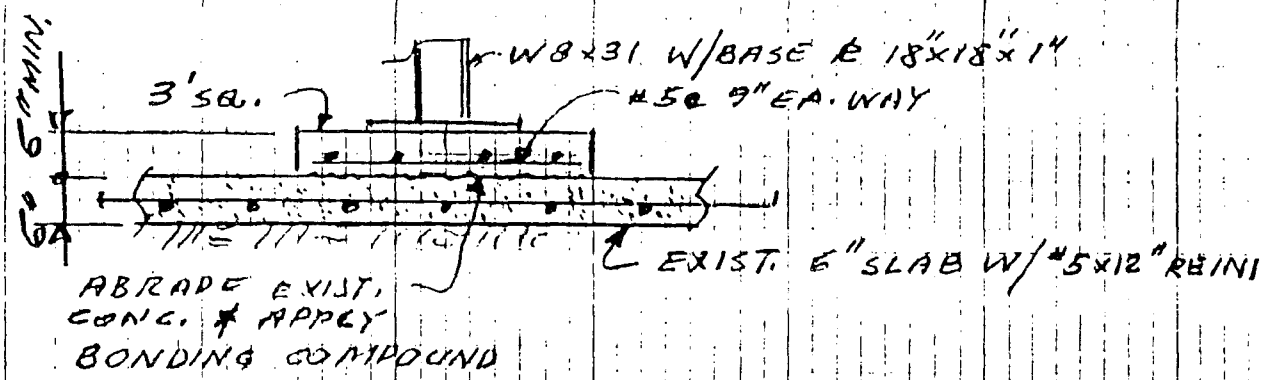
COL. LOAD = 13,000#; 4000 PSI CONC. MIX.

NEW CONC. PAD = 3'x3'x6" HIGH

AREA = 9 S.F.

ALLOWABLE LOAD = 9x1500# = 13,500# O.K.

REINF. NEW CONC. PAD WITH #5 @ 9" EACH WAY BOTTOM



SECTION

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS – CHICAGO, IL.

SUBJECT SHREDDER FACILITIES – BLDG. #43

SHEET 5 OF

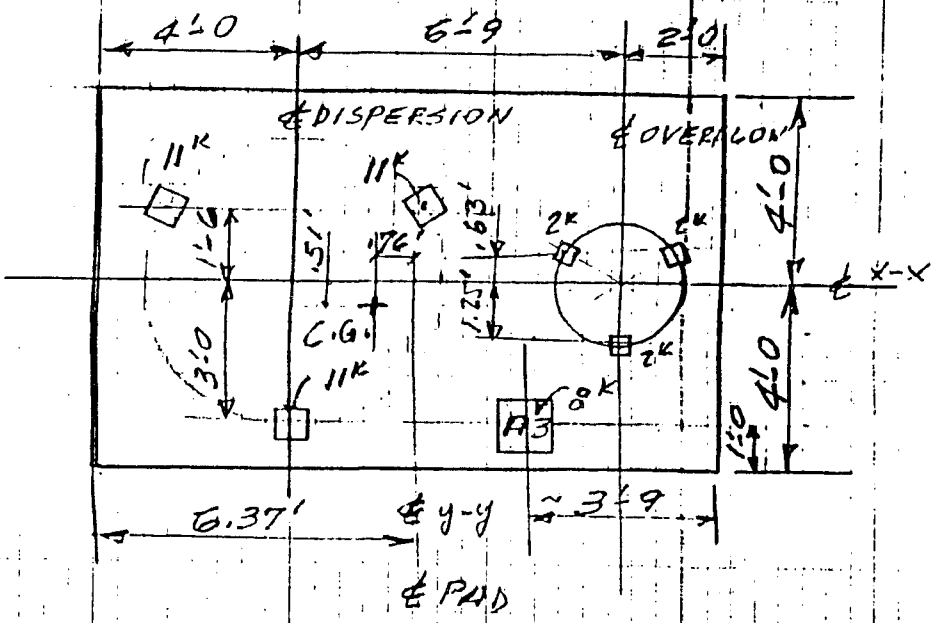
PROJECT NO. 1785-1

DATE 9.10.95

BY C.K.

FOR CERTIFICATION

8. NEW COMMON CONC. PAD FOR DISPERSION TANK, OVERFLOW TANK & COL. A3 = 8,000#

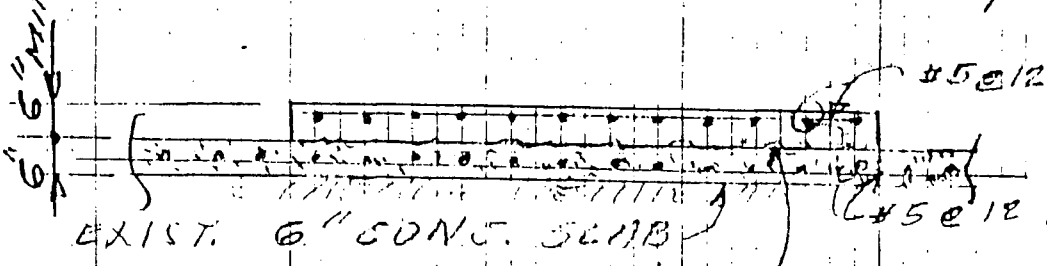


PLAN

$$p_s = \frac{47^k}{8 \times 12.75} + \frac{47 \times .76 \times 6}{8 \times 12.75^2} + \frac{47 \times .51 \times 6}{12.75 \times 8^2} = .46 + .16 + .18 = .80\ k/s$$

$= 880\#/SF < 1500$ OK

REINF. NEW 6" PAD WITH #5 x 12" c/c TOP EACH WAY



EXIST. 6" CONC. SLAB

ABRADE EXIST. SLAB & APPLY BONDING COMPOUND

SECTION

CLEAN HARBORS
ENVIRONMENTAL SERVICES, INC.
GENERAL WELDING & DESIGN
609 Pleasant Street P.O. Box 22
WEYMOUTH, MASSACHUSETTS 02189
(617) 331-5600 FAX (617) 335-2675

JOB GW5384
SHEET NO. _____ OF _____
CALCULATED BY L. SPAZIANI DATE 1-27-94
CHECKED BY _____ DATE _____
SCALE —

VERIFICATION OF LEG SUPPORTS — DISPERSION TANK

REF: SHAR, INC DRWG CC12331A (94-31-M16)

WEIGHT OF TANK —

TANK —	3340#	
NOZ —	800#	
MTR/DRIVES	3650#	
SCREW CONVR	2000#	(END SUPPORT)
	9790#	
WT LIQ @ 100%	22,440#	(1493 GAL @ 1.8 SP)
	32,230#	
MARGIN — 5%+ =	2000	
	34230#	

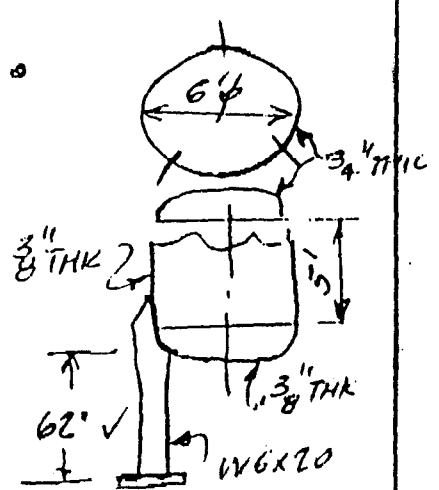
STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes
PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11-30-96

TOTAL CAP. ~ 1493 GAL
ASSUME 4500 GALS.

LEGS — W6 x 20 C.S. POSITIONED @ 120°

HEIGHT = 62' F_y = 36 KSI



ALLOWABLE LOAD - AISC — COL TABLES —

6' HT = 109 KIPS EACH LEG.

W6 x 20 OK

$\text{Impact} = \frac{P}{A} = \frac{34,230^{+}(.33)}{5.87\ IN^2}$ 1924#/IN² EA LEG — OK

CLEAN HARBORS
ENVIRONMENTAL SERVICES, INC.
GENERAL WELDING & DESIGN
609 Pleasant Street P.O. Box 22
WEYMOUTH, MASSACHUSETTS 02189
(617) 331-5600 FAX (617) 335-2675

JOB GW53B4

SHEET NO. _____ OF _____

CALCULATED BY L. SPAZIANI DATE 6-16-94

CHECKED BY _____ DATE _____

SCALE _____

VERIFICATION OF LEG SUPPORTS — PUMP FEED CHAMBER

REF: DRWG 94-31-M28 —

WT TANK —	1200#
NOZ	400#
ATTACHMENTS	600#
	2200#
WT HQ-300q —	4500#
	6700#
≈	7500#

3 LEGS @ 120° — 6" × 8.2# [A = 2.40 IN² Fy = 36 KSI

HEIGHT = 41"

$$f_{act} = \frac{P}{A} = \frac{7500^{\#}(3.3)}{2.40\ IN^2} = 1031\ \#/IN^2 \quad OK$$

I hereby certify that I, the undersigned am a Professional Engineer, licensed to practice in the State of Illinois. I have reviewed the assessment of Tank T-417 and attest that the tank system has sufficient structural integrity and compatibility with the wastes to be stored or treated to ensure that it will not collapse, rupture or fail. It is acceptable for the storing and treating of hazardous waste. The foundation, structural support, seams and connections are adequately designed incorporating good engineering practices.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Engineer Seal

Amos A Turner 11-7-2000

Amos Turner Date

Hoyer-Schlesinger-Turner, Inc.
3074 University Avenue
Highland Park, IL 60035
(847) 681-0470

AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

EXP. DATE 11-30-2001

H-S-T

HOYER-SCHLESINGER-TURNER,Inc.
ENGINEERS-ARCHITECTS
3074 University Ave.
Highland Park,IL 60035
Phone:847-461-0470 Fax:847-266-9829

October 27, 2000

Mr. James R. Laubsted
Facility Compliance Manager
CLEAN HARBORS SERVICES, INC.
11800 S. Stony Island Avenue
Chicago, IL 60617

RE: Inspection Report
Caustic Tank T-417

Dear Mr. Laubsted:

On October 10, 2000 I visually inspected the interior and exterior of Tank T-417.

Tank T-417 is located on the north side of the Bulk Liquid Flammable Storage Tank Farm (Unit 22). The tank was used for storing sodium hydroxide. Tank T-417 is located outdoors. The concrete containment for the tank farm will be modified to provide individual containment for this tank. The containment will be coated with Protecto-Coat 900, 30 mils thick as manufactured by Dudick, Inc. This coating is compatible with hazardous waste diluent or fuel to be stored.

Tank T-417 is a carbon steel vessel fabricated in 1986. Tank T-417 was empty at the time of inspection and was sandblasted by Clean Harbors personnel. The tank will be operated at ambient temperature and under 2" WC pressure from nitrogen blanketing. The tank will be equipped with a conversation vent and vented through a carbon bed.

Tank T-417 stores flammable liquids Class I. Maximum specific gravity of stored liquids is 1.2 and pH may vary from 4 to 10. The tank is constructed from carbon steel. It is 10'6" in diameter and 24"0" high straight side with a sloped bottom. The operating capacity is 15,000 gallons. This tank was built to UL-142 standard.

The internal and external visual inspection did not reveal any defects. The welds around nozzles and tank shell welds inspected from inside the tank were in good condition. The interior top plate did not show signs of rust. There were no other visible defects.

It is not possible to inspect the entire exterior of the tank by visual inspection. The tank is insulated with 2" thick insulation with metal jacket.

On October 12, 2000 Clean Harbors performed NDE-ultrasonic thickness measurements from the interior of the tank. These ultrasonic thickness test results are listed in Appendix TK-417-1.

The top as-built thickness was 0.250 inches. The four latest readings are very close in thickness to the as built thickness. The minimum reading was 0.248 inches which is 101% over the minimum of 0.123 inches recommended by the UL-142 standard.

The wall as-built thickness was 0.375 inches. The twelve latest readings each show minor decreases in thickness. The minimum reading was 0.368 inches which is 120% over the minimum of 0.167 inches recommended by the UL-142 standard.

The bottom as-built thickness was 0.500 inches. The four latest readings each show minor decreases in thickness. The minimum reading was 0.470 inches which is 96% over the minimum of 0.240 inches recommended by the UL-142 standard.

For tank design specifications, nozzle orientation and description, see CHSI Drawing No. 4295.

Structural design for the tank farm foundation, engineering design calculations and containment capacity calculations see CHSI Drawing 4291 and Attachment TK-417-2.

Therefore, I certify that after visual inspection, the tank is structurally sound. No evidence of cracks, bulging, corrosion pits or scales or weld defects were observed. Based on my inspection, the tank can be used for the intended purpose.

Very truly yours,

HOYER-SCHLESINGER-TURNER, INC.

Peter J. Bernes

Peter J. Bernes
Illinois #3659

STATE OF ILLINOIS
PETER J.
BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes

PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11.30.00

APPENDIX TK-417-1

ULTRA SONIC THICKNESS TESTING
T-417

October 12, 2000

INTERNAL

TOP

East	South	West	North
.250	.252	.252	.248

SHELL

.376	.380	.380	.368
.370	.372	.376	.368
.374	.380	.382	.380

BOTTOM

.470	.484	.500	.488

APPENDIX TK-417-2

HOYER-SCHLESINGER-TURNER, INC.

SHEET 1 OF 10
PROJECT NO. 1785-6
DATE 1.22.00
BY P. BERNES, S.E.

PROJECT CLEAN HARBORS - CHICAGO, ILL.
SUBJECT #22 TANK FARM MODIFICATION

DESIGN IS BASED ON LATEST EDITION OF CITY OF CHICAGO BUILDING CODE.

PROJECT CONSIST OF EXISTING TANK FARM MODIFICATION BY RELOCATING EXIST. TANK T-302B TO NEW LOCATION, INSTALLING TWO NEW 10'-6" DIA. DISHED BOTTOM TANKS OF 10,000 GAL. CAPACITY, ONE NEW 7'-0" DIA. DISHED BOTTOM TANK OF 6,000 GAL. CAPACITY AND ADDING NEW DIKE WALLS TO PROVIDE CONTAINMENT FOR EACH TANK SAPARETELY.

ORIGINALLY TANK FOUNDATIONS WERE DESIGNED FOR 15,000 G TANKS, BUT ACTUAL CAPACITY IS 10,000 GAL. ONLY. THEREFORE EXIST. TANK FOUNDATIONS ARE ADEQUATE TO SUPPORT RELOCATED TANK T-302B. WALL FOUNDATION DESIGN WAS BASED ON 2000 PSI SOIL BEARING CAPACITY. CONCRETE COMPRESSIVE STRENGTH = 4000 PSI AND REINF. STEEL = 60,000 PSI

ALL WORK TO BE COORDINATED WITH OWNERS PROJECT ENGINEER AND CLEAN HARBORS STANDARD DETAILS

ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST OSHA REQUIREMENTS

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes

PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11.30.00

HOYER-SCHLESINGER-TURNER, INC.

SHEET 1 OF 10

PROJECT CLEAN HARBORS - CHICAGO, ILL.

PROJECT NO. 1785-6

SUBJECT #22 TANK FARM MODIFICATION

DATE 1.22.00

BY P. BERNES, S.E

DESIGN IS BASED ON LATEST EDITION OF CITY OF CHICAGO BUILDING CODE.

PROJECT CONSIST OF EXISTING TANK FARM MODIFICATION BY RELOCATING EXIST. TANK T-302B TO NEW LOCATION, INSTALLING TWO NEW 10'-6" DIA. DISHED BOTTOM TANKS OF 10,000 GAL. CAPACITY, ONE NEW 7'-0" DIA. DISHED BOTTOM TANK OF 6,000 GAL. CAPACITY AND ADDING NEW DIKE WALLS TO PROVIDE CONTAINMENT FOR EACH TANK SAPARETELY.

ORIGINALLY TANK FOUNDATIONS WERE DESIGNED FOR 15,000 G TANKS, BUT ACTUAL CAPACITY IS 10,000 GAL. ONLY, THEREFORE EXIST. TANK FOUNDATIONS ARE ADEQUATE TO SUPPORT RELOCATED TANK T-302B. WALL FOUNDATION DESIGN WAS BASED ON 2000 PSI SOIL BEARING CAPACITY. CONCRETE COMPRESSIVE STRENGTH = 4000 PSI AND REINF. STEEL = 60,000 PSI

ALL WORK TO BE COORDINATED WITH OWNERS PROJECT ENGINEER AND CLEAN HARBORS STANDARD DETAILS

ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST OSHA REQUIREMENTS

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes

PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11.30.00

HOYER-SCHLESINGER-TURNER, INC.

SHEET 1 OF 10
PROJECT NO. [illegible]
DATE 1.22.00
BY P. BERNES

PROJECT CLEAN HARBORS - CHICAGO
SUBJECT F22 TANK FARM MODIFICATION

DESIGN IS BASED ON LATEST EDITION OF CITY OF CHICAGO BUILDING CODE.

PROJECT CONSIST OF EXISTING TANK FARM MODIFICATION BY RELOCATING EXIST. TANK T-302B TO NEW LOCATION, INSTALLING TWO NEW 10'-6" DIA. DISHED BOTTOM TANKS OF 10,000 GAL. CAPACITY, ONE NEW 7'-0" DIA. DISHED BOTTOM TANK OF 6,000 GAL. CAPACITY AND ADDING NEW DIKE WALLS TO PROVIDE CONTAINMENT FOR EACH TANK SEPARETELY.

ORIGINALLY TANK FOUNDATIONS WERE DESIGNED FOR 15,000 TANKS, BUT ACTUAL CAPACITY IS 10,000 GAL. ONLY, THEREFORE EXIST. TANK FOUNDATIONS ARE ADEQUATE TO SUPPORT RELOCATED TANK T-302B. WALL FOUNDATION DESIGN WAS BASED ON 2000 SOIL BEARING CAPACITY. CONCRETE COMPRESSIVE STRENGTH = 4000 PSI AND REINF. STEEL = 60,000 PSI

ALL WORK TO BE COORDINATED WITH OWNER'S PROJECT ENGINEER AND CLEAN HARBORS STANDARD DETAILS

ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST OSHA REQUIREMENTS.

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes

PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11.30.00

HOYER-SCHLESINGER-TURNER, INC.

SHEET 2 OF 10

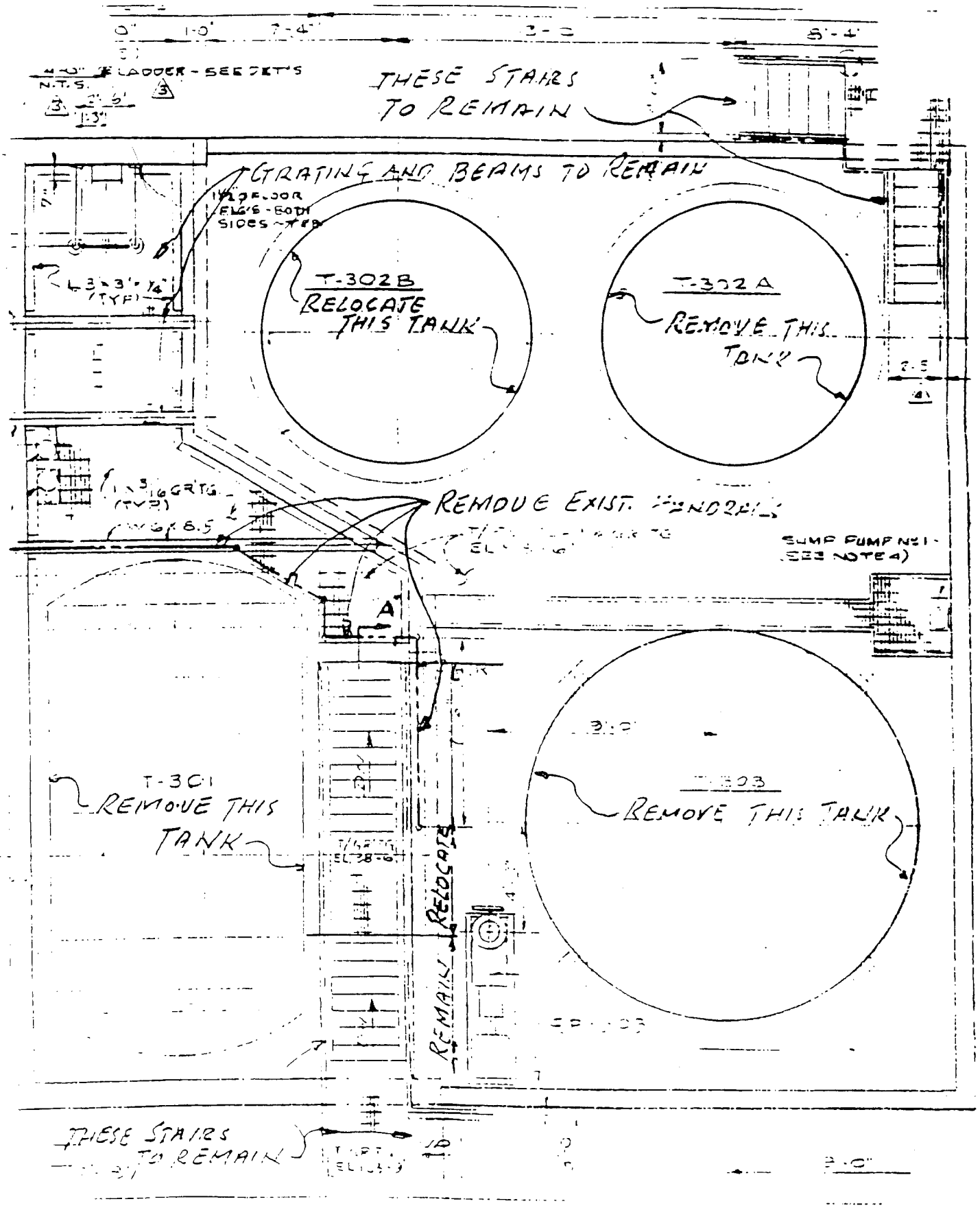
PROJECT CLEAN HARBORS - CHICAGO, ILL.

PROJECT NO. 1785-6

SUBJECT #22 TANK FARM MODIFICATIONS

DATE 1.22.90

BY P. BERNES, S.E.



PLAN OF EXISTING TANK FARM DEMO.

HOYER-SCHLESINGER-TURNER, INC.

SHEET 3 OF 10

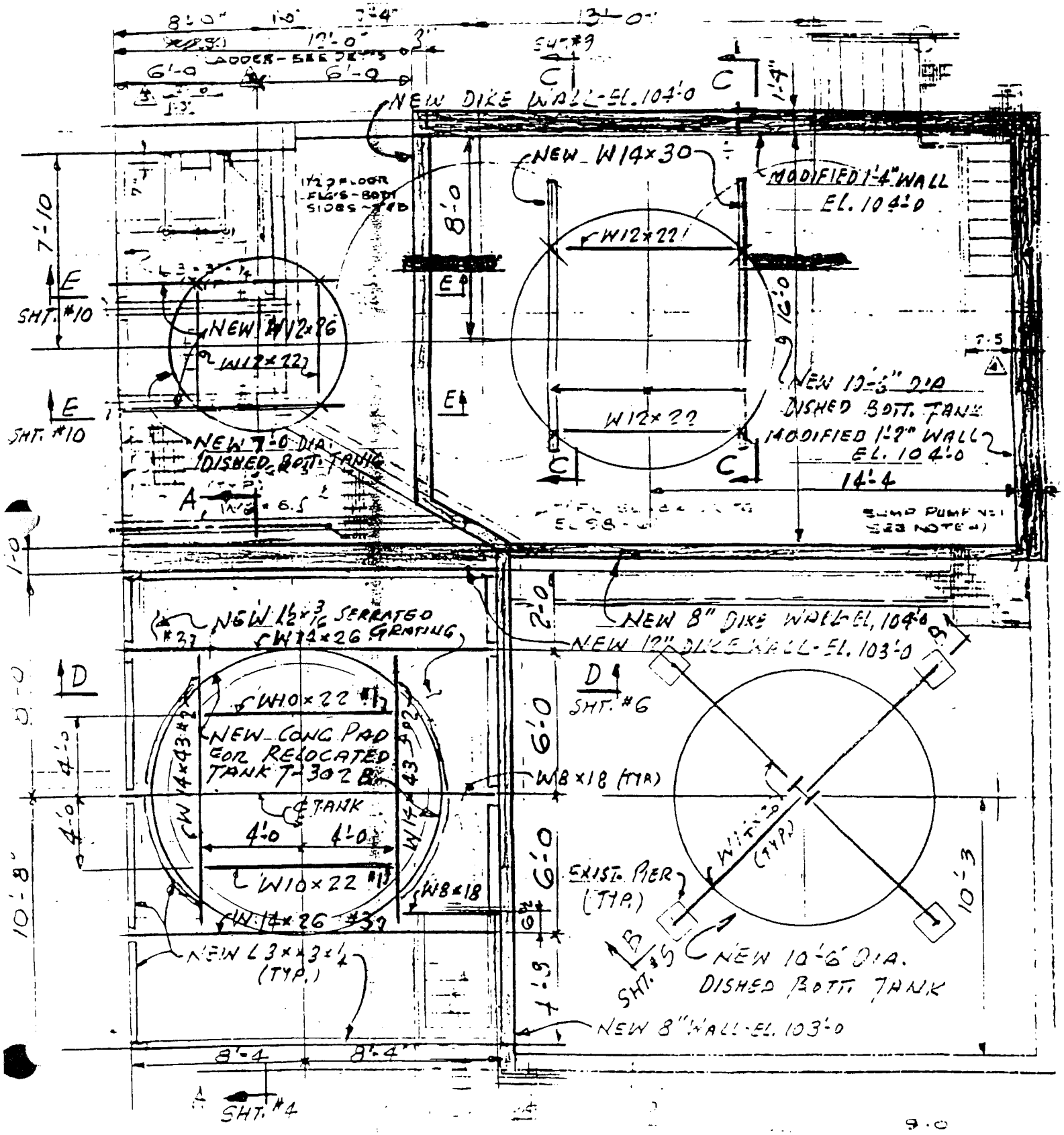
PROJECT CLEAN HARBORS - CHICAGO, ILL.

PROJECT NO. 1735-6

DATE 1.22.00

SUBJECT #22 TANK FARM MODIFICATION

BY P. BERNES, S.E.



PLAN OF MODIFIED EXIST. TANK FARM

PROJECT CLEAN HARBORS - CHICAGO, ILL.

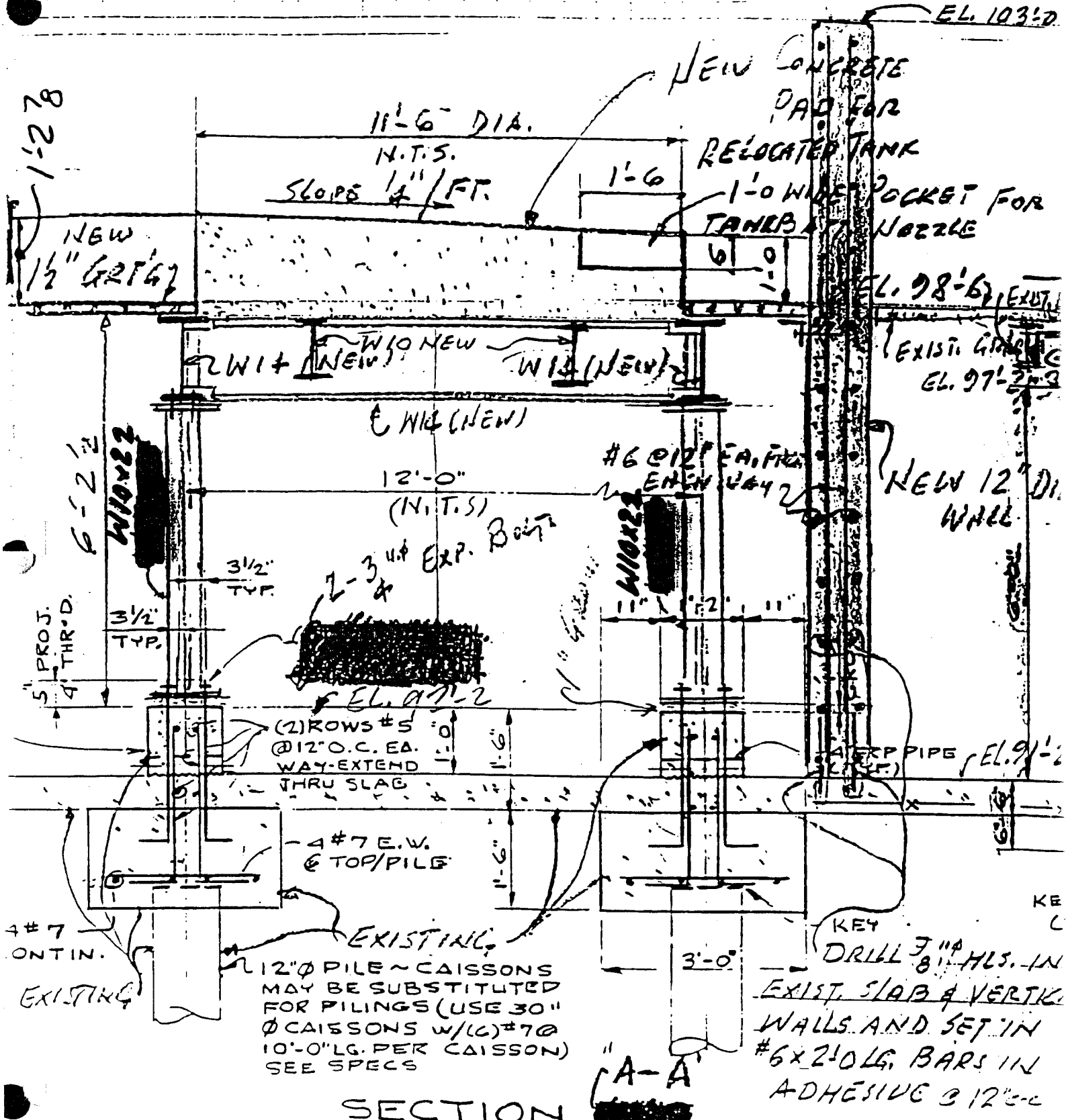
SUBJECT #22 TANK FARM MODIFICATION

SHEET 4 OF 10

PROJECT NO. 1785-6

DATE 1.22.00

BY P. BERNES, S.E.



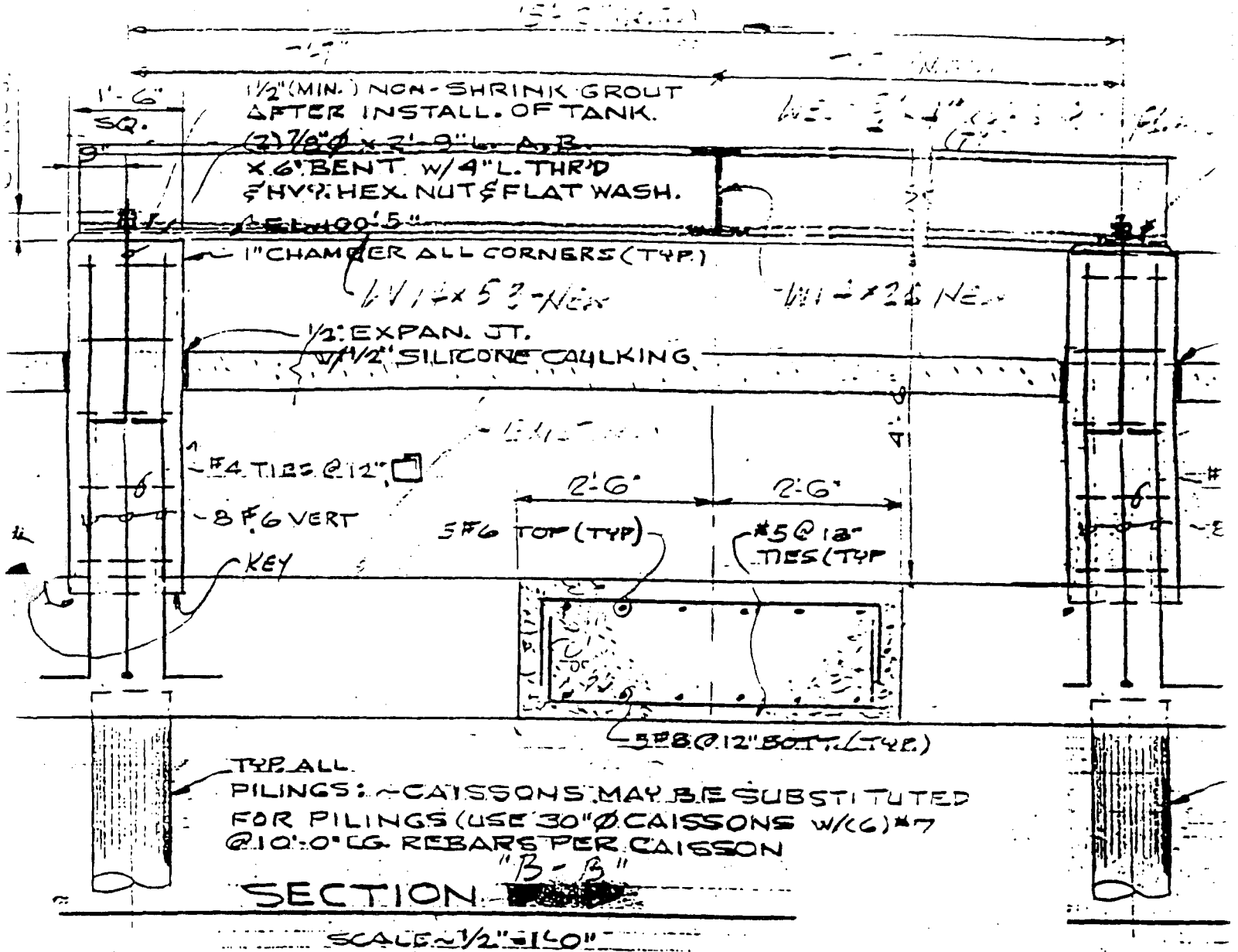
SECTION

SCALE ~ 1/2" = 1'-0"

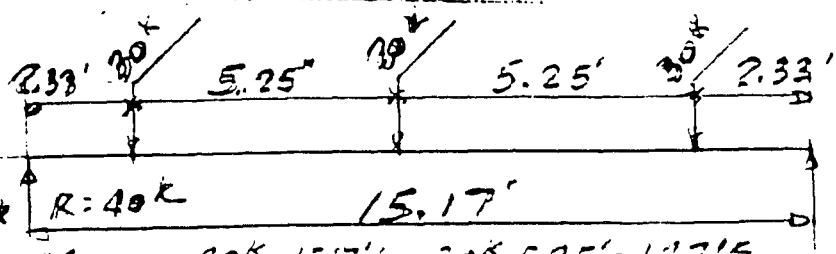
HOYER-SCHLESINGER-TURNER, INC.

SHEET 5 OF 10
PROJECT NO. [illegible]
DATE 1.22.00
BY S. BERNES, S.E.

PROJECT [illegible]
SUBJECT #22 TANK [illegible] MODIFICATION



TOTAL WEIGHT.
FULL = 118K +
PIPING, COL'S AND BEAMS = 120K
PER LEG = 120K/4 = 30K



BEARING = 40K/16" x 8" =

$t = \sqrt{\frac{3 \times .3 \times 22}{27}} = .5 \pm$

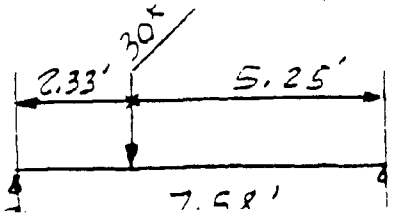
.658" > .547" OK

WEB BUCKLING RES = 5.47K < 9.11K OK

$M_{MAX} = 40^K \times 15.17'/2 - 30^K \times 5.25' = 147'^K$

USE W14 x 53 - $M_R = 156'^K > 147'^K$ O.K.

$R_1 = \frac{30^K \times 5.25'}{7.58'} =$



$M_{MAX} = 20^K \times 2.33' = 47'^K$

USE W14 x 22 - $M_R = 58'^K > 47'^K$

OK

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, IL

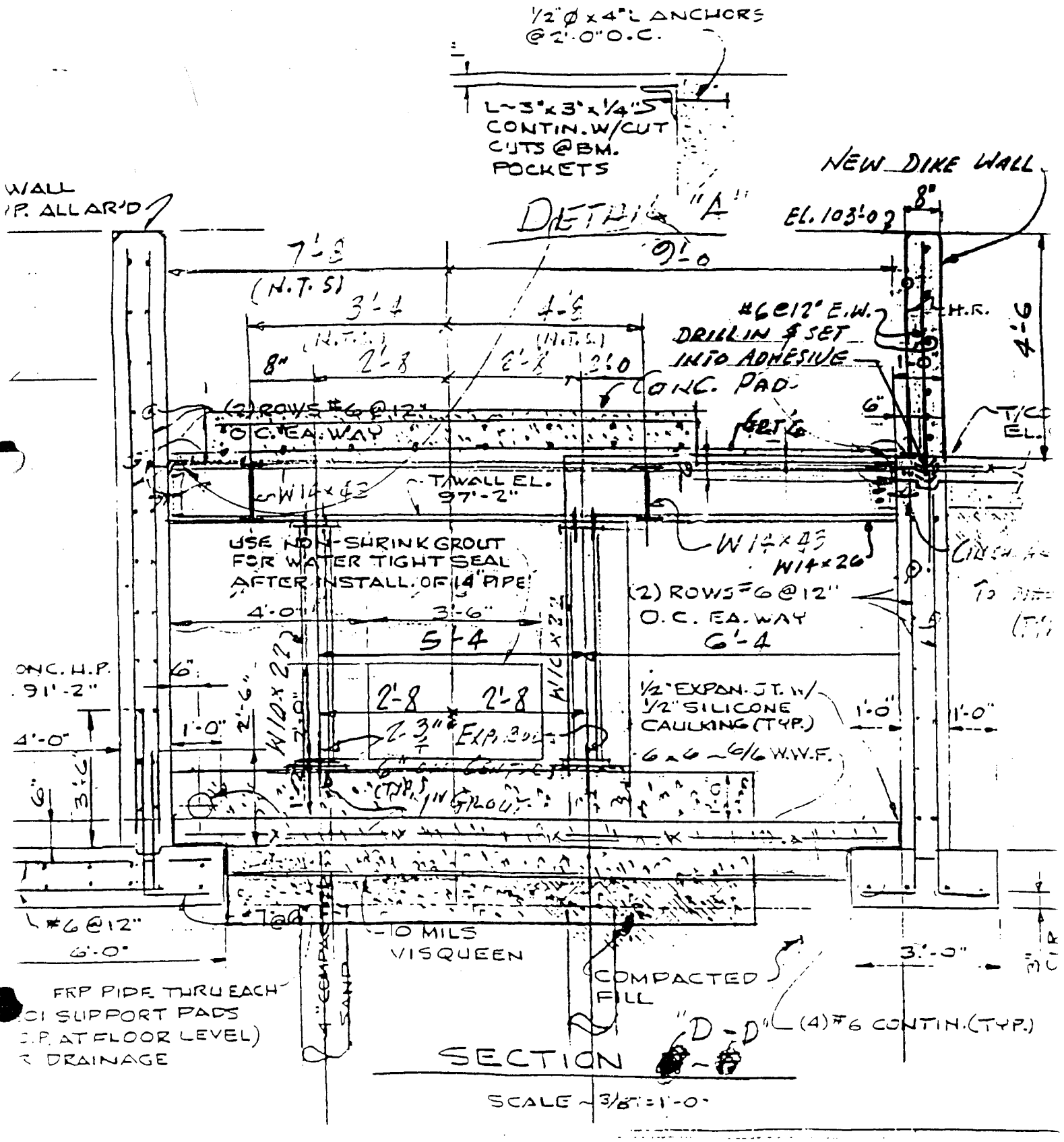
SUBJECT #22 TANK FARM MODIFICATION

SHEET 6 OF 10

PROJECT NO. 1785-6

DATE 1.22.00

BY P. BERINES, S.E.



HOYER-SCHLESINGER-TURNER, INC.

SHEET 7 OF 10
PROJECT NO. 178-[illegible]
DATE 1.22.00
BY P. BERNES, S.E

PROJECT CLEAN HARBORS - CHICAGO, IL.
SUBJECT #22 TANK FARM MODIFICATION

CONCR. PAD (SEC. "D-D" - SEE SHT. #3 & #6)

a) CALCULATE TOTAL LOAD - PSF. FOR RELOCATED TANK T-302.

CONTENTS = $\frac{10{,}000 \text{ GAL} \times 8.35 \text{ \#/GAL}}{\pi \times 5.25^2}$ = 965 PSF

1/2" THICK BOTT. PL = ONE SQ. FT. = 20 PSF

CONC. PAD = SQ. FT. × 1'-0 HIGH = 150 PSF

TOTAL = 1,135 PSF

b) CALCULATE REINF. REQUIRED (TWO WAY SLAB)

$M = \frac{1.14^{k}/2 \times 8^2}{8} = 4.56^{'k}$

A_s REQ'D = $\frac{4.56^{'k}}{1.76 \times 10} = .26 \text{ IN}^2$

USE #5 @ 12" C-C EA. WAY - TOP & BOTT.

$A_s = .31 \text{ IN}^2 > .26 \text{ IN}^2$ ok.

DESIGN OF SUPPORTING BEAMS & COL'S

a) CALCULATE TOTAL LOAD (SEE SHT'S #3 & #6)

TANK SHELL = $\pi \times 10.5 \times 24 \times 15.3$ PSF = 12,107#

" BOTT PL = $\pi \times 5.25^2 \times 20.4$ PSF = 1,766#

" TOP PL = $\pi \times 5.25^2 \times 10.2$ PSF = 883#

MANWAYS, NOZZLES & PIPING = 2,244#

TANK TOTAL = 17,000#

CONTENTS = 10,000 GAL × 8.35 #/GAL = 83,500#

CONC. PAD = $\pi \times 5.75^2 \times 1.0' \times 150$ PCF = 15,570#

TOTAL = 116,070#

HOYER-SCHLESINGER-TURNER, INC.

SHEET 8 OF 10

PROJECT CLEAN HARBORS - CHICAGO I.

PROJECT NO. 1785-

DATE 1.22.0

SUBJECT #22 TANK FARM MODIFICATION

BY P. BERNES, S.E

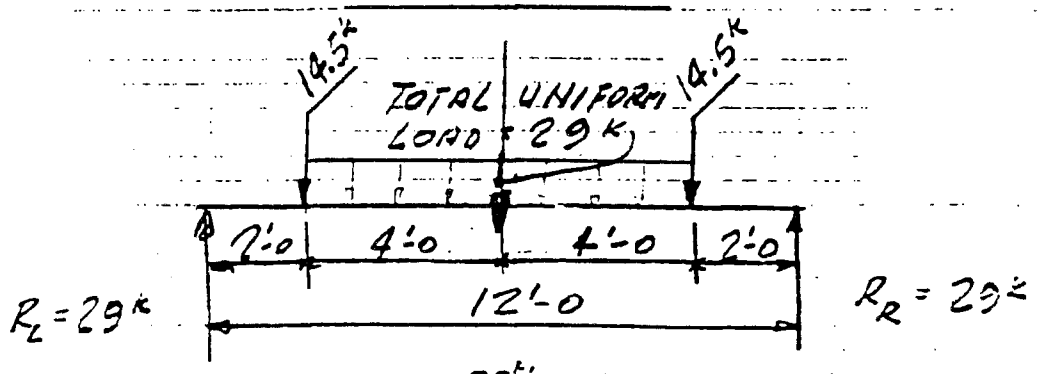
b) DESIGN OF SUPPORTING BEAMS - #1, #2 & #3

BEAM #1

TOTAL UNIFORM LOAD PER BEAM = 116K/4 = 29K

USE W10x22 - ALLOWABLE LOAD = 43K > 29K O.K.

BEAM #2

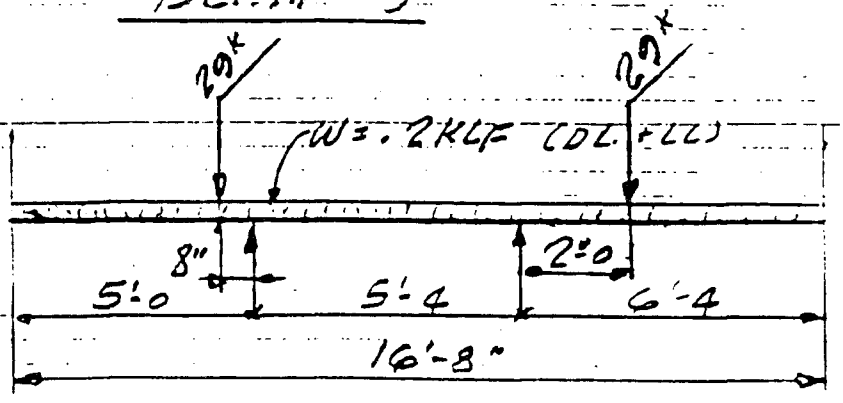


$R_L = R_R = 14.5^K + 29^K/2 = 29^K$

$M_{MAX} = 29^K \times 6' - 14.5^K \times 4' = 203'^K$

USE W14x43 - $M_R = 125'^K > 203'^K$ O.K.

BEAM #3



$M_{MAX} = 29^K \times 2.0' + 6.33' \times .2KLF \times 6.33/2 = 62'^K$

USE W14x26 - $M_R = 77'^K > 62'^K$ O.K.

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, ILL.

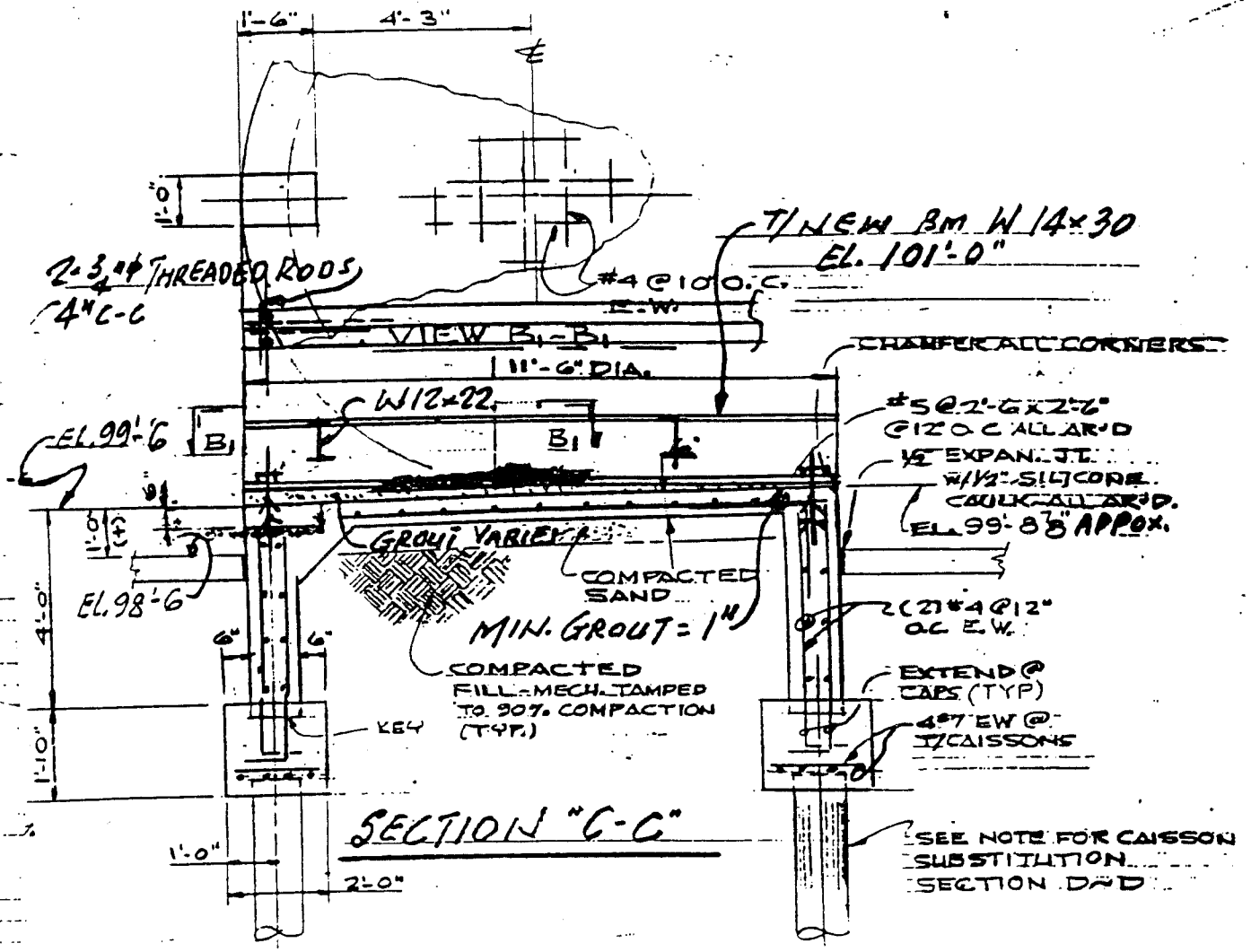
SUBJECT #22 TANK FARM MODIFICATION

SHEET 9 OF 10

PROJECT NO. 1785-6

DATE 1.22.00

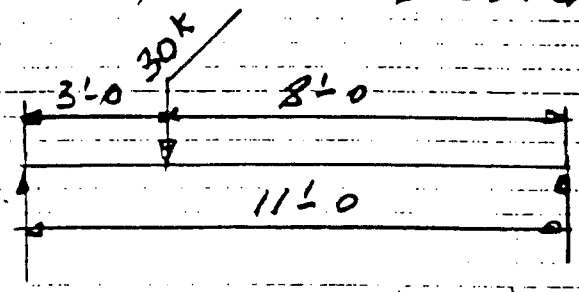
BY R. BERNES, J.E.



DISHED BOTTOM TANK SUPPORT BEAM DESIGN

TANK FULL = 118K
MISC. = 2K
TOTAL = 120K

LOAD PER LEG = 120K/4 = 30K



$R_L = \frac{30^K \times 8'}{11'} = 21.8^K$

$M_{MAX} = 21.8^K \times 3' = 65.45'^K$

USE W 14×30 $M_R = \frac{22 \times 41.0}{12} = 76.8'^K$

$76.8'^K > 65.45'^K$ O.K.

HOYER-SCHLESINGER-TURNER, INC.

SHEET 10 OF 10

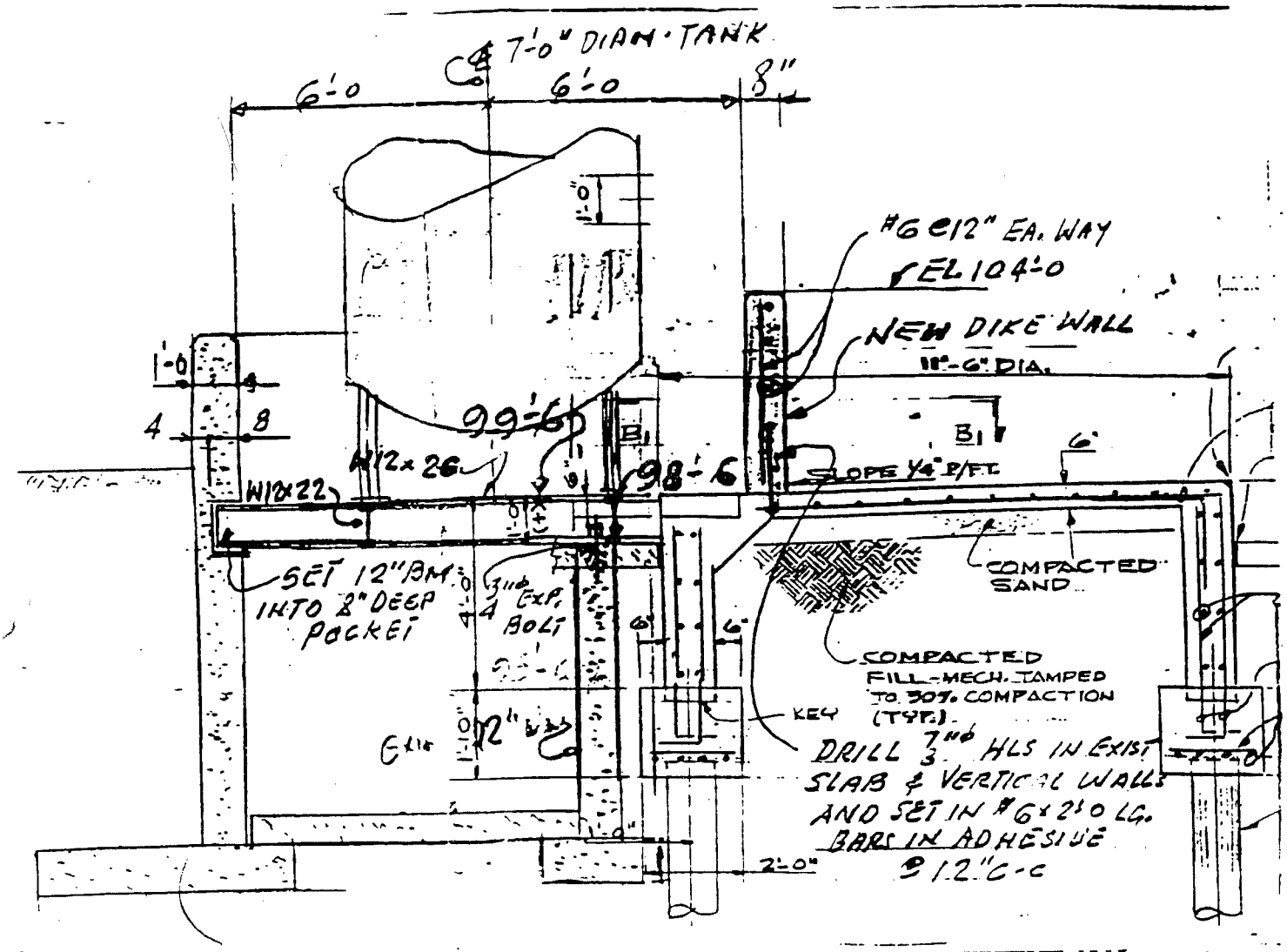
PROJECT CLEAN HARBORS - CHICAGO, IL.

PROJECT NO. 1785-6

SUBJECT #22 TANK FARM MODIFICATION

DATE 1.22.00

BY P. BERNES, S.E.



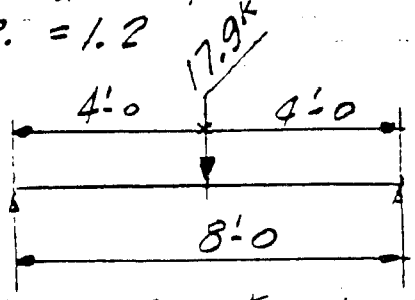
SECTION "E-E"

(SEE SHT. #3)

6,000 GAL. TANK = FULL TANK WEIGHT = 71.58^K

SP. GR. = 1.2 EMPTY VESSEL = 10.17^K

LOAD PER LEG = 71.58^K/4 = 17.90^K



R = 17.90^K x 4 / 8 = 8.95^K

$M_{MAX.}$ = 8.95^K x 4' = 35.80'^{K}

USE W12x26 M_R = 63'^{K} > 35.80'^{K} O.K.

I hereby certify that I, the undersigned am a Professional Engineer, licensed to practice in the State of Illinois. Tanks 101, 102, 107, 110 and 112 are currently used for hazardous waste fuel storage, lean waters, and acidic wastewaters. Under the proposed modifications, these tanks could also be used for chlorinated solvents, diluent and ignitable waste storage from shredding operations. I have reviewed the structural integrity and suitability of the existing tanks, ancillary equipment and secondary containment. These modifications were designed under my direct supervision and the design incorporates good engineering practices.

Tanks 101, 102, 107, 110 and 112 are suitable for intended use. The materials of construction for the tanks are compatible with the hazardous wastes intended to be stored/processed. The tanks are designed to be structurally sound for their usage of ignitable waste, diluent and chlorinated solvents. These tanks are aboveground on concrete foundations. No tank component is in contact with the soil or water. The tanks are not subjected to loadings caused by vehicular traffic.

The ancillary equipment was constructed and installed according to ANSI/ASME B31.3-1987, Chemical Plant and Refinery Piping. The materials of construction are compatible with the hazardous wastes intended to be stored/processed.

The structural design for the tankfarm foundation is suitable for intended use. Existing walls, floors, piers, foundations, and containment slabs are designed for intended load and will maintain structural integrity without failure. The secondary containment is provided with a 30 to 40 mil coat of Protecto-Coat 900 or equivalent in accordance with the manufacturer's recommendations. After careful consideration of all stored chemicals and discussion with the coating manufacturer representative, this was selected as the most suitable coating. Technical specifications are listed in Appendix D-10.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Engineer Seal

Amos Turner 9-9-2000

Amos Turner Date

Hoyer-Schlesinger-Turner, Inc.
3074 University Avenue
Highland Park, IL 60035
(847)681-0470

AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

EXP. DATE 11-30-2001

I hereby certify that I, the undersigned am a Professional Engineer, licensed to practice in the State of Illinois. Tanks 101, 102, 107, 110 and 112 are currently used for hazardous waste fuel storage, lean waters, and acidic wastewaters. Under the proposed modifications, these tanks could also be used for chlorinated solvents, diluent and ignitable waste storage from shredding operations. I have reviewed the structural integrity and suitability of the existing tanks, ancillary equipment and secondary containment. These modifications were designed under my direct supervision and the design incorporates good engineering practices.

Tanks 101, 102, 107, 110 and 112 are suitable for intended use. The materials of construction for the tanks are compatible with the hazardous wastes intended to be stored/processed. The tanks are designed to be structurally sound for their usage of ignitable waste, diluent and chlorinated solvents. These tanks are aboveground on concrete foundations. No tank component is in contact with the soil or water. The tanks are not subjected to loadings caused by vehicular traffic.

The ancillary equipment was constructed and installed according to ANSI/ASME B31.3-1987, Chemical Plant and Refinery Piping. The materials of construction are compatible with the hazardous wastes intended to be stored/processed.

The structural design for the tankfarm foundation is suitable for intended use. Existing walls, floors, piers, foundations, and containment slabs are designed for intended load and will maintain structural integrity without failure. The secondary containment is provided with a 30 to 40 mil coat of Protecto-Coat 900 or equivalent in accordance with the manufacturer's recommendations. After careful consideration of all stored chemicals and discussion with the coating manufacturer representative, this was selected as the most suitable coating. Technical specifications are listed in Appendix D-10.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Engineer Seal

Amos Turner 9-9-2000

Amos Turner Date

Hoyer-Schlesinger-Turner, Inc.
3074 University Avenue
Highland Park, IL 60035
(847)681-0470

AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

EXP. DATE 11-30-2001

H-S-T

HOYER-SCHLESINGER-TURNER,Inc.
CONSULTING ENGINEERS
3074 University Ave.
Highland Park, IL 60035
Phone: 847/461-0470 Fax: 847/266-9829

I hereby certify that I, the undersigned am a Professional Engineer, licensed to practice in the State of Illinois. I have conducted an assessment of the design for the proposed shredding operation Unit 24. I have reviewed the structural integrity and suitability of the proposed tanks, ancillary equipment, secondary containment and shredding process including dispersible materials operation and non-dispersible materials operation. Unit 24 was designed under my direct supervision and the design incorporates good engineering practices.

Tank 414 is suitable for intended use. The materials of construction for the tank are compatible with the hazardous wastes intended to be stored/processed. The tank is designed to be structurally sound for its use to disperse shredded waste materials. The tank will be installed above ground on concrete foundations. No tank component will be in contact with the soil or water. The tank has been designed subject to loadings caused by vehicular traffic.

The ancillary equipment will be constructed and installed according to ANSI/ASME B31.3-1987, Chemical Plant and Refinery Piping. The materials of construction are compatible with the hazardous wastes intended to be stored/processed.

The structural design for the tank foundation and shredder foundation is suitable for intended use. Walls, piers, foundations, floors and containment slabs are designed for intended load and will maintain structural integrity without failure. The foundation has been designed to prevent the effect of frost heave. The secondary containment shall be coated with a minimum 3/16 inch coat of Protecto-Crete 900 or equivalent in accordance with the manufacturer's recommendations. After careful consideration of all stored chemicals and discussion with the coating manufacturer representative, this was selected as the most suitable coating. Technical specifications are listed in Appendix D-10.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Amos Turner 02/16/2000

Amos Turner Date

Hoyer-Schlesinger-Turner, Inc.
3074 University Avenue
Highland Park, IL 60035
(847)681-0470

Engineer Seal

AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

EXP. DATE 11-30-01

H-S-T

HOYER-SCHLESINGER-TURNER,Inc.
CONSULTING ENGINEERS
3074 University Ave.
Highland Park, IL 60035
Phone: 847/461-0470 Fax: 847/266-9829

I hereby certify that I, the undersigned am a Professional Engineer, licensed to practice in the State of Illinois. I have conducted an assessment of the design for the proposed metalwash system Unit 68. I have reviewed the structural integrity and suitability of the proposed tanks, ancillary equipment, secondary containment and process. Unit 68 was designed under my direct supervision and the design incorporates good engineering practices.

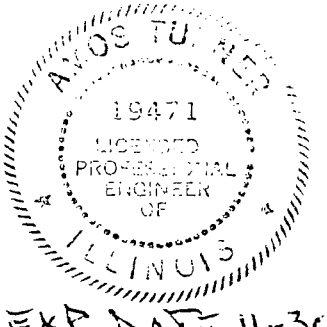
Tanks 424 and 427 are suitable for intended use. The materials of construction for the tanks are compatible with the hazardous wastes intended to be stored/processed. The tanks are designed to be structurally sound for their use to clean metal fragments of waste. The tanks will be installed above ground on concrete foundations. No tank component will be in contact with the soil or water. The tanks have been designed subject to loadings caused by vehicular traffic.

The ancillary equipment will be constructed and installed according to ANSI/ASME B31.3-1987, Chemical Plant and Refinery Piping. The materials of construction are compatible with the hazardous wastes intended to be stored/processed.

The structural design for the tank foundation is suitable for intended use. Walls, piers, foundations, floors and containment slabs are designed for intended load and will maintain structural integrity without failure. The foundation has been designed to prevent the effect of frost heave. The secondary containment shall be coated with a minimum 3/16 inch coat of Protecto-Crete 900 or equivalent in accordance with the manufacturer's recommendations. After careful consideration of all stored chemicals and discussion with the coating manufacturer representative, this was selected as the most suitable coating. Technical specifications are listed in Appendix D-10.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Engineer Seal



EXP DATE 11-30-00

01-26-00

Amos Turner — Date

Hoyer-Schlesinger-Turner, Inc.
3074 University Avenue
Highland Park, IL 60035
847/461-0470

H-S-T

HOYER-SCHLESINGER-TURNER,Inc.
CONSULTING ENGINEERS
3074 University Ave.
Highland Park, IL 60035
Phone: 847/461-0470 Fax: 847/266-9829

I hereby certify that I, the undersigned am a Professional Engineer, licensed to practice in the State of Illinois. I have conducted an assessment of the design for the proposed flammable tankfarm Unit 22. I have reviewed the structural integrity and suitability of the proposed tanks, ancillary equipment and modified secondary containment. Unit 22 was designed under my direct supervision and the design incorporates good engineering practices.

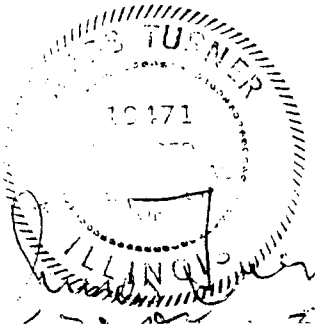
Tanks 415, 416 and 418 are suitable for intended use. The materials of construction for the tanks are compatible with the hazardous wastes intended to be stored/processed. The tanks are designed to be structurally sound for their usage of ignitable waste storage. The tanks will be installed above ground on concrete foundations. No tank component will be in contact with the soil or water. The tanks will not be subjected to loadings caused by vehicular traffic.

The ancillary equipment will be constructed and installed according to ANSI/ASME B31.3-1987, Chemical Plant and Refinery Piping. The materials of construction are compatible with the hazardous wastes intended to be stored/processed.

The structural design for the tankfarm foundation is suitable for intended use. Existing walls, piers, foundations, floors and containment slabs are designed for intended load and will maintain structural integrity without failure. Newly added dike walls are designed for intended load and will maintain structural integrity without failure. The foundation has been designed to prevent the effect of frost heave. The secondary containment will be provided with a 30 to 40 mil coat of Protecto-Coat 900 or equivalent in accordance with the manufacturer's recommendations. After careful consideration of all stored chemicals and discussion with the coating manufacturer representative, this was selected as the most suitable coating. Technical specifications are listed in Appendix D-10.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Engineer Seal



James Turner 01-26-00
James Turner Date

Hoyer-Schlesinger-Turner, Inc.
3074 University Avenue
Highland Park, IL 60035
847/461-0470

HOYER-SCHLESINGER-TURNER, INC.

SHEET 1 OF 10
PROJECT NO. 1785-6
DATE 1.22.00
BY P. BERNES, P.E.

PROJECT CLEAN HARBORS - CHICAGO, ILL.
SUBJECT F22 TANK FARM MODIFICATION

DESIGN IS BASED ON LATEST EDITION OF CITY OF CHICAGO BUILDING CODE.

PROJECT CONSIST OF EXISTING TANK FARM MODIFICATION BY RELOCATING EXIST. TANK T-302B TO NEW LOCATION, INSTALLING TWO NEW 10'-6" DIA. DISHED BOTTOM TANKS OF 10,000 GAL. CAPACITY, ONE NEW 7'-0" DIA. DISHED BOTTOM TANK OF 6,000 GAL. CAPACITY AND ADDING NEW DIKE WALLS TO PROVIDE CONTAINMENT FOR EACH TANK SEPARETELY.

ORIGINALLY TANK FOUNDATIONS WERE DESIGNED FOR 15,000 G TANKS, BUT ACTUAL CAPACITY IS 10,000 GAL. ONLY, THEREFORE EXIST. TANK FOUNDATIONS ARE ADEQUATE TO SUPPORT RELOCATED TANK T-302B. WALL FOUNDATION DESIGN WAS BASED ON 2000 PSF SOIL BEARING CAPACITY. CONCRETE COMPRESSIVE STRENGTH = 4000 PSI AND REINF. STEEL = 60,000 PSI

ALL WORK TO BE COORDINATED WITH OWNERS PROJECT ENGINEER AND CLEAN HARBORS STANDARD DETAILS

ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST OSHA REQUIREMENTS.

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes

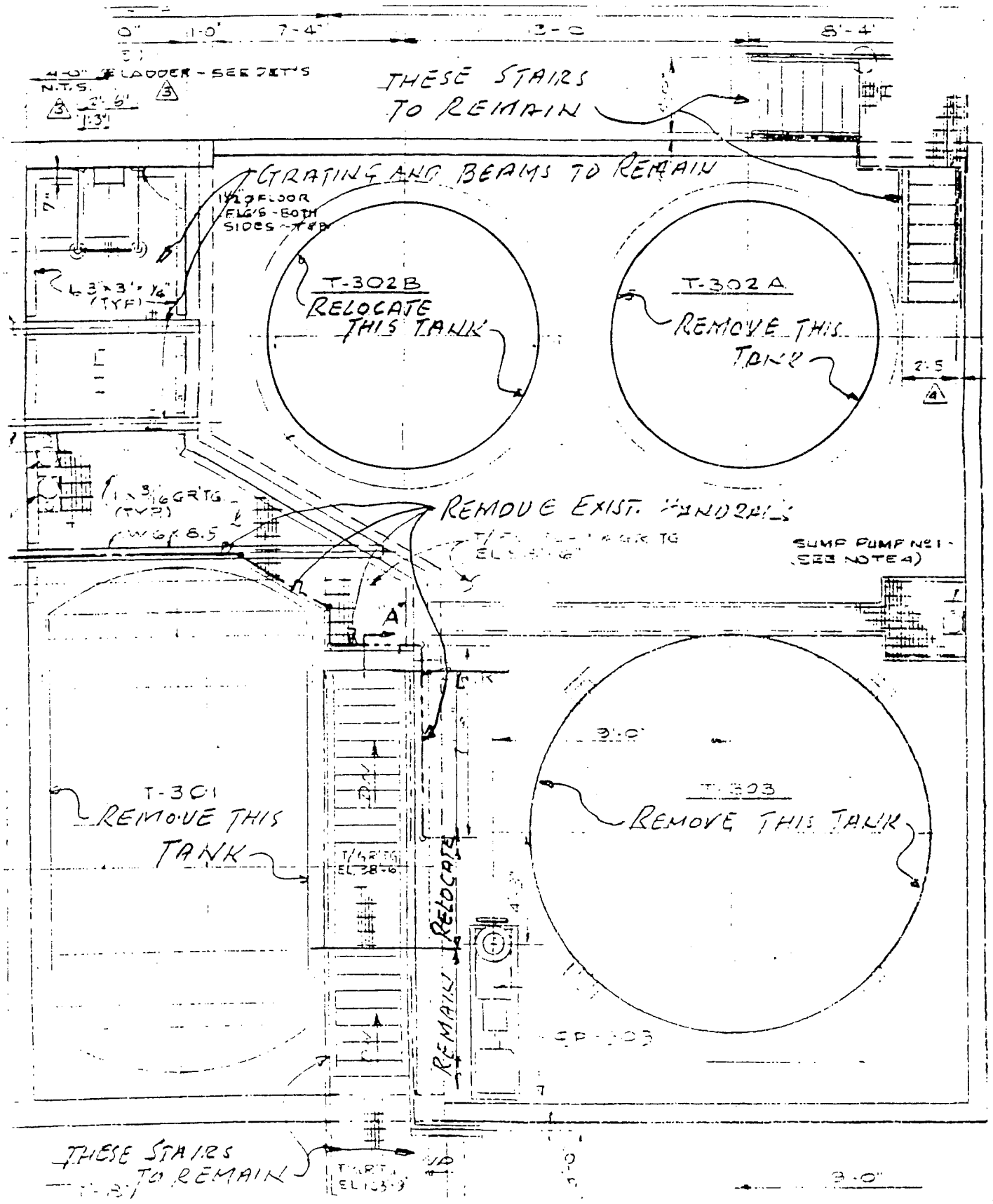
PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11.30.00

HOYER-SCHLESINGER-TURNER, INC.

SHEET 2 OF 10
PROJECT NO. 1785-6
DATE 1.22.00
BY P. BERNES, S.E.

PROJECT CLEAN HARBORS - CHICAGO, ILL.

SUBJECT #22 TANK FARM MODIFICATION



PLAN OF EXISTING TANK FARM DEMO.

HOYER-SCHLESINGER-TURNER, INC.

SHEET 3 OF 10

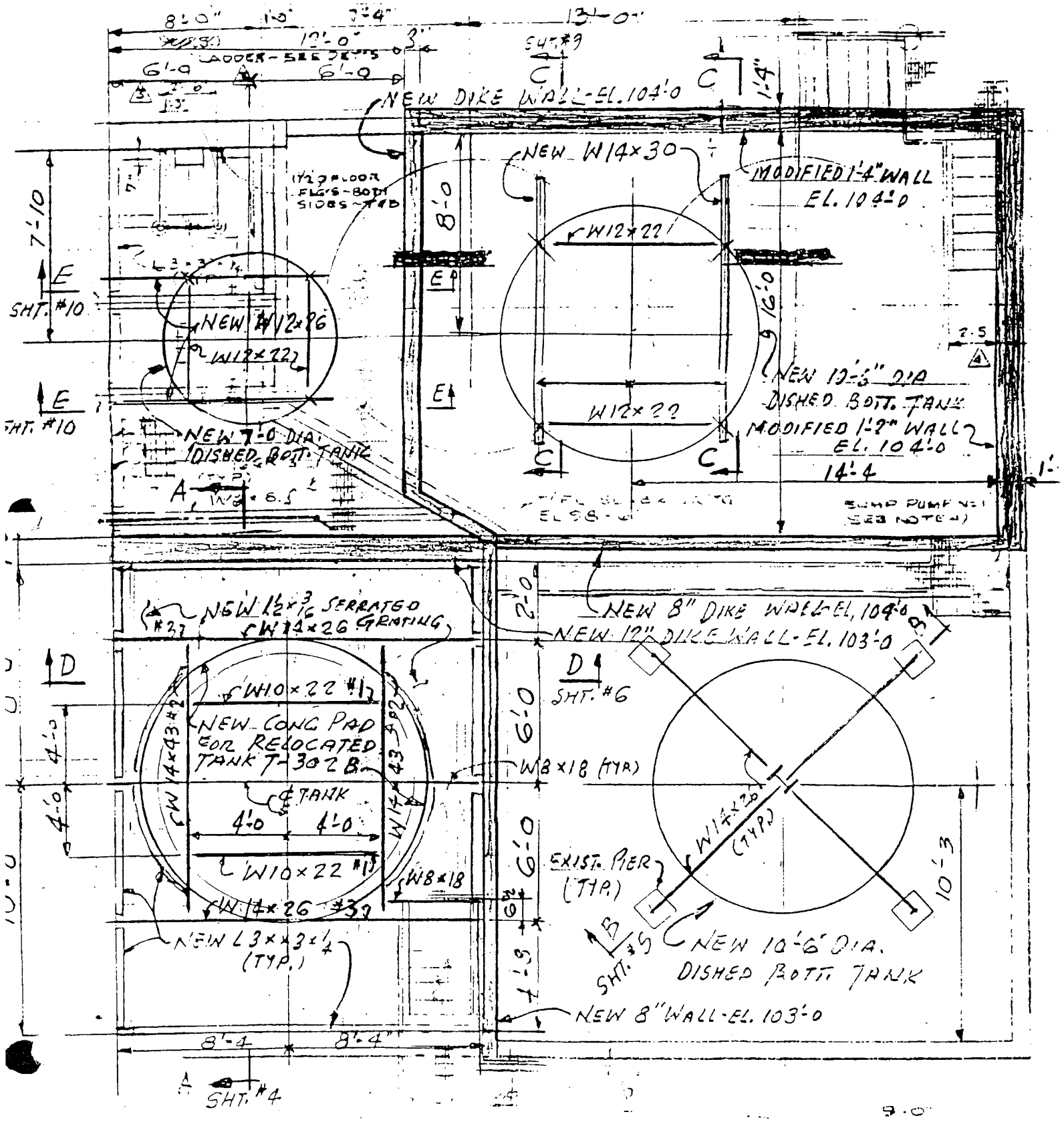
PROJECT CLEAN HARBORS - CHICAGO, ILL.

PROJECT NO. 1785-6

DATE 1.22.00

SUBJECT #22 TANK FARM MODIFICATION

BY P. BERNES S.E.



PLAN OF MODIFIED EXIST. TANK FARM

PROJECT CLEAN HARBORS - CHICAGO, ILL.

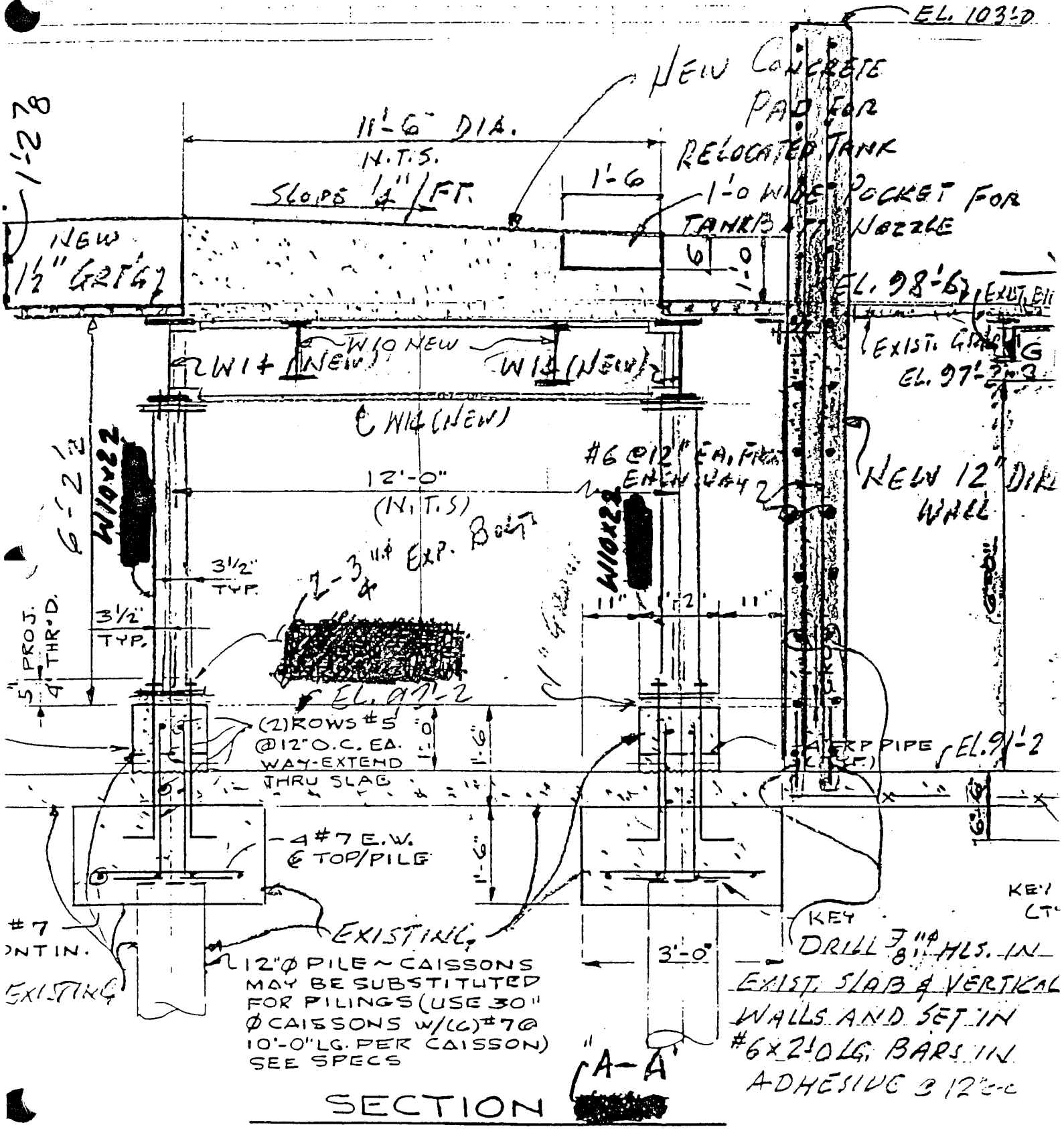
SUBJECT #22 TANK FARM MODIFICATION

SHEET 4 OF 10

PROJECT NO. 1785-6

DATE 1.22.00

BY P. BERNES, S.E.



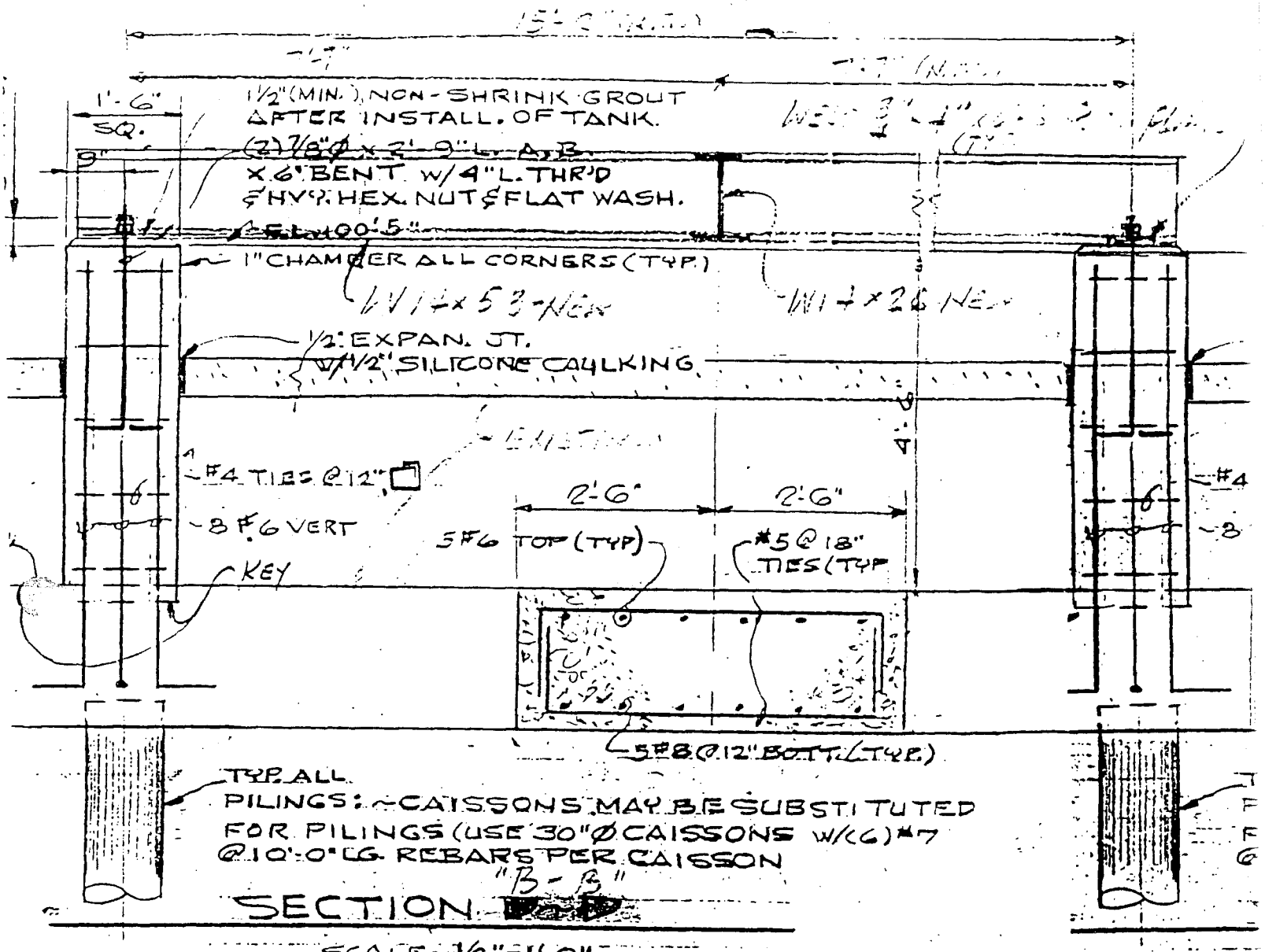
SECTION A-A

SCALE ~ 1/2" = 1'-0"

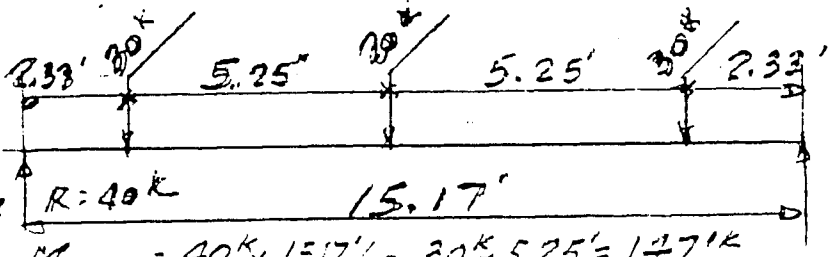
HOYER-SCHLESINGER-TURNER, INC.

SHEET 5 OF 10
PROJECT NO. 1785-3
DATE 1-22-00
BY P. BERNES S.E.

PROJECT CLEAN HARBORS - CALIFORNIA
SUBJECT #22 TANK FLOW MODIFICATION



TOTAL WEIGHT.
FULL = 118K +
PIPING, COL'S AND BEAMS = 120K
PER LEG = 120K/4 = 30K



$M_{MAX} = 40^K \times 15.17'/2 - 30^K \times 5.25' = 147'^K$

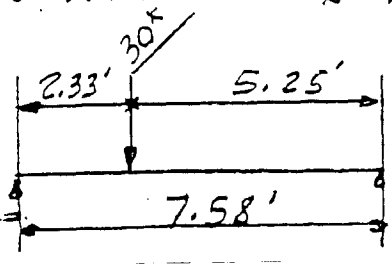
USE W14x53 - $M_R = 156'^K > 147'^K$ O.K.

BEARING = 40K/16"x8" = .3

$t = \sqrt{\frac{3 \times .3 \times 32^2}{27}} = .547"$

.658" > .547" O.K.

WEB BUCKLING RES. = 5.47KSI < 9.11KSI A. O.K.



$R_1 = \frac{30^K \times 5.25'}{7.58'} = 20^K$

$M_{MAX} = 20^K \times 2.33' = 47'^K$

USE W14x22 - $M_R = 58'^K > 47'^K$ O.K.

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, IL

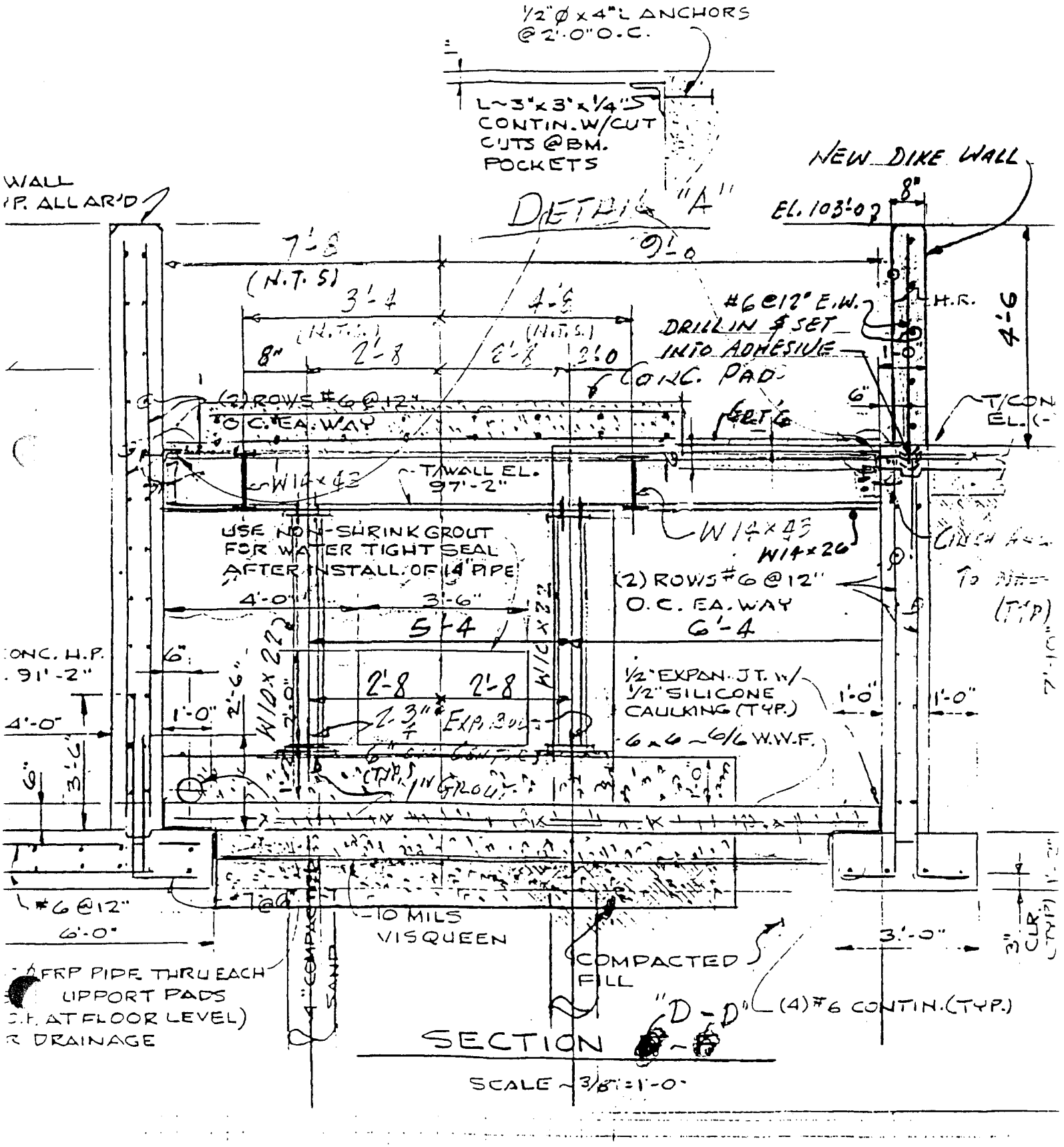
SUBJECT #22 TANK FARM MODIFICATION

SHEET 6 OF 10

PROJECT NO. 1785-6

DATE 1.22.00

BY P. BERNES, S.E.



HOYER-SCHLESINGER-TURNER, INC.

SHEET 7 OF 10

PROJECT CLEAN HARBORS - CHICAGO, IL.

PROJECT NO. 1785-1

SUBJECT #22 TANK FARM MODIFICATION

DATE 1.22.00

BY P. BERNES, S.E

CONCR. PAD (SEC. "D-D" - SEE SHT. #3 & #6)

a) CALCULATE TOTAL LOAD - PSF. FOR RELOCATED TANK T-302 E

CONTENTS = $\frac{10{,}000 \text{ GAL} \times 8.35 \text{ \#/GAL}}{\pi \times 5.25^2}$ = 965 PSF

1/2" THICK BOTT. PL = ONE SQ. FT. = 20 PSF

CONC. PAD = SQ. FT. × 1'-0 HIGH = 150 PSF

TOTAL = 1,135 PSF

b) CALCULATE REINF. REQUIRED (TWO WAY SLAB)

$M = \frac{1.14^{k}/2 \times 8^2}{8} = 4.56^{'k}$

A_s REQ'D = $\frac{4.56^{'k}}{1.76 \times 10} = .26 \text{ IN}^2$

USE #5 @ 12" C-C EA. WAY - TOP & BOTT.

$A_s = .31 \text{ IN}^2 > .26 \text{ IN}^2$ ok.

DESIGN OF SUPPORTING BEAMS & COL'S

a) CALCULATE TOTAL LOAD (SEE SHT'S #3 & #6)

TANK SHELL = $\pi \times 10.5 \times 24 \times 15.3$ PSF = 12,107#

" BOTT PL = $\pi \times 5.25^2 \times 20.4$ PSF = 1,766#

" TOP PL = $\pi \times 5.25^2 \times 10.2$ PSF = 883#

MANWAYS, NOZZLES & PIPING = 2,244#

TANK TOTAL = 17,000#

CONTENTS = 10,000 GAL × 8.35 #/GAL = 83,500#

CONC. PAD = $\pi \times 5.75^2 \times 1.0' \times 150$ PCF = 15,570#

TOTAL = 116,070#

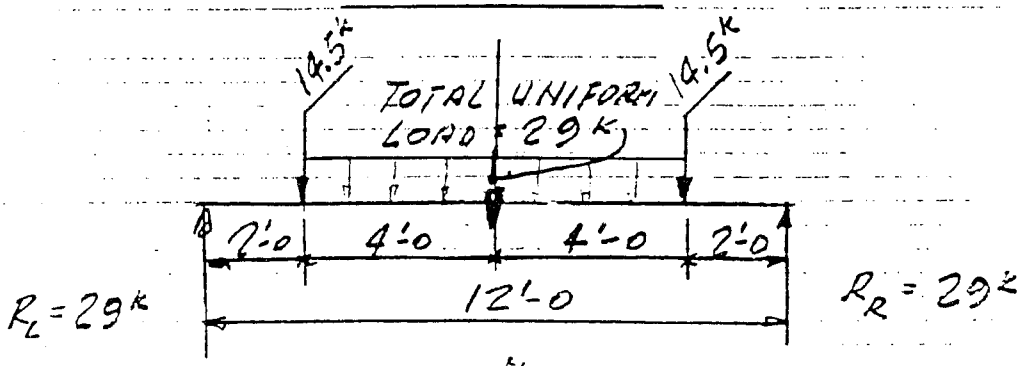
b) DESIGN OF SUPPORTING BEAMS - #1, #2 & #3

BEAM #1

TOTAL UNIFORM LOAD PER BEAM = 116K/4 = 29K

USE W10x22 - ALLOWABLE LOAD = 43K > 29K O.K.

BEAM #2

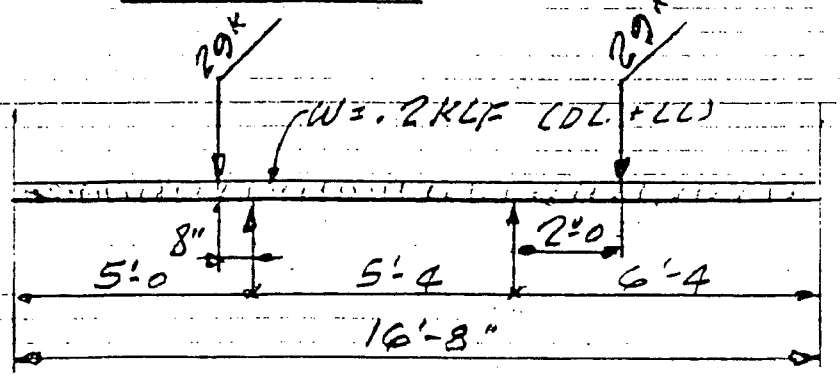


$R_L = R_R = 14.5^K + 29^K/2 = 29^K$

$M_{MAX} = 29^K \times 6' - 14.5^K \times 4' = 203'^K$

USE W14x43 - $M_R = 125'^K > 203'^K$ O.K.

BEAM #3



$M_{MAX} = 29^K \times 2.0' + 6.33' \times .2KLF \times 6.33/2 = 62'^K$

USE W14x26 - $M_R = 77'^K > 62'^K$ O.K.

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, ILL.

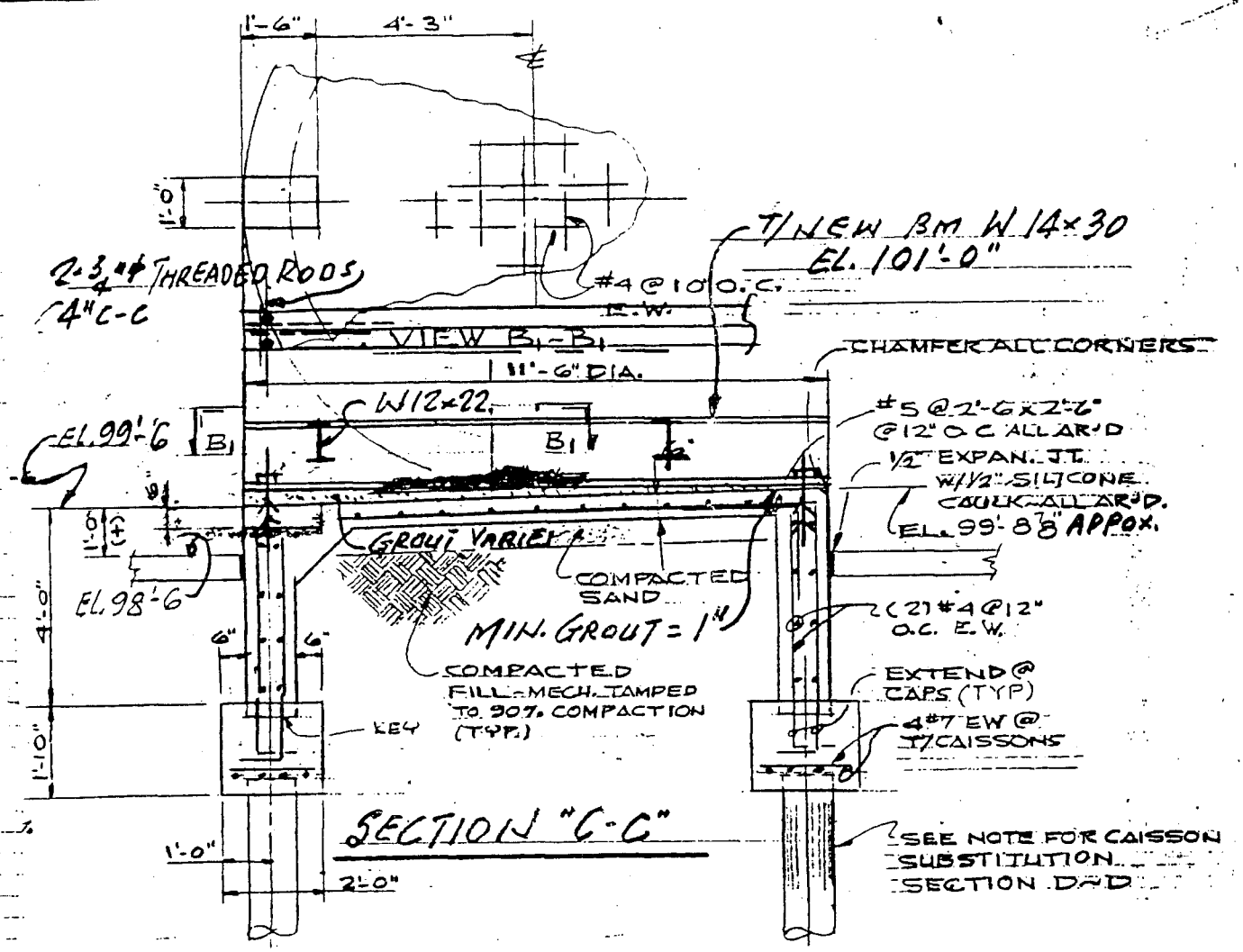
SUBJECT #22 TANK FARM MODIFICATION

SHEET 9 OF 10

PROJECT NO. 1785-6

DATE 1.22.00

BY P. BERNES, S.E.

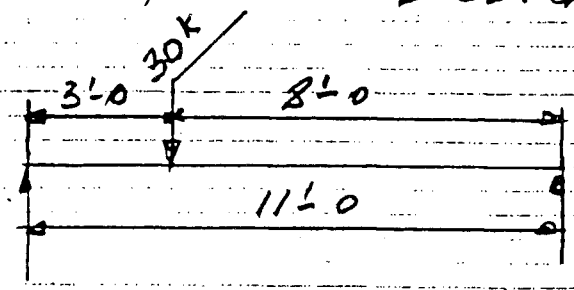


DISHED BOTTOM TANK SUPPORT BEAM DESIGN

TANK FULL = 118K
MISC. = 2K

TOTAL = 120K

LOAD PER LEG = 120K/4 = 30K



$R_L = \frac{30^K \times 8'}{11'} = 21.8^K$

$M_{max} = 21.8^K \times 3' = 65.45'^K$

USE W 14×30 $M_R = \frac{22 \times 41.9}{12} = 76.8'^K$

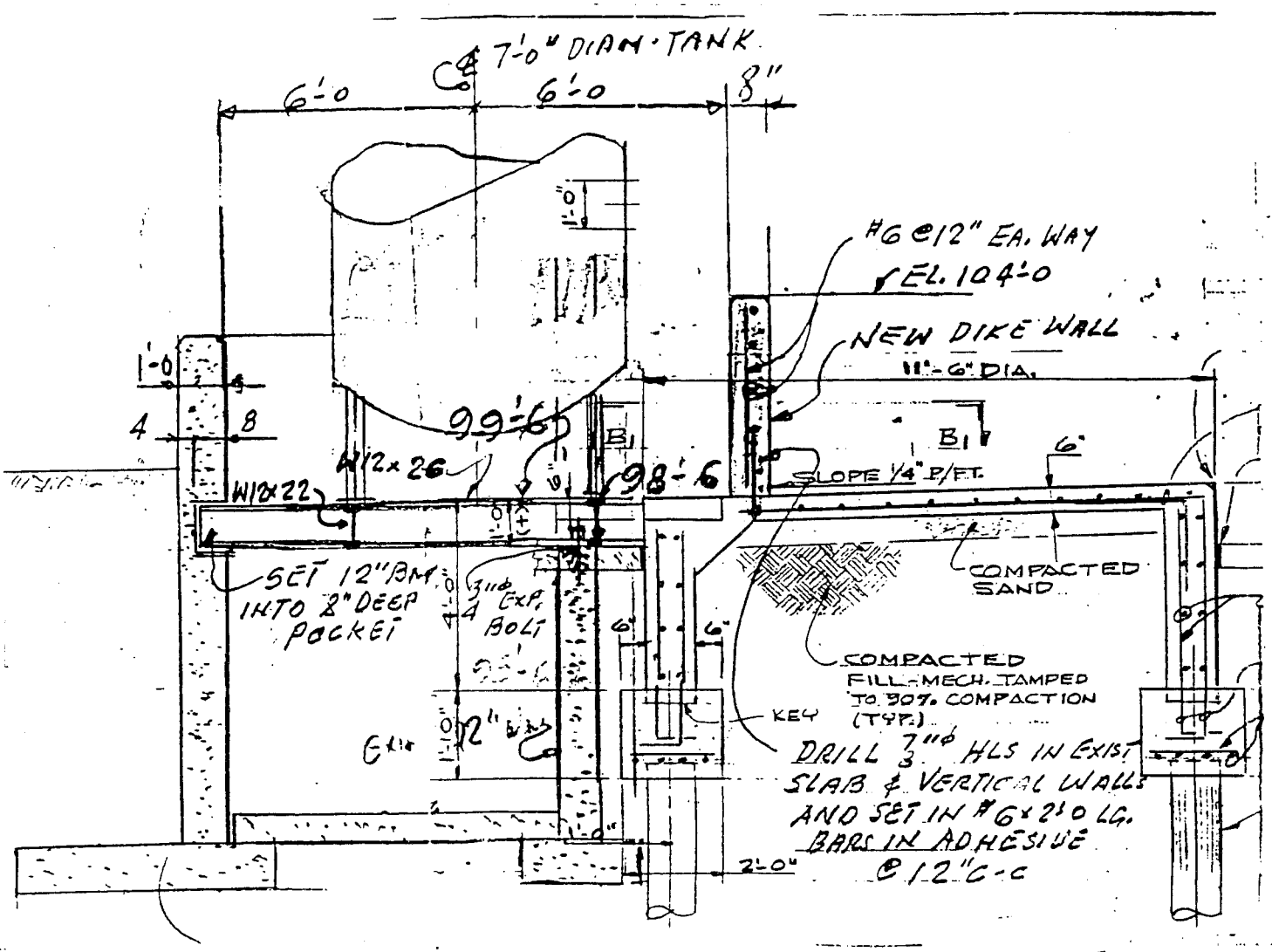
$76.8'^K > 65.45'^K$ O.K.

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, ILL.

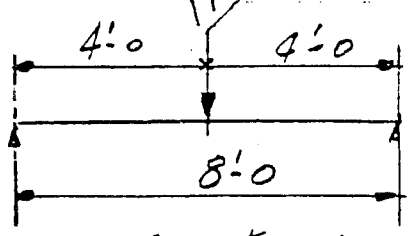
SUBJECT #22 TANK AREA MODIFICATION

SHEET 10 OF 10
PROJECT NO. 1785-6
DATE 1.22.00
BY P. BERNES, S.E.



SECTION "E-E"
(SEE SHT. #3)

16,000 GAL. TANK = FULL TANK WEIGHT = 71.58^K
SP. GR. = 1.2 EMPTY VESSEL = 10.17^K
LOAD PER LEG = 71.58^K/4 = 17.90^K



R: $\frac{17.90^K \times 4}{8}$ = 8.95^K

$M_{MAX.}$ = 8.95^K x 4' = 35.80'^{K}

USE W12x26 M_R = 63'^{K} > 35.80'^{K} O.K.

H-S-T

HOYER-SCHLESINGER-TURNER,Inc.
CONSULTING ENGINEERS
3074 University Ave.
Highland Park, IL 60035
Phone: 847/461-0470 Fax: 847/266-9829

I hereby certify that I, the undersigned am a Professional Engineer, licensed to practice in the State of Illinois. I further certify that the truck/roll-off loading/unloading pad Unit 69 was designed under my direc supervision and the design incorporates good engineering practices. Th structural design of Unit 69 is suitable for intended use. Foundations floors and containment slabs are designed for intended load and wil maintain structural integrity without failure. Water stops have bee incorporated in the design, wherever necessary.

Prior to coating, the concrete surfaces will be inspected for crackin and properly repaired if necessary.

The containment area will be coated with a 30 to 40 mil coat o Protecto-Coat 900 or equivalent in accordance with the manufacturer' recommendations. After careful consideration of all stored chemicals an discussion with the coating manufacturer representative, this was selecte as the most suitable coating. Technical specifications are listed Appendix D-10.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a syste designed to assure that qualified personnel properly gather and evaluate th information submitted. Based on my inquiry of the person or persons wh manage the system, or those persons directly responsible for gathering th information, the information submitted is, to the best of my knowledge and belief true, accurate and complete. I am aware that there are significan penalties for submitting false information, including the possibility o fine and imprisonment for knowing violations.

Engineer Seal

Amos Turner 01-26-00
Amos Turner Date

Hoyer-Schlesinger-Turner, Inc.
3074 University Avenue
Highland Park, IL 60035
847 461-0470

AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

EXP. DATE 11-30-00

Structural Calculations

For

Clean Harbors
Chicago, Illinois

Preliminary Foundation

January 20, 2000

By

Smith & Monroe & Gray Engineers, Inc.

PHILLIP W. RENYER
062042502
REGISTERED
PROFESSIONAL
ENGINEER
STATE OF ILLINOIS

1/20/2000

SMITH & MONROE & GRAY ENGINEERS, INC.

CIVIL & STRUCTURAL ENGINEERS
MATERIAL HANDLING & MECHANICAL

CLIENT SSI
PROJECT CLEAN HARBORS
CHICAGO, IL
BY PWR DATE 11/22/99 REV.
JOB NO. 99214 B SHEET 1 OF 15

PRELIMINARY

DESIGN DATA:

MIX TANK - 25.3 K

LAMELLA TANK - 138.6 K

STRUCT. FRAME - 150.0 K

313.9 K

MAX. LOAD TO ONE COLUMN

VERTICAL = 120 K

LATERAL LOAD TO BE 10%

OF TOTAL D.L.

C.G. OF D.L. & MATERIAL

AT 40' ABOVE BASE PLATES.

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MATERIAL DATA:

SOIL BRG. = 2000 PSF BASIC

CONCRETE F'_c = 4000 PSI

REBAR F_y = 60,000 PSI

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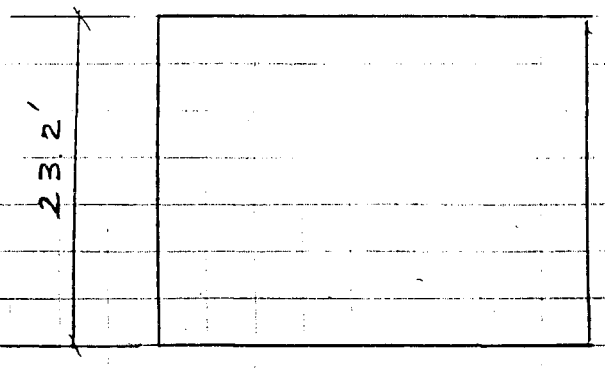
JOB NO. 99214 B SHEET 3 OF

CHECK FOOTING FOR TOTAL STRUCTURE LOAD -

MAX. P = 314 ^{k}

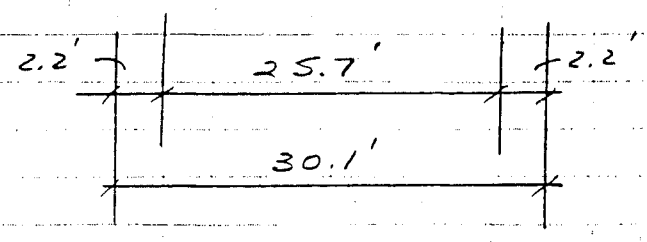
FOOTING AREA = 23.2' x 30.1' = 698 FT^2

$f_{BRG} = \frac{314}{698} = .45$ KSF



$F_{BRG.}$ = 2.0 KSF -

1.5(.15) = 1.77 KSF



.45 < 1.77 KSF ∴ OK

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JOB NO. 99214 B SHEET 4 OF

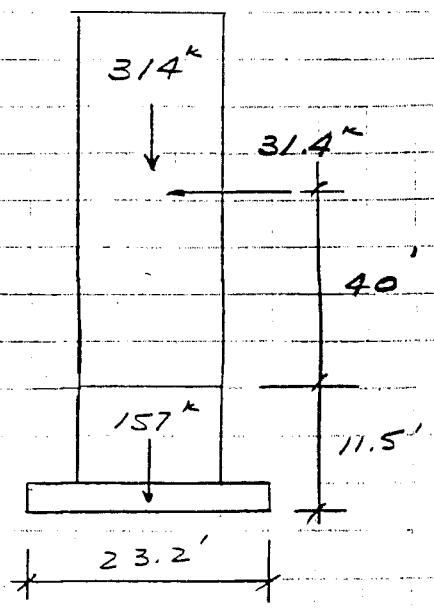
FIND MAX. HORIZ. LOAD TO COLUMNS

$= 314 \quad (.10) = 31.4^k$

$31.4/8 = 3.9^k$/COLUMN

FOOTING WT. =

$.15(1.5)(698) = 157^k$



O.T.M. $= 31.4(51.5) =$

$1{,}617'^k$

RESIST. M. $= (314 + 157)\left(\frac{23.2}{2}\right) =$

$5{,}464'^k$

OVR. TUR. S.F. =

$5{,}464/1{,}617 = 3.4 > 1.5 \therefore$ OK

$S = \frac{bh^2}{6} = \frac{30.1(23.2)^2}{6} = 2700 \text{ FT}^3$

$f_B = 1617/2700 = .60$ KSF <

$F_B = .45 + .15(1.5) = .67$ KSF $\therefore$ OK

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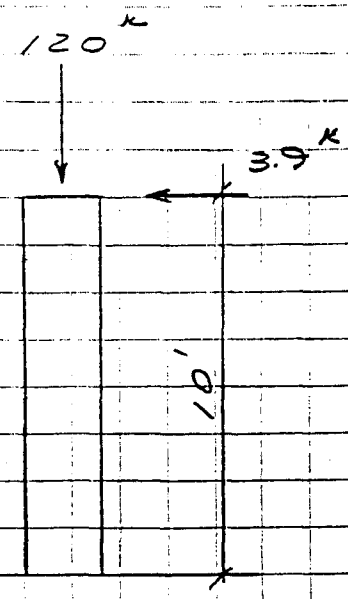
JOB NO. 992148 SHEET 5 OF

CHECK SINGLE COLUMN 20" x 26" FOR

MAX. VERT. LOAD = 120^k

MAX. HORIZ. LOAD = 3.9^k



$M = 3.9\,(10) = 39.0^{'k}$

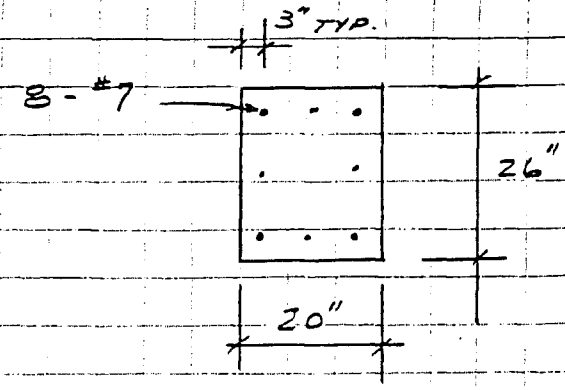
$M_u = 39.0^{'k}\,(1.7)(.75) = 49.7^{'k}$

$P = 120^k$

$P_u = 120\,(1.7)(.75) = 153.0^k$

$A_G = 20\,(26) = 520\ IN^2$

$A_s = 8\,(.6) = 4.8\ IN^2$ (8 - #7)



PG. STL. : $\frac{4.8}{520} = .009$

$K = 2.0 \qquad h = 20''$

$l_u = 10'\,(12) = 120''$

$Klu/h = \frac{2\,(120)}{20} = 12$

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$P_u / A_G = 120/520 = .23$ KSI

$\delta e / h = \frac{M_u / P_u}{20} = \frac{49.7(12)}{153(20)} = .195$

THEN MIN. $e = .195(h) = .195(20) = 3.9''$

$r = \frac{14''}{20''} = .7$

USE .60 FROM ACI TABLES

$\delta e / h = 1(2)/20 = .10$

$\rho_G = .10$

ULT. AXIAL LOAD = 1.65 KSI

1.65 > .23 ∴ OKAY

CONCRETE PIER 20" x 26" OKAY

FOR STRESS.

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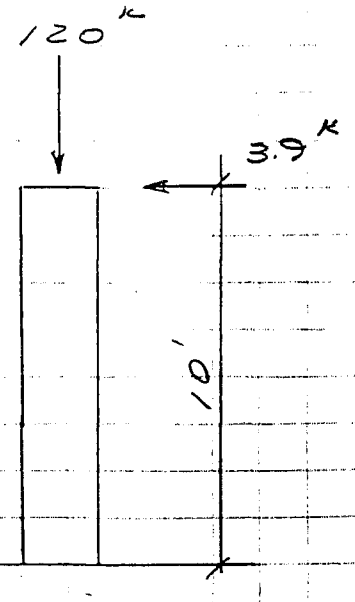
CHECK SINGLE COLUMN 14" x 17" FOR

MAX. VERT. LOAD = 120^k

MAX. HORIZ. LOAD = 3.9^k



$M = 3.9\,(10) = 39.0^{'k}$

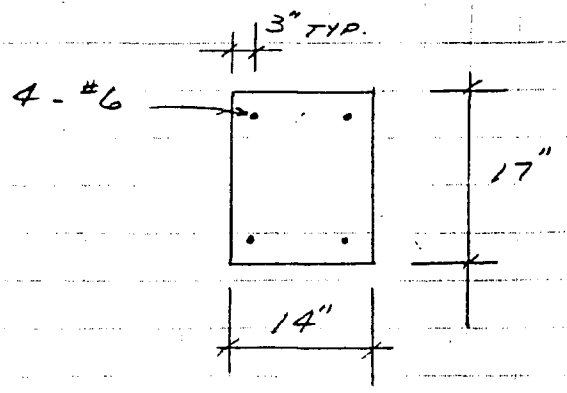
$M_u = 39.0^{'k}\,(1.7)(.75) = 49.7^{'k}$

$P = 120^k$

$P_u = 120\,(1.7)(.75) = 153.0^k$

$A_G = 14(17) = 238\ IN^2$

$A_s = 4(.31) = 1.24\ IN^2$



$P_G.\ STL. = \frac{1.24}{238} = .005$

$K = 2.0 \qquad h = 14''$

$l_u = 10'\,(12) = 120''$

$Kl_u/h = \frac{2(120)}{14} = 17 > 12$

DETERMINE SLENDERESS

$\gamma = \frac{14 - 3(2)}{14} = .57$

FOR $\rho = .005$ $\quad h_e/h = 1.0$

$P_u(1 + \beta_d)/A_g = 153(1+0)/14(17) = .65$ KSI

THEN $\delta/C_M = 1.43$ ACI COL. 2.10 PG 287

$C_m = 1.0$

$e = M_u/P_u = \frac{49.7(12)}{153} = 3.90''$

$\delta e/h = \frac{1.43(3.9)}{14} = .40$

IF $\rho_g = .01$ ULTIM. AXIAL STRESS

WOULD EQUAL .91 KSI

HOWEVER $\rho_g = .005$ THEN MAX. P

MUST BE 2 × DESIGN STRESS.

$2(.65) = 1.30 > .91$ THUS NO GOOD.*

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MIN. FLEXURAL STRENGTH OF COLUMN

IN SEISMIC ZONE II OR MORE :

$A_g f'_c/10 = 520(4)/10 = 208^k$

$P_u = 120^k < 208^k$ - 1921.4.2.1

SPECIAL REQUIREMENTS WILL NOT

BE NECESSARY

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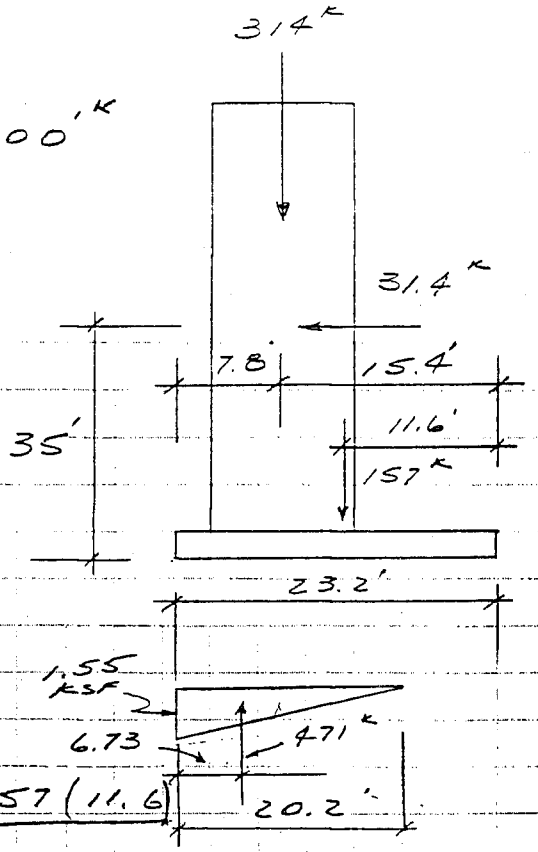
CHECK OVERTHRENING



O.T.M. = 31.4(35) = 1,100 'K

RESIST. M. = 314(7.8) + 157(11.6) = 4270 'K

S.F. = $\frac{4270}{1100}$ = 3.88

3.88 > 1.5 ∴ OK.

FIND RESULTANT

$$\frac{314(15.4) + 31.4(35) + 157(11.6)}{314 + 157}$$

16.47' 23.2 - 16.47 = 6.73'

6.73(3) = 20.2

Fa MAX. = $\frac{P(2)}{A} = \frac{471(2)}{20.2(30.1)}$ = 1.55 KSF

1.55 KSF > 2.00 KSF ∴

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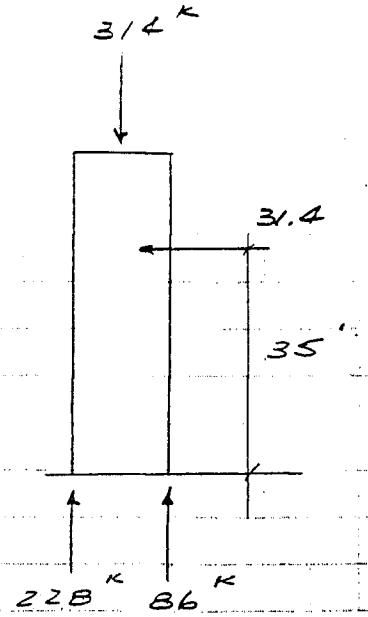
$314(7.7) + 31.4(35) = 228^k$

$314 - 228 = 86^k$

$228/30.1 = 7.6^k/FT.$

$86/30.1 = 2.9^k/FT.$



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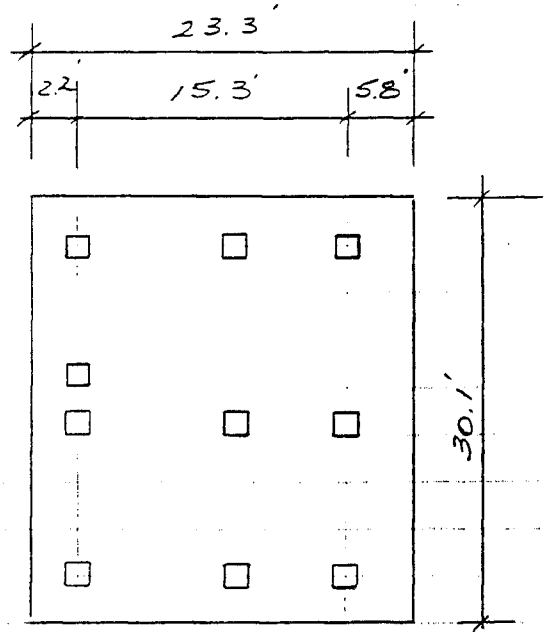
CHECK REINFORCING



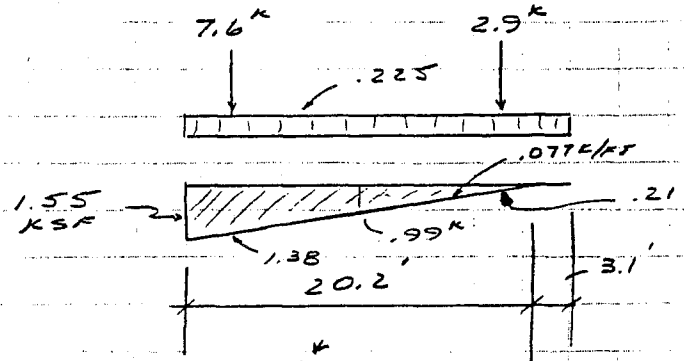
$1.55 / 20.2 = .077 k/ft$

$V_{1_L} = \left[\frac{1.55 + 1.55 - 2.2(.077)}{2}\right](2.2)$

$- .225(2.2) = 2.73^k$

$V_{1_R} = 7.6 - 2.73 = 4.87^k$

FIND 0 SHEAR @



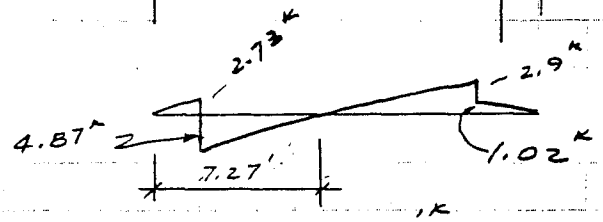
$7.6 + .225x - 1.55x + \frac{.077x^2}{2} = 0$

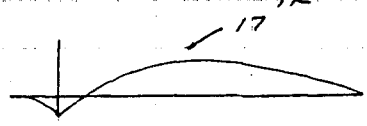
$x = .0385x^2 - 1.325x + 7.6$

$x = 7.27'$

$.077(7.27) = .56^k$

$1.55 - .56 = .99^k$





Mom @ 7.27' $= -\frac{.99(7.27)^2}{2} - \frac{(1.55-.99)(7.27)}{2}\left(\frac{2}{3}\right) + \frac{.225(7.27)^2}{2}$

$+ 7.6(7.27 - 2.2) = 17.0'^k \quad (12) = 204''^k$

MOM @ 2.2' = $\frac{(1.55-1.38)(2.2)^2}{2}\frac{2}{3} - \frac{1.38(2.2)^2}{2}$

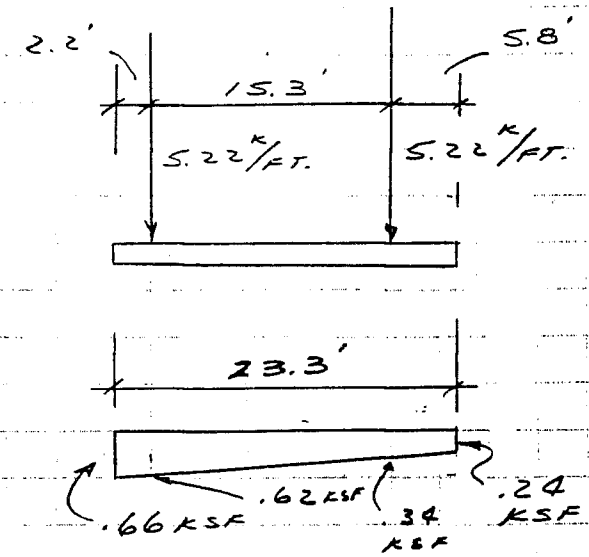
$+ \frac{.225(2.2)^2}{2} = -2.52'^{k} (12) = -30.3''^{k}$

FIND MAX. MOM. FOR L.L. + D.L.

CONDITION.

314/30.1 = 10.44 K/FT

10.44/2 = 5.22 K/FT.



$\frac{10.44(5.8 + \frac{15.3}{2})}{10.44} = 13.45'$

$e = \frac{23.3}{2} - 13.45 = -1.8'$

$M = 1.8(10.44) = 18.8'^{k}$

$A = 23.3 FT^2 \quad S = \frac{(23.3)^2}{6} = 90.5 FT.^3$

$P/A \pm M/S = 10.44/23.3 \pm 18.8/90.5 =$

.45 ± .21 OR .66 MAX. & .24 MIN.

.42/23.3 = .018 K/FT.

MAX. MOM. @ $5.22 - .66x + \frac{.018x^2}{2}$

x = 9.02'

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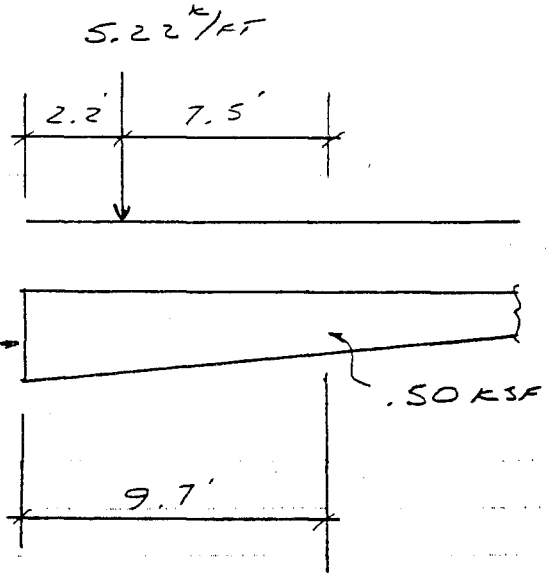


$.66 - 9.02(.018) =$

$.50$ KSF

$M = 5.22(7.5) - \frac{.5(9.7)^2}{2} - \frac{.16(9.7)^2}{2}\frac{2}{3} =$

$\underline{10.61}$ 'K

$10.61(12) = 127$ "K

MAX. MOM. = 204 "^{k}

M_u = 204(1.65) = 337 "^{k}

$\bar{M}$ = $A_s f_y jd$

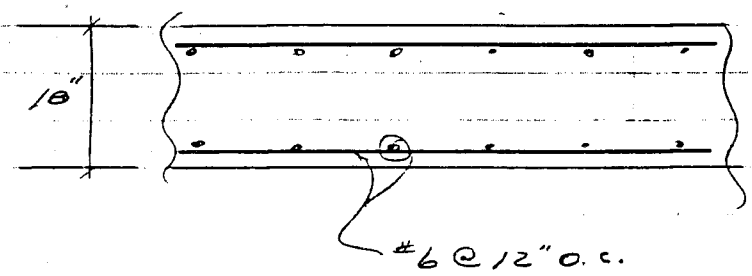
#6 @ 12" o.c. - A_s = .44 in^2

f_y = 60 ksi jd = (24 - 4)(.8) = 16"

$\bar{M}$ = .44(60)(16) = 422 "^{k}

$M_u < \phi \bar{M}$ = 337 "^{k} < .9(422) =

337 "^{k} < 380 "^{k} ∴ OKAY



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PRELIMINARY BUILDING DESIGN

W.L. = 90 MPH (ASSUMED)

$Q_s = 20.8$ MAX. HT. = 60'

THEN AVE. $C_e = 1.30$

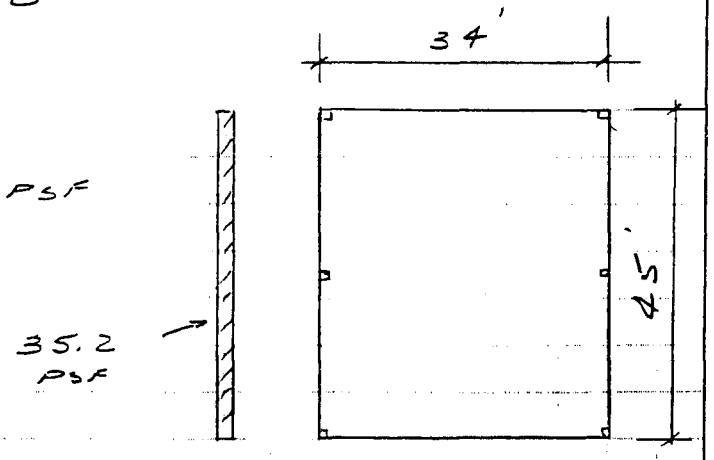
$I = 1.0$

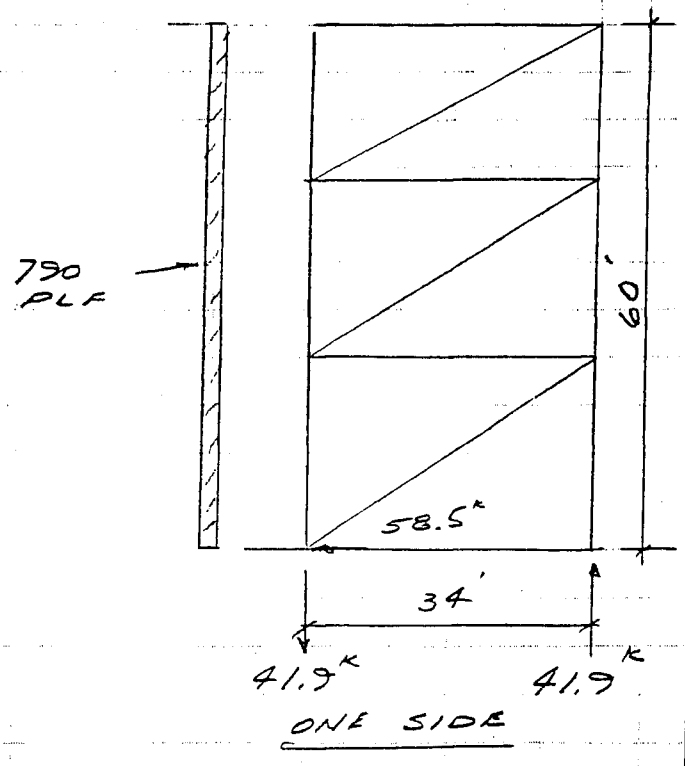
$P = 20.8(1.3)(1.3) = 35.2$ PSF

$V = \frac{35.2(45)}{2} = 790$ PLF

$\frac{790(60)}{1000} = 47.5^k$

$\frac{47.5(60)/2}{34} = 41.9^k$





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D.L. @ WALLS = 6 PSF $\frac{(60)}{1000}\left(\frac{34+22.5}{2}\right) = 10.2^k$

D.L. @ ROOF = $\frac{8 \text{ PSF}}{1000}\left(\frac{34}{2} \times \frac{22.5}{2}\right) = 1.5^k$

TOT. MIN. D.L. 11.7^k

41.9 (1.5) = 62.9 UPLIFT

$62.9 - 11.7 = 51.2^k$

CONC. REQ'D. = $\frac{51.2}{.15}$ 342 CU. FT.

TRY - 10' x 10' FTG. THEN

$342 / 10 \times 10 = 3.4'$ DEPTH

USE 3'-6" x 10' x 10' FOOTING.

SMITH & MONROE & GRAY ENGINEERS, INC.

CIVIL & STRUCTURAL ENGINEERS
MATERIAL HANDLING & MECHANICAL

CLIENT SSI
PROJECT
BY PWR DATE 12/20/99 REV.
JOB NO. 99214B SHEET B-3 OF B-3

DESIGN FOOTING @ TANK

9' ϕ × 14' HIGH -

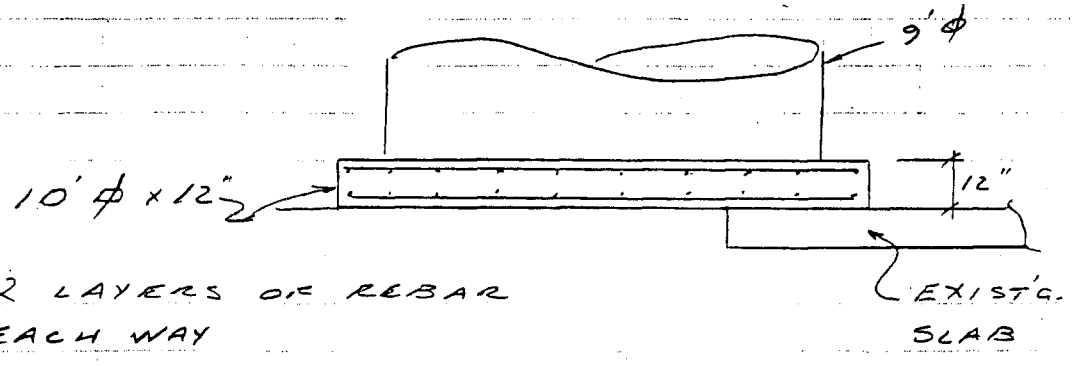
CAPACITY = $\pi(4.5)^2(14)$ = 890 CU. FT.

WT. @ 80 PCF

TOT. WT. = $\frac{890\ (80)}{1000}$ = 71.3 K

SLAB @ 10' ϕ - AREA = 100 SQ. FT.

$f_a = P/A = 71.3/100 = .71$ KSF



MIN. REIN. = .0020 (12)(12) = .29

SAY #5 @ 12" O.C. E.W.

Appendix D-43

Shredder/Hydropuplar Operations Manual

3.0 SYSTEM DESCRIPTION

3.1 ELECTRICAL SYSTEM

3.1.1 General

The shredding system is monitored and controlled by an Allen-Bradley PLC-5 series programmable controller. The controller interacts with the shredding system through a network of panel view display control buttons, limit switches, sensors and valves. This network is referred to as the "control circuit". Almost all of the control circuitry is routed into and out of the PLC-5 (There are a few control devices on the hydraulic power unit that are "hard wired"). The PLC-5 is programmed using ladder logic. The ladder logic "software" is what controls the interaction of the various elements of the system.

The "power circuit" is the (high-voltage) circuit used to drive the electric motors that run the hydraulic pumps (see below).

The power circuit is 480 volt, 3-phase, 60 Hz.

3.1.2 Control Circuit

The control circuit is 120 volt, 1-phase, 60 Hz.

Control circuit wiring on the main stack of the system conforms to Class 1, Division I, Groups C & D.

The "hot" leg of the control circuit is drawn of the left side of the electrical schematic. The right side of the schematic is "common". Each wire should have a number that corresponds to the schematic.

3.1.3 Programmable Controller

The operation of the shredding system is controlled by the Allen Bradley PLC-5. If the program needs to be changed for any reason, please consult SSI.

PLC-5 Users manuals are available from the factory. If there are any questions, please contact SSI.

The program is contained on RAM chips. If power is lost to the PLC-5, a battery will maintain the program for at least one year.

3.2 HYDRAULIC SYSTEM

3.2.1 General

The hydraulic system consists of four circuits; TWO open loop, fixed displacement shredder drives; one open loop, variable displacement, pressure compensated circuit to operate all hydraulic cylinders; and one open loop, variable displacement, pressure compensated circuit to operate the transfer auger. Each circuit is driven by a separate pump. The shredder drive circuits use a 200 hp electric motor coupled to a tandem vane pump assembly. The cylinder and auger circuits are driven off a 200 hp electric motor.

3.2.2 Shredder Drives

(see drawing 01-4568-D)

An open-loop hydraulic circuit is used. The electric motor drives a hydraulic pump which supplies oil to the hydraulic motor (mounted on the shredder). From the motor, the oil returns to the hydraulic reservoir. If the flow to the motor is reversed, the hydraulic motor will reverse. As shredding loads increase, the drive pressure increases. If the drive pressure exceeds a pre-set "reversing pressure", the circuit shifts a small control valve which operates a larger, directional control valve. This changes the rotation of the shredder for a short period before normal operation resumes.

There are both high pressure and low pressure filters in the circuit. Oil cleanliness is critical to maximize shredder performance and component life. Change elements as recommended.

3.2.3 Auger Circuit

(see drawing 01-4568-D)

The auger circuit consists of a drive motor, and a single pump. The pump is a variable displacement, "high pressure" piston pump equipped with a load sense option. The auger can be operated in both directions. When rotating clockwise, when viewed from the drive end, it moves material toward the drive end and into the solids auger. When rotating counter clockwise, when viewed from the drive end, it moves material away from the drive end and into the hydropulper. A 4- way 3 position valve controls the direction of rotation of the auger. A pressure switch indicates when the auger is jammed and it will automatically change rotation direction in an attempt to unjam itself. If the unjamming sequence is not successful the auger will stop and an auger jam fault will occur.

3.2.4 Cylinder Circuit

(see drawing 01-4568-D)

The cylinder circuit operates all of the hydraulic cylinders on your shredding system such as: drum ram, airlock infeed door, airlock discharge door, and the hopper ram. The cylinder pump is mounted behind the auger pump. It is a variable displacement piston pump. It is equipped with a pressure compensation control which can be adjusted. The operating pressure has been pre-set by SSI. Please do not attempt to adjust the operating pressure of the cylinder circuit without consulting SSI first. Equipment can easily be damaged if operated with too much pressure.

The cylinder pump delivers hydraulic oil to the cylinder valve manifold on the HPU. When the valves are not energized, the circuit does not move any oil and the pump displacement goes to "zero gpm" (some flow occurs through the case drain of the pump). If a valve is energized, the pressure momentarily drops in the circuit and the pump displacement is automatically increased to handle the flow requirements of the cylinder circuit.

3.3 DRUM LIFT

(see Essex Manual for S/N ER5813)

The drum lift will hoist two 55-gallon drums or one 85-gallon and one 55-gallon drum or one 48 x 48 x 48 cardboard Gaylord box to the floor of the airlock. The lift is designed to handle a maximum payload of 3000 lbs. It is equipped for 2 speed operation using two 3 way four position valves. To raise the lift the single DO8 valve is energized. To lower the lift both the DO8 and DO5 valves are energized and the combined flow is used. The lift is equipped with an infeed safety door and a "live roller" car. The lift car has two (2) photo-eyes to ensure the load is correctly positioned for loading and ascent.

The drum lift car position limit switches on the drum lift are "normally closed" as a fail-safe device in the event of a short in the control wiring. (Consult the system electrical schematic for details.) The drum lift is outfitted with several safety features. If a cable should break, the slack cable limit switch will detect the event and the PLC-5 will stop the drive motor. The lift car is equipped with a cam mechanism that will actuate clamping "dogs" in the event of a slack cable. In the automatic run mode, the car cannot move unless the safety door is closed. The upper and lower park positions for the car have dual limit switches.

3.4 INFEED HOPPER & AIRLOCK

(see Hopper/Airlock Assembly 01-4705-D)

The infeed hopper is equipped with an integral airlock and an assist ram to aid in feeding drums into the primary shredder. The hopper and airlock is also equipped with deflagration doors and ports for heat detectors, CO_2 injection nozzles, oxygen sampling ports, and nitrogen injection. The hopper is designed to withstand a peak pressure of 5 psig during a deflagration. The deflagration doors are designed to open at 0.2 psig and are equipped with limit switches which indicate if the door is not closed.

The airlock is built into the hopper assembly and consists of a separate chamber where drums are staged before being dropped onto the primary shredder. The infeed door is located between the drum lift and the hopper. The floor of the airlock is the discharge door. The door slides into an enclosed box. When the floor is fully open, the contents of the airlock can pass into the shredder throat. The airlock is equipped with nitrogen injection ports. After drums are placed into the airlock, nitrogen is injected for a pre-set amount of time to purge the chamber of oxygen. The floor surface as well as all guide channels are equipped with replaceable wear-strips of UHMW.

3.5 TRANSITION AND MAGNETIC - SEPARATOR CHUTES

The transition chute (located between the upper and middle shredders) and the magnetic separator chute (located below the lower shredder) are equipped with ports for heat detectors, CO_2 injection, oxygen sampling and nitrogen injection.

MAGNETIC SEPARATOR
(See Drawing 01-4750-D and ERIEZ manual)

The magnetic separator rotates continuously during the shredding process. The magnet pulls the metal from the stream and discharges it in a duct to the METAL WASHER. The position of the magnet within the non metallic housing is adjustable using the turnbuckle. See ERIEZ manual in VENDOR LITERATURE section. There is an adjustable baffle above the magnet which adjusts the direction of flow of material onto the magnet.

3.6 AUGER

The auger drive program is equipped to detect a jam and reverse the auger for a pre-determined (programmable) amount of time. It automatically reverses the auger if a jam is encountered. If the jam is not cleared after successive attempts the auger stops & a ALARM message is sent to the PANEL VIEW screen.The system will go into a fault mode indicating that the auger is jammed.

3.7 CONTROL PANELS

(See drawing 01-4316-B)

NOTE: All EMERGENCY STOP buttons, regardless of their location, have the same effect - activating the button will cut control power off to the system and everything will stop. The button must be manually pulled out in order to remove the condition. The HPU and shredding system must then be re-started.

3.7.1 PRIMARY CONTROL PANEL (CP1)

3.7.1.1 Control Buttons & Switches

The PANEL ENERGIZED light indicates when the 2 pole 10 Amp breaker is on and there is 110 V supplied to the panel.

The CP1 contains the CONTROL POWER ON key switch and SYSTEM / ON RESET button. These controls allow the PLC-5 to send and receive control signals. Any time control power is cut off, (power failure, emergency stop, control power "off") the SYSTEM ON/RESET button must be pressed to resume operation.

The SYSTEM is primarily controlled through the PANEL VIEW SCREEN (See SYSTEM OPERATING DESCRIPTION for details).

The six hpu PUMP RUN and PUMP STOP buttons allow these units to be operated in the event of a PANELVIEW FAULT. They are not used during normal operation but the STOP buttons will always work.

The "MAINTENANCE OVERRIDE key switch is intended to be used for positioning and testing equipment during maintenance. The maintenance override light indicates that the system has been switched into maintenance override.

With the MAINTENANCE OVERRIDE key switch on, PANELVIEW functions operate individually. These should be used only to position equipment during maintenance procedures.

DANGER!!

- IMPROPER USE OF THE MAINTENANCE OVERRIDE KEY SWITCH CAN CAUSE DAMAGE TO EQUIPMENT OR INJURY TO PERSONNEL.
- IN MAINTENANCE OVERRIDE, O_2 AND N_2 SYSTEMS ARE NOT OPERATIONAL. HAZARDOUS MATERIAL SHOULD BE REMOVED BEFORE GOING INTO MAINTENANCE OVERRIDE.
- WHEN SERVICE IS BEING PERFORMED, THE SYSTEM ELECTRICAL POWER MUST BE SHUT OFF AND THE BREAKERS LOCKED OUT TO PREVENT OPERATION OF THE EQUIPMENT.

The camera switch turns on power to the five cameras and monitors. The cameras are powered from a single 24 V transformer located in the CP1.

The lights switch turns on power to the five lights which are provided with each camera.

3.7.2 Drum Lift Control Panel

(see System Operation Description)

The four 3-position selector switches will only operate in MAINTENANCE OVERRIDE or MANUAL condition and are intended for positioning equipment during maintenance or service. These operators will only work if the DRUMLIFT MODE selector on the PANEL VIEW is in the remote position.

DANGER!!

- THE DRUM LIFT IS NOT A PERSONNEL LIFT AND SHOULD NOT BE USED AS SUCH.
- ALL EQUIPMENT SHOULD BE TURNED OFF AND THE MAIN CIRCUIT BREAKERS LOCKED OUT BEFORE SERVICING ANY EQUIPMENT.

The CYCLE START button is the button which opens the lift load door and allows the lift to be loaded. Once loaded, the CYCLE START will start the lift operation.

The OK TO CYCLE light indicates when the system is ready in AUTO mode.

3.7.3 Motor Starter Panels

(see drawing 01-4316-D sheet 5/21)

The motor starter panel, which has the power wiring for SYSTEM is designated MSP1 There is a single breaker with a locking door handle and an E-Stop. The breakers interrupt the 480 V power to the HPU.

3.7.4 Fire Suppression Equipment (CO_2)

(see Fire Suppression manual and drawing 01-4316-B sheets 19 & 20)

DANGER!!

- PART OF THE FIRE SUPPRESSION EQUIPMENT IS BEING INSTALLED IN COMPONENTS NOT SUPPLIED BY SSI. It is the customers responsibility to

The shredding system is equipped with EIGHTEEN heat detectors: two in the airlock; two in the roof of the infeed hopper; two in the roof of the transfer chute; two in the magnetic separator housing, two 2 in the hydrapulper, two in the metal chute and 6 in the metal washing equipment. In addition to the detectors there are 6 manual pull stations.

If any of these detectors go off, or a pull station is activated, a fire control panel sets off an alarm horn and discharges 200 pounds of CO_2 into the shredder stack. In addition, the alarm signal is sent to the PLC-5 controller and the effect is the same as an Emergency Stop - the system power is cut off. The fire control panel is equipped with battery back up and trouble detection. If the power goes off, the batteries continue to operate the system. If there is a problem with the detection wiring, the control panel indicates there is a problem and the PLC-5 uses the signal to stop operation of the system. An ALARM will appear on the PANEL VIEW screen.

3.7.5 Nitrogen Purging

The shredding system features a nitrogen distribution system that dispenses nitrogen gas (supplied by customer) into the airlock, the shredder stack, the hydrapulper and the metal washer. Four nitrogen solenoid valves control the flow of nitrogen to these 4 areas. The nitrogen that is sent into the airlock is controlled as part of the drum feeding sequence. As soon as a drum is fed into the airlock and the door is closed, nitrogen is fed into the chamber for a pre-determined amount of time. In addition, the level of oxygen is monitored in three locations on the shredder stack, the hydrapulper and the metal washer. If the concentration in any of these locations goes above a set level, nitrogen is fed into the corresponding area until the oxygen level drops to a lower set point (see Section 2.8 Servomex Settings). Nitrogen is also continuously fed into the hydropulper around the mechanical seal to help protect the mechanical seal.

3.7.6 Oxygen Sampling & Monitor
(see SERVOMEX Manuals)

Samples of gas inside the shredder stack are pulled into an oxygen monitor and tested for the concentration of oxygen. This information is passed to a controller. The samples are obtained using an aspirator pump that is powered by a small bleed-off of nitrogen gas. (see Servomex Manual for complete description). An second aspirator is used to continuously flush the lines which are not being sampled. This reduces the lag time between switching to a specific line and receiving a current O2 % readout for that line.

3.7.7 Deflagration doors

The infeed hopper, airlock, magnetic separator housing and chute below the magnet are equipped with deflagration doors. In the event of an deflagration, the doors open and provide a vent for the expansion of gases. The shredder stack and hopper have been designed to withstand a peak pressure of 5 psig. The door latches must be reset and the doors closed after a deflagration. Ducting from each panel to atmosphere must be installed prior to operating the system. Each door is equipped with a limit switch which sends a signal to the control panel when the door opens.

4.0 INSTALLATION

4.1 GENERAL INSTRUCTIONS

4.1.1 Ambient Temperature

The drive unit is provided with cooling capability under normal operating conditions from 35 degrees F to 100 degrees F. If it is necessary to install the unit in an extremely warm area, consideration should be given to improve air circulation. The drive system temperature should be monitored. Additional cooling might be necessary in some applications to insure a proper operating temperature.

If the unit is installed in an area where extreme cold conditions prevail, precautions should be taken to prevent damage to the components. The lubricating oil should be changed to match the expected operating environment as recommended in the maintenance section of this manual. In addition, when temperatures fall below 30 degrees F, the system should be turned on with no load for approximately twenty (20) minutes to warm the oils.

4.1.2 Cleanliness of Area Around Unit

Although a machine of this type inherently operates in an area, and under conditions, which are often dusty and dirty, precautions should be taken in the planning of the installation to keep the dust to a minimum. Seals prevent dust from entering the bearings. An air filter is also utilized on the gearbox and oil components. All filters should be cleaned as required to insure correct flow of air to these reservoirs. The cover to the gearbox should be closed at all times except, of course, when handling the lubricant or performing required maintenance. When greasing the bearings, all grease fittings must be carefully cleaned before introducing grease into the machine. It is also important to prevent build-up of material around machine components since the material will absorb moisture and cause corrosion of components.

4.2 WIRING

There are no knock-outs provided in the panel enclosures. Customer selects locations for knock outs to accommodate facility wiring.

WARNING!!

- ALL EXTERNAL WIRING, CONNECTIONS, AND INTERLOCK DEVICES MUST BE PROVIDED AND INSTALLED IN ACCORDANCE WITH THE LATEST NATIONAL ELECTRICAL CODES.
- ONLY AUTHORIZED ELECTRICIANS SHOULD INSTALL, MODIFY, AND MAINTAIN THE ELECTRICAL SYSTEM.
- SEALOFFS INSTALLED ON THE EQUIPMENT HAVE NOT BEEN POURED. THEY MUST BE POURED ON SITE PRIOR TO OPERATING THE EQUIPMENT.

The power wiring specifications for the shredder are listed in the unit specifications. A control transformer is used to produce the necessary 120 V, 1 phase, 60 Hertz control supply.

Electrical power wiring must be connected to the circuit breaker and from the starter to the motor. The control wiring (push buttons, key, etc.) is wired at the factory.

Additional wiring hook-ups may be required for optional accessory equipment. Refer to the "Electrical Schematic" drawings for a complete wiring diagram.

4.3 ELECTRICAL SCHEMATIC

(see 01-4316-B 21 shts)

4.3.1 General

The Power Circuit wiring specifications are listed in the unit specifications. The Control Circuit is 120 V, single phase, 60 Hz.

Each control circuit wire has a number that corresponds to the schematic. Each member represents a different electrical position.

4.3.2 Control Circuit

The top line is the tap from an external customer supplied 120 V single phase source.

4.3.3 Programmable Controller

The operation of the shredder is controlled by the Programmable Controller. If the program needs to be changed for any reason, please consult SSI Shredding Systems, Inc.

PC user manuals are available from the factory. If there are any questions, please contact SSI.

The program is contained on RAM chips. If power is lost to the PC, a battery will maintain the program for at least one year.

4.4 HYDRAULIC INSTALLATION

Your hydraulic shredder has been operationally tested at the factory and all of the adjustments properly set. For satisfactory performance, attachment of the hydraulic power unit to the shredder drive motor should follow accepted industry standards. Care must be exercised to prevent system contamination.

NOTE: FOR INSTALLATION OF MOTORS AND PUMPS--FOLLOW INSTRUCTIONS LOCATED IN VENDOR LITERATURE SECTION.

It is recommended that hoses between hydraulic pumps and motors be no longer than 15 feet. If the hydraulic pumps and motors are separated more than 15 feet SSI Shredding Systems recommends installing pipe with hoses on each end. If pipe is to be used, obtain the materials listed below. Before connecting any cylinders, actuators, or motors to the new pipe perform the testing and cleaning procedures listed below. Size hydraulic piping for oil flows of 10 to 20 feet per seconds (refer to the unit specifications for the actual pump flow).

Materials:

Pipe = Pickled and oiled pipe Grade A-106
Fittings = Socket weld type to match hoses

Pressure Testing:

Pre-charge pipes with Nitrogen to 2500 to 2600 psi. Check welds and joints with soap.

NOTE: -- A DROP IN PRESSURE OVER TIME INDICATES A LEAK, BUT NOT NECESSARILY IN THE PIPING.

Pipe Cleaning And Flushing:

Connect ends of pipe together with a hose. (Hydraulic motors, actuators, and cylinders, are not connected in the circuit during flushing.) Flush piping with hydraulic oil for 6 hours at rated flow. Oil temperature during flushing to be 100 F. Visually inspect for leaks after flushing. Change pressure and return filters.

4.5 SYSTEM OPERATION DESCRIPTION

STARTUP PROCEDURE:

(See Electrical Drawings 01-4316-B)

I. General

Oxygen monitoring equipment must be calibrated prior to startup (see Servomex literature).

A. Turn the nitrogen supply on. Turn the Nitrogen supply regulator on to 80-90 psi. Open the hand valve which supplies the nitrogen to the O2 sample panel.

B. Check that the "YELLOW" "PANEL ENERGIZED" light is on. If not Switch the double 10 Amp control circuit breakers ON (IN CP1). Yellow "PANEL ENERGIZED" light (ON CP1) will come on. These breakers should remain "ON" 24 hours, and only switched off for service.

C. Touch PANELVIEW screen to activate it. Go to MAIN SCREEN.

D. Turn cameras & lights ON (on CP1).

E. The fire suppression system must be operational. Only the green "Power on" light on the fire control panel should be on. If the TROUBLE, "yellow" or the ALARM "red" lights are on the system will not operate. Refer to the FIRE CONTROL PANEL section if any of these lights are on.

F. Turn control power KEY SWITCH to ON position (on CP1).

G. Press SYSTEM ON/RESET button. Button will light up. If the button does not light up check that all E-STOPS are out, that the fire control panel is OK and that all the access doors are closed.

H. Check that the MAINTENANCE OVERRIDE key switch is in the OFF position. If not switch it to the OFF position.

I. Press "HPU DETAIL" button on main screen to go to the HPU screen.

II. HPU Startup

NOTE: The buttons on the control panel should not be used during normal operation of the system. They are backups in case of a Panelview fault.

A. The HPU motors will not start unless the following conditions are met. If there is a fault an ALARM screen will automatically appear to tell you where the fault is.

1. Oil level OK
2. Suction valves open
3. No fire general or trouble alarm
4. No HOT OIL temp signal (> 140°F)

B. Press "HPU # 1 START". "HPU # 2 START", "HPU # 3 START" buttons to start the HPU motors. The starts are automatically sequenced.

C. HPU will start with a COLD OIL signal but the equipment will not run until temperature is above COLD OIL setting (80°F).

D. The "FAN TEST" button can be pressed at any time to check the operation of the fan. The fan comes on automatically above the 120 degrees F thermostat setting.

III. AIRLOCK & D.L. STARTING POSITIONS

A. Before going into "AUTO" the doors in the airlock should be fully closed. The DRUM LIFT load door should be closed.

B. At initial startup the Drum Lift car should be in the full down position

C. Turn the "MAINTENANCE OVERRIDE" key on, go to the "INFEED AIRLOCK" & "DRUM LIFT" screens and manually close these doors & lower the Lift Car.

D. Before starting any equipment the following external conditions must be met and an 'EXTERNAL SYSTEMS OK' permissive sent to the PLC.

THESE EXTERNAL PERMISSIVES may consist of the following or additional permissives

1. Building vents operational
2. Thermal oxidizer operating as required by customer.

E. At this point the shredder equipment will start to purge and will continue until the following conditions are met.

1. All O2 readings OK

2. An 'OK TO START EQUIPMENT' permissive is sent out.

F. START THE HYDROPULPER USING RECOMMENDED STARTUP PROCEDURES.

G. START the METAL WASHER

H. START all other downstream equipment which is required for the shredder to operate.

I. A permissive 'OK TO START SHREDDER' is now sent to the PLC. This allows the main shredder system to start.

IV. MAIN SYSTEM STARTUP

A. Go to the AUGER screen:

1. Select auger direction

2. Open the knife gate for the selected direction outlet (bulk solids to transfer auger or liquids to hydrapulper)

B. Return to the MAIN PAGE and press the "SYSTEM AUTO MODE START" button. Permissives required for startup:

1. HPU's running
2. O_2 system readings OK
3. N_2 system functional
4. Fire system OK
5. OK TO START SHREDDER permissive on
6. EXTERNAL SYSTEMS OK permissive on
7. MAINTENANCE OVERRIDE not on
8. MANUAL MODE not on

C. If all permissives are in effect the "AUTO RUN" bit is turned on and the following sequence of events occurs:

1. The auger starts to rotate (see auger section for startup permissives).

2. After a 3-second time delay, the magnetic separator starts to rotate (see magnetic separator section for startup permissives).

3. After a 3-second time delay, the secondary (bottom) shredder starts (see secondary shredder section for startup permissives).

4. After a time delay, 3 sec, the primary, top, shredder starts. See primary shredder section for startup permissives.

5. The hopper ram starts immediately when the primary shredder starts. It extends until it contacts the extend limit switch and has a signal for 1 second (see HOPPER RAM section).

6. The ram retracts fully. A "HOPPER EMPTY" bit is now set. At startup the system assumes there is material in the airlock and will cycle the doors.

7. The N_2 purge solenoid for the airlock comes on & N_2 flows into the airlock for a set time (The value of this timer can be changed in the "INFEED AIRLOCK" screen).

8. The airlock "DOOR OUT" opens fully until limit switch is contacted fully and then closes, until limit switch is contacted. This sets the "AIRLOCK CLEAR" bit.

9. At initial startup the drum lift will be in the full down position.If the drum lift car is in the full up position the AIRLOCK LOADING BEGINS, see "AIRLOCK LOADING".

V. DRUM LIFT OPERATION

A. Go to "DRUM LIFT" screen

B. The drum lift can be operated in a LOCAL or REMOTE mode. The LOCAL MODE allows the lift to be operated from the PV screen. The REMOTE MODE allows the lift to be operated from the control panel on the DRUM LIFT. The DRUM LIFT MODE button on the PV screen is used to switch between the screens.

C. REMOTE OPERATION:

1. When the system is in the auto mode (auto run bit is ON.) and the system is ready to accept Drums:
   a. The "CYCLE START" light flashes

b. The "OK TO CYCLE" comes on solid

2. The operator presses CYCLE START:

   a. The load door opens & rollers start simultaneously
   b. The "CYCLE START" comes on solid

3. The operator loads drums.

4. The drum breaks the rear photo eye.

   a. The rollers stop.
   b. DRUM LIFT LOADED status bit is set
   c. "Cycle start" flashes
   d. "OK TO CYCLE" stays solid

5. The operator pushes CYCLE START to start the lift up

   a. Load door closes
   b. "CYCLE START" comes on solid
   c. "OK TO CYCLE" goes off
   d. Drum lift car starts up
      (1) Permissives
         (a) pusher fully retracted
         (b) Load door fully down

(FROM THIS POINT THE OPERATION IS AUTOMATIC UNTIL THE LIFT CAR COMES BACK DOWN AND THE SYSTEM IS READY TO ACCEPT THE NEXT LOAD OF DRUMS). The operator repeats the steps in "DRUM LIFT OPERATION" above.

6. The lift car stops when:

   a. The center position timer times out (This timer must be set to a time 3 sec. less than the time required for the lift to travel to the full up position)
   b. Sends "OK TO START AIRLOCK INFEED" bit to airlock

7. Once airlock infeed door 1A is fully open the lift continues to its upper position.

8. Pusher extends & immediately retracts. Gives "AIRLOCK LOADED" bit when it is fully extended

9. When pusher is fully retracted:

   a. The lift car goes down
   b. Airlock infeed door closes (see airlock cycle)
   c. "CYCLE START" flashes & cycle repeats

D. LOCAL OPERATION **(This is for use with automatic feed conveyors and may need to be disabled on a manual feeding system)**

1. The operation is the same but opening the lift door & starting the drum lift is done by pressing the button on the "DRUM LIFT" screen. This button has 4 states:

   a. "RAISE DRUM LIFT"
   b. "DRUM LIFT LOADING"
   c. "LOAD DRUM LIFT"
   d. "DRUM LIFT BUSY"

E. FAULTS

1. If lift car hits up overtravel limit switch:

   a. Upper Overtravel latch bit is set
   b. Up solenoid is cut with this bit
   c. Car can only go down
   d. Car must go fully down & contact lower limit to reset bit

2. If lift car hits lower overtravel limit switch:

a. Lower Overtravel latch bit is set
b. Down solenoid is cut with this bit
c. Car can only go up
d. Car must go fully up & contact upper limit to reset bit

3. Watchdog Timers (function in auto mode only):

a. If timers time out power must be cycled to reset them
b. Timer values should be set equal to travel time plus 5-10 sec.

4. Slack Cable

a. This is hardlined into UP & DOWN rungs

OPERATION AFTER STARTUP

VI. AIRLOCK LOADING

A. Cycle Initiation

1. Cycle initiated by loaded lift car making midpoint staging,(center position), timer set point

B. Infeed door

1. In automatic opens fully when:

a. Floor plate door is fully closed
b. Floor plate door has cycled since last door opening

2. Remains fully open until:

a. Drum lift has reached upper limit
b. Drum ram has made complete full stroke cycle and contacts fully retracted limit switch

3. Closes fully

4. Watchdog timer (set to 15 seconds longer than normal cycle) initiates:

a. Infeed door jammed fault indication

5. Maintenance override or Manual modes.

a. Infeed door extend/retract selector switch is active
b. Drum pusher ram interlocked so that door may not close if ram is off of its fully retracted limit switch.

C. Purge

1. Initiates when infeed door closes

a. Activates N_2 Solenoid #1 for preset time interval. This time is set on a PV screen which is accessed from the INFEED AIRLOCK screen.
b. N_2 pressure to system must be above low pressure shutdown point.

D. Lower airlock door

1. In auto mode opens when:

a. Hopper airlock purge is complete
b. Ram is retracted

2. Pauses for 2 seconds

3. Closes fully

4. Watchdog timer (set to 15 seconds longer than normal cycle) initiates:

a. 3-try jam clearing routine
b. Airlock floor plate jammed fault indication.

VII. HOPPER RAM

A. Normal operation

1. Initiates when airlock floor plate door closes

2. Extends until a momentary (1.5 second) reversal is caused by:

   a. Auto chop reverse of shredder #1
   b. Manually initiated shredder #1 reverse
   c. Shredder #1 reverse induced by shredder #2 reversal
   d. Hydraulic reversal of shredder #1
   e. Ram high pressure switch on for 2 seconds

3. Retracts fully under the following conditions:

   a. Ram fully extended limit switch is made (normal cycle retract)
   b. Shredder #1 jam counter counts out and stops shredder
   c. If the ram high pressure switch dwell timer goes high 5 times in a row without being reset by one of the following conditions; extend jam alarm is set:
      (1) Ram fully extended limit switch is made
      (2) Ram fully retracted limit switch is made
      (3) Ram extend for 4 seconds without ram high pressure switch being on.
   d. Ram extend solenoid command remains on for 25 seconds without engaging the ram fully extended limit switch

4. When ram reaches fully extended position:

   a. Shredder clear of material bit is set
   b. Ram retracts and stays in retracted position until floor plate opens and closes.

5. Ram retract watchdog timer set 15 seconds longer than normal return stroke.

VIII. PRIMARY SHREDDER

A. Startup automatic, SEE STARTUP PROCEDURE.

1. Auto start / stop (PV)

2. Last forward or AUTOCHOP mode stays in effect

   a. Power up in forward operation

3. Permissive:

   a. HPUs running
   b. O_2 system readings OK
   c. N_2 system functional
   d. Fire system OK
   e. Secondary shredder running

B. Forward operation

1. Shredder runs in forward until hydraulic reversal occurs

   a. Hydraulic reversal requires no electrical control
   b. Pump unloading at 2500 PSI hydraulically activated, no electrical control required

2. Holding the shredder reverse push button (PV) causes shredder reverse in auto.

C. Autochop (Automatic only)

1. Selector switch (PV) to turn on autochop

   a. Shredder runs forward for duration of forward timer and then runs reverse for the duration of the reverse timer

2. Forward and reverse time values set independently on panel view screen

3. Autochop suppressed

   a. While door #2 open
   b. For 2 X forward timer after door closes

D. Maintenance override

1. Shredder will run:

   a. Forward while the shredder forward run push button (PV) is held
   b. Reverse while the shredder reverse run push button (PV) is held

IX. SECONDARY SHREDDER

A. Startup automatic SEE STARTUP PROCEDURE

B. Auto start / stop (PV)

C. Last forward or autochop mode stays in effect

1. Power up in forward operation

D. Permissive

1. HPUs running
2. O_2 system readings OK
3. N_2 system functional
4. Fire system OK
5. Auger running

E. Forward operation

1. Shredder runs in forward until hydraulic reversal occurs

   a. Hydraulic reversal requires no electrical control
   b. Pump unloading at 2500 PSI hydraulically activated, no electrical control required

2. Holding the shredder reverse push button (PV) causes shredder reverse in auto.

F. Autochop (automatic only)

1. Selector switch (PV) to turn on autochop

   a. Shredder runs forward for duration of forward timer and then runs reverse for the duration of the reverse timer

2. Forward and reverse time values set independently on panel view screen

G. Maintenance override

1. Shredder will run

   a. Forward while the shredder forward run push button (PV) is held
   b. Reverse while the shredder reverse run push button (PV) is held

X. MAGNETIC SEPARATOR:

A. Startup is automatic see "MAIN SYSTEM STARTUP" section of "STARTUP PROCEDURE"

1. Permissives required:

   a. "AUTO RUN" bit on
   b. Transfer auger running.
   c. Metal Washer Running.

XI. TRANSFER AUGER:

A. Startup is automatic see "MAIN SYSTEM STARTUP"

B. Permissives required:

1. "AUTO RUN" bit on
2. Auger direction set toward open knifegate.

C. Auger jam routine.

1. Auger JAM pressure switch on for .5 sec.
2. Reverse direction of rotation of augers for X seconds & start rev counter
3. Reverse counter is reset if auger runs forward for Y seconds. (Y > X)
4. If reverse counter gets to 2 the secondary shredder stops
5. If counter counts out augers stop, and HPU SHUTS DOWN

XII. N_2 PURGE, O_2 DETECTION & VENT OPERATION.

A. GENERAL: (SEE O_2, N_2 & VENT CONNECTIONS 01-XXXX-B)

There are 4 discrete chambers in the shredder system, including the METAL WASHER:

1. AIRLOCK
2. SHREDDER STACK which includes: hopper,shredder #1, transition chute, shredder #2, & magnetic separator chamber.
3. METAL WASHER
4. HYDROPULPER

B. OPERATION:

1. O_2 SAMPLE SYSTEM:

a. There are 5 O_2 sample ports and 1 sample cell. The O_2 sample valves cycle between the ports every 15 sec. There are 4 set points on the O_2 system
(1) HI-HI
(2) HI
(3) LOW
(4) LOW-LOW
The system samples continuously when the control power is on.

b. A reading at or above HI-HI will take the system out of AUTO RUN mode.

c. A reading between HI & HI-HI will turn the N_2 valve on for the chamber being sampled.

d. A reading between LO & LO-LO will turn the N_2 solenoid off for the chamber being sampled

e. A reading below LO-LO will take the system out of the AUTO RUN mode.

f. EXCEPTIONS:
(1) There is no O_2 sample port in the airlock chamber. Purging is achieved by introducing N_2 for a fixed time when the airlock is loaded. See AIRLOCK LOADING section.

C. N_2 PORTS & VENTS:

1. Each chamber has a N_2 SOLENOID valve to introduce nitrogen , and a VENT valve, to vent exhaust gases to the Thermal Oxidizer. The shredder stack, metal washer, and hydropulper chambers have relief valves which prevent internal pressure from exceeding the rupture pressure of the deflagration vents.

2. The N_2 valves and the vent valves open simultaneously for any given

chamber so as N_2 is introduced the displaced gases are vented.

XIII. MANUAL OPERATION:

On main PV screen the "MANUAL" button takes the system out of auto operation and allows the operator to activate each device manually. The buttons for manual operation are located on the individual screens. Switching out of manual switches the system back into "AUTO RUN" mode. Permissives required are:

A. HPUs running
B. O_2 system readings OK
C. N_2 system functional
D. Fire system OK
E. Hydropulper running
F. Thermal oxidizer operating.
G. MAINTENANCE OVERRIDE NOT ON.

XIV. MAINTENANCE OVERRIDE

NOTE: READ THIS SECTION CAREFULLY!

DANGER!!

►► IMPROPER USE OF THE MAINTENANCE OVERRIDE KEY SWITCH CAN CAUSE DAMAGE TO EQUIPMENT OR INJURY TO PERSONNEL.

►► WHEN MAINTENANCE IS BEING PERFORMED, THE SYSTEM ELECTRICAL POWER MUST BE SHUT OFF AND THE BREAKERS LOCKED OUT TO PREVENT OPERATION OF THE EQUIPMENT.

Maintenance Override On / Off

The shredding system is equipped with a MAINTENANCE OVERRIDE key switch and a series of control buttons for manual operation of the equipment. (These controls are located on the PCP.) These controls are provided as a means to troubleshoot the system if something should malfunction. When activated, these controls can be used to momentarily operate the major components of the system such as doors, rams, and shredders.

To prevent improper use of this function, the key to the MAINTENANCE OVERRIDE key switch is different from the other keys supplied with the system. It is suggested that access to this key is controlled. Only people who are trained in the operation of the system and who are aware of the consequences of operating in override mode should have access to this key. The system electrical power must be shut off and the breakers locked-out to prevent operation of the equipment when someone opens an access door or is inside the shredder stack.

XV. Operation of functions in MAINTENANCE OVERRIDE

The buttons for maintenance operation are the same buttons as the manual mode and are located on the individual screens. Switching out of manual switches the system back into "AUTO RUN" mode. Permissives required are:

1. HPUs running

XVI. ALARM SCREENS

A. GENERAL

There are alarm messages which appear on the PV in the event of a fault. The attached list "Alarm Window Messages" lists all the alarms. The alarms with an "A" on column 2 have an audio as well as a visual alarm.

B. OPERATION:

1. "Alarm Acknowledge"

   Each alarm must be acknowledged. This clears the Alarm from the screen but does not solve the problem which caused the alarm condition. The Alarms are acknowledged by pressing the "ALARM ACKNOWLEDGE" button. If the machine is turned off without the fault being resolved the alarm will re-appear as soon as the machine is turned on again.

2. "Alarm Silence"

   This silences the audio alarm.

3. "History"

   This shows the alarm history with the date & time of each occurrence.

4. "Status"

   This function is not used in this application.

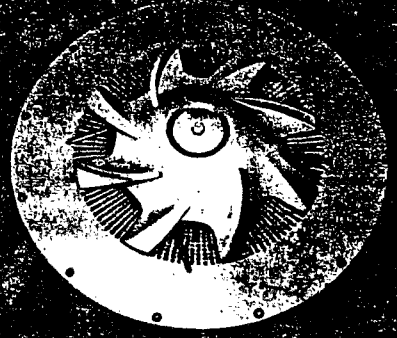
XVII. PANELVIEW SCREENS

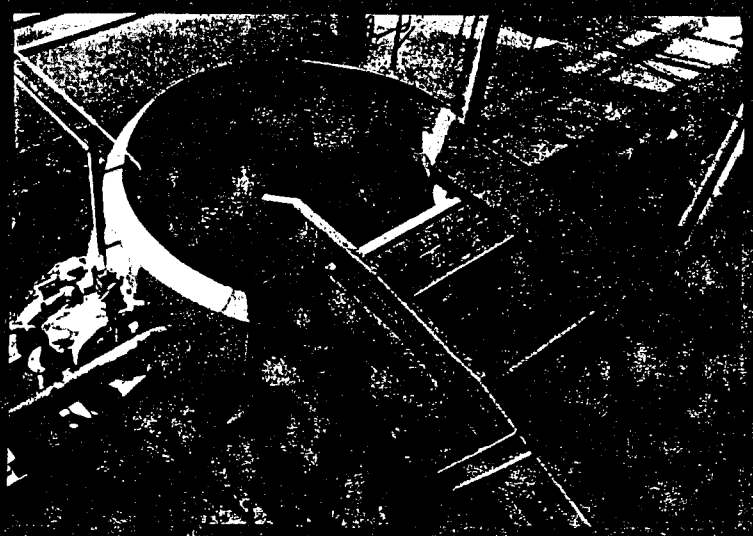
A. List of screens:

1. MAIN
2. HYDRAULIC POWER UNIT
3. DRUM LIFT
4. INFEED AIRLOCK
5. SHREDDER #1 & RAM
6. SHREDDER #1 FORWARD TIMER
7. SHREDDER #1 REVERSE TIMER
8. SHREDDER #2
9. SHREDDER #2 FORWARD TIMER
10. SHREDDER #2 REVERSE TIMER
11. MAGNETIC SEPARATOR
12. AUGER JAM COUNTER
13. AIRLOCK PURGE TIMER
14. OXYGEN SYSTEM

5.0 TROUBLESHOOTING

Black Clawson





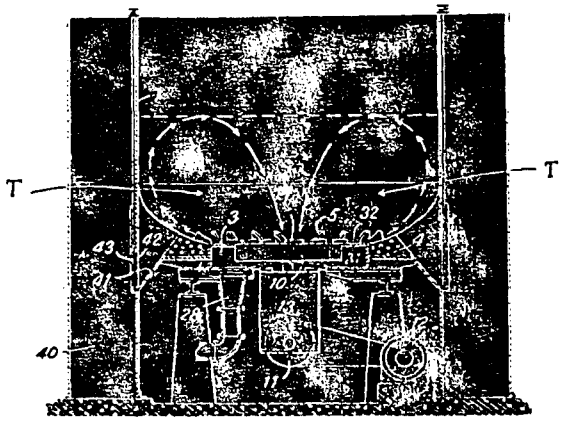
Hydrapulper® Pulping Machine

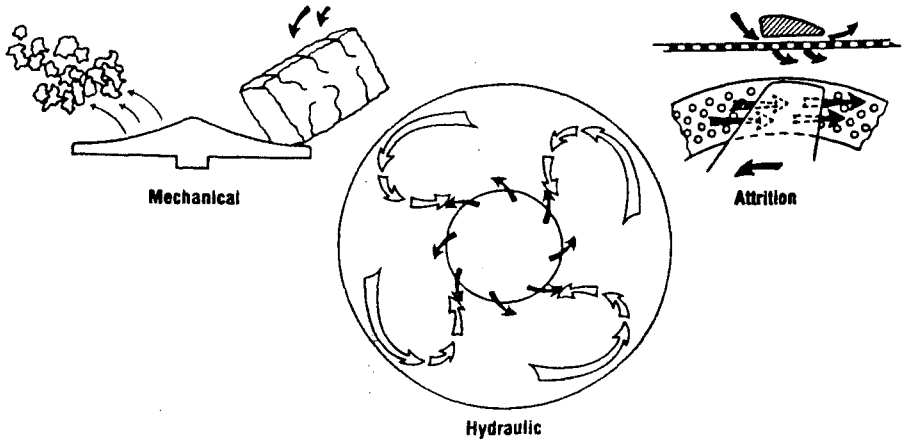
Nobody Ever Had a Better Idea for a Pulping Machine

Expertise from Experience

Black Clawson introduced the Hydrapulper more than 50 years ago and revolutionized the processing of cellulose fibers. We have more experience in pulper design and manufacture than any other supplier in the world. Black Clawson continues to lead the way in new pulping technology for greater defibering efficiency, productivity and energy conservation.

Every Hydrapulper installation is tailored to meet individual mill specifications. That's why more than 5000 units have been installed worldwide, operating in a multitude of applications on a wide variety of furnishes. Many of the earliest installations are still in operation today.





Pulper Selection

Hydrapulpers are designed for specific applications, based on the following criteria:

1. Furnish — type, description, quality
2. Capacity required — tons/day
3. Operation — batch or continuous
4. Consistency — pulping
5. Temperature — availability of steam or hot water
6. pH of water — acid or alkaline
7. Chemicals used
8. Contaminants in furnish
9. If wet strength is furnish — how much, what type
10. Materials of construction — corrosion, erosion resistant; acid, wear resistant
11. Space limitations
12. Location, mill geography
13. Electrical requirements
14. Type system — filler, liner
15. Grade paper, board manufactured
16. Quality required — defibering, cleanliness

Using this information, we can select the proper combination of tub, rotor design (size and speed), extraction plate, drive, controls and auxiliary equipment.

Pulper Operation

The Hydrapulper processes cellulose fibers in any form in a slurry of water that reduces stock to individual fibers and fiber bundles. The pulper combines mechanical and hydraulic forces induced by the rotor to process the furnish. The rotor has specially designed vanes to draw the furnish inward. It strikes the rotor and is thrown outward, up the sides of the pulper tub and back to the center. At the same time the rotor imparts a vigorous hydraulic action by forcing a relatively thin stream of stock at high velocity through the body of slower moving material to defiber the stock by rubbing fiber against fiber. Attrition action between the rotor and bedplate further defibers the furnish. Baffles in the bottom of the pulper prevent excessive circular motion, causing the stock to travel back to the center with a maximum vertical action.

These forces make the Hydrapulper work. The design of the tub, rotor, directional vanes and other functional parts cause the pulping action, circulation and defibering to take place at the lowest operating cost.

Batch Operation

The pulper operates in a batch mode when 100% defibering is required or extra time is needed for the addition of chemicals or heat. A specific amount of dry furnish and water are added to the pulper, and mixed until defibering or a chemical reaction is achieved. Then the entire content of the tub is discharged.

Sizes - Batch pulpers range in size from 2' to 22' diameter with capacities ranging to 32,000 pounds dry furnish per batch. For operation up to 8% consistency, pulpers are equipped with a standard Vokes™ or Powr-Savr™ rotor. With the addition of a Mid-Con™ turbine, consistencies up to 10% are possible.

Deinking - High consistency operation at 12-18%, particularly applicable in deinking systems, is achieved with the Hi-Con™ pulper and its triple-flighted, low-attrition rotor. Any of these pulper designs can be supplied with under rotor extraction in a variety of hole sizes. Alternatively, side-tub extraction can be accomplished with an auxiliary Hydrapurge III™ extractor/detrasher. Other methods of detrashing are also available.

Continuous Operation

Continuous operation is used in high tonnage systems that require stock defibering only to the extent that it can be extracted through a given hole size. Three Hydrapulper designs are available depending on application and type of furnish. Included are continuous pulpers with standard round tub design; Model "D" tub; a raised rotor, the "R" rotor design; and "D" tub with raised rotor.

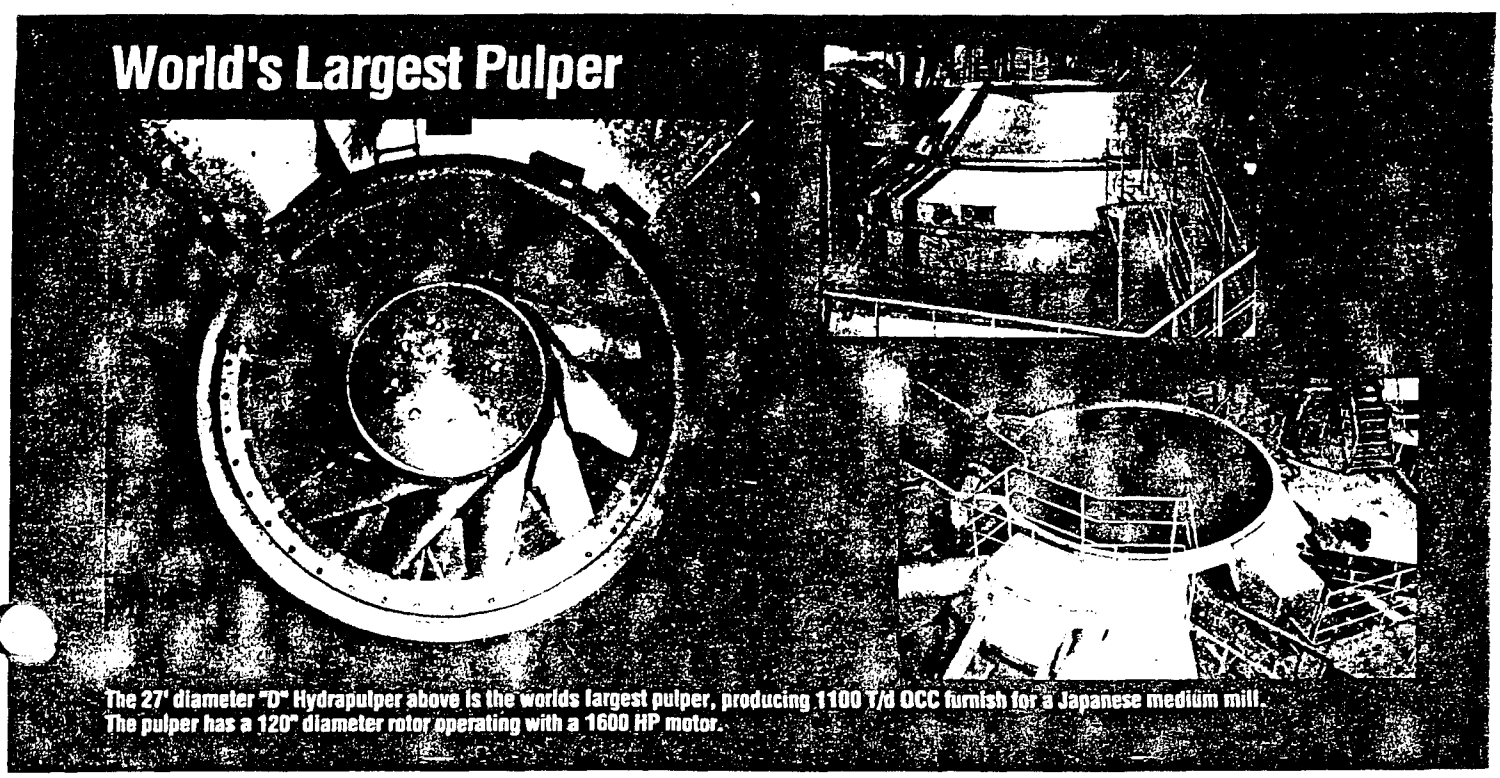
The round tub design is used in systems handling clean furnishes such as bleached hardwood or softwood kraft.

"D" Pulper - The Model "D" increases Hydrapulper capacity by improving bale submergence. The large bales typical of OCC and mixed waste furnishes tend to float and spin in a round tub pulper and may take a considerable amount of time to submerge. The "D" tub design increases turbulence in the tub causing the bale to submerge in a matter of seconds. Its flat wall disrupts the circular flow pattern of a round tub, displacing the vortex and creates a hydraulic nip to submerge the bale.

"R" Rotor - The "R", or raised rotor design, has the rotor, extraction bedplate and extraction chamber mounted above the flat bottom of the Hydrapulper tub. A trough is created around the rotor to accumulate heavy contaminants, directing them into a heavy junk removal device. This reduces rotor contact with contaminants, increasing both rotor and bedplate life. It also prevents the rag rope from riding on top of the rotor, preventing damage to both the rope and rotor.

Designs - All continuous Hydrapulper designs feature under-rotor extraction with extraction holes to the outer diameter of the rotor. The vane design ensures plug-free operation of the extraction plate. The leading flat vane face is directed downward to maximize pump-through while the trailing vane is profiled to lift any remaining undefibered stock or contaminants from the holes.

Sizes - Continuous Hydrapulpers are available in sizes from 5' to 27' diameter, or larger. Junk removing equipment includes the automatic ragger, 4' diameter trashwell with hydraulic grapple, and Hydrapurge II™/Selectpurge™ continuous detrashing system.



The 27' diameter "D" Hydrapulper above is the worlds largest pulper, producing 1100 T/d OCC furnish for a Japanese medium mill. The pulper has a 120" diameter rotor operating with a 1600 HP motor.

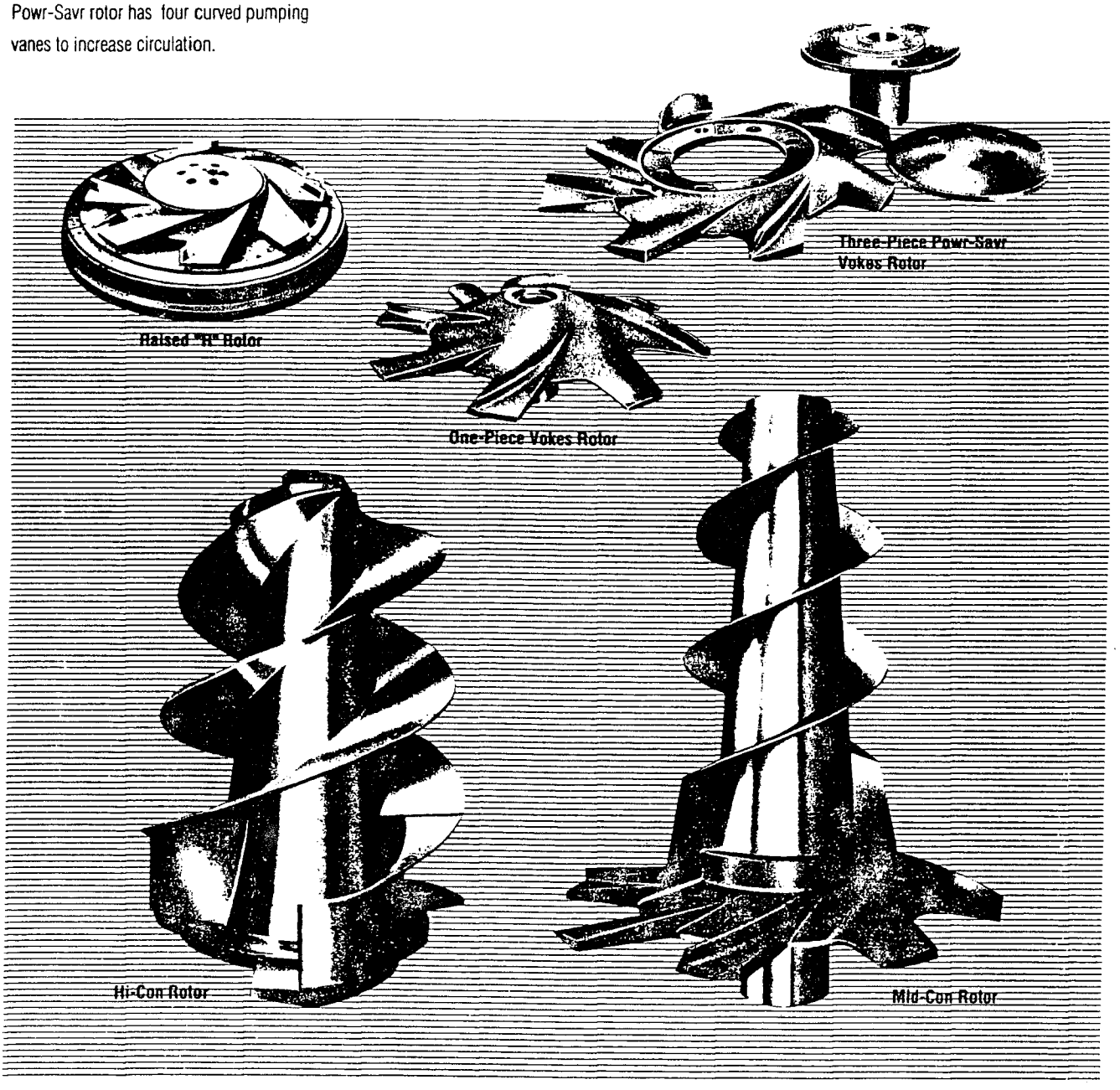
Hydrapulper Rotors

The Right Rotor for Every Application

Black Clawson offers a variety of rotors for use with the Hydrapulper. The Vokes rotor can be supplied in a three-piece design that generally is used on wastepaper furnishes to minimize maintenance and replacement time. A more economical one-piece rotor can be used with clean furnishes. Powr-Savr rotors are available in the one-piece or three-piece design. The Powr-Savr rotor has four curved pumping vanes to increase circulation.

Mid-Con Rotor - The Mid-Con rotor incorporates a double-flighted Mid-Con turbine mounted on a Vokes rotor base. The Mid-Con turbine is bolted directly to the vane ring of a three-piece rotor, or can be mounted on a one-piece rotor with the addition of an adaptor ring. It can usually be retrofitted to an existing pulper without having to change the drive or motor.

Hi-Con Rotor - The Hi-Con rotor is a triple-flighted, conically-shaped, low-attrition rotor specifically designed for circulating thick stock consistencies, up to 18%. The Hi-Con pulper achieves defibering through fiber to fiber friction as opposed to the standard batch Hydrapulper which relies principally on mechanical action.



Hydrapulper Drives

Hypoid Gear Drive

The Extra Heavy Drive is supplied for heavy duty applications, such as dirty filler furnishes, kraft corrugated waste, tough wet strength and frozen bales. It is a single reduction unit with hypoid ring and pinion gears. Its reliability, ruggedness and low maintenance have been proven in installations for more than 30 years.

Components - The drive components consist of four parts, the base plate (not shown), the sub-base, the lower and upper gear cases. The lower gear case houses the gear set, the pinion shaft and bearings, and the thrust bearing for the vertical drive shaft. It also serves as an oil reservoir. Every drive has an external oil cooling and circulating system to pressure lubricate the bearings and gears. It has fail-safe controls to stop drive motor if oil pressure falls below a pre-set value. It is made in three sizes rated up to 700 HP. Several gear ratios are available. Motor speeds range from 720 to 1200 RPM.

Lo-Profile™ Pulper Gear Drive

The Lo-Profile Pulper Gear Drive is designed specifically for low headroom situations. Its height is 25% less than comparable drives. It operates with 1200 or 1800 RPM motor input and has a minimum of 2.0 service factor mechanical horsepower rating. Drives are available for up to 1500 connected horsepower.

Discription - The Lo-Profile drive is a vertical, right angle, double reduction gear reducer. The input shaft gearing is spiral bevel and the output shaft gearing is low helix angle single helical. All gearing is carburized and hardened. Shafts are contained in anti-friction straight or tapered roller bearings. The housing is fabricated from heavy steel plate and contains a 300 degree pilot fit to provide a sturdy, stable fit to the pulper extraction chamber.

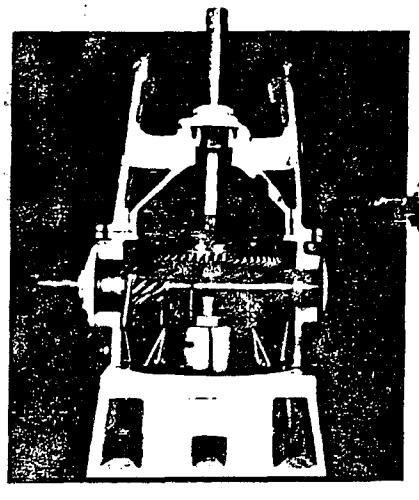
The Lo-Profile Pulper Gear Drive is furnished complete with fabricated steel subbase and sole plate; a circulating lubrication system with 1.5 horsepower motor driven pump, oil cooler, filter, pressure switch and pressure gauges.

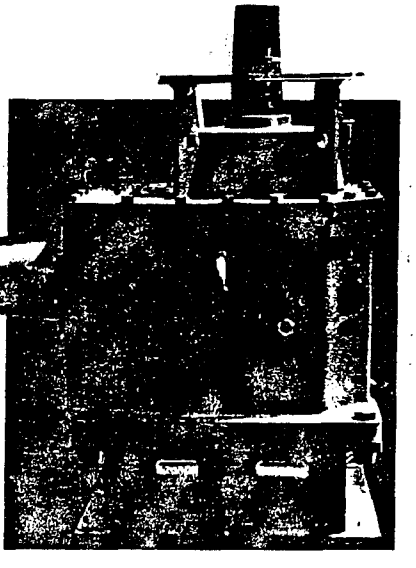
V-Belt Drive

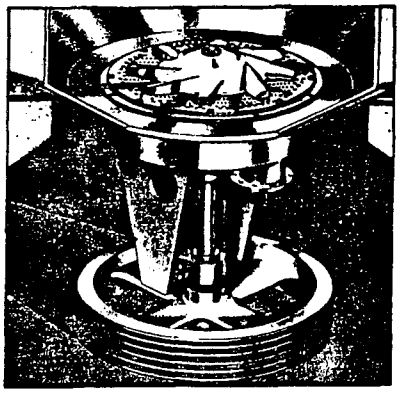
For medium to light duty applications a very serviceable, rugged V-belt drive can be used for Hydrapulpers with diameters of 8', 10' 12', 14' or 16'. The sheaves and belts are usually specified Super V or V-band design.

Hanging Type - These V-belt drives are the hanging type with a heavy duty right angle frame, hung from four mounting pads on the bottom of the extraction chamber. The drive shaft is carried by anti-friction, self-aligning, grease lubricated, split pillow block bearings. The upper non-expansion type thrust bearing shoulders on the shaft, preventing any downward slippage through the bearing. The end of the shaft is capped to prevent any sheave slippage.

Drive Motor & Sheave - The drive motor and sheave are mounted vertically on a motor base and rails. High capacity V-belts or V-bands turn the driven sheave and rotor. A drive guard completely covers the drive train. The drives are designed with a minimum service factor of 1.7 to 2.0. Normally, V-belt drives are limited to 300 HP.







Standard Pulper

	Pulper Size		8'	10'	12'	14'	16'	18'	20'
A	Tub Diameter - Inside	ft. mm	8.0 2440	10.0 3050	12.0 3650	14.0 4270	16.0 4880	18.0 5490	20.0 7000
B	Tub Flange Dia. - Outside	ft. mm	8.5 2590	10.5 3200	12.5 3800	14.5 4420	16.5 5030	18.5 5640	20.5 7150
C	Freeboard	in. mm	8 200	18 457	22 560	22 560	22 560	22 560	22 560
D	Tub Height	in. mm	71.5 1820	85.5 2172	106.5 2705	106.5 2705	109 2770	130 3300	135 3430
	No. of Support Columns		4	4	4	6	6	6	6
	Stock Volume	cu. ft. m^3	200 5.66	400 11.32	700 19.81	950 26.88	1250 35.37	1800 50.94	2400 67.92
	Batch Size - 6% Cons.	lbs. kg	750 340	1500 680	2500 1130	3500 1590	4500 2040	6500 2950	9000 4080
	Batch Size - 8% Cons.	lbs. kg	1000 450	2000 900	3000 1360	4500 2040	6000 2720	8000 3630	12,000 5440
	Drive — Hypoid Gear								
E	Support Structure Height	in. mm	— —	— —	77.5 1970	81 2060	84 2130	87 2210	90 2290
F	Total Overall Height	in. mm	— —	— —	184 4674	189 4800	193 4900	217 5510	225 5710
	Drive Size		—	—	No. 2	No. 2	No. 3	No. 3	No. 3
	Weight - Shipping	lbs. kg.	— —	— —	24,900 11,300	30,000 13,600	43,000 19,500	49,000 22,230	53,000 24,040
	Drive — V-Belt								
E	Support Structure Height	in. mm	48.5 1230	56.5 1430	64 1630	63.5 1610	78 1980	— —	— —
F	Total Overall Height	in. mm	120 3050	142 3607	170 4318	170 4318	180 4570	— —	— —
	Weight - Shipping	lbs. kg.	6000 2722	9500 4080	14,000 6350	17,500 1940	25,500 11,560	— —	— —

NOTE: DIMENSIONS AND WEIGHTS ARE APPROXIMATE. DO NOT USE FOR CONSTRUCTION.

Model "D" Continuous Pulper

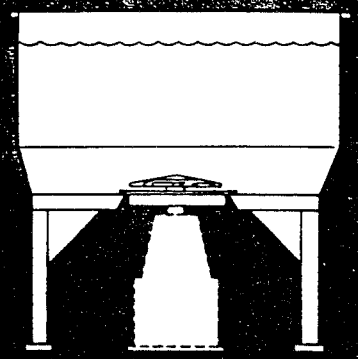
	Model		6D	7D	8D	9D	10D	11D	12D	13D
A	Tub Diameter-Inside	ft. mm	12.0 3660	14.0 4270	16.0 4880	18.0 5490	20.0 6100	22.0 6710	24.0 7315	26.0 7925
B	Tub Flange Dia.-Outside	ft. mm	12.5 3813	14.5 4423	16.5 5033	18.5 5643	20.5 6253	22.5 6863	24.5 7468	26.5 8077
C	Freeboard	in. mm	22.0 559	22.0 559	23.0 584	24.0 610	22.0 559	24.0 610	28.0 711	32.0 813
D	Tub Height	in. mm	122.0 3099	108.0 2743	108.75 2762	126.75 3220	135.82 3450	156.0 3962	172.0 4369	188.0 4775
E	Support Structure Height	in. mm	74.25 1886	80.0 2032	88.69 2253	88.75 2254	88.44 2246	89.25 2267	88.5 2248	88.5 2248
F	Overall Height	in. mm	196.25 4985	188.0 4775	197.44 5015	215.50 5474	224.25 5696	245.25 6229	260.5 6617	276.5 7023
	Stock Volume	cu. ft. m^3	600 17	800 23	1000 28	1500 43	2000 57	2600 74	3500 99	4500 127
	Capacity*	USODT/D ODMT/D	200 181	300 272	400 363	500 454	600 544	700 635	800 726	1000 907
	Weight-Shipping	lbs. kg	13,500 6124	23,400 10,614	36,800 16,693	42,500 19,278	53,400 24,222	64,100 29,076	77,000 34,927	92,500 40,293

*BASED ON OCC FURNISH, 5/8" DIAMETER EXIT HOLES, 140°F. OPERATING TEMPERATURE

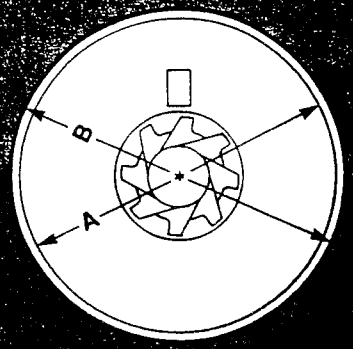
Hi-Con™ Pulper

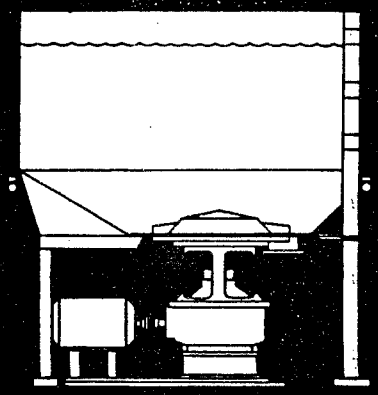
	Pulper Size		8'	10'	12'	13'	14'	15'	16'	17'	18'	20'	22'
A	Tub Diameter - Inside	ft. mm	8 2440	10 3050	12 3660	13 3965	14 4270	15 4575	16 4880	17 5185	18 5490	20 6100	22 6710
B	Tub Flange Dia.- Outside	ft. mm	8.5 2593	10.5 3203	12.5 3813	13.5 4118	14.5 4423	15.5 4728	16.5 5033	17.5 5338	18.5 5643	20.5 6253	22.5 6863
C	Freeboard	in. mm	48 1219	48 1219	48 1219	48 1219	48 1219	54 1372	60 1524	72 1829	72 1829	72 1829	84 2134
D	Tub Height	in. mm	93.0 2362	104.0 2642	115.0 2921	120.0 3048	132.0 3353	138.0 3505	150.0 3810	168.0 4267	174.0 4420	182.0 4623	208.0 5283
E	Support Structure Height	in. mm	65.0 1651	65.0 1651	71.0 1803	71.0 1803	71.0 1803	71.0 1803	78.0 1981	78.0 1981	78.0 1981	88.5 2248	88.5 2248
F	Total Overall Height	in. mm	158.0 4013	169.0 4293	186.0 4724	191.0 4851	203.0 5156	209.0 5309	228.0 5791	246.0 6248	252.0 6401	270.5 6871	296.5 7531
	Stock Volume	cu. ft. m^3	165 5	320 9	585 17	700 20	925 26	1075 30	1300 37	1575 45	1900 54	2500 71	3400 96
	Batch Size - 12% Cons.	lbs. kg	1200 544	2300 1043	4200 1905	5200 2359	6800 3084	8000 3629	9500 4309	11,800 5353	14,000 6350	18,000 8165	25,000 11,340
	Batch Size - 15% Cons.	lbs. kg	1500 680	3000 1361	5500 2495	6500 2948	8500 3856	10,000 4536	12,000 5443	14,750 6691	17,500 7938	23,000 10,433	32,000 14,515
	Weight - Shipping	lbs. kg	18,739 8500	28,860 13,091	41,250 18,711	46,750 21,206	49,200 22,317	51,600 23,406	59,100 26,808	62,400 28,305	75,650 34,315	87,125 39,516	94,525 42,877

Hydrapulper Configurations

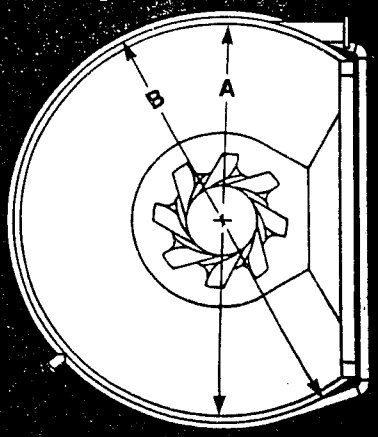


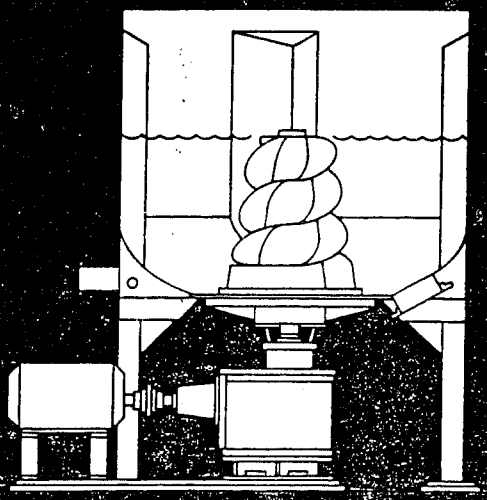
Standard
Batch/Continuous



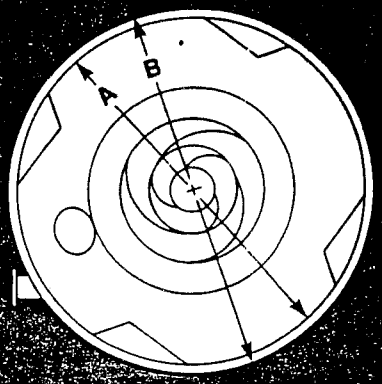


Model "D"
Continuous

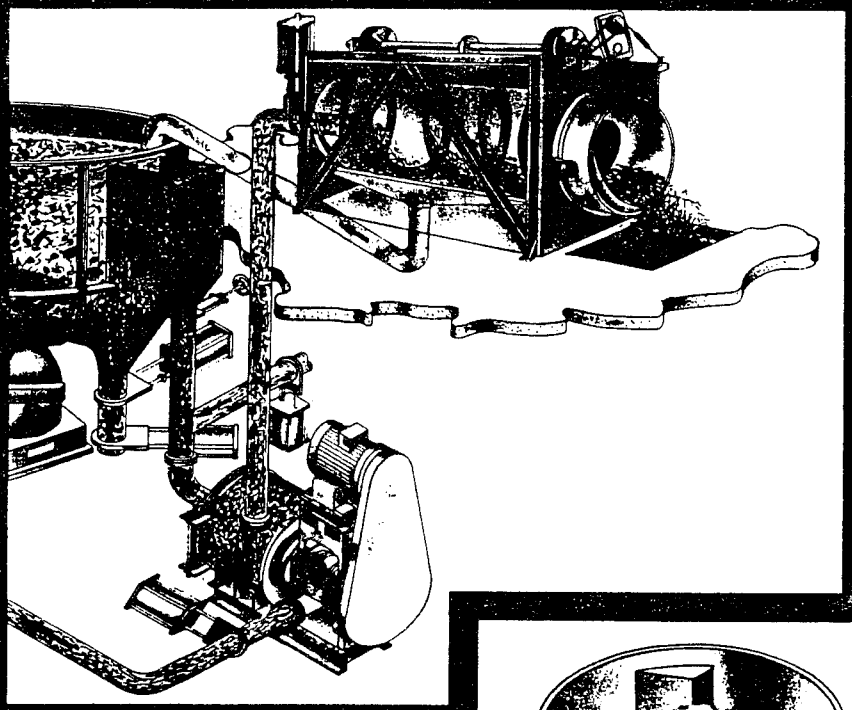


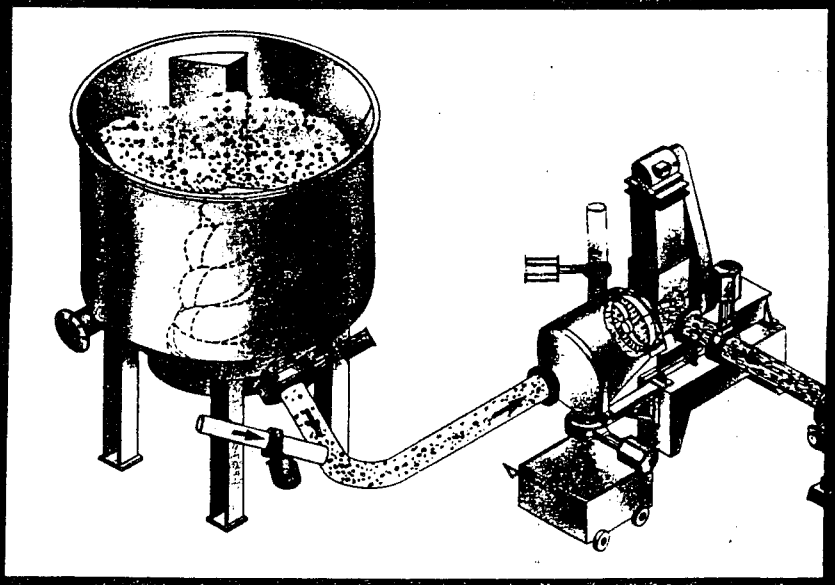


Hi-Con™
Batch



Hydrapurge™ Detrashing System





THERMO BLACK CLAWSON INC.

A Thermo Fibertek company

Recycled Fiber • Chemical Pulping • Stock Preparation

605 Clark Street, Middletown, OH 45042-2117 USA +1 513.424.7400 Fax +1 513.424.1168 www.blackclawson.com

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THERMO [illegible] **INC.**

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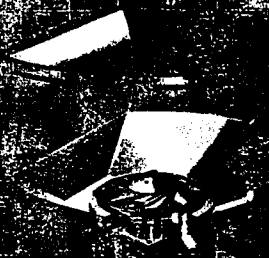
The Best Choice in pulping

Hydrapulper®
Pulping Systems



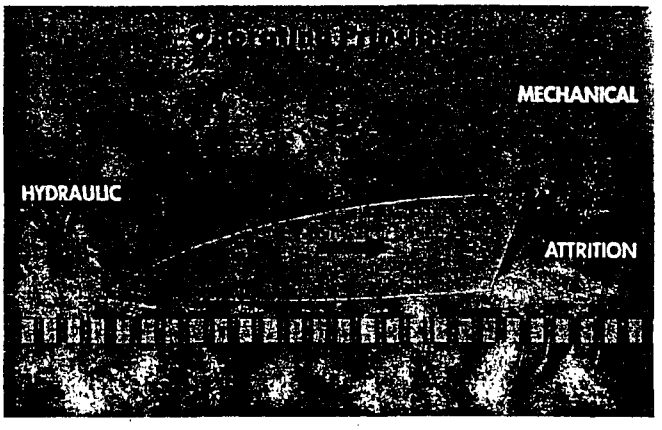
Helico®
Pulping Systems

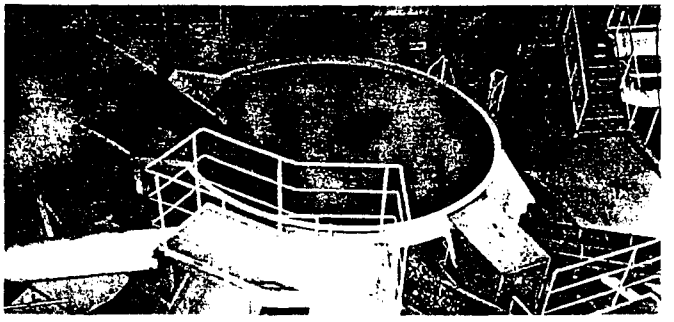
Nobody Ever had Better Ideas for Pulping Machines

Thermo Black Clawson has been developing pulping technology for over 60 years. Since we invented the Hydrapulper®, which revolutionized the pulping process, we've installed over 8,700 units worldwide. TBC continues to be the best choice in pulpers. As a Thermo Fibertek company, we have the advantage of drawing on the expertise of our sister company, E. & M. Lamort, to offer you the most comprehensive line of pulping and detrashing systems in the world.

With ongoing research and development, we continue to introduce new pulping technology to give your pulping operation greater defibering efficiency, productivity and optimum energy consumption. Proven in a variety of applications and on a wide range of furnishes, Thermo Black Clawson defines the standard for pulping technology.

Hydrapulper® and Helico® Pulpers





The 27' diameter "D" Hydrapulper above is one of the worlds largest pulpers and produces up to 1200 T/D OCC furnish for a Japanese medium mill. The pulper has a 120" diameter rotor operating with a 1600 HP motor.

Thermo Black Clawson pioneered the first...

1930's	1940's	1950's	1960's	1970's	1980's	1990's
Continuous pulping machine - Hydrapulper®	*Automatic ragger for rag rope removal* *Junk remover*	*Development of Batch and Continuous HR Pulpers* *Vokes™ Rotor introduced with under rotor stock extraction*	*Powr-Savr™ Rotor*	*Development of Broke Pulpers*	*Agi-Pulper™ wet end broke pulper* *D-Style Tub developed* *High Consistency Pulpers introduced* *Development of Batch and Continuous Pulper Detrashing Systems*	*Raised Rotor introduced* *Bowed wall on D-Style Tub introduced* *TBC and Lamort unite to provide the most comprehensive line of pulping systems in the world*

Original patent drawing for the Hydrapulper

Pulper

The Right Type for Every Application

Hydrapulpers are designed for specific applications, based on the following criteria:

- **Furnish – type, description, quality**
- **Capacity required – tons/day**
- **Operation – batch or continuous**
- **Consistency – pulping**
- **Temperature – availability of steam or hot water**
- **pH of water – acid or alkaline**
- **Chemicals used**
- **Contaminants in furnish**
- **If wet strength is furnish – how much, what type**
- **Materials of construction – corrosion, erosion resistant; acid, wear resistant**
- **Space limitations**
- **Location, mill geography**
- **Electrical requirements**
- **Type system – filler, liner**
- **Grade paper, board manufactured**
- **Quality required – defibering, cleanliness**

Using this information, we can select the proper combination of tub, rotor design (size and speed), extraction plate, drive, controls and auxiliary equipment.

Batch Operation

Batch pulping systems are used when 100% defibering is required, or when extra time is needed for the addition of chemicals or heat, such as in deinking or mixed waste applications. A specific amount of dry furnish and water are added to the pulper, and mixed until defibering or the desired chemical reaction is complete. Then the entire contents of the tub are discharged to the dump chest.

Sizes Batch pulpers range in size from 2' to 25' in diameter (up to 2400 cu. ft. stock volume) with capacities ranging to 32,000 pounds of dry furnish per batch. Typical batch times are 30-45 minutes, depending on the furnish. Sizing of the tub volume depends on the total production rate.

Tub Design Batch pulper tubs are typically round, with deflection vanes installed to direct the flow from the rotor down into the recirculating vortex. The action in the tub is critical to performance, as this is how the stock is wetted out and forced into the rotor for defibering.

Rotor Design For operation up to 8% consistency, pulpers are equipped with a Vokes™ or Powr-Savr™ rotor. With the addition of a Mid-Con™ turbine, consistencies up to 10% are possible. Helico® pulper rotors are used for high consistency operation up to 18%.

Detrashing Systems There are two choices for detrashing any batch type pulper: either a Batch Scavenger™ or a Hydrapurge III™ extractor/detrasher. The Scavenger is used for lower tonnage systems where it is less important to segregate heavy from light contaminants. The Hydrapurge with a Selectpurge™ screening drum is used in those instances where it is more important to achieve a separation between light and heavy contaminants.

Applications Typical applications of batch pulping are for deinking or mixed waste systems, or for fiber recovery from wet strength furnishes in tissue and toweling mills.

Continuous Operation

Continuous operation is used in high tonnage systems that require stock defibering only to the extent that it can be extracted through a given hole size. Alternate pulper designs are available, depending on application and type of furnish. Included are continuous pulpers with standard round tub design and Model "DR" Hydrapulper fitted with a "D" style tub and raised "R" rotor.

Sizes Continuous pulpers range in typical sizes from 12' to 27' in diameter (up to 5200 cu. ft. stock volume) with capacities up to 1400 tons per day. New designs are available on demand to achieve higher production rates.

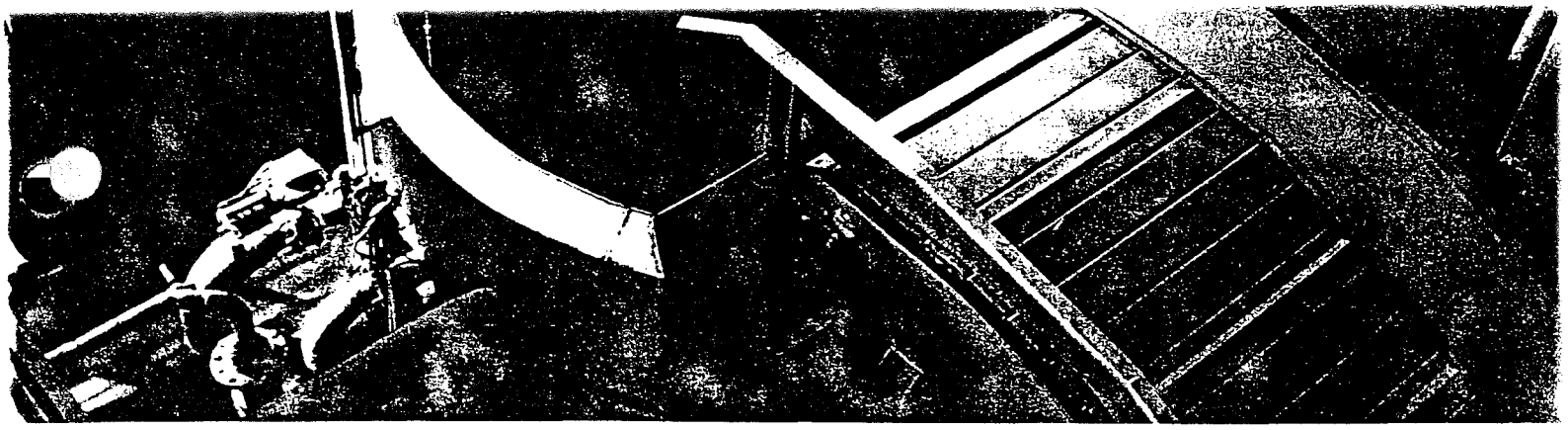
Tub Design The Model "D" increases Hydrapulper capacity by improving bale submergence. The large bales (typically of OCC and mixed waste furnishes) tend to float and spin in a round tub pulper, taking excessive time to wet out and submerge. The "D" tub design increases the turbulence in the tub, causing the bale to submerge rapidly. Its bowed "D" wall disrupts the circular flow pattern of a round tub displacing the vortex and creating a strong hydraulic nip to submerge the bale.

Rotor Design The raised "R" rotor design has the rotor, extraction bedplate and extraction chamber mounted above the flat bottom of the Hydrapulper tub. By doing so, a trough is created around the rotor to direct heavy debris into a junk removal device. This reduces rotor contact with contaminants, increasing both rotor and bedplate life. It also prevents the rag rope from riding on top of the rotor, thus eliminating damage to both the rope and the rotor.

All continuous Hydrapulper designs feature under-rotor extraction through a bedplate with holes that are extended beyond the outer diameter of the rotor. The rotor vane design ensures plug-free operation of the bedplate. The leading flat vane face is angled downward to maximize defibering and pump-through while the trailing edge is profiled to lift undefibered stock and contaminants from the holes.

Detrashing Systems Auxiliary detrashing equipment includes the automatic ragger and rope cutter, along with one of two continuous detrashing devices. For low tonnage applications, the Continuous Scavenger™ detrasher is used. It effectively removes junk from a continuous pulper by treating a side-stream flow and recirculating back into the pulper tub. For high tonnage systems, the Hydrapurge II/Selectpurge detrashing system is used to effectively remove trash from the pulper tub and, at the same time, increase downstream production rates. Heavyweight contaminants are removed from the pulper tub by the trashwell and grapple hoist. Lightweight contaminants are removed via a side stream flow to the Hydrapurge II, where useable fiber is extracted and sent downstream and lightweight contaminants are separated and sent to the Selectpurge for removal and thickening.

Applications Typical applications of continuous pulping are for OCC/Mixed Waste recycled fiber systems making medium or linerboard ("D" type) or for virgin pulp bale defibering (round type).



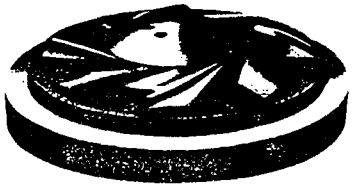
The Right Rotor for Every Application

Vokes Rotor The Vokes rotor can be supplied in a three-piece design with leveling screw or shim adjustment. This design is generally used on wastepaper furnishes to minimize maintenance and replacement time. A more economical one-piece Vokes rotor can be used with clean furnishes.

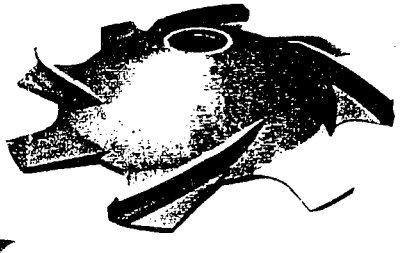
Powr-Savr Rotor The Powr-Savr rotor has four curved pumping vanes to increase circulation that allow operation at lower specific power imputs. Powr-Savr rotors are available in one-piece or three-piece designs.

Mid-Con Rotor The Mid-Con rotor incorporates a double-flighted Mid-Con turbine mounted on a Vokes rotor base. The Mid-Con turbine is bolted directly to the vane ring of a three-piece rotor, or can be mounted on a one-piece rotor with the addition of an adaptor ring. It can usually be retrofitted to an existing pulper without having to change the drive or motor.

Helico® Rotor The Helico rotor is a triple-flighted, conically-shaped, low-attrition rotor specifically designed for circulating thick stock consistencies, up to 18%. The Helico rotor achieves defibering through fiber-to-fiber friction. Its rugged, one-piece construction of cast stainless steel provides optimum corrosion resistance and long wear life.

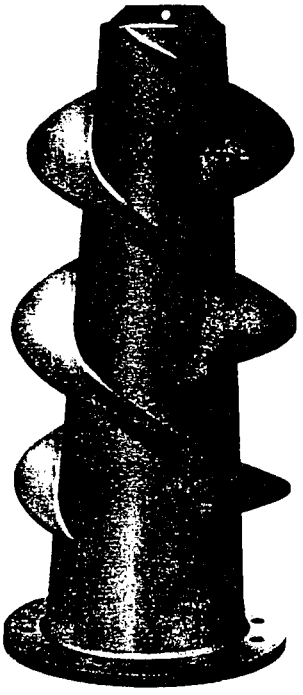


Raised "R" Rotor



One-Piece Vokes Rotor

Three-Piece Powr-Savr Vokes Rotor



Mid-Con Rotor

Helico Rotor

Lo-Profile™ Pulper Gear Drive

The Lo-Profile pulper gear drive is designed specifically for low headroom situations. Its height is 25% less than comparable drives. It operates with 1200 or 1800-RPM motor input and has a minimum of 2.0 service factor mechanical horsepower rating. Drives are available for up to 2000 connected horsepower.

The Lo-Profile drive is a vertical, right angle, double reduction gear reducer. The input shaft gearing is spiral bevel and the output shaft gearing is low helix angle single helical. All gearing is carburized and hardened. Shafts are contained in anti-friction straight or tapered roller bearings. The housing is fabricated from heavy steel plate for maximum strength and rigidity.

The Lo-Profile pulper gear drive is furnished complete with fabricated steel sub-base and sole plate; a circulation lubrication system with a motor driven pump, oil cooler, filter, flow switch and pressure gauge.

Hypoid Gear Drive

This extra heavy-duty drive is supplied for tough applications, such as mixed waste filler furnishes, kraft corrugated waste, wet strength and frozen bales. It is a single reduction unit with hypoid ring and pinion gears. Its reliability, ruggedness and low maintenance have been proven in installations for more than 50 years.

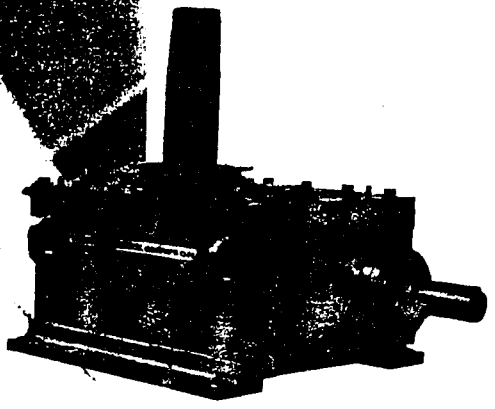
The drive components consist of the base plate, the sub-base and the lower and upper gear cases. The lower gear case houses the gear set, the pinion shaft and bearings, and the thrust bearing for the vertical drive shaft. It also serves as an oil reservoir. Every drive has an external oil cooling and circulating system to pressure lubricate the bearings and gears. It has failsafe controls to stop the drive motor if oil pressure or flow falls below a pre-set value. Hypoid gear drives are available in sizes up to 800 connected horsepower with motor speeds ranging from 720 to 1200 RPM. It has a minimum of 2.0 service factor mechanical horsepower rating.

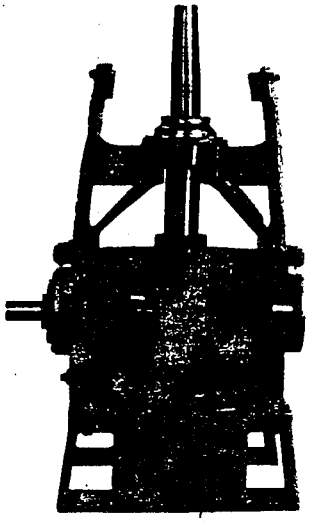
V-Belt Drive

For low power applications, a rugged V-belt drive can be used for smaller sized pulpers. The belts are usually specified Super V or V-band design for increased strength and serviceability.

The V-belt driven pulper can be furnished with a bracket-type or a cartridge-type hanging drive mounted from the bottom of the extraction chamber. The drive shaft is carried by grease lubricated bearings and the end of the shaft is capped to prevent any slippage of the sheave.

The drive motor and sheave are mounted vertically on a motor base. High capacity V-belts or V-bands turn the driven sheave and rotor. An OSHA-approved drive guard completely covers the entire drive train. The drives are designed with a minimum 1.7 mechanical service factor and are usually limited to 350 connected horsepower.





Standard Hydrapulper

Size (ft.)		8	10	12	14	16	18	20
A Tub Diameter – Inside	ft. mm	8 2438	10 3048	12 3658	14 4267	16 4877	18 5486	20 6096
B Freeboard	in. mm	8 203	18 457	22 559	22 559	22 559	22 559	22 559
C Tub Height	in. mm	72 1829	86 2184	105 2667	108 2743	112 2845	128 3251	136 3454
Number of Support Columns		4	4	4	6	6	6	6
Operating Volume	cu. ft. m^3	200 6	400 11	700 20	950 27	1250 35	1800 51	2400 68
Batch Size – 8% Consistency	lbs. kg	1000 454	2000 907	3000 1361	4500 2041	6000 2722	8000 3629	12,000 5443
Drive – Hypoid Gear								
D Overall Height	in. mm	–	–	184 4674	189 4801	193 4902	217 5512	225 5715
Drive Size		–	–	No. 2	No. 2	No. 3	No. 3	No. 4
Weight – Dry	lbs. kg	–	–	24,900 11,295	30,000 13,608	43,000 19,505	49,000 22,226	53,000 24,041
Weight – Operating	lbs. kg	–	–	68,594 31,114	89,300 40,506	121,026 54,897	161,357 73,192	202,809 91,994
Drive – V-Belt								
D Overall Height	in. mm	120 3048	142 3607	170 4318	172 4369	180 4572	– –	– –
Weight – Dry	lbs. kg	6000 2722	9500 4309	14,000 6350	17,500 7938	25,500 11,567	– –	– –
Weight – Operating	lbs. kg	18,484 8384	34,468 15,635	57,694 26,170	76,800 34,836	103,526 46,959	– –	– –

Model "DR" Continuous Hydrapulper

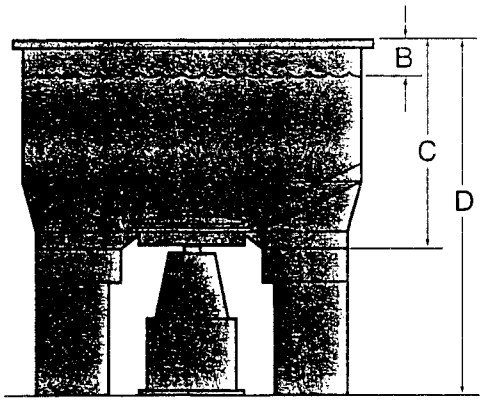
Model		6D	7D	8D	9D	10D	11D	12D	13D
[illegible]	[illegible]	[illegible]	[illegible]	[illegible] [illegible]	18 5486	20 6096	22 6706	[illegible]	26 7925
[illegible]	[illegible]	22 [illegible]	22 [illegible]	23 [illegible]	24 610	22 559	24 610	28 [illegible]	32 813
[illegible]	[illegible] mm	[illegible] 3073	[illegible] 3150	[illegible] 3251	136 3454	142 3607	153 3886	166 4216	184 4674
[illegible]	[illegible]	180 [illegible]	188 [illegible]	202 [illegible]	209 5309	216 5461	230 5842	238 [illegible]	256 6502
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2500 [illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1200 1089
[illegible]	[illegible]	13,500 6124	23,400 10,614	36,800 16,692	42,500 19,278	53,400 24,222	64,100 29,076	77,000 34,927	92,500 41,958
[illegible]	lbs. kg	50,952 23,112	73,336 33,265	99,221 45,006	136,131 61,749	178,241 80,850	226,394 102,692	295,472 134,026	373,393 169,371

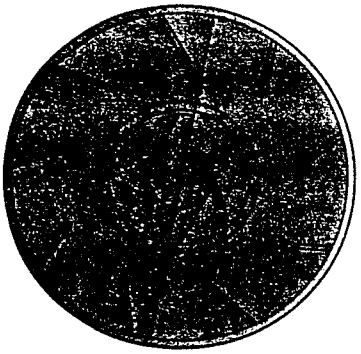
* Based on OCC furnish, 5/8" diameter extraction holes, 120° operating temperature

Helico High Consistency Pulper

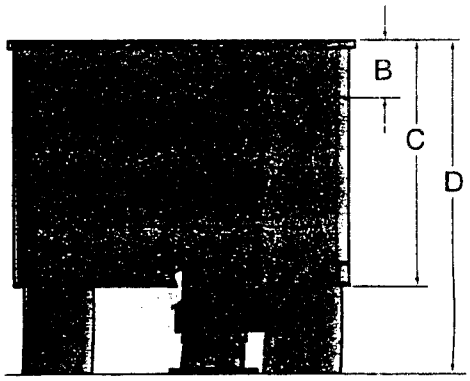
Size (cubic meters)		8	10	12	15	18	22.5	25	30	35	40	50	60	70
A Tub Diameter – Inside	in. mm	[illegible] [illegible]	[illegible] [illegible]	125 3175	141 3581	142 3607	154 3912	158 4013	176 4470	183 4648	189 4801	201 5105	211 5359	230 5842
B Freeboard	in. mm	[illegible] [illegible]	[illegible] [illegible]	[illegible] [illegible]	[illegible] [illegible]	68 1727	63 1600	59 1499	72 1829	77 1956	72 1829	72 1829	81 2057	84 2134
C Tub Height	in. mm	99 2515	104 2642	105 2667	110 2794	123 3124	130 3302	130 3302	144 3658	149 3785	155 3937	160 4064	168 4267	181 4597
D Overall Height	in. mm	149 3785	159 4039	160 4064	174 4420	197 5004	200 5080	204 5182	216 5486	226 5740	235 5969	248 6299	270 6858	280 7112
Operating Volume	cu. ft. m^3	282 8	353 10	424 12	530 15	636 18	794 22.5	883 25	1059 30	1236 35	1412 40	1766 50	2119 60	2472 70
Batch Size – 15% Consistency	lbs. kg	2650 1202	3300 1497	4000 1814	5000 2268	6000 2722	7500 3402	8300 3765	10,000 4536	11,500 5216	13,000 5897	16,500 7484	20,000 9072	23,000 10,433
Weight – Dry	lbs. kg	10,950 4967	13,600 6169	18,700 8482	24,600 11,159	29,100 13,200	35,400 16,057	37,800 17,146	46,000 20,866	54,500 24,721	55,900 25,356	63,500 28,804	83,000 37,649	102,300 46,403
Weight – Operating	lbs. kg	28,500 12,928	35,650 16,171	45,150 20,480	57,700 26,173	68,800 31,208	85,000 38,556	92,900 42,139	112,100 50,849	131,700 59,739	144,100 65,364	173,700 78,790	215,300 97,660	256,600 116,394

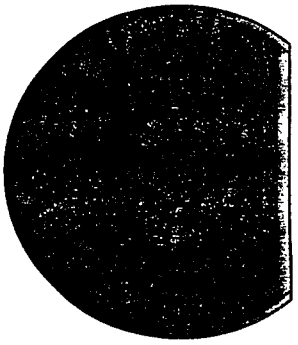
General dimensions – not certified for construction or installation



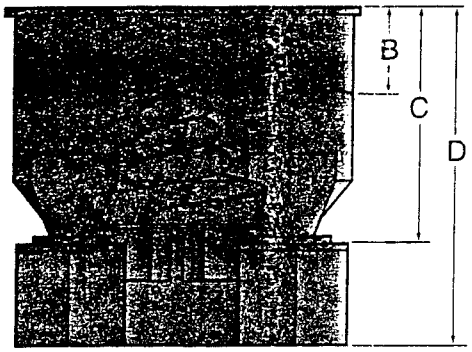


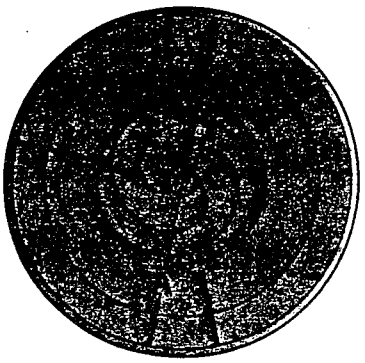
Standard Batch/Continuous





Model "DR" Continuous





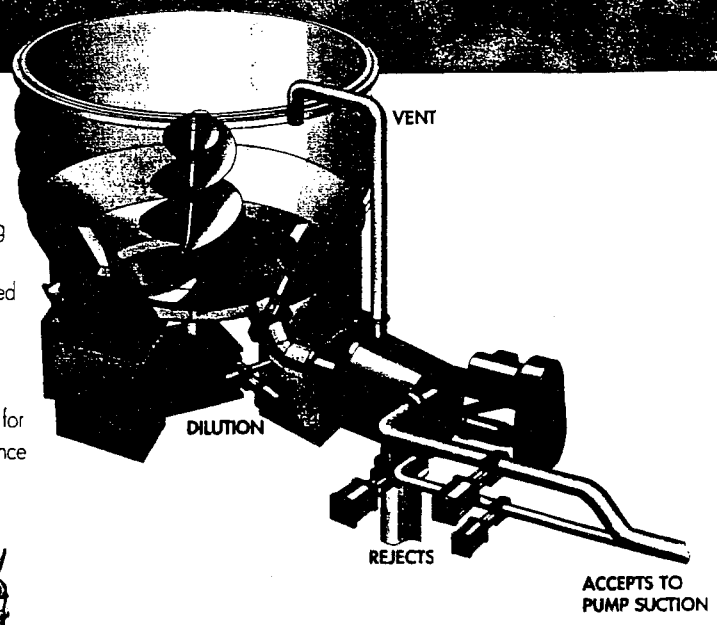
Helico Batch

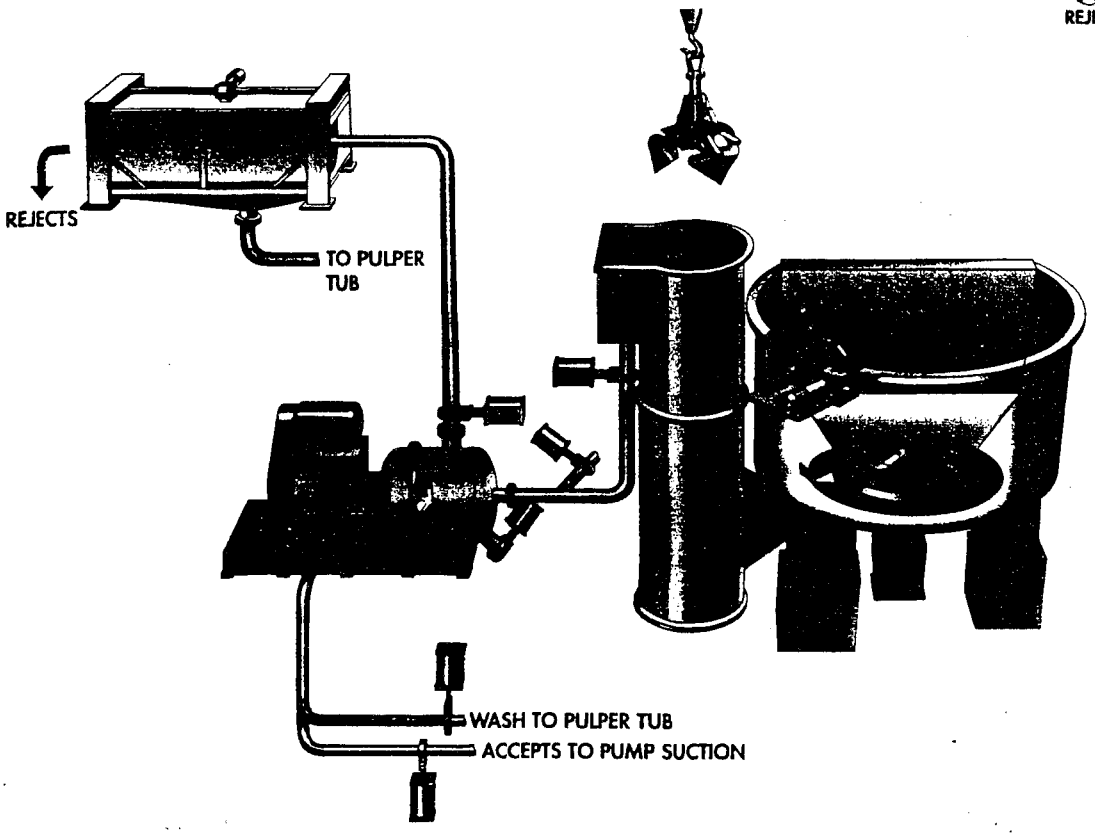
Pulper Detrashing Systems

Batch

Helipoire® System

- Keeps pulper tub clean – providing pre-screened extracted stock
- Extraction and detrashing performed simultaneously
- Decreases cycle time
- Increases system capacity
- Drive assembly mounted on trolley for easy rotor and bedplate maintenance





Continuous

Hydrapurge II Continuous Pulper Detrashing System

- Decreases or eliminates cleanout downtime
- Removes plastic in large pieces, with little degradation
- Contaminants are removed at operating floor level
- Increased pulper capacity
- Protection against tramp metal damage
- Eases burden on downstream equipment
- Drive assembly mounted on moveable base for easy rotor and bedplate maintenance
- External adjustment of rotor to bedplate clearance

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SMPP1102

Appendix D-44

Shredding System Subpart BB/CC Emission Calculations, Potential Pathways to Humans of Environmental Receptors

DESIGN ANALYSIS
OF
AIR POLLUTION CONTROL SYSTEM
CHICAGO FACILITY
FLAMMABLE TANK FARM & METAL WASH SYSTEM
AND
FUELS BLENDING/SHREDDING TOWER SYSTEM

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1. BACKGROUD

Clean Harbors of Chicago Inc. (CHCI), at their Chicago facility, proposes to operate a Shredding process/fuels blending; a tank farm that stores the blended fuels as well as other flammable wastes and a metal wash system. Two independently operated Air Pollution Control Devices (APCD) will be provided for the operation One APCD system will support shredding tower and fuel blending operation while the second APCD system will support the tank farm and the metal wash system.

As required by RCRA Air Standards, subpart cc, following engineering analysis provides the detailed tabulation and calculations for the APCD design verification as considered for several chemicals that, within permits, may be processed through these units.

2. APCD OPERATION

Primarily, both APCD contain two, properly sized, Granular Activated Carbon (GAC) beds, connected and used in series. Emissions from the storage tank farm is by natural displacement due to thermal as well as working losses, and that from the shredding tower system and metal wash system is forced/induced flow drawn by fans. The tank farm emissions are regulated by tank mounted conservation vents.

Each APCD system will be monitored as required by the permits. At any time, when monitoring indicates saturation of the lead carbon bed via established and approved test criteria, that bed is removed, the second bed is used in place of the lead bed and a new GAC bed is placed as a second bed. The spent carbon is sent out for its off-site regeneration.

3. LIST OF ORGANIC COMPOUNDS

For the purpose developing a comprehensive list of chemical compounds managed through the processes and their expected maximum concentrations, Clean Harbors performed a review of analytical data available from fuels blending operations at the Clean Harbors facilities in Baltimore, Maryland; Braintree, Massachusetts; Chicago, Illinois; and Cincinnati, Ohio. Based on this review and the review of OSHA regulated substances, CHI identified a total of 328 compounds that could potentially be present in the materials to be managed within the tank farm and the shredding operations. These compounds have been identified in Table 1 and Table 2 along with their expected maximum concentrations and the maximum operating temperature.

Table 1 contains compounds with potential maximum concentration (by weight) of 75% and 10%, while Table 2 contains those compounds expected to be present in levels of 1% and less than 1%.

These maximum concentrations are based on the conservative estimates from experience at the four (4) previously mentioned Clean Harbors facilities. The estimates of the maximum concentrations were derived as follows:

1. A list of potential compounds was accumulated from three sources:
   - List of OSHA regulated substances (29 CFR 1910, subpart Z)
   - The analytical survey of existing fuel blending operations at the Clean Harbors facilities in Baltimore, MD; Braintree, MA; and Cincinnati, OH.
   - And, the June 30, 1993 permit application for proposed storage tanks for fuels blending operation at Baltimore facility. This list was generated from the listed chemical constituents present in the EPA waste codes permitted for the fuels blending operation.

2. The compounds from each source in item 1 were combined into one (1) list.

3. Where analytical data from the Baltimore, Braintree and Cincinnati facilities was available for the identified compounds, the average concentration of each compound was calculated and, as a conservative measure, was doubled for this analysis. If the doubled average concentration was greater than the compound's concentration at any of the surveyed facilities, the doubled average concentration for that compound was selected as the basis for maximum expected concentration. If the doubled average was less than the highest concentration at any of surveyed facilities, the highest concentration was selected. This value then served as the basis for determining the maximum expected concentration for that compound.

4. Compounds, that were not identified through the analytical survey of the three (3) Clean Harbor facilities, were reviewed for their frequency of use in the industries that commonly generate waste fuel streams: paints and coating, petroleum and petrochemical, chemical manufacturing and others. Based on the prevalence of use, the compounds not included in the survey were assigned a likely maximum expected concentration.

5. Compounds that did have analytical results were reviewed again, and those with frequent commercial uses were adjusted to a higher concentration tier. Those that do not have common uses were changed to the closest higher tier.

6. For the ease of analysis, and some uniformity, these derived values then were rounded up to one of the three concentrations; 75%, 10% and 1%.

The list includes 328 toxic air pollutants (TAP). As indicated above, these compounds are divided into three tiers (75%, 10% & 1%) for assessment. The first tier consists of 23 compounds with a maximum concentration of 75% by weight. The second tier is comprised of 71 compounds with a maximum expected concentration of 10% by

weight. Each of the compounds in the first two tiers is assessed individually for estimated emissions based on maximum concentration. The final tier is composed of 235 compounds with a maximum expected concentration of 1% or less. Of the 235 compounds, 29 compounds have been identified to be present at low level, hence they are included in the analysis. The remaining 206 compounds have not been assessed for estimated emissions, since their presence has not been documented and, therefore, their occurrence will be rare. Because they may be received on a sporadic basis and at a very low concentration, it is also expected that if all of the compounds assessed met the emissions control criteria through the APCD used, then the remainder of third tier compounds will also meet the emissions standards.

4. VAPOR PRESSURE DATA

For the compounds under consideration, vapor pressure data has been tabulated in Table 3. The data includes actual values of vapor pressure at seven (7) select temperatures and is shown for the available compounds in the columns (*F, G, H, I, J, K* and *L*) of the Tables 3. This data has been obtained from various references. However such data could not be found for every compound of concern at all of the seven select temperatures. Therefore, independent of the discrete data points, Antoine's Equation has been used to compute vapor pressure for the compounds for which the equation constants were known. The computed values are tabulated in column Q of the Tables. Note that in calculating the vapor pressure normal operating temperature is assumed to be 60 degrees F.

5. CONCENTRAION OF CHEMICAL IN VAPORS (at Saturation)

Table 4 provides tabulation of computations to determine maximum possible chemical concentration in the vapor phase that would be present in the air emissions leaving the process units. The calculations assume that the chemical concentration in vapor phase in the storage tanks (headspace), metal wash system and that at shredding tower will be at equilibrium with the concentration of chemical in the liquid phase. In other words, the vapor phase is considered to be in a saturated state, in order to evaluate the worst case scenario.

The column "R" provides the vapor pressures used for the concentration calculations. The data for the vapor pressure is obtained from the Table 3. In the column, R, discrete temperature values of vapor pressure are used wherever the data point for the discrete temperature 60 degrees F is available. Otherwise, calculated values of vapor pressure are used.

To determine the mole fraction (tabulated in column T) of each chemical in the waste mixture, the expected maximum concentration (as identified in column S) of chemical has been used. The remaining component of the mixture is considered to be

"STODDARD SOLVENT"

The mole fraction data is used to arrive at the worst case vapor pressure (partial pressure at saturation) of each chemical. The partial pressure data is tabulated in the column "V".

Based on the partial pressure (Column V) and the molecular weight (column D), worst case concentration of each chemical is computed and presented in column "Y", in terms of pound mass of chemical per pound mass of air. This information is tabulated in two different forms in columns Z & AA.

6. VENT RATE

Tank farm vent system supports four storage tanks and the metal wash system. All Four storage tanks are connected to a common header in which a vent header blower discharge from metal wash system is connected leading to the air pollution control system. The system consists of two carbon columns in series. Each carbon column holds approximately 1,800 pounds of carbon. For a peak loading scenario, it is assumed that, one bulk truck is being unloaded at a rate of 200 Gallons/minute (gpm) into the storage tank, and blended fuel is being transferred into another storage tank at a rate of 200 gpm. Thus causing the total vapor displacement of 400 gpm (53,5 cfm) from the tanks. Assuming a maximum of 40,000 gallons of fuel being received per day and about 40,000 net gallons of blended fuels being generated, the peak operation will be "on" for approximately 200 minutes (3.5 hours). For off-peak operation, it is assumed that the thermal losses will be the only emissions occurring form the storage tanks. This will be about 1250 SCFH or 20 SCFM. This will occur for the duration of 12.5 hours per day. For the remaining 8 hrs a N2 inflow will be required to compensate for the cooling effect.

The Metal shredding system will have equivalent steady state vent rate of 20 SCFM of saturated vapors. The vent header from the metal wash system is connected to 200 SCFM capacity blower that will maintain a very slight negative pressure into the wash system.

Therefore the total peak and off-peak venting rates will be 73.5 and 40 SCFM. In addition, during the 8 hr. period of no emissions from the tanks, the metal wash system will have equivalent of 20 SCFM saturated vapors being vented. For a conservative approach, vent rates of 75 SCFM for 3.5 hrs. and 40 SCFM for 20.5 hrs. is used.

With the flow rates and the duration identified, columns AD and AG provide the chemical loading to the carbon for each period. Column AH shows the theoretical average vent rate. The total loading is shown in column AI, which is a result of addition of values in column AD and AG.

In case of the Shredding process & fuels blending operation, the N2 supply is provided at a rate of 200 SCFM controlled by an Oxygen sensor to maintain oxygen level at or below 8%. The shredding tower is also provided with N2 for initial purge and in-process purge due to opening and closing of airlock chamber. The combined flow rate of N2 to shredding tower is estimated to be 72.5 SCFM on an average steady state basis. The hydrapulper tank is vented into the common header leading to a vent blower rated at 300 SCFM. This blower maintains a slight negative pressure with in the system. At a nominal capacity of 30 drums/hour, the hydrapulper will have the working losses of 1650 SCFH or 27.5 SCFM. Therefore the combined vent rate of saturated vapors from the system wold be 100 SCFM. With a 10% contingency, this will be then 110 SCFM, as used in the calculations and shown in column "AB" of Table 6. Using the flow rate of 110 SCFM and vent rate of 300 SCFM, the chemical concentration in the exhaust at the APCD inlet is calculated and tabulated in column AD. Using the calculated concentration and the flow data, total maximum chemical loading per day is computed (column AF). The numbers in the column AF (lb./day), represent the maximum loading of each compound, assuming that the wastes processed during a 24 hour period would contain that particular chemical at the assumed concentration.

7. CARBON USAGE/BREAK-THROUGH TIME

The calculated maximum chemical loading per day (column "AI " of Table 7 and column "AF" of Table 8) was used to determine the estimated time before the break-through of the carbon could occur, if the loading rate were to be continued. The manufacturer of the activated carbon, Calgon Co., has provided the data for the adsorption capacity of Granulated Activated carbon (GAC) for each chemical. Each carbon vessel has 1800 lb. Carbon. Therefore, the break-through time is computed to provide the use of first vessel only. The second carbon bed in series acts as a back-up/safety.

Table 7 and 8 depict these calculations for tank farm/metal wash system and the shredding tower/fuels blending operation, respectively.

8. SUMMARY

The detailed calculations and the discussion herein, confirms that the two Granular Activated Carbon (GAC) units will provide adequate controls for the emissions of organic compounds considered.

The GAC units, 1800 lbs. each, are connected in series for the use as an Air Pollution Control Device (APCD) at CHI facility for the tank farm and the fuels blending operation.

It has been shown that under a worst case scenario, for any given chemical considered, several hours of control will be provided before a break-through of the first bed can occur.

Clean Harbors, Inc.
Chicago Facility
List of organic compounds

CAS Number	Constituent	Mol. Wt.	Density lb/gal	Max. Temp. deg. F	Conc. by wt. %
	Column ID -->	*D*	*E*	*P*	*S*
124-18-5	Decane	142.29	6.09	60	75%
112-40-3	Dodecane	170	6.25	60	75%
1120-21-4	Undecane	156.35	6.18	60	75%
95-47-6	1,2 dimethyle benzene	106.17	7.35	60	75%
78-93-3	2, BUTANINE	72.1	6.75	60	75%
108-10-1	4 methyl 2 pentanone	100.2	6.68	60	75%
67-64-1	ACETONE	58.08	6.63	60	75%
108-90-7	CHLOROBENZENE	112.6	9.24	60	75%
100-82-7	CYCLOHEXANE	84.16	6.52	60	75%
64-17-5	ETHANOL	46.07	6.61	60	75%
141-78-6	ETHYL ACETATE	88.1	7.55	60	75%
100-41-4	ETHYL BENZENE	106.17	7.23	60	75%
142-82-5	HEPTANE	100.2	5.73	60	75%
110-54-3	HEXANE	86.17	5.53	60	75%
78-83-1	ISOBUTYL ALCOHOL	74.12	6.71	60	75%
67-63-0	ISOPROPYL ALCOHOL	60.09	6.57	60	75%
67-56-1	METHANOL	32.04	6.63	60	75%
8030-30-6	NAPHTHA	127.08	7.32	60	75%
111-65-9	OCTANE	114.23	5.87	60	75%
8052-41-3	STODDARD SOLVENT	127.08	8.34	60	75%
108-88-3	TOLUENE	92.13	7.26	60	75%
8006-64-2	TURPENTINE	136	7.17	60	75%
1330-20-7	XYLENES	106.17	7.24	60	75%
611-14-3	1 ethyl 2 methyl benzene	120.2	7.35	60	10%
108-67-8	1,3,5 trimethyl benzene	120.21	7.21	60	10%
584-94-1	2,3 dimethyl hexane	114.23	5.94	60	10%
589-34-4	3 methyl hexane	120.21	5.72	60	10%
96-14-0	3 methyl pentane	86.18	5.54	60	10%
103-65-1	propyl benzene	120.21	7.19	60	10%
75-34-3	1,1 DICHLOROETHANE	98.97	9.86	60	10%
540-59-0	1,1 DICHLOROETHYLENE	96.95	10.76	60	10%
71-55-6	1,1,1 TRICHLOROETHANE	133.42	11.22	60	10%
630-20-6	1,1,1,2 TETRACHLOROETHANE	167.85	13.34	60	10%
76-13-1	1,1,2 TRICHLORO 1,2,2 TRIFLUOROETHANE	187.38	13.18	60	10%
79-00-5	1,1,2 TRICHLOROETHANE	133.4	11.16	60	10%
79-34-5	1,1,2,2 TETRACHLOROETHANE	167.85	13.24	60	10%
107-06-2	1,2 DICHLOROETHANE	98.97	10.5	60	10%
111-76-2	2 BUTOXYETHANOL	118.2	7.52	60	10%
110-80-5	2 ETHOXYETHANOL	90.14	7.81	60	10%
111-15-9	2 ETHOXYETHYL ACETATE	132.18	8.13	60	10%
591-78-6	2 HEXANONE	100.18	6.92	60	10%
110-49-6	2 METHOXYETHYL ACETATE	118.13	8.38	60	10%

Chicago Facility
List of organic compounds

CAS Number	Constituent	Mol. Wt.	Density lb/gal	Max. Temp. deg. F	Conc. by wt. %
	Column ID -->	*D*	*E*	*P*	*S*
95-48-7	2 methylphenol	108.14	8.74	60	10%
109-86-4	2 METHOXYETHANOL	76.11	8.06	60	10%
106-44-5	4 methylphenol	108.1	8.63	60	10%
98-83-9	A METHYL STYRENE	118	7.59	60	10%
75-07-0	ACETALDEHYDE	44	6.58	60	10%
64-19-07	ACETIC ACID	60.05	8.79	60	10%
75-5-8	ACETONITRILE	41.05	6.56	60	10%
71-43-2	BENZENE	78.11	7.37	60	10%
117-81-7	bis(2 ethylhexyl)phthalate	390.54	8.23	60	10%
56-23-5	CARBON TETRACHLORIDE	153.84	13.37	60	10%
67-66-3	CHLOROFORM	119.39	12.49	60	10%
1319-77-3	CRESOL	108.13	8.76	60	10%
98-82-8	CUMENE	120.2	7.21	60	10%
108-93-0	CYCLOHEXANOL	100.2	8.03	60	10%
108-94-1	CYCLOHEXANONE	98.2	7.91	60	10%
110-83-8	CYCLOHEXENE	82.15	6.76	60	10%
542-92-7	Cyclopentadiene	66.1	6.69	60	10%
84-74-2	di n butylphthalate	278.38	8.34	60	10%
117-84-0	di n octylphthalate	390.54	8.23	60	10%
108-83-8	DIISOBUTYL KETONE	142.23	6.72	60	10%
68-12-2	DIMETHYL FORMAMIDE	73.09	7.58	60	10%
131-11-3	dimethylphthalate	194.2	9.97	60	10%
123-91-1	DIOXANE	88.1	8.66	60	10%
541-85-5	ETHYL AMYL KETONE	128.24	6.86	60	10%
106-35-4	ETHYL BUTYL KETONE	114.21	6.84	60	10%
60-29-7	ETHYL ETHER	74.12	5.99	60	10%
56-81-5	GLYCERIN	92.11	10.51	60	10%
67-72-1	HEXACHLOROETHANE	236.72	17.44	60	10%
123-92-2	ISOAMYL ACETATE	130.18	7.31	60	10%
123-51-3	ISOAMYL ALCOHOL	88.15	6.76	60	10%
110-19-0	ISOBUTYL ACETATE	116.16	7.27	60	10%
78-59-1	ISOPHORONE	138.2	7.68	60	10%
108-21-4	ISOPROPYL ACETATE	102.15	7.29	60	10%
79-20-9	METHYL ACETATE	74.08	7.83	60	10%
108-11-2	METHYL AMYL ALCOHOL	102.18	6.73	60	10%
110-43-0	METHYL N AMYL KETONE	114.21	6.84	60	10%
107-87-9	METHYL PROPYL KETONE	86.15	6.7	60	10%
75-09-2	METHYLENE CHLORIDE	84.94	11.12	60	10%
123-86-4	N BUTYL ACETATE	116.18	7.34	60	10%
71-36-3	N BUTYL ALCOHOL	74.12	6.76	60	10%
98-95-3	NITROBENZENE	123.1	10.06	60	10%
109-66-0	PENTANE	72015	5.25	60	10%
108-95-2	PHENOL	94.11	8.83	60	10%
105-46-4	SEC BUTYL ACETATE	116.18	7.21	60	10%
78-92-2	SEC BUTYL ALCOHOL	74.12	6.73	60	10%

Chicago Facility
List of organic compounds

CAS Number	Constituent	Mol. Wt.	Density lb/gal	Max. Temp. deg. F	Conc. by wt. %
	Column ID -->	*D*	*E*	*P*	*S*
100-42-5	STYRENE	104.15	7.56	60	10%
75-65-0	TERT BUTYL ALCOHOL	74.12	6.6	60	10%
127-18-4	TETRACHLOROETHYLENE	165.83	13.55	60	10%
109-99-9	TETRAHYDROFURAN	72.12	7.42	60	10%
156-60-5	TRANS 1,2 DICHLOROETHYLENE	96.95	10.52	60	10%
79-01-6	TRICHLOROETHYLENE	131.4	12.27	60	10%
na	1,1' oxybis(2 methoxy) ethane	134.12	7.88	60	10%

Clean Harbors, Inc.
Chicago Facility
List of organic compounds

CAS Number	Constituent	Mol. Wt.	Density lb/gal	Max. Temp. deg. F	Conc. by wt. %
	Column ID -->	*D*	*E*	*P*	*S*
78-87-5	1,2 DICHLOROPROPANE	112.99	9.67	60	1%
79-46-9	2 NITROPROPANE*	89.09	8.26	60	1%
107-02-8	acrolein	56.1	7.03	60	1%
107-13-1	ACRYLONITRILE*	53.06	6.76	60	1%
107-18-6	ALLYL ALCOHOL	76.53	7.13	60	1%
107-05-1	Allyl Chloride	56.53	7.86	60	1%
62-53-3	Aniline	93.1	8.53	60	1%
91-59-8	b NAPTHAYLAMINE*	143.2	8.85	60	1%
542-88-1	BIS (CHLOROMETHYL) ETHER*	114.96	10.7	60	1%
106-99-0	BUTADIENE*	54.1	5.18	60	1%
75-15-0	CARBON DISULFIDE*	76.13	10.59	60	1%
142-40-3	DIMETHYLAMINE	45.08	5.6	60	1%
50-00-00	FORMALDEHYDE*	30.03	8.34	60	1%
77-47-4	hexachlorocyclopenatadiene	272.7	14.26	60	1%
302-01-2	hydrazine*	32.05	8.41	60	1%
60-34-4	methylhydrazine	46.09	7.29	60	1%
57-14-7	1,1 dimethylhydrazine	60.1	7.88	60	1%
75-01-4	vinyl chloride	62.5	8.08	60	1%
62-75-9	N nitrosodimethylamine	74.1	8.38	60	1%
74-90-8	hydrogen cyanide	27.03	5.77	60	1%
108-03-2	1 NITROPROPANE	89.09	8.29	60	1%
71-41-0	1 pentanol	88.15	6.81	60	1%
95-57-8	2 chlorophenol	128.56	10.49	60	1%
91-57-6	2 methylnapthalene	142.2	8.5	60	1%
109-89-7	DIETHYLAMINE	73.14	5.9	60	1%
79-10-7	acrylic acid	72.06	8.86	60	1%
83-32-9	acenaphthene	154.21	8.34	60	1%
75-00-3	CHLOROETHANE	64.52	7.45	60	1%
74-87-3	CHLOROMETHANE	50.49	8	60	1%
87-68-3	hexachlorobutadiene				<1%
122-66-7	1,2 diphenylhydrazine				<1%
606-20-2	2,6 DINITROTOLUENE				<1%
88-85-7	4,6 dinitro 2 methphenol				<1%
76-44-8	heptachlor				<1%
92-87-5	benzedine				<1%
na	1 isocyano butane				<1%
91-17-8	decahydro napthalene				<1%
1795-15-9	octyl cyclohexane				<1%
na	1 (2 methoxy propoxy) 2 propanol				<1%
600-25-9	1 CHLORO 1 NOTROPROPANE				<1%
594-72-9	1,1 DICHLORO 1 NITROETHANE				<1%
76-11-9	1,1,1,2 TETRACHLORO 2,2 DIFLUOROETHANE				<1%
76-12-0	1,1,2,2 TETRACHLORO 2,2 DIFLUOROETHANE				<1%
95-50-1	1,2 DCB				<1%

Chicago Facility
List of organic compounds

CAS Number	Constituent	Mol. Wt.	Density lb/gal	Max. Temp. deg. F	Conc. by wt. %
	Column ID -->	*D*	*E*	*P*	*S*
96-12-8	1,2 DIBROMO 3 CHLOROPROPANE*				<1%
96-18-4	1,2,3 TRICHLOROPROPANE				<1%
120-82-1	1,2,4 trichlorobenzene				<1%
541-73-1	1,3 DCB				<1%
106-46-7	1,4 DCB				<1%
na	2 (2 butoxy ethoxy) ethanol				<1%
na	2 (hexy/oxy) ethanol				<1%
126-99-8	2 CHLORO 1,3 BUTADIENE				<1%
110-75-8	2 chloroethyl vinyl ether				<1%
91-58-7	2 chloronapthalene				<1%
100-37-8	2 DIETHYLAMINOETHANOL				<1%
149-57-5	2 ethyl hexanoic acid				<1%
100-01-6	2 NITROANILINE				<1%
88-75-5	2 nitrophenol				<1%
120-83-2	2,4 dichlorophenol				<1%
105-67-9	2,4 dimethylphenol				<1%
95-95-4	2,4,5 trichlorophenol				<1%
88-06-2	2,4,6 trichlorophenol				<1%
99-09-2	3 NITROANILINE				<1%
101-55-3	4 bromophenylphenyl ether				<1%
59-50-7	4 chloro 3 methylphenol				<1%
106-47-8	4 chloroaniline				<1%
7005-72-3	4 chlorophenylphenyl ether				<1%
na	4 fluor 1,1' biphenyl				<1%
123-42-2	4 HYDROXY 4 METHYL 2 PENTANONE				<1%
100-01-6	4 NITROANILINE				<1%
92-93-3	4 NITRODIPHENYL				<1%
100-02-7	4 nitrophenol				<1%
532-27-4	a CHLOROACETOPHENONE				<1%
134-32-7	a NAPTHYLAMINE				<1%
208-96-8	acenaphthylene				<1%
79-27-6	ACETYLENE TETRABROMIDE				<1%
260-94-6	ACRIDINE				<1%
106-92-3	ALLYL GYLCIDYL ETHER				<1%
7440-39-3	barium				<1%
100-44-7	benzyl chloride				<1%
111-91-1	bis (2 chloroethoxy) methane				<1%
111-44-4	bis (2 chloroethyl) ether				<1%
108-60-1	bis (2 chloroisopropyl)ether				<1%
75-27-4	bromodichloromethane				<1%
75-25-2	bromoform				<1%
74-83-9	BROMOMETHANE				<1%
106-97-8	butane				<1%
109-73-9	BUTYLAMINE				<1%
85-68-7	butylbenzylphthalate				<1%
7440-43-9	cadmium				<1%
107-20-0	CHLOROACETALDEHYDE				<1%

Chicago Facility
List of organic compounds

CAS Number	Constituent	Mol. Wt.	Density lb/gal	Max. Temp. deg. F	Conc. by wt. %
	Column ID -->	*D*	*E*	*P*	*S*
74-97-5	CHLOROBROMOMETHANE				<1%
107-30-2	CHLOROMETHYL METHYL ETHER				<1%
7440-47-3	chromium				<1%
218-01-9	chrysene				<1%
10061-01-5	cis 1,3 dichloropropene				<1%
123-73-9	CROTONALDEHYDE				<1%
124-48-1	dibromochloromethane				<1%
106-93-4	DIBROMOETHANE				<1%
75-71-8	DICHLORODIFLUOROMETHANE				<1%
111-44-4	DICHLOROETHYL ETHER				<1%
76-14-2	DICHLOROTETRAFLUOROETHANE				<1%
84-66-2	diethylphthalate				<1%
75-61-6	DIFLUORODIBROMOMETHANE				<1%
2238-07-5	DIGLYCIDYL ETHER				<1%
123-31-9	DIHYDROXYBENZENE				<1%
108-18-9	DIISOPROPYLAMINE				<1%
127-19-5	DIMETHYL ACETAMIDE				<1%
121-69-7	DIMETHYLAMINOBENZENE				<1%
121-69-7	DIMETHYLANILINE				<1%
77-78-1	dimethylsulfate				<1%
92-52-4	DIPHENYL				<1%
34690-94-8	DIPROPYLENE GLYCOL METHYL EHTER				<1%
106-89-8	EPICHLOROHYDRIN				<1%
141-43-5	EHTANOLAMIN				<1%
140-88-5	ETHYL ACRYLATE				<1%
74-96-4	ETHYL BROMIDE				<1%
109-94-4	ETHYL FORMATE				<1%
75-04-7	ETHYLAMINE				<1%
107-15-3	ETHYLENEDIAMIN				<1%
75-21-8	ETHYLENE OXIDE*				<1%
206-44-0	fluoranthene				<1%
86-73-7	fluorene				<1%
64-18-6	formic acid				<1%
98-01-1	FURFURAL				<1%
98-00-0	FURFURYL ALCOHOL				<1%
110-80-5	GLYCOL MONOETHYL ETHER				<1%
556-52-5	GLYCIDOL				<1%
118-74-1	hexachlorobenzene				<1%
123-31-9	HYDROQUINONE				<1%
74-88-4	idomethane				<1%
108-20-3	ISOPROPYL ETHER				<1%
4016-14-2	ISOPROPYL GLYCIDYL ETHER				<1%
75-31-0	ISOPROPYLAMINE				<1%
463-15-4	KETENE				<1%
7439-92-1	lead				<1%
1634-04-4	methyl t butylether				<1%
74-99-7	METHYL ACETYLENE				<1%

Chicago Facility
List of organic compounds

CAS Number	Constituent	Mol. Wt.	Density lb/gal	Max. Temp. deg. F	Conc. by wt. %
	Column ID -->	*D*	*E*	*P*	*S*
107-31-3	METHYL FORMATE				<1%
80-62-6	METHYL METHACRYLATE				<1%
109-87-5	METHYLAL				<1%
74-89-5	METHYLAMINE				<1%
108-87-2	METHYLCYCLOHEXANE				<1%
25639-42-3	METHYLCYCLOHEXANOL				<1%
110-91-4	MORPHOLINE				<1%
2426-08-6	N BUTYL GLYCIDYL ETHER				<1%
109-60-4	N PROPYL ACETATE				<1%
71-23-4	N PROPYL ALCOHOL				<1%
91-20-3	NAPTHALENE				<1%
7440-02-0	nickel				<1%
99-08-1	NITROTOLUENE				<1%
583-60-8	o METHYLCYCLOHEXANONE				<1%
100-00-5	p NITROCHLOROBENZENE				<1%
106-50-3	p PHENYLENE DIAMINE				<1%
98-51-1	p TERT BUTYLTOLUENE				<1%
1321-64-8	PENTACHLORONAPHTHALENE				<1%
87-86-5	PENTACHLOROPHENOL				<1%
115-77-5	PENTAERYTHRITOL				<1%
85-01-8	phenanthrene				<1%
101-84-8	PHENYL EHTER				<1%
122-60-1	PHENYL GLYCIDYL ETHER				<1%
74-98-6	PROPANE				<1%
78-87-5	PROPYLENE DICHLORIDE				<1%
75-55-8	PROPYLENE IMENE				<1%
75-66-9	PROPYLENE OXIDE				<1%
110-86-1	pyrene				<1%
110-86-1	PYRIDINE				<1%
106-51-4	QUINONE				<1%
108-84-9	SEC HEXYL ACETATE				<1%
1320-73-2	SODIUM HYDROXIDE				<1%
1335-88-2	TETRACHLORONAPHTHALENE				<1%
78-00-2	TETRAETHYL LEAD				<1%
95-53-4	TOLUIDINE				<1%
10061-02-6	trans 1,3 dichloropropene				<1%
126-73-4	TRIBUTYL PHOSPHATE				<1%
75-69-4	TRICHLOROFLUOROMETHANE				<1%
1321-65-9	TRICHLORONAPHTHALENE				<1%
121-44-8	TRIETHYL AMINE				<1%
75-63-8	TRIFLUOROBROMOMETHANE				<1%
118-96-7	TRIORTHOCRESYL PHOSPHATE				<1%
115-86-6	TRIPHENYL PHOSPHATE				<1%
108-05-4	vinyl acetate				<1%
25013-15-4	VINYL TOLUENE				<1%
94-75-7	2,4 D				<1%
51-28-5	2,4 nitrophenol				<1%

Chicago Facility
List of organic compounds

CAS Number	Constituent	Mol. Wt.	Density lb/gal	Max. Temp. deg. F	Conc. by wt. %
	Column ID -->	*D*	*E*	*P*	*S*
121-14-2	2,4 DINITROTOLUENE				<1%
93-72-1	2,4,5 TP				<1%
91-94-1	3,3 dichlorobenzidine				<1%
60-11-7	4 dimethylaminoazobenzene				<1%
72-54-8	4,4' DDD				<1%
72-55-9	4,4' DDE				<1%
50-29-3	4,4' DDT				<1%
309-00-2	aldrine				<1%
319-84-6	alpha BHC				<1%
120-12-7	ANTHRACENE				<1%
7440-38-2	arsenic				<1%
56-55-3	benzo(a)anthracene				<1%
50-32-8	benzo(a)pyrene				<1%
205-99-2	benzo(b)fluoranthene				<1%
191-24-2	benzo(ghi)perylene				<1%
207-08-9	benzo(k)fluoranthene				<1%
7440-41-7	beryllium				<1%
319-85-7	beta BHC				<1%
57-74-9	chlordane				<1%
319-86-8	delta BHC				<1%
53-70-3	dibenzo(a,h)anthracene				<1%
132-64-9	dibenzofuran				<1%
60-57-1	dieldrine				<1%
534-52-1	DINITRO O CRESOL				<1%
528-29-0	DINITROBENZENE				<1%
115-29-7	endosulfan				<1%
na	endosulfan sulfate				<1%
72-20-8	endrin				<1%
na	endrin aldehyde				<1%
na	endrin ketone				<1%
1024-57-3	heptachlor epoxide				<1%
7783-06-4	HYDROGEN SULFIDE				<1%
193-39-5	indeno(1,2,3 cd)pyrene				<1%
58-89-9	lindane				<1%
108-31-6	maleic anhydride				<1%
7439-97-6	mercury				<1%
72-43-5	methoxychlor				<1%
621-64-7	N nitroso di n propylamine				<1%
86-30-6	N nitrosodiphenylamine				<1%
79-24-3	NITROETHANE				<1%
7664-41-7	ammonia				<1%
55-63-0	NITROGLYCERIN				<1%
75-52-5	NITROMETHANE				<1%
56-38-2	parathion				<1%
671-16-9	PCB				<1%
85-44-9	PHTHALIC ANHYDRIDE				<1%
7782-49-2	selenium				<1%

Chicago Facility
List of organic compounds

CAS Number	Constituent	Mol. Wt.	Density lb/gal	Max. Temp. deg. F	Conc. by wt. %
	Column ID -->	*D*	*E*	*P*	*S*
7740-22-4	silver				<1%
584-84-9	toluene 2,4 diisocyanate				<1%
8001-35-2	toxaphene				<1%

Clean Harbors, Inc.
Chicago Facility
Vapor Pressure Data

CAS Number	Constituent	Vapor Pressure (psia) at Temperature (degrees F)							Constants for Antoine's Equation (deg. C)			Max. Temp. deg. F	Estimated Vap Press psia
		40	50	60	70	80	90	100	A	B	C		
	Column ID -->	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*	*Q*
124-18-5	Decane	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	6.94	1495.17	193.86	60	0.0123
112-40-3	Dodecane	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	7.00	1639.27	181.84	60	0.0010
1120-21-4	Undecane	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	6.97	1569.57	187.70	60	0.0034
95-47-6	1,2 dimethyle benzene	0.0000	0.0000	0.0711	0.0000	0.0000	0.0000	0.0000	7.00	1474.68	213.69	60	0.0711
78-93-3	2, BUTANINE	0.7150	0.9280	1.1990	1.4890	2.0690	2.6680	3.3450	6.97	1209.60	216.00	60	1.0884
108-10-1	4 methyl 2 pentanone	0.0000	0.0000	0.2120	0.0000	0.0000	0.0000	0.0000	6.67	1168.40	191.90	60	0.2120
67-64-1	ACETONE	1.6820	2.1850	2.8620	3.7130	4.6990	5.9170	7.2510	7.12	1210.60	229.66	60	2.9282
108-90-7	CHLOROBENZENE	0.0000	0.0000	0.1335	0.0000	0.0000	0.0000	0.0000	6.98	1431.05	217.55	60	0.1335
100-82-7	CYCLOHEXANE	0.6770	0.9280	1.2180	1.6050	2.0690	2.6100	3.2490	6.84	1201.53	222.65	60	1.2114
64-17-5	ETHANOL	0.1930	0.4060	0.6190	0.8700	1.2180	1.6820	2.3200	8.32	1718.21	237.52	60	0.6578
141-78-6	ETHYL ACETATE	0.5800	0.8310	1.1020	1.4890	1.9340	2.5140	3.1910	7.10	1244.95	217.88	60	1.1330
100-41-4	ETHYL BENZENE	0.0000	0.0000	0.1085	0.0000	0.0000	0.0000	0.0000	6.98	1424.26	213.21	60	0.1085
142-82-5	HEPTANE	0.2900	0.4060	0.5410	0.7350	0.9670	1.2380	1.5860	6.90	1264.90	216.54	60	0.5401
110-54-3	HEXANE	1.1020	1.4500	1.8760	2.4360	3.0550	3.9060	4.8920	6.88	1171.17	224.41	60	1.9134
78-83-1	ISOBUTYL ALCOHOL	0.0580	0.0970	0.1350	0.1930	0.2710	0.3870	0.5410	7.47	1314.19	186.55	60	0.1812
67-63-0	ISOPROPYL ALCOHOL	0.2130	0.3290	0.4830	0.6770	0.9280	1.2960	1.7790	0.00	0.00	0.00	60	0.0000
67-56-1	METHANOL	0.7350	1.0060	1.4120	1.9530	2.6100	3.4610	4.5250	7.90	1474.08	229.13	60	1.4421
8030-30-6	NAPHTHA	0.0940	0.0940	0.0940	0.0940	0.0940	0.0940	0.1240	0.00	0.00	0.00	60	0.0000
111-65-9	OCTANE	0.0000	0.0000	0.0193	0.0000	0.0000	0.0000	0.0000	6.92	1351.99	209.15	60	0.1541
8052-41-3	STODDARD SOLVENT	0.0940	0.0940	0.0940	0.0940	0.0940	0.0940	0.1240	0.00	0.00	0.00	60	0.0000
108-88-3	TOLUENE	0.1740	0.2130	0.3090	0.4250	0.5800	0.7730	1.0060	6.95	1344.80	219.48	60	0.3301
8006-64-2	TURPENTINE	0.5250	0.5250	0.5610	0.6360	0.7180	0.8070	0.9030	0.00	0.00	0.00	60	0.0000
1330-20-7	XYLENES	0.0000	0.0000	0.1295	0.0000	0.0000	0.0000	0.0000	7.01	1426.27	215.11	60	0.1295
611-14-3	1 ethyl 2 methyl benzene	0.1900	0.1900	0.1900	0.1900	0.1900	0.1900	0.1900	0.00	0.00	0.00	60	0.0000
108-67-8	1,3,5 trimethyl benzene	0.0190	0.0190	0.0390	0.0590	0.0790	0.0990	0.1900	7.07	1569.62	209.58	60	0.0245
584-94-1	2,3 dimethyl hexane	0.1900	0.2800	0.3700	0.4600	0.5500	0.6500	0.7700	6.87	1315.50	214.16	60	0.2690
589-34-4	3 methyl hexane	0.7740	0.9600	1.1500	1.3400	1.5300	1.7200	1.9340	6.87	1240.20	219.22	60	0.7429
96-14-0	3 methyl pentane	1.9300	1.9300	1.9300	1.9300	1.9300	1.9300	1.9300	6.85	1152.37	227.13	60	2.4321
103-65-1	propyl benzene	0.1930	0.1930	0.1930	0.1930	0.1930	0.1930	0.1930	0.00	0.00	0.00	60	0.0000
75-34-3	1,1 DICHLOROETHANE	1.6820	2.2430	2.9010	3.7710	4.7380	5.8400	7.1930	6.98	1174.02	229.06	60	2.9103
540-59-0	1,1 DICHLOROETHYLENE	1.4500	2.0110	2.6680	3.4610	4.4090	5.6460	6.8070	6.97	1099.40	237.20	60	8.1045
71-55-6	1,1,1 TRICHLOROETHANE	0.9090	1.2180	1.5860	2.0300	2.6100	3.3070	4.1990	8.64	2136.60	302.80	60	1.6520
630-20-6	1,1,1,2 TETRACHLOROETHANE	0.0000	0.0000	0.1324	0.0000	0.0000	0.0000	0.0000	6.90	1365.88	209.74	60	0.1324
76-13-1	1,1,2 TRICHLORO 1,2,2 TRIFLUOROETHANE	0.0000	0.0000	4.3761	0.0000	0.0000	0.0000	0.0000	6.88	1099.90	227.50	60	4.3760
79-00-5	1,1,2 TRICHLOROETHANE	0.0000	0.0000	0.2450	0.0000	0.0000	0.0000	0.0000	6.95	1314.41	209.20	60	0.2450
79-34-5	1,1,2,2 TETRACHLOROETHANE	0.0000	0.0000	0.0431	0.0000	0.0000	0.0000	0.0000	6.63	1228.10	179.90	60	0.0431
107-06-2	1,2 DICHLOROETHANE	0.5610	0.7730	1.0250	1.4310	1.7400	2.2430	2.8040	7.03	1272.30	222.90	60	0.9458
110-80-5	2 ETHOXYETHANOL	0.0740	0.0740	0.0740	0.0740	0.0740	0.0740	0.0740	0.00	0.00	0.00	60	0.0000

Chicago Facility
Vapor Pressure Data

CAS Number	Constituent	Vapor Pressure (psia) at Temperature (degrees F)							Constants for Antoine's Equation (deg. C)			Max. Temp. deg. F	Estimated Vap Press psia
		40	50	60	70	80	90	100	A	B	C		
	Column ID -->	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*	*Q*
111-76-2	2 BUTOXYETHANOL	5.8030	5.8030	5.8030	5.8030	5.8030	5.8030	5.8030	0.00	0.00	0.00	60	0.0000
111-15-9	2 ETHOXYETHYL ACETATE	0.0230	0.0230	0.0230	0.0230	0.0230	0.0230	0.0230	0.00	0.00	0.00	60	0.0000
591-78-6	2 HEXANONE	0.1930	0.1930	0.1930	0.1930	0.1930	0.1930	0.1930	0.00	0.00	0.00	60	0.0000
110-49-6	2 METHOXYETHYL ACETATE	0.0392	0.0392	0.0392	0.0392	0.0972	0.0972	0.0972	0.00	0.00	0.00	60	0.0000
95-48-7	2 methylphenol	0.0000	0.0000	0.0018	0.0000	0.0000	0.0000	0.0000	6.91	1435.50	165.16	60	0.0018
109-86-4	2 METHOXYETHANOL	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.00	0.00	0.00	60	0.0000
106-44-5	4 methylphenol	0.0000	0.0000	0.0006	0.0000	0.0000	0.0000	0.0000	7.04	1511.08	161.85	60	0.0006
98-83-9	A METHYL STYRENE	0.0000	0.0000	0.0244	0.0000	0.0000	0.0000	0.0000	6.92	1486.88	202.40	60	0.0244
75-07-0	ACETALDEHYDE	0.0000	0.0000	12.1839	0.0000	0.0000	0.0000	0.0000	8.01	1600.02	291.81	60	12.1838
64-19-07	ACETIC ACID	0.0000	0.0000	0.1687	0.0000	0.0000	0.0000	0.0000	7.39	1533.31	222.31	60	0.1687
75-5-8	ACETONITRILE	0.6380	0.8310	1.0830	1.4120	1.8760	2.4560	3.1330	7.12	1314.40	230.00	60	1.1288
71-43-2	BENZENE	0.6380	0.8700	1.1600	1.5080	1.9720	2.6100	3.2870	6.91	1211.03	220.79	60	1.1679
117-81-7	bis(2 ethylhexyl)phthalate	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250	0.00	0.00	0.00	60	0.0000
56-23-5	CARBON TETRACHLORIDE	0.7930	1.0640	1.4120	1.7980	2.3010	2.9970	3.7710	6.93	1242.43	230.00	60	1.4478
67-66-3	CHLOROFORM	1.5280	1.9340	2.4750	3.1910	4.0610	5.1630	6.3420	6.49	929.44	196.03	60	2.4358
1319-77-3	CRESOL	0.0040	0.0060	0.0080	0.0120	0.0170	0.0240	0.0340	0.00	0.00	0.00	60	0.0000
98-82-8	CUMENE	0.0000	0.0000	0.0511	0.0000	0.0000	0.0000	0.0000	6.96	1460.79	207.78	60	0.0511
108-93-0	CYCLOHEXANOL	0.0000	0.0000	0.0017	0.0000	0.0000	0.0000	0.0000	6.26	912.87	109.13	60	0.0017
108-94-1	CYCLOHEXANONE	0.0000	0.0000	0.0550	0.0000	0.0000	0.0000	0.0000	7.85	2137.19	273.16	60	0.0541
110-83-8	CYCLOHEXENE	3.0950	3.0950	3.0950	3.0950	3.0950	3.0950	3.0950	6.84	1201.53	222.65	60	1.2114
542-92-7	Cyclopentadiene	7.6000	7.6000	7.6000	7.6000	7.6000	7.6000	7.6000	0.00	0.00	0.00	60	0.0000
84-74-2	di n butylphthalate	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.00	0.00	0.00	60	0.0000
117-84-0	di n octylphthalate	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250	0.00	0.00	0.00	60	0.0000
108-83-8	DIISOBUTYL KETONE	0.0350	0.0350	0.0350	0.0350	0.0500	0.0690	0.0950	0.00	0.00	0.00	60	0.0000
68-12-2	DIMETHYL FORMAMIDE	0.0000	0.0000	0.0404	0.0000	0.0000	0.0000	0.0000	6.93	1400.87	196.43	60	0.0404
131-11-3	dimethylphthalate	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.00	0.00	0.00	60	0.0000
123-91-1	DIOXANE	0.2320	0.3290	0.4250	0.6190	0.8310	1.1410	1.5080	7.43	1554.68	240.34	60	0.4385
541-85-5	ETHYL AMYL KETONE	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.00	0.00	0.00	60	0.0000
106-35-4	ETHYL BUTYL KETONE	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.00	0.00	0.00	60	0.0000
60-29-7	ETHYL ETHER	4.2150	5.6660	7.0190	8.7020	10.4420	13.3420	0.0000	6.92	1064.07	228.80	60	7.1087
56-81-5	GLYCERIN	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00	0.00	0.00	60	0.0000
67-72-1	HEXACHLOROETHANE	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.00	0.00	0.00	60	0.0000
123-92-2	ISOAMYL ACETATE	0.7370	0.7370	0.7370	0.7370	0.7370	0.6660	0.2710	7.44	1606.60	216.00	60	0.0608
123-51-3	ISOAMYL ALCOHOL	0.0120	0.0190	0.0300	0.0460	0.0700	0.1040	0.1520	0.00	0.00	0.00	60	0.0000
110-19-0	ISOBUTYL ACETATE	0.1880	0.1880	0.1880	0.2640	0.3640	0.4950	0.6640	0.00	0.00	0.00	60	0.0000
78-59-1	ISOPHORONE	0.0650	0.0650	0.0650	0.0650	0.0650	0.0650	0.0650	0.00	0.00	0.00	60	0.0000
108-21-4	ISOPROPYL ACETATE	0.3220	0.4540	0.6290	0.8590	1.1540	1.5300	2.0030	0.00	0.00	0.00	60	0.0000
79-20-9	METHYL ACETATE	1.4890	2.0110	2.7460	3.6930	4.6990	5.7620	6.9610	7.07	1157.63	219.73	60	2.6995
108-11-2	METHYL AMYL ALCOHOL	0.0730	0.0730	0.0730	0.1030	0.1450	0.2000	0.2740	0.00	0.00	0.00	60	0.0000
110-43-0	METHYL N AMYL KETONE	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.00	0.00	0.00	60	0.0000
107-87-9	METHYL PROPYL KETONE	0.1900	0.1900	0.1900	0.1900	0.3900	0.5900	0.7700	0.00	0.00	0.00	60	0.0000

Chicago Facility
Vapor Pressure Data

CAS Number	Constituent	Vapor Pressure (psia) at Temperature (degrees F)							Constants for Antoine's Equation (deg. C)			Max. Temp. deg. F	Estimated Vap Press psia
		40	50	60	70	80	90	100	A	B	C		
	Column ID -->	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*	*Q*
75-09-2	METHYLENE CHLORIDE	3.0940	4.2540	5.4340	6.7870	8.7020	10.3290	13.3420	7.41	1325.90	252.60	60	5.6346
123-86-4	N BUTYL ACETATE	0.2900	0.2900	0.2900	0.2900	0.2900	0.2900	0.2900	0.00	0.00	0.00	60	0.0000
71-36-3	N BUTYL ALCOHOL	0.0000	0.0000	0.0565	0.0000	0.0000	0.0000	0.0000	7.48	1362.39	178.77	60	0.0565
98-95-3	NITROBENZENE	0.0000	0.0000	0.0023	0.0000	0.0000	0.0000	0.0000	7.12	1746.60	201.80	60	0.0023
109-66-0	PENTANE	4.2930	5.4540	6.8280	8.4330	10.4450	12.9590	15.4740	6.85	1064.84	233.01	60	7.1523
108-95-2	PHENOL	0.0120	0.0120	0.0120	0.0120	0.0170	0.0240	0.0340	7.13	1516.79	174.95	60	0.0029
105-46-4	SEC BUTYL ACETATE	0.1540	0.2170	0.3010	0.4100	0.5510	0.7310	0.9580	0.00	0.00	0.00	60	0.0000
78-92-2	SEC BUTYL ALCOHOL	0.0720	0.1120	0.1710	0.2550	0.3730	0.5360	0.7570	0.00	0.00	0.00	60	0.0000
100-42-5	STYRENE	0.0000	0.0000	0.0718	0.0000	0.0000	0.0000	0.0000	7.14	1574.51	224.09	60	0.0718
75-65-0	TERT BUTYL ALCOHOL	0.1740	0.2900	0.4250	0.6380	0.9090	1.2380	1.7020	0.00	0.00	0.00	60	0.0000
127-18-4	TETRACHLOROETHYLENE	0.0000	0.0000	0.2071	0.0000	0.0000	0.0000	0.0000	6.98	1386.92	217.53	60	0.2071
109-99-9	TETRAHYDROFURAN	0.0000	0.0000	2.0322	0.0000	0.0000	0.0000	0.0000	7.00	1202.29	226.25	60	2.0382
156-60-5	TRANS 1,2 DICHLOROETHYLENE	2.5520	3.3840	4.3510	5.5300	6.8070	8.3150	10.0160	6.97	1141.90	231.90	60	4.3333
79-01-6	TRICHLOROETHYLENE	0.5030	0.6770	0.8890	1.1800	1.5080	2.0300	2.6100	6.52	1018.60	192.70	60	0.8190
na	1,1' oxybis(2 methoxy) ethane	0.0410	0.0410	0.0410	0.0410	0.0580	0.0800	0.1090	0.00	0.00	0.00	60	0.0000
78-87-5	1,2 DICHLOROPROPANE	0.6360	0.6360	0.6360	0.8360	1.0880	1.4030	1.7930	6.98	1308.10	222.80	60	0.6003
79-46-9	2 NITROPROPANE*	0.2370	0.2370	0.2370	0.3170	0.4200	0.5510	0.7160	0.00	0.00	0.00	60	0.0000
107-02-8	acrolein	3.3980	4.3580	5.5370	6.9710	8.7010	10.7700	13.2400	0.00	0.00	0.00	60	0.0000
107-13-1	ACRYLONITRILE*	0.8120	0.9670	1.3730	1.7990	2.3780	3.1330	4.0220	7.04	1232.53	222.47	60	1.4004
107-18-6	ALLYL ALCOHOL	0.1350	0.1930	0.2610	0.3870	0.5220	0.7160	1.0060	0.00	0.00	0.00	60	0.0000
107-05-1	Allyl Chloride	2.9980	3.7720	4.7970	6.0150	7.4470	9.1100	11.0250	0.00	0.00	0.00	60	0.0000
62-53-3	Aniline	0.0000	0.0000	0.0062	0.0000	0.0000	0.0000	0.0000	7.32	1731.52	206.05	60	0.0062
91-59-8	b NAPTHAYLAMINE*	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.0190	0.00	0.00	0.00	60	0.0000
542-88-1	BIS (CHLOROMETHYL) ETHER*	1.1600	1.1600	1.1600	1.1600	1.1600	1.1600	1.1600	0.00	0.00	0.00	60	0.0000
106-99-0	BUTADIENE*	14.6900	14.6900	14.6900	14.6900	14.6900	14.6900	14.6900	0.00	0.00	0.00	60	0.0000
75-15-0	CARBON DISULFIDE*	3.0360	3.8670	4.8340	6.0140	7.3870	9.1850	11.2150	6.94	1169.11	241.59	60	4.8072
142-40-3	DIMETHYLAMINE	13.1600	13.1600	13.1600	13.1600	13.1600	13.1600	13.1600	0.00	0.00	0.00	60	0.0000
50-00-00	FORMALDEHYDE*	0.0280	0.0280	0.0280	0.0280	0.0420	0.0610	0.0890	0.00	0.00	0.00	60	0.0000
77-47-4	hexachlorocyclopenatadiene	0.1800	0.1800	0.1800	0.1800	0.1800	0.1800	0.1800	0.00	0.00	0.00	60	0.0000
302-01-2	hydrazine*	0.0770	0.1110	0.1570	0.2210	0.3060	0.4190	0.5670	0.00	0.00	0.00	60	0.0000
60-34-4	methylhydrazine	0.5660	0.5660	0.5660	0.7690	1.0340	1.3760	1.8120	0.00	0.00	0.00	60	0.0000
57-14-7	1,1 dimethylhydrazine	0.0000	0.0000	1.8949	0.0000	0.0000	0.0000	0.0000	7.41	1305.91	225.53	60	1.8949
75-01-4	vinyl chloride	14.6900	14.6900	14.6900	14.6900	14.6900	14.6900	14.6900	0.00	0.00	0.00	60	0.0000
62-75-9	N nitrosodimethylamine	1.1600	1.1600	1.1600	1.1600	1.1600	1.1600	1.1600	0.00	0.00	0.00	60	0.0000
74-90-8	hydrogen cyanide	6.2840	7.8310	9.5140	11.8530	15.3920	18.5630	22.2370	7.53	1329.50	260.40	60	9.9216
108-03-2	1 NITROPROPANE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.11	1467.45	215.23	60	0.1101
71-41-0	1 pentanol	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.18	1314.56	168.11	60	0.0202
95-57-8	2 chlorophenol	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.88	1471.61	193.17	60	0.0130
91-57-6	2 methylnapthalene	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.07	1840.27	198.40	60	0.0006
109-89-7	DIETHYLAMINE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.80	583.30	144.10	60	2.7158

Chicago Facility
Vapor Pressure Data

CAS Number	Constituent	Vapor Pressure (psia) at Temperature (degrees F)							Constants for Antoine's Equation (deg. C)			Max. Temp. deg. F	Estimated Vap Press psia
		40	50	60	70	80	90	100	A	B	C		
	Column ID -->	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*	*Q*
79-10-7	acrylic acid	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.65	648.63	154.68	60	1.3436
83-32-9	acenaphthene	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.73	2534.23	245.58	60	0.0002
75-00-3	CHLOROETHANE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.99	1230.01	238.61	60	2.7101
74-87-3	CHLOROMETHANE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.09	1548.58	249.34	60	0.3415

Clean Harbors, Inc.
Chicago Facility
Conc. of Chemical in Vapors at Saturatic ion

CAS Number	Constituent	Mol. Wt.	Density lb/gal	Vapor Press. psia	Conc. by wt. %	Mole Fraction in Liquid		Partial Pressure			Saturated Conc. of Chemical		
						X(chem)	X(solvent)	PVP (chem) psia	PVP (Solvent) psia	TVP (Soln) psia	lb / lb mol air	lb/ cu.ft.air	mg/ cu.meter
	Column ID -->	*D*	*E*	*R*	*S*	*T*	*U*	*V*	*W*	*X*	*Y*	*Z*	*AA*
124-18-5	Decane	142.29	6.09	0.0190	75%	0.7282	0.2718	0.0138	0.0255	0.0394	0.134	0.00035	5641.85
112-40-3	Dodecane	170	6.25	0.0190	75%	0.6916	0.3084	0.0131	0.0290	0.0421	0.152	0.00040	6401.72
1120-21-4	Undecane	156.35	6.18	0.0190	75%	0.7092	0.2908	0.0135	0.0273	0.0408	0.143	0.00038	6037.20
95-47-6	1,2 dimethyle benzene	106.17	7.35	0.0711	75%	0.7822	0.2178	0.0556	0.0205	0.0761	0.401	0.00106	16911.41
78-93-3	2, BUTANINE	72.1	6.75	1.1990	75%	0.8410	0.1590	1.0083	0.0149	1.0233	4.946	0.01301	208336.54
108-10-1	4 methyl 2 pentanone	100.2	6.68	0.2120	75%	0.7919	0.2081	0.1679	0.0196	0.1874	1.144	0.00301	48205.49
67-64-1	ACETONE	58.08	6.63	2.8620	75%	0.8678	0.1322	2.4836	0.0124	2.4961	9.813	0.02581	413380.81
108-90-7	CHLOROBENZENE	112.6	9.24	0.1335	75%	0.7720	0.2280	0.1030	0.0214	0.1245	0.789	0.00208	33243.67
100-82-7	CYCLOHEXANE	84.16	6.52	1.2180	75%	0.8192	0.1808	0.9977	0.0170	1.0147	5.712	0.01502	240636.60
64-17-5	ETHANOL	46.07	6.61	0.6190	75%	0.8922	0.1078	0.5523	0.0101	0.5624	1.731	0.00455	72912.31
141-78-6	ETHYL ACETATE	88.1	7.55	1.1020	75%	0.8123	0.1877	0.8951	0.0176	0.9128	5.365	0.01411	225998.20
100-41-4	ETHYL BENZENE	106.17	7.23	0.1085	75%	0.7822	0.2178	0.0849	0.0205	0.1054	0.613	0.00161	25828.56
142-82-5	HEPTANE	100.2	5.73	0.5410	75%	0.7919	0.2081	0.4284	0.0196	0.4480	2.920	0.00768	123014.94
110-54-3	HEXANE	86.17	5.53	1.8760	75%	0.8156	0.1844	1.5301	0.0173	1.5475	8.970	0.02359	377855.70
78-83-1	ISOBUTYL ALCOHOL	74.12	6.71	0.1350	75%	0.8372	0.1628	0.1130	0.0153	0.1283	0.570	0.00150	24007.63
67-63-0	ISOPROPYL ALCOHOL	60.09	6.57	0.4830	75%	0.8638	0.1362	0.4172	0.0128	0.4300	1.706	0.00449	71849.03
67-56-1	METHANOL	32.04	6.63	1.4120	75%	0.9225	0.0775	1.3025	0.0073	1.3098	2.839	0.00747	119596.33
8030-30-6	NAPHTHA	127.08	7.32	0.0940	75%	0.7500	0.2500	0.0705	0.0235	0.0940	0.609	0.00160	25674.55
111-65-9	OCTANE	114.23	5.87	0.0193	75%	0.7695	0.2305	0.0149	0.0217	0.0366	0.116	0.00030	4870.65
8052-41-3	STODDARD SOLVENT	127.08	8.34	0.0940	75%	0.7500	0.2500	0.0705	0.0235	0.0940	0.609	0.00160	25674.55
108-88-3	TOLUENE	92.13	7.26	0.3090	75%	0.8054	0.1946	0.2489	0.0183	0.2672	1.560	0.00410	65704.31
8006-64-2	TURPENTINE	136	7.17	0.5610	75%	0.7371	0.2629	0.4135	0.0247	0.4382	3.826	0.01006	161155.35
1330-20-7	XYLENES	106.17	7.24	0.1295	75%	0.7822	0.2178	0.1013	0.0205	0.1217	0.731	0.00192	30808.08
611-14-3	1 ethyl 2 methyl benzene	120.2	7.35	0.1900	10%	0.1051	0.8949	0.0200	0.0841	0.1041	0.163	0.00043	6880.00
108-67-8	1,3,5 trimethyl benzene	120.21	7.21	0.0390	10%	0.1051	0.8949	0.0041	0.0841	0.0882	0.034	0.00009	1412.22
584-94-1	2,3 dimethyl hexane	114.23	5.94	0.3700	10%	0.1100	0.8900	0.0407	0.0837	0.1244	0.316	0.00083	13324.70
589-34-4	3 methyl hexane	120.21	5.72	1.1500	10%	0.1051	0.8949	0.1209	0.0841	0.2050	0.989	0.00260	41642.49
96-14-0	3 methyl pentane	86.18	5.54	1.9300	10%	0.1408	0.8592	0.2717	0.0808	0.3525	1.593	0.00419	67101.80
103-65-1	propyl benzene	120.21	7.19	0.1930	10%	0.1051	0.8949	0.0203	0.0841	0.1044	0.166	0.00044	6988.70
75-34-3	1,1 DICHLOROETHANE	98.97	9.86	2.9010	10%	0.1249	0.8751	0.3622	0.0823	0.4445	2.439	0.00641	102730.26
540-59-0	1,1 DICHLOROETHYLENE	96.95	10.76	2.6680	10%	0.1271	0.8729	0.3392	0.0821	0.4212	2.237	0.00588	94234.11
71-55-6	1,1,1 TRICHLOROETHANE	133.42	11.22	1.5860	10%	0.0957	0.9043	0.1518	0.0850	0.2368	1.378	0.00362	58034.42
630-20-6	1,1,1,2 TETRACHLOROETHANE	167.85	13.34	0.1324	10%	0.0776	0.9224	0.0103	0.0867	0.0970	0.117	0.00031	4940.41
76-13-1	1,1,2 TRICHLORO 1,2,2 TRIFLUOROETHANE	187.38	13.18	4.3761	10%	0.0701	0.9299	0.3066	0.0874	0.3941	3.909	0.01028	164665.32
79-00-5	1,1,2 TRICHLOROETHANE	133.4	11.16	0.2450	10%	0.0957	0.9043	0.0235	0.0850	0.1085	0.213	0.00056	8965.75
79-34-5	1,1,2,2 TETRACHLOROETHANE	167.85	13.24	0.0431	10%	0.0776	0.9224	0.0033	0.0867	0.0900	0.038	0.00010	1607.34
107-06-2	1,2 DICHLOROETHANE	98.97	10.5	1.0250	10%	0.1249	0.8751	0.1280	0.0823	0.2102	0.862	0.00227	36297.32
111-76-2	2 BUTOXYETHANOL	118.2	7.52	0.0740	10%	0.1067	0.8933	0.0079	0.0840	0.0919	0.063	0.00017	2674.82
110-80-5	2 ETHOXYETHANOL	90.14	7.81	5.8030	10%	0.1354	0.8646	0.7859	0.0813	0.8672	4.819	0.01268	203012.92
111-15-9	2 ETHOXYETHYL ACETATE	132.18	8.13	0.0230	10%	0.0965	0.9035	0.0022	0.0849	0.0871	0.020	0.00005	840.85
591-78-6	2 HEXANONE	100.18	6.92	0.1930	10%	0.1235	0.8765	0.0238	0.0824	0.1062	0.162	0.00043	6844.84

Chicago Facility
Conc. of Chemical in Vapors at Saturatic ion

CAS Number	Constituent	Mol. Wt.	Density lb/gal	Vapor Press. psia	Conc. by wt. %	Mole Fraction in Liquid X(chem)	Mole Fraction in Liquid X(solvent)	Partial Pressure PVP (chem) psia	Partial Pressure PVP (Solvent) psia	Partial Pressure TVP (Soln) psia	Saturated Conc. of Chemical lb / lb mol air	Saturated Conc. of Chemical lb/ cu.ft.air	Saturated Conc. of Chemical mg/ cu.meter
	Column ID -->	*D*	*E*	*R*	*S*	*T*	*U*	*V*	*W*	*X*	*Y*	*Z*	*AA*
110-49-6	2 METHOXYETHYL ACETATE	118.13	8.38	0.0392	10%	0.1068	0.8932	0.0042	0.0840	0.0881	0.034	0.00009	1416.84
95-48-7	2 methylphenol	108.14	8.74	0.0018	10%	0.1155	0.8845	0.0002	0.0831	0.0834	0.002	0.00000	64.24
109-86-4	2 METHOXYETHANOL	76.11	8.06	0.1200	10%	0.1565	0.8435	0.0188	0.0793	0.0981	0.097	0.00026	4095.84
106-44-5	4 methylphenol	108.1	8.63	0.0006	10%	0.1155	0.8845	0.0001	0.0831	0.0832	0.001	0.00000	22.76
98-83-9	A METHYL STYRENE	118	7.59	0.0244	10%	0.1069	0.8931	0.0026	0.0840	0.0866	0.021	0.00006	881.92
75-07-0	ACETALDEHYDE	44	6.58	12.1839	10%	0.2429	0.7571	2.9600	0.0712	3.0312	8.860	0.02330	373236.13
64-19-07	ACETIC ACID	60.05	8.79	0.1687	10%	0.1904	0.8096	0.0321	0.0761	0.1082	0.131	0.00035	5528.18
75-5-8	ACETONITRILE	41.05	6.56	1.0830	10%	0.2559	0.7441	0.2772	0.0699	0.3471	0.774	0.00204	32606.93
71-43-2	BENZENE	78.11	7.37	1.1600	10%	0.1531	0.8469	0.1776	0.0796	0.2572	0.944	0.00248	39752.43
117-81-7	bis(2 ethylhexyl)phthalate	390.54	8.23	0.0250	10%	0.0349	0.9651	0.0009	0.0907	0.0916	0.023	0.00006	976.31
56-23-5	CARBON TETRACHLORIDE	153.84	13.37	1.4120	10%	0.0841	0.9159	0.1187	0.0861	0.2048	1.242	0.00327	52332.25
67-66-3	CHLOROFORM	119.39	12.49	2.4750	10%	0.1058	0.8942	0.2618	0.0841	0.3458	2.126	0.00559	89557.23
1319-77-3	CRESOL	108.13	8.76	0.0080	10%	0.1155	0.8845	0.0009	0.0831	0.0841	0.007	0.00002	286.32
98-82-8	CUMENE	120.2	7.21	0.0511	10%	0.1051	0.8949	0.0054	0.0841	0.0895	0.044	0.00012	1851.05
108-93-0	CYCLOHEXANOL	100.2	8.03	0.0017	10%	0.1235	0.8765	0.0002	0.0824	0.0826	0.001	0.00000	58.87
108-94-1	CYCLOHEXANONE	98.2	7.91	0.0550	10%	0.1257	0.8743	0.0069	0.0822	0.0891	0.046	0.00012	1944.69
110-83-8	CYCLOHEXENE	82.15	6.76	3.0950	10%	0.1467	0.8533	0.4539	0.0802	0.5342	2.537	0.00667	106868.21
542-92-7	Cyclopentadiene	66.1	6.69	7.6000	10%	0.1760	0.8240	1.3377	0.0775	1.4152	6.015	0.01582	253398.29
84-74-2	di n butylphthalate	278.38	8.34	0.0010	10%	0.0483	0.9517	0.0000	0.0895	0.0895	0.001	0.00000	38.51
117-84-0	di n octylphthalate	390.54	8.23	0.0250	10%	0.0349	0.9651	0.0009	0.0907	0.0916	0.023	0.00006	976.31
108-83-8	DIISOBUTYL KETONE	142.23	6.72	0.0350	10%	0.0903	0.9097	0.0032	0.0855	0.0887	0.031	0.00008	1288.35
68-12-2	DIMETHYL FORMAMIDE	73.09	7.58	0.0404	10%	0.1619	0.8381	0.0065	0.0788	0.0853	0.032	0.00009	1369.06
131-11-3	dimethylphthalate	194.2	9.97	0.0190	10%	0.0678	0.9322	0.0013	0.0876	0.0889	0.017	0.00004	716.71
123-91-1	DIOXANE	88.1	8.66	0.4250	10%	0.1381	0.8619	0.0587	0.0810	0.1397	0.352	0.00093	14821.78
541-85-5	ETHYL AMYL KETONE	128.24	6.86	0.0190	10%	0.0992	0.9008	0.0019	0.0847	0.0866	0.016	0.00004	692.56
106-35-4	ETHYL BUTYL KETONE	114.21	6.84	0.0190	10%	0.1100	0.8900	0.0021	0.0837	0.0857	0.016	0.00004	684.23
60-29-7	ETHYL ETHER	74.12	5.99	7.0190	10%	0.1600	0.8400	1.1232	0.0790	1.2021	5.663	0.01490	238570.33
56-81-5	GLYCERIN	92.11	10.51	0.0001	10%	0.1329	0.8671	0.0000	0.0815	0.0815	0.000	0.00000	1.75
67-72-1	HEXACHLOROETHANE	236.72	17.44	0.0190	10%	0.0563	0.9437	0.0011	0.0887	0.0898	0.017	0.00005	725.54
123-92-2	ISOAMYL ACETATE	130.18	7.31	0.7370	10%	0.0979	0.9021	0.0721	0.0848	0.1569	0.639	0.00168	26903.99
123-51-3	ISOAMYL ALCOHOL	88.15	6.76	0.0300	10%	0.1381	0.8619	0.0041	0.0810	0.0852	0.025	0.00007	1046.32
110-19-0	ISOBUTYL ACETATE	116.16	7.27	0.1880	10%	0.1084	0.8916	0.0204	0.0838	0.1042	0.161	0.00042	6782.78
78-59-1	ISOPHORONE	138.2	7.68	0.0650	10%	0.0927	0.9073	0.0060	0.0853	0.0913	0.057	0.00015	2386.36
108-21-4	ISOPROPYL ACETATE	102.15	7.29	0.6290	10%	0.1214	0.8786	0.0764	0.0826	0.1590	0.531	0.00140	22361.07
79-20-9	METHYL ACETATE	74.08	7.83	2.7460	10%	0.1601	0.8399	0.4396	0.0790	0.5186	2.215	0.00583	93326.33
108-11-2	METHYL AMYL ALCOHOL	102.18	6.73	0.0730	10%	0.1214	0.8786	0.0089	0.0826	0.0915	0.062	0.00016	2595.26
110-43-0	METHYL N AMYL KETONE	114.21	6.84	0.0190	10%	0.1100	0.8900	0.0021	0.0837	0.0857	0.016	0.00004	684.23
107-87-9	METHYL PROPYL KETONE	86.15	6.7	0.1900	10%	0.1408	0.8592	0.0268	0.0808	0.1075	0.157	0.00041	6605.55
75-09-2	METHYLENE CHLORIDE	84.94	11.12	5.4340	10%	0.1425	0.8575	0.7746	0.0806	0.8552	4.476	0.01177	188540.59
123-86-4	N BUTYL ACETATE	116.18	7.34	0.2900	10%	0.1084	0.8916	0.0314	0.0838	0.1152	0.248	0.00065	10463.00
71-36-3	N BUTYL ALCOHOL	74.12	6.76	0.0565	10%	0.1600	0.8400	0.0090	0.0790	0.0880	0.046	0.00012	1921.61
98-95-3	NITROBENZENE	123.1	10.06	0.0023	10%	0.1029	0.8971	0.0002	0.0843	0.0846	0.002	0.00001	84.25
109-66-0	PENTANE	72015	5.25	6.8280	10%	0.0002	0.9998	0.0013	0.0940	0.0953	6.557	0.01725	276235.60
108-95-2	PHENOL	94.11	8.83	0.0120	10%	0.1305	0.8695	0.0016	0.0817	0.0833	0.010	0.00003	422.22

Chicago Facility
Conc. of Chemical in Vapors at Saturatic ion

CAS Number	Constituent	Mol. Wt.	Density lb/gal	Vapor Press. psia	Conc. by wt. %	Mole Fraction in Liquid X(chem)	Mole Fraction in Liquid X(solvent)	Partial Pressure PVP (chem) psia	Partial Pressure PVP (Solvent) psia	Partial Pressure TVP (Soln) psia	Saturated Conc. of Chemical lb / lb mol air	Saturated Conc. of Chemical lb/ cu.ft.air	Saturated Conc. of Chemical mg/ cu.meter
	Column ID -->	*D*	*E*	*R*	*S*	*T*	*U*	*V*	*W*	*X*	*Y*	*Z*	*AA*
105-46-4	SEC BUTYL ACETATE	116.18	7.21	0.3010	10%	0.1084	0.8916	0.0326	0.0838	0.1164	0.258	0.00068	10859.87
78-92-2	SEC BUTYL ALCOHOL	74.12	6.73	0.1710	10%	0.1600	0.8400	0.0274	0.0790	0.1063	0.138	0.00036	5812.16
100-42-5	STYRENE	104.15	7.56	0.0718	10%	0.1194	0.8806	0.0086	0.0828	0.0914	0.061	0.00016	2559.04
75-65-0	TERT BUTYL ALCOHOL	74.12	6.6	0.4250	10%	0.1600	0.8400	0.0680	0.0790	0.1470	0.343	0.00090	14445.42
127-18-4	TETRACHLOROETHYLENE	165.83	13.55	0.2071	10%	0.0785	0.9215	0.0162	0.0866	0.1029	0.183	0.00048	7721.58
109-99-9	TETRAHYDROFURAN	72.12	7.42	2.0322	10%	0.1637	0.8363	0.3327	0.0786	0.4113	1.632	0.00429	68766.04
156-60-5	TRANS 1,2 DICHLOROETHYLENE	96.95	10.52	4.3510	10%	0.1271	0.8729	0.5531	0.0821	0.6352	3.648	0.00959	153677.90
79-01-6	TRICHLOROETHYLENE	131.4	12.27	0.8890	10%	0.0970	0.9030	0.0863	0.0849	0.1711	0.771	0.00203	32482.22
na	1,1' oxybis(2 methoxy) ethane	134.12	7.88	0.0410	10%	0.0953	0.9047	0.0039	0.0850	0.0890	0.036	0.00009	1501.01
78-87-5	1,2 DICHLOROPROPANE	112.99	9.67	0.6360	1%	0.0112	0.9888	0.0071	0.0929	0.1001	0.055	0.00014	2313.29
79-46-9	2 NITROPROPANE*	89.09	8.26	0.2370	1%	0.0142	0.9858	0.0034	0.0927	0.0960	0.020	0.00005	859.44
107-02-8	acrolein	56.1	7.03	5.5370	1%	0.0224	0.9776	0.1239	0.0919	0.2158	0.473	0.00124	19912.60
107-13-1	ACRYLONITRILE*	53.06	6.76	1.3730	1%	0.0236	0.9764	0.0324	0.0918	0.1242	0.117	0.00031	4931.37
107-18-6	ALLYL ALCOHOL	76.53	7.13	0.2610	1%	0.0165	0.9835	0.0043	0.0924	0.0968	0.022	0.00006	944.27
107-05-1	Allyl Chloride	56.53	7.86	4.7970	1%	0.0222	0.9778	0.1065	0.0919	0.1984	0.410	0.00108	17254.29
62-53-3	Aniline	93.1	8.53	0.0062	1%	0.0136	0.9864	0.0001	0.0927	0.0928	0.001	0.00000	22.52
91-59-8	b NAPTHAYLAMINE*	143.2	8.85	0.0190	1%	0.0089	0.9911	0.0002	0.0932	0.0933	0.002	0.00000	69.27
542-88-1	BIS (CHLOROMETHYL) ETHER*	114.96	10.7	1.1600	1%	0.0110	0.9890	0.0128	0.0930	0.1058	0.100	0.00026	4220.02
106-99-0	BUTADIENE*	54.1	5.18	14.6900	1%	0.0232	0.9768	0.3405	0.0918	0.4323	1.253	0.00330	52785.69
75-15-0	CARBON DISULFIDE*	76.13	10.59	4.8340	1%	0.0166	0.9834	0.0802	0.0924	0.1726	0.415	0.00109	17487.33
142-40-3	DIMETHYLAMINE	45.08	5.6	13.1600	1%	0.0277	0.9723	0.3644	0.0914	0.4557	1.117	0.00294	47069.64
50-00-00	FORMALDEHYDE*	30.03	8.34	0.0280	1%	0.0410	0.9590	0.0011	0.0901	0.0913	0.002	0.00001	98.78
77-47-4	hexachlorocyclopenataadiene	272.7	14.26	0.1800	1%	0.0047	0.9953	0.0008	0.0936	0.0944	0.016	0.00004	659.04
302-01-2	hydrazine*	32.05	8.41	0.1570	1%	0.0385	0.9615	0.0060	0.0904	0.0964	0.013	0.00003	555.29
60-34-4	methylhydrazine	46.09	7.29	0.5660	1%	0.0271	0.9729	0.0153	0.0915	0.1068	0.048	0.00013	2025.65
57-14-7	1,1 dimethylhydrazine	60.1	7.88	1.8949	1%	0.0209	0.9791	0.0396	0.0920	0.1317	0.162	0.00043	6824.88
75-01-4	vinyl chloride	62.5	8.08	14.6900	1%	0.0201	0.9799	0.2956	0.0921	0.3877	1.257	0.00331	52950.63
62-75-9	N nitrosodimethylamine	74.1	8.38	1.1600	1%	0.0170	0.9830	0.0198	0.0924	0.1122	0.100	0.00026	4194.48
74-90-8	hydrogen cyanide	27.03	5.77	9.5140	1%	0.0453	0.9547	0.4313	0.0897	0.5211	0.793	0.00209	33411.21
108-03-2	1 NITROPROPANE	89.09	8.29	0.1101	1%	0.0142	0.9858	0.0016	0.0927	0.0942	0.009	0.00002	399.26
71-41-0	1 pentanol	88.15	6.81	0.0202	1%	0.0144	0.9856	0.0003	0.0927	0.0929	0.002	0.00000	73.24
95-57-8	2 chlorophenol	128.56	10.49	0.0130	1%	0.0099	0.9901	0.0001	0.0931	0.0932	0.001	0.00000	47.35
91-57-6	2 methylnapthalene	142.2	8.5	0.0006	1%	0.0089	0.9911	0.0000	0.0932	0.0932	0.000	0.00000	2.19
109-89-7	DIETHYLAMINE	73.14	5.9	2.7158	1%	0.0172	0.9828	0.0468	0.0924	0.1392	0.233	0.00061	9817.94
79-10-7	acrylic acid	72.06	8.86	1.3436	1%	0.0175	0.9825	0.0235	0.0924	0.1159	0.115	0.00030	4856.02
83-32-9	acenaphthene	154.21	8.34	0.0002	1%	0.0083	0.9917	0.0000	0.0932	0.0932	0.000	0.00000	0.73
75-00-3	CHLOROETHANE	64.52	7.45	2.7101	1%	0.0195	0.9805	0.0529	0.0922	0.1450	0.232	0.00061	9774.81
74-87-3	CHLOROMETHANE	50.49	8	0.3415	1%	0.0248	0.9752	0.0085	0.0917	0.1001	0.029	0.00008	1225.08

Clean Harbors, Inc.
Chicago Facility
Vent Rate

Tank Farm and Metal Wash System

CAS Number	Constituent	Saturated Conc. of Chemical in displacement air			Peak Operation			Off Peak Operation			Average Vent Rate per day cfm	Total Loading to Carbon per day
		lb / lb mol air	lb/ cu.ft.air	mg/ cu.meter	Vent Rate cfm	Hrs. of Oper. hrs	Total Loading lb chem	Vent Rate cfm	Hrs. of Oper. hrs	Total Loading lb chem		
	Column ID -->	*Y*	*Z*	*AA*	*AB*	*AC*	*AD*	*AE*	*AF*	*AG*	*AH*	*AI*
124-18-5	Decane	0.134	0.00035	5641.85	75	3.5	5.55	40	20.5	17.33	45.10	22.88
112-40-3	Dodecane	0.152	0.00040	6401.72	75	3.5	6.30	40	20.5	19.66	45.10	25.96
1120-21-4	Undecane	0.143	0.00038	6037.20	75	3.5	5.94	40	20.5	18.55	45.10	24.48
95-47-6	1,2 dimethyle benzene	0.401	0.00106	16911.41	75	3.5	16.63	40	20.5	51.95	45.10	68.58
78-93-3	2, BUTANINE	4.946	0.01301	208336.54	75	3.5	204.87	40	20.5	639.97	45 10	844.84
108-10-1	4 methyl 2 pentanone	1.144	0.00301	48205.49	75	3.5	47.40	40	20.5	148.08	45.10	195.48
67-64-1	ACETONE	9.813	0.02581	413380.81	75	3.5	406.50	40	20.5	1269.83	45.10	1676.33
108-90-7	CHLOROBENZENE	0.789	0.00208	33243.67	75	3.5	32.69	40	20.5	102.12	45.10	134.81
100-82-7	CYCLOHEXANE	5.712	0.01502	240636.60	75	3.5	236.63	40	20.5	739.19	45.10	975.82
64-17-5	ETHANOL	1.731	0.00455	72912.31	75	3.5	71.70	40	20.5	223.97	45.10	295.67
141-78-6	ETHYL ACETATE	5.365	0.01411	225998.20	75	3.5	222.24	40	20.5	694.22	45.10	916.46
100-41-4	ETHYL BENZENE	0.613	0.00161	25828.56	75	3.5	25.40	40	20.5	79.34	45.10	104.74
142-82-5	HEPTANE	2.920	0.00768	123014.94	75	3.5	120.97	40	20.5	377.88	45.10	498.85
110-54-3	HEXANE	8.970	0.02359	377855.70	75	3.5	371.57	40	20.5	1160.70	45.10	1532.27
78-83-1	ISOBUTYL ALCOHOL	0.570	0.00150	24007.63	75	3.5	23.61	40	20.5	73.75	45.10	97.36
67-63-0	ISOPROPYL ALCOHOL	1.706	0.00449	71849.03	75	3.5	70.65	40	20.5	220.71	45.10	291.36
67-56-1	METHANOL	2.839	0.00747	119596.33	75	3.5	117.61	40	20.5	367.38	45.10	484.98
8030-30-6	NAPHTHA	0.609	0.00160	25674.55	75	3.5	25.25	40	20.5	78.87	45.10	104.11
111-65-9	OCTANE	0.116	0.00030	4870.65	75	3.5	4.79	40	20.5	14.96	45.10	19.75
8052-41-3	STODDARD SOLVENT	0.609	0.00160	25674.55	75	3.5	25.25	40	20.5	78.87	45.10	104.11
108-88-3	TOLUENE	1.560	0.00410	65704.31	75	3.5	64.61	40	20.5	201.83	45.10	266.44
8006-64-2	TURPENTINE	3.826	0.01006	161155.35	75	3.5	158.47	40	20.5	495.04	45.10	653.51
1330-20-7	XYLENES	0.731	0.00192	30808.08	75	3.5	30.30	40	20.5	94.64	45.10	124.93
611-14-3	1 ethyl 2 methyl benzene	0.163	0.00043	6880.00	75	3.5	6.77	40	20.5	21.13	45.10	27.90
108-67-8	1,3,5 trimethyl benzene	0.034	0.00009	1412.22	75	3.5	1.39	40	20.5	4.34	45.10	5.73
584-94-1	2,3 dimethyl hexane	0.316	0.00083	13324.70	75	3.5	13.10	40	20.5	40.93	45.10	54.03
589-34-4	3 methyl hexane	0.989	0.00260	41642.49	75	3.5	40.95	40	20.5	127.92	45.10	168.87
96-14-0	3 methyl pentane	1.593	0.00419	67101.80	75	3.5	65.98	40	20.5	206.12	45.10	272.11
103-65-1	propyl benzene	0.166	0.00044	6988.70	75	3.5	6.87	40	20.5	21.47	45.10	28.34
75-34-3	1,1 DICHLOROETHANE	2.439	0.00641	102730.26	75	3.5	101.02	40	20.5	315.57	45.10	416.59
540-59-0	1,1 DICHLOROETHYLENE	2.237	0.00588	94234.11	75	3.5	92.67	40	20.5	289.47	45.10	382.14
71-55-6	1,1,1 TRICHLOROETHANE	1.378	0.00362	58034.42	75	3.5	57.07	40	20.5	178.27	45.10	235.34

Chicago Facility
Vent Rate

Tank Farm and Metal Wash System

CAS Number	Constituent	Saturated Conc. of Chemical in displacement air			Peak Operation			Off Peak Operation			Average Vent Rate per day cfm	Total Loading to Carbon per day
		lb / lb mol air	lb/ cu.ft.air	mg/ cu.meter	Vent Rate cfm	Hrs. of Oper. hrs	Total Loading lb chem	Vent Rate cfm	Hrs. of Oper. hrs	Total Loading lb chem		
	Column ID -->	*Y*	*Z*	*AA*	*AB*	*AC*	*AD*	*AE*	*AF*	*AG*	*AH*	*AI*
630-20-6	1,1,1,2 TETRACHLOROETHANE	0.117	0.00031	4940.41	75	3.5	4.86	40	20.5	15.18	45.10	20.03
76-13-1	1,1,2 TRICHLORO 1,2,2 TRIFLUOROETHANE	3.909	0.01028	164665.32	75	3.5	161.92	40	20.5	505.82	45.10	667.75
79-00-5	1,1,2 TRICHLOROETHANE	0.213	0.00056	8965.75	75	3.5	8.82	40	20.5	27.54	45.10	36.36
79-34-5	1,1,2,2 TETRACHLOROETHANE	0.038	0.00010	1607.34	75	3.5	1.58	40	20.5	4.94	45.10	6.52
107-06-2	1,2 DICHLOROETHANE	0.862	0.00227	36297.32	75	3.5	35.69	40	20.5	111.50	45.10	147.19
111-76-2	2 BUTOXYETHANOL	0.063	0.00017	2674.82	75	3.5	2.63	40	20.5	8.22	45.10	10.85
110-80-5	2 ETHOXYETHANOL	4.819	0.01268	203012.92	75	3.5	199.63	40	20.5	623.62	45.10	823.25
111-15-9	2 ETHOXYETHYL ACETATE	0.020	0.00005	840.85	75	3.5	0.83	40	20.5	2.58	45.10	3.41
591-78-6	2 HEXANONE	0.162	0.00043	6844.84	75	3.5	6.73	40	20.5	21.03	45.10	27.76
110-49-6	2 METHOXYETHYL ACETATE	0.034	0.00009	1416.84	75	3.5	1.39	40	20.5	4.35	45.10	5.75
95-48-7	2 methylphenol	0.002	0.00000	64.24	75	3.5	0.06	40	20.5	0.20	45.10	0.26
109-86-4	2 METHOXYETHANOL	0.097	0.00026	4095.84	75	3.5	4.03	40	20.5	12.58	45.10	16.61
106-44-5	4 methylphenol	0.001	0.00000	22.76	75	3.5	0.02	40	20.5	0.07	45.10	0.09
98-83-9	A METHYL STYRENE	0.021	0.00006	881.92	75	3.5	0.87	40	20.5	2.71	45.10	3.58
75-07-0	ACETALDEHYDE	8.860	0.02330	373236.13	75	3.5	367.02	40	20.5	1146.51	45.10	1513.54
64-19-07	ACETIC ACID	0.131	0.00035	5528.18	75	3.5	5.44	40	20.5	16.98	45.10	22.42
75-5-8	ACETONITRILE	0.774	0.00204	32606.93	75	3.5	32.06	40	20.5	100.16	45.10	132.23
71-43-2	BENZENE	0.944	0.00248	39752.43	75	3.5	39.09	40	20.5	122.11	45.10	161.20
117-81-7	bis(2 ethylhexyl)phthalate	0.023	0.00006	976.31	75	3.5	0.96	40	20.5	3.00	45.10	3.96
56-23-5	CARBON TETRACHLORIDE	1.242	0.00327	52332.25	75	3.5	51.46	40	20.5	160.75	45.10	212.22
67-66-3	CHLOROFORM	2.126	0.00559	89557.23	75	3.5	88.07	40	20.5	275.10	45.10	363.17
1319-77-3	CRESOL	0.007	0.00002	286.32	75	3.5	0.28	40	20.5	0.88	45.10	1.16
98-82-8	CUMENE	0.044	0.00012	1851.05	75	3.5	1.82	40	20.5	5.69	45.10	7.51
108-93-0	CYCLOHEXANOL	0.001	0.00000	58.87	75	3.5	0.06	40	20.5	0.18	45.10	0.24
108-94-1	CYCLOHEXANONE	0.046	0.00012	1944.69	75	3.5	1.91	40	20.5	5.97	45.10	7.89
110-83-8	CYCLOHEXENE	2.537	0.00667	106868.21	75	3.5	105.09	40	20.5	328.28	45.10	433.37
542-92-7	Cyclopentadiene	6.015	0.01582	253398.29	75	3.5	249.18	40	20.5	778.39	45.10	1027.57
84-74-2	di n butylphthalate	0.001	0.00000	38.51	75	3.5	0.04	40	20.5	0.12	45.10	0.16
117-84-0	di n octylphthalate	0.023	0.00006	976.31	75	3.5	0.96	40	20.5	3.00	45.10	3.96
108-83-8	DIISOBUTYL KETONE	0.031	0.00008	1288.35	75	3.5	1.27	40	20.5	3.96	45.10	5.22
68-12-2	DIMETHYL FORMAMIDE	0.032	0.00009	1369.06	75	3.5	1.35	40	20.5	4.21	45.10	5.55
131-11-3	dimethylphthalate	0.017	0.00004	716.71	75	3.5	0.70	40	20.5	2.20	45.10	2.91
123-91-1	DIOXANE	0.352	0.00093	14821.78	75	3.5	14.58	40	20.5	45.53	45.10	60.10
541-85-5	ETHYL AMYL KETONE	0.016	0.00004	692.56	75	3.5	0.68	40	20.5	2.13	45.10	2.81
106-35-4	ETHYL BUTYL KETONE	0.016	0.00004	684.23	75	3.5	0.67	40	20.5	2.10	45.10	2.77

Chicago Facility
Vent Rate

Tank Farm and Metal Wash System

CAS Number	Constituent	Saturated Conc. of Chemical in displacement air			Peak Operation			Off Peak Operation			Average	Total
		lb / lb mol air	lb/ cu.ft.air	mg/ cu.meter	Vent Rate cfm	Hrs. of Oper. hrs	Total Loading lb chem	Vent Rate cfm	Hrs. of Oper. hrs	Total Loading lb chem	Vent Rate per day cfm	Loading to Carbon per day
	Column ID -->	*Y*	*Z*	*AA*	*AB*	*AC*	*AD*	*AE*	*AF*	*AG*	*AH*	*AI*
60-29-7	ETHYL ETHER	5.663	0.01490	238570.33	75	3.5	234.60	40	20.5	732.84	45.10	967.44
56-81-5	GLYCERIN	0.000	0.00000	1.75	75	3.5	0.00	40	20.5	0.01	45.10	0.01
67-72-1	HEXACHLOROETHANE	0.017	0.00005	725.54	75	3.5	0.71	40	20.5	2.23	45.10	2.94
123-92-2	ISOAMYL ACETATE	0.639	0.00168	26903.99	75	3.5	26.46	40	20.5	82.64	45.10	109.10
123-51-3	ISOAMYL ALCOHOL	0.025	0.00007	1046.32	75	3.5	1.03	40	20.5	3.21	45.10	4.24
110-19-0	ISOBUTYL ACETATE	0.161	0.00042	6782.78	75	3.5	6.67	40	20.5	20.84	45.10	27.51
78-59-1	ISOPHORONE	0.057	0.00015	2386.36	75	3.5	2.35	40	20.5	7.33	45.10	9.68
108-21-4	ISOPROPYL ACETATE	0.531	0.00140	22361.07	75	3.5	21.99	40	20.5	68.69	45.10	90.68
79-20-9	METHYL ACETATE	2.215	0.00583	93326.33	75	3.5	91.77	40	20.5	286.68	45.10	378.45
108-11-2	METHYL AMYL ALCOHOL	0.062	0.00016	2595.26	75	3.5	2.55	40	20.5	7.97	45.10	10.52
110-43-0	METHYL N AMYL KETONE	0.016	0.00004	684.23	75	3.5	0.67	40	20.5	2.10	45.10	2.77
107-87-9	METHYL PROPYL KETONE	0.157	0.00041	6605.55	75	3.5	6.50	40	20.5	20.29	45.10	26.79
75-09-2	METHYLENE CHLORIDE	4.476	0.01177	188540.59	75	3.5	185.40	40	20.5	579.16	45.10	764.56
123-86-4	N BUTYL ACETATE	0.248	0.00065	10463.00	75	3.5	10.29	40	20.5	32.14	45.10	42.43
71-36-3	N BUTYL ALCOHOL	0.046	0.00012	1921.61	75	3.5	1.89	40	20.5	5.90	45.10	7.79
98-95-3	NITROBENZENE	0.002	0.00001	84.25	75	3.5	0.08	40	20.5	0.26	45.10	0.34
109-66-0	PENTANE	6.557	0.01725	276235.60	75	3.5	271.64	40	20.5	848.54	45.10	1120.18
108-95-2	PHENOL	0.010	0.00003	422.22	75	3.5	0.42	40	20.5	1.30	45.10	1.71
105-46-4	SEC BUTYL ACETATE	0.258	0.00068	10859.87	75	3.5	10.68	40	20.5	33.36	45.10	44.04
78-92-2	SEC BUTYL ALCOHOL	0.138	0.00036	5812.16	75	3.5	5.72	40	20.5	17.85	45.10	23.57
100-42-5	STYRENE	0.061	0.00016	2559.04	75	3.5	2.52	40	20.5	7.86	45.10	10.38
75-65-0	TERT BUTYL ALCOHOL	0.343	0.00090	14445.42	75	3.5	14.20	40	20.5	44.37	45.10	58.58
127-18-4	TETRACHLOROETHYLENE	0.183	0.00048	7721.58	75	3.5	7.59	40	20.5	23.72	45.10	31.31
109-99-9	TETRAHYDROFURAN	1.632	0.00429	68766.04	75	3.5	67.62	40	20.5	211.24	45.10	278.86
156-60-5	TRANS 1,2 DICHLOROETHYLENE	3.648	0.00959	153677.90	75	3.5	151.12	40	20.5	472.07	45.10	623.19
79-01-6	TRICHLOROETHYLENE	0.771	0.00203	32482.22	75	3.5	31.94	40	20.5	99.78	45.10	131.72
na	1,1' oxybis(2 methoxy) ethane	0.036	0.00009	1501.01	75	3.5	1.48	40	20.5	4.61	45.10	6.09
78-87-5	1,2 DICHLOROPROPANE	0.055	0.00014	2313.29	75	3.5	2.27	40	20.5	7.11	45.10	9.38
79-46-9	2 NITROPROPANE*	0.020	0.00005	859.44	75	3.5	0.85	40	20.5	2.64	45.10	3.49
107-02-8	acrolein	0.473	0.00124	19912.60	75	3.5	19.58	40	20.5	61.17	45.10	80.75
107-13-1	ACRYLONITRILE*	0.117	0.00031	4931.37	75	3.5	4.85	40	20.5	15.15	45.10	20.00
107-18-6	ALLYL ALCOHOL	0.022	0.00006	944.27	75	3.5	0.93	40	20.5	2.90	45.10	3.83
107-05-1	Allyl Chloride	0.410	0.00108	17254.29	75	3.5	16.97	40	20.5	53.00	45.10	69.97
62-53-3	Aniline	0.001	0.00000	22.52	75	3.5	0.02	40	20.5	0.07	45.10	0.09

Chicago Facility
Vent Rate

Tank Farm and Metal Wash System

CAS Number	Constituent	Saturated Conc. of Chemical in displacement air			Peak Operation			Off Peak Operation			Average Vent Rate per day cfm	Total Loading to Carbon per day
		lb / lb mol air	lb/ cu.ft.air	mg/ cu.meter	Vent Rate cfm	Hrs. of Oper. hrs	Total Loading lb chem	Vent Rate cfm	Hrs. of Oper. hrs	Total Loading lb chem		
	Column ID -->	*Y*	*Z*	*AA*	*AB*	*AC*	*AD*	*AE*	*AF*	*AG*	*AH*	*AI*
91-59-8	b NAPTHAYLAMINE*	0.002	0.00000	69.27	75	3.5	0.07	40	20.5	0.21	45.10	0.28
542-88-1	BIS (CHLOROMETHYL) ETHER*	0.100	0.00026	4220.02	75	3.5	4.15	40	20.5	12.96	45.10	17.11
106-99-0	BUTADIENE*	1.253	0.00330	52785.69	75	3.5	51.91	40	20.5	162.15	45.10	214.05
75-15-0	CARBON DISULFIDE*	0.415	0.00109	17487.33	75	3.5	17.20	40	20.5	53.72	45.10	70.91
142-40-3	DIMETHYLAMINE	1.117	0.00294	47069.64	75	3.5	46.29	40	20.5	144.59	45.10	190.88
50-00-00	FORMALDEHYDE*	0.002	0.00001	98.78	75	3.5	0.10	40	20.5	0.30	45.10	0.40
77-47-4	hexachlorocyclopenatadiene	0.016	0.00004	659.04	75	3.5	0.65	40	20.5	2.02	45.10	2.67
302-01-2	hydrazine*	0.013	0.00003	555.29	75	3.5	0.55	40	20.5	1.71	45.10	2.25
60-34-4	methylhydrazine	0.048	0.00013	2025.65	75	3.5	1.99	40	20.5	6.22	45.10	8.21
57-14-7	1,1 dimethylhydrazine	0.162	0.00043	6824.88	75	3.5	6.71	40	20.5	20.96	45.10	27.68
75-01-4	vinyl chloride	1.257	0.00331	52950.63	75	3.5	52.07	40	20.5	162.65	45.10	214.72
62-75-9	N nitrosodimethylamine	0.100	0.00026	4194.48	75	3.5	4.12	40	20.5	12.88	45.10	17.01
74-90-8	hydrogen cyanide	0.793	0.00209	33411.21	75	3.5	32.86	40	20.5	102.63	45.10	135.49
108-03-2	1 NITROPROPANE	0.009	0.00002	399.26	75	3.5	0.39	40	20.5	1.23	45.10	1.62
71-41-0	1 pentanol	0.002	0.00000	73.24	75	3.5	0.07	40	20.5	0.22	45.10	0.30
95-57-8	2 chlorophenol	0.001	0.00000	47.35	75	3.5	0.05	40	20.5	0.15	45.10	0.19
91-57-6	2 methylnapthalene	0.000	0.00000	2.19	75	3.5	0.00	40	20.5	0.01	45.10	0.01
109-89-7	DIETHYLAMINE	0.233	0.00061	9817.94	75	3.5	9.65	40	20.5	30.16	45.10	39.81
79-10-7	acrylic acid	0.115	0.00030	4856.02	75	3.5	4.78	40	20.5	14.92	45.10	19.69
83-32-9	acenaphthene	0.000	0.00000	0.73	75	3.5	0.00	40	20.5	0.00	45.10	0.00
75-00-3	CHLOROETHANE	0.232	0.00061	9774.81	75	3.5	9.61	40	20.5	30.03	45.10	39.64
74-87-3	CHLOROMETHANE	0.029	0.00008	1225.08	75	3.5	1.20	40	20.5	3.76	45.10	4.97

Clean Harbors, Inc.
Chicago Facility
Vent Rate

Shredding Tower & Fuels Blending Operation

CAS Number	Constituent	Saturated Conc. of Chemical in displacement air			Peak Operation				
		lb / lb mol air	lb/ cu.ft.air	mg/ cu.meter	Disp. Rate cfm	Vent Rate cfm	Chem. Conc. at APCD, lb/cu.ft.air	Hrs. of Oper. hrs	Total Chem Loading lb/day
	Column ID -->	*Y*	*Z*	*AA*	*AB*	*AC*	*AD*	*AE*	*AF*
124-18-5	Decane	0.134	0.00035	5641.85	110	300	0.000129158	24	55.80
112-40-3	Dodecane	0.152	0.00040	6401.72	110	300	0.000146554	24	63.31
1120-21-4	Undecane	0.143	0.00038	6037.20	110	300	0.000138209	24	59.71
95-47-6	1,2 dimethyle benzene	0.401	0.00106	16911.41	110	300	0.000387152	24	167.25
78-93-3	2, BUTANINE	4.946	0.01301	208336.54	110	300	0.004769432	24	2060.39
108-10-1	4 methyl 2 pentanone	1.144	0.00301	48205.49	110	300	0.001103564	24	476.74
67-64-1	ACETONE	9.813	0.02581	413380.81	110	300	0.009463494	24	4088.23
108-90-7	CHLOROBENZENE	0.789	0.00208	33243.67	110	300	0.000761045	24	328.77
100-82-7	CYCLOHEXANE	5.712	0.01502	240636.60	110	300	0.005508875	24	2379.83
64-17-5	ETHANOL	1.731	0.00455	72912.31	110	300	0.001669176	24	721.08
141-78-6	ETHYL ACETATE	5.365	0.01411	225998.20	110	300	0.005173759	24	2235.06
100-41-4	ETHYL BENZENE	0.613	0.00161	25828.56	110	300	0.000591291	24	255.44
142-82-5	HEPTANE	2.920	0.00768	123014.94	110	300	0.002816171	24	1216.59
110-54-3	HEXANE	8.970	0.02359	377855.70	110	300	0.008650221	24	3736.90
78-83-1	ISOBUTYL ALCOHOL	0.570	0.00150	24007.63	110	300	0.000549605	24	237.43
67-63-0	ISOPROPYL ALCOHOL	1.706	0.00449	71849.03	110	300	0.001644834	24	710.57
67-56-1	METHANOL	2.839	0.00747	119596.33	110	300	0.002737909	24	1182.78
8030-30-6	NAPHTHA	0.609	0.00160	25674.55	110	300	0.000587766	24	253.91
111-65-9	OCTANE	0.116	0.00030	4870.65	110	300	0.000111503	24	48.17
8052-41-3	STODDARD SOLVENT	0.609	0.00160	25674.55	110	300	0.000587766	24	253.91
108-88-3	TOLUENE	1.560	0.00410	65704.31	110	300	0.001504164	24	649.80
8006-64-2	TURPENTINE	3.826	0.01006	161155.35	110	300	0.003689317	24	1593.78
1330-20-7	XYLENES	0.731	0.00192	30808.08	110	300	0.000705287	24	304.68
611-14-3	1 ethyl 2 methyl benzene	0.163	0.00043	6880.00	110	300	0.000157503	24	68.04
108-67-8	1,3,5 trimethyl benzene	0.034	0.00009	1412.22	110	300	3.23299E-05	24	13.97
584-94-1	2,3 dimethyl hexane	0.316	0.00083	13324.70	110	300	0.000305041	24	131.78
589-34-4	3 methyl hexane	0.989	0.00260	41642.49	110	300	0.000953318	24	411.83

Chicago Facility
Vent Rate

Shredding Tower & Fuels Blending Operation

CAS Number	Constituent	Saturated Conc. of Chemical in displacement air			Peak Operation				
		lb / lb mol air	lb/ cu.ft.air	mg/ cu.meter	Disp. Rate cfm	Vent Rate cfm	Chem. Conc. at APCD, lb/cu.ft.air	Hrs. of Oper. hrs	Total Chem Loading lb/day
	Column ID -->	*Y*	*Z*	*AA*	*AB*	*AC*	*AD*	*AE*	*AF*
96-14-0	3 methyl pentane	1.593	0.00419	67101.80	110	300	0.001536156	24	663.62
103-65-1	propyl benzene	0.166	0.00044	6988.70	110	300	0.000159992	24	69.12
75-34-3	1,1 DICHLOROETHANE	2.439	0.00641	102730.26	110	300	0.002351796	24	1015.98
540-59-0	1,1 DICHLOROETHYLENE	2.237	0.00588	94234.11	110	300	0.002157294	24	931.95
71-55-6	1,1,1 TRICHLOROETHANE	1.378	0.00362	58034.42	110	300	0.001328577	24	573.95
630-20-6	1,1,1,2 TETRACHLOROETHANE	0.117	0.00031	4940.41	110	300	0.0001131	24	48.86
76-13-1	1,1,2 TRICHLORO 1,2,2 TRIFLUOROETHANE	3.909	0.01028	164665.32	110	300	0.00376967	24	1628.50
79-00-5	1,1,2 TRICHLOROETHANE	0.213	0.00056	8965.75	110	300	0.000205252	24	88.67
79-34-5	1,1,2,2 TETRACHLOROETHANE	0.038	0.00010	1607.34	110	300	3.67967E-05	24	15.90
107-06-2	1,2 DICHLOROETHANE	0.862	0.00227	36297.32	110	300	0.000830952	24	358.97
111-76-2	2 BUTOXYETHANOL	0.063	0.00017	2674.82	110	300	6.12345E-05	24	26.45
110-80-5	2 ETHOXYETHANOL	4.819	0.01268	203012.92	110	300	0.004647559	24	2007.75
111-15-9	2 ETHOXYETHYL ACETATE	0.020	0.00005	840.85	110	300	1.92496E-05	24	8.32
591-78-6	2 HEXANONE	0.162	0.00043	6844.84	110	300	0.000156698	24	67.69
110-49-6	2 METHOXYETHYL ACETATE	0.034	0.00009	1416.84	110	300	3.24357E-05	24	14.01
95-48-7	2 methylphenol	0.002	0.00000	64.24	110	300	1.47075E-06	24	0.64
109-86-4	2 METHOXYETHANOL	0.097	0.00026	4095.84	110	300	9.37658E-05	24	40.51
106-44-5	4 methylphenol	0.001	0.00000	22.76	110	300	5.2109E-07	24	0.23
98-83-9	A METHYL STYRENE	0.021	0.00006	881.92	110	300	2.01897E-05	24	8.72
75-07-0	ACETALDEHYDE	8.860	0.02330	373236.13	110	300	0.008544465	24	3691.21
64-19-07	ACETIC ACID	0.131	0.00035	5528.18	110	300	0.000126556	24	54.67
75-5-8	ACETONITRILE	0.774	0.00204	32606.93	110	300	0.000746468	24	322.47
71-43-2	BENZENE	0.944	0.00248	39752.43	110	300	0.000910049	24	393.14
117-81-7	bis(2 ethylhexyl)phthalate	0.023	0.00006	976.31	110	300	2.23505E-05	24	9.66
56-23-5	CARBON TETRACHLORIDE	1.242	0.00327	52332.25	110	300	0.001198038	24	517.55
67-66-3	CHLOROFORM	2.126	0.00559	89557.23	110	300	0.002050227	24	885.70
1319-77-3	CRESOL	0.007	0.00002	286.32	110	300	6.55481E-06	24	2.83
98-82-8	CUMENE	0.044	0.00012	1851.05	110	300	4.23759E-05	24	18.31
108-93-0	CYCLOHEXANOL	0.001	0.00000	58.87	110	300	1.3478E-06	24	0.58
108-94-1	CYCLOHEXANONE	0.046	0.00012	1944.69	110	300	4.45197E-05	24	19.23

Chicago Facility
Vent Rate

Shredding Tower & Fuels Blending Operation

CAS Number	Constituent	Saturated Conc. of Chemical in displacement air			Peak Operation				
		lb / lb mol air	lb/ cu.ft.air	mg/ cu.meter	Disp. Rate cfm	Vent Rate cfm	Chem. Conc. at APCD, lb/cu.ft.air	Hrs. of Oper. hrs	Total Chem Loading lb/day
	Column ID -->	*Y*	*Z*	*AA*	*AB*	*AC*	*AD*	*AE*	*AF*
110-83-8	CYCLOHEXENE	2.537	0.00667	106868.21	110	300	0.002446525	24	1056.90
542-92-7	Cyclopentadiene	6.015	0.01582	253398.29	110	300	0.005801027	24	2506.04
84-74-2	di n butylphthalate	0.001	0.00000	38.51	110	300	8.81627E-07	24	0.38
117-84-0	di n octylphthalate	0.023	0.00006	976.31	110	300	2.23505E-05	24	9.66
108-83-8	DIISOBUTYL KETONE	0.031	0.00008	1288.35	110	300	2.9494E-05	24	12.74
68-12-2	DIMETHYL FORMAMIDE	0.032	0.00009	1369.06	110	300	3.13417E-05	24	13.54
131-11-3	dimethylphthalate	0.017	0.00004	716.71	110	300	1.64076E-05	24	7.09
123-91-1	DIOXANE	0.352	0.00093	14821.78	110	300	0.000339314	24	146.58
541-85-5	ETHYL AMYL KETONE	0.016	0.00004	692.56	110	300	1.58548E-05	24	6.85
106-35-4	ETHYL BUTYL KETONE	0.016	0.00004	684.23	110	300	1.5664E-05	24	6.77
60-29-7	ETHYL ETHER	5.663	0.01490	238570.33	110	300	0.005461572	24	2359.40
56-81-5	GLYCERIN	0.000	0.00000	1.75	110	300	4.01608E-08	24	0.02
67-72-1	HEXACHLOROETHANE	0.017	0.00005	725.54	110	300	1.66098E-05	24	7.18
123-92-2	ISOAMYL ACETATE	0.639	0.00168	26903.99	110	300	0.000615911	24	266.07
123-51-3	ISOAMYL ALCOHOL	0.025	0.00007	1046.32	110	300	2.39534E-05	24	10.35
110-19-0	ISOBUTYL ACETATE	0.161	0.00042	6782.78	110	300	0.000155278	24	67.08
78-59-1	ISOPHORONE	0.057	0.00015	2386.36	110	300	5.46307E-05	24	23.60
108-21-4	ISOPROPYL ACETATE	0.531	0.00140	22361.07	110	300	0.00051191	24	221.15
79-20-9	METHYL ACETATE	2.215	0.00583	93326.33	110	300	0.002136512	24	922.97
108-11-2	METHYL AMYL ALCOHOL	0.062	0.00016	2595.26	110	300	5.9413E-05	24	25.67
110-43-0	METHYL N AMYL KETONE	0.016	0.00004	684.23	110	300	1.5664E-05	24	6.77
107-87-9	METHYL PROPYL KETONE	0.157	0.00041	6605.55	110	300	0.00015122	24	65.33
75-09-2	METHYLENE CHLORIDE	4.476	0.01177	188540.59	110	300	0.004316245	24	1864.62
123-86-4	N BUTYL ACETATE	0.248	0.00065	10463.00	110	300	0.000239529	24	103.48
71-36-3	N BUTYL ALCOHOL	0.046	0.00012	1921.61	110	300	4.39914E-05	24	19.00
98-95-3	NITROBENZENE	0.002	0.00001	84.25	110	300	1.9288E-06	24	0.83
109-66-0	PENTANE	6.557	0.01725	276235.60	110	300	0.00632384	24	2731.90
108-95-2	PHENOL	0.010	0.00003	422.22	110	300	9.66589E-06	24	4.18
105-46-4	SEC BUTYL ACETATE	0.258	0.00068	10859.87	110	300	0.000248614	24	107.40
78-92-2	SEC BUTYL ALCOHOL	0.138	0.00036	5812.16	110	300	0.000133057	24	57.48

Chicago Facility
Vent Rate

Shredding Tower & Fuels Blending Operation

CAS Number	Constituent	Saturated Conc. of Chemical in displacement air			Peak Operation				
		lb / lb mol air	lb/ cu.ft.air	mg/ cu.meter	Disp. Rate cfm	Vent Rate cfm	Chem. Conc. at APCD, lb/cu.ft.air	Hrs. of Oper. hrs	Total Chem Loading lb/day
	Column ID -->	*Y*	*Z*	*AA*	*AB*	*AC*	*AD*	*AE*	*AF*
100-42-5	STYRENE	0.061	0.00016	2559.04	110	300	5.85839E-05	24	25.31
75-65-0	TERT BUTYL ALCOHOL	0.343	0.00090	14445.42	110	300	0.000330698	24	142.86
127-18-4	TETRACHLOROETHYLENE	0.183	0.00048	7721.58	110	300	0.000176769	24	76.36
109-99-9	TETRAHYDROFURAN	1.632	0.00429	68766.04	110	300	0.001574256	24	680.08
156-60-5	TRANS 1,2 DICHLOROETHYLENE	3.648	0.00959	153677.90	110	300	0.003518136	24	1519.83
79-01-6	TRICHLOROETHYLENE	0.771	0.00203	32482.22	110	300	0.000743613	24	321.24
na	1,1' oxybis(2 methoxy) ethane	0.036	0.00009	1501.01	110	300	3.43625E-05	24	14.84
78-87-5	1,2 DICHLOROPROPANE	0.055	0.00014	2313.29	110	300	5.29579E-05	24	22.88
79-46-9	2 NITROPROPANE*	0.020	0.00005	859.44	110	300	1.9675E-05	24	8.50
107-02-8	acrolein	0.473	0.00124	19912.60	110	300	0.000455858	24	196.93
107-13-1	ACRYLONITRILE*	0.117	0.00031	4931.37	110	300	0.000112893	24	48.77
107-18-6	ALLYL ALCOHOL	0.022	0.00006	944.27	110	300	2.1617E-05	24	9.34
107-05-1	Allyl Chloride	0.410	0.00108	17254.29	110	300	0.000395001	24	170.64
62-53-3	Aniline	0.001	0.00000	22.52	110	300	5.15602E-07	24	0.22
91-59-8	b NAPTHAYLAMINE*	0.002	0.00000	69.27	110	300	1.58583E-06	24	0.69
542-88-1	BIS (CHLOROMETHYL) ETHER*	0.100	0.00026	4220.02	110	300	9.66085E-05	24	41.73
106-99-0	BUTADIENE*	1.253	0.00330	52785.69	110	300	0.001208419	24	522.04
75-15-0	CARBON DISULFIDE*	0.415	0.00109	17487.33	110	300	0.000400336	24	172.95
142-40-3	DIMETHYLAMINE	1.117	0.00294	47069.64	110	300	0.001077562	24	465.51
50-00-00	FORMALDEHYDE*	0.002	0.00001	98.78	110	300	2.26131E-06	24	0.98
77-47-4	hexachlorocyclopenatadiene	0.016	0.00004	659.04	110	300	1.50873E-05	24	6.52
302-01-2	hydrazine*	0.013	0.00003	555.29	110	300	1.27123E-05	24	5.49
60-34-4	methylhydrazine	0.048	0.00013	2025.65	110	300	4.63731E-05	24	20.03
57-14-7	1,1 dimethylhydrazine	0.162	0.00043	6824.88	110	300	0.000156242	24	67.50
75-01-4	vinyl chloride	1.257	0.00331	52950.63	110	300	0.001212195	24	523.67
62-75-9	N nitrosodimethylamine	0.100	0.00026	4194.48	110	300	9.60238E-05	24	41.48
74-90-8	hydrogen cyanide	0.793	0.00209	33411.21	110	300	0.00076488	24	330.43
108-03-2	1 NITROPROPANE	0.009	0.00002	399.26	110	300	9.14017E-06	24	3.95
71-41-0	1 pentanol	0.002	0.00000	73.24	110	300	1.67669E-06	24	0.72
95-57-8	2 chlorophenol	0.001	0.00000	47.35	110	300	1.08395E-06	24	0.47

Chicago Facility
Vent Rate

Shredding Tower & Fuels Blending Operation

CAS Number	Constituent	Saturated Conc. of Chemical in displacement air			Peak Operation				
		lb / lb mol air	lb/ cu.ft.air	mg/ cu.meter	Disp. Rate cfm	Vent Rate cfm	Chem. Conc. at APCD, lb/cu.ft.air	Hrs. of Oper. hrs	Total Chem Loading lb/day
	Column ID -->	*Y*	*Z*	*AA*	*AB*	*AC*	*AD*	*AE*	*AF*
91-57-6	2 methylnapthalene	0.000	0.00000	2.19	110	300	5.00758E-08	24	0.02
109-89-7	DIETHYLAMINE	0.233	0.00061	9817.94	110	300	0.000224761	24	97.10
79-10-7	acrylic acid	0.115	0.00030	4856.02	110	300	0.000111168	24	48.02
83-32-9	acenaphthene	0.000	0.00000	0.73	110	300	1.67036E-08	24	0.01
75-00-3	CHLOROETHANE	0.232	0.00061	9774.81	110	300	0.000223774	24	96.67
74-87-3	CHLOROMETHANE	0.029	0.00008	1225.08	110	300	2.80458E-05	24	12.12

Clean Harbors, Inc.
Chicago Facility
Estimated Break-through Time **Tank Farm and Metal wash System**

CAS Number	Constituent	Mol. Wt.	Total Loading to Carbon per day	Adsorption Cap. by wt. at 100 F in %	Carbon per Vessel lbs	Capacity of Carbon Vessel lb chem	Estimated Time Before Breakthrough in hrs
	Column ID -->	*D*	*AI*	*AJ*	*AK*	*AL*	*AM*
124-18-5	Decane	142.29	22.88	33.80%	1800	608.4	638
112-40-3	Dodecane	170	25.96	38.00%	1800	684	632
1120-21-4	Undecane	156.35	24.48	37.30%	1800	671.4	658
95-47-6	1,2 dimethyle benzene	106.17	68.58	44.20%	1800	795.6	278
78-93-3	2, BUTANINE	72.1	2356.96	40.60%	1800	730.8	7
108-10-1	4 methyl 2 pentanone	100.2	195.48	40.00%	1800	720	88
67-64-1	ACETONE	58.08	4247.05	38.70%	1800	696.6	4
108-90-7	CHLOROBENZENE	112.6	134.81	55.30%	1800	995.4	177
100-82-7	CYCLOHEXANE	84.16	2602.99	38.80%	1800	698.4	6
64-17-5	ETHANOL	46.07	1108.17	39.40%	1800	709.2	15
141-78-6	ETHYL ACETATE	88.1	2653.74	45.00%	1800	810	7
100-41-4	ETHYL BENZENE	106.17	104.74	43.70%	1800	786.6	180
142-82-5	HEPTANE	100.2	1462.42	34.20%	1800	615.6	10
110-54-3	HEXANE	86 17	3995.66	33.00%	1800	594	4
78-83-1	ISOBUTYL ALCOHOL	74.12	390.14	40.70%	1800	732.6	45
67-63-0	ISOPROPYL ALCOHOL	60.09	1073.15	39.20%	1800	705.6	16
67-56-1	METHANOL	32.04	1554.21	38.90%	1800	700.2	11
8030-30-6	NAPHTHA	127.08	137.34	49.90%	1800	898.2	157
111-65-9	OCTANE	114.23	157.35	35.30%	1800	635.4	97
8052-41-3	STODDARD SOLVENT	127.08	137.34	49.90%	1800	898.2	157
108-88-3	TOLUENE	92.13	867.45	43.30%	1800	779.4	22
8006-64-2	TURPENTINE	136	1051.91	36.40%	1800	655.2	15
1330-20-7	XYLENES	106.17	124.93	43.70%	1800	786.6	151
611-14-3	1 ethyl 2 methyl benzene	120.2	27.90	38.70%	1800	696.6	599
108-67-8	1,3,5 trimethyl benzene	120.21	27.90	38.70%	1800	696.6	599
584-94-1	2,3 dimethyl hexane	114.23	112.45	25.40%	1800	457.2	98

Chicago Facility
Estimated Break-through Time

Tank Farm and Metal wash System

CAS Number	Constituent	Mol. Wt.	Total Loading to Carbon per day	Adsorption Cap. by wt. at 100 F in %	Carbon per Vessel lbs	Capacity of Carbon Vessel lb chem	Estimated Time Before Breakthrough in hrs
	Column ID -->	*D*	*AI*	*AJ*	*AK*	*AL*	*AM*
589-34-4	3 methyl hexane	120.21	283.99	28.40%	1800	511.2	43
96-14-0	3 methyl pentane	86.18	272.11	23.70%	1800	426.6	38
103-65-1	propyl benzene	120.21	28.34	36.60%	1800	658.8	558
75-34-3	1,1 DICHLOROETHANE	98.97	1032.93	42.80%	1800	770.4	18
540-59-0	1,1 DICHLOROETHYLENE	96.95	974.96	36.70%	1800	660.6	16
71-55-6	1,1,1 TRICHLOROETHANE	133.42	623.07	49.90%	1800	898.2	35
630-20-6	1,1,1,2 TETRACHLOROETHANE	167.85	20.03	68.00%	1800	1224	1466
76-13-1	1,1,2 TRICHLORO 1,2,2 TRIFLUOROETHANE	187.38	667.74	56.80%	1800	1022.4	37
79-00-5	1,1,2 TRICHLOROETHANE	133.4	36.36	54.00%	1800	972	642
79-34-5	1,1,2,2 TETRACHLOROETHANE	167.85	6.52	61.40%	1800	1105.2	4069
107-06-2	1,2 DICHLOROETHANE	98.97	402.66	45.90%	1800	826.2	49
111-76-2	2 BUTOXYETHANOL	118.2	850.60	47.20%	1800	849.6	24
110-80-5	2 ETHOXYETHANOL	90.14	10.50	30.10%	1800	541.8	1239
111-15-9	2 ETHOXYETHYL ACETATE	132.18	3.41	20.90%	1800	376.2	2648
591-78-6	2 HEXANONE	100.18	27.76	24.50%	1800	441	381
110-49-6	2 METHOXYETHYL ACETATE	118.13	14.25	24.80%	1800	446.4	752
95-48-7	2 methylphenol	108.14	0.26	45.70%	1800	822.6	75798
109-86-4	2 METHOXYETHANOL	76.11	16.61	32.20%	1800	579.6	838
106-44-5	4 methylphenol	108.1	0.09	24.10%	1800	433.8	112723
98-83-9	A METHYL STYRENE	118	3.58	35.10%	1800	631.8	4240
75-07-0	ACETALDEHYDE	44	1513.53	26.20%	1800	471.6	7
64-19-07	ACETIC ACID	60.05	22.42	34.50%	1800	621	665
75-5-8	ACETONITRILE	41.05	382.52	26.10%	1800	469.8	29
71-43-2	BENZENE	78.11	456.79	35.30%	1800	635.4	33
117-81-7	bis(2 ethylhexyl)phthalate	390.54	3.96	53.20%	1800	957.6	5805
56-23-5	CARBON TETRACHLORIDE	153.84	566.76	56.10%	1800	1009.8	43
67-66-3	CHLOROFORM	119.39	930.59	53.00%	1800	954	25
1319-77-3	CRESOL	108.13	4.93	48.70%	1800	876.6	4263
98-82-8	CUMENE	120.2	7.51	36.70%	1800	660.6	2112

Chicago Facility
Estimated Break-through Time

Tank Farm and Metal wash System

CAS Number	Constituent	Mol. Wt.	Total Loading to Carbon per day	Adsorption Cap. by wt. at 100 F in %	Carbon per Vessel lbs	Capacity of Carbon Vessel lb chem	Estimated Time Before Breakthrough in hrs
	Column ID -->	*D*	*AI*	*AJ*	*AK*	*AL*	*AM*
108-93-0	CYCLOHEXANOL	100.2	0.24	38.80%	1800	698.4	70224
108-94-1	CYCLOHEXANONE	98.2	7.76	37.80%	1800	680.4	2104
110-83-8	CYCLOHEXENE	82.15	433.37	29.50%	1800	531	29
542-92-7	Cyclopentadiene	66.1	1027.57	28.10%	1800	505.8	12
84-74-2	di n butylphthalate	278.38	0.16	53.20%	1800	957.6	147164
117-84-0	di n octylphthalate	390.54	3.96	53.20%	1800	957.6	5805
108-83-8	DIISOBUTYL KETONE	142.23	14.18	22.30%	1800	401.4	679
68-12-2	DIMETHYL FORMAMIDE	73.09	5.55	35.50%	1800	639	2762
131-11-3	dimethylphthalate	194.2	2.91	53.20%	1800	957.6	7908
123-91-1	DIOXANE	88.1	213.27	39.40%	1800	709.2	80
541-85-5	ETHYL AMYL KETONE	128.24	2.81	27.20%	1800	489.6	4184
106-35-4	ETHYL BUTYL KETONE	114.21	2.77	27.20%	1800	489.6	4235
60-29-7	ETHYL ETHER	74.12	979.80	27.60%	1800	496.8	12
56-81-5	GLYCERIN	92.11	0.01	20.00%	1800	360	1214518
67-72-1	HEXACHLOROETHANE	236.72	2.94	47.20%	1800	849.6	6930
123-92-2	ISOAMYL ACETATE	130.18	40.12	26.20%	1800	471.6	282
123-51-3	ISOAMYL ALCOHOL	88.15	21.50	32.50%	1800	585	653
110-19-0	ISOBUTYL ACETATE	116.16	97.15	29.50%	1800	531	131
78-59-1	ISOPHORONE	138.2	9.68	43.30%	1800	779.4	1933
108-21-4	ISOPROPYL ACETATE	102.15	288.76	34.00%	1800	612	51
79-20-9	METHYL ACETATE	74.08	959.37	33.20%	1800	597.6	15
108-11-2	METHYL AMYL ALCOHOL	102.18	39.50	33.30%	1800	599.4	364
110-43-0	METHYL N AMYL KETONE	114.21	2.77	27.20%	1800	489.6	4235
107-87-9	METHYL PROPYL KETONE	86.15	108.56	24.10%	1800	433.8	96
75-09-2	METHYLENE CHLORIDE	84.94	1877.22	39.80%	1800	716.4	9
123-86-4	N BUTYL ACETATE	116.18	42.43	33.80%	1800	608.4	344
71-36-3	N BUTYL ALCOHOL	74.12	7.79	31.30%	1800	563.4	1735
98-95-3	NITROBENZENE	123.1	0.34	48.60%	1800	874.8	61446
109-66-0	PENTANE	72015	2538.62	25.60%	1800	460.8	4

Chicago Facility
Estimated Break-through Time

Tank Farm and Metal wash System

CAS Number	Constituent	Mol. Wt.	Total Loading to Carbon per day	Adsorption Cap. by wt. at 100 F in %	Carbon per Vessel lbs	Capacity of Carbon Vessel lb chem	Estimated Time Before Breakthrough in hrs
	Column ID -->	*D*	*AI*	*AJ*	*AK*	*AL*	*AM*
108-95-2	PHENOL	94.11	4.85	48.10%	1800	865.8	4283
105-46-4	SEC BUTYL ACETATE	116.18	140.16	38.50%	1800	693	119
78-92-2	SEC BUTYL ALCOHOL	74.12	104.34	31.20%	1800	561.6	129
100-42-5	STYRENE	104.15	10.38	38.30%	1800	689.4	1594
75-65-0	TERT BUTYL ALCOHOL	74.12	234.59	30.20%	1800	543.6	56
127-18-4	TETRACHLOROETHYLENE	165.83	31.31	62.90%	1800	1132.2	868
109-99-9	TETRAHYDROFURAN	72.12	279.69	33.50%	1800	603	52
156-60-5	TRANS 1,2 DICHLOROETHYLENE	96.95	1434.58	45.50%	1800	819	14
79-01-6	TRICHLOROETHYLENE	131.4	386.72	54.80%	1800	986.4	61
na	1,1' oxybis(2 methoxy) ethane	134.12	16.18	20.00%	1800	360	534
78-87-5	1,2 DICHLOROPROPANE	112.99	26.45	20.00%	1800	360	327
79-46-9	2 NITROPROPANE*	89.09	10.53	20.00%	1800	360	821
107-02-8	acrolein	56.1	193.09	20.00%	1800	360	45
107-13-1	ACRYLONITRILE*	53.06	58.58	20.00%	1800	360	147
107-18-6	ALLYL ALCOHOL	76.53	14.76	20.00%	1800	360	585
107-05-1	Allyl Chloride	56.53	160.81	20.00%	1800	360	54
62-53-3	Aniline	93.1	0.09	20.00%	1800	360	94607
91-59-8	b NAPTHAYLAMINE*	143.2	0.28	20.00%	1800	360	30757
542-88-1	BIS (CHLOROMETHYL) ETHER*	114.96	17.11	20.00%	1800	360	505
106-99-0	BUTADIENE*	54.1	214.05	20.00%	1800	360	40
75-15-0	CARBON DISULFIDE*	76.13	164.52	20.00%	1800	360	53
142-40-3	DIMETHYLAMINE	45.08	190.88	20.00%	1800	360	45
50-00-00	FORMALDEHYDE*	30.03	1.27	20.00%	1800	360	6786
77-47-4	hexachlorocyclopenatadiene	272.7	2.67	20.00%	1800	360	3233
302-01-2	hydrazine*	32.05	8.13	20.00%	1800	360	1062
60-34-4	methylhydrazine	46.09	26.30	20.00%	1800	360	329
57-14-7	1,1 dimethylhydrazine	60.1	27.68	20.00%	1800	360	312
75-01-4	vinyl chloride	62.5	214.72	20.00%	1800	360	40

Chicago Facility
Estimated Break-through Time

Tank Farm and Metal wash System

CAS Number	Constituent	Mol. Wt.	Total Loading to Carbon per day	Adsorption Cap. by wt. at 100 F in %	Carbon per Vessel lbs	Capacity of Carbon Vessel lb chem	Estimated Time Before Breakthrough in hrs
	Column ID -->	*D*	*AI*	*AJ*	*AK*	*AL*	*AM*
62-75-9	N nitrosodimethylamine	74.1	17.01	20.00%	1800	360	508
74-90-8	hydrogen cyanide	27.03	316.68	20.00%	1800	360	27
108-03-2	1 NITROPROPANE	89.09	1.62	20.00%	1800	360	5335
71-41-0	1 pentanol	88.15	0.30	20.00%	1800	360	29045
95-57-8	2 chlorophenol	128.56	0 19	20.00%	1800	360	45104
91-57-6	2 methylnapthalene	142.2	0.01	20.00%	1800	360	1031606
109-89-7	DIETHYLAMINE	73.14	39.81	20.00%	1800	360	217
79-10-7	acrylic acid	72.06	19.69	20.00%	1800	360	439
83-32-9	acenaphthene	154.21	0.00	20.00%	1800	360	2863247
75-00-3	CHLOROETHANE	64.52	39.64	20.00%	1800	360	218
74-87-3	CHLOROMETHANE	50.49	4.97	20.00%	1800	360	1739

Clean Harbors, Inc.
Chicago Facility
Estimated Break-through Time

Shredding Tower and Fuels blending operation

CAS Number	Constituent	Mol. Wt.	Total Chem Loading lb/day	Adsorption Capacity by weight in %	Carbon per Vessel lbs	Capacity of Carbon Vaessel lb chem	Estimated Time Before Breakthrough in hrs
	Column ID -->	*D*	*AF*	*AG*	*AH*	*AI*	*AJ*
124-18-5	Decane	142.29	55.80	32.30%	1800	581.4	250
112-40-3	Dodecane	170	63.31	38.00%	1800	684	259
1120-21-4	Undecane	156.35	59.71	36.00%	1800	648	260
95-47-6	1,2 dimethyle benzene	106.17	167.25	40.20%	1800	723.6	104
78-93-3	2, BUTANINE	72.1	2060.39	33.10%	1800	595.8	7
108-10-1	4 methyl 2 pentanone	100.2	476.74	35.60%	1800	640.8	32
67-64-1	ACETONE	58.08	4088.23	27.60%	1800	496.8	3
108-90-7	CHLOROBENZENE	112.6	328.77	49.20%	1800	885.6	65
100-82-7	CYCLOHEXANE	84.16	2379.83	31.90%	1800	574.2	6
64-17-5	ETHANOL	46.07	721.08	30.00%	1800	540	18
141-78-6	ETHYL ACETATE	88.1	2235.06	39.30%	1800	707.4	8
100-41-4	ETHYL BENZENE	106.17	255.44	39.60%	1800	712.8	67
142-82-5	HEPTANE	100.2	1216.59	30.40%	1800	547.2	11
110-54-3	HEXANE	86.17	3736.90	28.40%	1800	511.2	3
78-83-1	ISOBUTYL ALCOHOL	74.12	237.43	36.60%	1800	658.8	67
67-63-0	ISOPROPYL ALCOHOL	60.09	710.57	32.80%	1800	590.4	20
67-56-1	METHANOL	32.04	1182.78	24.00%	1800	432	9
8030-30-6	NAPHTHA	127.08	253.91	49.90%	1800	898.2	85
111-65-9	OCTANE	114.23	48.17	24.50%	1800	441	220
8052-41-3	STODDARD SOLVENT	127.08	253.91	49.90%	1800	898.2	85
108-88-3	TOLUENE	92.13	649.80	38.50%	1800	693	26
8006-64-2	TURPENTINE	136	1593.78	36.40%	1800	655.2	10
1330-20-7	XYLENES	106.17	304.68	40.20%	1800	723.6	57
611-14-3	1 ethyl 2 methyl benzene	120.2	68.04	36.30%	1800	653.4	230
108-67-8	1,3,5 trimethyl benzene	120.21	13.97	36.30%	1800	653.4	1123
584-94-1	2,3 dimethyl hexane	114.23	131.78	22.90%	1800	412.2	75

Chicago Facility
Estimated Break-through Time

Shredding Tower and Fuels blending operation

CAS Number	Constituent	Mol. Wt.	Total Chem Loading lb/day	Adsorption Capacity by weight in %	Carbon per Vessel lbs	Capacity of Carbon Vaessel lb chem	Estimated Time Before Breakthrough in hrs
	Column ID -->	*D*	*AF*	*AG*	*AH*	*AI*	*AJ*
589-34-4	3 methyl hexane	120.21	411.83	25.50%	1800	459	27
96-14-0	3 methyl pentane	86.18	663.62	20.70%	1800	372.6	13
103-65-1	propyl benzene	120.21	69.12	34.30%	1800	617.4	214
75-34-3	1,1 DICHLOROETHANE	98.97	1015.98	35.00%	1800	630	15
540-59-0	1,1 DICHLOROETHYLENE	96.95	931.95	29.70%	1800	534.6	14
71-55-6	1,1,1 TRICHLOROETHANE	133.42	573.95	43.00%	1800	774	32
630-20-6	1.1,1,2 TETRACHLOROETHANE	167.85	48.86	62.60%	1800	1126.8	553
76-13-1	1,1,2 TRICHLORO 1,2,2 TRIFLUOROETHANE	187.38	1628.50	48.20%	1800	867.6	13
79-00-5	1,1,2 TRICHLOROETHANE	133.4	88.67	47.70%	1800	858.6	232
79-34-5	1,1,2,2 TETRACHLOROETHANE	167.85	15.90	56.90%	1800	1024.2	1546
107-06-2	1,2 DICHLOROETHANE	98.97	358.97	38.20%	1800	687.6	46
111-76-2	2 BUTOXYETHANOL	118.2	26.45	47.20%	1800	849.6	771
110-80-5	2 ETHOXYETHANOL	90.14	2007.75	27.20%	1800	489.6	6
111-15-9	2 ETHOXYETHYL ACETATE	132.18	8.32	19.10%	1800	343.8	992
591-78-6	2 HEXANONE	100.18	67.69	21.70%	1800	390.6	138
110-49-6	2 METHOXYETHYL ACETATE	118.13	14.01	22.50%	1800	405	694
95-48-7	2 methylphenol	108.14	0.64	44.70%	1800	804.6	30393
109-86-4	2 METHOXYETHANOL	76.11	40.51	29.00%	1800	522	309
106-44-5	4 methylphenol	108.1	0.23	46.10%	1800	829.8	88468
98-83-9	A METHYL STYRENE	118	8.72	32.60%	1800	586.8	1615
75-07-0	ACETALDEHYDE	44	3691.21	17.20%	1800	309.6	2
64-19-07	ACETIC ACID	60.05	54.67	26.80%	1800	482.4	212
75-5-8	ACETONITRILE	41.05	322.47	17.90%	1800	322.2	24
71-43-2	BENZENE	78.11	393.14	30.40%	1800	547.2	33
117-81-7	bis(2 ethylhexyl)phthalate	390.54	9.66	53.20%	1800	957.6	2380
56-23-5	CARBON TETRACHLORIDE	153.84	517.55	48.90%	1800	880.2	41
67-66-3	CHLOROFORM	119.39	885.70	43.80%	1800	788.4	21
1319-77-3	CRESOL	108.13	2.83	46.70%	1800	840.6	7125
98-82-8	CUMENE	120.2	18.31	34.30%	1800	617.4	809

Chicago Facility
Estimated Break-through Time

Shredding Tower and Fuels blending operation

CAS Number	Constituent	Mol. Wt.	Total Chem Loading lb/day	Adsorption Capacity by weight in %	Carbon per Vessel lbs	Capacity of Carbon Vaessel lb chem	Estimated Time Before Breakthrough in hrs
	Column ID -->	*D*	*AF*	*AG*	*AH*	*AI*	*AJ*
108-93-0	CYCLOHEXANOL	100.2	0.58	40.30%	1800	725.4	29901
108-94-1	CYCLOHEXANONE	98.2	19.23	33.90%	1800	610.2	761
110-83-8	CYCLOHEXENE	82.15	1056.90	24.70%	1800	444.6	10
542-92-7	Cyclopentadiene	66.1	2506.04	23.20%	1800	417.6	4
84-74-2	di n butylphthalate	278.38	0.38	53.20%	1800	957.6	60343
117-84-0	di n octylphthalate	390.54	9.66	53.20%	1800	957.6	2380
108-83-8	DIISOBUTYL KETONE	142.23	12.74	19.80%	1800	356.4	671
68-12-2	DIMETHYL FORMAMIDE	73.09	13.54	31.20%	1800	561.6	995
131-11-3	dimethylphthalate	194.2	7.09	53.20%	1800	957.6	3242
123-91-1	DIOXANE	88.1	146.58	33.30%	1800	599.4	98
541-85-5	ETHYL AMYL KETONE	128.24	6.85	25.70%	1800	462.6	1621
106-35-4	ETHYL BUTYL KETONE	114.21	6.77	25.70%	1800	462.6	1641
60-29-7	ETHYL ETHER	74.12	2359.40	22.50%	1800	405	4
56-81-5	GLYCERIN	92.11	0.02	20.00%	1800	360	497998
67-72-1	HEXACHLOROETHANE	236.72	7.18	44.50%	1800	801	2679
123-92-2	ISOAMYL ACETATE	130.18	266.07	23.30%	1800	419.4	38
123-51-3	ISOAMYL ALCOHOL	88.15	10.35	30.70%	1800	552.6	1282
110-19-0	ISOBUTYL ACETATE	116.16	67.08	26.00%	1800	468	167
78-59-1	ISOPHORONE	138.2	23.60	40.80%	1800	734.4	747
108-21-4	ISOPROPYL ACETATE	102.15	221.15	29.70%	1800	534.6	58
79-20-9	METHYL ACETATE	74.08	922.97	26.20%	1800	471.6	12
108-11-2	METHYL AMYL ALCOHOL	102.18	25.67	30.50%	1800	549	513
110-43-0	METHYL N AMYL KETONE	114.21	6.77	25.70%	1800	462.6	1641
107-87-9	METHYL PROPYL KETONE	86.15	65.33	20.20%	1800	363.6	134
75-09-2	METHYLENE CHLORIDE	84.94	1864.62	27.80%	1800	500.4	6
123-86-4	N BUTYL ACETATE	116.18	103.48	30.90%	1800	556.2	129
71-36-3	N BUTYL ALCOHOL	74.12	19.00	28.80%	1800	518.4	655
98-95-3	NITROBENZENE	123.1	0.83	45.80%	1800	824.4	23745
109-66-0	PENTANE	72015	2731.90	21.30%	1800	383.4	3

Chicago Facility
Estimated Break-through Time

Shredding Tower and Fuels blending operation

CAS Number	Constituent	Mol. Wt.	Total Chem Loading lb/day	Adsorption Capacity by weight in %	Carbon per Vessel lbs	Capacity of Carbon Vaessel lb chem	Estimated Time Before Breakthrough in hrs
	Column ID -->	*D*	*AF*	*AG*	*AH*	*AI*	*AJ*
108-95-2	PHENOL	94.11	4.18	46.10%	1800	829.8	4769
105-46-4	SEC BUTYL ACETATE	116.18	107.40	34.90%	1800	628.2	140
78-92-2	SEC BUTYL ALCOHOL	74.12	57.48	28.20%	1800	507.6	212
100-42-5	STYRENE	104.15	25.31	35.40%	1800	637.2	604
75-65-0	TERT BUTYL ALCOHOL	74.12	142.86	26.90%	1800	484.2	81
127-18-4	TETRACHLOROETHYLENE	165.83	76.36	56.60%	1800	1018.8	320
109-99-9	TETRAHYDROFURAN	72.12	680.08	27.10%	1800	487.8	17
156-60-5	TRANS 1,2 DICHLOROETHYLENE	96.95	1519.83	36.70%	1800	660.6	10
79-01-6	TRICHLOROETHYLENE	131.4	321.24	47.00%	1800	846	63
na	1,1' oxybis(2 methoxy) ethane	134.12	14.84	20.00%	1800	360	582
78-87-5	1,2 DICHLOROPROPANE	112.99	22.88	20.00%	1800	360	378
79-46-9	2 NITROPROPANE*	89.09	8.50	20.00%	1800	360	1017
107-02-8	acrolein	56.1	196.93	20.00%	1800	360	44
107-13-1	ACRYLONITRILE*	53.06	48.77	20.00%	1800	360	177
107-18-6	ALLYL ALCOHOL	76.53	9.34	20.00%	1800	360	925
107-05-1	Allyl Chloride	56.53	170.64	20.00%	1800	360	51
62-53-3	Aniline	93.1	0.22	20.00%	1800	360	38790
91-59-8	b NAPTHAYLAMINE*	143.2	0.69	20.00%	1800	360	12612
542-88-1	BIS (CHLOROMETHYL) ETHER*	114.96	41.73	20.00%	1800	360	207
106-99-0	BUTADIENE*	54.1	522.04	20.00%	1800	360	17
75-15-0	CARBON DISULFIDE*	76.13	172.95	20.00%	1800	360	50
142-40-3	DIMETHYLAMINE	45.08	465.51	20.00%	1800	360	19
50-00-00	FORMALDEHYDE*	30.03	0.98	20.00%	1800	360	8844
77-47-4	hexachlorocyclopenatadiene	272.7	6.52	20.00%	1800	360	1326
302-01-2	hydrazine*	32.05	5.49	20.00%	1800	360	1573
60-34-4	methylhydrazine	46.09	20.03	20.00%	1800	360	431
57-14-7	1,1 dimethylhydrazine	60.1	67.50	20.00%	1800	360	128
75-01-4	vinyl chloride	62.5	523.67	20.00%	1800	360	16

Chicago Facility
Estimated Break-through Time

Shredding Tower and Fuels blending operation

CAS Number	Constituent	Mol. Wt.	Total Chem Loading lb/day	Adsorption Capacity by weight in %	Carbon per Vessel lbs	Capacity of Carbon Vaessel lb chem	Estimated Time Before Breakthrough in hrs
	Column ID -->	*D*	*AF*	*AG*	*AH*	*AI*	*AJ*
62-75-9	N nitrosodimethylamine	74.1	41.48	20.00%	1800	360	208
74-90-8	hydrogen cyanide	27.03	330.43	20.00%	1800	360	26
108-03-2	1 NITROPROPANE	89.09	3.95	20.00%	1800	360	2188
71-41-0	1 pentanol	88.15	0.72	20.00%	1800	360	11928
95-57-8	2 chlorophenol	128.56	0.47	20.00%	1800	360	18451
91-57-6	2 methylnapthalene	142.2	0.02	20.00%	1800	360	399394
109-89-7	DIETHYLAMINE	73.14	97.10	20.00%	1800	360	89
79-10-7	acrylic acid	72.06	48.02	20.00%	1800	360	180
83-32-9	acenaphthene	154.21	0.01	20.00%	1800	360	1197348
75-00-3	CHLOROETHANE	64.52	96.67	20.00%	1800	360	89
74-87-3	CHLOROMETHANE	50.49	12.12	20.00%	1800	360	713

POTENTIAL PATHWAYS OF EXPOSURE TO HUMANS OR ENVIRONMENTAL RECEPTORS

CHSI believes that operating the bulk liquid flammable tankfarm, truck loading/unloading pad, hazardous waste shredding sustem, and metalwashing system will present the same minimal level of potential exposure to humans and the environment as other operations at the facility (e.g., waste consolidation, waste stabilization, fuels blending, lab pack pour off, etc.). A number of off-site personnel or the environment to organic liquid, semi-solid and solid materials processed in the operation. These factors and the types of material to be managed and the potential exposurepathways, environmental receptors and magnitude and nature of exposures are discussed below.

(1) WASTES TO BE MANAGED

CHSI will use the Shredding System to manage hazardous waste organic liquid, semi-solid and solid and other hazardous wastes in containers. CHSI receives material such as latex paint, oil-based paint,fuels, solvents, non-solventthinners, lacquers, shellacs, and other organic materials. These materials will contain a variety of organic and inorganic compounds. The types of chemical constituents and their concentrations will vary based on the type of organic liquid, semi-solid and solid that is managed.

Because of the wide variability in the types of chemicals to be managed and their concentrations, for the purposes of this document, CHSI assumed a "worst case" scenario. The assumptions that were made include:

* Organic materials to be managed in the unit would be similar to those wastes already being managed in CHSI's on going fuels blending operations;

* Organic materials to be managed would consist primarily of volatile organic compounds (VOCs). In general, VOCs would be more likely volatilize than other organic or inorganic constituents compounds thereby presenting a worst case scenario when considering the potential impacts associating with inhalation.

* CHSI used the results of an analysis performed by Carlson Environmental, Inc. (Evaluation of Potential Hazardous Material Emergencies through Atmospheric Transport from the Current and Proposed Clean Harbors Facility, Chicago, Illinois) as part of its assessment of potential off-site air impacts. As part of Carlson's assessment, it assumed a number of organic compounds present in typical on-site operations. CHSI used the list of organic compounds developed by Carlson as the representative worst case of the type of compounds that could likely be found in the oganic material. The list of chemical compounds es provided in **Table A;** and

* Potential pathways and impacts considered normal operation of the unit and spill events.

(2) POTENTIAL PATHWAYS OF HUMAN EXPOSURE

CHSI considered three (3) different scenarios when assessing potential human exposures: (1) on-site worker operating/working shredding/metalwashing operations; (2) on-site worker working immediately outside the operating areas; and (3) person located off-site.

The typical potential pathways of human exposure for this activity could include:

* Adsorption of organic material through direct contact with the skin, eyes, etc. (direct adsorption) or adsorption by contact with organic (indirect adsorption)

* Ingestion of organic material (direct ingestion) or ingestion of soil, groundwater or surface water contaminated with organic (indirect adsorption)

* Inhalation of vapors associated with the management of organic materials

These human exposure pathways were evaluated for each of three (3) scenarios. The results of this assessment are provided below.

(A) On-site Worker at the Can Compactor

Adsorption

Like the waste management activities already taking place at CHSI, all employees working at the shredding/metalworking operations will wear the appropriate personnel protective equipment (PPE) for the materials being managed and the operations to be performed. This equipment will include: hard hat; safety glasses; steel toed shoes; Tyvek suit; and full face, cartridge respirator or self contained breathing apparatus (SCBA). The selection of the appropriate respirator cartridge will be based on the tyoes of waste being managed (e.g., volatile organic compounds).

All moving parts of the shredder and metalwashing units will be enclosed, making the units safe to operate.

Using the appropriate PPE, following CHSI's existing standard operation procedures for donning and doffing PPE and personal and eqipment decontamination will prevent or significantly minimize any worker exposure to or contact with organic materials to be managed in the shredding/metalwashing operations via adsorption pathways. In the unlikely event organic materials came into contact with an employees skin, eyes, etc. the employee would immediately wash/flush the affected area with water and/or and appropriate cleaner (e.g., soap). The employee would then be directed to seek proper medical attention off-site, if appropriate.

In addition to contact with organic material during normal, routine activities associated with operating the shredding and metalwashing systems, contact during non-routine activities (i.e.,spills) must also be considered. In the event of a spill of organic material within the building, the spill will be cleaned up by personnel wearing the appropriate PPE to minimize the potential

or contact with contaminants.

Ingestion

All workers involved with hazardous waste management activities have been trained in hazardous waste operations, the appropriate use of PPE, the proper means of PPE, equipment and personal decontamination, Because of this, the chance for exposure either through direct ingestion of organic materials is extremely unlikely to non-existant.

Since the shredding operation will be located within an enclosed building the possibility of a worker ingesting an environmental media (e.g., soil, grounwater, surface water) contaminated with organic material is non-existant, the tankfarm, unloading pad and metalwashing operation are located in concrete imperviously-coated containment areas. This would also restrict the possibility of a worker ingesting and environmental media. In addition to wearing the appropriate PPE and personal decontamination, eating, chewing gum or tobacco, and smoking cigarettes is restricted to designated areas on-site thereby significantly reducing any possivility for a worker to indirectly ingest contaminants.

Inhalation

A full face respirator equipped with cartridges specifically selected for the types of materials being managed or a SCBA will protect compactor workers from potential inhalation exposure. In addition to PPE, CHSI will also use institutional controls to limit the accumulation of organic vapors in the immediate area surrounding the shredding/metalwashing operations.

ugitive emmissions from these operations will be vented via a closed vent system to two (2) carbon adsorption units connected in series, Each unit will contain 1800 pounds of carbon. According to the carbon manufacturer, these units will remove nearly 100% of the volatile organics from the vented air prior to discharge to the atmosphere through a stack until breakthrough occurs (see discussion on carbon units in (2) (B), below).

The combination of wearing the appropriate respirator, using the appropriate respirator cartridges and removal of fugitive emmissions will prevent and/or significantly minimize worker exposure to organic vapors.

(B) On-site worker outside Units 22,24,68,69

Adsorption/Ingestion

Because shredding/metalwashing operations will take place within secondary containment, the only means for personnel working outside these units to come into contact with organic material would be in the event of a spill or release. Building 24 will provide approximatily 6223 gallons of secondary containment. As a result of the potential for a spill of organic material to escape building 24 is minimal.

In the unlikely event of a spill of organic material that migrates from Building 24, the spilled material will be captured and contained by outdoor, bermed concrete ares abutting Building 24. Spill clean up personnel would wear PPE appropriate to the material spilled to minimize the potential for contact with spilled material and clean up debris.

In the event of a spill of organic material in units 22,68 and 69, the spille material will be captured and contained by the imperviously-coated concrete containment for each unit. The containment capacities of units 68 and 69 are 10,602 gallons and 14,740 gallons respectively. Tanks 415, 416, 417 and 418 have individual imperviously coated concrete containment with capacities of 13,650 gallons, 12,890 gallons, 24,223 gallons and 14,256 gallons respectively. In the event of a spill into a containment area, spill clean-u personnel would wear PPE appropriate for the material spilled to minimize the potential for contact with spilled material and clean-up debris.

Inhalation

Personnel working outside these units could potentially come into contact wit organic materials by inhalation. As previously discussed, the area in which shredding/metalwashing operations occur is ventilated and vapors form the operation vented via a closed vent to set of two (2) carbon units in sseries.

Removal of volatile organic constituents in air using carbon is a recognized air pollution control technology that is utilized in many industrial and commercial applications. CHSI currently operates several carbon units to control emissions from a number of on-site operations. These units have been permitted by the Illinois Environmental Protection Agency.

According to the carbon vendor, the carbon will continue to remove 100% of th organic vapors from the ventilated air until breakthrough occurs. Once breakthrough of the carbon occurs, the removal efficiency of the carbon for certain volatile constituents will decrease.

Carbon breakthrough will be determined by monitoring the volatile organic concentrations in air at the inlet and outlet points of the first carbon unit in the series using an HNu monitoring device. Breakthrough will be determine when the first carbon unit approaches an 85% volatile organic removal efficiency.

In the event breakthrough of the first carbon canister in the series, the canister will be removed and either: (1) replaced with a 1800 pound caniste of fresh carbon; or (2) the second canister in the series will be connected to the can compactor so that it becomes the first unit in the series and a fresh carbon unit will be placed as the second unit in the series. The carbo canisters will be replaced within 24 hours of detecting breakthrough. During this 24-hour period the first and second canisters will continue to remove approximately 95% of the volatile organics in the air stream.

CHSI believes that operating the air pollution control units will prevent any exposure to workers to volatile organics emitted from shredding/metalwashing operations.

(C) **Potential Exposure Pathways to Off-Site Personnel**

Adsorption/Ingestion

Because the CHSI facility is a secure facility (e.g., fences and gates restricting access), the potential for direct or indirect exposure of off-site personnel to organic materials through adsorption is extremely unlikely to non-existent.

The potential for ingestion of organic material by off-site personnel is also extremely ulikely. The units will be located within the secure facility within an area equipped with impervious secondary containment. The area surrounding the unit will be inspected daily for spills and releases. All spills will be cleaned up immediately upon detection. As a result, the potential for spills of organic material to exit the containment is very unlikely. In the unlikely event organic material escaped secondary containment, CHSI personnel would immediately cleanup any spilled material thereby minimizing the impact, if any, to the environment. Impervious secondary containment and immediate cleanup of spills would make the significantly limit the potential for groundwater contamination caused by operating the unit . Since the nearest drinking water well is located approximiately three (3) miles from the facility, the potential for someone to drink water contaminated by a release form the unit is extremely unlikely to non-existant.

Inhalation

As discussed in Section (B), above, emissions from shredding/metalwashing operations will be vented through carbon prior discharge to the atmosphere. The units are designed and will be operated to remove up to 100% of the volatile organics prior to its discharge to the atmosphere. The carbon units will be monitored and replaced when breakthrough occurs.

As part of CHSI's RCRA Part B permit application, Carlson Environmental, Inc. performed and analysis titled "Evaluation of Potential Hazardous Material Emergencies through atmospheric Transport from the Current and Proposed Clean Iarbors Facility, Chicago, Illinois" (see **Apendix 7-A**). According to that analysis, the land use in the immediate vicinity of the CHSI facility is heavy industrial.. Land surrounding use the facility and some potential receptors are lised below:

* 0.5 miles from the CHSI facility
  - North - Undeveloped recreational areas
  - South - EmEs Company, Lake Calumet Slip #2
  - East - Land and Lake Landfill
  - West - Lake Calumet

* 1.0 miles from the CHSI facility
  - North - North turning basin of Lake Calumet, undeveloped recreational areas
  - South - Lake Calumet, bulk terminal plant
  - East - Land and Lake Landfill, Norfolk & Western Railway
  - West - Calumet Expressway

* 1.5 miles from the CHSI facility
  - North - Undeveloped recreational areas
  - South - 130th Street, rail yard
  - East - Rail yard
  - West - Arcade Park residential area, rail yard

* 2.0 miles from the CHSI facility
  North - Stony Island Expressway, 103rd Street
  South - Beaubien Woods Forest Preserve, Carver Area High
  East - Calumet Fiver, Buffalo Street
  West - Palmar Park residential areas, St. Martin de Porres High School

The predominant wind direction is to the south. The nearest sensitive receptors (e.g., schools, hospitals) to the CHSI facility are located aproximately two (2) miles away. Due to the nature of the materials managed and the air pollution control system that will be in place, the potential adverse impact to a person off-site from shredding/metalwashing activities is non-existant. The potential off-site inhalation impact to humans associated with a "worst case" spill (i.e.,containment) is extemely unlikely to non-existant.

(3) POTENTIAL ENVIRONMENTAL RECEPTORS

There are four (4) potential contaminant migration pathways: soils, grounkwater, surface water, and air. Environmental receptors would include aquatic life in Lake Calumet and birds.

Because can compacting activities will occur within an area equiped qith impervioun secondary containment and because this area will be inspected on a weekly basis for spills/released, the potential for spills/releases of organic material to enter the soil and groundwter is extremely minimal. As a result, ny impact to aquatic life in Lake Calumet from groundwater impacts from shredding/metalwashing activities would also be extremely unlikely to non-existent.

THe potential for direct contamination of Lake Calumet from spills or releases of organic material is non-existant due to the containment provided by these units and the proximity of these units in relation to the Lake.

Emmisions from shredding/metalwashing activities would be treated prior to discharge through a stack. As previously discussed, due to the removal efficiency of the carbon units, impacts to on-site birds (including sea gulls) are also considered extremely unlikely to non-existent. CHSI believes that these operations pose no greater risk thanm other activities currently permitted and taking place on- site.

Appendix 7-B contains a document titled "Environmental Assessmint Report" prepared by Carlson Environmental, Inc.. as part of CHSI's RCRA Part B permit application. This report contains an assessment of potential off-site environmental impacts associated with operation of the CHSI facility.

(4) POTENTIAL MAGNITUDE AND NATURE OF EXPOSURES

Workers in Units 22, 24, 68, and 69 have the greatest potential for exposure to the organic materials to be managed. The proper use of PPE and in place engineering controls (e.g., splash protection, ventilation and treatment of fugitive emissions associated with the operations will significantly minimize any risk for potential exposure to the chemicals being managed.

In the event a worker is exposed to organic materials, either through dermal contact, inhalation, or ingestion CHSI will follow the procedures currently i place for responding to worker exposure to chemicals. These procedures include, but are not limited to: (1) flushing the affected areas as may be appropriate using on-site showers/eyes washes; (2) providing any other first aid that might be appropriate; and (3) sending the worker to a local hospital for examination and/or treatment.

Impacts associated with other on-site and off-site personnel and imapacts to the environment are considered extremely minimal and would have no more impac than other waste management activities currently taking place at the facility

Table A
Chemical Constituents

Acrolein
Acrylyl chloride
Benzene
Carbon tetrachloride
Chlordane
Chlorobenzene
Chloroform
Cresols
Cyanuric fluoride
1,4-Dichlorobenzene
1,2-Dichloroethane
1,1-Dichloroethylene
Dimethyl sulfide
2,4-Dinitrotoluene
Ethyl benzene
Ethylene fluorhydrin
Ethyleneamine
Gasoline
Heptachlor
Hexachlorobenzene
Hexachlorobutadiene
Hexachloroethane
Isopropyl formate
Methacryloyl chloride
Methylcrylouloxyethyl isocyanate
Methyl Chloroformate
Methyl disulfide
Methyl ethyl ketone
Methyl hydraine
Methyl isocyanate
Methyltrichlorosilane
Methyl vinyl ketone
Methyl chloride
Naphthalene
Nickel carbonyl
Nitrobenzene
Pentaborane
Pentachlorophenol
Phenol
Propargyl bromide
Pyridine
Sulfur trioxide
Tetrachloroethylene
Toluene
1,1,1-Trichloroethylene
1,1,1-Trichlorethane
1,1,2-Trichloro-1,2,3-trifluoroethane
Vinyl chloride
Xylene

The tanks involved with the shredding system, tankfarm and metalwash system are fixed roof tanks with organic vapors routed through closed-vent systems to carbon adsorption control devices that provide a minimum organic removal efficiency of 95%. Valves, pumps, conservation vents, flame arrestors, agitator seals, emergency vents require initial and continuing visual and instrument monitoring to assure these operate with "no detectable organic emissions" and repair. Other connections such as flanges and seals such as hatches, caps, guages, instrument nozzles and blind flanges are subject to initial instrument monitoring and initial and continuing visual monitoring for "no detectable organic emissions" and repair. These require additional instrument monitoring each time they are opened. First repairs must be attempted within 5 days of detection with repair completed with 15 days detection. Instrument monitoring is completed using a Flame Ionization Detector.

Containers to be processed in the operations will vary in size. Those containers of less than 26 gallon capacity are not subject to Subpart CC. Larger capacity containers (to 119 gallon capacity) and those used to collect waste after processing must meet applicable US DOT regulations on packaging hazardous materials for transportation (49 CFR 178). Covers are removed from containers as they are loaded onto the elevator for the shredding operation. Shredded metal and other shredding contaminants are collected in drums and non-dispersible shredded materials collected in a hopper. Scissor-lifts connect the drums and hopper to the shredder when filling. The cover and closure device will be secured promptly upon conclusion of the filling operation. The drums will be rerouted to the shredder or routed to the metalwash operation. The hopper will be dumped into a roll-off container on Unit 69. The roll-off is equipped with a cover and closure device to form a continuous barrier over the container openings. The covers will remain closed and secure at all times except when adding or removing waste or other materials. A visual inspection looking for cracks, holes, gaps or open spaces into the interior of the container will be performed. Any container in storage for more than one year will be visually reinspected. For containers with a design capacity exceeding 119 gallons capacity and containing a waste that is "in light material service", the container will be monitored for all closures with a photoionization detector or similar instrument to confirm it operates "with no detectable organic emissions". The shredder, tankfarm and metalwash operations are connected to closed vent systems to route gases, vapors and fumes from the hazardous waste to control devices designed and operated to reduce the total organic content of the inlet vapor stream by at least 95% by weight. The closed vent system is designed and will be operated with no detectable emissions, as indicated by an instrument reading of less than 500 ppmv above background as determined by the procedure in 40 CFR 264.1034(b) and by visual inspections.

The initial leak detection monitoring will be conducted on or before the unit becomes operational for all closed-vent system joints, seams or other connections that are permanently or semi-permanently sealed. After initial leak detection monitoring, the unit will be inspected and monitored as follows:

Closed-vent system joints, seams or other connections that are permanently or semi-permanently sealed shall be visually inspected annually for defects which could result in air emissions. Defects include, but are not limited to, visible cracks, holes, gaps or loose connections. If any component is repaired or replaced or the connection is resealed, the component or connection will be monitored using the procedures specified in 40 CFR264.1034(b) to demonstrate that it operates with no detectable emissions.

Detectable emissions, as indicated by visual inspections, or by an instrument reading greater than 500 ppmv above background, will be controlled as soon as practicable, but no later than 15 calendar days after the emission is detected. A first attempt at repair shall be made no later than 5 calendar days after the emission is detected.

The closed vent systems and carbon adsorption systems will be operated at all times when emissions are vented to them.

A design analysis which demonstrates the carbon beds will reduce the total organic content of the inlet vapor stream by 95% is attached. The operating parameters in this analysis represent operating conditions at the highest load or capacity level expected to occur.

A flow indicating sensor will be installed to provide a record of the vent stream flow in each closed-vent system at least once an hour. A pressure measurement device will be installed in a readily accessible location to verify that the negative pressure is being maintained in each closed-vent system when operating.

The closed vent systems will not include any bypass devices that could be used to divert the gas or vapor stream to the atmosphere before entering the control device. Low leg drains, high point bleeds, analyzer vents, open-ended valves or lines, spring loaded pressure relief valves and other fittings used for safety purposes are not considered bypass devices.

Carbon adsorption systems will be used as the control device for the shredding operation and tankfarm/metalwashing operations. During periods of planned routine maintenance or a control device system malfunction, the control device is not required to reduce the amount of total organic content of the

inlet vapor stream by 95%. Periods of planned routine maintenance will not exceed 240 hours annually. This will be recorded on a semiannual basis describing the type of preventive maintenance necessary for the next six months, planned frequency of maintenance, and lengths of maintenance periods. The report will also describe planned routine maintenance during the previous six months including type of maintenance performed and total number of hours during the six months the control device did not reduce the total organic content of the inlet vapor stream by 95% during planned routine maintenance. Control device system malfunctions will be corrected as soon as practicable after occurrence in order to minimize excess air pollutant emissions. Gases, vapors and fumes will not be actively vented to the control device during periods of planned routine maintenance or control device system malfunction except when necessary to vent the gases, vapors and/or fumes to avoid an unsafe condition or to implement malfunction corrective actions or planned maintenance actions.

After initial start-up of the carbon adsorption system, all activated carbon will be replaced with new carbon within 24 hours of when monitoring indicates the control device did not reduce the inlet vapor stream by 95%. Monitoring will be conducted each day the units operate.

Manifests for shipments of spent carbon will be maintained at the facility. No spent carbon will be regenerated or disposed on-site. All carbon removed from the control devices will be managed per the requirements of 40 CFR 264.1034 below:

1) Regenerated/reactivated in a Subpart X unit;

2) Incinerated as a hazardous waste;

3) Burned in an industrial furnace or boiler.

Records will be maintained at the facility including design documentation, monitoring, operating and inspection information for the closed-vent system and carbon adsorption system. This will include:

1) Description and date of each modification;

2) Identification of operating parameters, description of monitoring device and diagram of monitoring location, and daily inspection for flow indication;

3) Monitoring inspections of carbon adsorption systems including date and time of monitoring and reading, carbon system start-up and shutdowns, records of management of carbon including carbon changes and off-site shipments;

4) Monitoring inspections of closed-vent systems including visual and instrument for initial and continuing operation, and negative pressure indicators;

5) Records of defects or leaks found, repairs made of the closed vent systems including instrument identification number, component identification number, operator's identification, dates of leak detection, first repair attempt, successful repair, successful repair reading, repair delays and justification;

6) Date, time and duration of each period the carbon system is operating below 95% reduction of total organic content of the inlet vapor stream.

A semiannual report will be submitted to the Regional Administrator detailing dates the carbon adsorption system operated below 95% reduction of total organic content of the inlet vapor stream and the carbon bed was not replaced within 24 hours. If the carbon beds are replaced within 24 hours during the six month period, no report is necessary.

I hereby certify as Facility Owner/Operator that the carbon adsorption bed system control device is designed to operate at an efficiency of 95% or greater reduction of total organic concentration from the closed vent system associated with the hazardous waste shredder and the closed vent system associated with the metalwashing/tankfarm as demonstrated by the attached design analysis. This design analysis considers vent stream composition, constituent concentrations, flow rate, relative humidity and temperature. This design analysis establishes the design outlet organic concentration level, capacity of the carbon bed, type and operating capacity of the activated carbon and design carbon replacement interval based based on the total carbon working capacity and the hazardous waste shredder and metalwashing/tankfarm operating schedules. I also certify that the operating parameters used in this design analysis reasonably represent the conditions that exist when the hazardous waste shredder and metalwashing/tankfarm would be operating at the highest load or capacity level reasonably expected to occur.

Signature Date

Stephen H. Moynihan, Senior Vice-President
Clean Harbors Services, Inc.

Appendix D-45

Engineering Certification Units 16 and 25

A. WIANT
COPY

CleanHarbors®
ENVIRONMENTAL SERVICES, INC.
325 WOOD ROAD • BRAINTREE, MA 02184
(617) 849-1800

July 25, 1995

Via Federal Express

Mr. Robert Watson, P.E.
Illinois Environmental Protection Agency
Division of Land Pollution Control -- #24
Permit Section
2200 Churchill Road
Post Office Box 19276
Springfield, IL 62794-9276

Re: Clean Harbors of Chicago, Inc.
Log No. B-16-M-2
Construction Certification Report

Dear Mr. Watson:

In accordance with the provisions of Conditions I.K.1 and II.D.I of the RCRA Part B Permit issued June 30, 1995 Clean Harbors of Chicago, Inc. (CHCI) is pleased to submit this Construction Certification Report (CCR) for certain units at the modified CHCI facility located at 11800 South Stony Island Avenue in Chicago, IL.

Today's submittal includes one (1) original and two (2) copies of the CCR as prepared by Hoyer Schlesinger Turner, Inc. The CCR includes all pertinent engineering design calculations, as-built drawings, and coating information required by the Agency. The report also includes the required independent professional engineer (PE) certification statement and seal.

If you have any questions, please feel free to contact me at (617) 849-1800, extension 4473.

Sincerely,

Paul A. Ahearn

Paul A. Ahearn
Manager, Regulatory Compliance

Enclosure

CERTIFICATION

This statement is to be completed by both the responsible officer and the registered professional engineer upon completion of construction in accordance with 35 IAC Section 702.126. Submit one copy of the certification with original signatures and two additional copies (four additional copies for UIC wells). Forward these certification statements and any information required by the permit to the following address:

Illinois Environmental Protection Agency
Bureau of Land - #33
Permit Section
2200 Churchill Road, P.O. Box 19276
Springfield, Illinois 62794-9276

FACILITY NAME: CLEAN HARBORS OF CHICAGO, INC.

IEPA SITE CODE: 0 3 1 6 0 0 0 0 5 1

U.S. EPA ID NO.: IL D 0 0 0 6 0 8 4 7 1

PART B PERMIT LOG #/UIC PERMIT #: B-16-M-2

PERMIT (OR MODIFICATION) ISSUANCE DATE: June 30, 1995

PERMIT CONDITION NO. REQUIRING CERTIFICATION: I.K.1 & II.D.1

The Units #16 & 25 has been constructed in accordance with the specifications in the Part B/UIC Permit. Documentation that the construction was in accordance with the permit is contained in the enclosed report. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature of Owner/Operator

Alan S. McKim, Director
Clean Harbors of Chicago, Inc.
Name and Title

Signature of Registered P.E.

Marie Vanagas
62--40801
Hoyer-Schlesinger-Turner, Inc.
Name of Registered P.E. and Illinois Registration Number

July 25, 1995
Date

(P.E. SEAL)
Exp'date
NOV 30 1995

MARIE VANAGAS
62-40801
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

This Agency is authorized to require this information under Illinois Revised Statutes, 1979, Chapter 111 1/2, Section 1039. Disclosure of this information is required under that Section. Failure to do so may prevent this form from being processed and could result in your application being denied. This form has been approved by the Forms Management Center.

IL 532-2109
IPC 655 10/92

CONSTRUCTION CERTIFICATION REPORT

UNIT #16

UNIT #25

Prepared for:

CLEAN HARBORS OF CHICAGO, INC.
11800 S. Stony Island Avenue
Chicago, Illinois 60617

Prepared by:

HOYER-SCHLESINGER-TURNER, INC.
Consulting Engineers
300 West Adams Street, Suite 630
Chicago, Illinois 60606

HST PROJECT No. 17851

July, 1995

HOYER-SCHLESINGER-TURNER inc.
ENGINEERS - CONSTRUCTORS
300 west adams street chicago illinois 60606 telephone 263-0556 area code 312

July 25, 1995

Mr. Paul Ahearn
Manager, Regulatory Compliance
CLEAN HARBORS OF CHICAGO, INC.
11800 South Stony Island Avenue
Chicago, Illinois 60617

Re: Construction Certification Report
Unit #16 and #25
11700 S. Stony Island Avenue
Chicago, Illinois 60617
HST Project No. 17851

Gentlemen:

This report presents the results of Hoyer-Schlesinger-Turner, Inc.'s (HST) involvement in construction and construction modification of the units listed above.

The construction documents were prepared under HST supervision, except as noted. HST engineers made numerous field trips to observe construction. The repair of cracks in the existing concrete slab of Unit #25 and application of coating and topping in all the areas was witnessed by HST Licensed Structural Engineer, Peter Bernes. The final inspection of Units #16 and #25 was performed by HST engineer, Marie Vanagas, PE on various dates.

The secondary containment system is designed and constructed to prevent any migration of wastes or accumulated liquid out to the soil, ground water or surface water at any time.

Unit #16 individual secondary containments are provided with automatic leak-detection system for catastrophic release. The presence of small drips, spills, leaks or precipitation in the secondary containment for the Unit #16 and Unit #25 is monitored through daily visual plant inspections.

Respectfully submitted,

HOYER-SCHLESINGER-TURNER, INC.

Marie Vanagas

Marie Vanagas, PE
Illinois Licensed Professional Engineer
License No. 062-040801

MARIE VANAGAS
62-40801
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

MV/ar

Exp. Date NOV 30 1995

SUMMARY OF INSPECTION

Unit #16 - Tanks - Section 1

Unit #16 - Piping System - Section 2

Unit #25 - Section 3

HOYER-SCHLESINGER-TURNER inc.
ENGINEERS - CONSTRUCTORS
300 west adams street chicago illinois 60606 telephone 263-0556 area code 312

July 25, 1995

Mr. Paul Ahearn
Manager, Regulatory Compliance
CLEAN HARBORS OF CHICAGO, INC.
11800 South Stony Island Avenue
Chicago, Illinois 60617

Re: Inspection Report
Tanks TK-101 thru TK-107,
TK-109, TK-110 and TK-112
11700 S. Stony Island Avenue
Chicago, Illinois 60617
HST Project No. 17851

Gentlemen:

On July 7 and July 10, 1995 I visually inspected the tanks listed above. The Flammable Storage Tank Farm is located at the SW corner of the plant. All tanks are located outdoors. Each tank has a separate concrete containment dike. All concrete containments, with the exception of the containment for Tanks TK-107 and TK-112, are coated with Protecto-Coat 900 System, 30 mils thick as manufactured by Dudick, Inc. The concrete containment for Tanks TK-107 and TK-112 was primed only. The coating will be applied in the near future. For dike coating technical information and chemical resistance chart, see Appendix 16-T-7. For tank farm layout and details, see as-built drawing CHCI No. 4215 (5404-S-04, Revision 0) in Appendix 16-T-1. Each individual containment is provided with an automatic emergency float leak detector.

The Tank Farm was originally built in 1982 for storage of oils and fuels. The tank farm was not in use from 1992. Tanks TK-101 to TK-104 were placed in service during 1986; the remaining tanks were in service from 1982. Recent modification to the tank farm was to alter the tanks and containments so that Class I flammable liquids can be stored in Tank TK-101 thru TK-107, TK-109 and TK-110. Tank TK-112 will store Class II flammable liquids. For structural integrity of containment and tank supports, see calculations in Appendix 16-T-2. Containment volume calculations are on drawing 5404-S-04.

All of the tanks were empty at the time of inspection. The tanks were decontaminated, washed with high pressure cold water without detergent. All tanks will be operated at ambient temperature, 2" wc pressure and with Nitrogen Blanketing. All of the tanks will be vented thru a carbon bed. Each tank is equipped with a conservation vent. The maximum specific gravity of the waste will be 1.2.

H-S-T

Confined space entry permit is included in Appendix 16-T-3.

For physical data, additional information and inspection findings, see attached schedule. Inspection findings were discussed with Project Manager, Mr. Alan F. Mount.

For tanks evaluations, modifications and calculations, see certified reports by Mr. Lee F. Mount, PE, dated January 1995 and March 14, 1995 in Appendix 16-T-4.

For tanks nozzles orientation and discs, see Appendix 16-T-5.

Therefore, I hereby certify that after visual inspection, the tanks are structurally sound, properly supported and set. No evidence of cracks, bulging or weld defects were observed, except as noted in "Remarks" of the Tank Schedule. Based on my inspection, the tanks can be put into operation after the leaking manholes on Tank TK-103 and TK-104 are corrected, hydro-testing the remainder of the tanks will be performed by plant personnel and all leaks, if any, are corrected and coating of the containment at Tanks TK-107 and TK-112 is completed.

Very truly yours,

HOYER-SCHLESINGER-TURNER, INC.
Consulting Engineers

Marie Vanagas

Marie Vanagas, PE
Project Engineer
Illinois No. 62-40801, Exp. 11/30/95

MARIE VANAGAS
62-40801
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

MV/ar
Encl.

CC: James R. Laubsted, CHI
Amos Turner, HST

HOYER-SCHLESINGER-TURNER, INC.

CLEAN HARBORS OF CHICAGO, INC.

STORAGE TANKS

LOCATION: OUTDOOR TANK FARM

TANK ID #	TANK USAGE	TYPE OF TANK	TANK SIZE (DIA. FT.)	pH	OPERATING TANK CAPACITY GALLONS	TANK FOUNDATION	TANK DESIGN CODE	REMARKS
TK-101	STORAGE ACID FLAM. LIQUID CLASS I	S.S. 316 CONE BOTTOM	12' X 17.5'	1 TO 10	12,000	CAISSONS AND LEGS	UL-142	1, 11
TK-102	STORAGE FLAM. LIQUID CLASS I PCB CONTAMINATED	C.S. CONE BOTTOM	12' X 17.5'	4 TO 10	12,000	CAISSONS AND LEGS	UL-142	2, 11
TK-103		C.S. CONE BOTTOM	12' X 17.5'	4 TO 10	12,000	CAISSONS AND LEGS	UL-142	3, 11
TK-104		C.S. CONE BOTTOM	12' X 17.5'	4 TO 10	12,000	CAISSONS AND LEGS	UL-142	4, 11
TK-105		C.S. CONE BOTTOM	12' X 17.5'	4 TO 10	12,000	CAISSONS AND LEGS	UL-142	5,8,11
TK-106		C.S. CONE BOTTOM	12' X 17.5'	4 TO 10	12,000	CAISSONS AND LEGS	UL-142	6,8,11
TK-107	STORAGE ACID FLAM. LIQUID	S.S. CONE BOTTOM	12' X 17.5'	1 TO 10	12,000	CAISSONS AND LEGS	UL-142	7,8,11
TK-109		C.S. CONE BOTTOM	12' X 17.5'	4 TO 10	12,000	CAISSONS AND LEGS	UL-142	9,8,11
TK-110	STORAGE FLAM. LIQUID CLASS I PCB CONTAMINATED	C.S. CONE BOTTOM	12' X 17.5'	4 TO 10	12,000	CAISSONS AND LEGS	UL-142	8,10,11
TK-112	STORAGE FLAM. LIQUID CLASS II	C.S. CONE BOTTOM	12' X 25.5'	4 TO 10	19,000	CAISSONS AND LEGS	UL-142	8,11,12

REMARKS

1. The welds around the new nozzles on the inside and outside of the tank were properly done and there were no visible defects. The existing welds are in good condition. There were not any other visible defects on the interior of the tank.

2. There was powder-like rust on the bottom and side walls of the interior. The interior of the top plate was rusted and flaking. There were no visible defects on the welds around the new nozzles on the inside or outside. The tank will be flushed after hydra-testing. The existing welds of the tank shell and around the existing nozzles were in good condition. There were no other visual defects on the interior of the tank.

3. All new and existing welds are in good condition and no visible defects were observed. The interior top plate has a lot of flake-like rust. There were no other visible defects.

4. All new and existing vessel welds were in good condition without visible defects. Coned bottom and walls were covered with powder-like rust. The interior of the top plate was rusted and flaking. There were no other visible defects. Some rust flakes were accumulated on the bottom and will be flushed after hydro-testing of the tank.

5. The interior bottom, walls and top were rusted. There was no flaking. The new and existing welds are in good condition. Overall, the tank interior is in good condition and no visible defects were observed.

6. The entire interior was slightly rusted. The new and existing welds are in good condition. Overall, the tank interior is in good condition and no visible defects were observed.

7. The interior was clean. The existing welds were in good condition. Small pits in the bottom plate were repaired by weld-on material. The walls and top of the tank were in good condition.

8. There is no recorded indication that the tank was built to UL-142 standard. The assumption that the tank was built to this standard is based on comparison with the tank fabricated to the standard.

9. The tank had many rusted spots. All new and existing welds were in good condition without visible defects. The tank interior is in good condition.

10. The interior of the tank was in good condition. Top plate was rusted. The walls and bottom had powder-like rust. All new and existing welds were in good condition.

11. The exterior of the tanks are not possible to inspect by visual inspection. All tanks are insulated with 2" tk insulation and metal jacket. The insulation and jacketing will be repaired on all tanks in the near future.

12. The walls and bottom of the interior had a light powder-like dust. The top plate was rusted. The new and existing welds were in good condition and overall tank condition is good.

APPENDIX

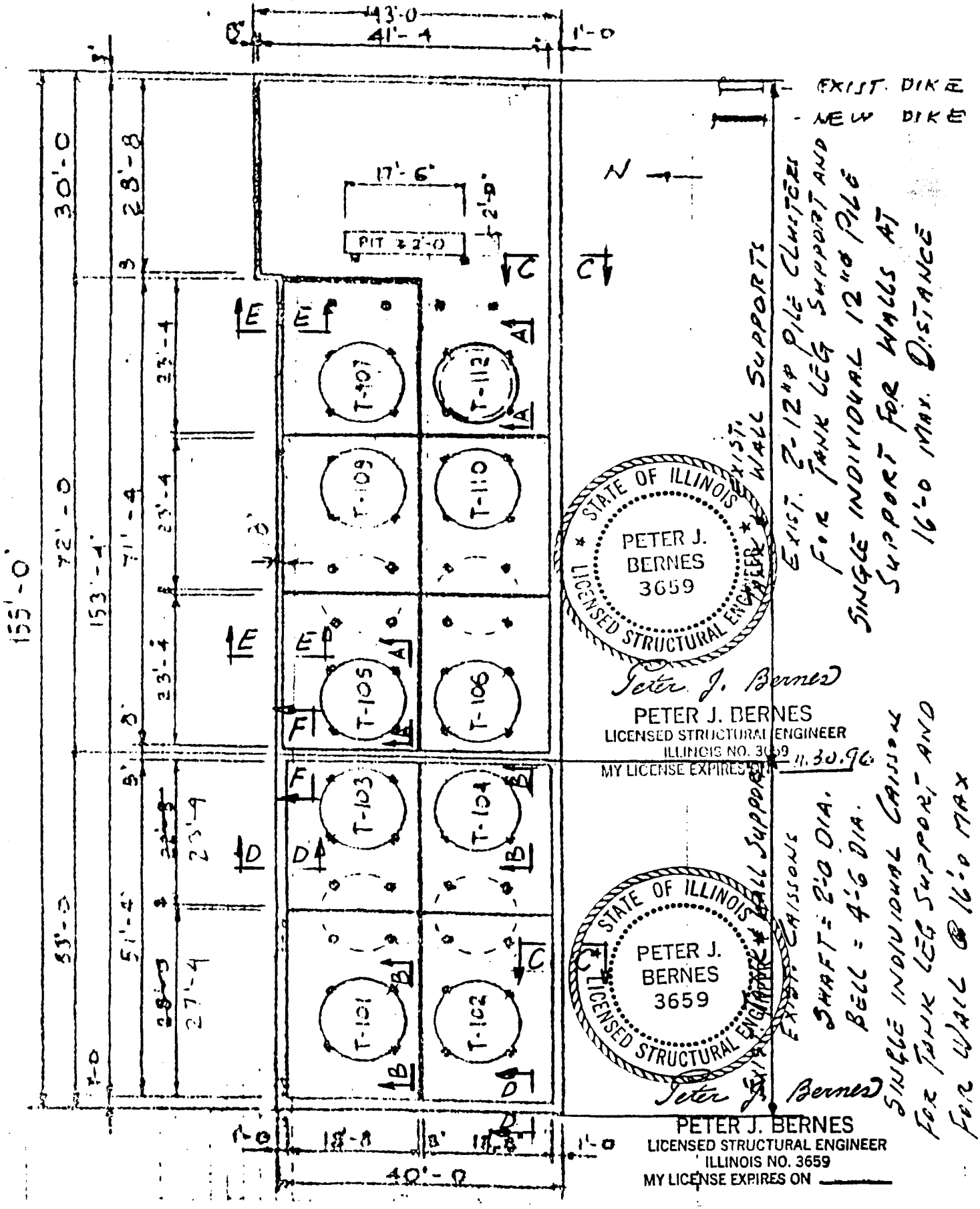
16-T-2

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, IL

SUBJECT EXIST. TANK FARM SUPPORT COMPUTATIONS

SHEET 1 OF 8
PROJECT NO. 17851
DATE 1.19.95
BY BERNES

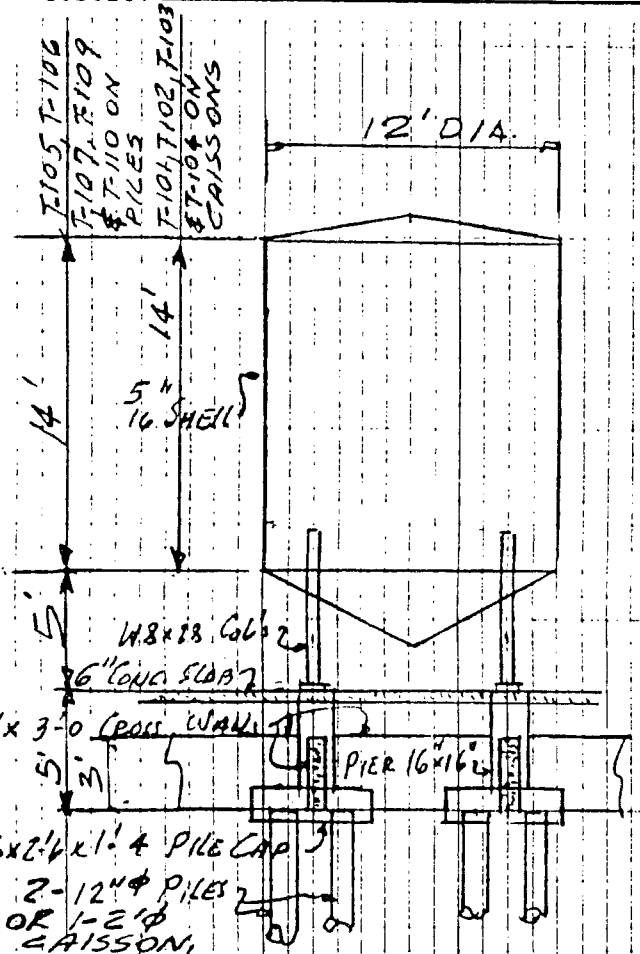


HOYER-SCHLESINGER-TURNER, INC.

PROJECT: CLEAN HARBORS - CHICAGO, IL

SUBJECT: EXIST. TANK FARM SUPPORT COMPUTATIONS

SHEET 2 OF 8
PROJECT NO. 17851
DATE 1.19.95
BY BERNES
CHK. C.K. 1.27.95



SECTION "A-A"

SEE SH-1

TANKS T-101 THRU T-107, T-109 & T-110

EMPTY TANK =

$= \pi(12 \times 14' + 12^2/4 + 6 \times \sqrt{3^2 \times 12^2}) \times 12.8 \times 1.05$

$= 11,985 + 4 \text{ LEGS} \times 7 \times 28 = 184$

TOTAL = 12,170#

PLUS NOZZLES, FLANGES AND SUPPORT:

= 7,830#

TOTAL EMPTY TANK = 12,170 + 7,830 =

= 20,000# ✓

LIQUID = 12,100 GAL × 8.33# × 1.5 =

= 151,298# ✓

TOTAL EMPTY + LIQUID =

= 20,000# + 151,298# = 171K

EACH LEG = 171/4 = 43K/LEG ✓

CONCRETE + SNOW

PILE CAP = 4.5' × 2.5 × 1.33 × .15	= 2.25K
PIER 1.33 × 1.33 × 5' × .15	= 1.33K
CROSS WALL 3' × .67' × 16 × .15	= 4.82K
FILL 4.5 × 2.5 × 3.5 × .10	= 3.94K
6" CONC. SLAB = 4.5 × 2.5 × .5 × .15	= .84K
SNOW $\pi R^2 \times 25$#	= 2.83K
	16.01 K/LEG

TOTAL LOAD PER LEG ON PILES

= 43K + 16K = 59K

TWO 2-12"φ WOOD PILES = 20 TON CAP. EACH

= 2 × 40K = 80K > 59K O.K.

CAISSON CAP. = $\pi \times R^2 \times 9^K = \pi \times 2.25^2 \times 9 = 143^K > 59^K$ O.K.

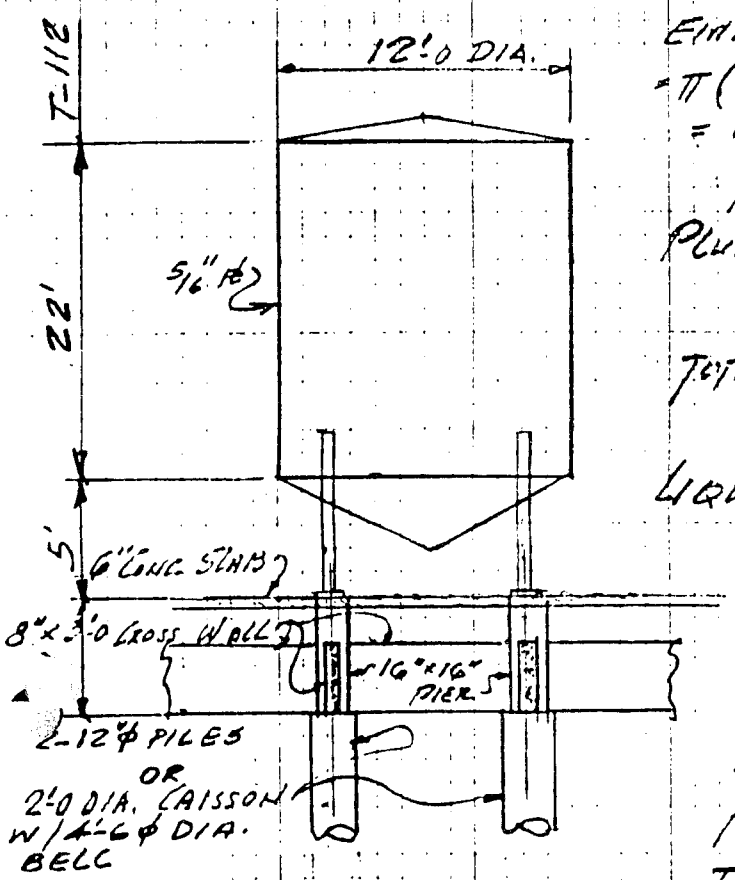
HOYER-SCHLESINGER-TURNER, INC.

SHEET 3 OF 8
PROJECT NO. 17851
DATE 1.20.95
BY BERNES
CHKD. G.R. 1.27.9

PROJECT CLEAN HARBORS - CHICAGO, IL

SUBJECT EXIST. TANK FARM SUPPORT COMPUTATIONS

TANK T-112



SECTION "B-B"
SEE SH. - 1

EMPTY TANK =
$= \pi(12 \times 22 + 12^2/4 + 6 \times \sqrt{3^2 \times 12^2}) \times 12.8 \times 1.05$
$= 15{,}834\# + 4$ LEGS $\times 7 \times 28 = 18{,}4\#$
TOTAL $\approx 16{,}000\#$

PLUS NOZZLES, FLANGES & SUPPORT =
$8{,}000\#$

TOTAL EMPTY TANK $= 16{,}000\# + 8{,}000\#$
$= 24{,}000\#$

LIQUID $= 19{,}600$ GAL $\times 8.336 \times 1.5 =$
$= 245{,}000\#$

TOTAL EMPTY + LIQUID =
$= 24{,}000 + 245{,}000\# = 269^K$

LOAD PER LEG $= 269/4 = 67^K$

FOR CONCRETE SEE SH. 2

TOTAL LOAD PER LEG =
$= 67^K + 16^K = 83^K$

TWO - 12" ϕ WOOD PILES @ 20 TON CAP. EACH =
$= 80^K \cong 83^K$ O.K.

TANKS T-101, T-102, T-103 & T-104 ON CAISSONS W/ BELL

TOTAL LOAD PER LEG $= 43^K$ (SEE SH. 2)

CONC. PIER $= 1.33 \times 1.33 \times 5' \times .15$	$= 1.33^K$
CROSS WALLS $3' \times .67' \times 16 \times .15$	$= 4.82^K$
CAISSON	$= 12.00^K$
	18.00^K

LIQUID $= 151^K$ (SEE SH. 2)

TOTAL PER LEG $= 43 + 18 = 61^K$

ONE CAISSON CAPACITY $= \pi R^2 \times q^K = \pi \times 2.25^2 \times q^K = 143^K$

$143^K > 61^K$ O.K.

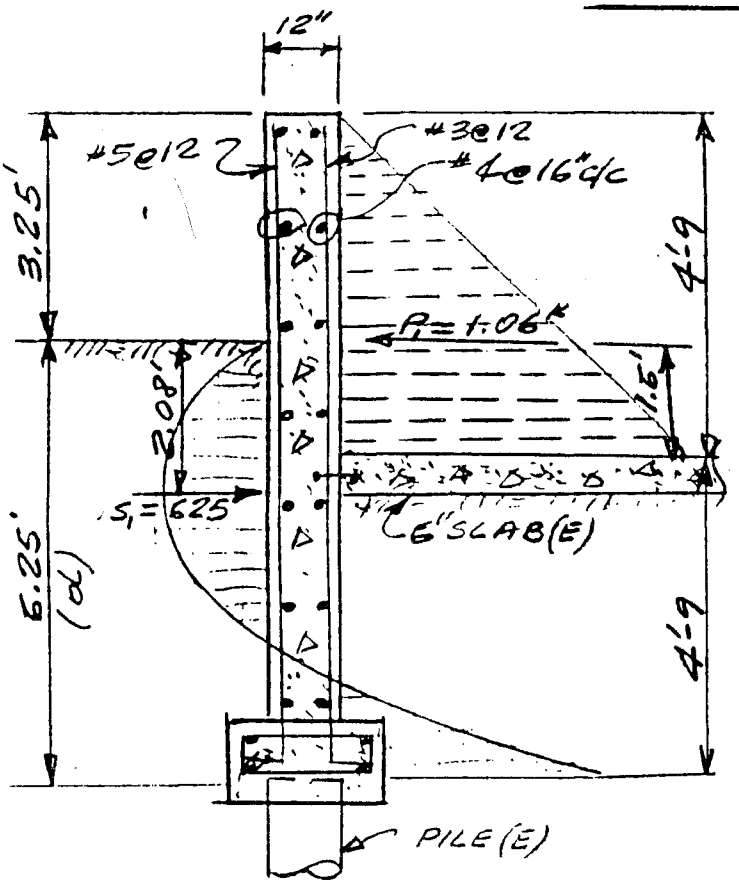
HOYER-SCHLESINGER-TURNER, INC.

SHEET 4 OF 8
PROJECT NO. 17851
DATE 1.20.95
BY BERNES

PROJECT CLEAN HARBORS, CHICAGO, IL.

SUBJECT EXIST. TANK FARM WALL COMPUTATIONS

SOUTH WALL ONLY



SECTION C-C

SHT. #1

$62.4 \times 4.75 \times 1.5 = 445^{\#}/SF$

$P_1 = 445 \times 4.75/2 = 1.06^K$

$d = \frac{A}{2}\left(1 + \sqrt{1 + \frac{4.36 \times h}{A}}\right)$

d = DEPTH OF EMBEDMENT FT.
= 6.25' (ACTUAL)

$A = \frac{2.34 \times P_1}{S_1 \times B} = \frac{2.34 \times 1{,}060}{625 \times 1.0} = 3.97$

$S_1 = \frac{p \times d}{3} = \frac{300 \times 6.25}{3} = 625$

$B = 1.0'$; $h = 2.08'$

h = HEIGTH ABOVE GROUND FORCE APPLIED, FT

$d = \frac{3.97}{2}\left(1 + \sqrt{1 + \frac{4.36 \times .5}{3.97}}\right)$

$= 1.99(1 + 1.24) = 4.47' < 6.25$ O.K.

$d = 4.47'$

$M = 1.06 \times 2.08 = 2.2^{IK}$

$A_s = \frac{2.2}{1.76 + 10} = .125^{\square''} \approx .11$ O.K.

CONCLUSION: NO ADDITIONAL SUPPORT REQUIRED FOR EXIST. SOUTH WALL

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS, CHICAGO, ILL.

SUBJECT EXIST. TANK FARM WALL COMPUTATIONS

SHEET 5 OF 8
PROJECT NO. 17851
DATE 1.20.95
BY BERNEC

CHECK VERTICAL LOAD ON 12" WALL & PILES SUPPORTING THE WALL (SEE PAGE 4)

WALL	8.5 x 1 x .15	=	1.28^k
FOOTING	2 x 1 x .15	=	.30^k
EARTH	5.25 x .5 x .10	=	.26^k
SURCHARGE	.5 x .20	=	.10^k
LIQUID	4.75 x .5 x .063 x 1.5	=	.22
6" SLAB	.5 x .5 x .15	=	.04^k
SOIL	3.25 x .5 x .10	=	.16^k
			2.36^k SAY 2.6^k/L.F.

CHECK REINF.

$$M = \frac{2.36 \times 16^2}{10} = 60.4^{'k}$$

$$A_{s\,reqd} = \frac{60.4}{1.76 \times 96} = .36^{\square''} < 2\text{-}\#5 = .62^{\square''} \text{ O.K.}$$

TOTAL LOAD PER PILE

$2.36^k \times 16' = 37.8^k$ SAY 38^k

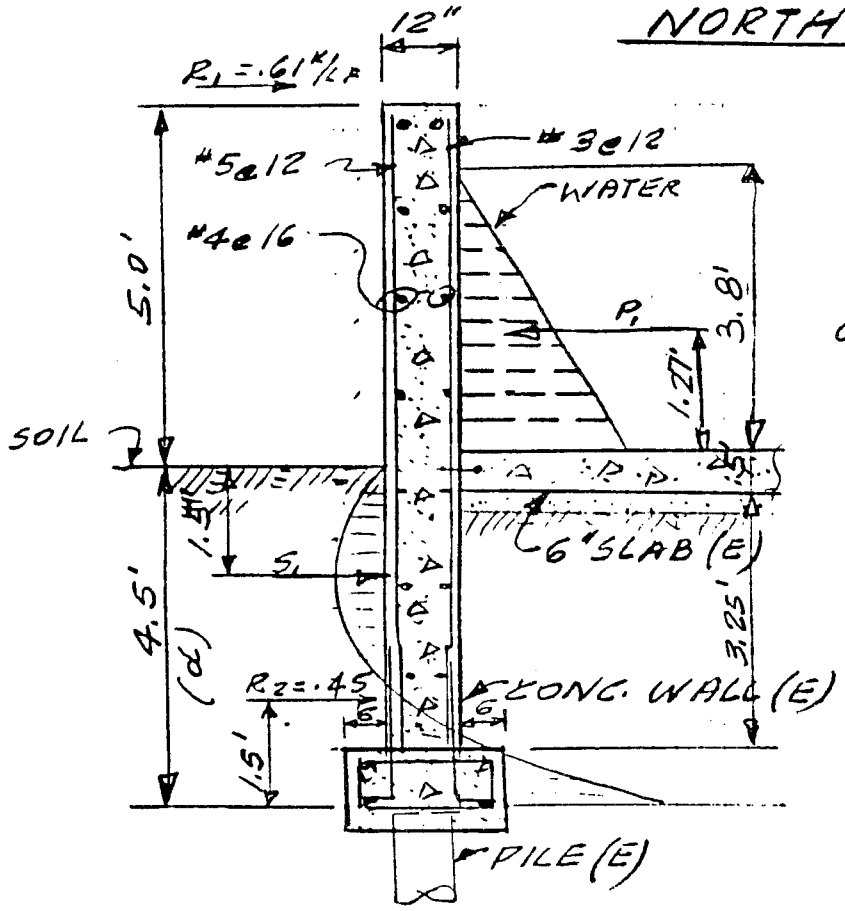
20 TON CAP. PILE $= 40^k > 38^k$ O.K.

HOYER-SCHLESINGER-TURNER, INC.

SHEET 6 OF 8
PROJECT NO. 17851
DATE 1.20.95
BY BERNES

PROJECT CLEAN HARBORS, CHICAGO, IL.
SUBJECT EXIST. TANK FARM WALL COMPUTATIONS

NORTH & WEST WALLS



SECTION D-D
SHT. #1

$62.4 \times 3.8' \times 1.5 = 356^{\#}/SF$

$P_1 = .356 \times 3.8/2 = 0.68^k$

$d = \frac{A}{2}\left(1 + \sqrt{1 + \frac{4.36 \times h}{A}}\right)$

d – DEPTH OF EMBEDMENT IN FT.

4.5' (ACTUAL)

$A = \frac{2.34 \times P_1}{S_1 \times B} = \frac{2.34 \times .68^k}{450 \times 1.0}$

$= 3.53$

$S_1 = \frac{P \times d}{3} = \frac{300 \times 4.5}{3} = 450$

$B = 1.0'$

$d = \frac{3.53}{2}\left(1 + \sqrt{1 + \frac{4.36 \times 1.27}{3.53}}\right) =$

$= 1.77 \times 2.6 = 4.6' = 4$

OK

CHECK WALL REINFORCING.

$M_1 = .68 \times 2.27 = 1.88^{'k}$

12" WALL – $A_{s\,req} = \frac{1.88}{1.76 \times 10} = .11^{\square''} < .31^{\square''}$ O.K.

8" WALL – $A_{s\,req} = \frac{1.88}{1.76 \times 4} = .27^{\square''} < .31^{\square''}$ O.K.

HOYER-SCHLESINGER-TURNER, INC.

REV. 1-24-15

SHEET 7 OF 8

PROJECT CLEAN HARBORS, CHICAGO, ILL.

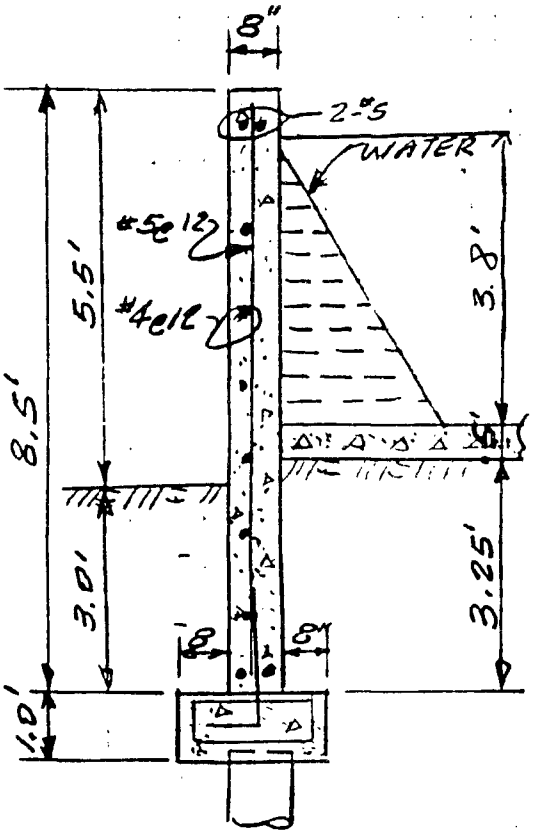
PROJECT NO. 17851

SUBJECT EXIST. TANK FARM WALL COMPUTATIONS

DATE 1.20.95

BY BERNES

8" CONC. DIKE WALL



SECTION E-E

SHT. #1

VERT. LOAD ON WALL

WALL	8.5 x .67 x .15	= .85^k
FOOTER	2.0 x 1.0 x .15	= .30^k
EARTH	3.0 x .67 x .10	= .20^k
SURCHARGE	.67 x .20	= .13^k
LIQUID	4.75 x .063 x 1.5 x .67	= .30^k
6" CONC. SLAB	.5 x .67 x .15	= .05^k
EARTH	3.25 x .67 x .10	= .22^k
		2.05^k

$$M = \frac{2.05 \times 16^2}{10} = 52.48^{'k}$$

$$A_{s\,reqd} = \frac{52.48}{1.76 \times 96} = .31^{\square''} < 2\text{-}\#5 = .62^{\square}$$

O.K.

LOAD ON PILE

$2.05 \times 16 = 33^k$

20 TON PILE $= 40^k > 33^k$

O.K.

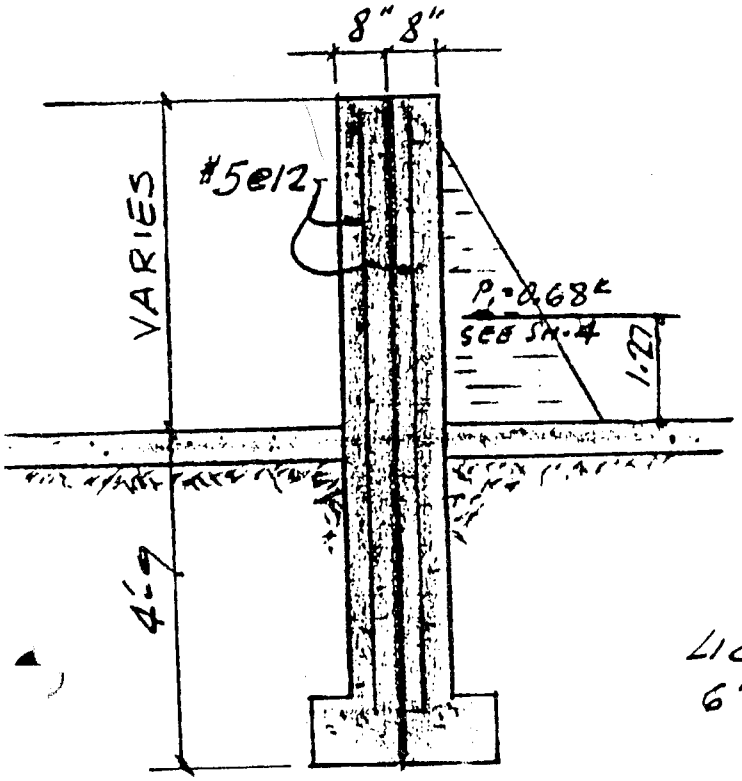
REV. 7-24-95

HOYER-SCHLESINGER-TURNER, INC.

SHEET 8 OF 8
PROJECT NO. 17851
DATE 1.20.95
BY BERNES

PROJECT CLEAN HARBORS CHICAGO, IL
SUBJECT EXIST. TANK FARM WALL COMPUTATIONS

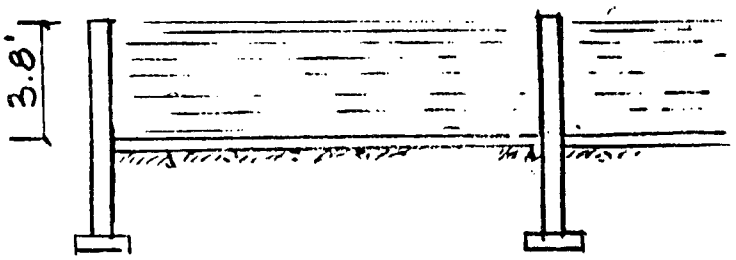
DOUBLE 8" DIKE WALL



SECTION "F-F"

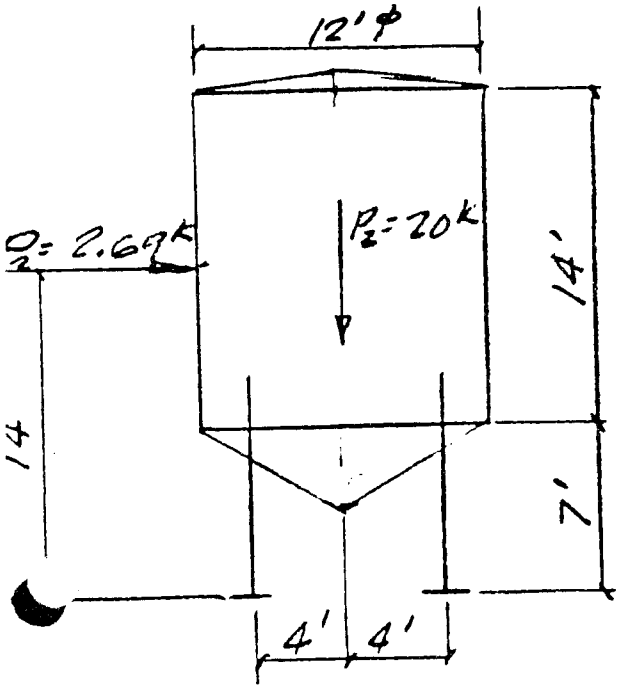
$M = .68^k \times 1.27 = .86^{'k}$

$A_s = .86/1.76 \times 4 = .12 in^2 < .31 in^2$ o.k



SOIL PRESSURE

LIQUID = 3.8' x 62.4 PSF x 1.5 = 356 PSF
6" CONC. SLAB = .5 x 150 = 75 "
TOTAL = 431 PSF
431 PSF < 1500 PSF o.k.



WIND = 20 PSF

WIND LOAD =
= 14' x 12' x .8 x 20 PSF = 2.69k

OTM = 2.69k x 14' = 37.66'k

RM = 20k x 4' = 80'k > 37.66'k

NO UPLIFT o.k.

S.F. = 80/37.66 = 2.12 > 1.5 o.k

TANK FULL + WIND
171/4 + 37.66/8 = 38.76k

TANK FULL NO WIND
171/4 = 34.2k

38.76/34.2 = 1.13 < 1.25
NO WIND CASE GOVERNS

APPENDIX

16-T-3

EFFLUENT TECHNOLOGY INC.

Confined Space Entry Permit (Pre-Entry/Entry Check List)

Date and Time Issued: 7/7/95 1:50PM

CLEAN HARBOR

Job site:

CHICAGO IL

Equipment to be worked on: TANK

INSPECTION 101

Pre-Entry (See Safety Procedure)

1. Atmospheric Checks: Time 1:50
   Oxygen 20.8 %
   Explosive N.D % L.E.L.
   Toxic N.D PPM

2. Source isolation (No Entry):

	N/A	Yes	No
Pumps or lines blinded	( )	(✓)	( )
disconnected, or blocked	( )	(✓)	( )

3. Ventilation Modification:

	N/A	Yes	No
Mechanical	( )	(✓)	( )
Natural Ventilation only	(✓)	( )	( )

4. Atmospheric check after Isolation and Ventilation:

Oxygen	20.7	>	19.5%
Explosive	N.D	<	10%
Toxic	N.D	<	10 PPM H(2)S
Time	2:10		

If conditions are in compliance with the above requirements and there is no reason to believe conditions may change adversely, then proceed to the Permit Space Pre-Entry Check List. Complete and post with this permit. If conditions are not in compliance with the above requirements or there is reason to believe that conditions may change adversely, proceed the Entry Check-List portion of this permit.

Date and Time Expires:

Lou Filosh

Job Supervisor

INSPECT TANK

Work to be performed:

Entry (See Safety Procedure)

1. Entry, standby, and back up persons: Yes No

Successfully completed required training?

Is it current? (✓) ( )

2. Equipment:

	N/A	Yes	No
Direct reading as monitor - tested	( )	(✓)	( )
Safety harnesses and lifelines for entry and standby persons	( )	(✓)	( )
Hoisting equipment	(✓)	( )	( )
Powered communications	(✓)	( )	( )
SCBA's for entry and standby persons	( )	(✓)	( )
Protective Clothing	( )	(✓)	( )
All electric equipment listed Class I, Division I, Group D and Non-sparking tools	(✓)	( )	( )

3. Contents of confined space

EMPTY

We have reviewed the work authorized by this permit and the information contained here-in. Written instructions and safety procedures have been received and are understood. Entry cannot be approved if any squares are marked in the "No" column. This permit is not valid unless all appropriate items are completed.

Permit and Check List Prepared By:

(Supervisor) [signature]

Approved By:

(Unit Supervisor)

Reviewed By (Confined Space Operations Personnel):

(printed name & signature)

M. VANAGAS

Marie Vanagas

EFFLUENT TECHNOLOGY INC.

Confined Space Entry Permit (Pre-Entry/Entry Check List)

Date and Time Issued: 7/7/95 9AM

CLEAN HARBORS

Job site:

STONEY ISLAND

Equipment to be worked on:

INSPECT TANK T102

Pre-Entry (See Safety Procedure)

1. Atmospheric Checks: Time 9:30

Oxygen _____ %

Explosive _____ % L.E.L.

Toxic _____ PPM

2. Source isolation (No Entry):

	N/A	Yes	No
Pumps or lines blinded	( )	(X)	( )
disconnected, or blocked	( )	(X)	( )

3. Ventilation Modification:

	N/A	Yes	No
Mechanical	( )	(X)	( )
Natural Ventilation only	( )	( )	( )

4. Atmospheric check after Isolation and Ventilation:

Oxygen 20.9 > 19.5%

Explosive < N.D. < 10%

Toxic < N.D. < 10 PPM H(2)S

Time 10:00AM

If conditions are in compliance with the above requirements and there is no reason to believe conditions may change adversely, then proceed to the Permit Space Pre-Entry Check List. Complete and post with this permit. If conditions are not in compliance with the above requirements or there is reason to believe that conditions may change adversely, proceed the Entry Check-List portion of this permit.

Date and Time Expires:

LOU FILOSA

Job Supervisor

INSPECT TANK

Work to be performed:

Entry (See Safety Procedure)

1. Entry, standby, and back up persons: Yes No

Successfully completed required training?

Is it current? (X) ( )

2. Equipment:

	N/A	Yes	No
Direct reading as monitor - tested	( )	(X)	( )
Safety harnesses and lifelines for entry and standby persons	( )	(X)	( )
Hoisting equipment	(X)	( )	( )
Powered communications	(X)	( )	( )
SCBA's for entry and standby persons	( )	(X)	( )
Protective Clothing	( )	(X)	( )
All electric equipment listed Class I, Division I, Group D and Non-sparking tools	(X)	( )	( )

3. Contents of confined space

EMPTY TANK

AT THIS TIME

We have reviewed the work authorized by this permit and the information contained here-in. Written instructions and safety procedures have been received and are understood. Entry cannot be approved if any squares are marked in the "No" column. This permit is not valid unless all appropriate items are completed.

Permit and Check List Prepared By:

(Supervisor) LOU FILOSA

Approved By:

(Unit Supervisor) [signature]

Reviewed By (Confined Space Operations Personnel):

(printed name & signature)

M. X

Marie Vanegas

EFFLUENT TECHNOLOGY INC.

Confined Space Entry Permit (Pre-Entry/Entry Check List)

Date and Time Issued: 7/10 9:00AM

CLEAN HARBORS

Job site:

CHICAGO, IL

Equipment to be worked on: TANK

INSPECTION 103

Pre-Entry (See Safety Procedure)

1. Atmospheric Checks: Time 9:00AM

   Oxygen 20.5 %

   Explosive N.D % L.E.L.

   Toxic N.D PPM

2. Source isolation (No Entry):

	N/A	Yes	No
Pumps or lines blinded	( )	(✓)	( )
disconnected, or blocked	( )	(✓)	( )

3. Ventilation Modification:

	N/A	Yes	No
Mechanical	( )	(✓)	( )
Natural Ventilation only	(✓)	( )	( )

4. Atmospheric check after Isolation and Ventilation:

   Oxygen 20.9 > 19.5%

   Explosive N.D < 10%

   Toxic N.D < 10 PPM H(2)S

   Time 9:00

If conditions are in compliance with the above requirements and there is no reason to believe conditions may change adversely, then proceed to the Permit Space Pre-Entry Check List. Complete and post with this permit. If conditions are not in compliance with the above requirements or there is reason to believe that conditions may change adversely, proceed the Entry Check-List portion of this permit.

Date and Time Expires:

LOU FILOSA

Job Supervisor

TANK INSPECTION

Work to be performed:

Entry (See Safety Procedure)

1. Entry, standby, and back up persons: Yes No

Successfully completed required training?

Is it current? (✓) ( )

2. Equipment:

	N/A	Yes	No
Direct reading as monitor - tested	( )	(✓)	( )
Safety harnesses and lifelines for entry and standby persons	( )	(✓)	( )
Hoisting equipment	(✓)	( )	( )
Powered communications	(✓)	( )	( )
SCBA's for entry and standby persons	( )	(✓)	( )
Protective Clothing	( )	(✓)	( )
All electric equipment listed Class I, Division I, Group D and Non-sparking tools	(✓)	( )	( )

3. Contents of confined space

EMPTY

We have reviewed the work authorized by this permit and the information contained here-in. Written instructions and safety procedures have been received and are understood. Entry cannot be approved if any squares are marked in the "No" column. This permit is not valid unless all appropriate items are completed.

Permit and Check List Prepared By:

(Supervisor)

Approved By:

(Unit Supervisor)

Reviewed By (Confined Space Operations Personnel):

(printed name & signature)

M. VARAGAS

Maria Varagas

EFFLUENT TECHNOLOGY INC.

Confined Space Entry Permit (Pre-Entry/Entry Check List)

Date and Time Issued: 7/19/95 10:04

CLEAN HARBORS

Job site:

CHICAGO, IL

Equipment to be worked on:

TANK T-104

Pre-Entry (See Safety Procedure)

1. Atmospheric Checks: Time _____
   Oxygen _____ %
   Explosive _____ % L.E.L.
   Toxic _____ PPM

2. Source isolation (No Entry):

	N/A	Yes	No
Pumps or lines blinded	( )	(X)	( )
disconnected, or blocked	( )	(X)	( )

3. Ventilation Modification:

	N/A	Yes	No
Mechanical	( )	(X)	( )
Natural Ventilation only	( )	( )	( )

4. Atmospheric check after Isolation and Ventilation:

Oxygen	20.9	>	19.5%
Explosive	N.D.	<	10%
Toxic	N.D.	<	10 PPM H(2)S
Time	10:15		

If conditions are in compliance with the above requirements and there is no reason to believe conditions may change adversely, then proceed to the Permit Space Pre-Entry Check List. Complete and post with this permit. If conditions are not in compliance with the above requirements or there is reason to believe that conditions may change adversely, proceed the Entry Check-List portion of this permit.

Date and Time Expires:

LOU FILOSA

Job Supervisor

INSPECT TANK

Work to be performed:

Entry (See Safety Procedure)

1. Entry, standby, and back up persons: Yes No

Successfully completed required training?

Is it current? (X) (

2. Equipment:

	N/A	Yes	No
Direct reading as monitor - tested	( )	(X)	(
Safety harnesses and lifelines for entry and standby persons	( )	(X)	(
Hoisting equipment	(X)	( )	(
Powered communications	(X)	( )	(
SCBA's for entry and standby persons	( )	(X)	(
Protective Clothing	( )	(X)	(

All electric equipment listed Class I, Division I, Group D and Non-sparking tools (X) ( ) (

3. Contents of confined space

EMPTY AT THIS TIME

We have reviewed the work authorized by this permit a the information contained here-in. Written instructions a safety procedures have been received and are understoc Entry cannot be approved if any squares are marked in t "No" column. This permit is not valid unless all appropria items are completed.

Permit and Check List Prepared By:

(Supervisor)

Approved By:

(Unit Supervisor)

Reviewed By (Confined Space Operations Personnel):

(printed name & signature)

M. VARGAS X

Mario Vargas

EFFLUENT TECHNOLOGY INC.

Confined Space Entry Permit (Pre-Entry/Entry Check List)

Date and Time Issued: 7/10/95 9:20

Job site: CLEAN HARBORS

Chicago, IL

Equipment to be worked on: TK 105

TANK INSPECTION

Pre-Entry (See Safety Procedure)

1. Atmospheric Checks: Time 9:20

Oxygen 20.8 %

Explosive N.D % L.E.L.

Toxic N.D PPM

2. Source isolation (No Entry):

	N/A	Yes	No
Pumps or lines blinded	( )	(✓)	( )
disconnected, or blocked	( )	(✓)	( )

3. Ventilation Modification:

	N/A	Yes	No
Mechanical	( )	(✓)	( )
Natural Ventilation only	(✓)	( )	( )

4. Atmospheric check after Isolation and Ventilation:

Oxygen 20.7 > 19.5%

Explosive N.D < 10%

Toxic N.D < 10 PPM H(2)S

Time 9:30

If conditions are in compliance with the above requirements and there is no reason to believe conditions may change adversely, then proceed to the Permit Space Pre-Entry Check List. Complete and post with this permit. If conditions are not in compliance with the above requirements or there is reason to believe that conditions may change adversely, proceed the Entry Check-List portion of this permit.

Date and Time Expires:

Job Supervisor

Work to be performed:

Entry (See Safety Procedure)

1. Entry, standby, and back up persons:

	Yes	No
Successfully completed required training? Is it current?	(X)	( )

2. Equipment:

	N/A	Yes	No
Direct reading as monitor - tested	( )	(X)	( )
Safety harnesses and lifelines for entry and standby persons	( )	(X)	( )
Hoisting equipment	(X)	( )	( )
Powered communications	(X)	( )	( )
SCBA's for entry and standby persons	( )	(X)	( )
Protective Clothing	( )	(X)	( )
All electric equipment listed Class I, Division I, Group D and Non-sparking tools	(X)	( )	( )

3. Contents of confined space

EMPTY

We have reviewed the work authorized by this permit and the information contained here-in. Written instructions and safety procedures have been received and are understood. Entry cannot be approved if any squares are marked in the "No" column. This permit is not valid unless all appropriate items are completed.

Permit and Check List Prepared By:

(Supervisor)

Approved By:

(Unit Supervisor)

Reviewed By (Confined Space Operations Personnel):

(printed name & signature)

M. VARAGAS

Marie Varagas

EFFLUENT TECHNOLOGY INC.

Confined Space Entry Permit (Pre-Entry/Entry Check List)

Date and Time Issued: 7/7/95 10:40

CLEAN HARBORS

Job site: 108ST

CHICAGO, IL

Equipment to be worked on:

TANK INSPECTION ~~108~~ TANK 106 N.W. 7-17-95

Pre-Entry (See Safety Procedure)

1. Atmospheric Checks: Time _____

Oxygen _____ %

Explosive _____ % L.E.L.

Toxic _____ PPM

2. Source isolation (No Entry):

	N/A	Yes	No
Pumps or lines blinded	( )	(X)	( )
disconnected, or blocked	( )	(X)	( )

3. Ventilation Modification:

	N/A	Yes	No
Mechanical	( )	(X)	( )
Natural Ventilation only	(X)	( )	( )

4. Atmospheric check after Isolation and Ventilation:

Oxygen _____ > 19.5%

Explosive _____ < 10%

Toxic _____ < 10 PPM H(2)S

Time _____

If conditions are in compliance with the above requirements and there is no reason to believe conditions may change adversely, then proceed to the Permit Space Pre-Entry Check List. Complete and post with this permit. If conditions are not in compliance with the above requirements or there is reason to believe that conditions may change adversely, proceed the Entry Check-List portion of this permit.

Date and Time Expires:

LOU FILUSA

Job Supervisor

INSPECT TANK

Work to be performed:

Entry (See Safety Procedure)

1. Entry, standby, and back up persons: Yes No

	N/A	Yes	No
Successfully completed required training? Is it current?		(X)	( )
2. Equipment:	N/A	Yes	No
Direct reading as monitor - tested	( )	(X)	( )
Safety harnesses and lifelines for entry and standby persons	( )	(X)	( )
Hoisting equipment	(X)	( )	( )
Powered communications	(X)	( )	( )
SCBA's for entry and standby persons	( )	(X)	( )
Protective Clothing	( )	(X)	( )
All electric equipment listed Class I, Division I, Group D and Non-sparking tools	(X)	( )	( )

3. Contents of confined space

EMPTY TANK

We have reviewed the work authorized by this permit and the information contained here-in. Written instructions and safety procedures have been received and are understood. Entry cannot be approved if any squares are marked in the "No" column. This permit is not valid unless all appropriate items are completed.

Permit and Check List Prepared By: [signature]

(Supervisor)

Approved By:

(Unit Supervisor)

Reviewed By (Confined Space Operations Personnel):

(printed name & signature)

M. VARGAS

[signature]

EFFLUENT TECHNOLOGY INC.

Confined Space Entry Permit (Pre-Entry/Entry Check List)

Date and Time Issued: 7/10/95 10:00

CLEAN HARBORS

Job site:

CHICAGO, IL

Equipment to be worked on:

TANK INSPECTION TK 107

Pre-Entry (See Safety Procedure)

1. Atmospheric Checks: Time 9:50

Oxygen 20.8 %

Explosive N.D % L.E.L.

Toxic N.D PPM

2. Source isolation (No Entry):

	N/A	Yes	No
Pumps or lines blinded	( )	(✓)	( )
disconnected, or blocked	( )	(✓)	( )

3. Ventilation Modification:

	N/A	Yes	No
Mechanical	( )	(✓)	( )
Natural Ventilation only	(✓)	( )	( )

4. Atmospheric check after Isolation and Ventilation:

Oxygen 20.8 > 19.5%

Explosive N.D < 10%

Toxic N.D < 10 PPM H(2)S

Time 10:00

If conditions are in compliance with the above requirements and there is no reason to believe conditions may change adversely, then proceed to the Permit Space Pre-Entry Check List. Complete and post with this permit. If conditions are not in compliance with the above requirements or there is reason to believe that conditions may change adversely, proceed the Entry Check-List portion of this permit.

Date and Time Expires:

LOU FILOSA

Job Supervisor

TANK INSPECTION

Work to be performed:

Entry (See Safety Procedure)

1. Entry, standby, and back up persons: Yes No

Successfully completed required training?

Is it current? (X) ( )

2. Equipment:

	N/A	Yes	No
Direct reading as monitor - tested	( )	(X)	( )
Safety harnesses and lifelines for entry and standby persons	( )	(X)	( )
Hoisting equipment	(X)	( )	( )
Powered communications	(X)	( )	( )
SCBA's for entry and standby persons	( )	(X)	( )
Protective Clothing	( )	(X)	( )
All electric equipment listed Class I, Division I, Group D and Non-sparking tools	(X)	( )	( )

3. Contents of confined space

EMPTY

We have reviewed the work authorized by this permit and the information contained here-in. Written instructions and safety procedures have been received and are understood. Entry cannot be approved if any squares are marked in the "No" column. This permit is not valid unless all appropriate items are completed.

Permit and Check List Prepared By:

(Supervisor)

Approved By:

(Unit Supervisor)

Reviewed By (Confined Space Operations Personnel):

(printed name & signature)

M. VANAGAS

Mario Vanagas

EFFLUENT TECHNOLOGY INC.

Confined Space Entry Permit (Pre-Entry/Entry Check List)

Date and Time Issued: 7/10/95 10:30

CLEAN HARBORS

Job site:

CHICAGO, IL

Equipment to be worked on:

TANK INSPECTION TANK 109

Pre-Entry (See Safety Procedure)

1. Atmospheric Checks: Time 10:30

Oxygen 20.8 %

Explosive N.D % L.E.L.

Toxic N.D PPM

2. Source isolation (No Entry):

	N/A	Yes	No
Pumps or lines blinded	( )	(✓)	( )
disconnected, or blocked	( )	(✓)	( )

3. Ventilation Modification:

	N/A	Yes	No
Mechanical	( )	(✓)	( )
Natural Ventilation only	(✓)	( )	( )

4. Atmospheric check after Isolation and Ventilation:

Oxygen _____ > 19.5%

Explosive _____ < 10%

Toxic _____ < 10 PPM H(2)S

Time 10:40

If conditions are in compliance with the above requirements and there is no reason to believe conditions may change adversely, then proceed to the Permit Space Pre-Entry Check List. Complete and post with this permit. If conditions are not in compliance with the above requirements or there is reason to believe that conditions may change adversely, proceed the Entry Check-List portion of this permit.

Date and Time Expires:

Job Supervisor

INSPECT TANK

Work to be performed:

Entry (See Safety Procedure)

1. Entry, standby, and back up persons: Yes No

Successfully completed required training?

Is it current? (X) ( )

2. Equipment:

	N/A	Yes	No
Direct reading as monitor - tested	( )	(X)	( )
Safety harnesses and lifelines for entry and standby persons	( )	(X)	( )
Hoisting equipment	(X)	( )	( )
Powered communications	(X)	( )	( )
SCBA's for entry and standby persons	( )	(X)	( )
Protective Clothing	( )	(X)	( )
All electric equipment listed Class I, Division I, Group D and Non-sparking tools	(X)	( )	( )

3. Contents of confined space

EMPTY

We have reviewed the work authorized by this permit and the information contained here-in. Written instructions and safety procedures have been received and are understood. Entry cannot be approved if any squares are marked in the "No" column. This permit is not valid unless all appropriate items are completed.

Permit and Check List Prepared By:

(Supervisor)

Approved By:

(Unit Supervisor)

Reviewed By (Confined Space Operations Personnel):

(printed name & signature)

M. VARNAGAS

Mario Varnagas

EFFLUENT TECHNOLOGY INC.

Confined Space Entry Permit (Pre-Entry/Entry Check List)

Date and Time Issued: 7/7/95 11:30

CLEAN HARBORS

Job site:

CHICAGO, IL

Equipment to be worked on:

TANK INSPECTION TANK 110

Pre-Entry (See Safety Procedure)

1. Atmospheric Checks: Time 11:30

Oxygen 20.9 %

Explosive N.D % L.E.L.

Toxic N.D PPM

2. Source isolation (No Entry):

	N/A	Yes	No
Pumps or lines blinded	( )	(X)	( )
disconnected, or blocked	( )	(X)	( )

3. Ventilation Modification:

	N/A	Yes	No
Mechanical	( )	(X)	( )
Natural Ventilation only	(X)	( )	( )

4. Atmospheric check after Isolation and Ventilation:

Oxygen 20.9 > 19.5%

Explosive N.D < 10% LEL

Toxic N.D < 10 PPM H(2)S

Time 11:35

If conditions are in compliance with the above requirements and there is no reason to believe conditions may change adversely, then proceed to the Permit Space Pre-Entry Check List. Complete and post with this permit. If conditions are not in compliance with the above requirements or there is reason to believe that conditions may change adversely, proceed the Entry Check-List portion of this permit.

Date and Time Expires:

LOU FLOSA

Job Supervisor

TANK INSPECTION

Work to be performed:

Entry (See Safety Procedure)

1. (Entry, standby, and back up) persons: (Yes) No

Successfully completed required training?

Is it current? (X) ( )

2. Equipment:

	N/A	Yes	No
Direct reading as monitor - tested	( )	(X)	( )
Safety harnesses and lifelines for entry and standby persons	( )	(X)	( )
Hoisting equipment	(X)	( )	( )
Powered communications	(X)	( )	( )
SCBA's for entry and standby persons	( )	(X)	( )
Protective Clothing	( )	(X)	( )
All electric equipment listed Class I, Division I, Group D and Non-sparking tools	(X)	( )	( )

3. Contents of confined space

EMPTY

We have reviewed the work authorized by this permit and the information contained here-in. Written instructions and safety procedures have been received and are understood. Entry cannot be approved if any squares are marked in the "No" column. This permit is not valid unless all appropriate items are completed.

Permit and Check List Prepared By:

(Supervisor)

Approved By:

(Unit Supervisor)

Reviewed By (Confined Space Operations Personnel):

(printed name & signature)

M. VARGAS VANAGAS

Manuel Vanagas

EFFLUENT TECHNOLOGY INC.

Confined Space Entry Permit (Pre-Entry/Entry Check List)

Date and Time Issued: 7/7/95 1:20

CLEAN HARBORS

Job site:

Chicago, IL

Equipment to be worked on: TANK

INSPECTION 112

Pre-Entry (See Safety Procedure)

1. Atmospheric Checks: Time _____

Oxygen _____ %

Explosive _____ % L.E.L.

Toxic _____ PPM

2. Source isolation (No Entry): N/A Yes No

Pumps or lines blinded ( ) (✓) ( )

disconnected, or blocked ( ) (✓) ( )

3. Ventilation Modification: N/A Yes No

Mechanical ( ) (✓) ( )

Natural Ventilation only (✓) ( ) ( )

4. Atmospheric check after Isolation and Ventilation:

Oxygen _____ > 19.5%

Explosive _____ < 10%

Toxic _____ < 10 PPM H(2)S

Time _____

If conditions are in compliance with the above requirements and there is no reason to believe conditions may change adversely, then proceed to the Permit Space Pre-Entry Check List. Complete and post with this permit. If conditions are not in compliance with the above requirements or there is reason to believe that conditions may change adversely, proceed the Entry Check-List portion of this permit.

Date and Time Expires:

LOU FILOSA

Job Supervisor

Work to be performed:

INSPECT TANK

Entry (See Safety Procedure)

1. Entry, standby, and back up persons: Yes No

Successfully completed required training?

Is it current? (✓) ( )

2. Equipment: N/A Yes No

Direct reading as monitor - tested ( ) (✓) ( )

Safety harnesses and lifelines for entry and standby persons ( ) (✓) ( )

Hoisting equipment (✓) ( ) ( )

Powered communications (✓) ( ) ( )

SCBA's for entry and standby persons ( ) (✓) ( )

Protective Clothing ( ) (✓) ( )

All electric equipment listed Class I, Division I, Group D and Non-sparking tools (✓) ( ) ( )

3. Contents of confined space

EMPTY

We have reviewed the work authorized by this permit and the information contained here-in. Written instructions and safety procedures have been received and are understood. Entry cannot be approved if any squares are marked in the "No" column. This permit is not valid unless all appropriate items are completed.

Permit and Check List Prepared By:

(Supervisor) [signature]

Approved By:

(Unit Supervisor) _____

Reviewed By (Confined Space Operations Personnel):

(printed name & signature)

M. VANAGAS

Mario Vanagas

APPENDIX

16-T-4

LEE F. MOUNT, P.E.
CIVIL ENGINEER
2 BAY VIEW AVENUE HINGHAM, MASSACHUSETTS 02043
(617) 749-5394

23 May 1995

Mr. Alan F. Mount, Project Manager
Clean Harbors of Chicago, Inc.
11800 S. Stony Island Avenue
Chicago, Illinois 60617

Subject: CWM Tank Farm
Tank Agitator Mounting and Nozzle Details

Enclosure: 1) Design Calculations and Fabrication Details
(10 sheets, original issue date 14 March 1995)

Dear Alan,

Enclosure 1) is submitted herewith for your information and records. Sheet nos. 1, 5, 6 & 9 have been updated and revised where necessary to reflect your actual "as built" conditions.

Yours truly,

Lee F. Mount

Lee F. Mount

Reviewed by:

Peter J. Bernes

PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11-30-96

LEE F. MOUNT, P.E.
Civil Engineer/Naval Architect
2 Bay View Avenue
HINGHAM, MASSACHUSETTS 02043
(617) 749-5394

JOB CWM/CHI TANK FARM
SHEET NO. COVER OF
CALCULATED BY L. F. MOUNT DATE 14 MAR '95
REV. 17 MAR. '95.
CHECKED BY DATE
SCALE FINAL ISSUE TO REFLECT 22 MAY '95
"AS BUILT" CONDITIONS

THE ENCLOSED CALCULATIONS AND FABRICATION DETAILS WERE CARRIED OUT IN SUPPORT OF CURRENT TANK UPGRADES PROPOSED FOR THE CLEAN HARBORS, CHICAGO STONY ISLAND FACILITY. AN OVERALL REVIEW AND ASSESSMENT OF THE STRUCTURAL INTEGRITY OF THESE EXISTING TANKS WAS COVERED IN A REPORT BY THE UNDERSIGNED DATED JAN. 1995. THIS REPORT ADDRESSES THE FITTING OF NEW TANK AGITATORS AS WELL AS ADDITIONAL NOZZLES.

CONTENTS

DESCRIPTION	SHEET NO.
SKETCH OF AGITATOR MOUNTING FLANGE (FOR TANKS 105, 106, 107	1
REFERENCES 109, 110, 112)	2
ESTIMATE OF STRESS DUE TO BENDING MOMENT @ FLANGE	2
ESTIMATE OF STRESS DUE TO TORQUE @ FLANGE	3
ESTIMATE OF STRESS DUE TO AGITATOR VERTICAL LOAD	3
CHECK OF LOADED TANK SUPPORT LEGS W/AGITATOR VERT. LOAD	4
TYPICAL PROPOSED 4" NOZZLE INSTALLATIONS	5
BAFFLE PLATE DESIGN REQ'MTS.	6
CHECK TANK INTEGRITY FOR OPERATION WITH 1.0 PSIG VAPOR PRESS.	7-8
SKETCH OF MODIFIED AGITATOR MOUNTING FLANGE (FOR TANKS 103 + 104)	9
TABULAR SUMMARY OF AGITATOR SPECS. + TANK PROPERTIES	10

PREPARED BY Lee F. Mount
LEE F. MOUNT
14 MARCH 1995

COMMONWEALTH OF MASSACHUSETTS
LEE FORREST MOUNT
21193
REGISTERED
PROFESSIONAL ENGINEER

LEE F. MOUNT, P.E.
Civil Engineer/Naval Architect
2 Bay View Avenue
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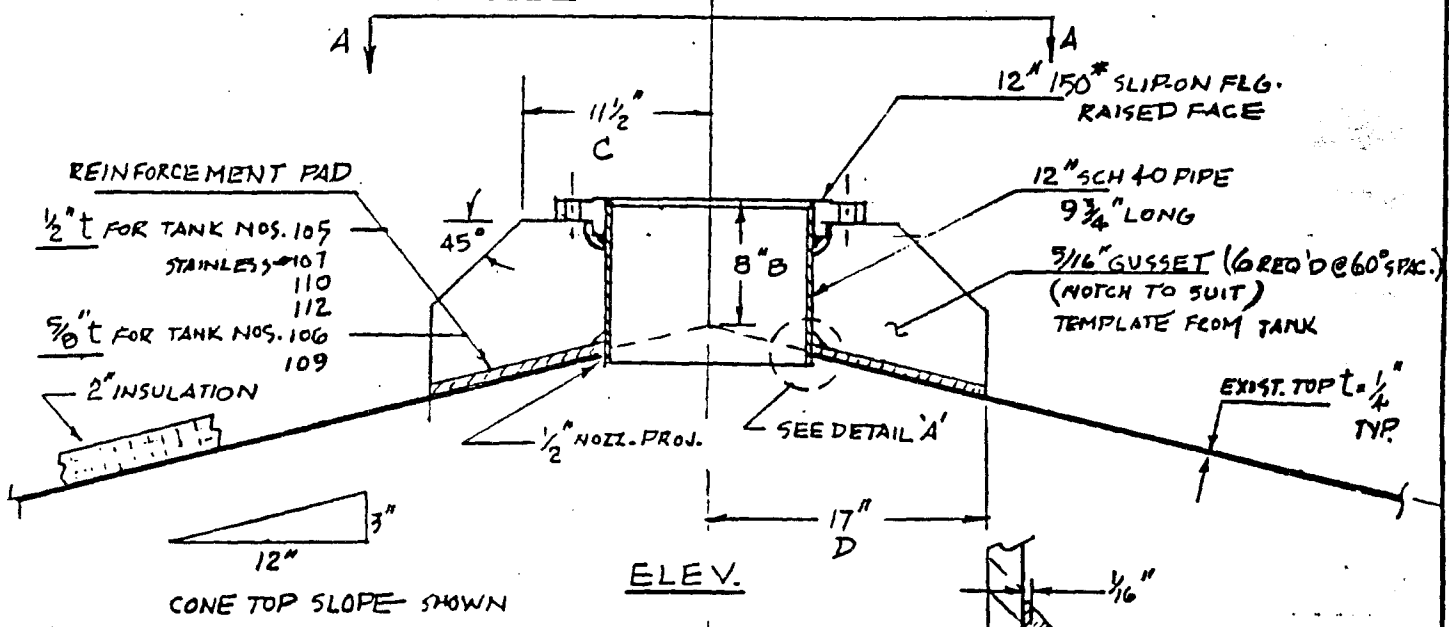
JOB CWM/CHI TANK AGITATORS
SHEET NO. 1 OF 10
CALCULATED BY L.F. MOUNT DATE 13 MAR. '95
REV. 15 MAR. '95
CHECKED BY DATE
SCALE 1" = 1'-0" & AS NOTED 22 MAY '95
"AS BUILT"

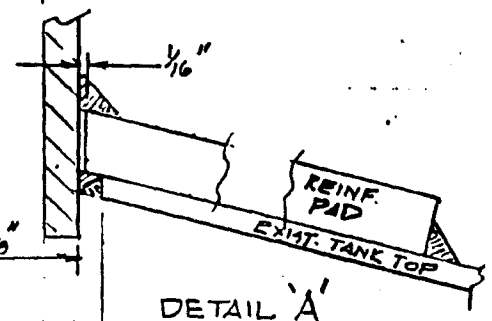
NEW MOUNTING FLANGE FOR TANK NOS. 105, 106, 107, 109, 110 & 112



ELEV.

CONE TOP SLOPE SHOWN

(SOME TANKS HAVE 2"/12" SLOPE)

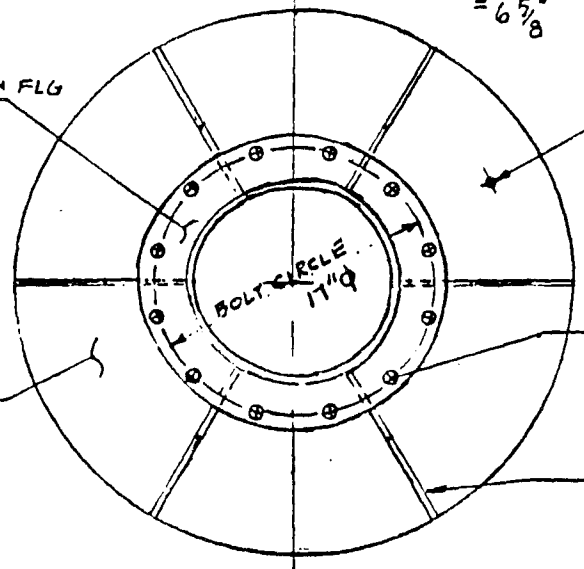


O.R. 12" PIPE = 6⅜"

RADIUS OF HOLE IN TOP = 6⅝"

DETAIL 'A'

(HALF SIZE)
PER UL-142 FIG. 11.2



PLAN A-A

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JOB CWM/CHI TANK AGITATOR & NOZZLE INSTALLA.
SHEET NO. 2 OF 10
CALCULATED BY L.F. MOUNT DATE 13 MAR. '95
CHECKED BY _____ DATE _____
SCALE _____

REFERENCES: 1) CHEMINEER AGITATOR DESIGN SYSTEM SPEC. SHEETS
2) UL-142, STEEL ABOVE GROUND TANKS
3) FORMULAS FOR STRESS & STRAIN, ROARK 4TH ED. 1965
4) API-650 WELDED STEEL TANKS FOR OIL STORAGE
5) CHEMINEER IOM MANUAL PG. 4-9 JUNE '93
6) ASME SECT VIII PRESSURE VESSEL CODE

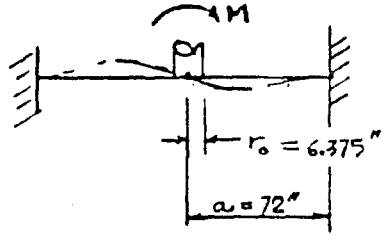
CHECK REINFORCED TANK TOP FOR AGITATOR LOADINGS

ASSUMPTIONS: LOADINGS - USE 15 HP TYPE C UNIT FOR MAX. BENDING MOMENT OF 5036 FT.-LBS & TORQUE OF 4274 FT.-LBS

- USE 5 HP TYPE B UNIT FOR MAX. VERTICAL LOAD OF SAY 3000 LBS

ESTIMATE STRESS DUE TO BENDING MOMENT

FROM REF 3) PG. 219, CASE 10 ASSUMES FLAT CIRCULAR PLT, EDGES FIXED, CENTRAL COUPLE



$$\text{MAX } S_r \text{ AT } r = r_o = \frac{3M}{4\pi t^2 r_o}\left[1 + \left(\frac{m+1}{m}\right)\text{LOG}\,\frac{2(.45a - r_o)}{.45ka}\right]$$

WHERE: $k = \dfrac{0.1a^2}{(r_o + .28a)^2} = \dfrac{0.1(72)^2}{[6.375 + .28(72)]^2}$

$= 0.736$

$M = 5036 \text{ FT-LBS} \times 12 = 60432 \text{ IN-LBS}$

$t = .25 + .625 = 0.875''$ (REINF. PAD)

m = RECIPROCAL OF POISSON'S RATIO

$= \frac{1}{.3} = 3.33$

$a = 72''$

$r_o = 6.375''$

$$\text{MAX } S_r = \frac{3(60432)}{4\pi(.875)^2(6.375)}\left[1 + 1.30\,\text{LOG}\,\frac{2[.45(72) - 6.375]}{.45(.736)(72)}\right] \quad (2.183)$$

$= 2956\,[1 + 1.3(.781)]$

$= 2956\,(2.02) = \boxed{5971 \text{ PSI}}$

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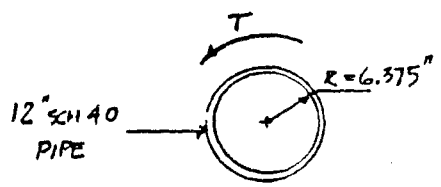
ESTIMATE SHEAR STRESS DUE TO TORQUE

$T = 4274$ FT-LBS $\times 12 = 51288$ IN-LBS

$\text{FORCE} = \frac{T}{r} = \frac{51288 \text{ IN-LBS}}{6.375''} = 8045$ LBS



$\text{CIRCUM.} = 2\pi(r) = 40''$

$\therefore \text{LOAD}/'' \text{ OF CIRCUM.} = \frac{8045}{40} = 201 \text{ LBS}/\text{IN}$

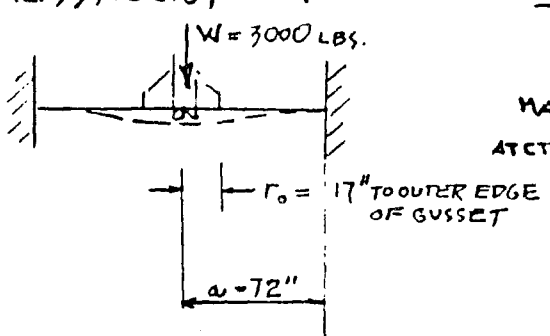
SAY TORQUE IS CARRIED BY 3/8" FILLET WELD @ REINF. PAD TO NOZZLE CONNECTION

ALLOWABLE WELD LOAD $= 11{,}200(.375) = \boxed{4200 \text{ LBS}/\text{IN} > 201 \text{ O.K.}}$

CONSERVATIVE IN THAT LOWER TANK TOP TO NOZZLE FULL PENETRATION WELD HAS NOT BEEN TAKEN INTO ACCOUNT.

ESTIMATE STRESS DUE TO VERTICAL LOAD

FROM REF. 3 / PG 218, CASE 7 ASSUMES FLAT CIRCULAR PLT., EDGES FIXED, UNIFORM LOAD OVER CONCENTRIC CIRCULAR AREA OF RADIUS r_o



$$\text{MAX } S_r \text{ AT CTE.} = \frac{3W}{2\pi m t^2}\left[(m+1)\log\frac{a}{r_o} + (m+1)\frac{r_o^2}{4a^2}\right]$$

WHERE: $W = 3000$ LBS

$t = .25 + .50$ (REINF PAD) $= 0.75''$ FOR TANK No 112

$m = 3.33$

$a = 72''$

$r_o = 17''$

$$\text{MAX } S_r = \frac{3(3000)}{2\pi(3.33)(.75)^2}\left[4.33\log 4.235 + 4.33(.0139)\right]$$

$$= 765\,(6.25 + .06)$$

$$= \boxed{4827 \text{ PSI}}$$

CONCLUDE: COMBINING STRESS DUE TO BENDING (5971) + STRESS DUE TO VERT. LOAD (4827) = 10,798 PSI

API 650 GIVES ALLOW STRESS OF 20,000 PSI FOR ASTM A285-C STEEL

THUS, THE STRESS DUE TO EXTERNAL LOADS IS ABT. 54% OF ALLOWABLE WHICH APPEARS TO BE REASONABLE

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JOB CWM/CHI TANKS
SHEET NO. 4 OF 10
CALCULATED BY L.F. MOUNT DATE 14 MAR '95
CHECKED BY _____ DATE _____
SCALE _____

CHECK TANK SUPPORT LEGS FOR AGITATOR VERT. LOAD

USE TANK NO 112 (LARGEST TANK + HEAVIEST AGITATOR)

ESTIMATED WEIGHT TO BE SUPPORTED BY 4 LEGS @ L=7.0' SIZE = W8×31

TANK STEEL

CONE TOP (1/4" PLT.) LATERAL AREA = BASE CIRCUM × 1/2 SLANT HT.

$= \pi D \times \frac{6.18'}{2}$

$= \pi 12 \times 3.09 = 116.5$ □' × 10.2#/FT² = 1188 LBS.

SHELL (5/16" PLT.) AREA = $\pi D H$

$= \pi 12 \times 22 = 829.4$ □' × 12.75#/FT² = 10575 LBS.

CONE BOTTOM (3/8" PLT.) LATERAL AREA = BASE CIRCUM × 1/2 SLANT HT.

$= \pi D \times \frac{6.95}{2}$

$= \pi 12 \times 3.48 = 131.2$ □' × 15.3#/FT² = 2007 LBS.

AGITATOR WEIGHT → 3000 LBS

SUBTOTAL 16770 LBS

ADD 20% FOR MISC. PIPING, PLATFORMS INSULATION, ETC. → 3350 LBS

LIQUID CONTENTS @ S.G. = 1.5 CAP. = $\frac{20{,}000 \text{ GAL.}}{7.48 \text{ GAL/CU.FT}}$ = 2674 CUFT × 62.4 × 1.5 = 250,286 LBS

TOTAL ESTIMATED WT. TO BE SUPPORTED = 270,406 LBS.

USE 276 KIPS

∴ EACH LEG CARRIES 276/4 = 69 KIPS

FROM AISC COL. TABLE @ KL = 2(7) = 14 FOR W8×31 (A36 STL.)

READ ALLOWABLE LOAD = $\boxed{137 \text{ KIPS} > 69 \text{ KIPS}}$

CONCLUDE: EXISTING COLUMN SUPPORT IS ADEQUATE FOR CONDITIONS

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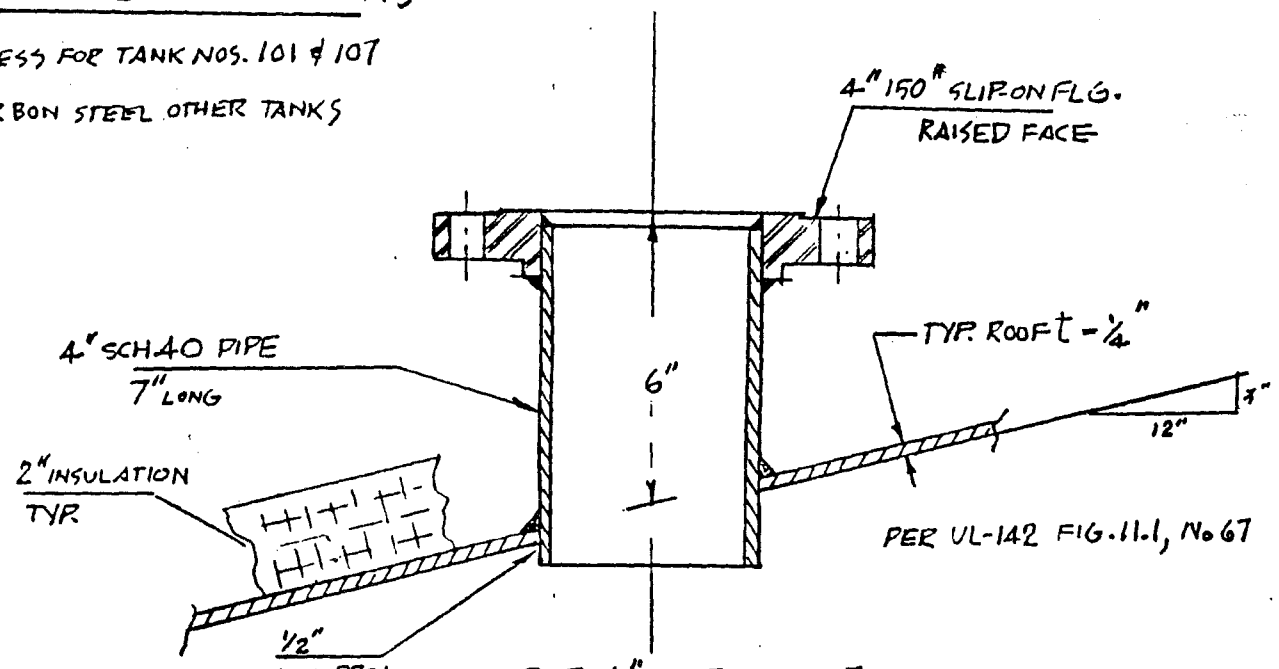
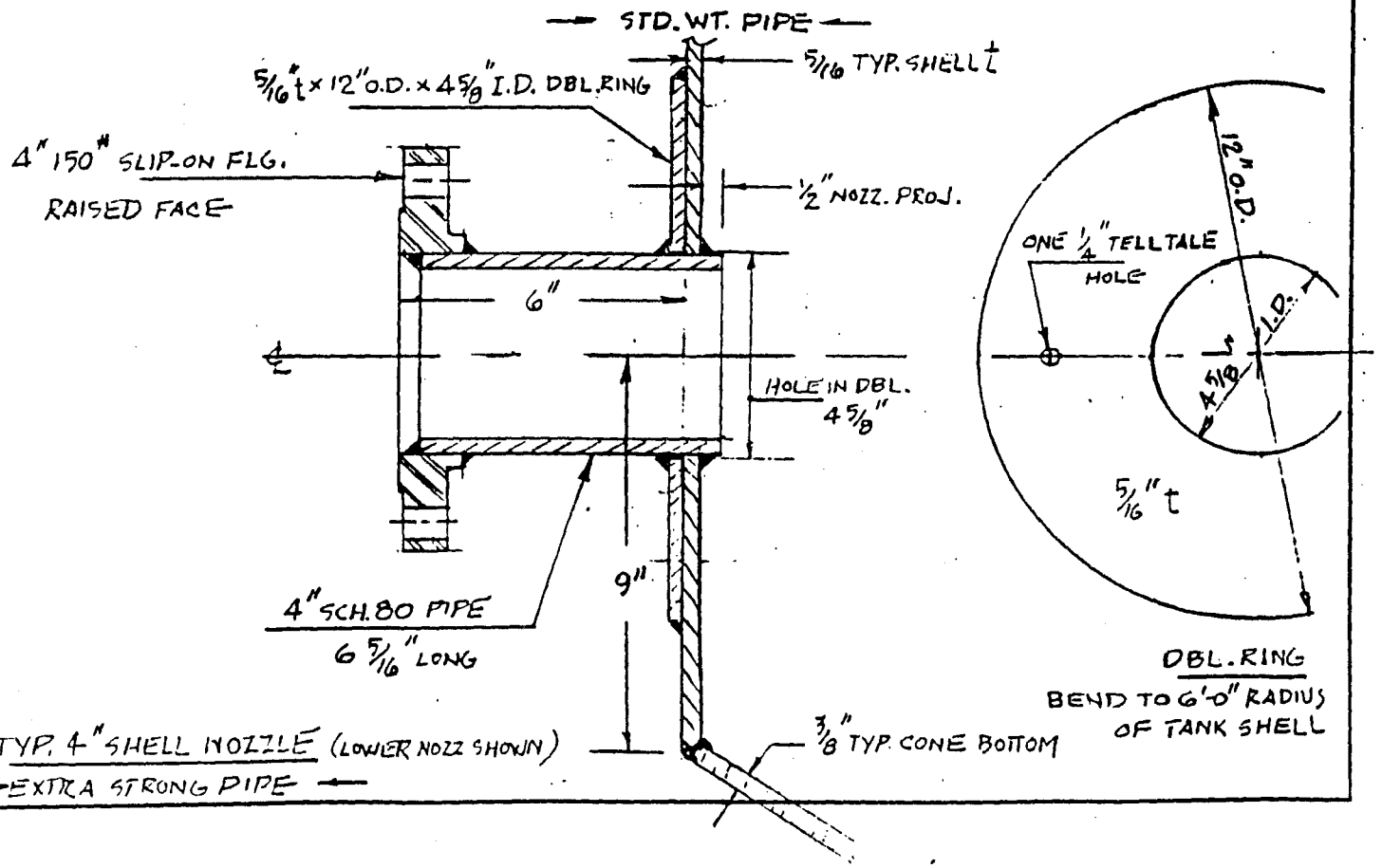
JOB CWM/CHI TANKS
SHEET NO. 5 OF 10
CALCULATED BY L.F. MOUNT DATE 14 MAR.'95
REV. 15 MAR.95
CHECKED BY DATE
SCALE 3" = 1'-0" 22 MAY'95
"AS BUILT"

4" NOZZLE INSTALLATIONS

STAINLESS FOR TANK NOS. 101 & 107
CARBON STEEL OTHER TANKS



TYP. 4" ROOF NOZZLE



TYP. 4" SHELL NOZZLE (LOWER NOZZ SHOWN)
EXTRA STRONG PIPE

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Civil Engineer/Naval Architect
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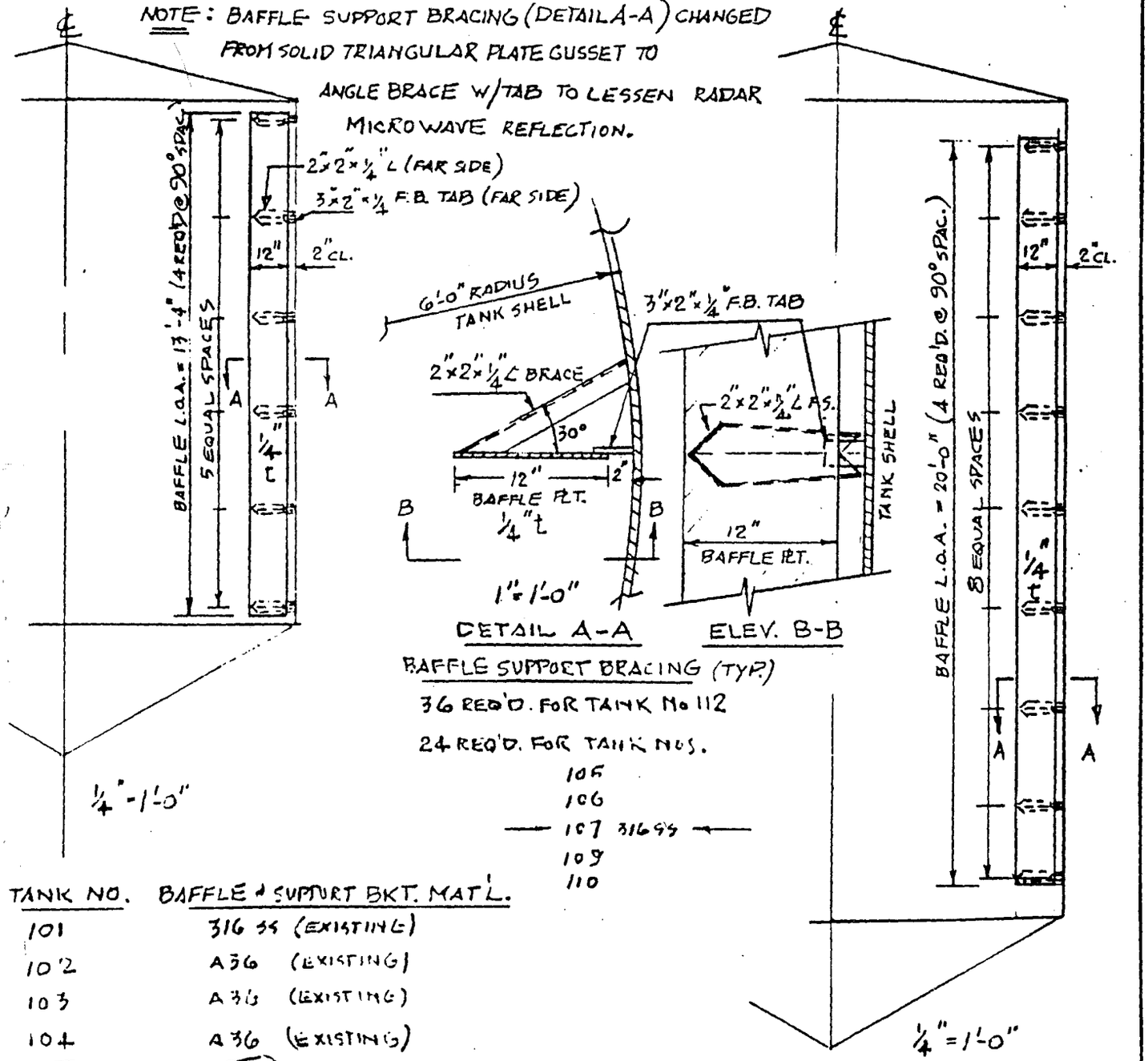
(617) 749-5394

JOB CWM/CHI TANKS
SHEET NO. 6 OF 10
CALCULATED BY L.F. MOUNT DATE 14 MAR. '95
CHECKED BY DATE REV. 15 MAR. '95
SCALE AS NOTED "AS BUILT" 22 MAY '95

BAFFLE PLATE DESIGN (SIZES AS RECOMMENDED IN REF. 1)

NOTE: BAFFLE SUPPORT BRACING (DETAIL A-A) CHANGED FROM SOLID TRIANGULAR PLATE GUSSET TO ANGLE BRACE W/TAB TO LESSEN RADAR MICROWAVE REFLECTION.



BAFFLE SUPPORT BRACING (TYP.)
36 REQ'D. FOR TANK No 112
24 REQ'D. FOR TANK NOS.
105
106
107 316 SS
109
110

TANK NO.	BAFFLE & SUPPORT BKT. MAT'L.	
101	316 SS	(EXISTING)
102	A36	(EXISTING)
103	A36	(EXISTING)
104	A36	(EXISTING)
(105)	(A36)	NEW
[illegible]	(A36)	NEW
(107)	(316 SS)	NEW
(109)	(A36)	NEW
(110)	(A36)	NEW

TANK No (112)
BAFFLE & SUPPORT BKTS.
A36 STEEL (NEW)

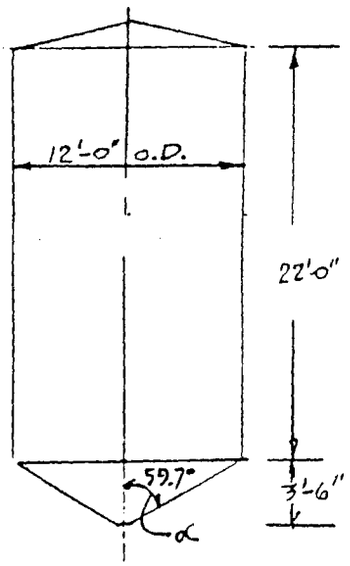
LEE F. MOUNT, P.E.
Civil Engineer/Naval Architect
2 Bay View Avenue
HINGHAM, MASSACHUSETTS 02043
(617) 749-5394

JOB CWM/CHI TANKS
SHEET NO. 7 OF 10
CALCULATED BY L.F. MOUNT DATE 14 MAR '95
CHECKED BY _____ DATE _____
SCALE _____

CHECK FOR TANK SERVICE OPERATION WITH 1.0 PSIG INTERNAL VAPOR PRESSURE (REF. 24" WATER)

USE TANK NO 112 WHICH HAS GREATEST DEPTH

ASSUME S.G. @ 1.5



MAX PRESSURE @ CONE BOTTOM $= \frac{62.4 \times 1.5 \times 25.5'}{144} = 16.6$ PSI

PLUS VAPOR PRESSURE 1.0 PSI

17.6 PSI

USE 18 PSI = P

USE ASME SECT VIII - DIV 1, APPENDIX 1 TO DETERMINE MIN. REQ'D RT. t FOR SHELL & CONE BOTTOM

FOR CYLINDRICAL SHELL:

$$t = \frac{PR_o}{SE + 0.4P}$$

WHERE: P = 18 PSI

$R_o = \frac{12}{2}(12) = 72''$

$$t = \frac{18(72)}{(13800).7 + 0.4(18)}$$

S = 13,800 PSI FOR A 285-C STL.

E = 0.7

$t = 0.134'' + .0625'' = 0.197$ IN. (UL-142 WOULD REDUCE t = 0.167 IN)

CORR ALLOW.

EXISTING AVG. t BASED ON ULTRASONIC TESTS IS $0.30'' > .197''$ O.K.

FOR CONE BOTTOM:

$$t = \frac{PD_o}{2\cos\alpha(SE + .4P)}$$

WHERE: $D_o = 144''$

$\alpha = 59.7°$

$$= \frac{18(144)}{2\cos 59.7°(13{,}800 \times .7 + .4 \times 18)}$$

$= 0.266'' + .0625'' = 0.329$ IN.

CORR ALLOW

EXISTING AVG. t BASED ON ULTRASONIC TESTS IS $.375'' > .329$ O.K.

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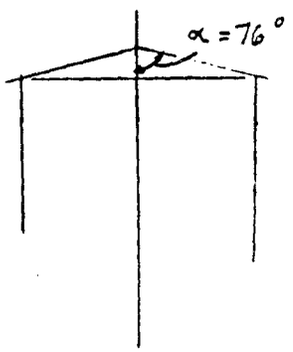
Civil Engineer/Naval Architect
2 Bay View Avenue
HINGHAM, MASSACHUSETTS 02043
(617) 749-5394

CHECK FOR 1.0 PSIG INTERNAL VAPOR PRESSURE (CON'D.)

FOR CONE TOP



FROM ASME SECT. VIII - DIV. 1

SOLVE FOR P:

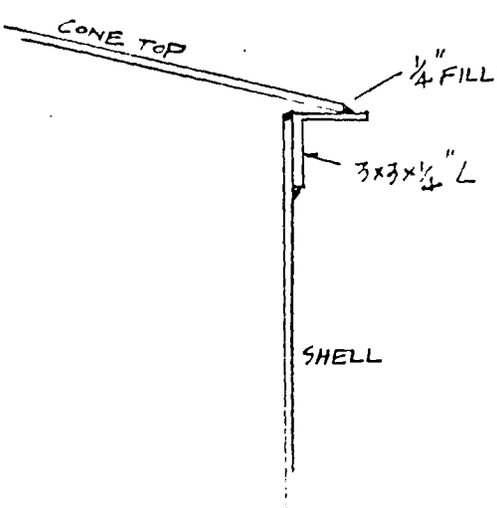
$$P = \frac{2SEt\cos\alpha}{D_o - 0.8t\cos\alpha}$$

WHERE $S = 13{,}800$ PSI
$E = 0.7$
$D_o = 144$ IN
$\alpha = 76°$
t = USE .25 − 1/16" CORR ALL. = .1875"

$$P = \frac{2(13{,}800)(.7)(.1875)(.242)}{144 - [.8(.1875)(.242)]}$$

$$= \frac{876.65}{144} = \boxed{6 \text{ PSI} > 1.0 \quad \text{O.K.}}$$

CHECK ROOF TOP CONNECTION WELD DETAIL



EST. LATERAL SURFACE AREA CONE TOP SUBJECTED TO 1.0 PSI PRESSURE

DIA. ≈ 148" (ROOF OVERHANGS SHELL)

LATERAL AREA = BASE CIRCUM. × 1/2 SLANT HT

$$= \pi D \times \frac{76.2''}{2}$$

$$= \pi(148) \times 38.1 = 17{,}715 \text{ IN}^2$$

∴ LOAD TO ROOF = $17{,}715 \text{ IN}^2 \times 1 \text{ LB/IN}^2 = 17{,}715$ LBS

CIRCUM. OF 1/4" FILLET ATTACHMENT WELD = $\pi D = \pi(148) = 465$ IN

∴ LOAD/IN ON 1/4" FILLET WELD = $\frac{17715}{465} = 38$ #/IN

VS

ALLOWABLE WELD LOAD OF 11,200 × .25 = 2800 #/IN O.K.

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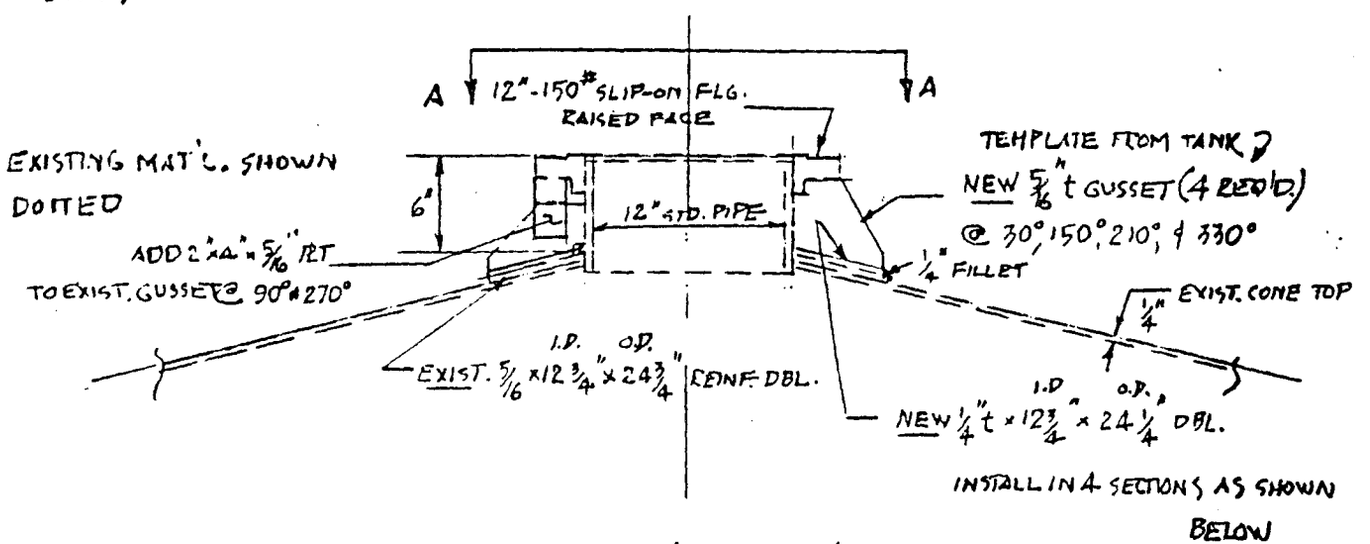
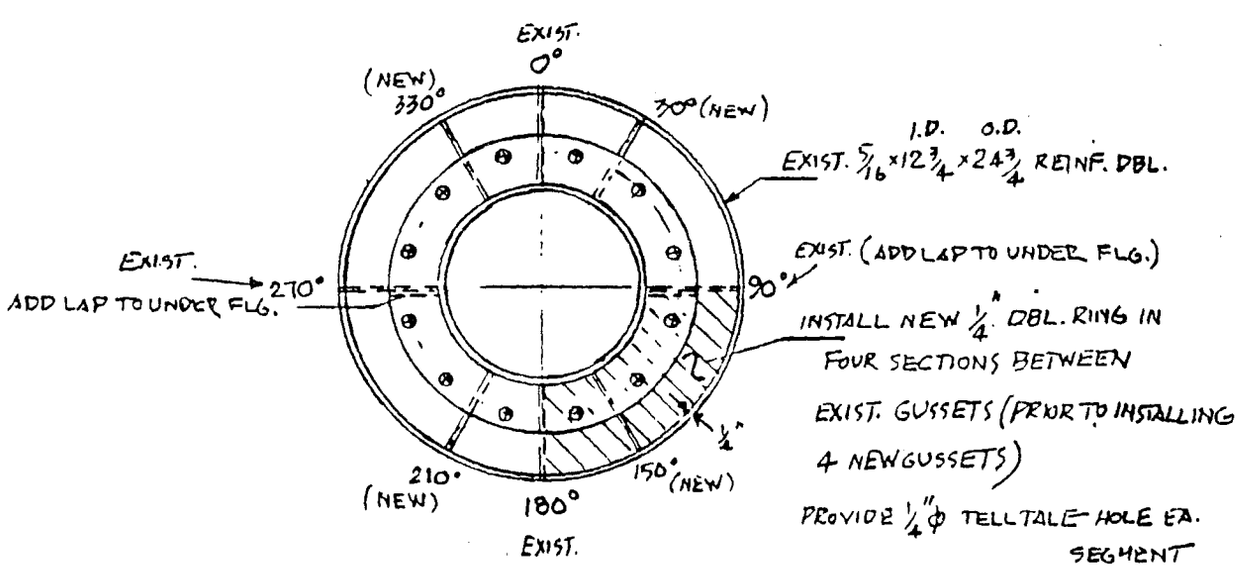
JOB CWM / CHI TANKS
SHEET NO. 9 OF 10
CALCULATED BY L. F. MOUNT DATE 16 MAR. '95
CHECKED BY DATE
SCALE 1" = 1'-0" 22 MAY '95
"AS BUILT"

MODS. TO TANK 103 & 104 EXISTING AGITATOR MOUNTING; TO ACCOMMODATE NEW 7.5 HP UNITS



ELEV.



PLAN A-A

TANK I.D.	AGITATOR SPECS. (FROM REF. 1) TYPE	HP	RPM	SHAFT L IN.	SHAFT DIA. IN.	WT. LBS.	NOZZLE BEND MOM FT.-LBS	NOZZLE TORQUE FT.-LBS.	BAFFLE REQ'D.	CASE SIZE	TANK PROPERTIES TOP HEAD t"	MIN HEAD t" (TBL 3)	NOZZLE SIZE	REINF PAD DIMENS. B (TBL 2)	C (TBL 2)	D FIG 3
101 S.S.	EXIST. (AS IS)	3.0			NO	CHANGE			YES (EXIST.)	2	.313 S.S.		12" EXIST			
102	EXIST. (AS IS)	3.0			NO	CHANGE			YES (EXIST.)	2	.250		12" EXIST			
103	A NEW	7.5	45	190.5	3	1914	2482	2099	YES (EXIST.)	4	.250	.500 .5625	12" EXIST.	8" 6"	11.5" 9.5	17" 12.375 ← (ACTUAL)
104	A NEW	7.5	45	190.5	3	1914	2482	2099	YES (EXIST.)	4	.241	.500 .5625	12" EXIST.	8" 6"	11.5" 9.5"	17" 12.375 ← (ACTUAL)
105	A NEW	7.5	45	190.5	3	1914	2482	2099	YES (NEW)	4	.250	.500	12"	8"	11.5"	17"
106	C NEW	15	45	190.5	3.5	2745	5036 MAX.	4274 MAX.	YES (NEW)	5	.250	.625	12"	8"	11.5"	17"
107 S.S.	EXIST. FROM 103	3.0							YES (NEW)	2 DESIGN FOR 4	.250 S.S.	.500	12"	8"	11.5"	17"
109	C NEW	15	45	190.5	3.5	2745	5036	4274	YES (NEW)	5	.250	.625	12"	8"	11.5"	17"
110	EXIST. FROM 104	3.0							YES (NEW)	2 DESIGN FOR 4	.230	.500	12"	8"	11.5"	17"
112	B NEW	5	30	270.0	3.5	2872 MAX.	2898	2337	YES (NEW)	4	.250	.500	12"	8"	11.5"	17"

EXISTING AGITATED TANKS

NO CHANGE

MODIFY (SHT. 9) MOUNTING

NEW MOUNTING (SHT. 1)

FROM ULTRASONIC TEST RESULTS

REINF. PAD t FROM REF. 5

CWM/CHI TANK AGITATORS
L.F. MOUNT 10 MAR '95
REV. 15 MAR '95
SHT 10 OF 10

LEE F. MOUNT, P.E.
CIVIL ENGINEER
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(617) 749-5394

RECEIVED
JUN 20 1995
HOYER-SCHLESINGER-TURNER, INC.

19 June 1995

Marie Vanagas
Hoyer-Schlesinger-Turner, Inc.
300 West Adams Street
Chicago, ILL. 60606

Subject: Clean Harbors of Chicago, Inc.
CWM Tank Farm

Enclosure: 1) Review and Assessment of Structural Integrity of Existing Tanks; LFMount Report dated January 1995

Dear Ms Vanagas,

In response to Clean Harbors' request, enclosure 1) is herewith forwarded for your information and records.

Yours truly,

Lee F. Mount

Lee F. Mount

REVIEWED By
Peter J. Bernes
PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11.30.96

LEE F. MOUNT, P.E.
CIVIL ENGINEER
2 BAY VIEW AVENUE HINGHAM, MASSACHUSETTS 02043
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CWM TANK FARM

Review and Assessment of Structural Integrity of Existing Tank Nos.

T - 101	T - 106
T - 102	T - 107
T - 103	T - 109
T - 104	T - 110
T - 105	T - 112

January 1995

Prepared For:

Clean Harbors of Chicago, Inc.

(In response to Illinois EPA comments)

INTRODUCTION

This report was prepared in response to the Illinois EPA's request for additional information on the structural condition of the existing hazardous waste storage and/or fuel tanks scheduled for reuse at your CWM Tank Farm.

The work scope involved a technical review of all available tank related documents furnished by Clean Harbors. Pertinent data was then summarized and tabulated for each tank on a "Existing Tank Status Form". The ultrasonic test measurements for thickness, shown on the status forms, were then analyzed in order to make estimates of corrosion rates and projected service life.

Reference documents consulted during the course of this study include:

* RCRA Tank Assessment - Tank Farm System, prepared for CWM Chemical Services Inc. by ALpha Consultants, Ltd. Jan. 1990

* Tank System Inspection, prepared for CWM Chemical Services Inc. by Sirrine Environmental Consultants Nov. 1991

* Straubing, Rubin & Kenes, Inc. Tank Design Drawings

* Imperial Steel Tank Co. Fabrication Drawings

* Supplemental ultrasonic thickness measurements taken on stainless steel Tank No. T-101 on 23 January '95 by MQS Inspection, Inc. (raw data)

TANK GENERAL DESCRIPTIONS AND HISTORY

The ten (10) existing tanks, numbered T-101 to T-107, T-109, T-110, & T-112, are 12 ft. dia. vertical, cone bottomed, leg supported, above ground, insulated tanks.

Tank T-112 has a nominal capacity of 20,000 gals. All other tanks are of 12,000 gal. capacity each.

Tank nos. T-101 and T-107 are of stainless steel construction. All others are of carbon steel.

The four (4) newer tank nos. T-101 to T-104, fabricated by Imperial Steel Tank Co., were placed in service during 1986. The remaining older six (6) tanks date from 1981.

Available records and fabrication drawings for tank nos. T-101 to T-104 indicate they were built to the Underwriters Laboratories, Inc. Standard UL-142 for steel above ground tanks and were to be labeled as such. The published UL-142 Standards "do not cover vertical tanks that are elevated by means of legs" and are not intended for liquids having a specific gravity exceeding that of water. In order to satisfy these exceptions, it was necessary for Imperial Steel to apply for Underwriters Lab review and inspection to obtain the UL Listing for these cone bottomed above ground steel tanks on legs.

The Imperial fabrication drawings list the following tank design parameters:

Design Pressure = hyrdostatic head due to contents

Design Temperature = 250° F

Specific Gravity = 1.5

Corrosion Allowance = 1/16 "

Although no fabrication drawings were found for the six (6) older tanks, the Straubing, Rubin & Kenes design plans indicate the same material thicknesses for the top, shell, and bottom as shown on the Imperial plans. Since these thicknesses have been further verified by ultrasonic test measurements, it seems reasonable to conclude that these older tanks were also built to the design standards of UL-142.

The most recent ultrasonic thickness measurements include those taken by Alpha Consultants in Aug. '89 and by MQS Inspection in Oct. '91 for the Serrine report.

Alpha Consultants conducted visual internal inspections on all tanks (except T-110, which was in service) in early Dec. '89 and an external site inspection on 3 Jan. '90. Serrine Environmental Consultants conducted a visual site inspection, including all tank externals, in Sept. '91.

SPECIFIC TANK DETAILS

For tabulation of existing tank detail design information and summary of latest ultrasonic thickness measurements, refer to the tank status form provided in Appendix A for each of the ten (10) tanks.

PROJECTED SERVICE LIFE

The following table summarizes results of calculations undertaken to establish corrosion rates, based on past service, in order to predict an expected service life for the eight (8) carbon steel tanks. For calculation details, refer to Appendix B.

Surface	Estimated Corrosion Rate	Estimated Retirement Thickness	% of "as built" Thickness Remaining at Retirement	Projected Life as of 1995
Tank Top T-110	2.5 Mils/yr	0.156"	62%	24 yrs.
Side Shell T-105&T-112	3.6 Mils/yr	0.188"	60%	21 yrs.
Cone Bottom T-102	3.0 Mils/yr	0.281"	71%	28 yrs.

NOTE:
The following assumptions were used in the development of this table:

Corrosion rates for the tank top and shell surfaces were arrived at by subtracting the lowest recorded minimum ultrasonic thickness reading to date from the "as built" thickness and then dividing by the tank age at time of thickness reading.

In arriving at an estimated corrosion rate for the bottom cone surface, it was found necessary to develop an adjusted "as built" thickness. This was required since the average recorded bottom thickness measurement for all tanks, and in most cases the minimum value also, exceeded the 0.375" thickness shown on the fabrication drawing. The "as built" thickness was therefore adjusted to 0.392" to more accurately reflect the ultrasonic readings which ten years later were giving averages and minimums greater than 0.375".

INSPECTION/TESTING PLAN PRIOR TO REUSE

In order to assess each tank's internal condition, material thickness, and integrity prior to being placed back in service, it is planned to do the following, once the tank has been found safe for man-entry:

* Conduct an initial visual inspection by a tank experienced technician in company with a registered professional engineer to determine general tank condition. A standard check list, similar to that used by Alpha Consultants for Tank T-109 and shown in Figure 1 will be used as a guide and for recording findings. Suspicious areas will be noted for a more rigorous inspection and scheduled for ultrasonic measurement if deemed necessary.

* Since these tanks are insulated, past ultrasonic readings taken from the tank exterior have been limited to those areas where a removable patch permits direct access to the plate surface beneath. Past surveys have included at each of 4 - 90° quadrants, 1 top point, 3 side points and 1 cone bottom point giving a total of 20 readings/tank. With the tank out of service and clean, it would seem desirable to take additional ultrasonic thickness measurements from within. The cone bottom and tank height will make this difficult and require a tank ladder or other means to reach the underside of the top plate.

* It is recommended that a minimum of 12 readings each be taken in a + pattern on the top and bottom surfaces. For the shell at mid-height, a girth sample of about 20 points around the circumference is desirable. Finally, a vertical row sample, top to bottom, of about 10 points at a location determined from the visual inspection to be most worthy of further exploration, should provide more than enough data to verify the existing surface thicknesses and to form a base for comparison with past and future thickness measurement readings. The ultrasonic test readings are to be taken by personnel qualified and certified as competent to use the test equipment. The test results are to be analyzed by a registered professional engineer experienced in steel tank design and construction.

FIGURE 1

ALPHA CONSULTANTS, Ltd.

CHECKLIST FOR VISUAL INSPECTION OF UNLINED VESSELS

OWNER CWM Chemical Services, Inc.-Chicago Incinerator
TEST SITE 11700 So. Stony Island Ave., Chicago, Il. 60617
DATE OF INSPECTION December 5, 1989
TIME OF INSPECTION 1525
SUPERVISORY ENGINEER Harris E. Dicker, P. E.
PHOTOGRAPHER/TECHNICIAN Robert A. Dicker
TECHNICIAN James L. Eggert

TANK NO. 109 (NO PCB IN TANK)
INTERIOR SHELL MATERIAL CS
CLADDING MATERIAL SST
INSULATION 2' FIBREGLASS SIDES & BOTTOM, 2" COL BLOCK TOP
EQUIPPED WITH MIXER NO

INITIAL ROOF INSPECTION FOR SAFETY
- HAZARDS OF FALLING OBJECTS NONE
- VISIBLE CORROSION NONE

MORE RIGOROUS INSPECTION OF ROOF & STRUCTURAL SUPPORTS
- VISIBLE LOSS OF METAL THICKNESS NONE
- VISIBLE CRACKS OR LEAKS AT WELDS NONE
- VISIBLE CRACKS AT NOZZLE CONNECTIONS NONE
- MALFUNCTIONING OF ROOF SEALS NONE
- VISIBLE DETERIORATION OF WATER DRAIN SYSTEM NONE
- CONDUCT HAMMER TESTING NO

TANK SHELL
- VISIBLE CRACKS AT SEAMS NONE
- VISIBLE CORROSION AT VAPOR SPACE/LIQUID LEVEL LINE NONE
- VISIBLE CRACKING OF PLATE JOINTS NONE
- VISIBLE CRACKING OF NOZZLE CONNECTION JOINTS NONE
- VISIBLE LOSS OF METAL THICKNESS NONE

TANK BOTTOM
- TYPE OF BOTTOM, SLOPED OR FLAT SLOPED
- VISIBLE CORROSION PITS NONE
- VISIBLE CRACKED SEAMS NONE
- TYPE OF CONNECTION TO SIDEWALL, WELDED OR RIVETED WELDED
- VISIBLE TIGHTNESS AT CONNECTION NONE
- VISIBLE DEPRESSIONS IN BOTTOM AREAS AROUND OR UNDER ROOF OR PIPE SUPPORTS NONE
- VISIBLE LOSS OF METAL THICKNESS NONE
- VISIBLE UNEVENESS OF BOTTOM NONE
- CONDUCT HAMMER TEST NO
- VISIBLE BULGES, BLISTERING OR SPALLING NONE
- WAS ULTRASONIC TESTING OF TANK WALLS, ETC. CONDUCTED YES

Source: OSWER Policy Directive No. 9483.00-1
Modified Version of Table 4-7, Page 4-35
"Permit Writer's Guidance for Hazardous Waste Tanks" U. S. EPA Contract 68-01-6515
(undated draft) pp 8-10.

SUMMARY DISCUSSION

Projected Service Life - The projected useful service life for the eight (8) carbon steel tanks is estimated to be on the order of 20 years from today.

- The projected service life for the two (2) stainless steel tanks (T-101 & T-107) is estimated to be more than 20 years as evidenced by the ultrasonic thickness readings which indicate little, if any significant material loss as of '91.

- These projected service life estimates are believed to be conservative in that minimum point readings, rather than average readings, were used to establish the corrosion rates. Furthermore, the projected service life calculations assume that corrosion has continued at the same rate during the past 3 years when the tanks have been out of service.

- These estimated rates can be expected to remain in effect so long as the future stored waste product corrosivity characteristics are compatible with and do not differ significantly from those products stored in the past. Also, the integrity of the external insulation cladding material must be maintained to prevent exterior corrosion from the weather.

- It is anticipated that these tanks, once returned to service, will be ultrasonically tested on an annual basis, at which time these estimated corrosion rates should be reviewed and modified if necessary to suit existing service conditions.

Type of Wastes Stored - The individual tank status forms, Appendix A, list the typical types of waste products stored in past service as well as those planned for future operations. Before any wastes are stored, the facility management is required to assess the compatibility of the waste with (1) the storage unit materials of construction and (2) the wastes being presently stored.

Conclusion - Based on a detailed technical review of the page 1 referenced documents, it is my opinion that the ten (10) existing tanks proposed for reuse at the CWM Tank Farm are structurally sound, free from leaks, and exhibit sufficient material thickness, as determined by ultrasonic measurements. They appear to meet applicable design guidance standards and the past visual inspection reports indicate them to be substantially free from corrosion. Therefore, it is my opinion that the existing reported condition and structural integrity of these storage tanks demonstrate suitability for continued service.

CERTIFICATION

"I certify, under penalty of law, that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including possible fines and imprisonment"

Registered Professional Engineer

Name: Lee F. Mount

Signature Lee F. Mount

Date: 24 January 1995

Massachusetts Registration No: 21193

APPENDIX A

EXISTING TANK STATUS FORMS

Tank Number	Page
T-101	A-1
T-102	A-2
T-103	A-3
T-104	A-4
T-105	A-5
T-106	A-6
T-107	A-7
T-109	A-8
T-110	A-9
T-112	A-10

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

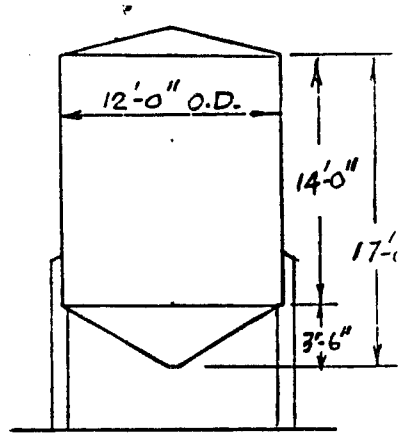
Tank No. T-101

Nominal Capacity 12,000 gals.

Mat'l. of Const. 316 Stainless

Approx. Year of Build 1986

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	NFPA CLASS 2 - AQUEOUS PCB/FUEL BLEND	ACIDIC WATERS, LEAN WATERS, AND/OR HAZARDOUS WASTE FUELS (NFPA CLASS 1-3 LIQUIDS)

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built		Ultrasonic Test Results			
				08/89 B		10/91 C	
		A	E	Avg.	Min.	Avg.	Min.
Top	0.086	0.250	0.313	0.320	0.316	0.316	0.305
Shell	0.115	0.313	0.313	0.323	0.310	0.332	0.320
Bottom	0.158	0.375	0.438	0.437	0.429	0.445	0.416

01/23/95 D		
TOP	0.316	0.303
SHELL	0.339	0.324
BOTTOM	0.439	0.411

NOTES:

A. FROM IMPERIAL STEEL FABRICATION DWG. '86

B. FROM ALPHA CONSULTANTS JAN. '90 RPT.

C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

D. ADD'L READINGS BY MQS TAKEN 23 JAN. '95

E. ESTIMATED ACTUAL AS BUILT t BASED ON ULTRASONIC RDGS. TO DATE

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

==========

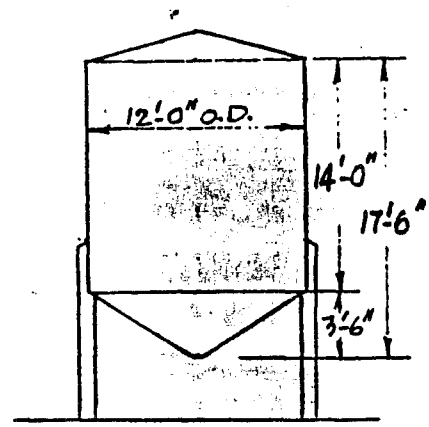
Tank No. T-102

Nominal Capacity 12,000 gals.

Mat'l. of Const. A-285-C STL.

Approx. Year of Build 1986

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	NFPA CLASS 2	PCB's
	PCB / FUEL BLEND	

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built A	Ultrasonic Test Results			
			08/89 B		10/91 C	
			Avg.	Min.	Avg.	Min.
Top	0.123	0.250	0.253	0.248	0.311	0.300
Shell	0.167	0.313	0.317	0.310	0.307	0.299
Bottom	0.240	0.375	0.380	0.371	0.399	0.389

NOTES:
A. FROM IMPERIAL STEEL TANK CO. FABRICATION DWG. '86
B. FROM ALPHA CONSULTANTS JAN. '90 RPT.
C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

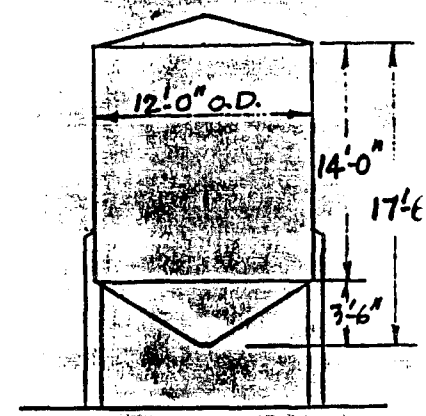
Tank No. T-103

Nominal Capacity 12,000 gals.

Mat'l. of Const. A-285-C STL.

Approx. Year of Build 1986

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 — 1.5
Class	NFPA CLASS 2	HAZARDOUS WASTE FUELS
	PCB / FUEL BLEND	(NFPA CLASS 1-3 LIQUIDS)

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built A	Ultrasonic Test Results 08/89 B Avg.	08/89 B Min.	10/91 C Avg.	10/91 C Min.
Top	0.123	0.250	0.255	0.252	0.254	0.248
Shell	0.167	0.313	0.317	0.310	0.317	0.299
Bottom	0.240	0.375	0.383	0.382	0.388	0.383

NOTES:

A. FROM IMPERIAL STEEL TANK CO. FABRICATION DWG. '86

B. FROM ALPHA CONSULTANTS JAN. '90 RPT.

C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

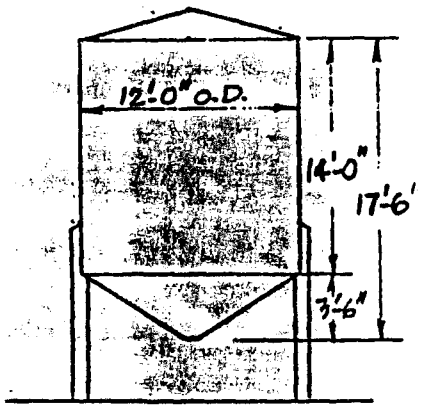
Tank No. T-104

Nominal Capacity 12,000 gals.

Mat'l. of Const. A-285-C STL.

Approx. Year of Build 1986

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	NFPA CLASS 2	HAZARDOUS WASTE FUELS
	PCB / FUEL BLEND	(NFPA CLASS 1-3 LIQUIDS)

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built A	Ultrasonic Test Results 08/89 B Avg.	08/89 B Min.	10/91 C Avg.	10/91 C Min.
Top	0.123	0.250	0.247	0.246	0.241	0.238
Shell	0.167	0.313	0.311	0.306	0.308	0.298
Bottom	0.240	0.375	0.386	0.385	0.387	0.378

NOTES:

A. FROM IMPERIAL STEEL TANK CO. FABRICATION DWG. '86

B. FROM ALPHA CONSULTANTS JAN. '90 RPT.

C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

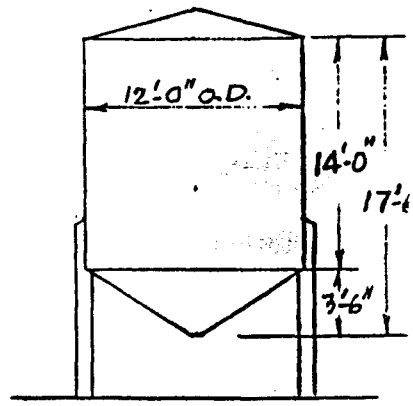
Tank No. T-105

Nominal Capacity 12,000 gals.

Mat'l. of Const. CARBON STEEL

Approx. Year of Build 1981

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	NFPA CLASS 2 FUELS LEAN WATER	HAZARDOUS WASTE FUELS (NFPA CLASS 1-3 LIQUIDS)

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built A	Ultrasonic Test Results 08/89 B Avg.	08/89 B Min.	10/91 C Avg.	10/91 C Min.
Top	0.123	0.250	0.250	0.238	0.254	0.250
Shell	0.167	0.313	0.305	0.303	0.299	0.277
Bottom	0.240	0.375	0.380	0.375	0.398	0.380

NOTES:

A. FROM STRAUBING, RUBIN, & KENES DESIGN DWG. 1-Q-001

B. FROM ALPHA CONSULTANTS JAN. '90 RPT.

C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

==========

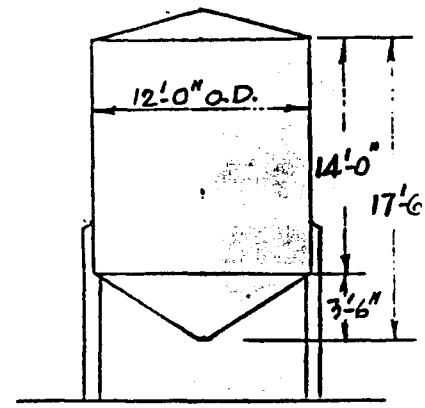
Tank No. T-106

Nominal Capacity 12,000 gals.

Mat'l. of Const. CARBON STEEL

Approx. Year of Build 1981

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	NFPA CLASS 2	HAZARDOUS WASTE FUELS
	LEAN WATER	(NFPA CLASS 1-3 LIQUIDS)

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built A	Ultrasonic Test Results 08/89 B Avg.	08/89 B Min.	10/91 C Avg.	10/91 C Min.
Top	0.123	0.250	0.250	0.247	0.252	0.250
Shell	0.167	0.313	0.304	0.301	0.295	0.278
Bottom	0.240	0.375	0.381	0.378	0.394	0.387

NOTES:

A. FROM STRAUBING, RUBIN & KENES DESIGN DWG. 1-Q-002

B. FROM ALPHA CONSULTANTS JAN. '90 RPT.

C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

==========

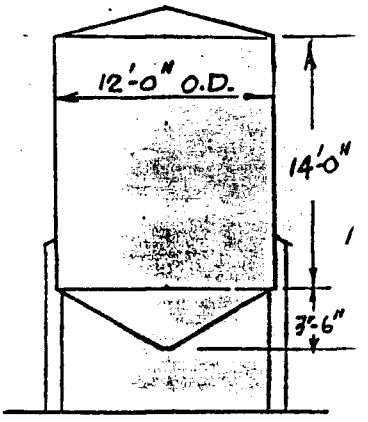
Tank No. T-107

Nominal Capacity 12,000 gals.

Mat'l. of Const. 316 Stainless

Approx. Year of Build

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	NFPA CLASS 2 - AQUEOUS RACA FUEL	ACIDIC WATERS, LEAN WATERS, AND/OR HAZARDOUS WASTE FUELS (NFPA CLASS 1-3 LIQUIDS)

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built A	Ultrasonic Test Results 08/89 B Avg.	08/89 B Min.	10/91 C Avg.	10/91 C Min.
Top	0.086	0.250	0.261	0.252	0.270	0.265
Shell	0.115	0.313	0.322	0.316	0.341	0.318
Bottom	0.158	0.375	0.386	0.386	0.402	0.398

NOTES:

A. FROM STRAUBING, RUBIN, & KENES DESIGN DWG. 1-Q-003

B. FROM ALPHA CONSULTANTS JAN. '90 RPT.

C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

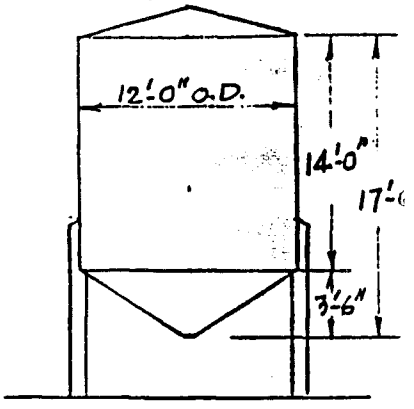
Tank No. T-109

Nominal Capacity 12,000 gals.

Mat'l. of Const. CARBON STEEL

Approx. Year of Build 1981

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	FUEL OIL (HEATED)	HAZARDOUS WASTE FUELS (NFPA CLASS 1-3 LIQUIDS)

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built A	Ultrasonic Test Results 08/89 B Avg.	08/89 B Min.	10/91 C Avg.	10/91 C Min.
Top	0.123	0.250	0.254	0.249	0.255	0.246
Shell	0.167	0.313	0.315	0.305	0.318	0.307
Bottom	0.240	0.375	0.385	0.384	0.414	0.397

NOTES:

A. FROM STRAUBING, RUBIN & KENES DESIGN DWG. 1-Q-005

B. FROM ALPHA CONSULTANTS JAN. '90 RPT.

C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

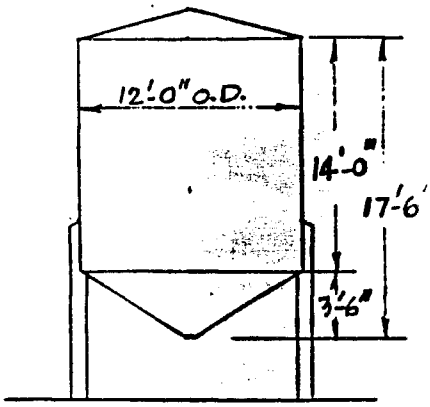
Tank No. T-110

Nominal Capacity 12,000 gals.

Mat'l. of Const. CARBON STEEL

Approx. Year of Build 1981

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	WASTE OILS	PCB's
	FUEL OIL	

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built A	Ultrasonic Test Results 08/89 B Avg.	08/89 B Min.	10/91 C Avg.	10/91 C Min.
Top	0.123	0.250	0.251	0.249	0.230	0.225
Shell	0.167	0.313	0.312	0.303	0.314	0.310
Bottom	0.240	0.375	0.388	0.387	0.428	0.414

NOTES:

A. FROM STRAUBING, RUBIN, & KENES DESIGN DWG. 1-Q-006

B. FROM ALPHA CONSULTANTS JAN. '90 RPT.

C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

CLEAN HARBORS OF CHICAGO, INC.

CWM TANK FARM

EXISTING TANK STATUS FORM

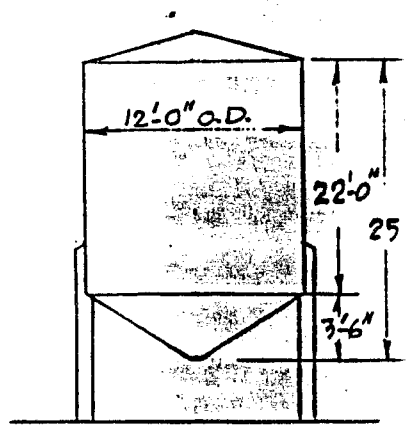
Tank No. T-112

Nominal Capacity 20,000 gals.

Mat'l. of Const. CARBON STEEL

Approx. Year of Build 1981

Designed Corrosion Allow. 1/16"



Stored Waste Characteristics:

	Past	Future
Specific Grav.	1.5 (design)	0.5 → 1.5
Class	NFPA CLASS 2 (FEED)	NEUTRAL PH WATERS, LEAN WATE
	LEAN WATER	AND/OR HAZARDOUS WASTE FUE
	PCB / FUEL BLEND	(NFPA CLASS 2-3 LIQUIDS ONLY)

Material Thicknesses (Inches):

Surface	per UL-142 Std.	As Built	Ultrasonic Test Results			
			08/89 B		10/91 C	
		A	Avg.	Min.	Avg.	Min.
Top	0.123	0.250	0.255	0.242	0.254	0.250
Shell	0.167	0.313	0.304	0.301	0.296	0.277
Bottom	0.240	0.375	0.375	0.370	0.401	0.389

NOTES:

A. FROM STRAUBING, RUBIN, & KENES DESIGN DWG. 1-Q-008

B. FROM ALPHA CONSULTANTS JAN. '90 RPT.

C. FROM SIRRINE ENVIR. CONSULTANTS NOV. '91 RPT.

APPENDIX B

ESTIMATED SERVICE LIFE CALCULATIONS

Surface	Page
Tank Top	B-1
Side Shell	B-2
Cone Bottom	B-3,4

ESTIMATED SERVICE LIFE BASED ON PAST CORROSION RATE OF EXISTING 8 CARBON STL. TANKS

FOR TANK TOP

FIND LOWEST MINIMUM ULTRASONIC RDG. AS OF '91 (CONSERVATIVE)

SEE TANK T-110 MIN. TOP RDG. = 0.225"

AS BUILT t = 0.250 ('81)
− 0.225
0.025" LOSS IN 10 YRS

∴ CORROSION RATE = $\frac{0.025}{10}$ = 0.0025"/YR (2.5 MILS/YR) ← USE

ESTABLISH RETIREMENT t @ 1/8" + 1/32" CORR ALLOW = 0.156" ← THIS IS ABT. 62% OF "AS BUILT"

PROJECTED LIFE:

STARTING t = 0.250 (1981)
LESS = 0.156 RETIREMENT t
0.094 PERMITTED LOSS

∴ YEARS TO REACH RETIREMENT t AT EXISTING CORROSION RATE:

$\frac{0.094"}{.0025"/YR}$ ≈ 38 YRS FROM '81
LESS −14 YRS ('81 TO '95)

24 YRS. FROM TODAY ←

CHECK MIN. t RDG. = 0.225 ('91)
− 0.156 RETIREMENT t
0.069"/.0025 ≈ 28 YRS FROM '91
LESS − 4 YRS ('91-'95)
24 YRS FROM TODAY ←

AGREES

ESTIMATED SERVICE LIFE BASED ON PAST CORROSION RATE OF EXISTING 8 CARBON STL. TANKS

FOR TANK SHELL

FIND LOWEST MINIMUM ULTRASONIC RDG. AS OF '91 (CONSERVATIVE)

SEE TANKS T-105 & T-112 MIN. SHELL RDG. = 0.277"

AS BUILT t = 0.313 ('81)
− 0.277
0.036" LOSS IN 10 YRS.

∴ CORROSION RATE = $\frac{0.036''}{10}$ = 0.0036"/YR (3.6 MILS/YR) ← USE

ESTABLISH RETIREMENT t @ 5/32 + 1/32 CORR. ALLOW = 0.1875" ← THIS IS ABT. 60% OF "AS BUILT"

PROJECTED LIFE:

STARTING t = 0.313 (1981)
LESS − .188 RETIREMENT t
0.125 PERMITTED LOSS

∴ YEARS TO REACH RETIREMENT t AT EXISTING CORROSION RATE:

= $\frac{0.125''}{.0036''/YR}$ ≈ 35 YRS. FROM '81
LESS − 14 YRS. ('81 TO '95)
21 YRS. FROM TODAY ←

CHECK MIN. t RDG. = 0.277 ('91)
− .188 RETIREMENT t
0.089" / .0036 ≈ 25 YRS FROM '91
LESS − 4 YRS ('91-'95)
21 YRS FROM TODAY ←

AGREES

ESTIMATED SERVICE LIFE BASED ON PAST CORROSION RATE OF EXISTING 8 CARBON STEEL TANKS

FOR CONE BOTTOM

	TANK T-102	TANK T-112
FIND LOWEST MINIMUM ULTRASONIC RDG.S:	0.371 ('89)	0.370 ('89)
	0.389 ('91)	0.389 ('91)

DETERMINATION OF ADJUSTED "AS BUILT" THICKNESS:

SINCE THE AVERAGE RECORDED THICKNESS FOR ALL TANKS IN BOTH MEASUREMENT YEARS ('89 & '91) WAS FOUND TO BE EQUAL TO OR GREATER THAN THE LISTED AS BUILT OF 0.315" IT IS BELIEVED A THICKER BOTTOM PLATE WAS USED IN THE CONSTRUCTION OF THESE CARBON STEEL TANKS. USING AN AVERAGE OF THE AVERAGE BOTTOM THICKNESS RECORDED FOR ALL 8 TANKS UP TO '91 YIELDS A VALUE OF 0.392" (THIS 4.5% INCREASE IS WITHIN PERMISSIBLE VARIATIONS IN OVER WEIGHT MILL PRACTICE TOLERANCES FOR ORDERED STEEL PLATE)

THE PROJECTED SERVICE LIFE CALCULATIONS WILL CONSIDER THIS ADJUSTED "AS BUILT" THICKNESS TO HAVE BEEN 0.392" WHEN THE TANK WAS NEW.

ESTIMATED CORROSION RATES:

	TANK T-102 (NEW IN '86)	TANK T-112 (NEW IN '81)
BASED ON 1989 SURVEY	.392 − .371 (MIN) = 0.021 / 3 YRS = 0.0070"/YR (LOOKS HIGH)	.392 − .370 (MIN) = 0.022 / 8 YRS = 0.0028"/YR (LOOKS POSSIBLE)
BASED ON 1991 SURVEY	.392 − .389 (MIN) = 0.003 / 5 YRS = 0.0006"/YR (LOOKS LOW)	.392 − .389 (MIN) = 0.003 / 10 YRS = 0.0003"/YR (LOOKS LOW)

FOR CORROSION RATE USE TANK T-102

ASSUME RDG. TAKEN IN 1990 WOULD BE AVG. OF '89 & '91 = $\frac{.371 + .389}{2} = 0.380"$

∴ CORROSION RATE = .392 − .380 = 0.012 / 4 YRS = 0.0030"/YR (3 MILS/YR.) ← USE

ESTIMATED SERVICE LIFE

CONE BOTTOM (CON'D.)

ESTABLISH RETIREMENT t @ $\frac{1}{4}$" + $\frac{1}{32}$ CORR. ALLOW. = 0.281" ← THIS IS ABT. 71% OF ADJUSTED "AS BUILT" t

PROJECTED LIFE:

STARTING ADJUSTED t = 0.392" (1986)
LESS − .281" RETIREMENT t
0.111" PERMITTED LOSS

∴ YEARS TO REACH RETIREMENT t AT EXISTING CORROSION RATE:

$= \frac{0.111}{.003"/YR}$ = 37 YRS. FROM '86
LESS − 9 YRS. ('86-'95)
28 YRS. FROM TODAY

CHECK MIN t RDG = 0.380" ASSUMED '90 AVG.
− 0.281 RETIREMENT t
$\frac{0.099}{.003}$ = 33 YRS FROM '90
LESS − 5 YRS ('90-'95)
28 YRS FROM TODAY

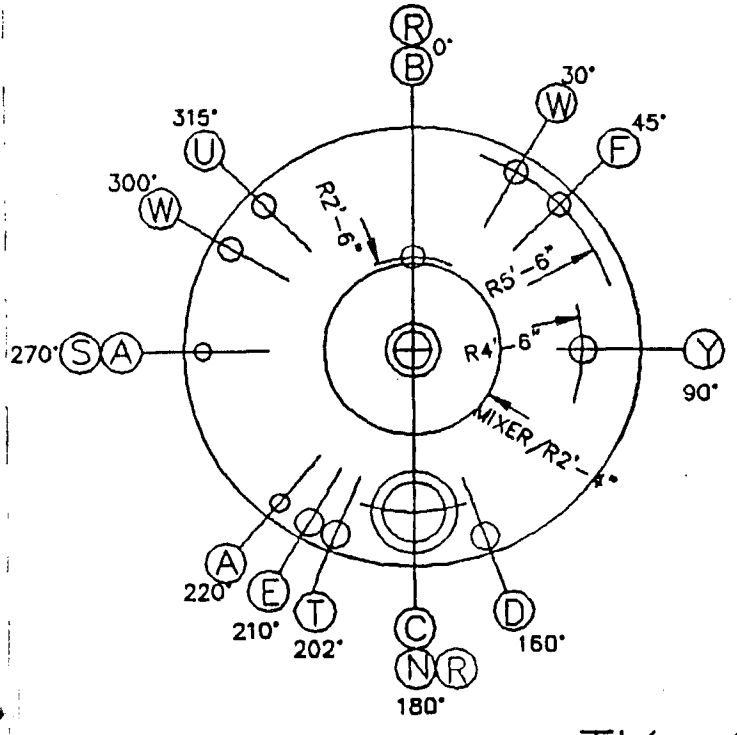
AGREES

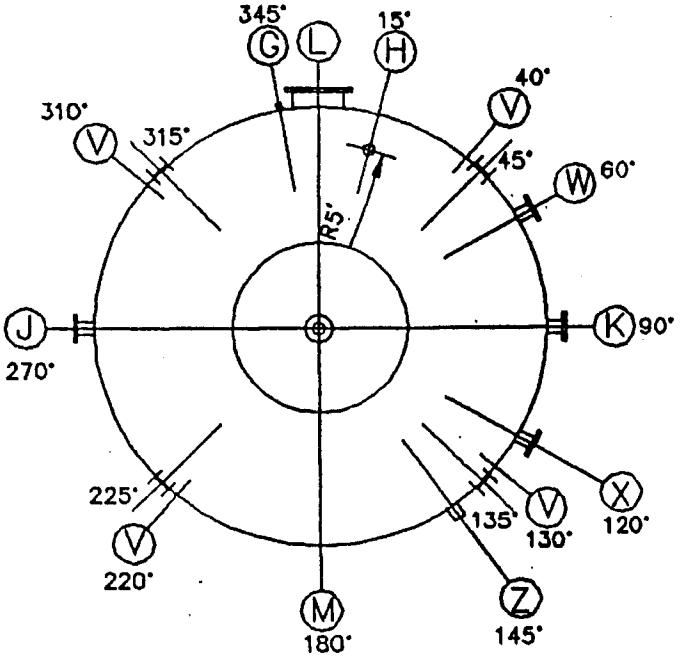
APPENDIX

16-T-5

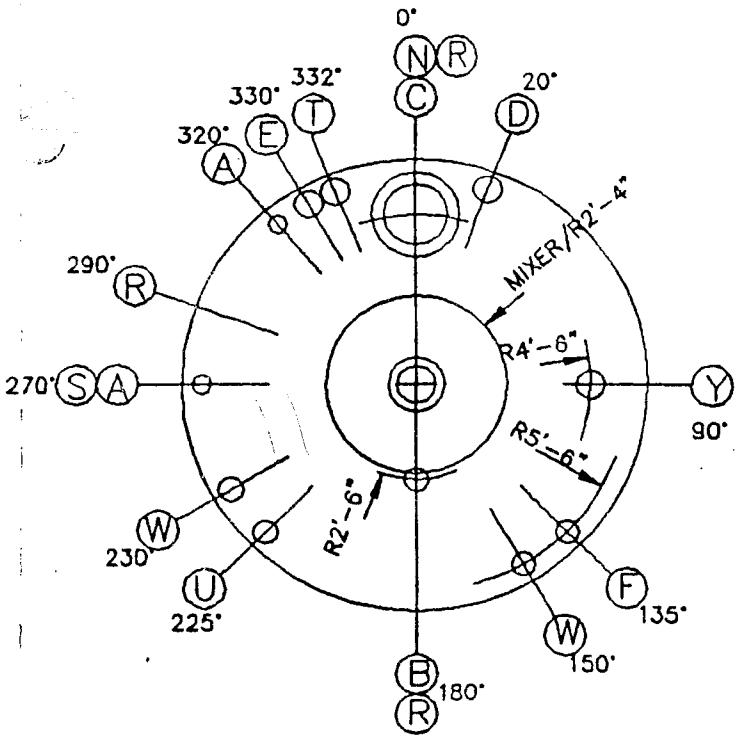
	MARK	REQD.	SIZE	TYPE	ELEVATION	DESCRIPTION
1	A	2	2"	150# RFSO	ROOF	NITROGEN BLANKET
2	B	1	3"	150# RFSO	ROOF	~~COV~~ CV – FA
3	C	1	20"	150#	ROOF	EMERGENCY VENT
4	D	1	4"	150# RFSO	ROOF	FILL
5	E	1	4"	150# RFSO	ROOF	HIGH LEVEL–LSH101
6	F	1	3"	150# RFSO	ROOF	SPARE
7	G	1	2"	3000# CPLG	12" F/CONE	SPARE
8	H	1	2"	3000# CPLG	CONE	SAMPLE
9	J	1	3"	150# RFSO	6" F/CONE	LOW LEVEL–LSL101
10	K	1	3"	150# RFSO	13" F/CONE	SPARE
11	L	1	24"	150#	12" F/CONE	MANWAY W/COVER
12	M	1	4"	150#FB–VALVE	CONE	DRAW–OFF
13	N	1	12"	150# RFSO	ROOF	MIXER MOUNT
14	R	AS SHWN		–	6'–3" F/ROOF	SUPPORT CLIP
15	S	AS SHWN		–	3'–9" F/ROOF	SUPPORT CLIP
16	T	1	4"	150# RFSO	ROOF	DPSL101 & DPSH101
17	U	1	3"	150# RFSO	ROOF	SPARE
18	V	4		–	SHELL	BAFFLE
19	W	2	3"	150# RFSO	ROOF	SPARE
20	W	1	3"	150# RFSO	6" F/CONE	SPARE
21	X*	2	4"	150# RFSO	9", 6'–6" F/C	DRAW–OFF
22	Y*	1	4"	150# RFSO	ROOF	LEVEL MONITOR–LT101
23	Z*	2	2"	3000# CPLG	9", 6'–6" F/C	SAMPLE

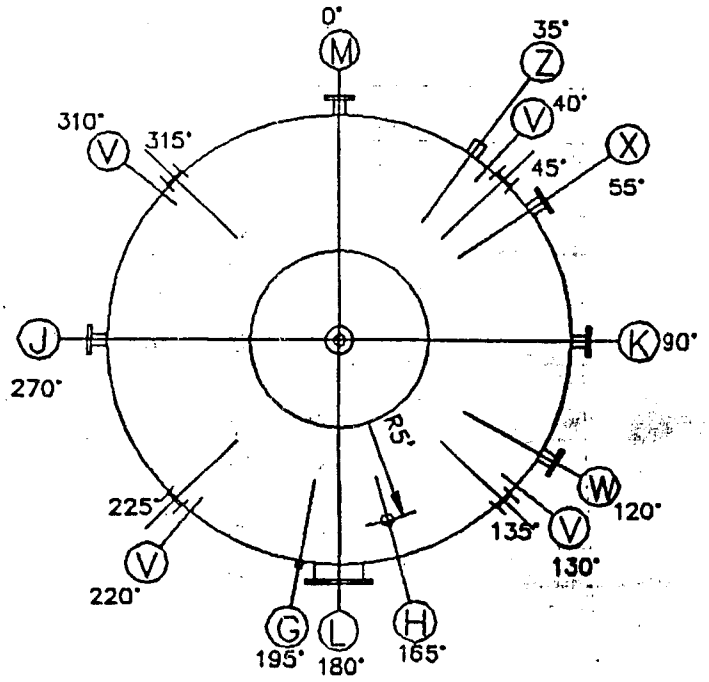
NOTE: * DESIGNATES NEW NOZZLE





TK–101





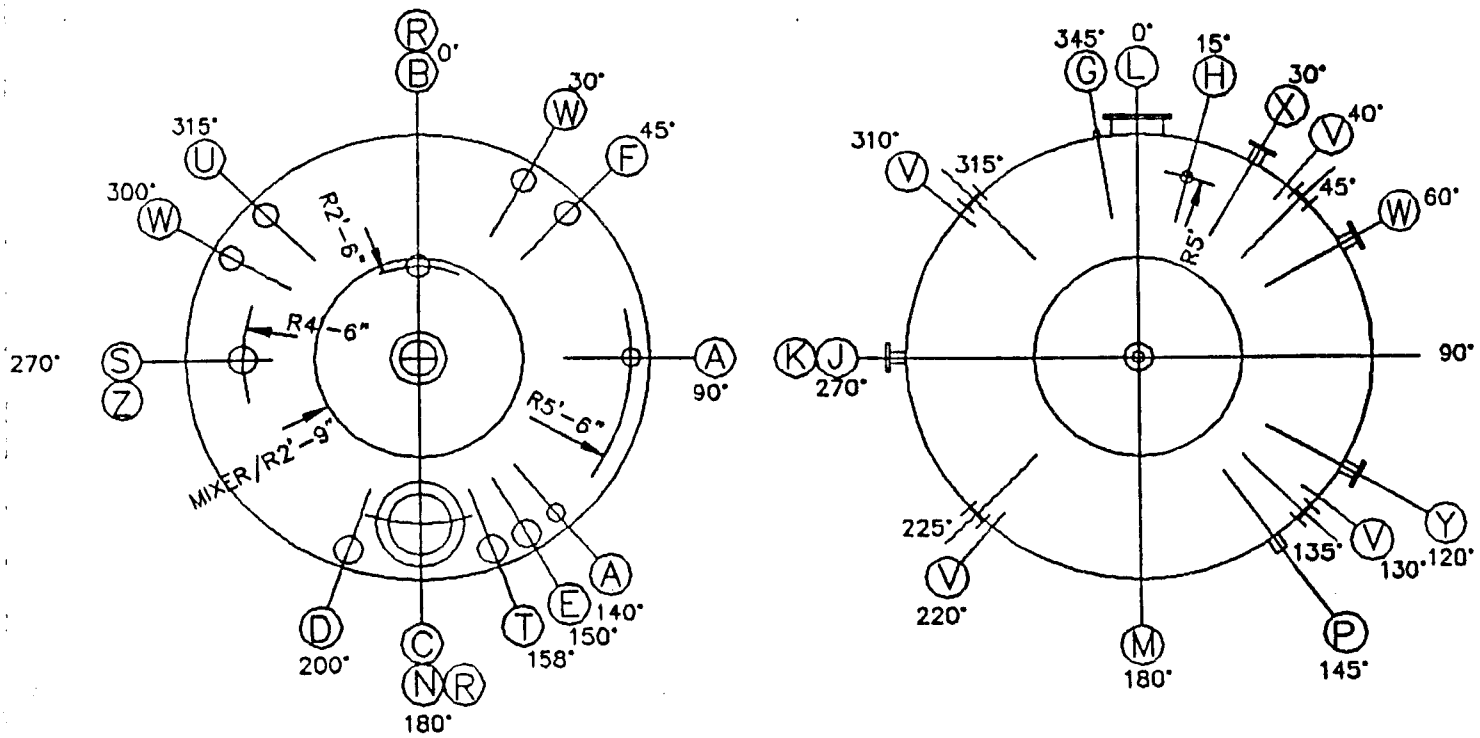
TK-102

MARK	REQD.	SIZE	TYPE	ELEVATION	DESCRIPTION
A	2	2"	150# RFSO	ROOF	NITROGEN BLANKET
B	1	3"	150# RFSO	ROOF	COV - FA
C	1	20"	150#	ROOF	EMERGENCY VENT
D	1	4"	150# RFSO	ROOF	FILL
E	1	4"	150# RFSO	ROOF	HIGH LEVEL-LSH102
F	1	3"	150# RFSO	ROOF	SPARE
G	1	2"	3000# CPLG	12" F/CONE	SPARE
H	1	2"	3000# CPLG	CONE	SAMPLE
J	1	3"	150# RFSO	6" F/CONE	LOW LEVEL-LSL102
K	1	3"	150# RFSO	13" F/CONE	SPARE
L	1	24"	150#	12" F/CONE	MANWAY W/COVER
M	1	4"	150#FB-VALVE	CONE	DRAW-OFF
N	1	12"	150# RFSO	ROOF	MIXER MOUNT
R	AS SHWN		-	6'-3" F/ROOF	SUPPORT CLIP
S	AS SHWN		-	3'-9" F/ROOF	SUPPORT CLIP
T	1	4"	150# RFSO	ROOF	DPSL102 & DPSH102
U	1	3"	150# RFSO	ROOF	SPARE
V	4		-	SHELL	BAFFLE
W	2	3"	150# RFSO	ROOF	SPARE
W	1	3"	150# RFSO	6" F/CONE	SPARE
X*	2	4"	150# RFSO	9",6'-6" F/C	DRAW-OFF
Y*	1	4"	150# RFSO	ROOF	LEVEL MONITOR-LT102
Z*	2	2"	3000# CPLG	9",6'-6" F/C	SAMPLE

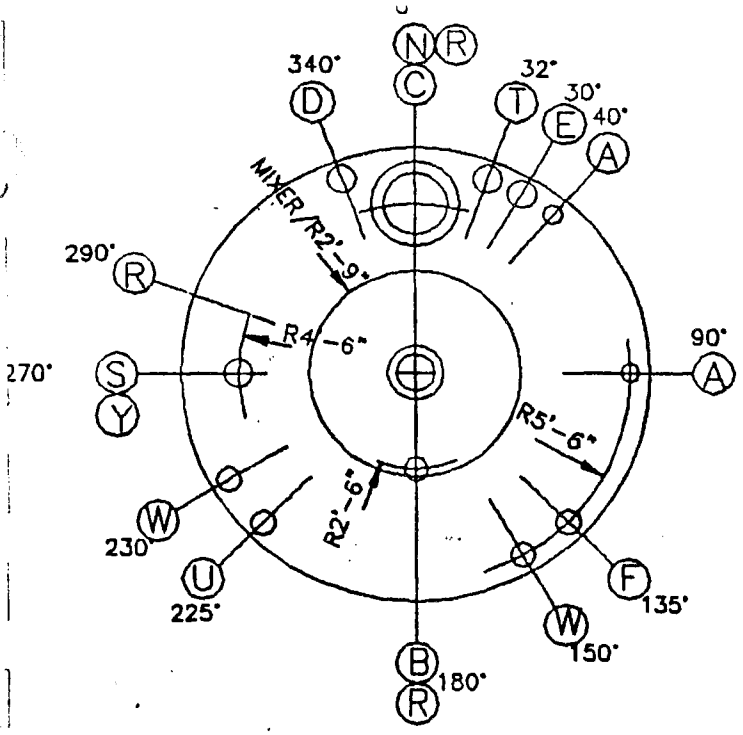
NOTE: * DESIGNATES NEW NOZZLE

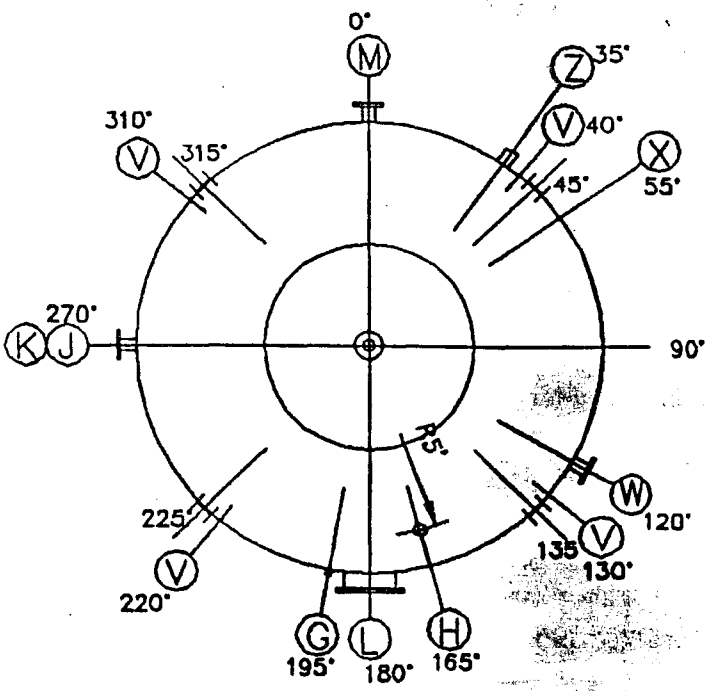
MARK	REQD.	SIZE	TYPE	ELEVATION	DESCRIPTION
A	2	2"	150# RFSO	ROOF	NITROGEN BLANKET
B	1	3"	150# RFSO	ROOF	COV – FA
C	1	20"	150#	ROOF	EMERGENCY VENT
D	1	4"	150# RFSO	ROOF	FILL
E	1	4"	150# RFSO	ROOF	HIGH LEVEL–LSH103
F	1	3"	150# RFSO	ROOF	SPARE
G	1	2"	3000# CPLG	12" F/CONE	SPARE
H	1	2"	3000# CPLG	CONE	SAMPLE
J	1	3"	150# RFSO	6" F/CONE	LOW LEVEL–LSL103
K	1	3"	150# RFSO	13" F/CONE	SPARE
L	1	24"	150#	12" F/CONE	MANWAY W/COVER
M	1	4"	150#FB–VALVE	CONE	DRAW–OFF
N	1	12"	150# RFSO	ROOF	MIXER MOUNT
P*	2	2"	3000# CPLG	9", 6'–6" F/C	SAMPLE
R	AS SHWN		–	6'–3" F/ROOF	SUPPORT CLIP
S	AS SHWN		–	3'–9" F/ROOF	SUPPORT CLIP
T	1	4"	150# RFSO	ROOF	DPSL103 & DPSH103
U	1	3"	150# RFSO	ROOF	SPARE
V	4		–	SHELL	BAFFLE
W	2	3"	150# RFSO	ROOF	SPARE
W	1	3"	150# RFSO	6" F/CONE	SPARE
X	1	12"	150# RFSO	12" F/CONE	SPARE
Y*	2	4"	150# RFSO	9", 6'–6" F/C	DRAW–OFF
Z*	1	4"	150# RFSO	ROOF	LEVEL MONITOR–LT103

NOTE: – * DESIGNATES NEW NOZZLE
– REINFORCE EXISTING NOZZLE "N"



TK–103





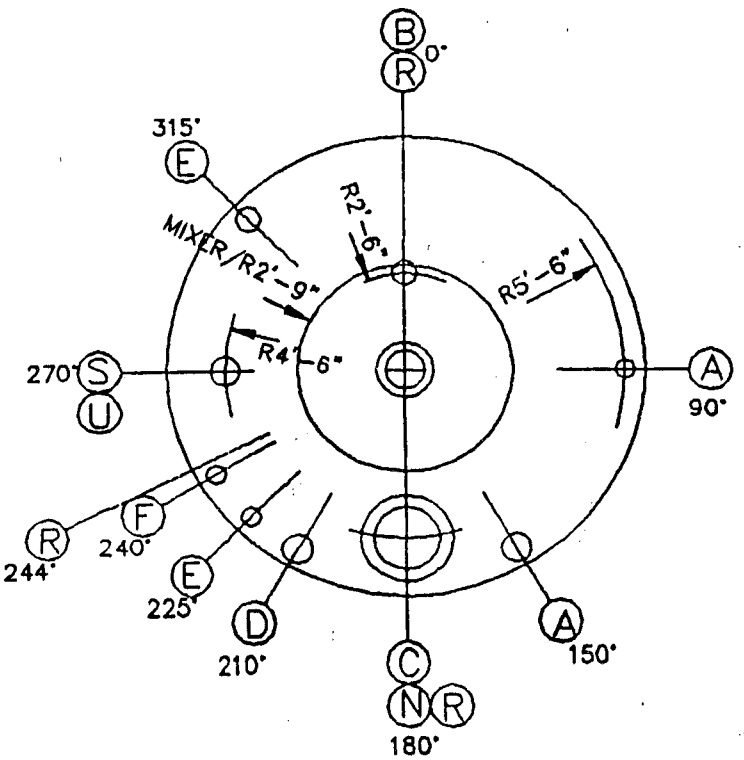
TK-104

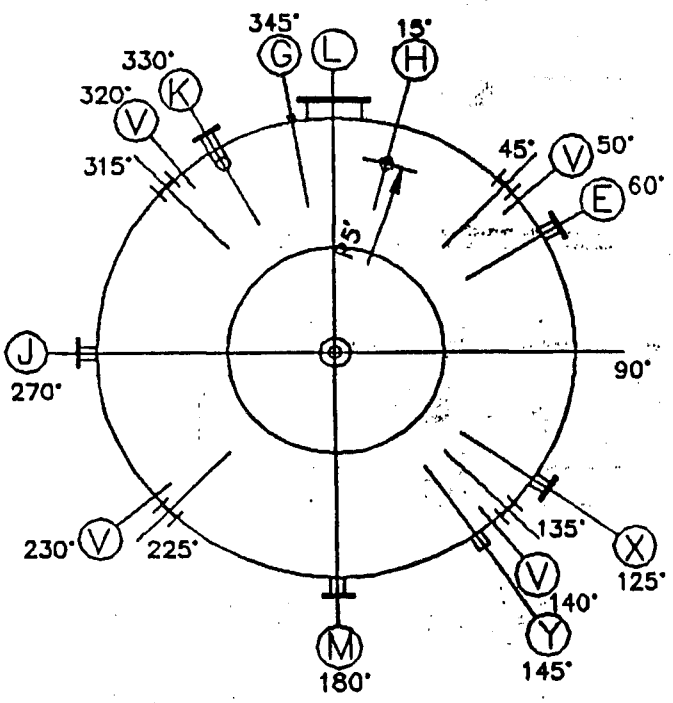
MARK	REQD.	SIZE	TYPE	ELEVATION	DESCRIPTION
A	2	2"	150# RFSO	ROOF	NITROGEN BLANKET
B	1	3"	150# RFSO	ROOF	COV - FA
C	1	20"	150#	ROOF	EMERGENCY VENT
D	1	4"	150# RFSO	ROOF	FILL
E	1	4"	150# RFSO	ROOF	HIGH LEVEL-LSH104
F	1	3"	150# RFSO	ROOF	SPARE
G	1	2"	3000# CPLG	12" F/CONE	SPARE
H	1	2"	3000# CPLG	CONE	SAMPLE
J	1	3"	150# RFSO	6" F/CONE	LOW LEVEL-LSL104
K	1	3"	150# RFSO	13" F/CONE	SPARE
L	1	24"	150#	12" F/CONE	MANWAY W/COVER
M	1	4"	150#FB-VALVE	CONE	DRAW-OFF
N	1	12"	150# RFSO	ROOF	MIXER MOUNT
R	AS SHWN		-	6'-3" F/ROOF	SUPPORT CLIP
S	AS SHWN		-	3'-9" F/ROOF	SUPPORT CLIP
T	1	4"	150# RFSO	ROOF	DPSL104 & DPSH104
U	1	3"	150# RFSO	ROOF	SPARE
V	4		-	SHELL	BAFFLE
W	2	3"	150# RFSO	ROOF	SPARE
W	1	3"	150# RFSO	6" F/CONE	SPARE
X*	2	4"	150# RFSO	6",6'-6"	DRAW-OFF
Y*	1	4"	150# RFSO	ROOF	LEVEL MONITOR-LT104
Z*	2	2"	3000# CPLG	9",6'-6" F/C	SAMPLE

NOTE: - * DESIGNATES NEW NOZZLE
- REINFORCE EXISTING NOZZLE "N"

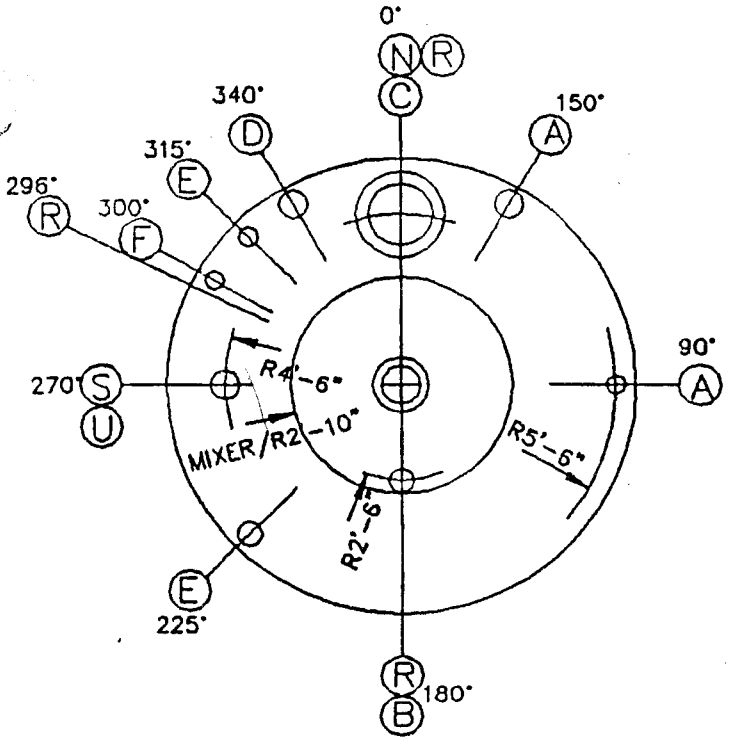
MARK	REQD.	SIZE	TYPE	ELEVATION	DESCRIPTION
A	2	2"	150# RFSO	ROOF	NITROGEN BLANKET
B*	1	3"	150# RFSO	ROOF	COV – FA
C	1	20"	150#	ROOF	EMERGENCY VENT
D	1	4"	150# RFSO	ROOF	FILL
E(225)	1	3"	150# RFSO	ROOF	HIGH LEVEL–LSH105
E(315)	1	3"	150# RFSO	ROOF	SPARE
F	1	3"	150# RFSO	ROOF	DPSL105 & DPSH105
G	1	2"	3000# CPLG	12" F/CONE	SPARE
H	1	2"	3000# CPLG	CONE	SAMPLE
J	1	3"	150# RFSO	6" F/CONE	LOW LEVEL–LSL105
K	1	3"	150# RFSO	13" F/CONE	SPARE
L	1	24"	150#	12" F/CONE	MANWAY W/COVER
M	1	4"	150#FB–VALVE	CONE	DRAW–OFF
N*	1	12"	150# RFSO	ROOF	MIXER MOUNT
R	AS SHWN		–	6'–3" F/ROOF	SUPPORT CLIP
S	AS SHWN		–	3'–9" F/ROOF	SUPPORT CLIP
E	1	3"	150# RFSO	6" F/CONE	SPARE
U*	1	4"	150# RFSO	ROOF	LEVEL MONITOR–LT105
V*	4		–	SHELL	BAFFLE
X*	2	4"	150# RFSO	9",6'–6" F/C	DRAW–OFF
Y*	2	2"	3000# CPLG	9",6'–6" F/C	SAMPLE

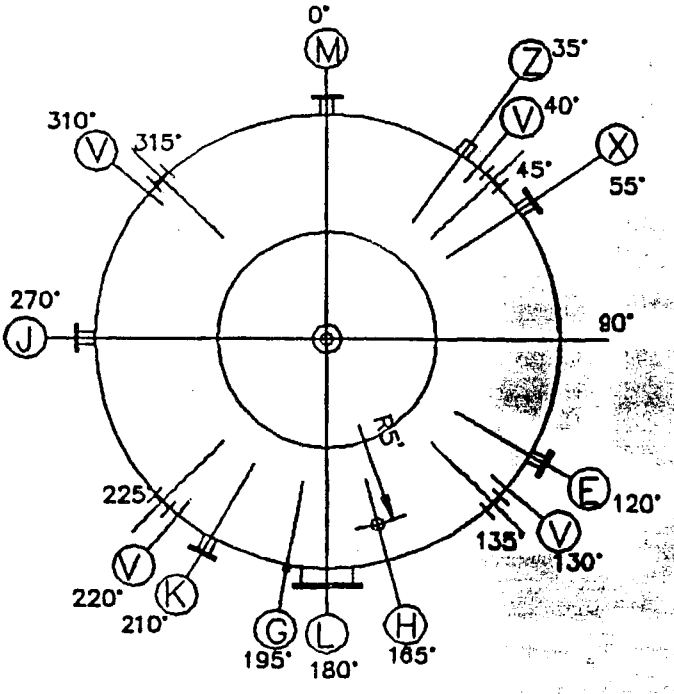
NOTE: * DESIGNATES NEW NOZZLE





TK–105





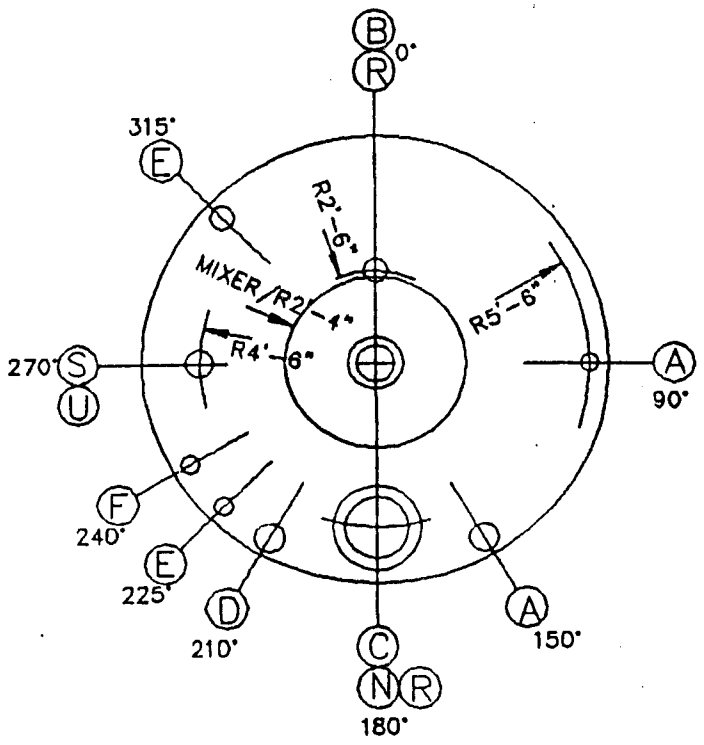
TK-106

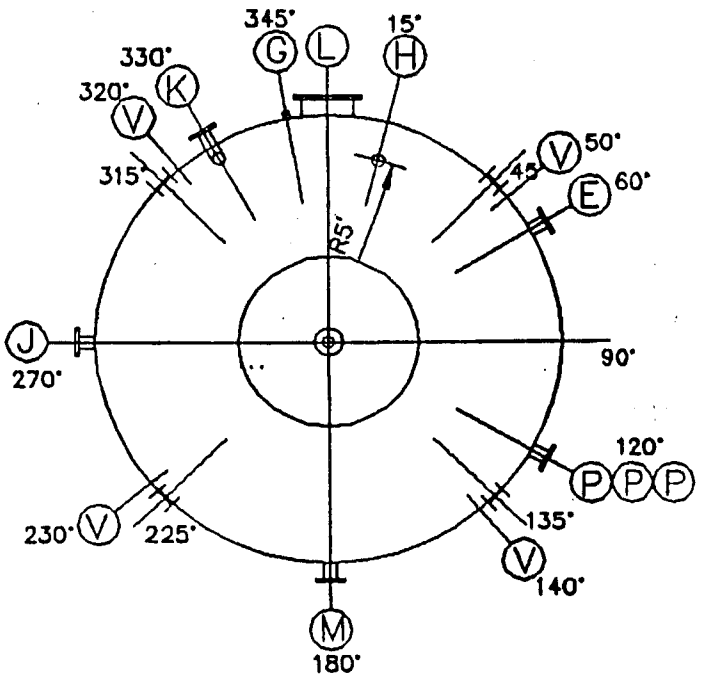
MARK	REQD.	SIZE	TYPE	ELEVATION	DESCRIPTION
A	2	2"	150# RFSO	ROOF	NITROGEN BLANKET
B*	1	3"	150# RFSO	ROOF	COV - FA
C	1	20"	150#	ROOF	EMERGENCY VENT
D	1	4"	150# RFSO	ROOF	FILL
E(315)	1	3"	150# RFSO	ROOF	HIGH LEVEL-LSH106
E(225)	1	3"	150# RFSO	ROOF	SPARE
F	1	3"	150# RFSO	ROOF	DPSL106 & DPSH106
G	1	2"	3000# CPLG	12" F/CONE	SPARE
H	1	2"	3000# CPLG	CONE	SAMPLE
J	1	3"	150# RFSO	6" F/CONE	LOW LEVEL-LSL106
K	1	3"	150# RFSO	13" F/CONE	SPARE
L	1	24"	150#	12" F/CONE	MANWAY W/COVER
M	1	4"	150#FB-VALVE	CONE	DRAW-OFF
N*	1	12"	150# RFSO	ROOF	MIXER MOUNT
R	AS SHWN		-	6'-3" F/ROOF	SUPPORT CLIP
S	AS SHWN		-	3'-9" F/ROOF	SUPPORT CLIP
E	1	3"	150# RFSO	6" F/CONE	SPARE
U*	1	4"	150# RFSO	ROOF	LEVEL MONITOR-LT106
V*	4		-	SHELL	BAFFLE
X*	2	4"	150# RFSO	9",6'-6" F/C	DRAW-OFF
Z*	2	2"	3000# CPLG	9",6'-6" F/C	SAMPLE

NOTE: * DESIGNATES NEW NOZZLE

MARK	REQD.	SIZE	TYPE	ELEVATION	DESCRIPTION
A	2	2"	150# RFSO	ROOF	NITROGEN BLANKET
B*	1	3"	150# RFSO	ROOF	COV – FA
C	1	20"	150#	ROOF	EMERGENCY VENT
D	1	4"	150# RFSO	ROOF	FILL
E(225)	1	3"	150# RFSO	ROOF	HIGH LEVEL–LSH107
E(315)	1	3"	150# RFSO	ROOF	SPARE
F	1	3"	150# RFSO	ROOF	DPSL107 & DPSH107
G	1	2"	3000# CPLG	12" F/CONE	SPARE
H	1	2"	3000# CPLG	CONE	SAMPLE
J	1	3"	150# RFSO	6" F/CONE	LOW LEVEL–LSL107
K	1	3"	150# RFSO	13" F/CONE	SPARE
L	1	24"	150#	12" F/CONE	MANWAY W/COVER
M	1	4"	150#FB–VALVE	CONE	DRAW–OFF
N*	1	12"	150# RFSO	ROOF	MIXER MOUNT
P	3	3"	150# RFSO	6",3'–6",6'–6"	DRAW–OFF
R	AS SHWN		–	6'–3" F/ROOF	SUPPORT CUP
S	AS SHWN		–	3'–9" F/ROOF	SUPPORT CUP
E	1	3"	150# RFSO	6" F/CONE	SPARE
U*	1	4"	150# RFSO	ROOF	LEVEL MONITOR–LT107
V*	4		–	SHELL	BAFFLE

NOTE: * DESIGNATES NEW NOZZLE

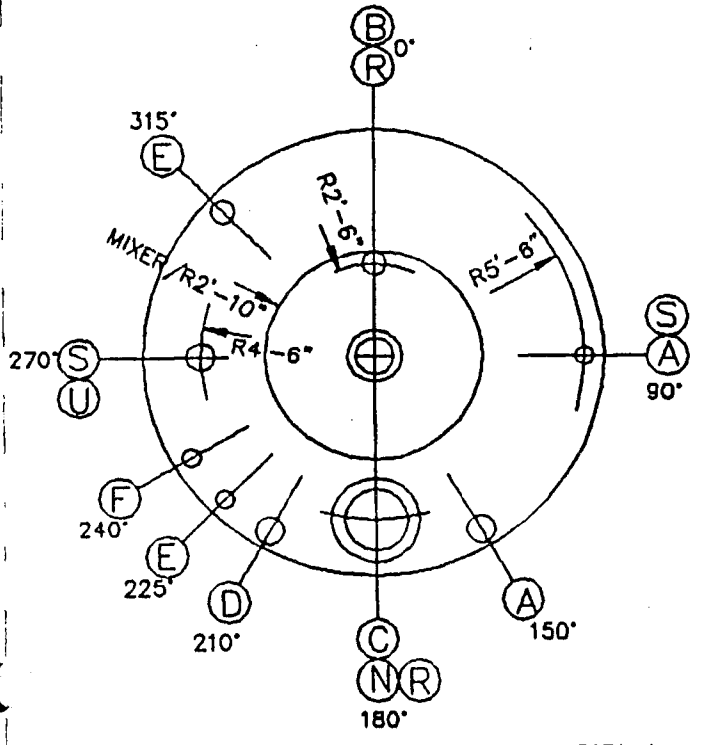


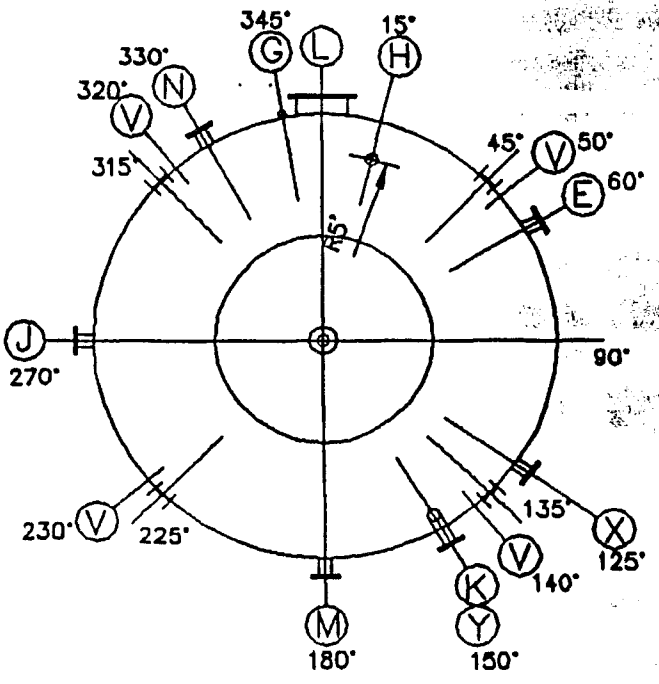


TK–107

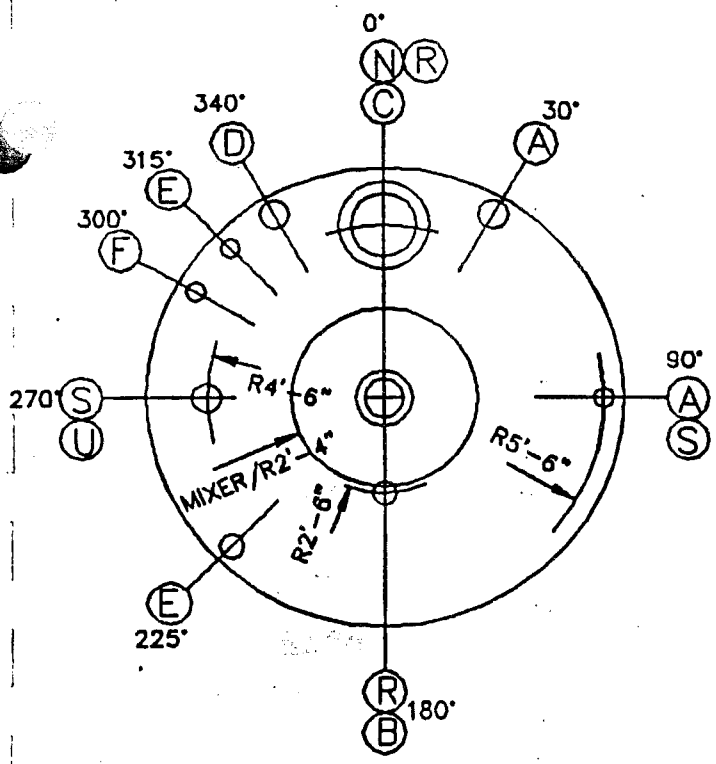
MARK	REQD.	SIZE	TYPE	ELEVATION	DESCRIPTION
A	2	2"	150# RFSO	ROOF	NITROGEN BLANKET
B*	1	3"	150# RFSO	ROOF	COV - FA
C	1	20"	150#	ROOF	EMERGENCY VENT
D	1	4"	150# RFSO	ROOF	FILL
E(225)	1	3"	150# RFSO	ROOF	HIGH LEVEL-LSH109
E(315)	1	3"	150# RFSO	ROOF	SPARE
F	1	3"	150# RFSO	ROOF	DPSL109 & DPSH109
G	1	2"	3000# CPLG	12" F/CONE	SPARE
H	1	2"	3000# CPLG	CONE	SAMPLE
J	1	3"	150# RFSO	6" F/CONE	LOW LEVEL-LSL109
K	1	3"	150# RFSO	13" F/CONE	SPARE
L	1	24"	150#	12" F/CONE	MANWAY W/COVER
M	1	4"	150#FB-VALVE	CONE	DRAW-OFF
N*	1	12"	150# RFSO	ROOF	MIXER MOUNT
R	AS SHWN		-	6'-3" F/ROOF	SUPPORT CLIP
S	AS SHWN		-	3'-9" F/ROOF	SUPPORT CLIP
E	1	3"	150# RFSO	6" F/CONE	SPARE
U*	1	4"	150# RFSO	ROOF	LEVEL MONITOR-LT109
V*	4		-	SHELL	BAFFLE
X*	2	4"	150# RFSO	9",6'-6" F/C	DRAW-OFF
Y*	2	2"	3000# CPLG	9",6'-6" F/C	SAMPLE

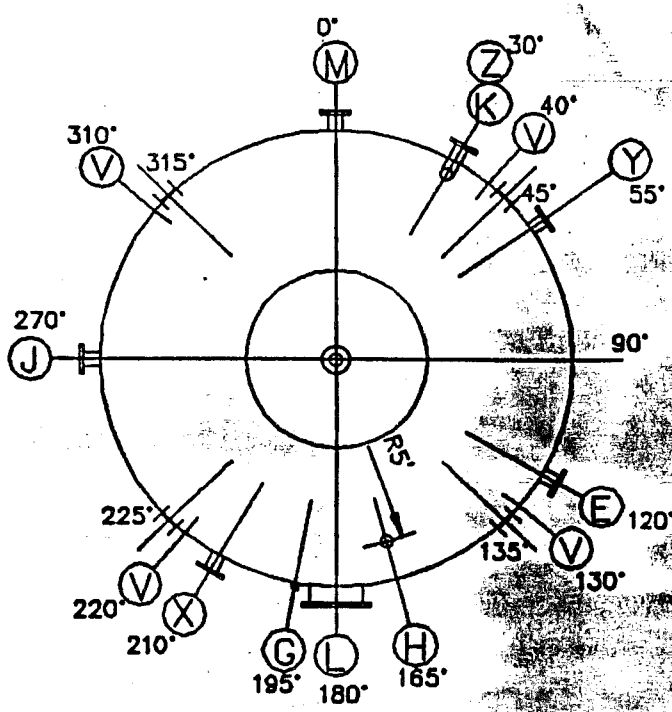
NOTE: * DESIGNATES NEW NOZZLE





TK-109

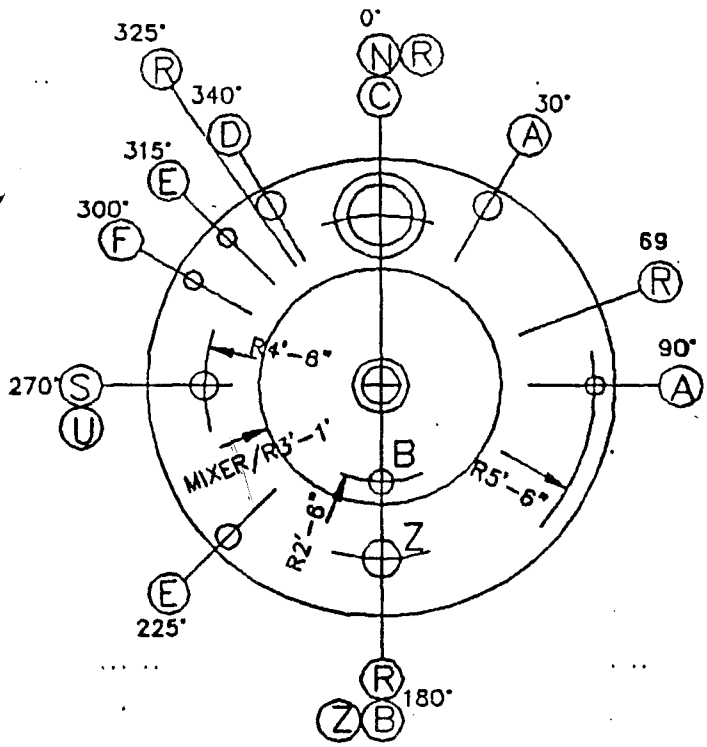


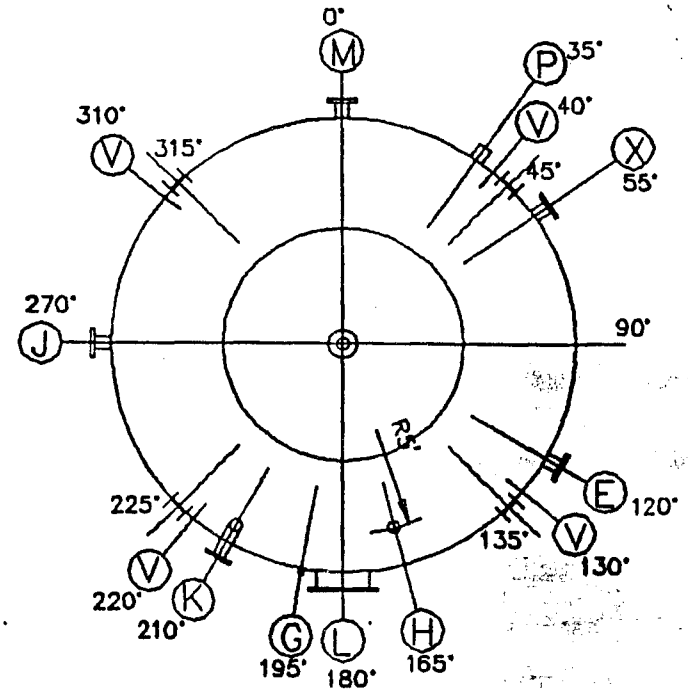


TK-110

MARK	REQD.	SIZE	TYPE	ELEVATION	DESCRIPTION
A	2	2"	150# RFSO	ROOF	NITROGEN BLANKET
B*	1	3"	150# RFSO	ROOF	COV - FA
C	1	20"	150#	ROOF	EMERGENCY VENT
D	1	4"	150# RFSO	ROOF	FILL
E(315)	1	3"	150# RFSO	ROOF	HIGH LEVEL-LSH110
E(225)	1	3"	150# RFSO	ROOF	SPARE
F	1	3"	150# RFSO	ROOF	DPSL110 & DPSH110
G	1	2"	3000# CPLG	12" F/CONE	SPARE
H	1	2"	3000# CPLG	CONE	SAMPLE
J	1	3"	150# RFSO	6" F/CONE	LOW LEVEL-LSL110
K	1	3"	150# RFSO	13" F/CONE	SPARE
L	1	24"	150#	12" F/CONE	MANWAY W/COVER
M	1	4"	150#FB-VALVE	CONE	DRAW-OFF
N*	1	12"	150# RFSO	ROOF	MIXER MOUNT
R	AS SHWN		-	6'-3" F/ROOF	SUPPORT CLIP
S	AS SHWN		-	3'-9" F/ROOF	SUPPORT CLIP
E	1	3"	150# RFSO	6" F/CONE	SPARE
U*	1	4"	150# RFSO	ROOF	LEVEL MONITOR-LT110
V*	4		-	SHELL	BAFFLE
X	1	12"	150# RFSO	12" F/CONE	HEATER
Y*	2	4"	150# RFSO	9",6'-6" F/C	DRAW-OFF
Z*	2	2"	3000# CPLG	9",6'-6" F/C	SAMPLE

NOTE: * DESIGNATES NEW NOZZLE





TK-112

MARK	REQD.	SIZE	TYPE	ELEVATION	DESCRIPTION
A	2	2"	150# RFSO	ROOF	NITROGEN BLANKET
B	1	3"	150# RFSO	ROOF	COV - FA
C	1	20"	150#	ROOF	EMERGENCY VENT
D	1	4"	150# RFSO	ROOF	FILL
E(315)	1	3"	150# RFSO	ROOF	HIGH LEVEL-LSH112
E(225)	1	3"	150# RFSO	ROOF	SPARE
F	1	3"	150# RFSO	ROOF	DPSL112 & DPSH112
G	1	2"	3000# CPLG	12" F/CONE	SPARE
H	1	2"	3000# CPLG	CONE	SAMPLE
J	1	3"	150# RFSO	6" F/CONE	LOW LEVEL-LSL112
K	1	3"	150# RFSO	13" F/CONE	SPARE
L	1	24"	150#	12" F/CONE	MANWAY W/COVER
M	1	4"	150#FB-VALVE	CONE	DRAW-OFF
N*	1	12"	150# RFSO	ROOF	MIXER MOUNT
P*	2	2"	3000# CPLG	9",6'-6" F/C	SAMPLE
R	AS SHWN		-	6'-3" F/ROOF	SUPPORT CLIP
S	AS SHWN		-	3'-9" F/ROOF	SUPPORT CLIP
E	1	3"	150# RFSO	6" F/CONE	SPARE
U*	1	4"	150# RFSO	ROOF	LEVEL MONITOR-LT112
V*	4		-	SHELL	BAFFLE
Z	1	12"	150# RFSO	ROOF	SPARE
X*	2	4"	150# RFSO	6",6'-6"	DRAW-OFF

NOTE: * DESIGNATES NEW NOZZLE

APPENDIX

16-T-7

Dudick Inc.

Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Streetsboro, Ohio 44241

216-562-1970
FAX No. 216-562-7638

Protecto-Crete 800/900

TROWEL-APPLIED, UNREINFORCED HIGH-DENSITY VINYL ESTER FLOOR TOPPING 1/4" (6.3 mm)

Protecto-Crete 800 is a high-performance vinyl ester floor topping designed for heavy truck traffic and abrasion resistance combined with excellent resistance to a variety of acids and caustics.

Protecto-Crete 900, in addition, will resist many of the organic solvents.

RECOMMENDED APPLICATIONS

- Food Processing Floors
- Plating Room Floors
- Pickling Room Floors
- Truck Loading Platforms
- Chemical Storage
- Dike Areas
- Aisleways
- Chemical Laboratories

CHEMICAL RESISTANCE

- Organic Acids
- Inorganic Acids
- Alkali Solutions
- Solvents (900 only)
- Oils
- Salts

A complete listing of substances and concentrations tested is available on request.

PHYSICAL PROPERTIES

Compressive Strength ASTM C579	11,000 PSI
Tensile Strength ASTM D638	1,800 PSI
Density	140 lbs./ft.^{3}
Flexural Strength ASTM C580	3,600 PSI
Thermal Shock Resistance	40°F-160°F

SPECIFICATIONS

Topping shall be a 1/4" thick unreinforced Bisphenol-A/Novolac vinyl ester material as manufactured by Dudick Inc. applied over primed concrete using a plasterer's trowel or screed. Application and installation shall be according to the manufacturer's recommendations.

THE PROTECTO-CRETE 800/900 SYSTEM

The Protecto-Crete 800/900 System uses a primer and a heavily aggregate-filled vinyl ester topcoat to achieve a strongly bonded monolithic topping with excellent physical and mechanical strength and chemical resistance.

Primer: The blasted or etched concrete surface must be primed to provide the "wetting out" required for good bonding. Priming is achieved with Primer 27 and Protecto-Crete 800/900 should be applied while the primer is still tacky.

Topcoat: The aggregate-filled, Protecto-Crete 800/900 topcoat develops a cured strength two to three times that of the concrete base to which it is applied to provide exceptional durability and prolong the life of the substrate from corrosion and mechanical abuse.

ESTIMATING QUANTITIES AND ORDER BILL OF MATERIAL

Note: Resin includes 10 oz./unit hardener as standard.

SQUARE FEET PER GALLON		
CONCRETE		
Primer 27	150-200	
P-Crete 800/900		
Basecoat	58-66 sq. ft./unit	1/4"
S-10 Solvent	500	Clean-up

Quantities shown are for estimating purposes only. Actual field usage may vary.

APPLICATION INSTRUCTIONS

SURFACE PREPARATION

Concrete: Concrete must be abrasive-blasted or etched with muriatic acid (solution of 1 part 20° Be HCl and 1 part water) to remove surface laitance and other contaminants. Concrete must be dry and free of curing compounds and form release agents. Surface texture should be similar to 40-60 grit sandpaper.

The prepared surface should have a tensile strength of between 250 and 300 PSI per ASTM D4541.

Additional surface preparation will be required if a 40-60 grit texture is not achieved and the surface laitance not completely removed after a single application of acid or with the first mechanical preparation procedure.

Hardener Amount/Gal. or Unit of Resin:

Hardener	Substrate Temperature	Primer 27	Protecto-Crete 800/900
PH-1	60-70°F	3-4 oz.	10 fl. oz./unit
PH-1	70-90°F	2-3 oz.	10 fl. oz./unit

PRIMING

Concrete: Concrete must always be primed to aid in the "wetting out" required for good bonding. Mix Primer 27 with PH-1 Hardener for 2-3 minutes and apply with a brush, roller or sprayer. Do not allow the primer to puddle. We recommend the topcoat be applied over tacky primer.

Protector-Crete 800/900 Mix Ratio:

Protecto-Crete 800/900 Resin	30 lbs.
PH-1 Hardener (@75°F)	10 fl. oz.
G-4 Aggregate	4-50 lb. bags

TOPCOAT

Add the entire contents of the pre-measured PH-1 Hardener to Protecto-Crete 800/900 (pre-measured) Liquid and blend thoroughly. Add 4 bags of G-4 aggregate and mix well. Protecto-Crete ingredients may be mixed in a concrete mixer or mortar box. Liquid and Hardener must be thoroughly blended together before aggregate is added.

Pour the Protecto-Crete mix into a wheelbarrow and transport to each workman's area. Dump directly onto the primed concrete.

The mix should be spread with a plasterer's trowel or with (3-4 ft.) wood screeds. Final finish with a trowel.

To terminate work, square cut the topping and start with the next work period butting to this edge. Permanent terminating lines should be made into saw cuts in the concrete.

Allow Protecto-Crete to cure overnight before subjecting the area to foot traffic.

Allow to cure 1-2 days at 70°F before permitting truck traffic.

Pot Life and Cure Cycles:

Protecto-Crete 800/900		
Temperature	Pot Life	Cure Time
50°F	50-60 Min.	72 Hrs.
75°F	30-40 Min.	48 Hrs.
90°F	20-30 Min.	24 Hrs.

Do not attempt to store mixed material. Residual material should be properly disposed of at the end of each work period.

Recommended application temperatures should be between 50°F and 110°F substrate temperature.

Application of Protecto-Crete 800/900 in direct sunlight may lead to blistering, pinholes, or wrinkling in the floor topping due to outgassing of air in the concrete and high substrate temperatures.

CLEANING

Clean tools and equipment with S-10 Cleaning Solvent.

SHIPPING

The S-10 Cleaning Solvent is a red label item with a flash point of 52°F (PMCC). The Hardener is classified as Organic Peroxide and carries a yellow warning label. Protecto-Crete liquids are red label items and classified flammable.

STORAGE

Warning: All Dudick products classified by DOT labels as either white, yellow or red labels, must not mixed or stored together as an explosive reaction may occur.

Protecto-Crete Liquid and Hardener are flammable and an oxidizer, respectively, and should be stored in a cool, dry place, away from open flame, sparks and other hazards. Protecto-Crete 800/900 ingredients are stable for 3 months when properly stored under 75°F. Excessive heat may cause premature gelling and reduce available working time (pot life).

SAFETY

M.S.D.S. - Sheets must always be read before using products. Protecto-Crete systems are intended for application by experienced, professional personnel. Dudick Inc. can supply Protecto-Crete Systems supervision to help determine that the surface has been properly prepared, the ingredients correctly mixed, and the materials properly and safely applied.

If Protecto-Crete materials are to be applied by your own personnel or by a third-party contractor, please be sure that they are aware of the following safety precautions:

• Exposure to vinyl ester resins and hardeners may cause severe dermatitis reactions in some people. Cleanliness of the skin and clothing is critical and must be of paramount concern.

• Safety glasses, gloves, and suitable protective clothing must be worn at all times.

• Suitable respirators should be used.

• If contact with hardeners occurs, remove any clothing involved and wash the skin with large amounts of water. Discard the clothing. Do not attempt to wash and reuse it. Protecto-Crete Liquid may be washed off with S-10 Cleaning Solvent, MEK, or lacquer thinner. DO NOT USE ACETONE.

• Fumes are flammable and heavier than air. Proper ventilation should be maintained to minimize breathing of concentrated fumes.

• If a rash or dermatitis occurs, remove the individual from the work area and seek a doctor's care for dermatitis.

• Keep open flames and sparks away from the area where toppings are being mixed and applied.

• In case of eye contact, wash with water for at least 15 minutes and consult a physician. If swallowed, do not induce vomiting; call a physician immediately.

Note:

Dudick Inc. ("Dudick") warrants all goods of its manufacture to be as represented in its catalogs and that the application of its products by its employees or sub-contractors shall be performed in a workmanlike manner. Dudick's obligation under this warranty shall be the repair to and replacement of any applications which its examination shall disclose to be defective. Dudick makes no warranty concerning the suitability of its product for application to any surface, it being understood that the goods have been selected and the application ordered by the purchaser. DUDICK INC. MAKES NO WARRANTY, EXPRESS OR IMPLIED, THAT THE GOODS SHALL BE MERCHANTABLE OR THAT THE GOODS ARE FIT FOR ANY PARTICULAR PURPOSE. THE WARRANTY OF REPAIR OR REPLACEMENT SET FORTH HEREIN IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES ARISING BY LAW OR OTHERWISE; AND DUDICK INC. SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DOWN TIME, DAMAGES TO PROPERTY OF THE PURCHASER OR OTHER PERSONS, OR DAMAGES FOR WHICH THE PURCHASER MAY BE LIABLE TO OTHER PERSONS, WHETHER OR NOT OCCASIONED BY DUDICK'S NEGLIGENCE. This warranty shall not be extended, altered or varied except by written instrument signed by Dudick and Purchaser.

Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Streetsboro, Ohio 44241
(12-91)

Dudick Inc.

Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Streetsboro, Ohio 44241

216-562-1970
FAX No. 216-562-7638

Protecto-Coat 800/900/ 805/905

FLAKE-FILLED HIGH PERFORMANCE VINYL ESTER COATING, 30-40 MILS (1.0 mm)

Protecto-Coat Systems are designed to protect concrete and steel from splash and spills and mild immersion exposures of organic, inorganic acids, alkalies and solvents. The 805/905 adds fluoride protection.

RECOMMENDED APPLICATIONS

- Structural Steel
- Elevated Water Storage Towers
- Plating Lines, Exterior
- Pickling Lines, Exterior
- SO_2 Scrubber Duct Work
- Spent Carbon Storage
- Floors (Spillage)
- Steel Pump Supports
- Thickener Mechanisms
- Underground Tanks and Piping
- Catwalks
- Interiors of Chemical Storage Tanks

CHEMICAL RESISTANCE

- Organic Acids
- Inorganic Acids
- Alkali Solutions
- Solvents (900 only)
- Oils
- Salts

A complete listing of substances and concentrations tested is available on request.

Temperature Limits:
Immersion up to 120°F
Dry — 250°F - Continuous
300°F - Intermittent

PHYSICAL PROPERTIES

Tensile Strength ASTM C307	2,500-2,800 PSI
Flexural Strength ASTM C790	5,000-5,200 PSI
Adhesion to Steel	2,000 PSI
Barcol Hardness	35-40
P-Coat 805/905	
Electrical Properties	1.5-2.0 Megaohms
Color	White, Gray
Solids	100% Reactive

SPECIFICATIONS

Coating shall be 30-40 mils thick, flake-filled vinyl ester based resin, consisting of a base and topcoat of 15-20 mils each, as manufactured by Dudick, Inc. Materials shall be brush, roller, or spray applied in accordance with manufacturer's recommended practices.

OTHER PROTECTO-COAT 800/900 COATINGS AVAILABLE

Protecto-Coat 800 and 900 coatings are two distinct formulations designed to offer a wide range of high performance coatings suitable for many different industrial and manufacturing applications. In turn, each coating may be chosen with flake or graphite fillers to enhance the protection necessary for a specific chemical environment, and is available in formulations for either brush, roller or spray application. All Protecto-Coat 800 and 900 coatings (except graphite filled) are available in white or gray.

Protecto-Coat 800 is a thermosetting vinyl ester coating which utilizes a flake filler for resistance to a wide variety of acids, caustics, salts, oils and mild alkali solutions, and offers superior protection against organic acids and caustics. The 800 series offers the most versatile protection in the Protecto-Coat line and is the most widely used vinyl ester.

Protecto-Coat 801 is Protecto-Coat 800 formulated for two component spray application.

Protecto-Coat 805 is a Protecto-Coat 800 coating with graphite flake fillers for improved protection against fluorides and higher caustic concentrations or where conductive properties are needed.

Protecto-Coat 900 is a higher cross link density coating and offers the highest solvent and acid resistance.

Protecto-Coat 901 is Protecto-Coat 900 for two component spray application.

Protecto-Coat 905 is Protecto-Coat 900 with graphite flake fillers for improved protection against fluorides and higher caustic concentrations or where conductive properties are needed.

THE PROTECTO-COAT SYSTEM

The Protecto-Coat System uses two layers of thermosetting flake-filled vinyl ester resins to build up the protection that vulnerable steel and concrete need in chemically oriented manufacturing or processing operations. When fully cured, the separate elements lose their individual identity and become a single, monolithic coating.

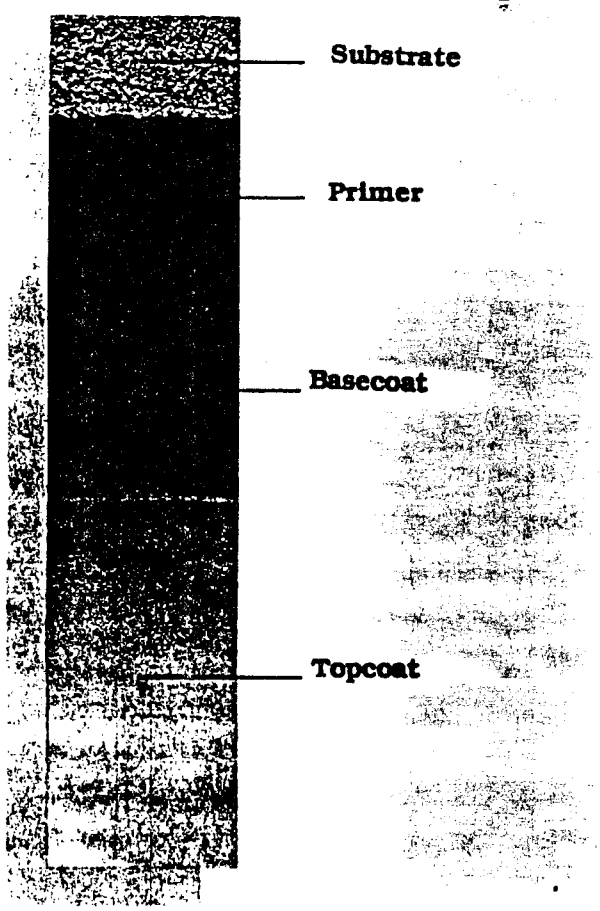
Primer 27 is designed to prevent abrasive-blasted steel from developing rust bloom prior to the application of a Protecto-Coat coating. For maximum performance all steel surfaces should be primed, but primer may not be needed for mild, non-immersion service. Concrete, however, must always be primed to aid in the "wetting out" required for good bonding.

Basecoat/Topcoat: Protecto-Coat resins are filled with flakes or graphite flakes to reduce the coefficient of expansion. Protecto-Coat 800/900 resins, filled with flakes or graphite flakes, provide a chemical resistant outer barrier. Overlapping leaf arrangement of flakes reduces water vapor permeation and permits chemical exposures at higher temperatures without increasing the thickness of the coating.

ESTIMATING QUANTITIES AND ORDER BILL OF MATERIAL

Note: Resins include 3 oz. hardener as standard.

SQUARE FEET PER GALLON		
	CONCRETE	STEEL
Primer 27	150-200	250-300
P-Coat 800/900/805/905		
Actual 30-40 Mil. DFT	30	30
Theoretical 30-40 Mil. DFT	45	45
S-10 Solvent	500	500



Quantities shown are for estimating purposes only. Actual field usage may very.

APPLICATION INSTRUCTIONS

SURFACE PREPARATION

Metal: For immersion service, abrasive blast to a white metal finish and a 2-3 mils minimum profile according to SSPC 5 or NACE #1. For fume or splash service, abrasive blast to a near white metal finish according to SSPC 10.

Concrete: Concrete must be abrasive blasted or etched with muriatic acid (Solution of 1 part 20° Be HCl and 1 part water) to remove surface laitance and other contaminants. Concrete must be free of curing compounds and form release agents. Surface texture should be similar to 40-60 grit sandpaper. Additional surface preparation will be required if a 40-60 grit texture is not achieved and the surface laitance not completely removed after a single application of acid or with the first mechanical preparation procedure.

If after abrasive blasting, honeycombs/voids appear on the concrete or steel, these have to be filled with a suitable material. Contact a Dudick Representative for this information.

Hardener Amount/Gal. Resin.

HARDENER	SUBSTRATE TEMPERATURE	PRIMER 27	P-C 800/900 BASECOAT/ TOPCOAT	P-C 805/905 BASECOAT/ TOPCOAT
PH-1	60°-70°F	3-4 oz.	3-4 oz.	3-4 oz.
PH-1	70°-90°F	2-3 oz.	2-3 oz.	2-3 oz.

Recommended application temperatures should be between 50°F and 110°F substrate temperature.

PRIMING

Metal: For maximum performance, prime all steel surfaces with Primer 27 3-4 mil. WFT, mixed with appropriate amount of PH-1 Hardener. For mild non-immersion service, priming of steel may be omitted.

Concrete: Concrete surfaces must be primed using Primer 27 and the appropriate amount of PH-1 Hardener. Concrete must be thoroughly dry before application of primer by spray, roller, or brush. Do not allow the primer to puddle.

BASECOAT

Add appropriate amount of PH-1 Hardener for each gallon of Protecto-Coat Liquid and mix thoroughly until uniform color is achieved. Apply a 15-20 mils thick basecoat using spray, brush or roller. Apply to an even, smooth finish.

Allow basecoat application to cure to at least a "firm" or slightly "tacky" feel before applying the topcoat.

TOPCOAT

Add appropriate amount of PH-1 Hardener for each gallon of Protecto-Coat Liquid and mix thoroughly until a uniform color is achieved. Apply a 15-20 mils thick topcoat using a spray brush or roller. Apply to an even, smooth finish.

Cure cycles for Protecto-Coat Coatings are:

Temperature	Recoat Time	Cure Time
50°F	12 Hours	96 Hours
75°F	4 Hours	48 Hours
90°F	3 Hours	24 Hours

Protecto-Coat 900 must be recoated within 8 hours when exposed to direct sunlight.

If these recoat times are exceeded, consult a Dudick representative. Sanding or abrasive blasting may be required before the next coat. Recoat times are dramatically reduced when the coating is exposed to direct sunlight.

Application of Protecto-Coat 800/900 in direct sunlight may lead to blistering, pinholes, or wrinkling in the copating due to outgassing of air in the concrete and high substrate temperatures.

Standard Formulation: (Brush, Roller or Pressure Pot) Spray applications can be made with conventional air spray equipment with a pressure pot. Binks #18 spray gun with #68 fluid nozzle and 68 air nozzle, or Binks #62 spray gun with #68 fluid nozzle and #68 air nozzle are recommended.

Plural component spray applications can be made with a Binks 8-to-1 Pump. A Binks Model 18 NC spray gun 59BSSX9-47 with a 102-3430 ACI valve. Catalyst would need to be supplied by a 101-5202 catalyst tank. 1/2" ID material supply hose is recommended.

Brush or roller application may require additional coats to meet specified dry film thickness.

Pot Life of the opened and mixed Protecto-Coat 800/900, 805/905 will depend on the temperature at the work site. To prevent material waste and avoid damage to equipment, do not open and mix more material than can be used according to the following table:

TEMPERATURE	POT LIFE
50°F	1 Hour
75°F	40 Min.
90°F	25 Min.

Do not attempt to store mixed material. Residual material should be properly disposed of at the end of each work period. Where immersion service is required, spark test the coating with a 5,000 volt AC spark tester. Mark and repair all pinholes. Use Protecto-Coat Liquid mixed with the amount of hardener appropriate for the substrate temperature. Retest only the repairs.

CLEANING

Use S10 Cleaning Solvent to clean tools and equipment.

SHIPPING

Protecto-Coat Liquids are red label items with flash points of 73°F (PMCC), classified "Flammable Liquid." Hardener PH-1 is classified as an Organic Peroxide and a yellow label item. S-10 Cleaning Solvent is a flammable liquid with a flash point of 52°F (PMCC).

STORAGE

Warning: All Dudick products classified by DOT labels as either white, yellow or red labels, must not be mixed or stored together as an explosive reaction may occur.

When stored in a cool and dry location, Protecto-Coat 800/900/805/905 ingredients have a 3-month shelf life. Exposure to excessive heat may cause premature gelling and reduce working time.

SAFETY

M.S.D.S. - Sheets must always be read before using products. Protecto-Coat coatings are intended for application by experienced, professional personnel. Dudick Inc. can supply Protecto-Coat coatings supervision to help determine that the surface has been properly prepared, the ingredients correctly mixed, and the materials properly and safely applied.

If Protecto-Coat materials are to be applied by your own personnel or by a third-party contractor, please be sure that they are aware of the following safety precautions:

• Exposure to resins, solvents and hardeners may cause severe dermatitis reactions in some people. Cleanliness of the skin and clothing is critical and must be of paramount concern.

• Safety glasses, gloves and suitable protective clothing must be worn at all times during application.

• Suitable respirators should be used during application.

• If contact with hardeners occurs, remove any clothing involved and wash the skin with water. Discard the clothing. Do not attempt to wash and reuse it. Protecto-Coat Liquid may be washed off with S-10 Cleaning Solvent, MEK, or lacquer thinner.

• DO NOT USE ACETONE. Acetone forms a potentially explosive mixture with peroxides.

•Fumes are flammable and heavier than air. Proper ventilation should be maintained to minimize breathing of concentrated fumes

• If a rash or dermatitis occurs, remove the individual from the work area and seek a physicians care for dermatitis.

• Keep open flames and sparks away from the area where toppings are being mixed and applied.

• In case of eye contact, wash with water for at least 15 minutes and consult a physician. If swallowed, do not induce vomiting; call a physician immediately.

Note:

Dudick Inc. ("Dudick") warrants all goods of its manufacture to be as represented in its catalogs and that the application of its products by its employees or sub-contractors shall be performed in a workmanlike manner. Dudick's obligation under this warranty shall be the repair to and replacement of any applications which its examination shall disclose to be defective. Dudick makes no warranty concerning the suitability of its product for application to any surface, it being understood that the goods have been selected and the application ordered by the purchaser. DUDICK INC. MAKES NO WARRANTY, EXPRESS OR IMPLIED, THAT THE GOODS SHALL BE MERCHANTABLE OR THAT THE GOODS ARE FIT FOR ANY PARTICULAR PURPOSE. THE WARRANTY OF REPAIR OR REPLACEMENT SET FORTH HEREIN IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES ARISING BY LAW OR OTHERWISE; AND DUDICK INC. SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DOWN TIME, DAMAGES TO PROPERTY OF THE PURCHASER OR OTHER PERSONS, OR DAMAGES FOR WHICH THE PURCHASER MAY BE LIABLE TO OTHER PERSONS, WHETHER OR NOT OCCASIONED BY DUDICK'S NEGLIGENCE. This warranty shall not be extended, altered or varied except by written instrument signed by Dudick and Purchaser.

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Corrosion-Proof Products
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(12-91)

Temperature/Chemical Resistance Key

Indicator	Definition	Indicator	Definition	Indicator	Definition
I	Material will withstand constant flow or Immersion service.	1	Good to the maximum temperature of the product	NR	Not recommended
S	Material is suitable for intermittent or Spillage service	2	High Temperature Service to 160° F (71° C)	NI	No information available
F	Material will tolerate Fumes only	3	Moderate Temperature Service to 140° F (60° C)	PV	Performance varies with conditions. Consult Dudick for recommendations or testing
		4	Warm Temperature Service to 100° F (37° C)		

Example	48. Boric Acid	14	14	14	14	14	13	I1	I1	S1	S1	S1	I2	I:
		AID	AID	AID	AID	AID	AID	AID	AID	AID	AID	AID		

Each grid block in the Guide shows all the information which is available on the product for the use shown. Thus, a block which shows I2, indicates that the product is capable of providing immersion service up to 160° F. Similarly, a block which shows F1 indicates the material will tolerate temperatures to the maximum capability shown in the Temperature Limits chart below, but that it is designed for exposure only to fumes.

Temperature Limits

Product	Substrate	Maximum Temperature	Notes
Protecto-Coat Series	*Metal* *Concrete/Steel*	130° F 54° C 130° F 54° C	[1] Steel: Constant Flow; Steel Dry or Intermittent Spills: 200°F (93°C) to 350°F (96°C) [2] Concrete: Constant Flow
Protecto-Crete Series	*Metal* *Concrete*	Not Recommended 250° F 120° C	[3] Intermittent Spills, otherwise maximum temperature is 150°F
Protecto-Flake Series	*Metal* [4] *Concrete*	180° F 83° C Not Applicable	[4] Steel: Immersion; Steel, Dry: 250°F (121°C)
Protecto-Glass Series	*Metal* [5] *Concrete*	160° F 71° C 160° F 71° C	[5] Steel: Constant Flow
Protecto-Line Series	*Metal* [6] *Concrete* [7]	160° F 71° C 160° F 71° C	[6] Steel: Constant Flow and Immersion [7] Concrete: Constant Flow
Protecto-Seal Series	*Metal* [8] *Tile/Concrete* [8]	Not Applicable 160° F 71° C	[8] Tile: Constant Flow and Immersion
Grout Series	*Metal* *Concrete*	Not Applicable 160° F 71° C	

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Key

I Material will withstand constant flow or immersion service
S Material is suitable for intermittent or Spillage service
F Material will tolerate fumes only

	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
1. Acetaldehyde	F4	NR	PV	PV	F4	F4	NR	NR	S4	S4	NR	NR	NR	NR
2. Acetic Acid (0-10%)	I3	F4	I4	I4	I4	I4	S1	S1	S1	S1	S1	I3	I3	I3
3. Acetic Acid (10-50%)	S4	NR	S1	S1	S1	S1	F1	F1	S4	S4	S3	I4	I4	I4
4. Acetic Acid (50-100%)	F4	NR	S3	S3	S3	S3	NR	NR	NR	NR	S3	PV	PV	S4
5. Acetic Anhydride	F4	NR	S4	S4	S4	S4	PV	PV	NR	NR	S4	S4	S4	S4
6. Acetone	S4	NR	NR	F4	NR	NR	NR	S3	S4	S4	s4	NR	NR	NR
7. Acetyl Chloride	F4	F4	PV	PV	PV	PV	PV	PV	S4	S4	S4	PV	PV	PV
8. Acrylic Acid	PV	F4	PV	PV	PV	PV	PV	PV	NR	NR	S4	I4	I4	I4
9. Acrylonitrile	NR	NR	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	PV
10. Adipic Acid	I4	I4	I4	I4	I4	I4	PV	PV	S4	S4	S4	I4	I4	I4
11. Alcohol (Ethyl)	S4	S4	I4	I4	I4	I4	I4	I4	S4	S4	S1	I1	I1	I1
12. Alcohol (Methyl)	S4	NR	PV	PV	F4	F4	S4	S4	S4	S4	S1	I4	I4	I4
13. Allyl Chloride	F4	NR	NR	NR	NR	NR	PV	PV	NR	S4	S1	PV	PV	S4
14. Alum	S4	I4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I3	I3	I2
15. Aluminum Bromide	S4	F4	I4	I4	I4	I4	F1	F1	S4	S4	S1	I1	I1	I1
16. Aluminum Chloride	I4	I4	I4	I4	I4	I4	I1	I1	S3	S3	S1	I1	I1	I1
17. Aluminum Fluoride*	S1	S4	S1	S1	S1	S1	NR	NR	S1	S1	S1	I4	I4	I4
18. Aluminum Hydroxide	I4	S4	F4	F4	S4	S4	S4	S4	S1	S1	S1	I4	I3	I3
19. Aluminum Sulfate	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S4	I3	I3	I2
20. Ammonia (Dry)	S4	S4	F1	F1	F1	F1	F1	F1	S1	S1	S1	I3	I3	I3
21. Ammonium Chloride	S1	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
22. Ammonium Fluoride*	S4	S4	I4	I4	I4	S4	NR	NR	S1	S1	S2	I3	I3	I3
23. Ammonium Hydroxide	I4	I4	F4	F4	S4	S4	I1	I1	S1	S1	S1	I2	I2	I2
24. Ammonium Nitrate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
25. Ammonium Persulfate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
26. Ammonium Sulfate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
27. Ammonium Sulfide	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
28. Ammonium Sulfite	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
29. Amyl Acetate	F4	NR	S4	S4	S4	S4	NR	NR	NR	NR	NR	PV	F4	F4
30. Amyl Alcohol	F4	F4	S1	S1	S1	I4	NR	NR	S3	S3	S3	I4	I4	I4
31. Aniline	NR	NR	S4	S4	S4	S4	NR	NR	NR	NR	NR	NR	I4	I4
32. Aniline Hydrochloride	F4	F4	S4	S4	S4	S4	F4	F4	S3	S3	S3	I4	I4	I4
33. Antimony Chloride	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
34. Aqua Regia	NR	NR	NR	NR	NR	F4	NR	NR	NR	NR	NR	NR	NR	NR
35. Arsenic Acid	F4	F4	I4	I4	I4	I3	S4	S4	S1	S1	S1	I3	I3	PV
36. Barium Acetate	S4	S4	S4	S4	S4	S4	F4	F4	S4	S4	S3	I4	I4	I4
37. Barium Chloride	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
38. Barium Hydroxide	I4	I4	S3	S3	S2	I4	I1	I1	S1	S1	S4	I4*	I4*	I3*
39. Barium Sulfide	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
40. Benzaldehyde	PV	PV	NR	NR	NR	NR	NR	S4	PV	PV	PV	PV	NR	PV
41. Benzene	F4	NR	PV	PV	NR	NR	NR	S4	S4	S4	S4	NR	NR	S4
42. Benzene Sulfonic Acid	F4	F4	I4	I4	I4	I4	F4	F4	S4	S4	S1	I1	I1	I1
43. Benzene Sulfonic Chloride	F4	F4	I4	I4	I4	I3	F4	F4	S4	S4	S1	I1	I1	I1
44. Benzoic Acid	S4	S4	I4	I4	I4	I3	F4	F4	S1	S1	S1	I1	I1	I1
45. Benzoyl Chloride	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	NR	NR	PV
46. Black Liquor*	S4	S4	S1	I4	I1	I1	I1	NR	S1	S1	S3	I3	I3	I3
47. Bleach (5.5%)*	S4	F4	PV	PV	I1	I1	F1	NR	NR	I3	S4	NR	NR	I1
48. Boric Acid	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I2	I2	I2
49. Bromine, Wet Gas	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	F4	F4	F4
50. Bromine Water (5%)	F4	NR	S4	S4	S4	S4	S4	S4	NR	S4	S4	I4	I4	I4
51. Butadiene	S4	PV	PV	PV	PV	PV	NR	NR	S4	S4	S4	PV	PV	PV
52. Butanol	F4	NR	S4	S4	S4	S4	NR	NR	S4	S4	S1	I3	I3	I3
53. Butyl Acetate	F4	NR	NR	NR	F4	F4	NR	S4	S4	S4	NR	NR	NR	PV
54. Butyl Carbitol	F4	PV	PV	PV	F4	F4	PV	PV	S4	S4	PV	I4	I4	I4
55. Butyl Cellosolve	F4	NR	PV	NR	S4	S4	NR	S4	S4	S4	S4	NR	NR	S4
56. Butyric Acid	F4	NR	F4	F4	F3	F3	NR	NR	NR	NR	NR	I3	I3	I3
57. Cadmium Plating (Cyanide)	S4	S4	S1	S1	S1	S1	S1	S1	S1	S1	S3	I3	I3	I3

*May need synthetic fabric or carbon fillers. Consult a Dudick Corrosion-Proof, Inc. technical representative for more complete information on these products.

Dudick

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	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
58. Calcium Bisulfite	S4	S4	I4	I4	I3	I3	F1	F1	S3	S3	S1	I1	I1	I1
59. Calcium Carbonate (Soda Ash)	I4	I4	I4	I4	I3	I3	I1	NR	S1	S1	S4	I3	I3	I3
60. Calcium Chloride	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
61. Calcium Hydroxide*	I4	I4	I4	I4	I3	I4	I1	NR	S1	S1	S3	I3	I3	I3
62. Calcium Hypochlorite (5%)*	F4	F4	F4	F4	S4	S4	F4	NR	S4	S4	S3	NR	NR	NR
63. Calcium Nitrate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
64. Caprylic Acid	NR	NR	I4	I4	I4	I4	NR	NR	NR	NR	NR	I4	I4	I4
65. Carbon Disulfide	F4	NR	S4	S4	S4	S4	NR	NR	S4	S4	S4	F4	F4	F4
66. Carbon Tetrachloride	F4	F4	S4	S4	S3	S3	NR	NR	S3	S3	S3	NR	I4	I4
67. Castor Oil	I4	I4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
68. Chloracetic Acid	F4	NR	F4	F4	F4	F4	F1	F1	NR	S4	S4	F3	F3	F3
69. Chloral	NR	NR	NR	NR	NR	NR	NR	NR	S4	S4	NR	NR	NR	NR
70. Chlorine Dioxide	F4	NR	S4	S4	S3	S3	NR	NR	NR	S4	S3	I4	I4	I3
71. Chlorine Gas (Dry)	NR	NR	F4	F4	F3	F3	NR	NR	NR	NR	S4	I4	I4	I3
72. Chlorine Gas (Wet)	NR	NR	NR	NR	F4	F3	NR	NR	NR	S4	S2	F4	F4	F4
73. Chlorine Water (Saturated)	NR	NR	S4	S4	S3	S3	F4	F4	S4	S4	S2	I4	I4	I4
74. Chlorobenzene	F4	NR	NR	NR	S4	S4	NR	NR	S4	S4	NR	NR	NR	S4
75. Chloroform	F4	NR	NR	NR	NR	NR	NR	NR	S4	S4	NR	NR	NR	NR
76. Chlorophenol	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
77. Chlorosulfonic Acid	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
78. Chlorotoluene	F4	NR	S4	S4	S4	S4	NR	NR	NR	NR	S4	I4	NR	PV
79. Chromic Acid (10%)	F4	F4	S4	S4	S4	S4	S4	S4	S4	S4	S4	I4	I4	I4
80. Chromic Acid (40%)	F4	NR	S4	S4	S4	S4	S4	S4	S4	S4	S4	I4	I4	PV
81. Chromic Chloride	S4	S4	I4	I4	I4	I3	S1	S1	S1	S1	S1	I1	I1	I1
82. Citric Acid	S4	F4	I4	I4	I4	I3	S1	S1	S4	S4	S1	I1	I1	I1
83. Copper Plating (Cyanide)	S3	S3	S4	S4	S3	S3	S1	S1	S2	S2	S4	I4	I4	I3
84. Copper Plating (Acid)	S4	S4	S3	S3	S3	S3	S1	S1	S2	S2	S1	I1	I1	I1
85. Copper Salts	S3	S3	I4	I4	I4	I4	S1	S1	S1	S1	S1	I1	I1	I1
86. Corn Oil	S3	S3	I4	I4	I4	I3	I1	I1	S3	S3	S1	I1	I1	I1
87. Corn Starch	S1	S1	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
88. Corn Sugar	S1	S1	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
89. Cottonseed Oil	S3	S3	I4	I4	I4	I3	I1	I1	S3	S3	S1	I1	I1	I1
90. Cresol	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	NR	NR	PV
91. Cresylic Acid	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
92. Crude Oil	S4	PV	I4	I4	I4	I4	PV	PV	PV	I1	S1	I1	I1	I1
93. Detergent Sulfonated	S4	PV	I4	I4	I4	I4	PV	PV	PV	I1	PV	I1	I1	I1
94. Dextrose	I3	S3	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
95. Dibutyl Phthalate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I3	I3	I3
96. Dichloro Acetic Acid (20%)	F4	NR	I4	I4	I4	I4	F1	F1	NR	NR	S3	I4	I4	I4
97. Diesel Fuel	I4	S4	I4	I4	I4	I4	S3	S3	S1	S1	S1	I1	I1	I1
98. Diethylamine (100%)	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	NR	NR	PV
99. Dimethyl Formamide	F4	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	I4	NR	PV
100. Esters, Fatty Acids	S4	PV	I4	I4	I4	I4	PV	PV	PV	S4	PV	I3	I3	I3
101. Ethyl Acetate	F4	NR	NR	NR	NR	NR	F1	F1	S4	S4	S4	NR	NR	NR
102. Ethyl Alcohol	S4	S4	I4	I4	I4	I4	I4	I4	S4	S4	S4	I4	I4	I4
103. Ethylamine	NR	NR	NR	NR	PV	PV	NR	NR	PV	PV	PV	NR	NR	PV
104. Ethylchloroformate	F4	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	PV	NR	PV
105. Ethyl Ether	F4	NR	NR	NR	PV	PV	NR	F4	S4	S4	S4	PV	PV	PV
106. Ethylene Dichloride	F4	NR	NR	NR	NR	NR	NR	F4	NR	NR	NR	PV	NR	NR
107. Ethylene Glycol	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
108. Ethylene Oxide	F4	NR	PV	PV	PV	PV	PV	PV	PV	PV	S1	PV	PV	PV
109. Ethyl Sulfate	F4	PV	PV	PV	PV	PV	PV	PV	S4	S4	NR	I4	I4	I4
110. Ferric Chloride	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	NR	I1	I1	I1
111. Ferric Sulfate	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
112. Ferrous Chloride	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
113. Ferrous Sulfate	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
114. Fluoboric Acid*	F4	PV	S4	S4	S4	S4	PV	PV	S4	S4	S4	NR	PV	NR

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	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
115. Fluorine Gas*	NR	NR	NR	NR	NR	NR	NR	NR	PV	PV	PV	NR	PV	PV
116. Fluosilicic Acid*	F4	PV	S4	S4	S4	S4	PV	PV	S4	S4	S4	NR	PV	NR
117. Formaldehyde	F4	F4	I4	I4	I4	I4	F4	F4	S1	S1	S1	I1	I1	I1
118. Formic Acid	F4	NR	S4	S4	S4	I4	PV	PV	NR	NR	S4	I4	I4	I4
119. Fuel Oil 1 & 2	S1	S4	I4	I4	I4	I4	NR	NR	S1	S1	S1	I1	I1	I1
120. Furfural	F4	NR	S4	S4	S4	S4	PV	PV	PV	PV	PV	NR	PV	PV
121. Furfural Alcohol	S4	PV	S4	S4	S4	S4	S4	S4	S1	S1	S1	I4	I4	I4
122. Gasoline	I4	I4	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
123. Glucose	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
124. Gluconic Acid (50%)	PV	PV	F4	F4	S4	S4	PV	PV	PV	PV	S4	S4	S4	I4
125. Glycol	I4	I4	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
126. Glycolic Acid	NR	NR	S4	S4	S4	S4	F1	F1	S4	S4	S4	I3	I3	I3
127. Gold Plating (Cyanide)	S4	S4	S1	S1	S1	I3	S1	S1	S1	S1	S4	I4	I4	I3
128. Grape Juice	I3	I3	I3	I3	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
129. Green Liquor	S4	S4	I4	I4	I3	I3	I1	I1	S1	S1	S3	I1	I1	I1
130. Heptane	S4	S4	S1	S1	S1	S1	I4	I4	S1	S1	S1	I2	I2	I2
131. Heptanoic Acid	PV	PV	S4	S4	S4	S4	F1	F1	PV	PV	I3	I3	I3	I3
132. Hexane	F4	F4	S1	S1	S1	S1	I4	I4	S1	S1	S1	I2	I2	I2
133. Hydrazine (35%)	F4	PV	NR	NR	NR	NR	NR	NR	S4	S4	S4	NR	NR	NR
134. Hydraulic Fluid	S4	PV	PV	PV	I3	I3	PV	PV	S1	S1	S1	PV	PV	I1
135. Hydriodic Acid (20%)	F4	F4	S4	S4	S4	I4	S1	S1	PV	PV	S4	I4	I4	I4
136. Hydrobromic Acid (20%)	F4	F4	S4	S4	S4	S4	S1	S1	PV	S4	S4	I4	I4	I4
137. Hydrocarbons (Aliphatic)	S4	PV	I4	I4	I4	I4	I1	I4	S1	S1	S4	I1	I1	I1
138. Hydrocarbons (Aromatic)	S4	PV	PV	PV	F4	F4	NR	NR	S4	S4	S4	PV	PV	I1
139. Hydrochloric Acid (1-25%)	S4	F4	S3	S3	S3	I3	F1	F1	S4	S4	S4	I1	I1	I1
140. Hydrochloric Acid (25-37%)	F4	NR	F3	F3	F3	I4	F1	F1	S4	S4	S4	PV	PV	I2
141. Hydrofluoric Acid (1-10%)*	NR	NR	F3	NR	F3	F3	NR	NR	NR	NR	NR	NR	NR	NR
142. Hydrofluoric Acid (10-53%)*	NR	NR	F4	NR	F4	F4	NR	NR	NR	NR	NR	NR	NR	NR
143. Hyrofluosilicic Acid*	F4	F4	F3	NR	F3	F3	PV	PV	NR	NR	NR	I2	PV	NR
144. Hydrogen Bromide	F4	PV	PV	PV	F1	F1	PV	PV	PV	PV	S4	PV	PV	I4
145. Hydrogen Peroxide (30%)	S4	NR	PV	PV	F4	I4	PV	PV	NR	S4	S4	PV	PV	I4
146. Hydrogen Sulfide	S1	S4	I4	I4	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
147. Hypochlorous Acid	NR	NR	NR	NR	F3	F3	NR	NR	NR	S4	S4	NR	NR	NR
148. Iodine	NR	NR	F4	F4	F3	F3	F1	F1	PV	S4	S4	I4	I4	I3
149. Insecticides	S4	PV	PV	PV	F4	F4	PV	PV	PV	S4	S3	PV	PV	I3
150. Isophorone	S4	PV	PV	PV	PV	PV	PV	PV	S4	S4	PV	I4	I4	I4
151. Isopropyl Acetate	F4	NR	NR	NR	NR	NR	PV	PV	S4	S4	NR	PV	PV	S4
152. Isopropyl Alcohol	S4	S4	PV	PV	S4	S4	PV	PV	S1	S1	S1	I1	I1	I1
153. Isopropyl Amine	F4	PV	PV	PV	F4	F4	NR	NR	PV	PV	NR	PV	PV	S4
154. Isopropyl Ether	S4	S4	PV	PV	F4	F4	NR	NR	S4	S4	S4	I4	I4	I4
155. Jet Fuel	I4	I4	I4	I4	I4	I4	F1	F1	S1	S1	S1	I1	I1	I1
156. Kaolin	I1	I1	PV	PV	I1	I1	I1	I1	I1	I1	I1	PV	PV	I1
157. Kerosene	I4	I4	I4	I4	I4	I4	I1	I4	S1	S1	S1	I1	I1	I1
158. Lasso Herbicide (10%)	F4	PV	S4	S4	S4	S4	F4	F4	PV	S4	S4	I4	I4	I4
159. Lactic Acid (1-20%)	S4	F4	I4	I4	I4	I3	S1	S1	S4	S4	S1	I1	I1	I1
160. Lactic Acid (20%-Con)	S4	NR	S4	S4	I4	I3	S1	S1	NR	S4	S4	I4	I3	I3
161. Lauric Acid	F4	PV	I4	I4	I3	I3	S1	S1	NR	S3	S1	I1	I1	I1
162. Lead Acetate	I4	I4	I4	I4	I3	I3	F1	F1	S1	S1	S1	I1	I1	I1
163. Linseed Oil	S3	S3	I1	I1	I1	I1	I1	I1	S4	S4	S1	I1	I1	I1
164. Magnesium Sulfate	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
165. Maleic Acid	S3	S3	S3	S3	S1	I4	S1	S1	S1	S1	S4	I3	I3	I1
166. Manganese Salts	I4	I4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
167. Mercury Salts	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
168. Methyl Alcohol	S4	NR	PV	PV	F4	F4	NR	S4	S4	S4	S1	I4	I4	I4
169. Methyl Acetate	F4	NR	NR	NR	F4	F4	PV	PV	S4	S4	S4	PV	PV	PV
170. Methylene Chloride	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
171. Methyl Chloride	NR	NR	NR	NR	NR	NR	NR	S4	NR	NR	NR	NR	NR	NR

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	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
172. Methyl Ethyl Ketone	NR	NR	NR	NR	NR	NR	NR	NR	PV	S4	NR	PV	PV	NR
173. Methyl Isobutyl Ketone	F4	NR	NR	NR	NR	NR	NR	NR	S4	S4	S4	PV	PV	NR
174. Milk Products	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
175. Mineral Oil	I4	I4	I4	I4	I4	I4	S4	S4	S1	S1	S1	I1	I1	I1
176. Molasses	I4	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
177. Naphthalene	S4	S4	S4	S4	S3	S3	S4	S4	S4	S4	S4	I4	I4	I3
178. Naphtha	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I3	I1	I1
179. Naphthenic Acid	PV	PV	I4	I4	PV	PV	PV	PV	S4	S4	PV	I4	I4	PV
180. Nickel Chloride	S4	S4	S4	S4	S4	S4	S4	S4	S1	S1	S1	I1	I1	I1
181. Nickel Plating (Bright)	S4	S4	S4	S4	S4	I4	I4	I4	S1	S1	S1	I1	I1	I1
182. Nickel Salts	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
183. Nitric Acid (5%)	S4	S4	S3	S3	I3	I4	S4	S4	S4	S4	S1	I3	I3	I2
184. Nitric Acid (10%)	S4	S4	S3	S3	I3	I4	S4	S4	S4	S4	S1	I3	I3	I2
185. Nitric Acid (20%)	NR	NR	F4	F4	F4	F3	NR	NR	NR	S4	S2	I4	I4	I4
186. Nitric Acid (40%)	NR	NR	F4	F4	F4	F3	NR	NR	NR	S4	S4	I4	I4	I4
187. Nitric Acid (60%)	NR	NR	NR	NR	F4	F4	NR	NR	NR	NR	S4	S4	S4	S4
188. Nitric Acid (Conc.)*	NR	NR	NR	NR	F4	F4	NR	NR	NR	NR	NR	NR	NR	F4
189. Nitrobenzene	NR	NR	NR	NR	NR	NR	NR	S4	PV	PV	NR	PV	PV	PV
190. Nitrous Acid	NR	NR	PV	PV	PV	PV	PV	PV	PV	PV	S3	I3	I3	I2
191. Octanoic Acid	F4	F4	S4	S4	S3	I4	PV	PV	PV	PV	S3	I4	I4	I4
192. Oils (Animal)	I1	I1	I1	I1	S1	S1	I1	I1	S1	S1	S1	I1	I1	I1
193. Oils (Mineral)	I1	I1	I1	I1	S1	S1	I1	I1	S1	S1	S1	I1	I1	I1
194. Oils (Vegetable)	I1	I1	I1	I1	S1	S1	I1	I1	S1	S1	S1	I1	I1	I1
195. Oleic Acid	F4	NR	I4	I4	I3	I3	NR	NR	S4	S4	S1	I1	I2	I1
196. Oxalic Acid (Sat'd)	S4	S4	I4	I4	I3	I3	S1	S1	S1	S1	S1	I3	I1	I1
197. Ozone	S4	PV	PV	PV	I2	I2	S3	S3	S1	S1	S1	PV	PV	S4
198. Palmitic Acid	PV	PV	S4	S4	S3	S3	PV	PV	PV	PV	S4	I1	I1	I1
199. Pentachlorethane	PV	PV	PV	PV	S1	S1	PV	PV	S1	S1	S4	PV	PV	S1
200. Perchloric Acid	NR	NR	PV	PV	F4	F4	PV	PV	S1	S1	S1	PV	PV	PV
201. Perchlorethylene	F4	NR	NR	NR	F4	F4	NR	S4	S4	S4	S4	S4	PV	S4
202. Phenol (0%-10%)	NR	NR	PV	PV	F4	F4	NR	NR	S4	S4	S2	PV	PV	PV
203. Phenol (85%)	NR	NR	NR	NR	F4	F4	NR	NR	PV	S4	PV	NR	NR	PV
204. Phosphoric Acid (Conc.)	F4	NR	S3	S3	S1	I4	NR	NR	S4	S4	S1	I1	I1	I1
205. Phosphorous Oxychloride	NR	NR	PV	PV	F4	F4	PV	PV	S4	S4	S4	PV	PV	PV
206. Phosphorous Trichloride	NR	NR	PV	PV	F4	F4	PV	PV	S4	S4	PV	PV	PV	PV
207. Phthalic Acid	NR	PV	S1	S1	S1	S1	PV	PV	PV	PV	S1	I1	I1	I1
208. Potassium Bichromate	S4	S4	I4	I4	I4	I3	S4	S4	S4	S4	S1	I4	I4	I1
209. Potassium Bromate	S4	S4	I4	I4	I4	I4	I4	I4	S4	S4	S1	I4	I4	I4
210. Potassium Bromide	S4	S4	I4	I4	I4	I3	I4	I4	PV	S4	S1	I1	I1	I1
211. Potassium Carbonate	I4	I4	PV	PV	I4	I3	I4	NR	S1	S1	S1	I4	I4	I4
212. Potassium Chlorate	S4	S4	I4	I4	I4	I3	I4	NR	S1	S1	S1	I1	I1	I1
213. Potassium Chloride	I4	I1	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
214. Potassium Cyanide	S4	S4	I4	I4	PV	I4	I4	I4	S1	S1	S1	I1	I1	I1
215. Potassium Hydroxide (10%)*	I4	S4	S1	S1	I4	I4	I4	NR	S1	S1	S1	I4	I4	I4
216. Potassium Hydroxide (Conc.)*	I4	S4	NR	S4	S4	S4	S1	NR	S1	S1	S1	NR	NR	NR
217. Potassium Nitrate	I4	I4	I4	I4	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
218. Potassium Permanganate	I4	I4	I4	I4	I3	I3	S1	S1	S1	S1	S1	PV	I1	I1
219. Potassium Peroxide	S4	S4	S4	S4	PV	PV	F4	F4	S1	S1	PV	I4	I4	I4
220. Potassium Persulfate	S4	S4	I4	I4	I3	I3	S1	S1	S1	S1	S1	I1	I1	I1
221. Potassium Sulfate	S4	S4	I4	I4	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
222. Pulpstock Chlorinated	NR	NR	S4	S3	S3	S3	NR	NR	NR	S3	S4	S4	S4	S4
223. Propionic Acid	NR	NR	NR	NR	F4	F4	NR	NR	PV	PV	PV	PV	NR	PV
224. Propylene Glycol	S4	NR	I3	I3	I3	I3	I4	I4	S4	S4	S4	I4	I4	I3
225. Pyridine	NR	NR	NR	NR	F4	F4	NR	NR	NR	NR	NR	NR	NR	NR
226. Salicylic Acid	S1	S1	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
227. Seawater	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
228. Silver Nitrate	S1	S1	S1	S1	S1	S1	PV	PV	S1	S1	S1	I1	I1	I1

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	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
172. Methyl Ethyl Ketone	NR	NR	NR	NR	NR	NR	NR	NR	PV	S4	NR	PV	PV	NR
173. Methyl Isobutyl Ketone	F4	NR	NR	NR	NR	NR	NR	NR	S4	S4	S4	PV	PV	NR
174. Milk Products	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
175. Mineral Oil	I4	I4	I4	I4	I4	I4	S4	S4	S1	S1	S1	I1	I1	I1
176. Molasses	I4	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
177. Naphthalene	S4	S4	S4	S4	S3	S3	S4	S4	S4	S4	S4	I4	I4	I3
178. Naphtha	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I3	I1	I1
179. Naphthenic Acid	PV	PV	I4	I4	PV	PV	PV	PV	S4	S4	PV	I4	I4	PV
180. Nickel Chloride	S4	S4	S4	S4	S4	S4	S4	S4	S1	S1	S1	I1	I1	I1
181. Nickel Plating (Bright)	S4	S4	S4	S4	S4	I4	I4	I4	S1	S1	S1	I1	I1	I1
182. Nickel Salts	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
183. Nitric Acid (5%)	S4	S4	S3	S3	I3	I4	S4	S4	S4	S4	S1	I3	I3	I2
184. Nitric Acid (10%)	S4	S4	S3	S3	I3	I4	S4	S4	S4	S4	S1	I3	I3	I2
185. Nitric Acid (20%)	NR	NR	F4	F4	F4	F3	NR	NR	NR	S4	S2	I4	I4	I4
186. Nitric Acid (40%)	NR	NR	F4	F4	F4	F3	NR	NR	NR	S4	S4	I4	I4	S4
187. Nitric Acid (60%)	NR	NR	NR	NR	F4	F4	NR	NR	NR	NR	S4	S4	S4	S4
188. Nitric Acid (Conc.)*	NR	NR	NR	NR	F4	F4	NR	NR	NR	NR	NR	NR	NR	F4
189. Nitrobenzene	NR	NR	NR	NR	NR	NR	NR	S4	PV	PV	NR	PV	PV	PV
190. Nitrous Acid	NR	NR	PV	PV	PV	PV	PV	PV	PV	PV	S3	I3	I3	I2
191. Octanoic Acid	F4	F4	S4	S4	S3	I4	PV	PV	PV	PV	S3	I4	I4	I4
192. Oils (Animal)	I1	I1	I1	I1	S1	S1	I1	I1	S1	S1	S1	I1	I1	I1
193. Oils (Mineral)	I1	I1	I1	I1	S1	S1	I1	I1	S1	S1	S1	I1	I1	I1
194. Oils (Vegetable)	I1	I1	I1	I1	S1	S1	I1	I1	S1	S1	S1	I1	I1	I1
195. Oleic Acid	F4	NR	I4	I4	I3	I3	NR	NR	S4	S4	S1	I1	I2	I1
196. Oxalic Acid (Sat'd)	S4	S4	I4	I4	I3	I3	S1	S1	S1	S1	S1	I3	I1	I1
197. Ozone	S4	PV	PV	PV	I2	I2	S3	S3	S1	S1	S1	PV	PV	S4
198. Palmitic Acid	PV	PV	S4	S4	S3	S3	PV	PV	PV	PV	S4	I1	I1	I1
199. Pentachlorethane	PV	PV	PV	PV	S1	S1	PV	PV	S1	S1	S4	PV	PV	S1
200. Perchloric Acid	NR	NR	PV	PV	F4	F4	PV	PV	S1	S1	S1	PV	PV	PV
201. Perchlorethylene	F4	NR	NR	NR	F4	F4	NR	S4	S4	S4	S4	S4	PV	S4
202. Phenol (0%-10%)	NR	NR	PV	PV	F4	F4	NR	NR	S4	S4	S2	PV	PV	PV
203. Phenol (85%)	NR	NR	NR	NR	F4	F4	NR	NR	PV	S4	PV	NR	NR	PV
204. Phosphoric Acid (Conc.)	F4	NR	S3	S3	S1	I4	NR	NR	S4	S4	S1	I1	I1	I1
205. Phosphorous Oxychloride	NR	NR	PV	PV	F4	F4	PV	PV	S4	S4	S4	PV	PV	PV
206. Phosphorous Trichloride	NR	NR	PV	PV	F4	F4	PV	PV	S4	S4	PV	PV	PV	PV
207. Phthalic Acid	NR	PV	S1	S1	S1	S1	PV	PV	PV	PV	S1	I1	I1	I1
208. Potassium Bichromate	S4	S4	I4	I4	I4	I3	S4	S4	S4	S4	S1	I4	I4	I1
209. Potassium Bromate	S4	S4	I4	I4	I4	I4	I4	I4	S4	S4	S1	I4	I4	I4
210. Potassium Bromide	S4	S4	I4	I4	I4	I3	I4	I4	PV	S4	S1	I1	I1	I1
211. Potassium Carbonate	I4	I4	PV	PV	I4	I3	I4	NR	S1	S1	S1	I4	I4	I4
212. Potassium Chlorate	S4	S4	I4	I4	I4	I3	I4	NR	S1	S1	S1	I1	I1	I1
213. Potassium Chloride	I4	I1	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
214. Potassium Cyanide	S4	S4	I4	I4	PV	I4	I4	I4	S1	S1	S1	I1	I1	I1
215. Potassium Hydroxide (10%)*	I4	S4	S1	S1	I4	I4	I4	NR	S1	S1	S1	I4	I4	I4
216. Potassium Hydroxide (Conc.)*	I4	S4	NR	S4	S4	S4	S1	NR	S1	S1	S1	NR	NR	NR
217. Potassium Nitrate	I4	I4	I4	I4	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
218. Potassium Permanganate	I4	I4	I4	I4	I3	I3	S1	S1	S1	S1	S1	PV	I1	I1
219. Potassium Peroxide	S4	S4	S4	S4	PV	PV	F4	F4	S1	S1	PV	I4	I4	I4
220. Potassium Persulfate	S4	S4	I4	I4	I3	I3	S1	S1	S1	S1	S1	I1	I1	I1
221. Potassium Sulfate	S4	S4	I4	I4	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
222. Pulpstock Chlorinated	NR	NR	S4	S3	S3	S3	NR	NR	NR	S3	S4	S4	S4	S4
223. Propionic Acid	NR	NR	NR	NR	F4	F4	NR	NR	PV	PV	PV	PV	NR	PV
224. Propylene Glycol	S4	NR	I3	I3	I3	I3	I4	I4	S4	S4	S4	I4	I4	I3
225. Pyridine	NR	NR	NR	NR	F4	F4	NR	NR	NR	NR	NR	NR	NR	NR
226. Salicylic Acid	S1	S1	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
227. Seawater	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
228. Silver Nitrate	S1	S1	S1	S1	S1	S1	PV	PV	S1	S1	S1	I1	I1	I1

*May need synthetic fabric, or carbon fillers. Consult a Dudick Corrosion-Proof, Inc. technical representative for more complete information on these products.

Dudick

Key

- I — Material will withstand constant flow or immersion service
- S — Material is suitable for intermittent or Spillage service
- F — Material will tolerate fumes only

	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
229. Sodium Acetate	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
230. Sodium Bicarbonate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
231. Sodium Bisulfate	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
232. Sodium Bisulfite	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
233. Sodium Bromate	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
234. Sodium Carbonate (see soda ash)	I4	I4	I4	I4	I3	I3	I1	NR	S1	S1	S4	I1	I1	I1
235. Sodium Chlorate	NR	PV	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
236. Sodium Chloride	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1
237. Sodium Chlorite (50%)	NR	NR	S4	S4	S3	S3	S4	S4	S4	S4	S4	I4	I4	I3
238. Sodium Chromate	S4	S4	I4	I4	I3	I3	S4	S4	S1	S1	S1	PV	PV	I1
239. Sodium Cyanide	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
240. Sodium Dichromate	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	PV	I4	I3
241. Sodium Fluoride*	S4	S4	NR	NR	I4	I4	PV	PV	S4	S4	S4	NR	NR	NR
242. Sodium Hydroxide (10%)*	I4	S4	S1	S1	I1	I1	I1	NR	S1	S1	S1	NR	NR	NR
243. Sodium Hydroxide (50%)*	I4	S4	S1	S1	I1	I4	I1	NR	S1	S1	S4	NR	NR	NR
244. Sodium Hypochlorite (3%)*	F4	F4	NR	S4	S4	S4	F1	NR	S3	S3	S1	NR	I4	I4
245. Sodium Hypochlorite (17%)	NR	NR	NR	PV	S4	S4	NR	NR	S4	S4	S4	NR	PV	S4
246. Sodium Peroxide	S4	S4	I4	I4	I4	I4	I1	I1	S4	S4	NR	PV	PV	S4
247. Sodium Phosphate	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
248. Sodium Sulfate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
249. Sodium Sulfide	S4	S4	PV	PV	I4	I3	I1	I1	S1	S1	S1	I4	I4	I4
250. Sodium Sulfite	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
251. Sodium Tartrate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
252. Sodium Thiosulfate (Hypo)	I4	S4	I4	I4	I3	I3	S1	NR	S1	S1	S1	I1	I1	I1
253. Soybean Oil	PV	PV	I4	I4	I3	I3	I1	I1	PV	S1	S1	I1	I1	I1
254. Stearic Acid	S4	S4	PV	PV	I4	I4	PV	PV	S4	S4	S1	I2	I2	I2
255. Succinic Acid	S4	F4	PV	PV	I4	I4	PV	PV	S3	S3	S3	I4	I4	I4
256. Sugar	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
257. Sulfite Liquor (Paper)	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
258. Sulfur Dioxide	F1	F1	S4	I4	I4	I4	I1	I1	S1	S1	S1	F4	I1	I1
259. Sulfur Trioxide	F4	F4	PV	PV	S4	S3	S1	S1	S1	S1	S1	I4	I4	I4
260. Sulfuric Acid (2%-20%)	S1	S4	S1	S1	S1	S1	S1	S1	S3	S3	S1	I1	I1	I1
261. Sulfuric Acid (20%-50%)	S1	F4	S1	S1	S1	S1	F1	F1	S4	S4	S1	I3	I3	I2
262. Sulfuric Acid (50%-70%)	S1	F4	F3	F3	F1	F1	F4	F4	NR	S4	NR	I4	I4	I2
263. Sulfuric Acid (70%-80%)	S1	NR	NR	NR	NR	NR	NR	NR	NR	S4	NR	PV	PV	PV
264. Sulfuric Acid (80%-98%)	S1	NR	NR	NR	NR	NR	NR	NR	NR	S4	NR	NR	NR	NR
265. Sulfurous Acid	S4	S4	I4	I4	I4	I3	S4	S4	S4	S4	S1	I1	I1	I1
266. Tall Oil	I4	S4	I4	I4	I4	I3	I1	I1	S4	S4	S1	I1	I1	I1
267. Tannic Acid	S4	PV	I4	I4	I4	I4	PV	PV	S4	S4	S4	I1	I1	I1
268. Tartaric Acid	U4	I4	I4	I4	I3	I3	S1	S1	S1	S1	S1	I1	I1	I1
269. Tetrachlorethane	F4	PV	NR	NR	F4	F4	NR	S4	S4	S4	NR	PV	PV	PV
270. Thionyl Chloride	NR	NR	NR	NR	NR	NR	NR	S4	NR	NR	NR	NR	NR	NR
271. Titanium Tetrachloride	S4	F4	I4	I4	I3	I3	S4	S4	S1	S1	S1	I1	I1	I1
272. Toluene	F4	NR	NR	NR	F4	F4	NR	S4	S4	S4	NR	S4	S4	S4
273. Toluene Sulfonic Acid	S3	S3	I4	I4	I3	I3	S4	S4	S1	S1	S1	I1	I1	I1
274. Trichloroacetic Acid (20%)	NR	NR	F4	F4	I4	I3	F4	F4	NR	NR	S1	I4	I4	I4
275. Trichloroethylene	NR	PV	NR	NR	F4	F4	NR	S4	S4	S4	NR	PV	PV	PV
276. Trisodium Phosphate	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S4	I3	I3	I3
277. Turpentine	S4	S4	PV	PV	I4	I4	NR	I1	S1	S1	NR	PV	PV	PV
278. Tween Surfactants	PV	PV	I4	I4	I4	I4	PV	PV	S1	S1	S1	I1	I1	I1
279. Urea Solutions	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
280. Vinegar	S4	F4	I1	I1	I1	I1	I4	I4	S1	S1	S1	I1	I1	I1
281. Water, distilled & demineralized	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
282. White Liquor (Paper)	I4	I4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
283. Xylene (Xylol)	S4	NR	NR	NR	NR	NR	NR	I1	S4	S4	NR	I4	I4	I4
284. Zinc Salt	I4	I4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
285. Zinc Plating (Acid Sulfate)	S3	S3	I4	I4	I3	I3	S1	S1	S1	S1	S1	I1	I1	I1

*May need synthetic fabric, or carbon fillers. Consult a Dudick Corrosion-Proof, Inc. technical representative for more complete information on these products.

HOYER-SCHLESINGER-TURNER inc.
ENGINEERS - CONSTRUCTORS
300 west adams street chicago illinois 60606 telephone 263-0556 area code 312

July 25, 1995

Mr. Paul Ahearn
Manager, Regulatory Compliance
CLEAN HARBORS OF CHICAGO, INC.
11800 South Stony Island Avenue
Chicago, Illinois 60617

Re: Unit #16 Piping System Inspection Report
11700 S. Stony Island Avenue
Chicago, Illinois 60617
HST Project No. 17851

Gentlemen:

On July 15, July 18 and July 19, 1995 I witnessed pressure testing of piping system for Unit #16 Tanks TK-101 thru TK-107, TK-109, TK-110 and TK-112.

The tanks discharge and fill lines will be insulated and heat traced at a later date. For this reason, the lines are provided with Rupture Disks. The emergency internal check valves were not installed on any line below normal liquid level.

The piping system installation meets secondary containment requirements per 40 CFR 264.193 (f) and requirements per IEPA Title 35, Subtitle G, Section 724.293 (f).

The tests were performed with water, at the minimum pressure of 100 psig.

For hydrostatic test record, see Appendix 16-P-1. The drawings showing tested lines are included in Appendix 16-P-2. Reference drawing 2916-F-07 is included in Appendix 16-P-3.

The following drawings for the piping system are included in Appendix 16-P-3:

CHCI Dwg. No.	Drawing No.	Name
4252	2916-P-01	Piping Arrangement - Flammable Storage Tank Farm - Unit #16
4207	2916-P-05	Process Flow, Piping & Instrumentation Diagram - Modified Fuels Blending Operation - Sheet 3 of 5
4207	2916-P-07	Process Flow, Piping & Instrumentation Diagram - Modified Fuels Blending Operation - Sheet 4 of 5
4207	2916-P-08	Process Flow, Piping & Instrumentation Diagram - Modified Fuels Blending Operation - Sheet 5 of 5
4251	2916-M-21	Rail Car & Truck Unloading - Area Unit #13 & #15

H-S-T

The as-built drawings ISO-List, ISO-Legend and ISO-001 thru ISO-016 are included in Appendix 16-P-4.

During the testing on July 18 and July 19, many of the flanged connections were leaking due to defective gaskets. The gaskets in all leaking connections will be replaced with Teflon gaskets and systems will be retested under plant engineer supervision. The Teflon gaskets are chemically compatible with waste material. See Appendix 16-P-5.

The 3" Ø C.S. line to rail car loading/unloading will be tested at a later date due to defective 3-way valve. The 3" Ø C.S. line P-167-DI from fuel blending, 3" Ø C.S. line P-163-DI to fuel blending and 2" Ø C.S. line P-DRUM-DI from Drum Consolidation will be tested at a later date.

Therefore, I hereby certify that after visual inspection of the piping system, witnessing hydro-testing and after all defects are corrected, the piping system could be put into operation.

Very truly yours,

HOYER-SCHLESINGER-TURNER, INC.
Consulting Engineers

Marie Vanagas

Marie Vanagas, PE
Project Engineer
Illinois No. 62-40801, Exp. 11/30/95

MARIE VANAGAS
62-40801
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

MV/ar
Encl.

CC: James R. Laubsted, CHI
Amos Turner, HST

APPENDIX

16-P-1

HYDROSTATIC TEST RECORD

Date 7-15-95

Clean Harbors of Chicago
11700 S. Stoney Island Ave
Chicago Il

Closed: V-577 V-591
V-578 V-618
V-579 V-614

Tank/line/valve tested:

Tank # 101 Valve # (s) Open: V-613

Process Line # (s) P-101D

Description: Discharge line from tank, 4"ϕ SCH 40S TP 316/TP SPEC. A 312

Drawing # 2916-F-08 REV 0

Applicable Specification Pipe SS 4" SCH 40S TP 316 A 312/SA/312

TEST PREPARATION:

YES Joints Accessible

N/A Expansion Joints Restrained

Removed ~~Relief Valves~~/Rupture discs isolated

N/A Low Press Equipment Isolated

YES System Supports Sufficient

YES System Vented

YES Connections Checked

YES Test Gauges in Place

N/A Recorder Serial #_____

TEST PARAMETERS:

Guage Range 0 PSIG to 300 PSIG (1-1/2 to 4 x test press)

Guage Calibration 1. I.D.#_____ Due Date_____

Test Pressure - Internal 100 PSIG External ATM PSIG

Test Medium - WATER Condition CHICAGO CITY WATER

Test Temperature ____F (70F min Sec I/60F min Sec 8, 11 & B31.1)

Ambient Temperature 97 F & 95% Humidity

HYDROSTATIC TEST RECORD

Date 7-15-95

Clean Harbors of Chicago
11700 S. Stoney Island Ave
Chicago Il

Tank/line/valve tested:

Closed: V-682 V-678
V-683 V-665
V-664 V-666

Tank # 102 Valve # (s) Open: V-681

Process Line # (s) P-102D

Description: Discharge line from Tank, incl. Discharge at different levels, 4"ϕ SCH40 ASTM A53B

Drawing # 2916-F-08 REV 0

Applicable Specification Pipe CS. ASTM A53B E 4"ϕ SCH. 40

TEST PREPARATION:

YES Joints Accessible

N/A Expansion Joints Restrained

Removed ~~Relief Valves~~/Rupture discs isolated

N/A Low Press Equipment Isolated

YES System Supports Sufficient

YES System Vented

YES Connections Checked

YES Test Gauges in Place

N/A Recorder Serial # —

TEST PARAMETERS:

Guage Range 0 PSIG to 300 PSIG (1-1/2 to 4 x test press)

Guage Calibration 1. I.D.# _____ Due Date _____

Test Pressure - Internal ~~100~~ 110 PSIG External ~~AMB.~~ PSIG

Test Medium - WATER Condition City Water

Test Temperature 70 F (70F min Sec I/60F min Sec 8, 11 & B31.1)

Ambient Temperature 98 F 97% Humidity

HYDROSTATIC TEST RECORD

Date 7-18-1995

Clean Harbors of Chicago
11700 S. Stoney Island Ave
Chicago Il

For open & closed valves see dwg. PT-003 and 2916-F-07

Tank/line/valve tested:

Tank # TK-101 & TK-107 Valve # (s) _____

Process Line # (s) P-101F, P-107D, P-107F, P-178S, P-178D

Description: Discharge and fill line to TK-107 and fill to TK-101, line to loading manifold

Drawing # PT-003/10 2916-F-07/0 REV —

Applicable Specification Pipe 3" & 4" SCH 40S ASTM A 312

TEST PREPARATION:

YES Joints Accessible

N/A Expansion Joints Restrained

Removed ~~Relief Valves~~/Rupture discs isolated

N/A Low Press Equipment Isolated

YES System Supports Sufficient

YES System Vented

YES Connections Checked

YES Test Gauges in Place

N/A Recorder Serial # _____

TEST PARAMETERS:

Guage Range 0 PSIG to 300 PSIG (1-1/2 to 4 x test press)

Guage Calibration 1. I.D.# N/A Due Date _____

Test Pressure - Internal 100 PSIG External ATM PSIG

Test Medium - WATER Condition city water

Test Temperature 70 F (70F min Sec I/60F min Sec 8, 11 & B31.1)

Ambient Temperature 88 F 75% RH

HYDROSTATIC TEST RECORD

Date 7-15-1995

Clean Harbors of Chicago
11700 S. Stoney Island Ave
Chicago Il

Closed: V-401 V-405 V-480
V-402 V-514 V-487
V-403 V-515 V-488
V-415 V-516 V-490
V-517

Tank/line/valve tested:

Tank # TK-103 Valve # (s) OPEN: V-489

Process Line # (s) P-103D & P-103F (Discharge + fill)

Description: 4" SCH 40, welded or flanged connections will be heat traced & insulated, ASTM A 5388, Tank discharge & fill

Drawing # PT-001/A 2916-F-05/0 2916-F-07/0 REV Included with Dwg. No.

Applicable Specification ASTM A 5388

TEST PREPARATION:

YES Joints Accessible

N/A Expansion Joints Restrained

Removed ~~Relief Valves~~/Rupture discs isolated

N/A Low Press Equipment Isolated

YES System Supports Sufficient

YES System Vented

YES Connections Checked

YES Test Gauges in Place

N/A Recorder Serial # —

TEST PARAMETERS:

Guage Range 0 PSIG to 300 PSIG (1-1/2 to 4 x test press)

Guage Calibration 1. I.D.# _____ Due Date _____

Test Pressure - Internal 100 PSIG External ATM PSIG

Test Medium - WATER Condition City Water

Test Temperature 65 F (70F min Sec I/60F min Sec 8, 11 & B31.1)

Ambient Temperature 97 F & 90% Humidity

HYDROSTATIC TEST RECORD

Date 7-15-95

Clean Harbors of Chicago
11700 S. Stoney Island Ave
Chicago Il

Tank/line/valve tested:

Tank # TK-104 Valve # (s) _____

Process Line # (s) P-104D & P-104F

Description: Tank Discharge & Fill, 4"ϕ SCH 40 ASTM 53B

Drawing # PT-001/A PT-002/A REV —

Applicable Specification CS. SCH40 ASTM 53B

TEST PREPARATION:

YES Joints Accessible

N/A Expansion Joints Restrained

Removed Relief Valves/Rupture discs isolated

N/A Low Press Equipment Isolated

YES System Supports Sufficient

YES System Vented

YES Connections Checked

YES Test Gauges in Place

N/A Recorder Serial # _____

TEST PARAMETERS:

Guage Range 0 PSIG to 300 PSIG (1-1/2 to 4 x test press)

Guage Calibration 1. I.D.# _____ Due Date _____

Test Pressure - Internal 105 PSIG External ATM PSIG

Test Medium - WATER Condition City of Chicago water

Test Temperature 70 F (70F min Sec I/60F min Sec 8, 11 & B31.1)

Ambient Temperature 98 F 97% humidity

HYDROSTATIC TEST RECORD

Date 7-18-95

Clean Harbors of Chicago
11700 S. Stoney Island Ave
Chicago Il

Tank/line/valve tested: See dwg PT-001, PT-002 & 2916-F-07

Tank # TK-103, TK-104, TK-105, TK-106, TK-109 Valve # (s) P-103F, P-104F, P-105F, P-106D, P-109F, P-163S

Process Line # (s) P-103D, P-104D, P-105D, P-106D, P-109D, P-160S, P-173S

Description: DRAINS, FILL LINES TO TK-103, TK-104, TK-105, TK-106 & TK-109 & DRAIN, FILL & LOADING MANIFOLD

Drawing # PT-001/0, PT-002/0, 2916-F-07/0 REV _____

Applicable Specification 4"ϕ & 3"ϕ CS ASTM A53B

TEST PREPARATION:

YES Joints Accessible

N/A Expansion Joints Restrained

Removed ~~Relief Valves~~/Rupture discs isolated

N/A Low Press Equipment Isolated

YES System Supports Sufficient

YES System Vented

YES Connections Checked

YES Test Gauges in Place

N/A Recorder Serial # _____

TEST PARAMETERS:

Guage Range 0 PSIG to 300 PSIG (1-1/2 to 4 x test press)

Guage Calibration 1. I.D.# N/A Due Date _____

Test Pressure - Internal 100 PSIG External ATM PSIG

Test Medium - WATER Condition City Water

Test Temperature 70 F (70F min Sec I/60F min Sec 8, 11 & B31.1)

Ambient Temperature 88 F 75% RH

APPENDIX

16-P-5

"Mirror Finish" TFE O-Rings

Why "Mirror Finish" O-Rings Are Better

"Mirror-Finish" TFE O-Rings are shiny-smooth without surface chips, threads or marks which might cause serious leakage.

This highest quality finish is designed to give a better initial seal with less break-in time and is offered for the first time at no extra cost. Observe a sample—you can see the difference!

TFE as an O-Ring

TFE has made such an outstanding record as a packing and gasket material that it is often considered for O-Ring applications.

The major handicap to the use of TFE as an O-Ring has been its inelasticity in comparison to rubber. This often creates a problem in switching from rubber or other elastomer to TFE O-Rings on equipment not designed to accommodate TFE, especially where the ring must be stretched and snapped into a groove or where compression set may be a problem.

There are several ways to simplify or eliminate this problem and in order to help the O-Ring user, a number of valuable suggestions are offered in this brochure for making proper use of TFE O-Rings in both dynamic (moving) and static (stationary) applications.

Superiority of TFE as an O-Ring Material

Though rubber O-Rings have been highly successful as a sealing means, TFE O-Rings are superior in several ways and in many applications involving heat or chemicals.

Virgin TFE	Rubber or other elastomer
Completely unaffected by all common fluids.	May be attacked and swelled by many oils, solvents and chemicals.
Softens but not burned at temperatures up to 500° F.	May harden or burn from excessive heat.
Friction is much lower. Lowest of any solid material. Static and dynamic coefficients are the same so there is no 'breakaway'.	Relatively high friction and "breakaway" particularly when dry.
Lubrication is less critical and may sometimes be omitted.	Lubrication desirable in dynamic applications.
No twisting or 'snaking' is encountered. Wear is uniform.	Tendency to twist, extrude, abrade or cut in dynamic application.

TFE O-Ring Squeeze and Groove Design

SEE ILLUSTRATION AT RIGHT FOR TYPICAL GROOVE DESIGN

Any "O" Ring handbook will give more detailed information on standard O-Ring squeeze and groove design.

Groove Design The grooves for TFE O-Rings are similar to those used for rubber, though the cross-sectional squeeze on the ring is less and the groove length is shorter.

These changes are occasioned by the relative stiffness of TFE and the fact that the rings roll very little.

Grooves with 5-degree sloping sides are easier to machine than grooves with straight sides and are usually satisfactory. The grooves should have a smooth machine finish—25 to 32 rms—and be free of imperfections. For the best seal and lowest friction, running and sealing surfaces should be 16 rms or less.

Ring Sizes Fluorocarbon O-Rings are made in a wider range of sizes than rubber O-Rings. The ARP 568* uniform O-Ring numbering system of the SAE is used by most manufacturers. However, because TFE O-Rings are ordinarily machined, O-Rings of special dimensions can be readily obtained.

ARP 568* DASH NUMBERS	NOMINAL ID RANGES IN INCHES	"W" DIMENSION CROSS SECTION DIAMETER (IN)	MINIMUM CROSS-SECT. SQUEEZE	GROOVE LENGTH
006 to 050	1/8 to 5-1/4	.070 ± .003	.005	.080
105 to 178	5/32 to 9-3/4	.103 ± .003	.006	.110
201 to 281	3/16 to 15	.139 ± .004	.007	.160
309 to 349	7/16 to 4-1/2	.210 ± .005	.008	.240
425 to 472	4-1/2 to 23	.275 ± .006	.010	.315

*Uniform Dash Numbering System for O-Rings, Aeronautical Recommended Practice, Society of Automotive Engineers Inc.

CHICAGO GASKETS OF TEFLON

PROPERTIES OF TFE GASKETS

CHEMICAL RESISTANCE—TFE gaskets are inert in acids, alkalis, salts and solvents. In fact, they are completely resistant to all industrial liquids and gases, with few exceptions.

PRESSURE LIMIT—With standard pipe flanges and flanged fittings TFE gaskets can normally be used to seal pressures up to 300 psi. For higher pressures, some confining arrangement such as tongue and groove or male and female is used. Pressure alone does not limit the use of TFE gaskets if proper selection of gaskets and flanges is made.

EFFECTIVE TEMPERATURE—TFE gaskets are noted for their excellent resistance to heat. They should not be used where the temperature will exceed 450°F without thorough testing by the user. TFE is also noted for its resistance to low temperature and has in many instances sealed LOX successfully at minus 320°F.

COMPRESSION CHARACTERISTICS—The mechanical properties of solid TFE gaskets are comparable to those of the best grade of compressed sheet packing. Thus gasket design for the two materials is similar.

The tendency for solid TFE gaskets to cold flow is not excessive and is usually encountered during the first few hours after the load is applied. Bolts should be re-tightened within 24 hours and checked periodically after that.

The mechanical properties of TFE envelope gaskets with compressed fillers is the same as for plain compressed gaskets. Cold flow is usually not a problem here. For softer fillers such as blue felt used on glass and glass-lined flanges, bolt loadings must be adjusted accordingly.

BOLT LOADINGS—Bolt Torques for CRT gaskets are published by DeDietrich (USA), Inc. Bulletin 501 and by Pfaudler Co. in Instruction Manual IM 81-100-3. Other data on gasket factors and bolt loadings will be found in the ASME Boiler Construction Code.

The gasket factor for Teflon is the same as that shown for asbestos with a suitable binder. The primary proof that torque values are adequate is the hydrostatic or gas-pressure test.

PRODUCT QUALITY CONTROL—TFE gaskets are odorless and tasteless and will never discolor or affect process fluids in any way. They are not deteriorated by sterilization, detergents or cleaning solvents.

VALUE OF TFE GASKETS—Gaskets are an expendable item in process equipment. Their cost must be measured in terms of service life and operating economies. Due to their long life TFE gaskets have an intrinsic value far greater than their purchase cost. A batch saved, a purer product, the elimination of leakage problems and shut downs generates savings far greater than the cost of the gaskets themselves. The rapidly increasing use of "Chicago" TFE gaskets proves their economy and reliability.

TFE SPAN—With the proper selection of gaskets and flanges TFE gaskets will outlast non-TFE types by many times, in the strongest solutions.

CONSTRUCTION INFORMATION

WHERE TO USE TFE GASKETS—They may be used to seal, hot or cold:

- All concentrated and dilute acids
- Caustic alkalis and salts
- All solvents, hydrocarbons and their derivatives
- Organic and inorganic compounds of all types

TFE ENVELOPE GASKETS—They are made by flanging a TFE envelope or jacket over the inner edge of a resilient filler gasket of circular or elliptical shape. They can usually be substituted directly for other gasket simply by selecting the proper filler listed herein.

Fillers are available in different degrees of softness and thickness for use on metal flanges and fittings as well as glass, glass-lined steel and other pipe flange materials.

Envelope construction as an alternative to solid TFE is often used for reasons for economy, serviceability or availability.

MACHINED TFE ENVELOPES—(Also known as "Milled Center" or "Full Flow".) For these lathe machined envelopes the TFE is milled out between the leaves to provide a space for the proper thickness of filler. The envelope provides a close fit on the inside diameter of the filler so that minimal air is trapped between filler and envelope, thus minimizing fracturing of the leaves. Also the inside diameter of this gasket is usually the same as the pipe size so that a better flow results in the pipe. There is less entrapment of fluids and solids than occurs when the slit envelope design is used.

SLIT TFE ENVELOPES—For ring gaskets up to 20" ID the envelopes are made by slit lathe cutting from TFE tubing. These envelopes are never welded at the ID but are made solid from a single piece of material and split into two leaves.

"SEAMLESS"™ TFE SHIELDS OR ENVELOPES—For all large envelope gaskets and for all ovals such as manway and hand-hole gaskets, the envelopes can be made from tape which has been skived from molded virgin TFE tube and formed to the shape of the gasket filler. The ends are fused to form a single-thickness closure which is stronger than the envelope itself.

FILLER MATERIALS—A choice of filler materials is available as indicated in this catalog; the most popular being non-asbestos. Occasionally a fabric-reinforced neoprene is used.

STANDARD RING GASKETS—Ring gaskets cover the face of the flange to the inside edge of the bolts and are always furnished unless full face gaskets are specified.

FULL FACE GASKETS—Available in solid TFE or in TFE envelope type. Full face fillers with bolt holes are usually supplied with ring-type envelopes. Full TFE coverage is also available in a number of sizes if specified.

SPECIAL RING GASKETS—All solid and envelope type gaskets are available for use with special diameter flanges. Users should provide detailed information on dimensions required and the filler materials desired.

CHICAGO GASKET COMPANY *"Technicians in Teflon®"*

1285 W. NORTH AVE., CHICAGO, IL 60622 • CALL TOLL FREE OUTSIDE ILLINOIS 1-800-833-5666
IN ILLINOIS 312-486-3060 • FOR FAST RESPONSE FAX US AT 1-312-486-3784

"Seamless" ™ Chicago Gasket Co. "Teflon" DuPont Reg. T.M.

H-S-T

UNIT #25

Unit #25 - Container Management Building is an existing structure. There is no change in usage of the building. Building #25 is 200 ft. long and 28 ft. wide and has a 6" thick reinforced concrete floor slab. It will store containers with PCB poisons and acids and alkaline/poisons in separated containment sections divided by 6" high curbs. For dividing curbs location (new and existing), locations of stored drums, secondary containment calculations and other details, see as-built CHCI Dwg. No. 4210 (2916-M-19) in Appendix 25-1. For information on the floor slab and foundations, see CWM Chemical Services Dwg. No. O-B-019 in Appendix 25-1. The drawing indicates the floor to be 6" floating concrete slab with a 6" high curb on the perimeter. For structural calculations, see Appendix 25-2. An assumption was made for the floor slab reinforcing based on minimum reinforcement for shrinkage.

The secondary containment calculations are included in as-built drawing, CHCI Dwg. No. 4210 (2916-M-19).

The structure was built in 1982. Previous inspections reveal numerous cracks in the concrete secondary containment slab. The cracks appear to be of the shrinkage type. These types of cracks typically do not continue to expand after original stress from shrinkage has been relieved. The cracks were routed out and filled with Protecto-Crete 900. Prior to the application of Primer 27, the entire surface was cleaned and the existing coating was mechanically removed. The final floor coating is Protecto-Crete, 1/4" thick. Primer 27, Protecto-Crete is manufactured by Dudick, Inc. The dike walls coating is specified on Drawing 2916-M-19. See Appendix 16-T-7 for technical information and chemical resistance chart. The repair of cracks and application of coating was witnessed by HST Licensed Structural Engineer, Peter Bernes.

The final visual inspection of the containment did not reveal any cracks, gaps, scratches or other damage. The dike wall between Alkalines/Poisons and acids will be coated prior to usage of the building.

APPENDIX

25-2

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, IL
SUBJECT EXIST. DRUM STORAGE BLDG. # 25

SHEET 1 OF 3
PROJECT NO. 1785
DATE 10.24.94
BY BERNES

FOR CERTIFICATION

REF.: CWM CHEMICAL SERVICES, INC DWG. No. 0-B-019
CLEAN HARBORS ENVIR. SERV., INC DWG No. 2916-M-19

1.) CONTAINMENT CALCULATIONS:

BUILDINGS FLOOR SLAB IS SUBDIVIDED INTO 3 SEPARA. SECTIONS. EACH SECTION IS SEPARATED BY 6"x8" CURB

1ST SECTION CONTAINS 128 DRUMS
2ND " " 472 " WITH ROLL-OFF
3RD " " 336 "

FOR CALCULATIONS SEE DWG. 2916-M-19

2.) STRUCTURAL ANALYSIS OF EXIST 6" CONC. SLAB

LOADING: 4.0 SQ. PALLET AREA SUPPORTS 8 DRUMS

8 DRUMS x (55 GAL x 1.5 SP. GR. x 8.36 #/GAL + 50# DRUMS + PALLET

TOTAL LOAD = 5920 #

FLOOR SLAB LOADING = 5920#/4x4 = 380 PSF.

SLAB THICKNESS OF 6" REINF. W/ONE LAYER OF WWF 6x6 - W2.9 x W2.9 IS CAPABLE TO SUPPORT 450 PSF < 380 PSF O.K.
(SEE PORTLAND CEMENT ASSOC. TABLE FOR SLABS ON GROUND BY CRSI PG. 14-11 - SHEET #3

3) FORK LIFT TRUCK LOADING

LIFT TRUCK = 10,000 #
LOAD = 6,000 #
TOTAL = 16,000 #

85% ON DRIVE AXLE = 13,600 #

WHEEL LOAD W/30% IMPACT = 8,800 #

CONTACT AREA = 7.5" x 7.5" = 57 IN²

CONCRETE WORKING STRESS

$$WS = \frac{MR}{SF} = 640/2 = 320 \text{ PSI}$$

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes
PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11-30-94

HOYER-SCHLESINGER-TURNER, INC.

SHEET 2 OF 3
PROJECT NO. 1785
DATE 10.24.94
BY BERNE

PROJECT CLEAN HARBORS - CHICAGO, IL
SUBJECT EXIST. DRUM STORAGE BLDG. #25

FOR CERTIFICATION

SUBGRADE MODULUS K=200PSI (ASSUMED)
SAFETY FACTOR FOR FREQUENT OPERATIONS = 2
SLAB STRESS PER 1000# OF AXLE LOAD

$$\frac{W^S}{\text{AXLE LOAD}} = \frac{320}{16} = 20.0 \text{ PSI}/1000\#$$

WHEEL SPACING = 29" C-C

SEE DESIGN CHART FIG. 5 BELOW THIS SHEET

EXIST. FLOOR SLAB 6" THK W/WWF 6x6-W2.9xW2.9 PROVIDES SUFFICIENT STRENGTH TO SUPPORT FORK LIFT TRUCK W/LOAD

PCA CONCRETE FLOORS ON GROUND

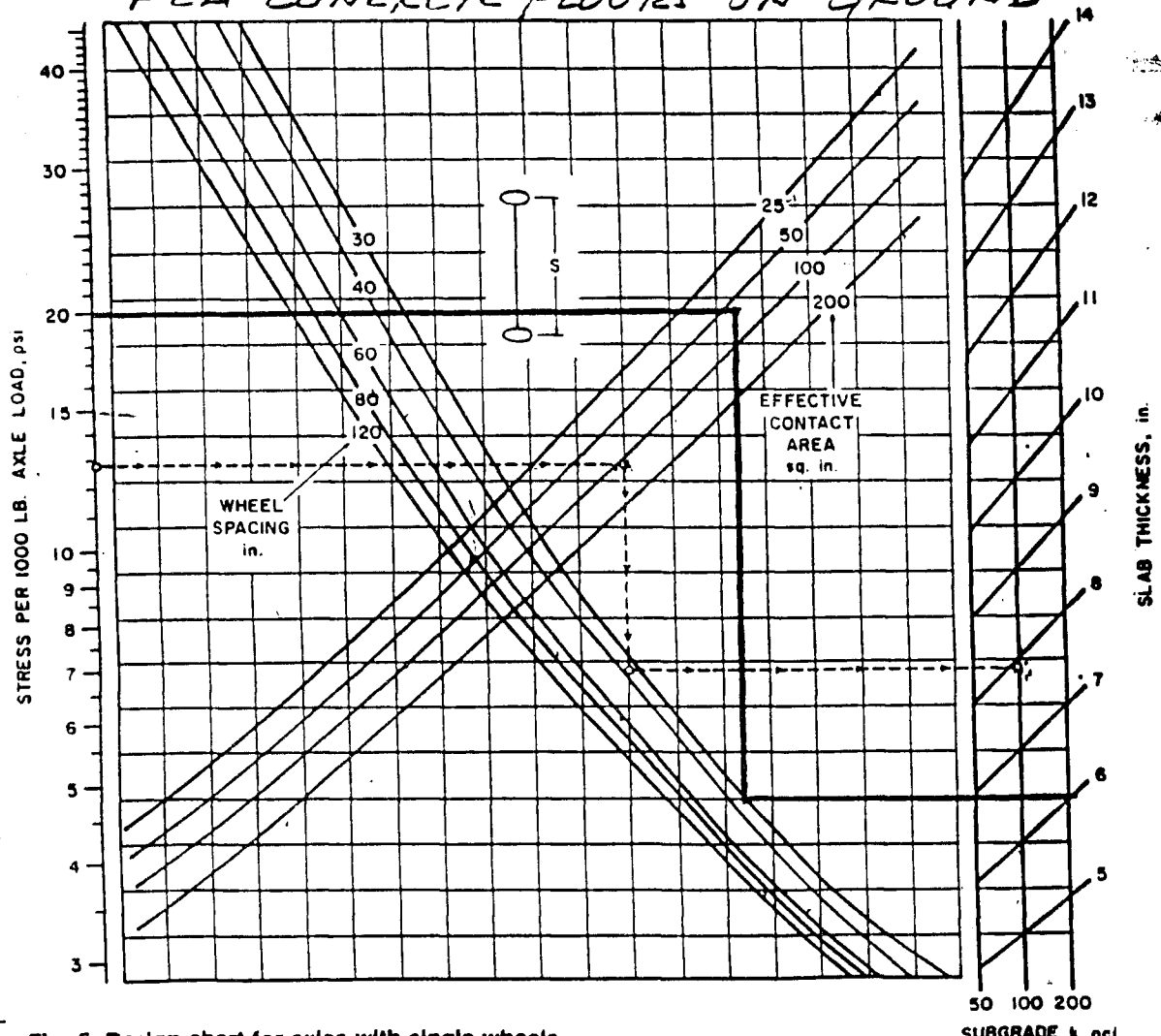

Fig. 5. Design chart for axles with single wheels.

HOYER-SCHLESINGER-TURNER, INC.

SHEET 3 OF 3
PROJECT NO. 1785
DATE 10.24.74
BY BERNEL

PROJECT CLEAN HARBORS - CHICAGO, IL
SUBJECT EXIST. DRUM STORAGE BLDG #25

EMPIRICAL SLAB DESIGN

SLABS ON GROUND *

For any slab on the ground, adequate preparation of subgrade for drainage and compaction is of prime importance. Dowelled expansion joints and weakened plane contraction joints should be carefully located, including expansion joints at all walls.

The design of slabs on the ground to distribute concentrated or uniform loads involves the elastic properties of the subsoil and the slab itself. An analysis can be made but is quite involved. Slabs for the very lightest occupancy should be not less than 4" thick, and slabs for other occupancies may be empirically selected, the following being about minimum and sometimes less than what is required by ACI 807 for supported slabs:—

Occupancy **	Min. Slab Thickness	Reinforcement ‡
Sub-slabs under other slabs	2"	None
Domestic or light commercial (loaded less than 100 psf)	4"	One layer 6 x 6 10/10 welded wire fabric, minimum for ideal conditions; 6 x 6 8/8 for average conditions.
Commercial—institutional—barns (loaded 100-200 psf)	5"	One layer 6 x 6 8/8 welded wire fabric or one layer 6 x 6 6/6.
Industrial (loaded not over 400-500 psf) and pavements for industrial plants, gas stations, and garages	6"	One layer 6 x 6 6/6 welded wire fabric or one layer 6 x 6 4/4.
Industrial (loaded 600–800 psf) and heavy pavements for industrial plants, gas stations, and garages	6"	Two layers 6 x 6 6/6 welded wire fabric or two layers 6 x 6 4/4
Industrial (loaded 1500 psf) †	7"	Two mats of bars (one top, one bottom), each of #4 bars @ 12" c/c, each way
Industrial (loaded 2500 psf) †	8"	Two mats of bars (one top, one bottom), each of #5 bars @ 12" c/c, each way
Industrial (loaded 3000–3500 psf) †	9"	Two mats of bars (one top, one bottom), each of #5 bars @ 8" to 12" c/c, each way

* For further details, see "Concrete Floors on Ground," and "Concrete Airport Pavement," Portland Cement Association, 33 West Grand Avenue, Chicago, Illinois, 1952, and "Design of Concrete Floors on Ground for Warehouse Loadings," Aug. 1957 Journal, American Concrete Institute, P. O. Box 4754, Redford Sta., Detroit 19, Mich.

** For loads in excess of, say, 500 psf, use at least 3000 psi quality controlled concrete, and investigate subsoil conditions with extra care. Fill material and compaction should be equivalent to ordinary highway practice. If laboratory control of compaction is available, the load capacities can be increased in the ratio of the actual compaction coefficient, k, to 100.

† For loads in excess of, say, 1500 psf the subsoil conditions should be investigated with extra care.

‡ Place first layer of reinforcement 2 in. below top of slab; second layer, 2 in. up from bottom of slab.

CleanHarbors
ENVIRONMENTAL SERVICES, INC.
1200 CROWN COLONY DRIVE, P.O. BOX 9137 • QUINCY, MA 02269-9137
(617) 849-1800

Via Federal Express

May 18, 1995

Mr. Robert Watson, P.E.
Illinois Environmental Protection Agency
Division of Land Pollution Control -- #24
Permit Section
2200 Churchill Road
Post Office Box 19276
Springfield, IL 62794-9276

Re: Clean Harbors of Chicago, Inc.
Log No. B-16-M-2
Tank Farm Technical Information

Dear Mr. Watson:

Clean Harbors of Chicago, Inc. (CHCI) is pleased to submit one (1) copy of the enclosed technical drawings and other information relative to the modified bulk liquid Tank Farm (Unit 16) at the CWM Chemical Services, Inc. hazardous waste facility.

The purpose of today's submittal is to provide the Agency with an advance copy of information that is required as part of the Construction Certification Report (CCR). The CCR is required by the Agency under the terms of the November 22, 1994 Temporary Authorization to Construct and the March 17, 1995 Draft Part B Permit. As we discussed earlier this week, CHCI shall submit "as-built" information as each specific construction unit (e.g., Tank Farm, Building 43, etc.) is completed in order to give the Agency sufficient review time to facilitate a final license determination shortly after the close of the Public Comment period on June 3, 1995. A formal which that includes all required certification statements shall be submitted for Agency approval upon completion of all construction areas and prior to facility startup. Today's package includes the following:

A. PID's, Piping Arrangement, Nozzle Orientation & Use (full-size and reduced 11x17" versions)

1. CHCI Dwg. No. 4207, Sheet 3 of 5. Process Flow, Piping & Instrumentation Diagram - Modified Fuels Blending Operation, Issue H.

2. CHCI Dwg. No. 4207, Sheet 4 of 5. Process Flow, Piping & Instrumentation Diagram - Modified Fuels Blending Operation, Issue D.

3. CHCI Dwg. No. 4207, Sheet 5 of 5. Process Flow, Piping & Instrumentation Diagram - Tank Farm Operation, Issue B.

4. CHCI Dwg. No. 4252. Piping Arrangement - Flammable Storage Tank Farm. Issue C.

5. CHCI Dwg. No. 4256. Flammable Storage Tanks Nozzle Orientation & Use. Issue A.

B. Isometric Drawings (Stapled Package, 11x17" size only)

1. ISO No. 001 Sheet 1. Tank - 103, 104, 105, 106 & 109 Drain Piping.

2. ISO No. 001 Sheet 2. Typical Detail for Tank Bottom Drain Connection.

3. ISO No. 002. Drain Manifold for Tanks 103, 104, 105, 106 & 109.

4. ISO No. 003 Sheet 1. Pump 173A & 173B Piping.

5. ISO No. 003 Sheet 2. Typical Detail for Pump Discharge Instrument Mounting.

6. ISO No. 004. Pump 160A and 160B Piping.

7. ISO No. 005. Pump 163A Piping.

8. ISO No. 006. Tank Fill Manifold for Tanks 103, 104, 105, 106 & 109.

9. ISO No. 007. Truck and Rail Car Loading Manifold.

10. ISO No. 008. Fill Piping for Tanks 101, 103, 105, 107 & 109.

11. ISO No. 009. Fill Piping for Tanks 102, 104, 106, 110 & 112.

12. ISO No. 010. Suction Piping for pumps 162, 184, 181.

13. ISO No. 011. Discharge Piping for Pumps 181, 184, 162, 178.

14. ISO No. 012. Suction Piping for Pump 178.

15. ISO No. 013. North side Pipe Rack - Vent and Relief Header.

16. ISO No. 014. Pipe Rack to Drum Processing & Fuels Blending Building.

17. ISO No. 015. Typical Arrangement for Carbon System.

18. ISO No. 016. Northeast Pipe Rack - P178DI, P163DI, P167DI, PDrumDI.

C. Tank Farm Control Panel (Preliminary Construction Version)

1. CHCI Dwg. No. 5404-K-02. Tank Farm Operation - Nameplate & Legend Plate Schedules.

2. CHCI Dwg. No. 5404-K-03. Tank Farm Operation - PLC Control Panel Layout Details & Subpanel.

3. CHCI Dwg. No. 5404-K-28. Tank Farm Operation - Annunciator Control Panel Layout Details & Subpanel.

D. Manufacturer Equipment Information ("Cut Sheets" or "CS")

1. Ashcroft - Bimetal Thermometer and Thermowells for Thermometers

2. Ashcroft - High and Low Pressure Switches

3. Ashcroft - Temperature Switches and Thermowells for Temperature Switches

4. Griswold - Centrifugal Pumps

5. Protectoseal - Conservation Breather Vent

6. Protectoseal - Emergency Pressure Vent

7. Anderson/Keystone - Nitrogen Supply Regulator Assembly

8. Protectoseal - Flame Arrester

9. CEI - Tank Level Switches

10. Miller/Appalachian - Nitrogen Supply Regulator Assembly

CleanHarbors

If you have any questions regarding this information, please do not hesitate to contact me at (617) 849-1800, extension 4473.

Sincerely,

Paul A. Ahearn

Paul A. Ahearn
Manager, Regulatory Compliance

Enclosures

cc: Stephen Pozner, V.P., Compliance and Health & Safety, CHESI
Anton Martig, USEPA (Letter Only)
James Laubsted, CHCI

CleanHarbors
CLEAN HARBORS SERVICES, INC.
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(773) 646-6202 • FAX (773) 646-6381
Visit our Website at www.cleanharbors.com

Certified Mail #7099 3400 0015 2715 2203

March 20, 2001

Mr. Mark A. Schollenberger, P.E.
Illinois Environmental Protection Agency
Bureau of Land - Permit Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Dear Mr. Schollenberger:

Clean Harbors Services, Inc. (CHSI) is submitting a Construction Certification Report for Building 25 (Unit 25). This report covers the building itself and air pollution control devices except for pouroff hoods, scrubbers and associated tanks for the acid and alkaline pouroffs. Certification for the Building 25 Truck Pad was submitted January 31, 2001.

Enclosed are three copies of the report. An additional copy is being sent to the Field Operations Office in Des Plaines, IL.

If you have any questions or require additional information, please contact me at (773) 646-6202.

Sincerely,

James R. Laubsted
Facility compliance Manager

IEPA Field Office, Des Plaines, IL
Certified Mail #7099 3400 0015 2715 2197

CONSTRUCTION CERTIFICATION

This statement is to be completed by both the responsible officer and the registered professional engineer upon completion of construction in accordance with 35 IAC Section 702.126. Submit one copy of the certification with original signatures and two additional copies (four additional copies for UIC wells). Forward these certification statements and any information required by the permit to the following address:

Illinois Environmental Protection Agency
Bureau of Land - #33
Permit Section
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

FACILITY NAME: Clean Harbors Services, Inc.

IEPA SITE CODE: 0 3 1 6 0 0 0 0 5 1

U.S. EPA ID NO.: ILD 0 0 0 6 0 8 4 7 1

PART B PERMIT LOG #/UIC PERMIT #: 16

PERMIT (OR MODIFICATION) ISSUANCE DATE: September 12, 2000

PERMIT CONDITION NO. REQUIRING CERTIFICATION: Section I, K.1

The Unit 25 has been constructed in accordance with the specifications in the Part B/UIC Permit. Documentation that the construction was in accordance with the permit is contained in the enclosed report. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature of Owner/Operator	Christopher J. Murphy V.P. - General Manager Name and Title
Signature of Registered P.E.	AMOS TURNER 19471 Name of Registered P.E. and Illinois Registration Number
3-9-2001 Date	(P.E. SEAL)

AMOS TURNER 19471 LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

This Agency is authorized to require this information under Illinois Revised Statutes, 1979, Chapter 111 ½, Section 1039. Disclosure of this information is required under that Section. Failure to do so may prevent this form from being processed and could result in your application being denied. This form has been approved by the Forms Management Center.

Unit 25

Unit 25 - Container Management Building is an existing structure. The building was previously used for storage of acids, alkalines, poisons and PCBs, consolidation of lab packs and venting of atmospheric compressed gases. The new usage of the building includes the addition of storage of flammables and reactives, and the consolidation and pour-off of lab pack containers for flammables and solids.

Unit 25 was modified to include:

1) addition of an overhead door to the Alkaline/Poison Bay

2) addition of a firewall separating the Acid and Flammable Bays

3) removal of a curb in the new Flammable Bay

4) relocation of two existing lab pack consolidation stations in Building 25 and the addition of a fire protection system for the flammable lab pack consolidation station

5) addition of a Flammable and Solids pour-off hood and emission controls for lab packs

6) addition of fireproofing to roof, walls and structural supports in Flammable storage and staging areas

7) upgrading the fire protection system in the Flammable Bay

8) addition of skylights to the roof

The acid and alkaline pour-off hoods and emission control systems have not been constructed at this time.

The storage capacity of each bay and containment volumes are:

	Capacity (55 gallon equivalents)	Containment Volume
Alkaline/Poisons/PCBs	248 drums	7189 gallons
Acids	136 drums	4322 gallons
Flammable	184 drums	7302 gallons

Building 25 is 200 feet long and 28 feet wide and has a six inch thick reinforced concrete floor slab. The storage bays are divided by six inch high curbs with six inch high curbs on the perimeters. For dividing curb location, locations of stored drums, secondary containment calculations and other details, see as-built CHSI Drawing No. 4282 (4630-M-05).

The final inspection of the containment did not reveal and cracks, gaps, scratches or other damage. The floor coating is Protecto-Crete 900, 1/4 inch thick. The dike walls are coated with Protecto-Coat 900, 30 mils thick. The area in the Flammable Bay where the curb was removed was coated with Poxi-Rock CR-Flooring, 1/4 inch thick, as manufactured by Rock Tred, Inc. Technical data, application and chemical resistance for this coating is included as an attachment.

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

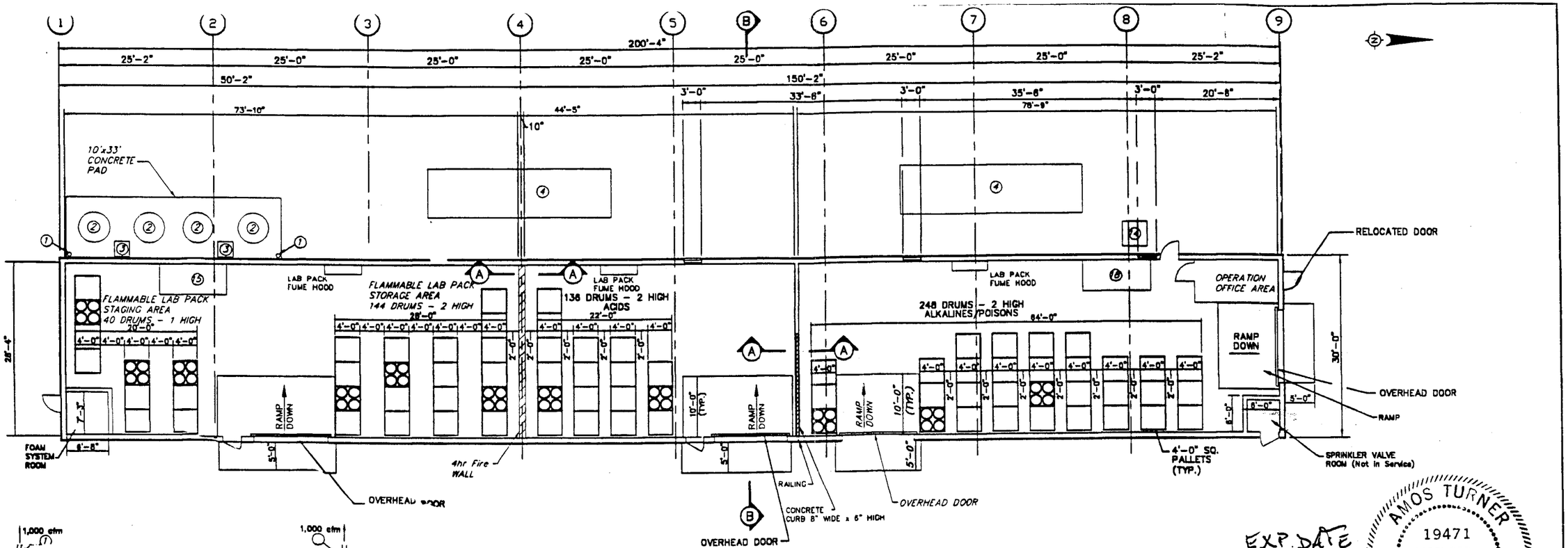
Peter J. Bernes

PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11.30.2001

MARCH 8TH 2001
Peter J. Bernes

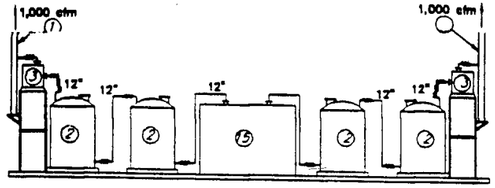
AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

EXP. DATE 11-30-2001



PLAN

SCALE 1/8" = 1'-0"

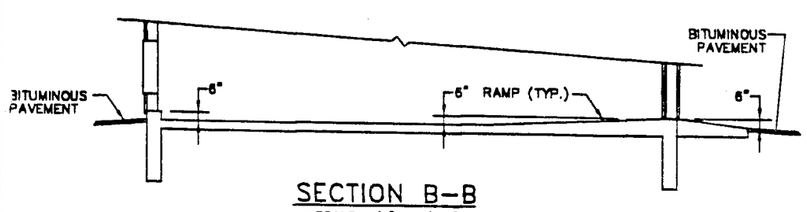


ELEVATION

ACTIVATED CARBON ADSORPTION SYSTEM ARRANGEMENT
SCALE: NONE

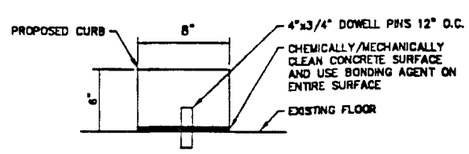
PROPOSED EQUIPMENT		
ITEM NO	QTY	DESCRIPTION
1	2	12" STACK
2	4	1,800 lb. CARBON BED ENVIROTROL MODEL VPM-3000 OR EQUAL
3	2	1,000 cfm EXHAUST BLOWER
4	2	SPENT ABSORBENT STORAGE ROLL-OFF
14	1	DUST COLLECTOR WITH 2,000 acfm BLOWER
15	1	LAB PACK FLAMMABLE POUR-OFF HOOD #1
16	1	LAB PACK NON-POWDERED/SOLIDS POUR-OFF HOOD #4

AREA DESCRIPTION	REQ'D. CONTAINMENT PER RCRA			RECTANGULAR VOLUME OF AREA				VOLUME OCCUPIED BY RAMP				VOL. OCCUPIED BY INSIDE ROOMS	TOTAL CAPACITY (GALS.)
	D	V	R	V	L	H	A	RW	RL	RH	RA	IR	
	NO. OF DRUMS	TOTAL VOL. OF WASTE IN GALS.	CONT. CAP REQ'D. (D.I.V.) IN GALS.	AREA WIDTH IN FT.	AREA LENGTH IN FT.	CURB HEIGHT IN FT.	CONT. CAP OF AREA (W)(L)(H)7.48	RAMP WIDTH IN FT.	RAMP LENGTH IN FT.	RAMP HEIGHT IN FT.	VOL. OCCUPIED BY RAMP 1/2 (RW)(RL)(RH)7.48	VOL. OCCUPIED (LENGHT)(WIDTH)(0.5)7.48	Vt=A-RA-IR
ACIDS	136	7,480	748	44.00	28.33	0.5	4,662 GAL.	18.16	10	0.5	340 GAL.	NONE	4,322
ALKALINE/POISONS	248	13,640	1,364	78.75	28.33	0.5	8,343 GAL.	(1) 14 (2) 18	10 10	0.5 0.5	262 GAL. 337 GAL.	(1) (16)(7)(0.5)7.48 = 420 GAL. (2) (6)(6)(0.5)7.48 = 135 GAL.	7,189
FLAMMABLES STAGING AREA FLAMMABLES STORAGE AREA TOTAL FLAMMABLES	40 144 184	2,200 7,920 10,120	220 792 1,012	74.0	28.33	0.5	7,840 GAL.	19.08	10	0.5	357 GAL.	(6.68)(7.25)(0.5)7.48 = 181 GAL.	7,302



SECTION B-B

SCALE 1/4" = 1'-0"



SECTION A-A

SCALE: NONE

NOTES:

1. ALL EXISTING CONCRETE CONTAINMENT FLOORS AND RAMPS HORIZONTAL SURFACES ARE COATED WITH PROTECTO-CRETE 900 SYSTEM 1/4" THICK, AS MANUFACTURED BY DUDICK INC. ALL EXISTING CONCRETE CONTAINMENT CURBS VERTICAL AND HORIZONTAL SURFACES ARE COATED WITH PROTECTO-COAT 900 SYSTEM, 30 MILS THICK AS MANUFACTURED BY DUDICK INC. OR EQUAL
2. NEW CONCRETE RAMP IN ALKALINE STORAGE AREA SHALL BE COATED WITH PROTECTO-CRETE 900 SYSTEM 1/4" THICK, AS MANUFACTURED BY DUDICK INC. OR EQUAL
3. THIS AREA WILL ALSO BE USED FOR THE MANAGEMENT, STORAGE AND TREATMENT OF COMPRESSED GAS WASTES.
4. IN FLAMMABLE STORAGE AREA LAB PACKS WILL BE STORED TWO HIGH. LIQUID FLAMMABLE DRUMS WILL ONLY BE STORED ONE HIGH.

EXP. DATE 11-30-2001

AMOS TURNER 19471 LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

STATE OF ILLINOIS PETER J. BERNES 3659 LICENSED STRUCTURAL ENGINEER

Peter J. Bernes

PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11.30.2001

DO NOT SCALE

CHSI DWG. NO. 4282

03-08-01

REV.	DESCRIPTION	DRN.	CHKD.	APPR.	DATE
B	AS BUILT	AAA			3/8/01
A	RCRA PART B MODIFICATION				

CleanHarbors
ENVIRONMENTAL SERVICES, INC.
1501 Washington Street
Braintree, Massachusetts 02185
Telephone (781) 849-1800

TITLE: CLEAN HARBORS SERVICES, INC.
11800 S. STONY ISLAND AVENUE
CHICAGO, ILLINOIS 60617

PROPOSED
CONTAINER MANAGEMENT LAYOUT BUILDING #25

PROJECT NO. CH-114630 | DRAWING NO. 4630-M-05
SCALE AS NOTED

SNYDER-SCHLEIFFER-TURNER, INC.
CONSULTING ENGINEERS

Poxi-Rock CR-Flooring

DATA SHEET

DESCRIPTION:

POXI-ROCK® CR-Flooring is a unique, 3- component, 100% solids epoxy resin-based floor surfacing material formulated to have superior chemical resistance. It has been designed for patching and surfacing large floor areas, which are subjected to corrosive chemical spillages and abrasive traffic. POXI-ROCK CR-Flooring meets all of the USDA guidelines for use in federally inspected poultry and meat plants.

POXI-ROCK is also available in Standard, Power Trowel (PT), and Cooler (LT) flooring formulas.

RECOMMENDED USES:

When the three components of POXI-ROCK CR-Flooring are combined, they become an easily troweled mortar which cures chemically to an extremely tough, corrosion, and abrasion resistant surface. POXI-ROCK CR-Flooring is used on concrete floors that are subjected to moderate to heavy traffic and severe chemical spillages, such as chemical processing and storage rooms.

FEATURES:

- Superior Chemical Resistance
- Novalac-Epoxy Based Formulation
- 100% Solids
- Wears 10x Better Than Concrete
- High Compressive Strength
- Cures Fast
- USDA Accepted
- VOC Compliant

PACKAGING:

POXI-ROCK CR-Flooring is packaged in pre-proportioned units for error-free mixing and application. Available in two unit sizes.

The small (1 batch) unit consists of 12 individual batches. One batch consists of one Part-A, one Part-B and one bag of Part-C. The Part-A Hardeners are packaged in quart containers and are shipped 4 to a carton for a total of three cartons per kit. The Part-B Resins are packed in gallon cans and shipped four per carton as well. The Part-C is packed in individual bags.

The large (4-batch) unit consists of four individual batches of Part's A & B liquids and 12 bags of aggregate. One large batch consists of one Part-A, one Part-B and three bags of Part-C Aggregate. The Part-A Hardeners are packaged in 3-pint containers and shipped four to a carton. The Part-B Resins are packed in 2-gallon containers and shipped loose along with 12 bags of Part-C Aggregate.

General Properties:	Data
Shelf Life	2 Years
Coverage	200 F^2 @ nominal ¼" for Small & Large Units
Application Temp & Humidity	65°F to 85°F @ less than 75% R.H.
Colors	Gray & Variety with Chem-Rock Colorants
Packaging	Small & Large 200 F^2 Units
Working Time @ 75 °F	20 minutes
Application Methods	Screed then finish with steel finishing trowel and/or power trowel
Cure Rate @ 75 °F	
Foot Traffic	4-6 hrs.
Medium Traffic	16-20 hrs.
Heavy Traffic	48+ hrs.
Chemical Resistance	72+ hrs.

Tests	Methods	Typical Value
Bond Strength (psi)	ACI COM #503 (pp. 1139-1141)	400+ w/ concrete failure
Compressive Strength (psi)	ASTM C-579	11,500 psi
Tensile Strength (psi)	ASTM C-307	2,300 psi
Flexural Strength (psi)	ASTM D-790	4,400 psi
Flexural Modulus of Elasticity (psi)	ASTM D-790	2.06×10^6 psi
Hardness-Shore D	ASTM D-2240	85+
Thermal Coefficient of Linear Expansion	ASTM D-696	3.8×10^{-4} in/in/°F
% Solids by Volume	ASTM D-1644	99.5
Indentation	MIL-D-3134F	None
Abrasion Resistance (mg) (CS-17 wheel, 1000 GM load, 1,000 cycles)	ASTM D-1044	90
Water Absorption (%)	ASTM C-413	0.16%

ROCK-TRED Corporation, 3415 Howard St., Skokie, IL 60076 . (800)762-8733 . Fax (847)679-6665

AVERAGE:

The two pre-proportioned units will cover approximately 200 sq. ft. @ a nominal 1/4" thickness per unit over a relatively smooth concrete surface. Each individual small batch will cover about 16.67 sq.ft., while the larger batch will cover about 50 sq. ft @ ¼".

SURFACE PREPARATION:

The substrate must be clean, dry and sound with new concrete cured for at least 30 days at 70 °F. Remove dust, laitance, grease, curing compounds, waxes, foreign particles, disintegrated or soft base materials, and any previously applied potentially incompatible coatings. Create a surface profile on concrete by either steel shot blasting or acid etching. Repair cracks and joints with ROCK-TRED's Crack 'N Patch® or Elast-Poxi®SR-Joint Fill.

For additional concrete preparation information and methods, refer to ROCK-TRED's "14 Ways to Prepare a Floor" bulletin. If the concrete surface is not prepared properly, product adhesion will fail and warranties will be voided.

FOR BEST RESULTS:

- POXI-ROCK CR-PRIMER must be applied before application of the POXI-ROCK CR-Flooring.
- DO NOT Use POXI-ROCK CR-Flooring in areas where floor temperature will exceed 180°F continuously or 240°F intermittently.
- DO NOT Apply POXI-ROCK CR-Flooring over brick, slate, ceramic tile, quarry tile or asphaltic materials.
- POXI-ROCK CR-Flooring may be installed on any structurally sound and properly prepared concrete, metal or wood surface.
- POXI-ROCK CR-Flooring is designed for Interior Use Only
- DO NOT Thin POXI-ROCK CR-Flooring.
- DO NOT Use when Humidity Exceeds 75% Indoors.
- New Concrete Must Cure For at Least 30 Days @ 70°F.

PRIMING:

The POXI-ROCK CR-Flooring is always applied to a "wet" primed surface. Before beginning the mixing and application of the CR-Primer, be sure that the concrete floor to be surfaced is thoroughly dried. The Primer is applied at the rate of approx. 250 sq. ft. per gallon with a 3/8" nap roller or in combination with a flat rubber squeegee.

Do not apply the POXI-ROCK CR-Flooring if the Poxi-Rock CR-Primer has cured to a hard film. If this occurs, you will need to re-apply the Primer.

Review ROCK-TRED'S Material Safety Data Sheets (MSDS) for this product prior to mixing and applying. In addition, thoroughly review the Application Guide and product labels.

MIXING:

Note: Before beginning the mixing and application of the POXI-ROCK CR-Flooring, set up the mixing area in a convenient location near the area to be surfaced.

If the Neutral Part-C Aggregate is to be used, the Chem-Rock Colorant is first mixed into the Part-B Resin at the rate of 1.5-2.5 oz. for the small batch unit and 4.5-7.5 oz. for the larger batch unit.

Pour entire contents of Part A container into the Part B pail and mix thoroughly with a Spiral Mixing Blade (available from ROCK-TRED) attached to a low speed drill (400-600 rpm) for approximately 3-5 minutes. Take care not to induce air into the material when mixing.

Add the mixed liquids slowly into a Rock-Tred "Epoxy Mortar" mixer and add the Part-C Aggregate into the mixer while running. Mix thoroughly to make sure all three components are well blended, which should take about 60-90 seconds.

APPLICATION:

The mixed mortar is immediately spread evenly over the "primed" surface using a ROCK-TRED 24"-Wheeled Screed Unit. Spread the small batch unit over approx. 16.67 sq.ft. and the larger batch unit over approx.50 sq.ft. The 24" Wheeled Screed Unit is typically set for 5/16" screed for a final ¼" thickness after compaction.

Finish using clean 3" x 12" steel finishing trowel for the edges, cove bases and the larger areas. The finished floor should be free of trowel marks and relatively smooth with no porosity.

In areas not abutting a vertical surface, the Poxi-Rock CR-Flooring should be troweled into "chase", which is a special groove cut into the concrete at the time of preparation.

POT LIFE:

At 75°F and 50% R.H., the Poxi-Rock CR-Flooring has a useful working time or pot life of 18-20 minutes.

CLEAN UP:

Application equipment should be cleaned using soap and water or solvent where necessary.

DISPOSAL:

Empty containers may contain product residue, including flammable or combustible vapors. Do not cut, puncture or weld near these containers. Label warnings must be observed until containers have been commercially cleaned or reconditioned. Containers to be thrown out must be disposed in accordance with federal, state and local regulations. Use only licensed hazardous waste disposal companies.

CUSTOMER NOTE:

For information on application situations not covered above, contact your local ROCK-TRED representative or the corporate office at 1-800-ROC-TRED.

WARRANTY STATEMENT:
Information about ROCK-TRED products is given to the best of our knowledge, based on tests and experience. However, as products are often applied or used under conditions beyond our control, ROCK-TRED cannot guarantee anything but the quality of the products. ROCK-TRED warrants its products meet specifications set by ROCK-TRED, but we reserve the right to change given specifications without notice. ROCK-TRED DISCLAIMS ALL WARRANTIES RELATING TO THE PRODUCTS AND THEIR APPLICATION, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Resale of ROCK-TRED products constitutes acceptance of the terms of this limited warranty and the terms and the conditions set out in our invoice, contrary provisions of buyer's purchase documents not withstanding. Upon receipt of merchandise, purchaser has 30 days to notify ROCK-TRED in writing that materials are defective. In the event ROCK-TRED finds that the product delivered is off specification, ROCK-TRED will, at its sole discretion, either replace the product or refund the purchase price thereof, and ROCK-TRED's choice of one of these remedies is the buyer's sole remedy. In no event shall the liability of ROCK-TRED exceed the purchase price of shipped merchandise. ROCK-TRED will under no circumstances be liable for special, incidental or consequential damages. Claims must be in writing. Claims after 30 days are void.

ROCK-TRED
Manufacturing and Headquarters: 3415 Howard St., Skokie, IL 60076-4032 U.S.A.
(800) ROC-TRED • (800) 762-8733 • (847) 673-8200 • FAX (847) 673-6665

POXI-ROCK CR-Flooring

CHEMICAL RESISTANCE GUIDE

The following tests were run on POXI-ROCK™ CR-FLOORING™ under close laboratory supervision. The samples for testing were prepared in accordance with standard procedures and cured for 7 days @ 77°F. The samples were subjected to the chemicals listed below and inspected at each interval indicated. The results and the corresponding recommendations will indicate the potential suitability of this ROCK-TRED product for your particular requirements. All tests were conducted at approximately 77°F.

No warranty is expressed or implied regarding this information. Specific results obtained by the customer are affected by conditions which are beyond ROCK TRED's control. Therefore customers must make their own tests to determine product suitability for a particular purpose.

EFFECT CODE

A-None
B-Stains
C-Softens
D- Slight Erosion
E- Moderate Erosion
F- Disintegrates

RECOMMENDATION CODE

1- Recommended Constant Exposure
2- Recommended Intermittent Exposure
3- Recommended with Immediate Washdown
4- Not Recommended

ACIDS-INORGANIC

CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATION
Boric	30%	A	A	1
Boric	Sat.	A	A	1
Chromic Acid	20%	A	A	1
Chromic Acid	40%	A	A	1
Chromic Acid	60%	A	A	1
Fluoboric Acid	12%	A	A	1
Fluoboric Acid	24%	A	A	1
Hydrochloric	10%	A	A	1
Hydrochloric	20%	A	A	1
Hydrochloric	37%	A	A	1
Hydrofluoric	10%	A	A	1
Hydrofluoric	30%	A	A	1
Hypochlorous	5%	A	A	1
Nitric	10%	A	A	1
Nitric	20%	A	B	2
Nitric	50%	B	C	2
Nitric	Conc	C	C	3
Perchloric	70%	A	A	1
Phosphoric	10%	A	A	1
Phosphoric	50%	A	A	1
Phosphoric	75%	A	A	1
Sulfuric	20%	A	A	1
Sulfuric	50%	A	A	1
Sulfuric	70%	A	A	1
Sulfuric	Conc	A	A	1

AUTO-BRAKE & HYDRAULIC FLUIDS

CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATION
Brake Fluid	100%	A	A	1
Hy-JetFuel#3	100%	A	A	1
Motor Oil	100%	A	A	1
Skydrol 500A	100%	A	A	1
Skydrol 500B	100%	A	A	1
Transmission Fluid	100%	A	A	1

ACIDS-ORGANIC

CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATIO
Acetic	10%	A	A	1
Acetic	20%	A	A	1
Acetic	50%	A	A	1
Acetic	Glacial	A	A	1
Benzoic Acid	Conc	A	A	1
Butyric	10%	A	A	1
Citric	20%	A	A	1
Citric	50%	A	A	1
Cresylic	10%	A	A	1
Formic	30%	A	A	1
Lactic	40%	A	A	1
Lactic	80%	A	A	1
Maleic	30%	A	A	1
Maleic	60%	A	A	1
Malic	50%	A	A	1
Monochloric Acetic	5%	A	A	1
Monochloric Acetic	10%	A	A	1
Trichloro Acetic	5%	A	A	1
Oleic	Sat.	A	A	1
Oxalic	Sat.	A	A	1
Picric	Sat.	A	A	1
Stearic	Conc	A	A	1
Tannic	30%	A	A	1

ALCOHOLS

CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATI
Diacetone Alcohol	100%	A	A	1
Ethyl Alcohol	100%	A	A	1
Ethylene Glycol	100%	A	A	1
Glycerine	100%	A	A	1
Isopropyl Alcohol	100%	A	A	1
Methyl Alcohol	100%	A	A	1
Phenol	5%	A	A	1
Triethylene Glycol	100%	A	A	1

ROCK-TRED Corporation, 3415 Howard St., Skokie, IL 60076 . (800)762-8733 . Fax (847)679-6665

ALKALIES & SALTS

CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATION
Ammonium Chloride	50%	A	A	1
Ammonium Hydroxide	10%	A	A	1
Ammonium Hydroxide	20%	A	A	1
Ammonium Hydroxide	50%	A	A	1
Ammonium Nitrate	Sat.	A	A	1
Ammonium Persulfate	Sat.	A	A	1
Ammonium Sulfate	Sat.	A	A	1
Calcium Chloride	50%	A	A	1
Calcium Hydroxide	Sat.	A	A	1
Calcium Hypochlorite	15%	A	A	1
Ferric Chloride	Sat.	A	A	1
Ferric sulfate	Sat.	A	A	1
Potassium Hydroxide	40%	A	A	1
Sodium Bicarbonate	Sat.	A	A	1
Sodium Bisulfate	Sat.	A	A	1
Sodium Carbonate	Sat.	A	A	1
Sodium Chloride	20%	A	A	1
Sodium Hydroxide	10%	A	A	1
Sodium Hydroxide	50%	A	A	1
Sodium Sulfate	Sat.	A	A	1
Sodium Sulfide	Sat.	A	A	1
Trisodium Phosphate	10%	A	A	1

KETONES-ESTERS

CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATION
Acetone	100%	A	A	1
Amyl Acetate	100%	A	A	1
Butyl Acetate	100%	A	A	1
Ethyl Acetate	100%	A	A	1
Methyl Ethyl Ketone	100%	A	A	1
Methyl Isobutyl Ketone	100%	A	A	1
PM Acetate	100%	A	A	1

MISCELLANEOUS

CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATION
Acrylonitrile	100%	A	B	2
Aniline	100%	A	A	1
Beer	100%	A	A	1
Bromine	100%	A	B	2
Butyl Lactate	100%	A	A	1
Carbon Disulfide	100%	A	A	1
Carbon Tetrachloride	100%	A	A	1
Chloroform	100%	A	A	1
Cola	100%	A	A	1
Corn Oil	100%	A	A	1
Cyclohexane	100%	A	A	1
Cyclohexane	100%	A	A	1
Diethyl Phthalate	100%	A	A	1

MISCELLANEOUS

CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATION
Dimethyl Phthalate	100%	A	A	1
Ethylene Dichloride	100%	A	B	2
Formaldehyde	100%	A	A	1
Fruit Juice	100%	A	A	1
Grease	100%	A	A	1
Hydrogen Peroxide	50%	A	A	1
Ketchup	100%	A	A	1
Lanolin	100%	A	A	1
Lard	100%	A	A	1
Linseed Oil	100%	A	A	1
Mayonnaise	100%	A	A	1
Methyl Salicylate	50%	A	B	2
Milk	100%	A	A	1
Mustard	100%	A	A	1
2-Nitro-Propane	100%	A	A	1
Pyridine	Sat.	B	C	3
Sugar	Sat.	A	A	1
Tannic Acid	Sat.	A	A	1
Tartaric Acid	2%	A	A	1
Tide Solution	100%	A	A	1
Triacetin	100%	A	A	1
Triethanolamine	100%	A	A	1
Turpentine	100%	A	A	1
Water	100%	A	A	1
Wine	100%	A	A	1

SOLVENTS-ALIPHATIC

CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATION
Gasoline	100%	A	A	1
Hexane	100%	A	A	1
Jet Fuel A-1	100%	A	A	1
Mineral Spirits	100%	A	A	1
Naphtha	100%	A	A	1

SOLVENTS-AROMATIC

CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATION
Chlorobenzene	100%	A	A	1
SC-100	100%	A	A	1
Toluene	100%	A	A	1
Xylene	100%	A	A	1

SOLVENTS-CHLORINATED

CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATION
Dichlorobenzene	100%	A	A	1
Methylene Chloride	100%	A	C	2
Perchloroethane	100%	A	A	1
1,1,1,trichloroethane	100%	A	A	1
Tetrachloroethylene	100%	A	A	1

WARRANTY STATEMENT
Information about ROCK-TRED products is given to the best of our knowledge, based on tests and experience. However, as products are often applied or used under conditions beyond our control, ROCK-TRED cannot guarantee anything but the quality of the products. ROCK-TRED warrants its products meet specifications set by ROCK-TRED, but we reserve the right to change given specifications without notice. ROCK-TRED DISCLAIMS ALL WARRANTIES RELATING TO THE PRODUCTS AND THEIR APPLICATION, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Receipt of ROCK-TRED products constitutes acceptance of the terms of this limited warranty and the terms and the conditions set out in our invoice, contrary provisions of buyer's purchase documents not withstanding. Upon receipt of merchandise, purchaser has 30 days to notify ROCK-TRED in writing that materials are defective. In the event ROCK-TRED finds that the product delivered is off specification, ROCK-TRED will, at its sole discretion, either replace the product or refund the purchase price thereof, and ROCK-TRED's choice of one of these remedies is the buyer's sole remedy. In no event shall the liability of ROCK-TRED exceed the purchase price of shipped merchandise. ROCK-TRED will under no circumstances be liable for special, incidental or consequential damages. Claims must be in writing. Claims after 30 days are void.

ROCK TRED
Flooring Solutions Since 1939

Manufacturing and Headquarters: 7440 N. St. Louis Ave., Skokie, IL 60076-4032 U.S.A.
(800) ROC-TRED • (800) 762-8733 • (847) 673-8200 • FAX (847) 679-6665

CleanHarbors
SERVICES, INC.
11800 SOUTH STONY ISLAND AVENUE • CHICAGO, IL 60617
(773) 646-6202 • FAX (773) 646-6381
Visit our Website at www.cleanharbors.com

January 31, 2001

Mr. Mark A. Schollenberger, P.E.
Illinois Environmental Protection Agency
Bureau of Land – Permit Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Dear Mr. Schollenberger:

Clean Harbors Services, Inc. (CHSI) is submitting a Construction Certification Report for the Building 25 Truck Loading/Unloading Pad. I am enclosing three copies. An additional copy is being sent to the Field Operations Office in Des Plaines, IL. Construction certification of Building 25 will be sent after its completion.

If you have any questions or require additional information, please contact me at (773) 646-6202, x233.

Sincerely,

James R. Laubsted
Facility Compliance Manager

CONSTRUCTION CERTIFICATION

This statement is to be completed by both the responsible officer and the registered professional engineer upon completion of construction in accordance with 35 IAC Section 702.126. Submit one copy of the certification with original signatures and two additional copies (four additional copies for UIC wells). Forward these certification statements and any information required by the permit to the following address:

Illinois Environmental Protection Agency
Bureau of Land - #33
Permit Section
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

FACILITY NAME: Clean Harbors Services, Inc.

IEPA SITE CODE: 0 3 1 6 0 0 0 0 5 1

U.S. EPA ID NO.: IL D 0 0 0 6 0 8 4 7 1

PART B PERMIT LOG #/UIC PERMIT #: 16

PERMIT (OR MODIFICATION) ISSUANCE DATE: September 12, 2000

PERMIT CONDITION NO. REQUIRING CERTIFICATION: Section I, K.1

The Truck Loading/Unloading Pad- Unit 25 has been constructed in accordance with the specifications in the Part B/UIC Permit. Documentation that the construction was in accordance with the permit is contained in the enclosed report. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature of Owner/Operator

Christopher J. Murphy
V.P. - General Manager
Name and Title

Signature of Registered P.E.

AMOS TURNER 062-019471
Name of Registered P.E. and Illinois Registration Number

EXP.DATE 11/30/01

01-29-2001
Date

AMOS TURNER 19471 LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

(P.E. SEAL)

This Agency is authorized to require this information under Illinois Revised Statutes, 1979, Chapter 111 ½, Section 1039. Disclosure of this information is required under that Section. Failure to do so may prevent this form from being processed and could result in your application being denied. This form has been approved by the Forms Management Center.

Container Storage Building - Unit 25
Truck Loading/Unloading Pad

The Truck Loading/Unloading Pad is a new concrete pad without a canopy. The pad was constructed as shown on the attached CHSI Drawing No. 4283 (As-Built).

The containment calculations are included as an attachment.

The entire secondary containment was coated with Chem-Rock Novo Poxi, 30 mils thick, as manufactured by Rock Tred, Inc. Technical data, application and chemical resistance for this coating is included as an attachment.

During the visual inspection, the Truck Loading/Unloading Pad was in excellent condition. There were no cracks, gaps, scratches or other damage. No penetrations are present within the containment structure.

AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

Amos Turner

EXPIRATION DATE
11-30-2001

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes

PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11.30.01

HOYER-SCHLESINGER-TURNER inc.
ENGINEERS - CONSTRUCTORS
300 west adams street chicago illinois 60606 telephone 263-0556 area code 312

CONTAINMENT CAPACITY CALCULATIONS FOR UNIT 25 TRUCK PAD

REQUIRED CAPACITY

(A) Volume of 88-55 Gal. drums= 88x55= 4840 gallons
10% of total volume = 484 gallons

(B) Precipitation allowance for maximum rainfall of 4.7 inches
(4.7/12)'x45'x13.34'x7.481 = 1,759 gallons

TOTAL REQUIRED CAPACITY = 2,243

AVAILABLE CAPACITY

(A) Volume of the sump
=2'x2'x2'x7.481 = 59 gallons

(B) Volume of large sloped section
=1/2x12'x43'x2.67'x7.481 = 5,153 gallons

(C) Volume of small sloped section
=1/2x12'x2'x2.62'x7.481 = 235 gallons

TOTAL AVAILABLE CONTAINMENT CAPACITY = 5,447 gallons

Amos Turner 08-26-99

Amos Turner
Licensed Professional Engineer
Illinois License No. 19471; expiration date 11/30/99

AMOS TURNER
19471
LICENSED PROFESSIONAL ENGINEER OF
ILLINOIS

Chem-Rock Novo-Poxi

DATA SHEET

DESCRIPTION:

Chem-Rock®Novo-Poxi is a two-component, 100% solids epoxy-novolac floor coating system, designed for application between 10-16 mils. Chem-Rock Novo-Poxi also will withstand hot spillages. This system meets all of the USDA guidelines for use in federally inspected poultry and meat plants. Available in clear, gray and 16 standard colors, when Chem-Rock Novo-Poxi Colorbase is used in combination with Chem-Rock Colorants.
Chem-Rock is also available in a standard, high build (HB), and low temp. curing (LT) formulations

RECOMMENDED USES:

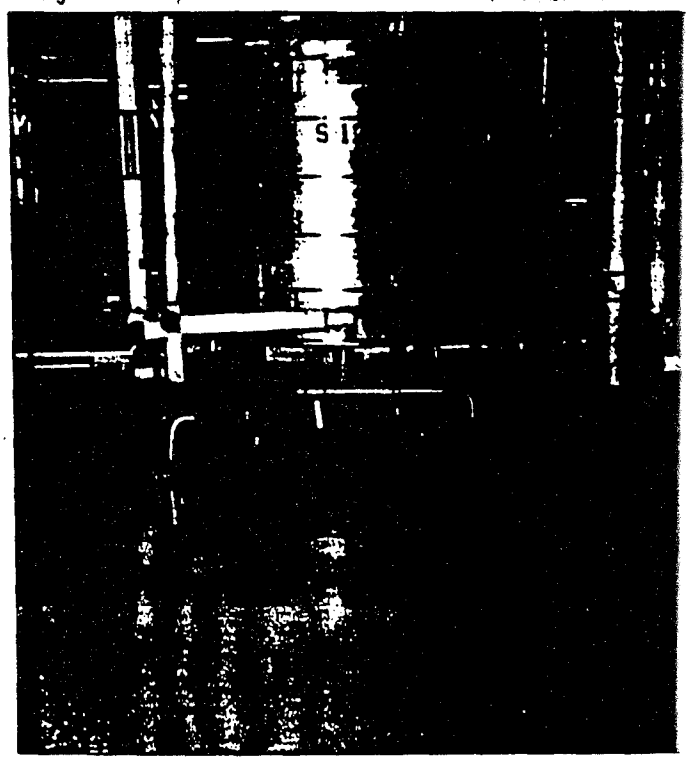
Chem-Rock Novo-Poxi is used on concrete floors that are subjected to moderate to heavy traffic and severe chemical spillages, such as chemical processing and storage rooms. Chem-Rock Novo-Poxi is also used as a binder in broadcast type applications where extreme chemical resistance and/or heat resistance is required.

FEATURES:

- Solvent-Free ... low odor
- Excellent Chemical Resistance
- Higher heat resistance to 250°F
- Novolac epoxy formulation
- Easy to apply
- Extensive Range of Colors
- Gloss Finish or Anti-Slip
- VOC Compliant
- Good Abrasion Resistance

PACKAGING:

Chem-Rock Novo-Poxi is available in pre-proportioned small ¾-gal ar larger 2-Batch 6-gal units for easy job-site mixing and application. The small ¾-gal unit consists of one container of Part-A Hardener and one container Part-B Resin, both of which are packaged together in a single carton. T larger 2-batch unit consists of 2 containers of Part-A Hardener, which a packaged together in a single carton. The two (2) Part-B Resins are pac aged in individual 4.25-gal pails. When combined, each batch contains a to of 3-gal of mixed product.



General Properties:	Data
Shelf Life	2 Years
Application Temp & Humidity	55°F to 85°F @ less than 75% R.H.
Induction	None
Mixing Ratio: (A to B)	1 to 2 by volume
Coverage	100 to 160 sq. ft. per gal @ 10 to 16 wet mils
Colors	Clear, Gray & Variety with Chem-Rock Colorants
Packaging	¾-gal and 6-gal Units; 15 Gal and 165-Gal Bulk Units
Working Time @ 75°F	28 minutes
Application Methods	Flat Squeegee & High quality 3/8" nap roller
Cure Rate @ 75°F	
Recoat	8 hrs
Foot Traffic	12 hrs
Heavy Traffic	24+ hrs
Chemical Resistance	72+ hrs

Test	Method	Typical Value
Bond Strength (psi)	ACI COM #503 (pp. 1139-1141)	400+ w/ concrete failure
% Solids by Volume	ASTM D-1644	100.0
Flash Point	Pensky-Martens CC	>200°F
UV Light Resistance	Q-U-V Accelerated Weather Tester	Good
Hardness-Shore D	ASTM D-2240	82+
VOC	EPA Method 24	0.10 lbs/gal
Gloss (60°)	BYK-Gardner Tri-Gloss	90+
Impact Resistance	ASTM D-2794	160 in-lbs.
Indentation	MIL-D-3134F	None
Abrasion Resistance (mg) (CS-17 wheel 1000 GM load, 1 000 cycles)	ASTM D-1044	75
Flammability	ASTM D-635	Self-Extinguishin
Dry Heat Resistance		180°F Constant 250°F Intermitte
Water Absorption (%)	ASTM C-413	0.15%

ROCK-TRED Corporation. 3415 Howard St., Skokie, IL 60076 . (800)762-8733 . Fax (847)679-6665

) available in 15-gal and 165-gal bulk units for large areas. The 15-gal ·K unit consists of one 5-gal pail of Part-A and two 5-gal pails of Part-B. The J5-gal drum unit consists of one 55-gal drum(Part A) and two 55-gal drums(Part B).

COVERAGE:

This product should be applied at the rate of approximately 100-160 sq. ft. per gallon, which is between 10 to 16 wet mils. As with all coatings, coverage is dependent on the smoothness and porosity of the surface.

SURFACE PREPARATION:

The substrate must be clean, dry and sound with new concrete cured for at least 30 days at 70 °F. Remove dust, laitance, grease, curing compounds, waxes, foreign particles, disintegrated or soft base materials, and any previously applied potentially incompatible coatings. Create a surface profile on concrete by either steel shot blasting or acid etching. Repair cracks and joints with ROCK-TRED's Crack 'N Patch® or Elasti-Poxi® Joint Fill.
For additional concrete preparation information and methods, refer to ROCK-TRED's "14 Ways to Prepare a Floor" bulletin. If the concrete surface is not prepared properly, product adhesion will fail and warranties will be voided.

FOR BEST RESULTS:

- For Interior Use Only.
- New Concrete Must Cure For at Least 30 Days @ 70°F
- DO NOT Thin the Chem-Rock Novo-Poxi.
- Apply a Test Patch to Ensure Compatibility Over Old Paint
  DO NOT Allow Material to Puddle During Application.
  Allow Each Coat to Dry Tack-Free Before Recoating.
- DO NOT Use when Humidity Exceeds 75% Indoors.
- Apply Topcoat within 24 Hours of Previous Coat.
- Discard any Material Subjected to Freezing.
- DO NOT Apply to Structurally Unsound Surfaces.
- DO NOT Apply heavier than recommended wet film thickness.

PRIMING:

For optimum results, prime the prepared concrete floor first with Agua-Rock®Primer/Sealer. The Agua-Rock Primer/Sealer can be applied at the rate of 350-450 sq. ft. per gallon. On rougher areas and shot-blasted floors, the coverage rates will be reduced to about 300-350 sq. ft. per gallon.

Allow the Agua-Rock Primer/Sealer to dry thoroughly before mixing and applying the Chem-Rock Seal/Coat. The primed floor should be tack free and clear in appearance before applying Chem-Rock Novo-Poxi coating system. This will vary with temperature and humidity but is normally between 4-5 hours @ 75°F and 50% R.H.

Review ROCK-TRED'S Material Safety Data Sheets (MSDS) for this product prior to mixing and applying. In addition, thoroughly review the Application Guide and product labels.

MIXING:

Avoid mixing and application of this product if the floor temperature is below 55°F or above 85°F. Also avoid application if the humidity if higher than 75% R.H. The temperature of the floor, materials and air in the area of the installation all play a role in how the product will apply and cure.
If Chem-Rock Colorants are to be used with the clear or colorbase, the appropriate quantity of Colorant is added (see mix ratios chart on Chem-Rock Colorant Data Sheet) to the Part-B Resin and mixed in uniformly before the Part-A Hardener is added.
Pour entire contents of Part A container into Part B container. DO NOT change the ratio of A to B. Blend thoroughly for a minimum of 2 minutes with a spiral mixing blade (available from ROCK-TRED) attached to a low-speed (400-600 RPM) electric drill. Take care not to induce air into the material when mixing. This will cause "bubbles" in the coating when applied.

APPLICATION:

This product can be applied from a roller tray or by pouring in a bead directly onto the concrete surface. A high quality, 3/8" nap roller should be used. The individual(s) applying the Chem-Rock Novo-Poxi should be wearing "spiked sandals" available from ROCK-TRED. The coating must be rolled as evenly as possible. Avoid excess agitation of the liquids with the roller. This will lessen chances of bubbling of the final film.

POT LIFE:

At 75°F and 50% R.H., both clear and pigmented systems have a useful working time or pot life of 25-35 minutes. Using any product beyond this time will result in variable results and therefore any mixed product beyond the pot life should be discarded.

CLEAN UP:

Application equipment should be cleaned using soap and water or solvent where necessary. Roller covers should be discarded after use.

DISPOSAL:

Empty containers may contain product residue, including flammable or combustible vapors. Do not cut, puncture or weld near these containers. Label warnings must be observed until containers have been commercially cleaned or reconditioned. Containers to be thrown out must be disposed in accordance with federal, state and local regulations. Use only licensed hazardous waste disposal companies.

CUSTOMER NOTE:

For information on application situations not covered above, contact your local ROCK-TRED representative or the corporate office at 1-800-ROC-TRED.

WARRANTY STATEMENT
Information about ROCK-TRED products is given to the best of our knowledge, based on tests and experience. However, as products are often applied or used under conditions beyond our control, ROCK-TRED cannot guarantee anything but the quality of the products. ROCK-TRED warrants its products meet specifications set by ROCK-TRED, but we reserve the right to change given specifications without notice. ROCK-TRED DISCLAIMS ALL WARRANTIES RELATING TO THE PRODUCTS AND THEIR APPLICATION, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Receipt of ROCK-TRED products constitutes acceptance of the terms of this limited warranty and the terms and the conditions set out in our invoice, contrary provisions of buyer's purchase documents not withstanding. Upon receipt of merchandise, purchaser has 30 days to notify ROCK-TRED in writing that materials are defective. In the event ROCK-TRED finds that the product delivered is off specification, ROCK-TRED will at its sole discretion, either replace the product or refund the purchase price thereof, and ROCK-TRED's choice of one of these remedies is the buyer's sole remedy. In no event shall the liability of ROCK-TRED exceed the purchase price of shipped merchandise. ROCK-TRED will under no circumstances be liable for special, incidental or consequential damages. Claims must be in writing. Claims after 30 days are void.

ROCK-TRED
Flooring Solutions Since 1939
Manufacturing and Headquarters: 3415 Howard St., Skokie, IL 60076-4032 U.S.A.
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CHEM-ROCK Novo-Poxi

CHEMICAL RESISTANCE GUIDE

The following tests were run on CHEM-ROCK® NOVO-POXI® under close laboratory supervision. The samples for testing were prepared in accordance with standard procedures and cured for 7 days @ 77°F. The samples were subjected to the chemicals listed below and inspected a each interval indicated. The results and the corresponding recommendations will indicate the potential suitability of this ROCK-TRED product fo your particular requirements. All tests were conducted at approximately 77°F.

No warranty is expressed or implied regarding this information. Specific results obtained by the customer are affected by conditions which are beyond ROCK TRED's control. Therefore customers must make their own tests to determine product suitability for a particular purpose.

EFFECT CODE

A-None
B-Stains
C-Softens
D- Slight Erosion
E- Moderate Erosion
F- Disintegrates

RECOMMENDATION CODE

1- Recommended Constant Exposure
2- Recommended Intermittent Exposure
3- Recommended with Immediate Washdown
4- Not Recommended

ACIDS-INORGANIC

CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATION
Boric	30%	A	A	1
Boric	Sat.	A	A	1
Chromic Acid	20%	A	A	1
Chromic Acid	40%	A	A	1
Chromic Acid	60%	A	A	1
Fluoboric Acid	12%	A	A	1
Fluoboric Acid	24%	A	A	1
Hydrochloric	10%	A	A	1
Hydrochloric	20%	A	A	1
Hydrochloric	37%	A	A	1
Hydrofluoric	10%	A	A	1
Hydrofluoric	30%	A	A	1
Hypochlorous	5%	A	A	1
Nitric	10%	A	A	1
Nitric	20%	A	B	2
Nitric	50%	B	C	2
Nitric	Conc	C	C	3
Perchloric	70%	A	A	1
Phosphoric	10%	A	A	1
Phosphoric	50%	A	A	1
Phosphoric	75%	A	A	1
Sulfuric	20%	A	A	1
Sulfuric	50%	A	A	1
Sulfuric	70%	A	A	1
Sulfuric	Conc	A	A	1

AUTO-BRAKE & HYDRAULIC FLUIDS

CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATION
Brake Fluid	100%	A	A	1
Hy-JetFuel#3	100%	A	A	1
Motor Oil	100%	A	A	1
Skydrol 500A	100%	A	A	1
Skydrol 500B	100%	A	A	1
Transmission Fluid	100%	A	A	1

ACIDS-ORGANIC

CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATIO
Acetic	10%	A	A	1
Acetic	20%	A	A	1
Acetic	50%	A	A	1
Acetic	Glacial	A	A	1
Benzoic Acid	Conc	A	A	1
Butyric	10%	A	A	1
Citric	20%	A	A	1
Citric	50%	A	A	1
Cresylic	10%	A	A	1
Formic	30%	A	A	1
Lactic	40%	A	A	1
Lactic	80%	A	A	1
Maleic	30%	A	A	1
Maleic	60%	A	A	1
Malic	50%	A	A	1
Monochloric Acetic	5%	A	A	1
Monochloric Acetic	10%	A	A	1
Trichloro Acetic	5%	A	A	1
Oleic	Sat.	A	A	1
Oxalic	Sat.	A	A	1
Picric	Sat.	A	A	1
Stearic	Conc	A	A	1
Tannic	30%	A	A	1

ALCOHOLS

CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATIO
Diacetone Alcohol	100%	A	A	1
Ethyl Alcohol	100%	A	A	1
Ethylene Glycol	100%	A	A	1
Glycerine	100%	A	A	1
Isopropyl Alcohol	100%	A	A	1
Methyl Alcohol	100%	A	A	1
Phenol	5%	A	A	1
Triethylene Glycol	100%	A	A	1

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ALKALIES & SALTS				
CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATION
Ammonium Chloride	50%	A	A	1
Ammonium Hydroxide	10%	A	A	1
Ammonium Hydroxide	20%	A	A	1
Ammonium Hydroxide	50%	A	A	1
Ammonium Nitrate	Sat.	A	A	1
Ammonium Persulfate	Sat.	A	A	1
Ammonium Sulfate	Sat.	A	A	1
Calcium Chloride	50%	A	A	1
Calcium Hydroxide	Sat.	A	A	1
Calcium Hypochlorite	15%	A	A	1
Ferric Chloride	Sat.	A	A	1
Ferric sulfate	Sat.	A	A	1
Potassium Hydroxide	40%	A	A	1
Sodium Bicarbonate	Sat.	A	A	1
Sodium Bisulfate	Sat.	A	A	1
Sodium Carbonate	Sat.	A	A	1
Sodium Chloride	20%	A	A	1
Sodium Hydroxide	10%	A	A	1
Sodium Hydroxide	50%	A	A	1
Sodium Sulfate	Sat.	A	A	1
Sodium Sulfide	Sat.	A	A	1
Trisodium Phosphate	10%	A	A	1

KETONES-ESTERS				
CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATION
Acetone	100%	A	A	1
Amyl Acetate	100%	A	A	1
Butyl Acetate	100%	A	A	1
Ethyl Acetate	100%	A	A	1
Methyl Ethyl Ketone	100%	A	A	1
Methyl Isobutyl Ketone	100%	A	A	1
PM Acetate	100%	A	A	1

MISCELLANEOUS				
CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATION
Acrylonitrile	100%	A	B	2
Aniline	100%	A	A	1
Beer	100%	A	A	1
Bromine	100%	A	B	2
Butyl Lactate	100%	A	A	1
Carbon Disulfide	100%	A	A	1
Carbon Tetrachloride	100%	A	A	1
Chloroform	100%	A	A	1
Cola	100%	A	A	1
Corn Oil	100%	A	A	1
Cyclohexane	100%	A	A	1
Cyclohexane	100%	A	A	1
Diethyl Phthalate	100%	A	A	1

MISCELLANEOUS				
CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATION
Dimethyl Phthalate	100%	A	A	1
Ethylene Dichloride	100%	A	B	2
Formaldehyde	100%	A	A	1
Fruit Juice	100%	A	A	1
Grease	100%	A	A	1
Hydrogen Peroxide	50%	A	A	1
Ketchup	100%	A	A	1
Lanolin	100%	A	A	1
Lard	100%	A	A	1
Linseed Oil	100%	A	A	1
Mayonnaise	100%	A	A	1
Methyl Salicylate	50%	A	B	2
Milk	100%	A	A	1
Mustard	100%	A	A	1
2-Nitro-Propane	100%	A	A	1
Pyridine	Sat.	B	C	3
Sugar	Sat.	A	A	1
Tannic Acid	Sat.	A	A	1
Tartaric Acid	2%	A	A	1
Tide Solution	100%	A	A	1
Triacetin	100%	A	A	1
Triethanolamine	100%	A	A	1
Turpentine	100%	A	A	1
Water	100%	A	A	1
Wine	100%	A	A	1

SOLVENTS-ALIPHATIC				
CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATION
Gasoline	100%	A	A	1
Hexane	100%	A	A	1
Jet Fuel A-1	100%	A	A	1
Mineral Spirits	100%	A	A	1
Naphtha	100%	A	A	1

SOLVENTS-AROMATIC				
CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATION
Chlorobenzene	100%	A	A	1
SC-100	100%	A	A	1
Toluene	100%	A	A	1
Xylene	100%	A	A	1

SOLVENTS-CHLORINATED				
CHEMICAL	CONC	1-HR	24-HRS	RECOMMENDATION
Dichlorobenzene	100%	A	A	1
Methylene Chloride	100%	A	C	2
Perchloroethane	100%	A	A	1
1,1,1,trichloroethane	100%	A	A	1
Tetrachloroethylene	100%	A	A	1

Chem-Rock Novo-Poxi CR Guide Rev.: 1 1/99

WARRANTY STATEMENT:
Information about ROCK-TRED products is given to the best of our knowledge, based on tests and experience. However, as products are often applied or used under conditions beyond our control, ROCK-TRED cannot guarantee anything but the quality of the products. ROCK-TRED warrants its products meet specifications set by ROCK-TRED, but we reserve the right to change given specifications without notice. ROCK-TRED DISCLAIMS ALL WARRANTIES RELATING TO THE PRODUCTS AND THEIR APPLICATION, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Receipt of ROCK-TRED products constitutes acceptance of the terms of this limited warranty and the terms and the conditions set out in our invoice, contrary provisions of buyer's purchase documents not withstanding. Upon receipt of merchandise, purchaser has 30 days to notify ROCK-TRED in writing that materials are defective. In the event ROCK-TRED finds that the product delivered is off specification, ROCK-TRED will, at its sole discretion, either replace the product or refund the purchase price thereof, and ROCK-TRED's choice of one of these remedies is the buyer's sole remedy. In no event shall the liability of ROCK-TRED exceed the purchase price of shipped merchandise. ROCK-TRED will under no circumstances be liable for special, incidental or consequential damages. Claims must be in writing. Claims after 30 days are void.

ROCK TRED
Flooring Solutions Since 1939

Manufacturing and Headquarters: 7440 N. St. Louis Ave., Skokie, IL 60076-4032 U.S.A.
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HYDROSTATIC TEST RECORD

Date 7-18-1995

Clean Harbors of Chicago
11700 S. Stoney Island Ave
Chicago Il

Tank/line/valve tested:

Tank # TK-112 Valve # (s) FOR CLOSED AND OPEN VALVES SEE DWG. PT-006 & 2916-F-07

Process Line # (s) P-112D, P-112F & P-162S

Description:

Drawing # PT-006 10 2916-F-07/0 REV —

Applicable Specification C.S 4" & 3" SCH 40 ASTM A-53B

TEST PREPARATION:

YES Joints Accessible

N/A Expansion Joints Restrained

Removed ~~Relief Valves~~/Rupture discs isolated

N/A Low Press Equipment Isolated

YES System Supports Sufficient

YES System Vented

YES Connections Checked

YES Test Gauges in Place

N/A Recorder Serial #

TEST PARAMETERS:

Guage Range 0 PSIG to 300 PSIG (1-1/2 to 4 x test press)

Guage Calibration 1. I.D.# N/A Due Date

Test Pressure - Internal ~~105~~ 107 PSIG External ATM PSIG

Test Medium - WATER Condition City water

Test Temperature 70 F (70F min Sec I/60F min Sec 8, 11 & B31.1)

Ambient Temperature 80 F 75% RH

HYDROSTATIC TEST RECORD

Date 7-19-95

Clean Harbors of Chicago
11700 S. Stoney Island Ave
Chicago Il

Tank/line/valve tested: FOR CLOSED & OPEN VALVES SEE DWGS

Tank # TK-102 & TK-110 Valve # (s) PT-004 & PT-005

Process Line # (s) P-102D, P-102F, P-110D & P-110F, P-181S P-184S

Description: Line P-102D was tested second time
Lines were interconected by hose from V-719 to V-691

Drawing # PT-004/Rev0 PT-005/Rev0 REV —

Applicable Specification C.S 4" SCH 40 & 3" SCH 40 ASTM A53B

TEST PREPARATION:

YES Joints Accessible

N/A Expansion Joints Restrained

REMOVED ~~Relief Valves~~/Rupture discs isolated

N/A Low Press Equipment Isolated

YES System Supports Sufficient

YES System Vented

YES Connections Checked

YES Test Gauges in Place

N/A Recorder Serial #_____

TEST PARAMETERS:

Guage Range 0 PSIG to 300 PSIG (1-1/2 to 4 x test press)

Guage Calibration 1. I.D.# N/A Due Date_____

Test Pressure - Internal ~~100~~ 105 PSIG External ATM PSIG

Test Medium - WATER Condition City water

Test Temperature 65 F (70F min Sec I/60F min Sec 8, 11 & B31.1)

Ambient Temperature 87 F 75% RH

Appendix D-46

Engineering Certifications Units B and C

CONSTRUCTION CERTIFICATION REPORT

UNIT "B" - Bulk Storage Pad

UNIT "C" - Truck Staging Area

Prepared for:

CLEAN HARBORS OF CHICAGO, INC.
11800 S. Stony Island Avenue
Chicago, Illinois 60617

Prepared by:

HOYER-SCHLESINGER-TURNER, INC.
Consulting Engineers
300 West Adams Street, Suite 630
Chicago, Illinois 60606

HST Project No. 17851

September 1995

HOYER-SCHLESINGER-TURNER inc.
ENGINEERS - CONSTRUCTORS
300 west adams street chicago illinois 60606 telephone 263 0556 area code 312

September 1, 1995

Mr. Paul Ahearn
Manager, Regulatory Compliance
CLEAN HARBORS OF CHICAGO, INC.
11800 South Stony Island Avenue
Chicago, Illinois 60617

Re: Construction Certification Report
Unit "B" and "C"
11700 South Stony Island Avenue
Chicago, Illinois 60617
HST Project No. 17851

Gentlemen:

This report presents the results of Hoyer-Schlesinger-Turner, Inc.'s (HST) involvement in construction and construction modification of the Units "B" - Bulk Solid Storage Pad and Unit "C" - Truck Staging Area.

The construction documents were prepared under HST supervision. HST engineers made numerous field trips to observe construction. I witnessed the application of the coating of Units "B" and "C" on August 25, 1995 and performed the final inspection on August 31, 1995.

We designed and constructed the secondary containment system to prevent any migration of wastes or accumulated liquid out to the soil, ground water or surface water at anytime.

The presence of small drips, spills, leaks or precipitation in the secondary containment for both Units will be monitored through daily visual plant inspections.

Respectfully submitted,

HOYER-SCHLESINGER-TURNER, INC.

Marie Vanagas

Marie Vanagas, PE
Illinois Licensed Professional Engineer
License No. 062-040801

MARIE VANAGAS
62-40801
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

Exp. 11-30-95

MV/ar

SUMMARY OF INSPECTION

UNIT "B" - Bulk Solid Storage Pad

Unit "C" - Truck Staging Area

UNIT "B"

Unit "B" - Bulk Solid Storage Pad is a new concrete structure without a canopy. The pad is located on the existing Clean Harbors of Chicago, Inc. (CHCI) portion of the facility.

Unit "B" - Bulk Solid Storage Pad is a hazardous waste transportation vehicle storage unit authorized under the June 30, 1995 modified RCRA Part B issued to CHCI.

Unit "B" was approved under the November 1993 Part B permit, but was not constructed at the time.

Unit "B" is authorized for the storage of up to 180 cubic yards - (6) 30 cubic yards roll-off containers (or equivalent) of hazardous waste solids. No wastes containing free liquids will be allowed to be stored in this area. Unit "B" was moved to a new position near the south-east fence-line of the combined CHCI/CWM property.

The concrete slab of Unit "B" is constructed of a 10-inch thick reinforced concrete. The storage pad is divided into six (6) storage bays to provide proper segregation of potentially incompatible materials. The bays are separated by concrete curbing which increase in height over the length of the bay, from 3 inches at the front (west side) of the bay to 21 inches at the rear (east side) of the bay. The entire secondary containment is coated.

For construction details see CHCI Dwg. No. 4218 (Dwg. 2916-S-05 Rev. 0) in Appendix B-1.

For calculations of structural integrity, see Appendix B-2. The containment calculations are on the drawing.

The entire secondary containment was coated with Protecto-Coat 900, 30 mils thick, as manufactured by Dudick, Inc. For technical data, application and Chemical Resistance Chart, see Appendix B-3.

There are the following deviations from Part B Approved and As-Built on CHCI Dwg. No. 4218 (Dwg. No. 2916-S-05):

Rev. F - 01/19/95

Part B Approved	As-Built - Rev. 0 - 08/29/95
1. Plan	Moved Bulk Solid Storage Pad south and moved Truck Staging Area north (switched locations).
2. Section B-B	Added water stop.
3. Notes	Added note 7 & 8.
4.	Added Section E-E.

During the visual inspection, the Truck Staging Area was in excellent condition. There were no cracks, gaps, scratches or other damage. No penetrations are present within the containment structure.

APPENDIX

B-1

CleanHarbors®
ENVIRONMENTAL SERVICES, INC.
325 WOOD ROAD • BRAINTREE, MA 02184
(617) 849-1800

"B" & "C"

Via Federal Express

Mr. Robert Watson, P.E.
Illinois Environmental Protection Agency
Division of Land Pollution Control -- #24
Permit Section
2200 Churchill Road
Post Office Box 19276
Springfield, IL 62794-9276

Re: Clean Harbors of Chicago, Inc.
Log No. B-16-M-2
Construction Certification Report

Dear Mr. Watson:

In accordance with the provisions of Conditions I.K.1 and II.D.I of the RCRA Part B Permit issued June 30, 1995 Clean Harbors of Chicago, Inc. (CHCI) is pleased to submit this Construction Certification Report (CCR) for certain units at the modified CHCI facility located at 11800 South Stony Island Avenue in Chicago, IL.

Today's submittal includes one (1) original and two (2) copies of the CCR as prepared by Hoyer Schlesinger Turner, Inc. The CCR includes all pertinent engineering design calculations, as-built drawings, and coating information required by the Agency. The report also includes the required independent professional engineer (PE) certification statement and seal.

If you have any questions, please feel free to contact me at (617) 849-1800, extension 4473.

Sincerely,

Paul A. Ahearn

Paul A. Ahearn
Manager, Regulatory Compliance

Enclosure

CERTIFICATION

This statement is to be completed by both the responsible officer and the registered professional engineer upon completion of construction in accordance with 35 IAC Section 702.126. Submit one copy of the certification with original signatures and two additional copies (four additional copies for UIC wells). Forward these certification statements and any information required by the permit to the following address:

Illinois Environmental Protection Agency
Bureau of Land - #33
Permit Section
2200 Churchill Road, P.O. Box 19276
Springfield, Illinois 62794-9276

FACILITY NAME: CLEAN HARBORS OF CHICAGO, INC.

IEPA SITE CODE: 0 3 1 6 0 0 0 0 5 1

U.S. EPA ID NO.: IL D 0 0 0 6 0 8 4 7 1

PART B PERMIT LOG #/UIC PERMIT #: B-16-M-2

PERMIT (OR MODIFICATION) ISSUANCE DATE: June 30, 1995

PERMIT CONDITION NO. REQUIRING CERTIFICATION: I.K.1 & II.D.1

The Unit "B" and "C" has been constructed in accordance with the specifications in the Part B/UIC Permit. Documentation that the construction was in accordance with the permit is contained in the enclosed report. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Alan S. McKim

Signature of Owner/Operator

Alan S. McKim, Director
Clean Harbors of Chicago, Inc.

Name and Title

Marie Vanagas

Signature of Registered P.E.

Marie Vanagas
62--40801
Hoyer-Schlesinger-Turner, Inc.

Name of Registered P.E. and Illinois Registration Number

September 1, 1995

Date

(P.E. SEAL)
Exp. Date
Nov. 30, 1995

MARIE VANAGAS
62-40801
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

This Agency is authorized to require this information under Illinois Revised Statutes, 1979, Chapter 111 1/2, Section 1039. Disclosure of this information is required under that Section. Failure to do so may prevent this form from being processed and could result in your application being denied. This form has been approved by the Forms Management Center.

IL 532-2109
LPC 655 10/92

APPENDIX

B-2

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, IL

SUBJECT APPROVED BULK SOLIDS STORAGE PAD "B"

SHEET 1 OF 2
PROJECT NO. 1785.
DATE 7.20.95
BY BERNES

a) DATA FOR ROLL-OFF CONTAINER

LARGEST CONTAINER = 6000 GALS

TOTAL LOAD = 6000 GAL × 1.2 SP.GR. × 8.35 #/GAL = 60 K

AXLE LOAD = 30 K

WHEEL SPACING = 72"

No. OF WHEELS ON AXLE = 2

SOLID TIRES 8" WIDE

LOAD CONTACT AREA PER TIRE = 4 × 8 = 32 IN.²

b) SUBGRADE AND CONCRETE DATA

CONCRETE FLEXURAL STRENGTH MR = 640 PSI @ 28 DAYS

K-VALUE = 100 PCI

DESIGN

1.) SAFETY FACTOR = 2.0

2.) CONCRETE WORKING STRESS $WS = \frac{MR}{SF} = 640/2 = 320$ PSI

3.) SLAB STRESS PER 1,000 # OF AXLE LOAD

$= \frac{WS}{\text{AXLE LOAD}} = 320/30 = 10.67$ PSI

4.) FROM FIG. 5 (SEE SHEET #2)

SLAB THICKNESS REQ'D = 9" < 10" PROVIDED O.K.

5.) REINFORCEMENT

$A_s = \frac{2 \times L \times W}{2 \times f_s} = \frac{2 \times 70.67' \times 125}{2 \times 24{,}000} = .29$ IN²

#4 @ 12 T & B > .29 IN² O.K.

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes

PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11-30-9

HOYER-SCHLESINGER-TURNER, INC.

SHEET 2 OF 2

PROJECT CLEAN HARBORS - CHICAGO, IL

PROJECT NO. 783

SUBJECT APPROVED BULK SOLIDS STORAGE PAD "B"

DATE 7.20.95

BY BERNES, J

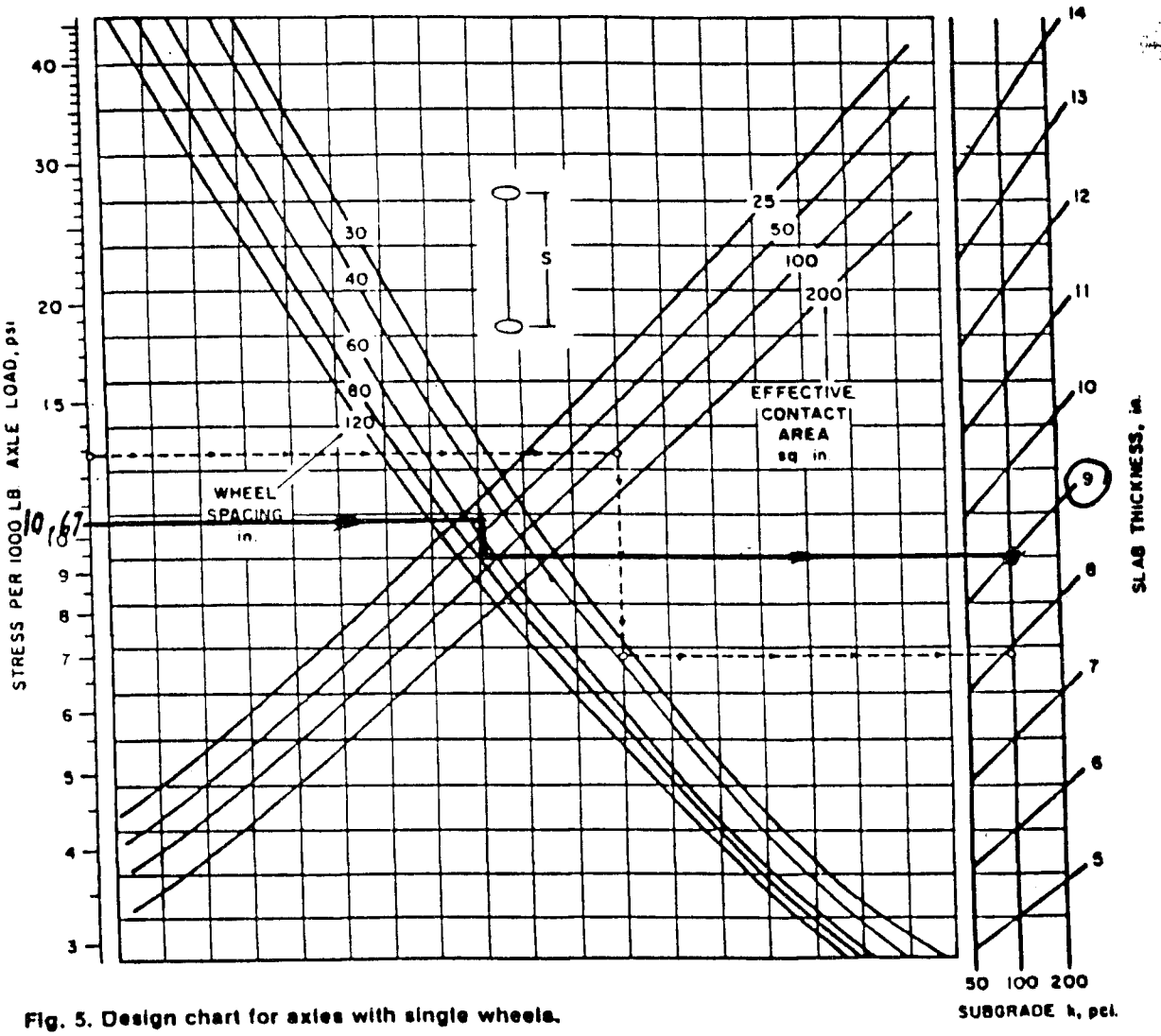

Fig. 5. Design chart for axles with single wheels.

APPENDIX

B-3

Dudick Inc.

Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Streetsboro, Ohio 44241

216-562-1970
FAX No. 216-562-7638

Protecto-Coat 800/900/ 805/905

FLAKE-FILLED HIGH PERFORMANCE VINYL ESTER COATING, 30-40 MILS (1.0 mm)

Protecto-Coat Systems are designed to protect concrete and steel from splash and spills and mild immersion exposures of organic, inorganic acids, alkalies and solvents. The 805/905 adds fluoride protection.

RECOMMENDED APPLICATIONS

- Structural Steel
- Elevated Water Storage Towers
- Plating Lines, Exterior
- Pickling Lines, Exterior
- SO_2 Scrubber Duct Work
- Spent Carbon Storage
- Floors (Spillage)
- Steel Pump Supports
- Thickener Mechanisms
- Underground Tanks and Piping
- Catwalks
- Interiors of Chemical Storage Tanks

CHEMICAL RESISTANCE

- Organic Acids
- Inorganic Acids
- Alkali Solutions
- Solvents (900 only)
- Oils
- Salts

A complete listing of substances and concentrations tested is available on request.

Temperature Limits:
Immersion up to 120°F
Dry — 250°F – Continuous
300°F – Intermittent

PHYSICAL PROPERTIES

Tensile Strength ASTM C307	2,500-2,800 PSI
Flexural Strength ASTM C790	5,000-5,200 PSI
Adhesion to Steel	2,000 PSI
Barcol Hardness	35-40
P-Coat 805/905 Electrical Properties	1.5-2.0 Megaohms
Color	White, Gray
Solids	100% Reactive

SPECIFICATIONS

Coating shall be 30-40 mils thick, flake-filled vinyl ester based resin, consisting of a base and topcoat of 15-20 mils each, as manufactured by Dudick, Inc. Materials shall be brush, roller, or spray applied in accordance with manufacturer's recommended practices.

OTHER PROTECTO-COAT 800/900 COATINGS AVAILABLE

Protecto-Coat 800 and 900 coatings are two distinct formulations designed to offer a wide range of high performance coatings suitable for many different industrial and manufacturing applications. In turn, each coating may be chosen with flake or graphite fillers to enhance the protection necessary for a specific chemical environment, and is available in formulations for either brush, roller or spray application. All Protecto-Coat 800 and 900 coatings (except graphite filled) are available in white or gray.

Protecto-Coat 800 is a thermosetting vinyl ester coating which utilizes a flake filler for resistance to a wide variety of acids, caustics, salts, oils and mild alkali solutions, and offers superior protection against organic acids and caustics. The 800 series offers the most versatile protection in the Protecto-Coat line and is the most widely used vinyl ester.

Protecto-Coat 801 is Protecto-Coat 800 formulated for two component spray application.

Protecto-Coat 805 is a Protecto-Coat 800 coating with graphite flake fillers for improved protection against fluorides and higher caustic concentrations or where conductive properties are needed.

Protecto-Coat 900 is a higher cross link density coating and offers the highest solvent and acid resistance.

Protecto-Coat 901 is Protecto-Coat 900 for two component spray application.

Protecto-Coat 905 is Protecto-Coat 900 with graphite flake fillers for improved protection against fluorides and higher caustic concentrations or where conductive properties are needed.

THE PROTECTO-COAT SYSTEM

The Protecto-Coat System uses two layers of thermosetting flake-filled vinyl ester resins to build up the protection that vulnerable steel and concrete need in chemically oriented manufacturing or processing operations. When fully cured, the separate elements lose their individual identity and become a single, monolithic coating.

Primer 27 is designed to prevent abrasive-blasted steel from developing rust bloom prior to the application of a Protecto-Coat coating. For maximum performance all steel surfaces should be primed, but primer may not be needed for mild, non-immersion service. Concrete, however, must always be primed to aid in the "wetting out" required for good bonding.

Basecoat/Topcoat: Protecto-Coat resins are filled with flakes or graphite flakes to reduce the coefficient of expansion. Protecto-Coat 800/900 resins, filled with flakes or graphite flakes, provide a chemical resistant outer barrier. Overlapping leaf arrangement of flakes reduces water vapor permeation and permits chemical exposures at higher temperatures without increasing the thickness of the coating.

ESTIMATING QUANTITIES AND ORDER BILL OF MATERIAL

Note: Resins include 3 oz. hardener as standard.

SQUARE FEET PER GALLON	CONCRETE	STEEL
Primer 27	150-200	250-300
P-Coat 800/900/805/905		
Actual 30 40 Mil. DFT	30	30
Theoretical 30-40 Mil. DFT	45	45
S-10 Solvent	500	500

Quantities shown are for estimating purposes only. Actual field usage may very.

APPLICATION INSTRUCTIONS

SURFACE PREPARATION

Metal: For immersion service, abrasive blast to a white metal finish and a 2-3 mils minimum profile according to SSPC 5 or NACE #1. For fume or splash service, abrasive blast to a near white metal finish according to SSPC 10.

Concrete: Concrete must be abrasive blasted or etched with muriatic acid (Solution of 1 part 20° Be HCl and 1 part water) to remove surface laitance and other contaminants. Concrete must be free of curing compounds and form release agents. Surface texture should be similar to 40-60 grit sandpaper. Additional surface preparation will be required if a 40-60 grit texture is not achieved and the surface laitance not completely removed after a single application of acid or with the first mechanical preparation procedure.

If after abrasive blasting, honeycombs/voids appear on the concrete or steel, these have to be filled with a suitable material. Contact a Dudick Representative for this information.

Hardener Amount/Gal. Resin.

HARDENER	SUBSTRATE TEMPERATURE	PRIMER 27	P-C 800/900 BASECOAT/ TOPCOAT	P-C 805/905 BASECOAT/ TOPCOAT
PH-1	60°-70°F	3-4 oz.	3-4 oz.	3-4 oz.
PH-1	70°-90°F	2-3 oz.	2-3 oz.	2-3 oz.

Recommended application temperatures should be between 50°F and 110°F substrate temperature.

PRIMING

Metal: For maximum performance, prime all steel surfaces with Primer 27 3-4 mil. WFT, mixed with appropriate amount of PH-1 Hardener. For mild non-immersion service, priming of steel may be omitted.

Concrete: Concrete surfaces must be primed using Primer 27 and the appropriate amount of PH-1 Hardener. Concrete must be thoroughly dry before application of primer by spray, roller, or brush. Do not allow the primer to puddle.

BASECOAT

Add appropriate amount of PH-1 Hardener for each gallon of Protecto-Coat Liquid and mix thoroughly until uniform color is achieved. Apply a 15-20 mils thick basecoat using spray, brush or roller. Apply to an even, smooth finish.

Allow basecoat application to cure to at least a "firm" or slightly "tacky" feel before applying the topcoat.

TOPCOAT

Add appropriate amount of PH-1 Hardener for each gallon of Protecto-Coat Liquid and mix thoroughly until a uniform color is achieved. Apply a 15-20 mils thick topcoat using a spray brush or roller. Apply to an even, smooth finish.

Cure cycles for Protecto-Coat Coatings are:

Temperature	Recoat Time	Cure Time
50°F	12 Hours	96 Hours
75°F	4 Hours	48 Hours
90°F	3 Hours	24 Hours

Protecto-Coat 900 must be recoated within 8 hours when exposed to direct sunlight.

If these recoat times are exceeded, consult a Dudick representative. Sanding or abrasive blasting may be required before the next coat. Recoat times are dramatically reduced when the coating is exposed to direct sunlight.

Application of Protecto-Coat 800/900 in direct sunlight may lead to blistering, pinholes, or wrinkling in the copating due to outgassing of air in the concrete and high substrate temperatures.

Standard Formulation: (Brush, Roller or Pressure Pot) Spray applications can be made with conventional air spray equipment with a pressure pot. Binks #18 spray gun with #68 fluid nozzle and 68 air nozzle, or Binks #62 spray gun with #68 fluid nozzle and #68 air nozzle are recommended.

Plural component spray applications can be made with a Binks 8-to-1 Pump. A Binks Model 18 NC spray gun 59BSSX9-47 with a 102-3430 ACI valve. Catalyst would need to be supplied by a 101-5202 catalyst tank. 1/2" ID material supply hose is recommended.

Brush or roller application may require additional coats to meet specified dry film thickness.

Pot Life of the opened and mixed Protecto-Coat 800/900, 805/905 will depend on the temperature at the work site. To prevent material waste and avoid damage to equipment, do not open and mix more material than can be used according to the following table:

TEMPERATURE	POT LIFE
50°F	1 Hour
75°F	40 Min.
90°F	25 Min.

Do not attempt to store mixed material. Residual material should be properly disposed of at the end of each work period. Where immersion service is required, spark test the coating with a 5,000 volt AC spark tester. Mark and repair all pinholes. Use Protecto-Coat Liquid mixed with the amount of hardener appropriate for the substrate temperature. Retest only the repairs.

CLEANING

Use S10 Cleaning Solvent to clean tools and equipment.

SHIPPING

Protecto-Coat Liquids are red label items with flash points of 73°F (PMCC), classified "Flammable Liquid." Hardener PH-1 is classified as an Organic Peroxide and a yellow label item. S-10 Cleaning Solvent is a flammable liquid with a flash point of 52°F (PMCC).

STORAGE

Warning: All Dudick products classified by DOT labels as either white, yellow or red labels, must not be mixed or stored together as an explosive reaction may occur.

When stored in a cool and dry location, Protecto-Coat 800/900/805/905 ingredients have a 3-month shelf life. Exposure to excessive heat may cause premature gelling and reduce working time.

SAFETY

M.S.D.S. - Sheets must always be read before using products. Protecto-Coat coatings are intended for application by experienced, professional personnel. Dudick Inc. can supply Protecto-Coat coatings supervision to help determine that the surface has been properly prepared, the ingredients correctly mixed, and the materials properly and safely applied.

If Protecto-Coat materials are to be applied by your own personnel or by a third-party contractor, please be sure that they are aware of the following safety precautions:

• Exposure to resins, solvents and hardeners may cause severe dermatitis reactions in some people. Cleanliness of the skin and clothing is critical and must be of paramount concern.

• Safety glasses, gloves and suitable protective clothing must be worn at all times during application.

• Suitable respirators should be used during application.

• If contact with hardeners occurs, remove any clothing involved and wash the skin with water. Discard the clothing. Do not attempt to wash and reuse it. Protecto-Coat Liquid may be washed off with S-10 Cleaning Solvent, MEK, or lacquer thinner.

• DO NOT USE ACETONE. Acetone forms a potentially explosive mixture with peroxides.

•Fumes are flammable and heavier than air. Proper ventilation should be maintained to minimize breathing of concentrated fumes

• If a rash or dermatitis occurs, remove the individual from the work area and seek a physicians care for dermatitis.

• Keep open flames and sparks away from the area where toppings are being mixed and applied.

• In case of eye contact, wash with water for at least 15 minutes and consult a physician. If swallowed, do not induce vomiting; call a physician immediately.

Note:

Dudick Inc. ("Dudick") warrants all goods of its manufacture to be as represented in its catalogs and that the application of its products by its employees or sub-contractors shall be performed in a workmanlike manner. Dudick's obligation under this warranty shall be the repair to and replacement of any applications which its examination shall disclose to be defective. Dudick makes no warranty concerning the suitability of its product for application to any surface, it being understood that the goods have been selected and the application ordered by the purchaser. DUDICK INC. MAKES NO WARRANTY, EXPRESS OR IMPLIED, THAT THE GOODS SHALL BE MERCHANTABLE OR THAT THE GOODS ARE FIT FOR ANY PARTICULAR PURPOSE. THE WARRANTY OF REPAIR OR REPLACEMENT SET FORTH HEREIN IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES ARISING BY LAW OR OTHERWISE; AND DUDICK INC. SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DOWN TIME, DAMAGES TO PROPERTY OF THE PURCHASER OR OTHER PERSONS, OR DAMAGES FOR WHICH THE PURCHASER MAY BE LIABLE TO OTHER PERSONS, WHETHER OR NOT OCCASIONED BY DUDICK'S NEGLIGENCE. This warranty shall not be extended, altered or varied except by written instrument signed by Dudick and Purchaser.

Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Streetsboro, Ohio 44241
(12-91)

Temperature/Chemical Resistance Key

Indicator	Definition	Indicator	Definition	Indicator	Definition
I	Material will withstand constant flow or Immersion service.	1	Good to the maximum temperature of the product	*NR*	Not recommended
S	Material is suitable for intermittent or Spillage service	2	High Temperature Service to 160° F (71° C)	*NI*	No information available
F	Material will tolerate Fumes only	3	Moderate Temperature Service to 140° F (60° C)	*PV*	Performance varies with conditions. Consult Dudick for recommendations or testing
		4	Warm Temperature Service to 100° F (37° C)		

Example

48. Boric Acid	14	14	14	14	14	13	11	11	S1	S1	S1	12	1:
	AID	AID	AID	AID	AID	AID	AID	AID	AID	AID	AID		C

Each grid block in the Guide shows all the information which is available on the product for the use shown. Thus, a block which shows I2, indicates that the product is capable of providing immersion service up to 160° F. Similarly, a block which shows F1 indicates the material will tolerate temperatures to the maximum capability shown in the Temperature Limits chart below, but that it is designed for exposure only to fumes.

Temperature Limits

Product	Substrate	Maximum Temperature	Notes
Protecto-Coat Series	*Metal* *Concrete/Steel*	130° F 54° C 130° F 54° C	[1] Steel: Constant Flow; Steel Dry or Intermittent Spills: 200°F (93°C) to 350°F (96°C) [2] Concrete: Constant Flow
Protecto-Crete Series	*Metal* *Concrete*	Not Recommended 250° F 120° C	[3] Intermittent Spills, otherwise maximum temperature is 150°F
Protecto-Flake Series	*Metal* [4] *Concrete*	180° F 83° C Not Applicable	[4] Steel: Immersion; Steel, Dry: 250°F (121°C)
Protecto-Glass Series	*Metal* [5] *Concrete*	160° F 71° C 160° F 71° C	[5] Steel: Constant Flow
Protecto-Line Series	*Metal* [6] *Concrete* [7]	160° F 71° C 160° F 71° C	[6] Steel: Constant Flow and Immersion [7] Concrete: Constant Flow
Protecto-Seal Series	*Metal* [8] *Tile/Concrete* [8]	Not Applicable 160° F 71° C	[8] Tile: Constant Flow and Immersion
Grout Series	*Metal* *Concrete*	Not Applicable 160° F 71° C	

Dudick

Key

- I — Material will withstand constant flow or immersion service
- S — Material is suitable for intermittent or Spillage service
- F — Material will tolerate fumes only

	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
1. Acetaldehyde	F4	NR	PV	PV	F4	F4	NR	NR	S4	S4	NR	NR	NR	NR
2. Acetic Acid (0-10%)	I3	F4	I4	I4	I4	I4	S1	S1	S1	S1	S1	I3	I3	I3
3. Acetic Acid (10-50%)	S4	NR	S1	S1	S1	S1	F1	F1	S4	S4	S3	I4	I4	I4
4. Acetic Acid (50-100%)	F4	NR	S3	S3	S3	S3	NR	NR	NR	NR	S3	PV	PV	S4
5. Acetic Anhydride	F4	NR	S4	S4	S4	S4	PV	PV	NR	NR	S4	S4	S4	S4
6. Acetone	S4	NR	NR	F4	NR	NR	NR	S3	S4	S4	s4	NR	NR	NR
7. Acetyl Chloride	F4	F4	PV	PV	PV	PV	PV	PV	S4	S4	S4	PV	PV	PV
8. Acrylic Acid	PV	F4	PV	PV	PV	PV	PV	PV	NR	NR	S4	I4	I4	I4
9. Acrylonitrile	NR	NR	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	PV
10. Adipic Acid	I4	I4	I4	I4	I4	I4	PV	PV	S4	S4	S4	I4	I4	I4
11. Alcohol (Ethyl)	S4	S4	I4	I4	I4	I4	I4	I4	S4	S4	S1	I1	I1	I1
12. Alcohol (Methyl)	S4	NR	PV	PV	F4	F4	S4	S4	S4	S4	S1	I4	I4	I4
13. Allyl Chloride	F4	NR	NR	NR	NR	NR	PV	PV	NR	S4	S1	PV	PV	S4
14. Alum	S4	I4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I3	I3	I2
15. Aluminum Bromide	S4	F4	I4	I4	I4	I4	F1	F1	S4	S4	S1	I1	I1	I1
16. Aluminum Chloride	I4	I4	I4	I4	I4	I4	I1	I1	S3	S3	S1	I1	I1	I1
17. Aluminum Fluoride*	S1	S4	S1	S1	S1	S1	NR	NR	S1	S1	S1	I4	I4	I4
18. Aluminum Hydroxide	I4	S4	F4	F4	S4	S4	S4	S4	S1	S1	S1	I4	I3	I3
19. Aluminum Sulfate	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S4	I3	I3	I2
20. Ammonia (Dry)	S4	S4	F1	F1	F1	F1	F1	F1	S1	S1	S1	I3	I3	I3
21. Ammonium Chloride	S1	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
22. Ammonium Fluoride*	S4	S4	I4	I4	I4	S4	NR	NR	S1	S1	S2	I3	I3	I3
23. Ammonium Hydroxide	I4	I4	F4	F4	S4	S4	I1	I1	S1	S1	S1	I2	I2	I2
24. Ammonium Nitrate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
25. Ammonium Persulfate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
26. Ammonium Sulfate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
27. Ammonium Sulfide	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
28. Ammonium Sulfite	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
29. Amyl Acetate	F4	NR	S4	S4	S4	S4	NR	NR	NR	NR	NR	PV	F4	F4
30. Amyl Alcohol	F4	F4	S1	S1	S1	I4	NR	NR	S3	S3	S3	I4	I4	I4
31. Aniline	NR	NR	S4	S4	S4	S4	NR	NR	NR	NR	NR	NR	I4	I4
32. Aniline Hydrochloride	F4	F4	S4	S4	S4	S4	F4	F4	S3	S3	S3	I4	I4	I4
33. Antimony Chloride	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
34. Aqua Regia	NR	NR	NR	NR	NR	F4	NR	NR	NR	NR	NR	NR	NR	NR
35. Arsenic Acid	F4	F4	I4	I4	I4	I3	S4	S4	S1	S1	S1	I3	I3	PV
36. Barium Acetate	S4	S4	S4	S4	S4	S4	F4	F4	S4	S4	S3	I4	I4	I4
37. Barium Chloride	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
38. Barium Hydroxide	I4	I4	S3	S3	S2	I4	I1	I1	S1	S1	S4	I4*	I4*	I3*
39. Barium Sulfide	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
40. Benzaldehyde	PV	PV	NR	NR	NR	NR	NR	S4	PV	PV	PV	PV	NR	PV
41. Benzene	F4	NR	PV	PV	NR	NR	NR	S4	S4	S4	S4	NR	NR	S4
42. Benzene Sulfonic Acid	F4	F4	I4	I4	I4	I4	F4	F4	S4	S4	S1	I1	I1	I1
43. Benzene Sulfonic Chloride	F4	F4	I4	I4	I4	I3	F4	F4	S4	S4	S1	I1	I1	I1
44. Benzoic Acid	S4	S4	I4	I4	I4	I3	F4	F4	S1	S1	S1	I1	I1	I1
45. Benzoyl Chloride	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	NR	NR	PV
46. Black Liquor*	S4	S4	S1	I4	I1	I1	I1	NR	S1	S1	S3	I3	I3	I3
47. Bleach (5.5%)*	S4	F4	PV	PV	I1	I1	F1	NR	NR	I3	S4	NR	NR	I1
48. Boric Acid	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I2	I2	I2
49. Bromine, Wet Gas	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	F4	F4	F4
50. Bromine Water (5%)	F4	NR	S4	S4	S4	S4	S4	S4	NR	S4	S4	I4	I4	I4
51. Butadiene	S4	PV	PV	PV	PV	PV	NR	NR	S4	S4	S4	PV	PV	PV
52. Butanol	F4	NR	S4	S4	S4	S4	NR	NR	S4	S4	S1	I3	I3	I3
53. Butyl Acetate	F4	NR	NR	NR	F4	F4	NR	S4	S4	S4	NR	NR	NR	PV
54. Butyl Carbitol	F4	PV	PV	PV	F4	F4	PV	PV	S4	S4	PV	I4	I4	I4
55. Butyl Cellosolve	F4	NR	PV	NR	S4	S4	NR	S4	S4	S4	S4	NR	NR	S4
56. Butyric Acid	F4	NR	F4	F4	F3	F3	NR	NR	NR	NR	NR	I3	I3	I3
57. Cadmium Plating (Cyanide)	S4	S4	S1	S1	S1	S1	S1	S1	S1	S1	S3	I3	I3	I3

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	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
58. Calcium Bisulfite	S4	S4	I4	I4	I3	I3	F1	F1	S3	S3	S1	I1	I1	I1
59. Calcium Carbonate (Soda Ash)	I4	I4	I4	I4	I3	I3	I1	NR	S1	S1	S4	I3	I3	I3
60. Calcium Chloride	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
61. Calcium Hydroxide*	I4	I4	I4	I4	I3	I4	I1	NR	S1	S1	S3	I3	I3	I3
62. Calcium Hypochlorite (5%)*	F4	F4	F4	F4	S4	S4	F4	NR	S4	S4	S3	NR	NR	NR
63. Calcium Nitrate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
64. Caprylic Acid	NR	NR	I4	I4	I4	I4	NR	NR	NR	NR	NR	I4	I4	I4
65. Carbon Disulfide	F4	NR	S4	S4	S4	S4	NR	NR	S4	S4	S4	F4	F4	F4
66. Carbon Tetrachloride	F4	F4	S4	S4	S3	S3	NR	NR	S3	S3	S3	NR	I4	I4
67. Castor Oil	I4	I4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
68. Chloracetic Acid	F4	NR	F4	F4	F4	F4	F1	F1	NR	S4	S4	F3	F3	F3
69. Chloral	NR	NR	NR	NR	NR	NR	NR	NR	S4	S4	NR	NR	NR	NR
70. Chlorine Dioxide	F4	NR	S4	S4	S3	S3	NR	NR	NR	S4	S3	I4	I4	I3
71. Chlorine Gas (Dry)	NR	NR	F4	F4	F3	F3	NR	NR	NR	NR	S4	I4	I4	I3
72. Chlorine Gas (Wet)	NR	NR	NR	NR	F4	F3	NR	NR	NR	S4	S2	F4	F4	F4
73. Chlorine Water (Saturated)	NR	NR	S4	S4	S3	S3	F4	F4	S4	S4	S2	I4	I4	I4
74. Chlorobenzene	F4	NR	NR	NR	S4	S4	NR	NR	S4	S4	NR	NR	NR	S4
75. Chloroform	F4	NR	NR	NR	NR	NR	NR	NR	S4	S4	NR	NR	NR	NR
76. Chlorophenol	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
77. Chlorosulfonic Acid	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
78. Chlorotoluene	F4	NR	S4	S4	S4	S4	NR	NR	NR	NR	S4	I4	NR	PV
79. Chromic Acid (10%)	F4	F4	S4	S4	S4	S4	S4	S4	S4	S4	S4	I4	I4	I4
80. Chromic Acid (40%)	F4	NR	S4	S4	S4	S4	S4	S4	S4	S4	S4	I4	I4	PV
81. Chromic Chloride	S4	S4	I4	I4	I4	I3	S1	S1	S1	S1	S1	I1	I1	I1
82. Citric Acid	S4	F4	I4	I4	I4	I3	S1	S1	S4	S4	S1	I1	I1	I1
83. Copper Plating (Cyanide)	S3	S3	S4	S4	S3	S3	S1	S1	S2	S2	S4	I4	I4	I3
84. Copper Plating (Acid)	S4	S4	S3	S3	S3	S3	S1	S1	S2	S2	S1	I1	I1	I1
85. Copper Salts	S3	S3	I4	I4	I4	I4	S1	S1	S1	S1	S1	I1	I1	I1
86. Corn Oil	S3	S3	I4	I4	I4	I3	I1	I1	S3	S3	S1	I1	I1	I1
87. Corn Starch	S1	S1	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
88. Corn Sugar	S1	S1	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
89. Cottonseed Oil	S3	S3	I4	I4	I4	I3	I1	I1	S3	S3	S1	I1	I1	I1
90. Cresol	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	NR	NR	PV
91. Cresylic Acid	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
92. Crude Oil	S4	PV	I4	I4	I4	I4	PV	PV	PV	I1	S1	I1	I1	I1
93. Detergent Sulfonated	S4	PV	I4	I4	I4	I4	PV	PV	PV	I1	PV	I1	I1	I1
94. Dextrose	I3	S3	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
95. Dibutyl Phthalate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I3	I3	I3
96. Dichloro Acetic Acid (20%)	F4	NR	I4	I4	I4	I4	F1	F1	NR	NR	S3	I4	I4	I4
97. Diesel Fuel	I4	S4	I4	I4	I4	I4	S3	S3	S1	S1	S1	I1	I1	I1
98. Diethylamine (100%)	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	NR	NR	PV
99. Dimethyl Formamide	F4	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	I4	NR	PV
100. Esters, Fatty Acids	S4	PV	I4	I4	I4	I4	PV	PV	PV	S4	PV	I3	I3	I3
101. Ethyl Acetate	F4	NR	NR	NR	NR	NR	F1	F1	S4	S4	S4	NR	NR	NR
102. Ethyl Alcohol	S4	S4	I4	I4	I4	I4	I4	I4	S4	S4	S4	I4	I4	I4
103. Ethylamine	NR	NR	NR	NR	PV	PV	NR	NR	PV	PV	PV	NR	NR	PV
104. Ethylchloroformate	F4	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	PV	NR	PV
105. Ethyl Ether	F4	NR	NR	NR	PV	PV	NR	F4	S4	S4	S4	PV	PV	PV
106. Ethylene Dichloride	F4	NR	NR	NR	NR	NR	NR	F4	NR	NR	NR	PV	NR	NR
107. Ethylene Glycol	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
108. Ethylene Oxide	F4	NR	PV	PV	PV	PV	PV	PV	PV	PV	S1	PV	PV	PV
109. Ethyl Sulfate	F4	PV	PV	PV	PV	PV	PV	PV	S4	S4	NR	I4	I4	I4
110. Ferric Chloride	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	NR	I1	I1	I1
111. Ferric Sulfate	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
112. Ferrous Chloride	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
113. Ferrous Sulfate	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
114. Fluoboric Acid*	F4	PV	S4	S4	S4	S4	PV	PV	S4	S4	S4	NR	PV	NR

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	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
115. Fluorine Gas*	NR	NR	NR	NR	NR	NR	NR	NR	PV	PV	PV	NR	PV	PV
116. Fluosilicic Acid*	F4	PV	S4	S4	S4	S4	PV	PV	S4	S4	S4	NR	PV	NR
117. Formaldehyde	F4	F4	I4	I4	I4	I4	F4	F4	S1	S1	S1	I1	I1	I1
118. Formic Acid	F4	NR	S4	S4	S4	I4	PV	PV	NR	NR	S4	I4	I4	I4
119. Fuel Oil 1 & 2	S1	S4	I4	I4	I4	I4	NR	NR	S1	S1	S1	I1	I1	I1
120. Furfural	F4	NR	S4	S4	S4	S4	PV	PV	PV	PV	PV	NR	PV	PV
121. Furfural Alcohol	S4	PV	S4	S4	S4	S4	S4	S4	S1	S1	S1	I4	I4	I4
122. Gasoline	I4	I4	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
123. Glucose	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
124. Gluconic Acid (50%)	PV	PV	F4	F4	S4	S4	PV	PV	PV	PV	S4	S4	S4	I4
125. Glycol	I4	I4	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
126. Glycolic Acid	NR	NR	S4	S4	S4	S4	F1	F1	S4	S4	S4	I3	I3	I3
127. Gold Plating (Cyanide)	S4	S4	S1	S1	S1	I3	S1	S1	S1	S1	S4	I4	I4	I3
128. Grape Juice	I3	I3	I3	I3	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
129. Green Liquor	S4	S4	I4	I4	I3	I3	I1	I1	S1	S1	S3	I1	I1	I1
130. Heptane	S4	S4	S1	S1	S1	S1	I4	I4	S1	S1	S1	I2	I2	I2
131. Heptanoic Acid	PV	PV	S4	S4	S4	S4	F1	F1	PV	PV	I3	I3	I3	I3
132. Hexane	F4	F4	S1	S1	S1	S1	I4	I4	S1	S1	S1	I2	I2	I2
133. Hydrazine (35%)	F4	PV	NR	NR	NR	NR	NR	NR	S4	S4	S4	NR	NR	NR
134. Hydraulic Fluid	S4	PV	PV	PV	I3	I3	PV	PV	S1	S1	S1	PV	PV	I1
135. Hydriodic Acid (20%)	F4	F4	S4	S4	S4	I4	S1	S1	PV	PV	S4	I4	I4	I4
36. Hydrobromic Acid (20%)	F4	F4	S4	S4	S4	S4	S1	S1	PV	S4	S4	I4	I4	I4
137. Hydrocarbons (Aliphatic)	S4	PV	I4	I4	I4	I4	I1	I4	S1	S1	S4	I1	I1	I1
138. Hydrocarbons (Aromatic)	S4	PV	PV	PV	F4	F4	NR	NR	S4	S4	S4	PV	PV	I1
139. Hydrochloric Acid (1-25%)	S4	F4	S3	S3	S3	I3	F1	F1	S4	S4	S4	I1	I1	I1
140. Hydrochloric Acid (25-37%)	F4	NR	F3	F3	F3	I4	F1	F1	S4	S4	S4	PV	PV	I2
141. Hydrofluoric Acid (1-10%)*	NR	NR	F3	NR	F3	F3	NR	NR	NR	NR	NR	NR	NR	NR
142. Hydrofluoric Acid (10-53%)*	NR	NR	F4	NR	F4	F4	NR	NR	NR	NR	NR	NR	NR	NR
143. Hyrofluosilicic Acid*	F4	F4	F3	NR	F3	F3	PV	PV	NR	NR	NR	I2	PV	NR
144. Hydrogen Bromide	F4	PV	PV	PV	F1	F1	PV	PV	PV	PV	S4	PV	PV	I4
145. Hydrogen Peroxide (30%)	S4	NR	PV	PV	F4	I4	PV	PV	NR	S4	S4	PV	PV	I4
146. Hydrogen Sulfide	S1	S4	I4	I4	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
147. Hypochlorous Acid	NR	NR	NR	NR	F3	F3	NR	NR	NR	S4	S4	NR	NR	NR
148. Iodine	NR	NR	F4	F4	F3	F3	F1	F1	PV	S4	S4	I4	I4	I3
149. Insecticides	S4	PV	PV	PV	F4	F4	PV	PV	PV	S4	S3	PV	PV	I3
150. Isophorone	S4	PV	PV	PV	PV	PV	PV	PV	S4	S4	PV	I4	I4	I4
151. Isopropyl Acetate	F4	NR	NR	NR	NR	NR	PV	PV	S4	S4	NR	PV	PV	S4
152. Isopropyl Alcohol	S4	S4	PV	PV	S4	S4	PV	PV	S1	S1	S1	I1	I1	I1
153. Isopropyl Amine	F4	PV	PV	PV	F4	F4	NR	NR	PV	PV	NR	PV	PV	S4
154. Isopropyl Ether	S4	S4	PV	PV	F4	F4	NR	NR	S4	S4	S4	I4	I4	I4
155. Jet Fuel	I4	I4	I4	I4	I4	I4	F1	F1	S1	S1	S1	I1	I1	I1
156. Kaolin	I1	I1	PV	PV	I1	I1	I1	I1	I1	I1	I1	PV	PV	I1
157. Kerosene	I4	I4	I4	I4	I4	I4	I1	I4	S1	S1	S1	I1	I1	I1
158. Lasso Herbicide (10%)	F4	PV	S4	S4	S4	S4	F4	F4	PV	S4	S4	I4	I4	I4
159. Lactic Acid (1-20%)	S4	F4	I4	I4	I4	I3	S1	S1	S4	S4	S1	I1	I1	I1
160. Lactic Acid (20% Con)	S4	NR	S4	S4	I4	I3	S1	S1	NR	S4	S4	I4	I3	I3
161. Lauric Acid	F4	PV	I4	I4	I3	I3	S1	S1	NR	S3	S1	I1	I1	I1
162. Lead Acetate	I4	I4	I4	I4	I3	I3	F1	F1	S1	S1	S1	I1	I1	I1
163. Linseed Oil	S3	S3	I1	I1	I1	I1	I1	I1	S4	S4	S1	I1	I1	I1
164. Magnesium Sulfate	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
165. Maleic Acid	S3	S3	S3	S3	S1	I4	S1	S1	S1	S1	S4	I3	I3	I1
166. Manganese Salts	I4	I4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
167. Mercury Salts	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
168. Methyl Alcohol	S4	NR	PV	PV	F4	F4	NR	S4	S4	S4	S1	I4	I4	I4
169. Methyl Acetate	F4	NR	NR	NR	F4	F4	PV	PV	S4	S4	S4	PV	PV	PV
170. Methylene Chloride	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
171. Methyl Chloride	NR	NR	NR	NR	NR	NR	NR	S4	NR	NR	NR	NR	NR	NR

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	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
172. Methyl Ethyl Ketone	NR	NR	NR	NR	NR	NR	NR	NR	PV	S4	NR	PV	PV	NR
173. Methyl Isobutyl Ketone	F4	NR	NR	NR	NR	NR	NR	NR	S4	S4	S4	PV	PV	NR
174. Milk Products	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
175. Mineral Oil	I4	I4	I4	I4	I4	I4	S4	S4	S1	S1	S1	I1	I1	I1
176. Molasses	I4	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
177. Naphthalene	S4	S4	S4	S4	S3	S3	S4	S4	S4	S4	S4	I4	I4	I3
178. Naphtha	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I3	I1	I1
179. Naphthenic Acid	PV	PV	I4	I4	PV	PV	PV	PV	S4	S4	PV	I4	I4	PV
180. Nickel Chloride	S4	S4	S4	S4	S4	S4	S4	S4	S1	S1	S1	I1	I1	I1
181. Nickel Plating (Bright)	S4	S4	S4	S4	S4	I4	I4	I4	S1	S1	S1	I1	I1	I1
182. Nickel Salts	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
183. Nitric Acid (5%)	S4	S4	S3	S3	I3	I4	S4	S4	S4	S4	S1	I3	I3	I2
184. Nitric Acid (10%)	S4	S4	S3	S3	I3	I4	S4	S4	S4	S4	S1	I3	I3	I2
185. Nitric Acid (20%)	NR	NR	F4	F4	F4	F3	NR	NR	NR	S4	S2	I4	I4	I4
186. Nitric Acid (40%)	NR	NR	F4	F4	F4	F3	NR	NR	NR	S4	S4	I4	I4	I4
187. Nitric Acid (60%)	NR	NR	NR	NR	F4	F4	NR	NR	NR	NR	S4	S4	S4	S4
188. Nitric Acid (Conc.)*	NR	NR	NR	NR	F4	F4	NR	NR	NR	NR	NR	NR	NR	F4
189. Nitrobenzene	NR	NR	NR	NR	NR	NR	NR	S4	PV	PV	NR	PV	PV	PV
190. Nitrous Acid	NR	NR	PV	PV	PV	PV	PV	PV	PV	PV	S3	I3	I3	I2
191. Octanoic Acid	F4	F4	S4	S4	S3	I4	PV	PV	PV	PV	S3	I4	I4	I4
192. Oils (Animal)	I1	I1	I1	I1	S1	S1	I1	I1	S1	S1	S1	I1	I1	I1
193. Oils (Mineral)	I1	I1	I1	I1	S1	S1	I1	I1	S1	S1	S1	I1	I1	I1
194. Oils (Vegetable)	I1	I1	I1	I1	S1	S1	I1	I1	S1	S1	S1	I1	I1	I1
195. Oleic Acid	F4	NR	I4	I4	I3	I3	NR	NR	S4	S4	S1	I1	I2	I1
196. Oxalic Acid (Sat'd)	S4	S4	I4	I4	I3	I3	S1	S1	S1	S1	S1	I3	I1	I1
197. Ozone	S4	PV	PV	PV	I2	I2	S3	S3	S1	S1	S1	PV	PV	S4
198. Palmitic Acid	PV	PV	S4	S4	S3	S3	PV	PV	PV	PV	S4	I1	I1	I1
199. Pentachlorethane	PV	PV	PV	PV	S1	S1	PV	PV	S1	S1	S4	PV	PV	S1
200. Perchloric Acid	NR	NR	PV	PV	F4	F4	PV	PV	S1	S1	S1	PV	PV	PV
201. Perchlorethylene	F4	NR	NR	NR	F4	F4	NR	S4	S4	S4	S4	S4	PV	S4
202. Phenol (0%-10%)	NR	NR	PV	PV	F4	F4	NR	NR	S4	S4	S2	PV	PV	PV
203. Phenol (85%)	NR	NR	NR	NR	F4	F4	NR	NR	PV	S4	PV	NR	NR	PV
204. Phosphoric Acid (Conc.)	F4	NR	S3	S3	S1	I4	NR	NR	S4	S4	S1	I1	I1	I1
205. Phosphorous Oxychloride	NR	NR	PV	PV	F4	F4	PV	PV	S4	S4	S4	PV	PV	PV
206. Phosphorous Trichloride	NR	NR	PV	PV	F4	F4	PV	PV	S4	S4	PV	PV	PV	PV
207. Phthalic Acid	NR	PV	S1	S1	S1	S1	PV	PV	PV	PV	S1	I1	I1	I1
208. Potassium Bichromate	S4	S4	I4	I4	I4	I3	S4	S4	S4	S4	S1	I4	I4	I1
209. Potassium Bromate	S4	S4	I4	I4	I4	I4	I4	I4	S4	S4	S1	I4	I4	I4
210. Potassium Bromide	S4	S4	I4	I4	I4	I3	I4	I4	PV	S4	S1	I1	I1	I1
211. Potassium Carbonate	I4	I4	PV	PV	I4	I3	I4	NR	S1	S1	S1	I4	I4	I4
212. Potassium Chlorate	S4	S4	I4	I4	I4	I3	I4	NR	S1	S1	S1	I1	I1	I1
213. Potassium Chloride	I4	I1	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
214. Potassium Cyanide	S4	S4	I4	I4	PV	I4	I4	I4	S1	S1	S1	I1	I1	I1
215. Potassium Hydroxide (10%)*	I4	S4	S1	S1	I4	I4	I4	NR	S1	S1	S1	I4	I4	I4
216. Potassium Hydroxide (Conc.)*	I4	S4	NR	S4	S4	S4	S1	NR	S1	S1	S1	NR	NR	NR
217. Potassium Nitrate	I4	I4	I4	I4	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
218. Potassium Permanganate	I4	I4	I4	I4	I3	I3	S1	S1	S1	S1	S1	PV	I1	I1
219. Potassium Peroxide	S4	S4	S4	S4	PV	PV	F4	F4	S1	S1	PV	I4	I4	I4
220. Potassium Persulfate	S4	S4	I4	I4	I3	I3	S1	S1	S1	S1	S1	I1	I1	I1
221. Potassium Sulfate	S4	S4	I4	I4	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
222. Pulpstock Chlorinated	NR	NR	S4	S3	S3	S3	NR	NR	NR	S3	S4	S4	S4	S4
223. Propionic Acid	NR	NR	NR	NR	F4	F4	NR	NR	PV	PV	PV	PV	NR	PV
224. Propylene Glycol	S4	NR	I3	I3	I3	I3	I4	I4	S4	S4	S4	I4	I4	I3
225. Pyridine	NR	NR	NR	NR	F4	F4	NR	NR	NR	NR	NR	NR	NR	NR
226. Salicylic Acid	S1	S1	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
227. Seawater	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
228. Silver Nitrate	S1	S1	S1	S1	S1	S1	PV	PV	S1	S1	S1	I1	I1	I1

*May need synthetic fabric, or carbon fillers. Consult a Dudick Corrosion-Proof, Inc. technical representative for more complete information on these products.

Dudick

Key

I Material will withstand constant flow or immersion service
S Material is suitable for intermittent or Spillage service
F Material will tolerate fumes only

	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
229. Sodium Acetate	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
230. Sodium Bicarbonate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
231. Sodium Bisulfate	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
232. Sodium Bisulfite	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
233. Sodium Bromate	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
234. Sodium Carbonate (see soda ash)	I4	I4	I4	I4	I3	I3	I1	NR	S1	S1	S4	I1	I1	I1
235. Sodium Chlorate	NR	PV	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
236. Sodium Chloride	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1
237. Sodium Chlorite (50%)	NR	NR	S4	S4	S3	S3	S4	S4	S4	S4	S4	I4	I4	I3
238. Sodium Chromate	S4	S4	I4	I4	I3	I3	S4	S4	S1	S1	S1	PV	PV	I1
239. Sodium Cyanide	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
240. Sodium Dichromate	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	PV	I4	I3
241. Sodium Fluoride*	S4	S4	NR	NR	I4	I4	PV	PV	S4	S4	S4	NR	NR	NR
242. Sodium Hydroxide (10%)*	I4	S4	S1	S1	I1	I1	I1	NR	S1	S1	S1	NR	NR	NR
243. Sodium Hydroxide (50%)*	I4	S4	S1	S1	I1	I4	I1	NR	S1	S1	S4	NR	NR	NR
244. Sodium Hypochlorite (3%)*	F4	F4	NR	S4	S4	S4	F1	NR	S3	S3	S1	NR	I4	I4
245. Sodium Hypochlorite (17%)	NR	NR	NR	PV	S4	S4	NR	NR	S4	S4	S4	NR	PV	S4
246. Sodium Peroxide	S4	S4	I4	I4	I4	I4	I1	I1	S4	S4	NR	PV	PV	S4
247. Sodium Phosphate	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
248. Sodium Sulfate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
249. Sodium Sulfide	S4	S4	PV	PV	I4	I3	I1	I1	S1	S1	S1	I4	I4	I4
250. Sodium Sulfite	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
251. Sodium Tartrate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
252. Sodium Thiosulfate (Hypo)	I4	S4	I4	I4	I3	I3	S1	NR	S1	S1	S1	I1	I1	I1
253. Soybean Oil	PV	PV	I4	I4	I3	I3	I1	I1	PV	S1	S1	I1	I1	I1
254. Stearic Acid	S4	S4	PV	PV	I4	I4	PV	PV	S4	S4	S1	I2	I2	I2
255. Succinic Acid	S4	F4	PV	PV	I4	I4	PV	PV	S3	S3	S3	I4	I4	I4
256. Sugar	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
257. Sulfite Liquor (Paper)	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
258. Sulfur Dioxide	F1	F1	S4	I4	I4	I4	I1	I1	S1	S1	S1	F4	I1	I1
259. Sulfur Trioxide	F4	F4	PV	PV	S4	S3	S1	S1	S1	S1	S1	I4	I4	I4
260. Sulfuric Acid (2%-20%)	S1	S4	S1	S1	S1	S1	S1	S1	S3	S3	S1	I1	I1	I1
261. Sulfuric Acid (20%-50%)	S1	F4	S1	S1	S1	S1	F1	F1	S4	S4	S1	I3	I3	I2
262. Sulfuric Acid (50%-70%)	S1	F4	F3	F3	F1	F1	F4	F4	NR	S4	NR	I4	I4	I2
263. Sulfuric Acid (70%-80%)	S1	NR	NR	NR	NR	NR	NR	NR	NR	S4	NR	PV	PV	PV
264. Sulfuric Acid (80%-98%)	S1	NR	NR	NR	NR	NR	NR	NR	NR	S4	NR	NR	NR	NR
265. Sulfurous Acid	S4	S4	I4	I4	I4	I3	S4	S4	S4	S4	S1	I1	I1	I1
266. Tall Oil	I4	S4	I4	I4	I4	I3	I1	I1	S4	S4	S1	I1	I1	I1
267. Tannic Acid	S4	PV	I4	I4	I4	I4	PV	PV	S4	S4	S4	I1	I1	I1
268. Tartaric Acid	U4	I4	I4	I4	I3	I3	S1	S1	S1	S1	S1	I1	I1	I1
269. Tetrachlorethane	F4	PV	NR	NR	F4	F4	NR	S4	S4	S4	NR	PV	PV	PV
270. Thionyl Chloride	NR	NR	NR	NR	NR	NR	NR	S4	NR	NR	NR	NR	NR	NR
271. Titanium Tetrachloride	S4	F4	I4	I4	I3	I3	S4	S4	S1	S1	S1	I1	I1	I1
272. Toluene	F4	NR	NR	NR	F4	F4	NR	S4	S4	S4	NR	S4	S4	S4
273. Toluene Sulfonic Acid	S3	S3	I4	I4	I3	I3	S4	S4	S1	S1	S1	I1	I1	I1
274. Trichloroacetic Acid (20%)	NR	NR	F4	F4	I4	I3	F4	F4	NR	NR	S1	I4	I4	I4
275. Trichloroethylene	NR	PV	NR	NR	F4	F4	NR	S4	S4	S4	NR	PV	PV	PV
276. Trisodium Phosphate	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S4	I3	I3	I3
277. Turpentine	S4	S4	PV	PV	I4	I4	NR	I1	S1	S1	NR	PV	PV	PV
278. Tween Surfactants	PV	PV	I4	I4	I4	I4	PV	PV	S1	S1	S1	I1	I1	I1
279. Urea Solutions	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
280. Vinegar	S4	F4	I1	I1	I1	I1	I4	I4	S1	S1	S1	I1	I1	I1
281. Water, distilled & demineralized	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
282. White Liquor (Paper)	I4	I4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
283. Xylene (Xylol)	S4	NR	NR	NR	NR	NR	NR	I1	S4	S4	NR	I4	I4	I4
284. Zinc Salt	I4	I4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
285. Zinc Plating (Acid Sulfate)	S3	S3	I4	I4	I3	I3	S1	S1	S1	S1	S1	I1	I1	I1

*May need synthetic fabric, or carbon fillers. Consult a Dudick Corrosion Proof, Inc. technical representative for more complete information on these products.

Products

.ere is a Dudick Corrosion-Proof product) protect virtually any area of a plant and any piece of production, storage or handling equipment from the corrosive effects of moisture and chemical attack.

Eight standard product lines are available and each offers a range of products developed to meet the special requirements encountered in most manufacturing or processing environments. However, any product in any system can be modified to tailor the physical, mechanical, environmental or application properties to the unique needs of a specific application.

A series of catalogs is available describing the specific properties of each product in each of these systems. Of course, our factory personnel are available to work with your architect, plant management, engineering, and maintenance personnel to recommend a standard or custom formulated Dudick Corrosion-Proof product that meets your exact performance and durability requirements.

Floor Toppings/Linings

Designed for:

- Heavy Traffic
- New Concrete
- Existing & Eroded Concrete
- Full Range of Chemical Spills
- Conductivity
- Light Duty
- Cleanability
- Colors/Appearance

Tank Linings

Designed for:

- Concrete or Steel
- Process Vessels
- "E" Coat Tanks
- Holding Tanks
- Sumps, Pits, Trenches

Secondary Containment Linings

Designed for:

- Tank Farms
- Holding Pits

Coatings

Designed for:

- Tank Exteriors
- Structural Steel

Corrosion System Designs

The Dudick Systems are designed with:

- Heavy Aggregate for High Impact & Abuse
- Glass Reinforcement for Expansion & Contraction
- Epoxy, Polyester, Vinylester, Urethane & Acrylic Resins

Services Offered:

- Concrete Specifications
- Steel Specifications
- Lining & Topping Specifications
- Installation Detail Drawings
- Field Tech Service
- Application Recommendations

Experience

Dudick Corrosion-Proof products have been used in nearly every type of manufacturing and processing operation where chemical environments or high moisture conditions present a constant corrosion problem.

Our products are protecting the plants and equipment of most of the Fortune 500 companies and hundreds of smaller, local firms. They are used at major U.S. government installations and in many municipal water and sewage treatment plants.

They have been installed in every geographic area of the United States and have been exported to many European countries.

While our experience covers nearly every type of industrial environment, a few specific examples deserve special mention because they help demonstrate many of the special capabilities of Dudick Corrosion-Proof, Inc. products and people.

Pulp and Paper Industry

Dudick Corrosion-Proof, Inc. developed a special series of products to reline the interiors of the tile chests used in pulp and paper manufacturing operations. Installed by Dudick personnel under tight turnaround schedules, these relining systems have demonstrated their ability to eliminate leaking problems and to stand up to the severe chemical environments involved. Many of these installations have already endured more than seven years of constant service without a single failure.

Chemical Processing Industry

Dudick Corrosion-Proof products are used extensively to protect vulnerable equipment and structures in chemical processing and petroleum refining operations. Our systems have achieved excellent service records in chemical environments ranging from pH 1 to pH 14, including extended exposures to high concentrations at elevated temperature.

Power and Energy

Dudick Corrosion-Proof materials are used extensively in coal and oil powered electrical generating plants including trenches, waste water treatment tanks, and the severe environment of flue gas desulfurization systems (ducts and scrubbers).

Food Processing

Several Dudick Corrosion-Proof products are available in special formulations which meet FDA requirements for food proximity and food contact. Our Protecto-Line and Protecto-Crete floor toppings, for example, provide important resistance to both accidental spills and the harsh chemical cleaning agents required to maintain sanitation. In addition, our lining systems provide important protection for storage vats and processing equipment where chemically active ingredients are involved.

Metal Working

Dudick Corrosion-Proof products are used in many areas in both primary metals manufacturing and metals finishing operations. These include pickling lines, waste water treatment facilities, stack emission control systems and etching and plating rooms.

Waste Water Treatment

Dudick Corrosion-Proof products effectively protect the major components of waste water treatment facilities such as settling tanks, aeration units, retention tanks, activated carbon pits and oil skimmers.

Exotic Metals

Occasionally, plants or equipment built with exotic metal vessels and piping systems will be converted to other production uses where even they are susceptible to corrosion. Dudick Corrosion-Proof, Inc. has successfully lined stainless steel, Inconel, aluminum, as well as the soft metals, with specially designed protective systems appropriate to their new missions.

Aerospace

Dudick Corrosion-Proof lined the entire interior of the building (big enough to hold a 747) where the reusable space shuttle fuel tanks are sandblasted and cleaned with an acid spray. We also provided the corrosion protection for several small aluminum plates essential for the function of the air regeneration systems aboard the Enterprise and Columbia shuttles.

Electronics

Dudick Corrosion-Proof products are used in many electronic component manufacturing and assembly areas. They provide both resistance to the acids used in manufacturing processes and provide the cleanability essential to the maintenance of a clean-room environment.

Composite Flooring

In many industrial plants service requirements will vary significantly from one area to another. Rather than recommend a single floor topping designed to meet the most severe requirements, Dudick Corrosion-Proof will develop a more cost-effective composite system with performance tailored to the actual needs of specific production zones.

UNIT "C"

Unit "C" - Truck Staging Area is a new concrete pad without a canopy. The pad is located on the existing Clean Harbors of Chicago, Inc. (CHCI) portion of the facility.

Unit "C" - Truck Staging Area is a hazardous waste transportation vehicle storage unit authorized under the June 30, 1995 modified RCRA Part B issued to CHCI.

Unit "C" - Truck Staging Area is a coated concrete secondary containment truck staging. Area is located along the eastern edge of the facility, north of Unit "B" - Bulk Solids Storage Pad. The Truck Staging Area is sized to accommodate up to six (6) transportation units (non-ignitable wastes only) such as bulk transfers awaiting analytical approval for the inorganic wastewater treatment system or van trailers waiting for a slot at the Outdoor Container Storage Area unloading dock.

The concrete slab of Unit "C" is constructed of a 10-inch thick reinforced concrete. The storage pad is divided into two (2) storage bays to provide segregation of potentially incompatible materials. The bays are separated by concrete curbing which increase in height over the length of the bay, from 3 inches at the front (west side) of the bay to 25 inches at the rear (east side) of the bay. The entire secondary containment is coated.

For construction details see CHCI Dwg. No. 4218 (Dwg. 2916-S-05 Rev. 0) in Appendix B-1.

For calculations of structural integrity, see Appendix C-1. The containment calculations are on the drawing.

The entire secondary containment was coated with Protecto-Coat 900, 30 mils thick, as manufactured by Dudick, Inc. For technical data, application and Chemical Resistance Chart, see Appendix B-3.

There are the following deviations from Part B Approved and As-Built on CHCI Dwg. No. 4218 (Dwg. No. 2916-S-05):

Rev. F - 01/19/95 Part B Approved	As-Built - Rev. 0 - 08/29/95
1. Plan	Moved Truck Staging Area to north and moved Bulk Solid Storage Pad south (switched locations). Deleted one sump. Sump is divided by stainless steel plate. Added bump to front side of pad to increase containment capacity.
2. Section A-A	Added bump on the front side of the pad. Added sump dividing plate.
3. Section B-B	Added water stop.

4.	Added Section D-D and Detail #2.
5. . Secondary Containment Calculations	Changed to reflect structural changes. New revised available containment capacity is 12,583 gal.
6. Notes	Added note 7 & 8.

During the visual inspection, the Truck Staging Area was in excellent condition. There were no cracks, gaps, scratches or other damage. No penetrations are present within the containment structure.

APPENDIX

C-1

HOYER-SCHLESINGER-TURNER, INC.

SHEET 1 OF 3

PROJECT CLEAN HARBORS - CHICAGO, IL

PROJECT NO. 17851

SUBJECT PROPOSED TRUCK STAGING AREA "C"

DATE 7.20.95

BY BERNES, S.E.

LOADING: ILLINOIS DEPARTMENT OF TRANSPORTATION STANDARD HIGHWAY LOADING OF H20-S16-44

a.) DATA FOR TRAILER

AXLE LOAD = 42 K - DUAL WHEEL LOADING

WHEEL SPACING 13" x 56" x 18"

No. OF WHEELS ON AXLE = 4

TIRE INFLATION PRESSURE = 100 PSI

TIRE CONTACT AREA = $\frac{42{,}000}{4 \times 100}$ = 105 SQ. IN

b.) SUBGRADE & CONCRETE DATA:

CONC. FLEXURAL STRENGTH MR = 640 PSI @ 28 DAYS

K-VALUE = 100 PCI

DESIGN

1.) SAFETY FACTOR = 2.0

2.) CONC. WORKING STRESS (WS)

$WS = \frac{MR}{SF} = 640/2 = 320$ PSI

3.) EQUIVALENT SINGLE-WHEEL LOAD FROM FIG. 4 (SEE SHEET #2)

$= .775 \times 42^k = 32.55^k$

4.) SLAB STRESS PER 1,000 # OF AXLE LOAD =

$= WS/\text{AXLE LOAD} = 320/32.55 = 9.83$ PSI

5.) FROM FIG. 3 (SEE SHEET #3)

SLAB THICKNESS REQ'D = 8.75" < 10" O.K.

6.) REINFORCEMENT

$A_s = \frac{2 \times L \times w}{2 \times f_s} = \frac{2 \times 70.67 \times 125}{2 \times 24{,}000} = .37 \text{ IN}^2$

USE #4 @ 12" C-C TOP & BOTT.

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes

PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11-30-

PROJECT CLEAN HARBORS - CHICAGO, IL

SUBJECT PROPOSED TRUCK STAGING AREA "C"

SHEET 2 OF 3

PROJECT NO. 17851

DATE 7.20.95

BY BERNES, S.C.

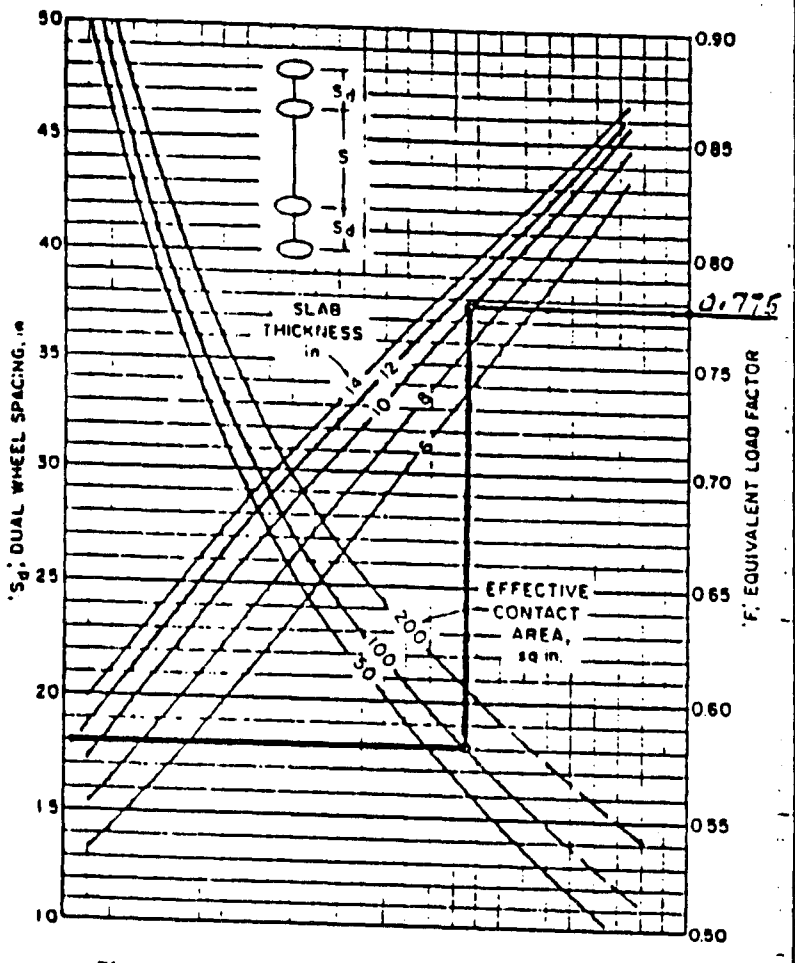


Fig. 4. Design chart for axles with dual wheels.

PROJECT CLEAN HARBORS - CHICAGO, IL

SUBJECT PROPOSED TRUCK STAGING AREA "C"

SHEET 3 OF 3

PROJECT NO. 17551

DATE 7.20.95

BY BERNES, S.E

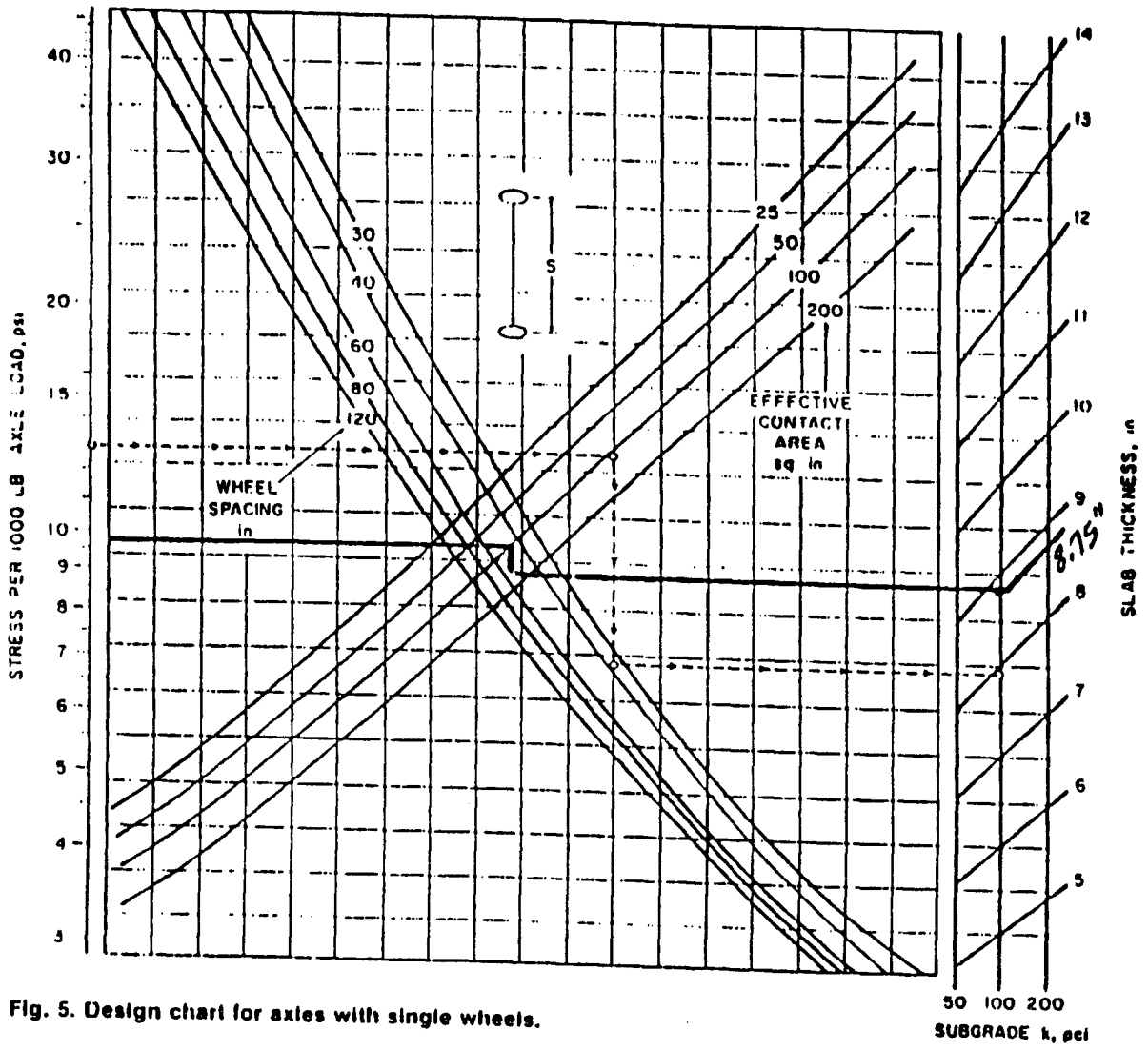


Fig. 5. Design chart for axles with single wheels.

State of Illinois
ENVIRONMENTAL PROTECTION AGENCY

Mary A. Gade, Director

2200 Churchill Road, Springfield, IL 62794-9276

217/524-3300

October 5, 1995

Clean Harbors of Chicago, Inc.
11800 South Stony Island Avenue
Chicago, Illinois 60617

Re: 0316000051 -- Cook County
Clean Harbors of Chicago, Inc.
ILD000608471
Log No. B-16-M-2
RCRA Permit File

Gentlemen:

The Agency has completed its review of the Construction Certification Report dated September, 1995 for the Bulk Storage Pad (Unit "B") and the Truck Staging Area (Unit "C"). The Agency inspected these units on September 12, 1995. Pursuant to the Agency's review and inspection, the Construction Certification Report for the above units is approved.

Storage of compressed gases in these units is not allowed until the requirements of Condition I(E)(8) have been fulfilled.

Due to the changes in the final containment volumes of the above units, please submit a Class 1 modification to reflect these changes.

If you have any questions regarding this letter, please feel free to call Mark A. Schollenberger, P.E. at 217/524-3307.

Sincerely,

Edwin C. Bakowski, P.E.
Manager, Permit Section
Bureau of Land

ECB:MAS:rd\95941.WPD

Appendix D-47

Engineering Certification Unit 26

CleanHarbors®
ENVIRONMENTAL SERVICES, INC.
325 WOOD ROAD • BRAINTREE, MA 02184
(617) 849-1800

Via Federal Express

Mr. Robert Watson, P.E.
Illinois Environmental Protection Agency
Division of Land Pollution Control -- #24
Permit Section
2200 Churchill Road
Post Office Box 19276
Springfield, IL 62794-9276

Re: Clean Harbors of Chicago, Inc.
Log No. B-16-M-2
Construction Certification Report

Dear Mr. Watson:

In accordance with the provisions of Conditions I.K.1 and II.D.I of the RCRA Part B Permit issued June 30, 1995 Clean Harbors of Chicago, Inc. (CHCI) is pleased to submit this Construction Certification Report (CCR) for certain units at the modified CHCI facility located at 11800 South Stony Island Avenue in Chicago, IL.

Today's submittal includes one (1) original and two (2) copies of the CCR as prepared by Hoyer Schlesinger Turner, Inc. The CCR includes all pertinent engineering design calculations, as-built drawings, and coating information required by the Agency. The report also includes the required independent professional engineer (PE) certification statement and seal.

If you have any questions, please feel free to contact me at (617) 849-1800, extension 4473.

Sincerely,

Paul A. Ahearn

Paul A. Ahearn
Manager, Regulatory Compliance

Enclosure

CERTIFICATION

This statement is to be completed by both the responsible officer and the registered professional engineer upon completion of construction in accordance with 35 IAC Section 702.126. Submit one copy of the certification with original signatures and two additional copies (four additional copies for UIC wells). Forward these certification statements and any information required by the permit to the following address:

Illinois Environmental Protection Agency
Bureau of Land - #33
Permit Section
2200 Churchill Road, P.O. Box 19276
Springfield, Illinois 62794-9276

FACILITY NAME: CLEAN HARBORS OF CHICAGO, INC.

IEPA SITE CODE: 0 3 1 6 0 0 0 0 5 1

U.S. EPA ID NO.: IL D 0 0 0 6 0 8 4 7 1

PART B PERMIT LOG #/UIC PERMIT #: B-16-M-2

PERMIT (OR MODIFICATION) ISSUANCE DATE: June 30, 1995

PERMIT CONDITION NO. REQUIRING CERTIFICATION: I.K.1 & II.D.1

The Unit #26 has been constructed in accordance with the specifications in the Part B/UIC Permit. Documentation that the construction was in accordance with the permit is contained in the enclosed report. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Alan S. McKim

Signature of Owner/Operator

Alan S. McKim, Director
Clean Harbors of Chicago, Inc.

Name and Title

Marie Vanagas

Signature of Registered P.E.

Marie Vanagas
62--40801
Hoyer-Schlesinger-Turner, Inc.

Name of Registered P.E. and Illinois Registration Number

September 9, 1995

Date

(P.E. SEAL) MARIE VANAGAS 62-40801 REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS

This Agency is authorized to require this information under Illinois Revised Statutes, 1979, Chapter 111 1/2, Section 1039. Disclosure of this information is required under that Section. Failure to do so may prevent this form from being processed and could result in your application being denied. This form has been approved by the Forms Management Center.

CONSTRUCTION CERTIFICATION REPORT

UNIT #26 - Ignitable Container Management Building

Prepared for:

CLEAN HARBORS OF CHICAGO, INC.
11800 S. Stony Island Avenue
Chicago, Illinois 60617

Prepared by:

HOYER-SCHLESINGER-TURNER, INC.
Consulting Engineers
300 West Adams Street, Suite 630
Chicago, Illinois 60606

HST Project No. 17851

September 1995

HOYER-SCHLESINGER-TURNER inc.
ENGINEERS - CONSTRUCTORS
300 west adams street chicago illinois 60606 telephone 263-0556 area code 312

September 9, 1995

Mr. Paul Ahearn
Manager, Regulatory Compliance
CLEAN HARBORS OF CHICAGO, INC.
11800 South Stony Island Avenue
Chicago, Illinois 60617

Re: Construction Certification Report
Unit #26 - Ignitable Container Management Building
11700 South Stony Island Avenue
Chicago, Illinois 60617
HST Project No. 17851

Gentlemen:

This report presents the results of Hoyer-Schlesinger-Turner, Inc.'s (HST) involvement in construction modification of the Unit #26 - Ignitable Container Management Building.

The construction documents for modification of the existing building were prepared under HST supervision. HST engineers made numerous field trips to observe construction. The repair of cracks in the existing concrete slab of Unit #26 and application of the coating was witnessed by HST Licensed Structural Engineer, Peter Bernes. The final inspection of Unit #26 was performed by HST engineer, Marie Vanagas, PE on September 8, 1995.

The secondary containment system is designed and constructed to prevent any migration of wastes or accumulated liquid out to the soil, ground water or surface water at any time.

The presence of small drips, spills, leaks or precipitation in the secondary containment for Unit #26 will be monitored through daily visual plant inspections.

Respectfully submitted,

HOYER-SCHLESINGER-TURNER, INC.

Marie Vanagas

Marie Vanagas, PE
Illinois Licensed Professional Engineer
License No. 062-040801
Expiration Date: 11/30/95

MARIE VANAGAS
62-40801
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

MV/ar

SUMMARY OF INSPECTION

UNIT #26

Unit #26 - Ignitable Container Management Building is an existing fully enclosed structure. There is no change in the usage of the building. However, the building was modified to comply with the City of Chicago Building Code, Chapter 15-24, to have 4 HR fire rating. A new fire suppression system was installed and fire vents were added to the roof structure. Explosion vents of the structure are existing. New explosion vent was added for The Pumping Enclosure which was built within the building on the north side. For construction details, see CHCI Dwg. No. 4210 (Dwg. 2916-M-18, Rev. 0) in Appendix 26-1.

Unit #26 is authorized under the June 30, 1995 modified RCRA Part B issued to CHCI.

The building was built in 1982. It has a smooth reinforced concrete floor (6" concrete slab with W/6 x 6 - 6/6 WWF) and a 9-inch high containment curb all around the perimeter of the building. Secondary Containment calculations are shown on CHCI Dwg. 4210 in Appendix 26-1. For calculations of structural integrity, see Appendix 26-3. The entrances to the building are raised and provided with ramps. The secondary containment is topped with Protecto-Crete 900, 1/4 inch thick unreinforced high density vinyl ester, trowel applied as manufactured by Dudick, Inc. See Appendix 26-2 for technical information and chemical resistance chart.

The Ignitable Container Management Building - Unit #26 is authorized for the storage of up to 10,560 gallons of hazardous waste (192 - 55-gallon drums or equivalent - 1 high) ignitable liquids and solids. The waste stored in this building consists primarily of hazardous wastes which are intended to be processed in the CHCI Fuels Blending Operation located in the adjacent Building 43. Such containers are transferred to the Fuels Blending Operation by means of an enclosed and contained conveyor system which connects the two buildings. In addition, Building #26 is equipped with an enclosed and ventilated drum Pump Enclosure/lab pack pouroff station to facilitate the pumping of liquids/sludge directly to the bulk ignitable liquid tank farm through distribution Fill Manifold. 2" Ø pipe line was pressure tested on August 31, 1995. For pipe diagram - Dwg. PT-007 and Hydrostatic Test Record, see Appendix 26-4. A lab pack consolidation station that includes an operating fume hood is located in the north-east corner of the building.

"As-Built" CHCI Dwg. No. 4210 (Dwg. No. 2916-M-18) shows the following revisions from Part B Approved drawings:

Rev. C - 01/19/95 Part B Approved	As-Built - Rev. 0 - 08/29/95
1. Plan	Activated carbon vents moved from indoor to the outside (north side of building). Pump relocated to inside of Pumping Enclosure. Pumping Enclosure redesigned. Conveyor shortened. Southern Ramp at overhead door left as originally designed. Overhead 2" Ø pipe relocated.

2.	Section B-B	Section shortened. Modified north exit.
3.	Notes	Added note 4.
4.	Section C-C	Modified to reflect changes in plan.
5.	Secondary Containment Calcs	Changed to reflect ramps modification. New available secondary containment is 12,415 gallons.

During the visual inspection, the Secondary Containment was in excellent condition. There were no cracks, gaps, scratches or other damage. No penetrations are present within the containment structure.

APPENDIX

26-2

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, IL

SUBJECT DRUM HANDLING BUILDING #26

SHEET 1 OF 3
PROJECT NO. 1785
DATE 10. 25. 94
BY BERNES

FOR CERTIFICATION

REF.: CWM CHEMICAL SERVICES, INC. DWG. NO. 1-F-005
CLEAN HARBORS DWG. NO. 2916-M-18

1) CONTAINMENT CALCULATIONS:
FOR SECONDARY CONTAINMENT CALCULATIONS
SEE DWG. 2916-M-18 BY CLEAN HARBORS
REQUIRED = 1,056 GALS < 12,751 GALS PROVIDED O.K.

2. STRUCTURAL ANALYSIS OF EXIST. 6" CONC. SLAB
LOADING: 4.0 SQ. PALLET AREA SUPPORTS 4-DRUMS.
4-DRUMS x (55 GAL. x 1.5 SP. GR. x 8.36 #/GAL + 50#)
TOTAL LOAD = 3000#
FLOOR SLAB LOADING = 3000/4x4 = 188 PSF
SLAB THICKNESS OF = 6" REINF. W/ONE LAYER
OF WWF 6x6-W2.9xW2.9 IS CAPABLE TO
SUPPORT 450 PSF < 188 PSF O.K.
(SEE PORTLAND CEMENT ASSOC. TABLE FOR
SLABS ON GROUND BY CRSI PG. 14-11 - SHEET #3)

3. FORK LIFT TRUCK LOADING

LIFT TRUCK	= 10,000#
LOAD	= 3,000#
TOTAL	= 13,000#

85% ON DRIVE AXLE = 11,050#
WHEEL LOAD W/30% IMPACT = 7,180#
CONTACT AREA = 7.5" x 7.5" = 57 IN²
CONCRETE WORKING STRESS

$$WS = \frac{MR}{SF} = 640/2 = 320 \text{ PSI}$$

SUBGRADE MODULUS K = 200 (ASSUMED)
SAFETY FACTOR FOR FREQUENT OPERATIONS = 2

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes
PETER J. BERNES
LICENSED STRUCTURAL ENGIN
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11-3

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, IL

SUBJECT DRUM HANDLING BUILDING #26

SHEET 2 OF 3

PROJECT NO. 1785

DATE 10-25-99

BY BECKER

FOR CERTIFICATION

SLAB STRESS PER 1000# OF AXLE LOAD

$\frac{W_S}{\text{AXLE LOAD}} = 320/13 = 24.60$ PSI/1000#

WHEEL SPACING = 29" C.C.

SEE DESIGN CHART FIG. 5 BELOW - THIS SHEET.

EXIST. FLOOR SLAB 6" THK. W/ WWF 6x6-W2.9xW2.9 PROVIDES SUFFICIENT STRENGTH TO SUPPORT FORK LIFT TRUCK W/ LOAD

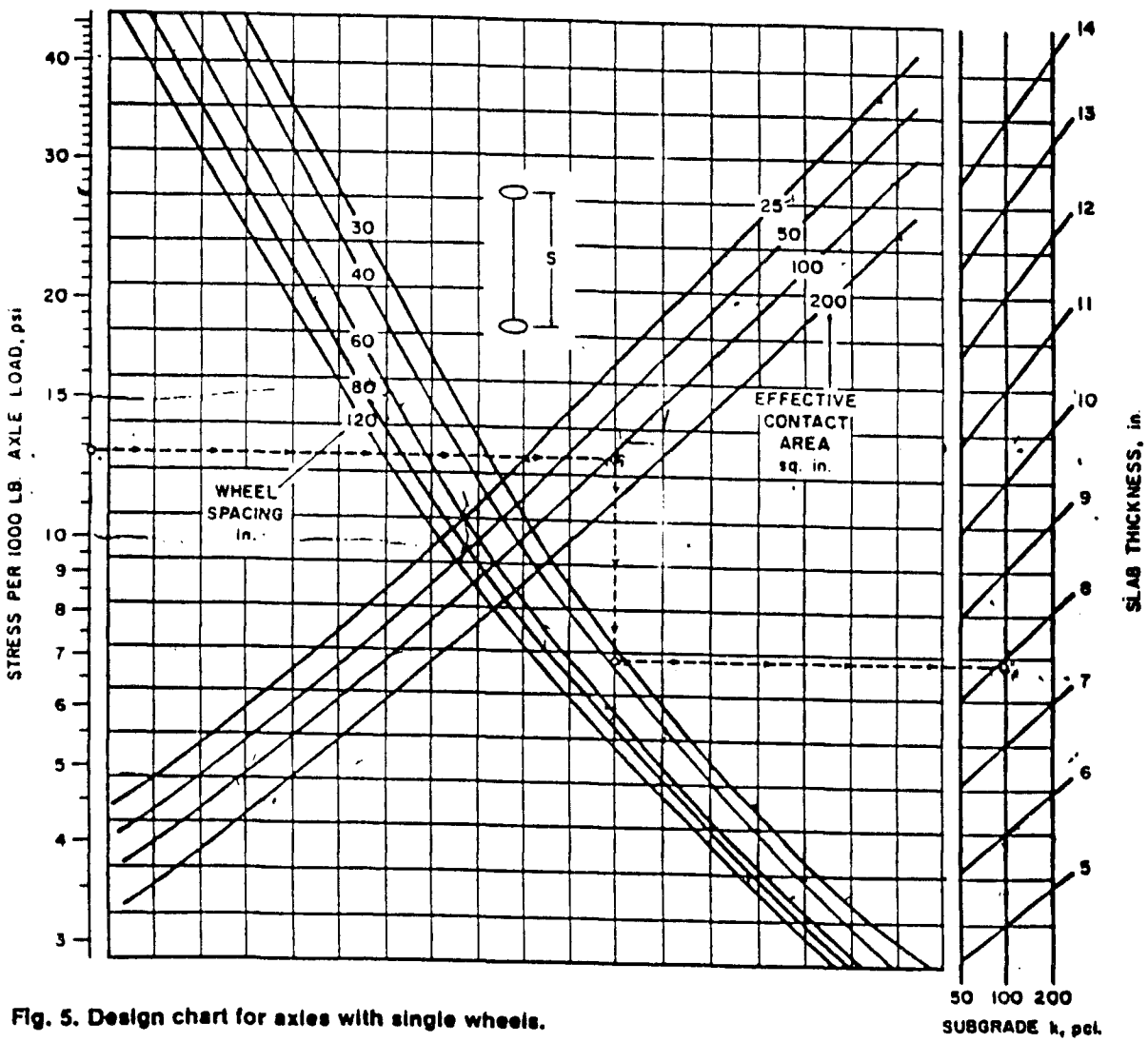


Fig. 5. Design chart for axles with single wheels.

HOYER-SCHLESINGER-TURNER, INC.

SHEET 3 OF 3

PROJECT CLEAN HARBORS - CHICAGO, IL

PROJECT NO. 1785

SUBJECT DRUM HANDLING BUILDING #26

DATE 10-25-94

BY BERNEC

FOR CERTIFICATION

EMPIRICAL SLAB DESIGN

14-11

SLABS ON GROUND *

For any slab on the ground, adequate preparation of subgrade for drainage and compaction is of prime importance. Dowelled expansion joints and weakened plane contraction joints should be carefully located, including expansion joints at all walls.

The design of slabs on the ground to distribute concentrated or uniform loads involves the elastic properties of the subsoil and the slab itself. An analysis can be made but is quite involved. Slabs for the very lightest occupancy should be not less than 4" thick, and slabs for other occupancies may be empirically selected, the following being about minimum and sometimes less than what is required by ACI 807 for supported slabs:—

Occupancy **	Min. Slab Thickness	Reinforcement ‡
Sub-slabs under other slabs	2"	None
Domestic or light commercial (loaded less than 100 psf)	4"	One layer 6 x 6 10/10 welded wire fabric, minimum for ideal conditions; 6 x 6 8/8 for average conditions.
Commercial—institutional—barns (loaded 100-200 psf)	5"	One layer 6 x 6 8/8 welded wire fabric or one layer 6 x 6 6/6.
Industrial (loaded not over 400-500 psf) and pavements for industrial plants, gas stations, and garages	6"	One layer 6 x 6 6/6 welded wire fabric or one layer 6 x 6 4/4.
Industrial (loaded 600–800 psf) and heavy pavements for industrial plants, gas stations, and garages	6"	Two layers 6 x 6 6/6 welded wire fabric or two layers 6 x 6 4/4
Industrial (loaded 1500 psf) †	7"	Two mats of bars (one top, one bottom), each of #4 bars @ 12" c/c, each way
Industrial (loaded 2500 psf) †	8"	Two mats of bars (one top, one bottom), each of #5 bars @ 12" c/c, each way
Industrial (loaded 3000–3500 psf) †	9"	Two mats of bars (one top, one bottom), each of #5 bars @ 8" to 12" c/c, each way

* For further details, see "Concrete Floors on Ground," and "Concrete Airport Pavement," Portland Cement Association, 33 West Grand Avenue, Chicago, Illinois, 1952, and "Design of Concrete Floors on Ground for Warehouse Loadings," Aug. 1957 Journal, American Concrete Institute, P. O. Box 4754, Redford Stn., Detroit 19, Mich.

** For loads in excess of, say, 500 psf, use at least 3000 psi quality controlled concrete, and investigate subsoil conditions with extra care. Fill material and compaction should be equivalent to ordinary highway practice. If laboratory control of compaction is available, the load capacities can be increased in the ratio of the actual compaction coefficient, k, to 100.

† For loads in excess of, say, 1500 psf the subsoil conditions should be investigated with extra care.

‡ Place first layer of reinforcement 2 in. below top of slab; second layer, 2 in. up from bottom of slab.

APPENDIX

26-3

Dudick Inc.

Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Streetsboro, Ohio 44241

216-562-1970
FAX No. 216-562-7638

Protecto-Crete 800/900

TROWEL-APPLIED, UNREINFORCED HIGH-DENSITY VINYL ESTER FLOOR TOPPING 1/4" (6.3 mm)

Protecto-Crete 800 is a high-performance vinyl ester floor topping designed for heavy truck traffic and abrasion resistance combined with excellent resistance to a variety of acids and caustics.

Protecto-Crete 900, in addition, will resist many of the organic solvents.

RECOMMENDED APPLICATIONS

Food Processing Floors
Plating Room Floors
Pickling Room Floors
Truck Loading Platforms
Chemical Storage
Dike Areas
Aisleways
Chemical Laboratories

CHEMICAL RESISTANCE

Organic Acids
Inorganic Acids
Alkali Solutions
Solvents (900 only)
Oils
Salts

A complete listing of substances and concentrations tested is available on request.

PHYSICAL PROPERTIES

Compressive Strength ASTM C579	11,000 PSI
Tensile Strength ASTM D638	1,800 PSI
Density	140 lbs./ft.^{3}
Flexural Strength ASTM C580	3,600 PSI
Thermal Shock Resistance	40°F-160°F

SPECIFICATIONS

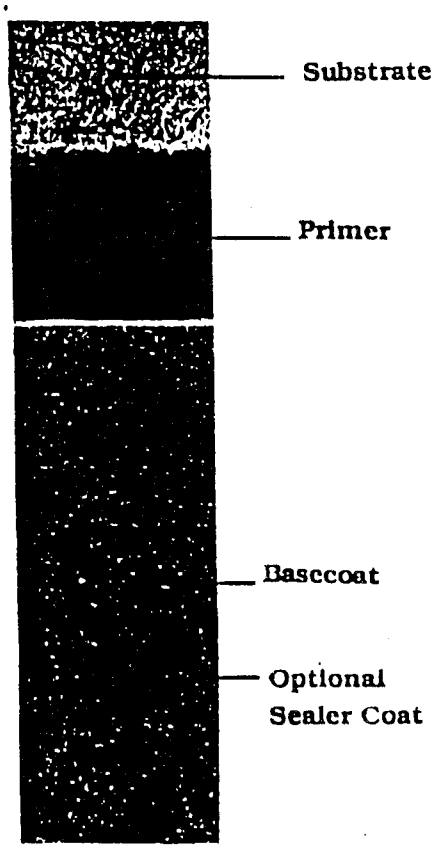
Topping shall be a 1/4" thick unreinforced Bisphenol-A/Novolac vinyl ester material as manufactured by Dudick Inc. applied over primed concrete using a plasterer's trowel or screed. Application and installation shall be according to the manufacturer's recommendations.

THE PROTECTO-CRETE 800/900 SYSTEM

The Protecto-Crete 800/900 System uses a primer and a heavily aggregate-filled vinyl ester topcoat to achieve a strongly bonded monolithic topping with excellent physical and mechanical strength and chemical resistance.

Primer: The blasted or etched concrete surface must be primed to provide the "wetting out" required for good bonding. Priming is achieved with Primer 27 and Protecto-Crete 800/900 should be applied while the primer is still tacky.

Topcoat: The aggregate-filled, Protecto-Crete 800/900 topcoat develops a cured strength two to three times that of the concrete base to which it is applied to provide exceptional durability and prolong the life of the substrate from corrosion and mechanical abuse.



ESTIMATING QUANTITIES AND ORDER BILL OF MATERIAL

Note: Resin includes 10 oz./unit hardener as standard.

SQUARE FEET PER GALLON		
CONCRETE		
Primer 27	150-200	
P-Crete 800/900		
Basecoat	58-66 sq. ft./unit	1/4"
S-10 Solvent	500	Clean-up

Quantities shown are for estimating purposes only. Actual field usage may vary.

APPLICATION INSTRUCTIONS

SURFACE PREPARATION

Concrete: Concrete must be abrasive-blasted or etched with muriatic acid (solution of 1 part 20° Be HCl and 1 part water) to remove surface laitance and other contaminants. Concrete must be dry and free of curing compounds and form release agents. Surface texture should be similar to 40-60 grit sandpaper.

The prepared surface should have a tensile strength of between 250 and 300 PSI per ASTM D4541.

Additional surface preparation will be required if a 40-60 grit texture is not achieved and the surface laitance not completely removed after a single application of acid or with the first mechanical preparation procedure.

Hardener Amount/Gal. or Unit of Resin:

Hardener	Substrate Temperature	Primer 27	Protecto-Crete 800/900
PH-1	60-70°F	3-4 oz.	10 fl. oz./unit
PH-1	70-90°F	2-3 oz.	10 fl. oz./unit

PRIMING

Concrete: Concrete must always be primed to aid in the "wetting out" required for good bonding. Mix Primer 27 with PH-1 Hardener for 2-3 minutes and apply with a brush, roller or sprayer. Do not allow the primer to puddle. We recommend the topcoat be applied over tacky primer.

Protector-Crete 800/900 Mix Ratio:

Protecto-Crete 800/900 Resin	**30 lbs.**
PH-1 Hardener (@75°F)	**10 fl. oz.**
G-4 Aggregate	**4-50 lb. bags**

TOPCOAT

Add the entire contents of the pre-measured PH-1 Hardener to Protecto-Crete 800/900 (pre-measured) Liquid and blend thoroughly. Add 4 bags of G-4 aggregate and mix well. Protecto-Crete ingredients may be mixed in a concrete mixer or mortar box. Liquid and Hardener must be thoroughly blended together before aggregate is added.

Pour the Protecto-Crete mix into a wheelbarrow and transport to each workman's area. Dump directly onto the primed concrete.

The mix should be spread with a plasterer's trowel or with (3-4 ft.) wood screeds. Final finish with a trowel.

To terminate work, square cut the topping and start with the next work period butting to this edge. Permanent terminating lines should be made into saw cuts in the concrete.

Allow Protecto-Crete to cure overnight before subjecting the area to foot traffic.

Allow to cure 1-2 days at 70°F before permitting truck traffic.

Pot Life and Cure Cycles:

Protecto-Crete 800/900		
Temperature	Pot Life	Cure Time
50°F	50-60 Min.	72 Hrs.
75°F	30-40 Min.	48 Hrs.
90°F	20-30 Min.	24 Hrs.

Do not attempt to store mixed material. Residual material should be properly disposed of at the end of each work period.

Recommended application temperatures should be between 50°F and 110°F substrate temperature.

Application of Protecto-Crete 800/900 in direct sunlight may lead to blistering, pinholes, or wrinkling in the floor topping due to outgassing of air in the concrete and high substrate temperatures.

CLEANING

Clean tools and equipment with S-10 Cleaning Solvent.

SHIPPING

The S-10 Cleaning Solvent is a red label item with a flash point of 52°F (PMCC). The Hardener is classified as Organic Peroxide and carries a yellow warning label. Protecto-Crete liquids are red label items and classified flammable.

STORAGE

Warning: All Dudick products classified by DOT labels as either white, yellow or red labels, must not mixed or stored together as an explosive reaction may occur.

Protecto-Crete Liquid and Hardener are flammable and an oxidizer, respectively, and should be stored in a cool, dry place, away from open flame, sparks and other hazards. Protecto-Crete 800/900 ingredients are stable for 3 months when properly stored under 75°F. Excessive heat may cause premature gelling and reduce available working time (pot life).

SAFETY

M.S.D.S. - Sheets must always be read before using products. Protecto-Crete systems are intended for application by experienced, professional personnel. Dudick Inc. can supply Protecto-Crete Systems supervision to help determine that the surface has been properly prepared, the ingredients correctly mixed, and the materials properly and safely applied.

If Protecto-Crete materials are to be applied by your own personnel or by a third-party contractor, please be sure that they are aware of the following safety precautions:

- Exposure to vinyl ester resins and hardeners may cause severe dermatitis reactions in some people. Cleanliness of the skin and clothing is critical and must be of paramount concern.

- Safety glasses, gloves, and suitable protective clothing must be worn at all times.

• Suitable respirators should be used.

• If contact with hardeners occurs, remove any clothing involved and wash the skin with large amounts of water. Discard the clothing. Do not attempt to wash and reuse it. Protecto-Crete Liquid may be washed off with S-10 Cleaning Solvent, MEK, or lacquer thinner. DO NOT USE ACETONE.

• Fumes are flammable and heavier than air. Proper ventilation should be maintained to minimize breathing of concentrated fumes.

• If a rash or dermatitis occurs, remove the individual from the work area and seek a doctor's care for dermatitis.

• Keep open flames and sparks away from the area where toppings are being mixed and applied.

• In case of eye contact, wash with water for at least 15 minutes and consult a physician. If swallowed, do not induce vomiting; call a physician immediately.

Note:

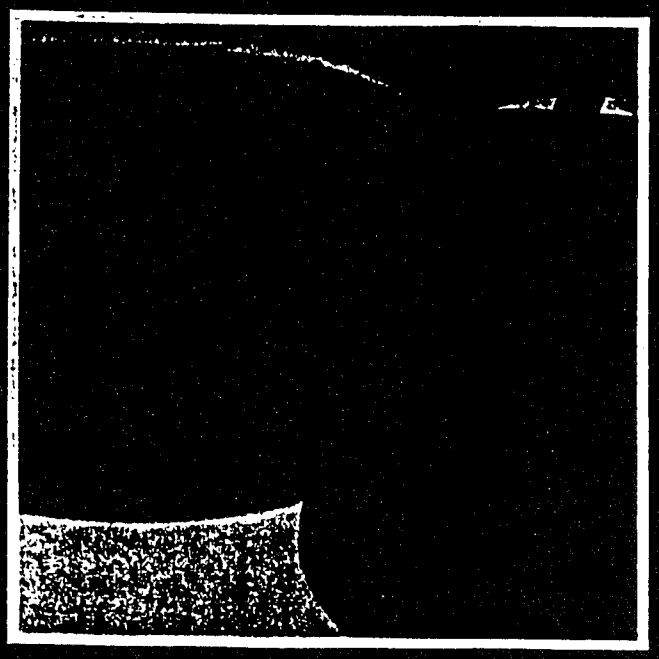
Dudick Inc. ("Dudick") warrants all goods of its manufacture to be as represented in its catalogs and that the application of its products by its employees or sub-contractors shall be performed in a workmanlike manner. Dudick's obligation under this warranty shall be the repair to and replacement of any applications which its examination shall disclose to be defective. Dudick makes no warranty concerning the suitability of its product for application to any surface, it being understood that the goods have been selected and the application ordered by the purchaser. DUDICK INC. MAKES NO WARRANTY, EXPRESS OR IMPLIED, THAT THE GOODS SHALL BE MERCHANTABLE OR THAT THE GOODS ARE FIT FOR ANY PARTICULAR PURPOSE. THE WARRANTY OF REPAIR OR REPLACEMENT SET FORTH HEREIN IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES ARISING BY LAW OR OTHERWISE; AND DUDICK INC. SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DOWN TIME, DAMAGES TO PROPERTY OF THE PURCHASER OR OTHER PERSONS, OR DAMAGES FOR WHICH THE PURCHASER MAY BE LIABLE TO OTHER PERSONS, WHETHER OR NOT OCCASIONED BY DUDICK'S NEGLIGENCE. This warranty shall not be extended, altered or varied except by written instrument signed by Dudick and Purchaser.

Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Streetsboro, Ohio 44241
(12-91)

Dudick

Chemical Resistance

Corrosion Resistant Monolithics



Introduction

Dudick Corrosion-Proof products are available in standard systems for use as floor toppings, vessel linings or equipment coatings. Each system is manufactured in a number of resin bases to provide corrosion protection over the entire range of chemical activity from pH 1 through pH 14. Depending on the system and the fillers and reinforcement chosen, protection can be maintained at elevated temperatures. Several fire retardant formulations are also available.

It should be noted that a prospective user is not limited to the basic environmental properties listed for each system. Any product in the Dudick Corrosion-Proof line can be modified to provide the moisture and chemical resistance required for a specific application.

To this end, Dudick Corrosion-Proof maintains a product testing laboratory which is completely equipped to evaluate the ability of our products to perform in actual end-use situations.

All testing is performed using the actual liquid or liquids which will be encountered in the field. These are usually supplied by the prospective customer to be sure that the concentrations involved and any possible combinations of chemicals are consistent with field conditions.

Perhaps the most significant aspect of our testing program is the use of Atlas Test Cells. These allow us to simulate factors such as stratification, agitation, volume variances and environmental factors (i.e temperature differences on the outside and inside of vessel walls) to achieve a more accurate and realistic evaluation than is possible with simple coupon tests.

The use of Atlas Test Cells also allows us to vary resins, fillers, and reinforcement materials separately to determine which can provide the best performance under the specified conditions.

Of course, appropriate physical and mechanical tests are also an important part of any product testing sequence.

How to Use the Corrosion Guide

The corrosion resistant properties described in this Guide have been determined either by analysis (the typical ability of a resin to resist attack by a specific chemical substance), by testing, or by actual field performance experience. Thus, the ratings shown are useful in helping a potential user make a preliminary evaluation for further investigation.

Since most installations involving hostile chemical environments also involve dynamic processes which can vary widely from industry to industry and plant to plant, it is always necessary to consult the Dudick Corrosion-Proof factory for guidance before making a final selection.

This is especially critical when a chemical is not listed or where a combination of chemicals are present. Thorough testing in the Dudick laboratory using the actual chemicals under simulated processing or storage conditions is the only way to assure satisfactory end-use performance.

To simplify the information presentation, this Guide provides temperature limit data (page 1) and Chemical performance characteristics in separate charts. If an anticipated condition is not covered, please consult a Dudick Corrosion-Proof representative or the factory for additional information or to arrange an appropriate performance test.

Special Note

All technical data and recommendations presented here are believed to be reliable at the time of publication. Because field conditions can vary significantly, all data should be considered only as suggestions of possible applications. Dudick Corrosion-Proof, Inc. assumes no responsibility for results obtained or damages incurred from any use whether or not the use resulted from the recommendations in this Guide. Any recommendations or technical advice rendered is not to be taken as a license to operate under or intended to suggest the infringement of any existing patent. Liability, if any, is limited to replacement of products.

Temperature/Chemical Resistance Key

Indicator	Definition	Indicator	Definition	Indicator	Definition
I	Material will withstand constant flow or Immersion service.	1	Good to the maximum temperature of the product	*NR*	Not recommended
S	Material is suitable for intermittent or Spillage service	2	High Temperature Service to 160° F (71° C)	*NI*	No information available
F	Material will tolerate Fumes only	3	Moderate Temperature Service to 140° F (60° C)	*PV*	Performance varies with conditions. Consult Dudick for recommendations or testing
		4	Warm Temperature Service to 100° F (37° C)		

Example	48. Boric Acid	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I2	I
		AID	AID	AID	AID	AID	AID	AID	AID	AID	AID	AID		

Each grid block in the Guide shows all the information which is available on the product for the use shown. Thus, a block which shows I2, indicates that the product is capable of providing immersion service up to 160° F. Similarly, a block which shows F1 indicates the material will tolerate temperatures to the maximum capability shown in the Temperature Limits chart below, but that it is designed for exposure only to fumes.

Temperature Limits

Product	Substrate	Maximum Temperature	Notes
Protecto-Coat Series	*Metal* *Concrete/Steel*	130° F 54° C 130° F 54° C	[1] Steel: Constant Flow; Steel Dry or Intermittent Spills: 200°F (93°C) to 350°F (96°C) [2] Concrete: Constant Flow
Protecto-Crete Series	*Metal* *Concrete*	Not Recommended 250° F 120° C	[3] Intermittent Spills, otherwise maximum temperature is 150°F
Protecto-Flake Series	*Metal* [4] *Concrete*	180° F 83° C Not Applicable	[4] Steel: Immersion; Steel, Dry: 250°F (121°C)
Protecto-Glass Series	*Metal* [5] *Concrete*	160° F 71° C 160° F 71° C	[5] Steel: Constant Flow
Protecto-Line Series	*Metal* [6] *Concrete* [7]	160° F 71° C 160° F 71° C	[6] Steel: Constant Flow and Immersion [7] Concrete: Constant Flow
Protecto-Seal Series	*Metal* [8] *Tile/Concrete* [8]	Not Applicable 160° F 71° C	[8] Tile: Constant Flow and Immersion
Grout Series	*Metal* *Concrete*	Not Applicable 160° F 71° C	

Dudick

Key

- I — Material will withstand constant flow or immersion service
- S — Material is suitable for intermittent or Spillage service
- F — Material will tolerate fumes only

	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
1. Acetaldehyde	F4	NR	PV	PV	F4	F4	NR	NR	S4	S4	NR	NR	NR	NR
2. Acetic Acid (0-10%)	I3	F4	I4	I4	I4	I4	S1	S1	S1	S1	S1	I3	I3	I3
3. Acetic Acid (10-50%)	S4	NR	S1	S1	S1	S1	F1	F1	S4	S4	S3	I4	I4	I4
4. Acetic Acid (50-100%)	F4	NR	S3	S3	S3	S3	NR	NR	NR	NR	S3	PV	PV	S4
5. Acetic Anhydride	F4	NR	S4	S4	S4	S4	PV	PV	NR	NR	S4	S4	S4	S4
6. Acetone	S4	NR	NR	F4	NR	NR	NR	S3	S4	S4	s4	NR	NR	NR
7. Acetyl Chloride	F4	F4	PV	PV	PV	PV	PV	PV	S4	S4	S4	PV	PV	PV
8. Acrylic Acid	PV	F4	PV	PV	PV	PV	PV	PV	NR	NR	S4	I4	I4	I4
9. Acrylonitrile	NR	NR	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	PV
10. Adipic Acid	I4	I4	I4	I4	I4	I4	PV	PV	S4	S4	S4	I4	I4	I4
11. Alcohol (Ethyl)	S4	S4	I4	I4	I4	I4	I4	I4	S4	S4	S1	I1	I1	I1
12. Alcohol (Methyl)	S4	NR	PV	PV	F4	F4	S4	S4	S4	S4	S1	I4	I4	I4
13. Allyl Chloride	F4	NR	NR	NR	NR	NR	PV	PV	NR	S4	S1	PV	PV	S4
14. Alum	S4	I4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I3	I3	I2
15. Aluminum Bromide	S4	F4	I4	I4	I4	I4	F1	F1	S4	S4	S1	I1	I1	I1
16. Aluminum Chloride	I4	I4	I4	I4	I4	I4	I1	I1	S3	S3	S1	I1	I1	I1
17. Aluminum Fluoride*	S1	S4	S1	S1	S1	S1	NR	NR	S1	S1	S1	I4	I4	I4
18. Aluminum Hydroxide	I4	S4	F4	F4	S4	S4	S4	S4	S1	S1	S1	I4	I3	I3
19. Aluminum Sulfate	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S4	I3	I3	I2
20. Ammonia (Dry)	S4	S4	F1	F1	F1	F1	F1	F1	S1	S1	S1	I3	I3	I3
21. Ammonium Chloride	S1	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
22. Ammonium Fluoride*	S4	S4	I4	I4	I4	S4	NR	NR	S1	S1	S2	I3	I3	I3
23. Ammonium Hydroxide	I4	I4	F4	F4	S4	S4	I1	I1	S1	S1	S1	I2	I2	I2
24. Ammonium Nitrate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
25. Ammonium Persulfate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
26. Ammonium Sulfate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
27. Ammonium Sulfide	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
28. Ammonium Sulfite	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
29. Amyl Acetate	F4	NR	S4	S4	S4	S4	NR	NR	NR	NR	NR	PV	F4	F4
30. Amyl Alcohol	F4	F4	S1	S1	S1	I4	NR	NR	S3	S3	S3	I4	I4	I4
31. Aniline	NR	NR	S4	S4	S4	S4	NR	NR	NR	NR	NR	NR	I4	I4
32. Aniline Hydrochloride	F4	F4	S4	S4	S4	S4	F4	F4	S3	S3	S3	I4	I4	I4
33. Antimony Chloride	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
34. Aqua Regia	NR	NR	NR	NR	NR	F4	NR	NR	NR	NR	NR	NR	NR	NR
35. Arsenic Acid	F4	F4	I4	I4	I4	I3	S4	S4	S1	S1	S1	I3	I3	PV
36. Barium Acetate	S4	S4	S4	S4	S4	S4	F4	F4	S4	S4	S3	I4	I4	I4
37. Barium Chloride	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
38. Barium Hydroxide	I4	I4	S3	S3	S2	I4	I1	I1	S1	S1	S4	I4*	I4*	I3*
39. Barium Sulfide	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
40. Benzaldehyde	PV	PV	NR	NR	NR	NR	NR	S4	PV	PV	PV	PV	NR	PV
41. Benzene	F4	NR	PV	PV	NR	NR	NR	S4	S4	S4	S4	NR	NR	S4
42. Benzene Sulfonic Acid	F4	F4	I4	I4	I4	I4	F4	F4	S4	S4	S1	I1	I1	I1
43. Benzene Sulfonic Chloride	F4	F4	I4	I4	I4	I3	F4	F4	S4	S4	S1	I1	I1	I1
44. Benzoic Acid	S4	S4	I4	I4	I4	I3	F4	F4	S1	S1	S1	I1	I1	I1
45. Benzoyl Chloride	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	NR	NR	PV
46. Black Liquor*	S4	S4	S1	I4	I1	I1	I1	NR	S1	S1	S3	I3	I3	I3
47. Bleach (5.5%)*	S4	F4	PV	PV	I1	I1	F1	NR	NR	I3	S4	NR	NR	I1
48. Boric Acid	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I2	I2	I2
49. Bromine, Wet Gas	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	F4	F4	F4
50. Bromine Water (5%)	F4	NR	S4	S4	S4	S4	S4	S4	NR	S4	S4	I4	I4	I4
51. Butadiene	S4	PV	PV	PV	PV	PV	NR	NR	S4	S4	S4	PV	PV	PV
52. Butanol	F4	NR	S4	S4	S4	S4	NR	NR	S4	S4	S1	I3	I3	I3
53. Butyl Acetate	F4	NR	NR	NR	F4	F4	NR	S4	S4	S4	NR	NR	NR	PV
54. Butyl Carbitol	F4	PV	PV	PV	F4	F4	PV	PV	S4	S4	PV	I4	I4	I4
55. Butyl Cellosolve	F4	NR	PV	NR	S4	S4	NR	S4	S4	S4	S4	NR	NR	S4
56. Butyric Acid	F4	NR	F4	F4	F3	F3	NR	NR	NR	NR	NR	I3	I3	I3
57. Cadmium Plating (Cyanide)	S4	S4	S1	S1	S1	S1	S1	S1	S1	S1	S3	I3	I3	I3

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	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
58. Calcium Bisulfite	S4	S4	I4	I4	I3	I3	F1	F1	S3	S3	S1	I1	I1	I1
59. Calcium Carbonate (Soda Ash)	I4	I4	I4	I4	I3	I3	I1	NR	S1	S1	S4	I3	I3	I3
60. Calcium Chloride	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
61. Calcium Hydroxide*	I4	I4	I4	I4	I3	I4	I1	NR	S1	S1	S3	I3	I3	I3
62. Calcium Hypochlorite (5%)*	F4	F4	F4	F4	S4	S4	F4	NR	S4	S4	S3	NR	NR	NR
63. Calcium Nitrate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
64. Caprylic Acid	NR	NR	I4	I4	I4	I4	NR	NR	NR	NR	NR	I4	I4	I4
65. Carbon Disulfide	F4	NR	S4	S4	S4	S4	NR	NR	S4	S4	S4	F4	F4	F4
66. Carbon Tetrachloride	F4	F4	S4	S4	S3	S3	NR	NR	S3	S3	S3	NR	I4	I4
67. Castor Oil	I4	I4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
68. Chloracetic Acid	F4	NR	F4	F4	F4	F4	F1	F1	NR	S4	S4	F3	F3	F3
69. Chloral	NR	NR	NR	NR	NR	NR	NR	NR	S4	S4	NR	NR	NR	NR
70. Chlorine Dioxide	F4	NR	S4	S4	S3	S3	NR	NR	NR	S4	S3	I4	I4	I3
71. Chlorine Gas (Dry)	NR	NR	F4	F4	F3	F3	NR	NR	NR	NR	S4	I4	I4	I3
72. Chlorine Gas (Wet)	NR	NR	NR	NR	F4	F3	NR	NR	NR	S4	S2	F4	F4	F4
73. Chlorine Water (Saturated)	NR	NR	S4	S4	S3	S3	F4	F4	S4	S4	S2	I4	I4	I4
74. Chlorobenzene	F4	NR	NR	NR	S4	S4	NR	NR	S4	S4	NR	NR	NR	S4
75. Chloroform	F4	NR	NR	NR	NR	NR	NR	NR	S4	S4	NR	NR	NR	NR
76. Chlorophenol	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
77. Chlorosulfonic Acid	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
78. Chlorotoluene	F4	NR	S4	S4	S4	S4	NR	NR	NR	NR	S4	I4	NR	PV
79. Chromic Acid (10%)	F4	F4	S4	S4	S4	S4	S4	S4	S4	S4	S4	I4	I4	I4
80. Chromic Acid (40%)	F4	NR	S4	S4	S4	S4	S4	S4	S4	S4	S4	I4	I4	PV
81. Chromic Chloride	S4	S4	I4	I4	I4	I3	S1	S1	S1	S1	S1	I1	I1	I1
82. Citric Acid	S4	F4	I4	I4	I4	I3	S1	S1	S4	S4	S1	I1	I1	I1
83. Copper Plating (Cyanide)	S3	S3	S4	S4	S3	S3	S1	S1	S2	S2	S4	I4	I4	I3
84. Copper Plating (Acid)	S4	S4	S3	S3	S3	S3	S1	S1	S2	S2	S1	I1	I1	I1
85. Copper Salts	S3	S3	I4	I4	I4	I4	S1	S1	S1	S1	S1	I1	I1	I1
86. Corn Oil	S3	S3	I4	I4	I4	I3	I1	I1	S3	S3	S1	I1	I1	I1
87. Corn Starch	S1	S1	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
88. Corn Sugar	S1	S1	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
89. Cottonseed Oil	S3	S3	I4	I4	I4	I3	I1	I1	S3	S3	S1	I1	I1	I1
90. Cresol	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	NR	NR	PV
91. Cresylic Acid	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
92. Crude Oil	S4	PV	I4	I4	I4	I4	PV	PV	PV	I1	S1	I1	I1	I1
93. Detergent Sulfonated	S4	PV	I4	I4	I4	I4	PV	PV	PV	I1	PV	I1	I1	I1
94. Dextrose	I3	S3	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
95. Dibutyl Phthalate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I3	I3	I3
96. Dichloro Acetic Acid (20%)	F4	NR	I4	I4	I4	I4	F1	F1	NR	NR	S3	I4	I4	I4
97. Diesel Fuel	I4	S4	I4	I4	I4	I4	S3	S3	S1	S1	S1	I1	I1	I1
98. Diethylamine (100%)	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	NR	NR	PV
99. Dimethyl Formamide	F4	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	I4	NR	PV
100. Esters, Fatty Acids	S4	PV	I4	I4	I4	I4	PV	PV	PV	S4	PV	I3	I3	I3
101. Ethyl Acetate	F4	NR	NR	NR	NR	NR	F1	F1	S4	S4	S4	NR	NR	NR
102. Ethyl Alcohol	S4	S4	I4	I4	I4	I4	I4	I4	S4	S4	S4	I4	I4	I4
103. Ethylamine	NR	NR	NR	NR	PV	PV	NR	NR	PV	PV	PV	NR	NR	PV
104. Ethylchloroformate	F4	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	PV	NR	PV
105. Ethyl Ether	F4	NR	NR	NR	PV	PV	NR	F4	S4	S4	S4	PV	PV	PV
106. Ethylene Dichloride	F4	NR	NR	NR	NR	NR	NR	F4	NR	NR	NR	PV	NR	NR
107. Ethylene Glycol	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
108. Ethylene Oxide	F4	NR	PV	PV	PV	PV	PV	PV	PV	PV	S1	PV	PV	PV
109. Ethyl Sulfate	F4	PV	PV	PV	PV	PV	PV	PV	S4	S4	NR	I4	I4	I4
110. Ferric Chloride	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	NR	I1	I1	I1
111. Ferric Sulfate	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
112. Ferrous Chloride	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
113. Ferrous Sulfate	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
114. Fluoboric Acid*	F4	PV	S4	S4	S4	S4	PV	PV	S4	S4	S4	NR	PV	NR

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	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
115. Fluorine Gas*	NR	NR	NR	NR	NR	NR	NR	NR	PV	PV	PV	NR	PV	PV
116. Fluosilicic Acid*	F4	PV	S4	S4	S4	S4	PV	PV	S4	S4	S4	NR	PV	NR
117. Formaldehyde	F4	F4	I4	I4	I4	I4	F4	F4	S1	S1	S1	I1	I1	I1
118. Formic Acid	F4	NR	S4	S4	S4	I4	PV	PV	NR	NR	S4	I4	I4	I4
119. Fuel Oil 1 & 2	S1	S4	I4	I4	I4	I4	NR	NR	S1	S1	S1	I1	I1	I1
120. Furfural	F4	NR	S4	S4	S4	S4	PV	PV	PV	PV	PV	NR	PV	PV
121. Furfural Alcohol	S4	PV	S4	S4	S4	S4	S4	S4	S1	S1	S1	I4	I4	I4
122. Gasoline	I4	I4	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
123. Glucose	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
124. Gluconic Acid (50%)	PV	PV	F4	F4	S4	S4	PV	PV	PV	PV	S4	S4	S4	I4
125. Glycol	I4	I4	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
126. Glycolic Acid	NR	NR	S4	S4	S4	S4	F1	F1	S4	S4	S4	I3	I3	I3
127. Gold Plating (Cyanide)	S4	S4	S1	S1	S1	I3	S1	S1	S1	S1	S4	I4	I4	I3
128. Grape Juice	I3	I3	I3	I3	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
129. Green Liquor	S4	S4	I4	I4	I3	I3	I1	I1	S1	S1	S3	I1	I1	I1
130. Heptane	S4	S4	S1	S1	S1	S1	I4	I4	S1	S1	S1	I2	I2	I2
131. Heptanoic Acid	PV	PV	S4	S4	S4	S4	F1	F1	PV	PV	I3	I3	I3	I3
132. Hexane	F4	F4	S1	S1	S1	S1	I4	I4	S1	S1	S1	I2	I2	I2
133. Hydrazine (35%)	F4	PV	NR	NR	NR	NR	NR	NR	S4	S4	S4	NR	NR	NR
134. Hydraulic Fluid	S4	PV	PV	PV	I3	I3	PV	PV	S1	S1	S1	PV	PV	I1
135. Hydriodic Acid (20%)	F4	F4	S4	S4	S4	I4	S1	S1	PV	PV	S4	I4	I4	I4
136. Hydrobromic Acid (20%)	F4	F4	S4	S4	S4	S4	S1	S1	PV	S4	S4	I4	I4	I4
137. Hydrocarbons (Aliphatic)	S4	PV	I4	I4	I4	I4	I1	I4	S1	S1	S4	I1	I1	I1
138. Hydrocarbons (Aromatic)	S4	PV	PV	PV	F4	F4	NR	NR	S4	S4	S4	PV	PV	I1
139. Hydrochloric Acid (1-25%)	S4	F4	S3	S3	S3	I3	F1	F1	S4	S4	S4	I1	I1	I1
140. Hydrochloric Acid (25-37%)	F4	NR	F3	F3	F3	I4	F1	F1	S4	S4	S4	PV	PV	I2
141. Hydrofluoric Acid (1-10%)*	NR	NR	F3	NR	F3	F3	NR	NR	NR	NR	NR	NR	NR	NR
142. Hydrofluoric Acid (10-53%)*	NR	NR	F4	NR	F4	F4	NR	NR	NR	NR	NR	NR	NR	NR
143. Hyrofluosilicic Acid*	F4	F4	F3	NR	F3	F3	PV	PV	NR	NR	NR	I2	PV	NR
144. Hydrogen Bromide	F4	PV	PV	PV	F1	F1	PV	PV	PV	PV	S4	PV	PV	I4
145. Hydrogen Peroxide (30%)	S4	NR	PV	PV	F4	I4	PV	PV	NR	S4	S4	PV	PV	I4
146. Hydrogen Sulfide	S1	S4	I4	I4	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
147. Hypochlorous Acid	NR	NR	NR	NR	F3	F3	NR	NR	NR	S4	S4	NR	NR	NR
148. Iodine	NR	NR	F4	F4	F3	F3	F1	F1	PV	S4	S4	I4	I4	I3
149. Insecticides	S4	PV	PV	PV	F4	F4	PV	PV	PV	S4	S3	PV	PV	I3
150. Isophorone	S4	PV	PV	PV	PV	PV	PV	PV	S4	S4	PV	I4	I4	I4
151. Isopropyl Acetate	F4	NR	NR	NR	NR	NR	PV	PV	S4	S4	NR	PV	PV	S4
152. Isopropyl Alcohol	S4	S4	PV	PV	S4	S4	PV	PV	S1	S1	S1	I1	I1	I1
153. Isopropyl Amine	F4	PV	PV	PV	F4	F4	NR	NR	PV	PV	NR	PV	PV	S4
154. Isopropyl Ether	S4	S4	PV	PV	F4	F4	NR	NR	S4	S4	S4	I4	I4	I4
155. Jet Fuel	I4	I4	I4	I4	I4	I4	F1	F1	S1	S1	S1	I1	I1	I1
156. Kaolin	I1	I1	PV	PV	I1	I1	I1	I1	I1	I1	I1	PV	PV	I1
157. Kerosene	I4	I4	I4	I4	I4	I4	I1	I4	S1	S1	S1	I1	I1	I1
158. Lasso Herbicide (10%)	F4	PV	S4	S4	S4	S4	F4	F4	PV	S4	S4	I4	I4	I4
159. Lactic Acid (1-20%)	S4	F4	I4	I4	I4	I3	S1	S1	S4	S4	S1	I1	I1	I1
160. Lactic Acid (20%-Con)	S4	NR	S4	S4	I4	I3	S1	S1	NR	S4	S4	I4	I3	I3
161. Lauric Acid	F4	PV	I4	I4	I3	I3	S1	S1	NR	S3	S1	I1	I1	I1
162. Lead Acetate	I4	I4	I4	I4	I3	I3	F1	F1	S1	S1	S1	I1	I1	I1
163. Linseed Oil	S3	S3	I1	I1	I1	I1	I1	I1	S4	S4	S1	I1	I1	I1
164. Magnesium Sulfate	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
165. Maleic Acid	S3	S3	S3	S3	S1	I4	S1	S1	S1	S1	S4	I3	I3	I1
166. Manganese Salts	I4	I4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
167. Mercury Salts	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
168. Methyl Alcohol	S4	NR	PV	PV	F4	F4	NR	S4	S4	S4	S1	I4	I4	I4
169. Methyl Acetate	F4	NR	NR	NR	F4	F4	PV	PV	S4	S4	S4	PV	PV	PV
170. Methylene Chloride	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
171. Methyl Chloride	NR	NR	NR	NR	NR	NR	NR	S4	NR	NR	NR	NR	NR	NR

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	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
172. Methyl Ethyl Ketone	NR	NR	NR	NR	NR	NR	NR	NR	PV	S4	NR	PV	PV	NR
173. Methyl Isobutyl Ketone	F4	NR	NR	NR	NR	NR	NR	NR	S4	S4	S4	PV	PV	NR
174. Milk Products	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
175. Mineral Oil	I4	I4	I4	I4	I4	I4	S4	S4	S1	S1	S1	I1	I1	I1
176. Molasses	I4	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
177. Naphthalene	S4	S4	S4	S4	S3	S3	S4	S4	S4	S4	S4	I4	I4	I3
178. Naphtha	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I3	I1	I1
179. Naphthenic Acid	PV	PV	I4	I4	PV	PV	PV	PV	S4	S4	PV	I4	I4	PV
180. Nickel Chloride	S4	S4	S4	S4	S4	S4	S4	S4	S1	S1	S1	I1	I1	I1
181. Nickel Plating (Bright)	S4	S4	S4	S4	S4	I4	I4	I4	S1	S1	S1	I1	I1	I1
182. Nickel Salts	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
183. Nitric Acid (5%)	S4	S4	S3	S3	I3	I4	S4	S4	S4	S4	S1	I3	I3	I2
184. Nitric Acid (10%)	S4	S4	S3	S3	I3	I4	S4	S4	S4	S4	S1	I3	I3	I2
185. Nitric Acid (20%)	NR	NR	F4	F4	F4	F3	NR	NR	NR	S4	S2	I4	I4	I4
186. Nitric Acid (40%)	NR	NR	F4	F4	F4	F3	NR	NR	NR	S4	S4	I4	I4	I4
187. Nitric Acid (60%)	NR	NR	NR	NR	F4	F4	NR	NR	NR	NR	S4	S4	S4	S4
188. Nitric Acid (Conc.)*	NR	NR	NR	NR	F4	F4	NR	NR	NR	NR	NR	NR	NR	F4
189. Nitrobenzene	NR	NR	NR	NR	NR	NR	NR	S4	PV	PV	NR	PV	PV	PV
190. Nitrous Acid	NR	NR	PV	PV	PV	PV	PV	PV	PV	PV	S3	I3	I3	I2
191. Octanoic Acid	F4	F4	S4	S4	S3	I4	PV	PV	PV	PV	S3	I4	I4	I4
192. Oils (Animal)	I1	I1	I1	I1	S1	S1	I1	I1	S1	S1	S1	I1	I1	I1
193. Oils (Mineral)	I1	I1	I1	I1	S1	S1	I1	I1	S1	S1	S1	I1	I1	I1
194. Oils (Vegetable)	I1	I1	I1	I1	S1	S1	I1	I1	S1	S1	S1	I1	I1	I1
195. Oleic Acid	F4	NR	I4	I4	I3	I3	NR	NR	S4	S4	S1	I1	I2	I1
196. Oxalic Acid (Sat'd)	S4	S4	I4	I4	I3	I3	S1	S1	S1	S1	S1	I3	I1	I1
197. Ozone	S4	PV	PV	PV	I2	I2	S3	S3	S1	S1	S1	PV	PV	S4
198. Palmitic Acid	PV	PV	S4	S4	S3	S3	PV	PV	PV	PV	S4	I1	I1	I1
199. Pentachlorethane	PV	PV	PV	PV	S1	S1	PV	PV	S1	S1	S4	PV	PV	S1
200. Perchloric Acid	NR	NR	PV	PV	F4	F4	PV	PV	S1	S1	S1	PV	PV	PV
201. Perchlorethylene	F4	NR	NR	NR	F4	F4	NR	S4	S4	S4	S4	S4	PV	S4
202. Phenol (0%-10%)	NR	NR	PV	PV	F4	F4	NR	NR	S4	S4	S2	PV	PV	PV
203. Phenol (85%)	NR	NR	NR	NR	F4	F4	NR	NR	PV	S4	PV	NR	NR	PV
204. Phosphoric Acid (Conc.)	F4	NR	S3	S3	S1	I4	NR	NR	S4	S4	S1	I1	I1	I1
205. Phosphorous Oxychloride	NR	NR	PV	PV	F4	F4	PV	PV	S4	S4	S4	PV	PV	PV
206. Phosphorous Trichloride	NR	NR	PV	PV	F4	F4	PV	PV	S4	S4	PV	PV	PV	PV
207. Phthalic Acid	NR	PV	S1	S1	S1	S1	PV	PV	PV	PV	S1	I1	I1	I1
208. Potassium Bichromate	S4	S4	I4	I4	I4	I3	S4	S4	S4	S4	S1	I4	I4	I1
209. Potassium Bromate	S4	S4	I4	I4	I4	I4	I4	I4	S4	S4	S1	I4	I4	I4
210. Potassium Bromide	S4	S4	I4	I4	I4	I3	I4	I4	PV	S4	S1	I1	I1	I1
211. Potassium Carbonate	I4	I4	PV	PV	I4	I3	I4	NR	S1	S1	S1	I4	I4	I4
212. Potassium Chlorate	S4	S4	I4	I4	I4	I3	I4	NR	S1	S1	S1	I1	I1	I1
213. Potassium Chloride	I4	I1	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
214. Potassium Cyanide	S4	S4	I4	I4	PV	I4	I4	I4	S1	S1	S1	I1	I1	I1
215. Potassium Hydroxide (10%)*	I4	S4	S1	S1	I4	I4	I4	NR	S1	S1	S1	I4	I4	I4
216. Potassium Hydroxide (Conc.)*	I4	S4	NR	S4	S4	S4	S1	NR	S1	S1	S1	NR	NR	NR
217. Potassium Nitrate	I4	I4	I4	I4	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
218. Potassium Permanganate	I4	I4	I4	I4	I3	I3	S1	S1	S1	S1	S1	PV	I1	I1
219. Potassium Peroxide	S4	S4	S4	S4	PV	PV	F4	F4	S1	S1	PV	I4	I4	I4
220. Potassium Persulfate	S4	S4	I4	I4	I3	I3	S1	S1	S1	S1	S1	I1	I1	I1
221. Potassium Sulfate	S4	S4	I4	I4	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
222. Pulpstock Chlorinated	NR	NR	S4	S3	S3	S3	NR	NR	NR	S3	S4	S4	S4	S4
223. Propionic Acid	NR	NR	NR	NR	F4	F4	NR	NR	PV	PV	PV	PV	NR	PV
224. Propylene Glycol	S4	NR	I3	I3	I3	I3	I4	I4	S4	S4	S4	I4	I4	I3
225. Pyridine	NR	NR	NR	NR	F4	F4	NR	NR	NR	NR	NR	NR	NR	NR
226. Salicylic Acid	S1	S1	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
227. Seawater	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
228. Silver Nitrate	S1	S1	S1	S1	S1	S1	PV	PV	S1	S1	S1	I1	I1	I1

*May need synthetic fabric, or carbon fillers. Consult a Dudick Corrosion-Proof, Inc. technical representative for more complete information on these products.

Dudick

Key

I Material will withstand constant flow or immersion service
S Material is suitable for intermittent or Spillage service
F Material will tolerate fumes only

	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
229. Sodium Acetate	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
230. Sodium Bicarbonate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
231. Sodium Bisulfate	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
232. Sodium Bisulfite	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
233. Sodium Bromate	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
234. Sodium Carbonate (see soda ash)	I4	I4	I4	I4	I3	I3	I1	NR	S1	S1	S4	I1	I1	I1
235. Sodium Chlorate	NR	PV	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
236. Sodium Chloride	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1
237. Sodium Chlorite (50%)	NR	NR	S4	S4	S3	S3	S4	S4	S4	S4	S4	I4	I4	I3
238. Sodium Chromate	S4	S4	I4	I4	I3	I3	S4	S4	S1	S1	S1	PV	PV	I1
239. Sodium Cyanide	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
240. Sodium Dichromate	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	PV	I4	I3
241. Sodium Fluoride*	S4	S4	NR	NR	I4	I4	PV	PV	S4	S4	S4	NR	NR	NR
242. Sodium Hydroxide (10%)*	I4	S4	S1	S1	I1	I1	I1	NR	S1	S1	S1	NR	NR	NR
243. Sodium Hydroxide (50%)*	I4	S4	S1	S1	I1	I4	I1	NR	S1	S1	S4	NR	NR	NR
244. Sodium Hypochlorite (3%)*	F4	F4	NR	S4	S4	S4	F1	NR	S3	S3	S1	NR	I4	I4
245. Sodium Hypochlorite (17%)	NR	NR	NR	PV	S4	S4	NR	NR	S4	S4	S4	NR	PV	S4
246. Sodium Peroxide	S4	S4	I4	I4	I4	I4	I1	I1	S4	S4	NR	PV	PV	S4
247. Sodium Phosphate	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
248. Sodium Sulfate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
249. Sodium Sulfide	S4	S4	PV	PV	I4	I3	I1	I1	S1	S1	S1	I4	I4	I4
250. Sodium Sulfite	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
251. Sodium Tartrate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
252. Sodium Thiosulfate (Hypo)	I4	S4	I4	I4	I3	I3	S1	NR	S1	S1	S1	I1	I1	I1
253. Soybean Oil	PV	PV	I4	I4	I3	I3	I1	I1	PV	S1	S1	I1	I1	I1
254. Stearic Acid	S4	S4	PV	PV	I4	I4	PV	PV	S4	S4	S1	I2	I2	I2
255. Succinic Acid	S4	F4	PV	PV	I4	I4	PV	PV	S3	S3	S3	I4	I4	I4
256. Sugar	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
257. Sulfite Liquor (Paper)	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
258. Sulfur Dioxide	F1	F1	S4	I4	I4	I4	I1	I1	S1	S1	S1	F4	I1	I1
259. Sulfur Trioxide	F4	F4	PV	PV	S4	S3	S1	S1	S1	S1	S1	I4	I4	I4
260. Sulfuric Acid (2%-20%)	S1	S4	S1	S1	S1	S1	S1	S1	S3	S3	S1	I1	I1	I1
261. Sulfuric Acid (20%-50%)	S1	F4	S1	S1	S1	S1	F1	F1	S4	S4	S1	I3	I3	I2
262. Sulfuric Acid (50%-70%)	S1	F4	F3	F3	F1	F1	F4	F4	NR	S4	NR	I4	I4	I2
263. Sulfuric Acid (70%-80%)	S1	NR	NR	NR	NR	NR	NR	NR	NR	S4	NR	PV	PV	PV
264. Sulfuric Acid (80%-98%)	S1	NR	NR	NR	NR	NR	NR	NR	NR	S4	NR	NR	NR	NR
265. Sulfurous Acid	S4	S4	I4	I4	I4	I3	S4	S4	S4	S4	S1	I1	I1	I1
266. Tall Oil	I4	S4	I4	I4	I4	I3	I1	I1	S4	S4	S1	I1	I1	I1
267. Tannic Acid	S4	PV	I4	I4	I4	I4	PV	PV	S4	S4	S4	I1	I1	I1
268. Tartaric Acid	U4	I4	I4	I4	I3	I3	S1	S1	S1	S1	S1	I1	I1	I1
269. Tetrachlorethane	F4	PV	NR	NR	F4	F4	NR	S4	S4	S4	NR	PV	PV	PV
270. Thionyl Chloride	NR	NR	NR	NR	NR	NR	NR	S4	NR	NR	NR	NR	NR	NR
271. Titanium Tetrachloride	S4	F4	I4	I4	I3	I3	S4	S4	S1	S1	S1	I1	I1	I1
272. Toluene	F4	NR	NR	NR	F4	F4	NR	S4	S4	S4	NR	S4	S4	S4
273. Toluene Sulfonic Acid	S3	S3	I4	I4	I3	I3	S4	S4	S1	S1	S1	I1	I1	I1
274. Trichloroacetic Acid (20%)	NR	NR	F4	F4	I4	I3	F4	F4	NR	NR	S1	I4	I4	I4
275. Trichloroethylene	NR	PV	NR	NR	F4	F4	NR	S4	S4	S4	NR	PV	PV	PV
276. Trisodium Phosphate	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S4	I3	I3	I3
277. Turpentine	S4	S4	PV	PV	I4	I4	NR	I1	S1	S1	NR	PV	PV	PV
278. Tween Surfactants	PV	PV	I4	I4	I4	I4	PV	PV	S1	S1	S1	I1	I1	I1
279. Urea Solutions	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
280. Vinegar	S4	F4	I1	I1	I1	I1	I4	I4	S1	S1	S1	I1	I1	I1
281. Water, distilled & demineralized	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
282. White Liquor (Paper)	I4	I4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
283. Xylene (Xylol)	S4	NR	NR	NR	NR	NR	NR	I1	S4	S4	NR	I4	I4	I4
284. Zinc Salt	I4	I4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
285. Zinc Plating (Acid Sulfate)	S3	S3	I4	I4	I3	I3	S1	S1	S1	S1	S1	I1	I1	I1

*May need synthetic fabric, or carbon fillers. Consult a Dudick Corrosion-Proof, Inc. technical representative for more complete information on these products.

Products

There is a Dudick Corrosion-Proof product to protect virtually any area of a plant and any piece of production, storage or handling equipment from the corrosive effects of moisture and chemical attack.

Eight standard product lines are available and each offers a range of products developed to meet the special requirements encountered in most manufacturing or processing environments. However, any product in any system can be modified to tailor the physical, mechanical, environmental or application properties to the unique needs of a specific application.

A series of catalogs is available describing the specific properties of each product in each of these systems. Of course, our factory personnel are available to work with your architect, plant management, engineering, and maintenance personnel to recommend a standard or custom formulated Dudick Corrosion-Proof product that meets your exact performance and durability requirements.

Floor Toppings/Linings

Designed for:

- Heavy Traffic
- New Concrete
- Existing & Eroded Concrete
- Full Range of Chemical Spills
- Conductivity
- Light Duty
- Cleanability
- Colors/Appearance

Tank Linings

Designed for:

- Concrete or Steel
- Process Vessels
- "E" Coat Tanks
- Holding Tanks
- Sumps, Pits, Trenches

Secondary Containment Linings

Designed for:

- Tank Farms
- Holding Pits

Coatings

Designed for:

- Tank Exteriors
- Structural Steel

Corrosion System Designs

The Dudick Systems are designed with:

- Heavy Aggregate for High Impact & Abuse
- Glass Reinforcement for Expansion & Contraction
- Epoxy, Polyester, Vinylester, Urethane & Acrylic Resins

Services Offered:

- Concrete Specifications
- Steel Specifications
- Lining & Topping Specifications
- Installation Detail Drawings
- Field Tech Service
- Application Recommendations

Experience

Dudick Corrosion-Proof products have been used in nearly every type of manufacturing and processing operation where chemical environments or high moisture conditions present a constant corrosion problem.

Our products are protecting the plants and equipment of most of the Fortune 500 companies and hundreds of smaller, local firms. They are used at major U.S. government installations and in many municipal water and sewage treatment plants.

They have been installed in every geographic area of the United States and have been exported to many European countries.

While our experience covers nearly every type of industrial environment, a few specific examples deserve special mention because they help demonstrate many of the special capabilities of Dudick Corrosion-Proof, Inc. products and people.

Pulp and Paper Industry

Dudick Corrosion-Proof, Inc. developed a special series of products to reline the interiors of the tile chests used in pulp and paper manufacturing operations. Installed by Dudick personnel under tight turnaround schedules, these relining systems have demonstrated their ability to eliminate leaking problems and to stand up to the severe chemical environments involved. Many of these installations have already endured more than seven years of constant service without a single failure.

Chemical Processing Industry

Dudick Corrosion-Proof products are used extensively to protect vulnerable equipment and structures in chemical processing and petroleum refining operations. Our systems have achieved excellent service records in chemical environments ranging from pH 1 to pH 14, including extended exposures to high concentrations at elevated temperature.

Power and Energy

Dudick Corrosion-Proof materials are used extensively in coal and oil powered electrical generating plants including trenches, waste water treatment tanks, and the severe environment of flue gas desulfurization systems (ducts and scrubbers).

Food Processing

Several Dudick Corrosion-Proof products are available in special formulations which meet FDA requirements for food proximity and food contact. Our Protecto-Line and Protecto-Crete floor toppings, for example, provide important resistance to both accidental spills and the harsh chemical cleaning agents required to maintain sanitation. In addition, our lining systems provide important protection for storage vats and processing equipment where chemically active ingredients are involved.

Metal Working

Dudick Corrosion-Proof products are used in many areas in both primary metals manufacturing and metals finishing operations. These include pickling lines, waste water treatment facilities, stack emission control systems and etching and plating rooms.

Waste Water Treatment

Dudick Corrosion-Proof products effectively protect the major components of waste water treatment facilities such as settling tanks, aeration units, retention tanks, activated carbon pits and oil skimmers.

Exotic Metals

Occasionally, plants or equipment built with exotic metal vessels and piping systems will be converted to other production uses where even they are susceptible to corrosion. Dudick Corrosion-Proof, Inc. has successfully lined stainless steel, Inconel, aluminum, as well as the soft metals, with specially designed protective systems appropriate to their new missions.

Aerospace

Dudick Corrosion-Proof lined the entire interior of the building (big enough to hold a 747) where the reusable space shuttle fuel tanks are sandblasted and cleaned with an acid spray. We also provided the corrosion protection for several small aluminum plates essential for the function of the air regeneration systems aboard the Enterprise and Columbia shuttles.

Electronics

Dudick Corrosion-Proof products are used in many electronic component manufacturing and assembly areas. They provide both resistance to the acids used in manufacturing processes and provide the cleanability essential to the maintenance of a clean-room environment.

Composite Flooring

In many industrial plants service requirements will vary significantly from one area to another. Rather than recommend a single floor topping designed to meet the most severe requirements, Dudick Corrosion-Proof will develop a more cost-effective composite system with performance tailored to the actual needs of specific production zones.

APPENDIX

26-4

HYDROSTATIC TEST RECORD

Date 8-31-95

Clean Harbors of Chicago
11700 S. Stoney Island Ave
Chicago Il

Tank/line/valve tested:

Tank # N/A Valve # (s) Air valve Closed: V-544, V-781

Process Line # (s) P-DRUM-DI

Description: 2"ϕ C.S SCH. 40 ASTM 53A
All welded where out of secondary containment

Drawing # PT-007 REV 0

Applicable Specification ASTM 53A, Piping System per 40 CFR 264.193(f)

TEST PREPARATION:

YES Joints Accessible — N/A Expansion Joints Restrained

YES Relief Valves (Rupture discs) ~~Isolated~~ Removed

N/A Low Press Equipment Isolated — YES System Supports Sufficient

YES System Vented — YES Connections Checked

YES Test Gauges in Place — N/A Recorder Serial #_____

TEST PARAMETERS:

Guage Range 0 PSIG to 200 PSIG (1-1/2 to 4 x test press)

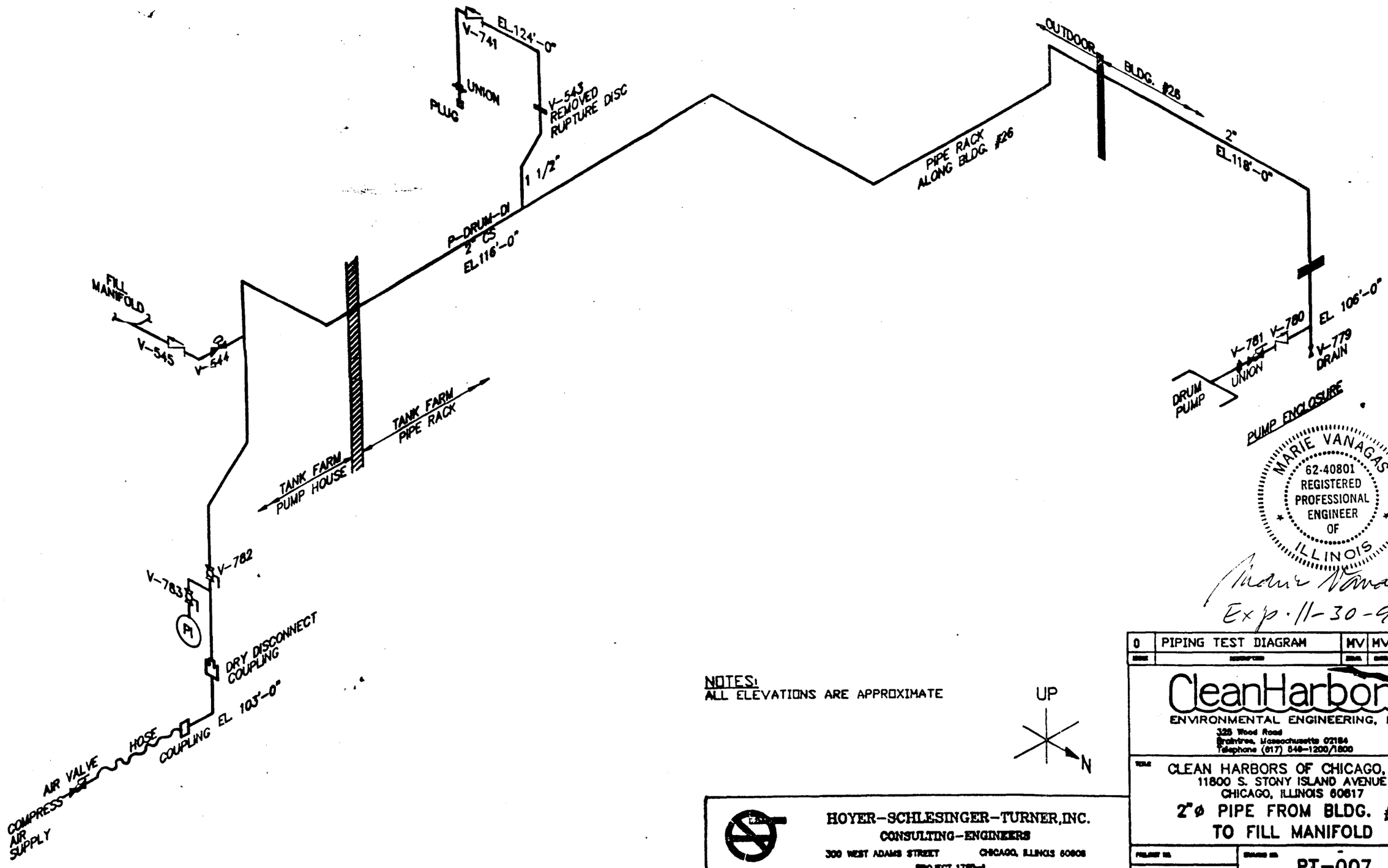
Guage Calibration I. I.D.# N/A Due Date —

Test Pressure - Internal 102 PSIG External ATM PSIG

Test Medium - WATER Condition City of Chicago Water. Piping filled with Water and pressurized with air

Test Temperature 70 F (70F min Sec I/60F min Sec 8, 11 & B31.1)

Ambient Temperature 86 F 68% RH



NOTES:
ALL ELEVATIONS ARE APPROXIMATE

UP
N

HOYER-SCHLESINGER-TURNER, INC.
CONSULTING-ENGINEERS
300 WEST ADAMS STREET CHICAGO, ILLINOIS 60606
PROJECT 1780-1

0	PIPING TEST DIAGRAM	MV	MV	

CleanHarbors
ENVIRONMENTAL ENGINEERING, INC.
325 Wood Road
Braintree, Massachusetts 02184
Telephone (617) 848-1200/1800

CLEAN HARBORS OF CHICAGO, INC.
11800 S. STONY ISLAND AVENUE
CHICAGO, ILLINOIS 60617

2"ø PIPE FROM BLDG. #26
TO FILL MANIFOLD

SCALE NONE

DRAWING NO. PT-007

Appendix D-48

Engineering Certifications Units 43 and 60

CleanHarbors®
ENVIRONMENTAL SERVICES, INC.
325 WOOD ROAD • BRAINTREE, MA 02184
(617) 849-1800

September 15, 1995

Via Federal Express

Mr. Robert Watson, P.E.
Illinois Environmental Protection Agency
Division of Land Pollution Control -- #24
Permit Section
2200 Churchill Road
Post Office Box 19276
Springfield, IL 62794-9276

Re: Clean Harbors of Chicago, Inc.
Log No. B-16-M-2
Construction Certification Report

Dear Mr. Watson:

In accordance with the provisions of Conditions I.K.1 and II.D.I of the RCRA Part B Permit issued June 30, 1995 Clean Harbors of Chicago, Inc. (CHCI) is pleased to submit this Construction Certification Report (CCR) for certain units at the modified CHCI facility located at 11800 South Stony Island Avenue in Chicago, IL.

Today's submittal includes one (1) original and two (2) copies of the CCR as prepared by Hoyer Schlesinger Turner, Inc. The CCR includes all pertinent engineering design calculations, as-built drawings, and coating information required by the Agency. The report also includes the required independent professional engineer (PE) certification statement and seal.

If you have any questions, please feel free to contact me at (617) 849-1800, extension 4473.

Sincerely,

Paul A. Ahearn

Paul A. Ahearn
Manager, Regulatory Compliance

Enclosure

CERTIFICATION

This statement is to be completed by both the responsible officer and the registered professional engineer upon completion of construction in accordance with 35 IAC Section 702.126. Submit one copy of the certification with original signatures and two additional copies (four additional copies for UIC wells). Forward these certification statements and any information required by the permit to the following address:

Illinois Environmental Protection Agency
Bureau of Land - #33
Permit Section
2200 Churchill Road, P.O. Box 19276
Springfield, Illinois 62794-9276

FACILITY NAME: CLEAN HARBORS OF CHICAGO, INC.

IEPA SITE CODE: 0 3 1 6 0 0 0 0 5 1

U.S. EPA ID NO.: IL D 0 0 0 6 0 8 4 7 1

PART B PERMIT LOG #/UIC PERMIT #: B-16-M-2

PERMIT (OR MODIFICATION) ISSUANCE DATE: June 30, 1995

PERMIT CONDITION NO. REQUIRING CERTIFICATION: I.K.1 & II.D.1

The Unit #43 and Unit #60 has been constructed in accordance with the specifications in the Part B/UIC Permit. Documentation that the construction was in accordance with the permit is contained in the enclosed report. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Alan S. McKim

Signature of Owner/Operator

Alan S. McKim, Director
Clean Harbors of Chicago, Inc.

Name and Title

Marie Vanagas

Signature of Registered P.E.

Marie Vanagas
62--40801
Hoyer-Schlesinger-Turner, Inc.

Name of Registered P.E. and Illinois Registration Number

09/15/95

Date

(P.E. SEAL)

MARIE VANAGAS
62-40801
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

EXP. 11/30/95

This Agency is authorized to require this information under Illinois Revised Statutes, 1979, Chapter 111 1/2, Section 1039. Disclosure of this information is required under that Section. Failure to do so may prevent this form from being processed and could result in your application being denied. This form has been approved by the Forms Management Center.

CONSTRUCTION CERTIFICATION REPORT

UNIT #43 - Fuels Blending Operation

UNIT #60 - Roll-Off Pad for Fuels Blending

Prepared for:

CLEAN HARBORS OF CHICAGO, INC.
11800 S. Stony Island Avenue
Chicago, Illinois 60617

Prepared by:

HOYER-SCHLESINGER-TURNER, INC.
Consulting Engineers
300 West Adams Street, Suite 630
Chicago, Illinois 60606

HST Project No. 17851

September 1995

HOYER-SCHLESINGER-TURNER inc.
ENGINEERS — CONSTRUCTORS
300 west adams street chicago illinois 60606 telephone 263-0556 area code 312

September 15, 1995

Mr. Paul Ahearn
Manager, Regulatory Compliance
CLEAN HARBORS OF CHICAGO, INC.
11800 South Stony Island Avenue
Chicago, Illinois 60617

Re: Construction Certification Report
Unit #43 - Fuels Blending Operation
Unit #60 - Roll-Off Pad for Fuels Blending
11700 South Stony Island Avenue
Chicago, Illinois 60617
HST Project No. 17851

Gentlemen:

This report presents the results of Hoyer-Schlesinger-Turner, Inc.'s (HST) involvement in construction and construction modification of the Units #43-Fuels Blending Operation and Unit #60-Roll-Off Pad for Fuels Blending.

The construction documents for modifications of the existing building #43 and for the new structure #60 were prepared under HST supervision. HST engineers made numerous field trips to observe construction. The repair of cracks in the existing concrete slab of Unit #43 and application of the coating for both units was witnessed by HST Licensed Structural Engineer, Peter Bernes. The final inspection of Unit #43 and Unit #60 was performed by HST engineer, Marie Vanagas, PE on September 11, 1995.

The secondary containment system is designed and constructed to prevent any migration of wastes or accumulated liquid out to the soil, ground water or surface water at any time.

The presence of small drips, spills, leaks or precipitation in the secondary containment for Unit #43 and Unit #60 will be monitored through daily visual plant inspections.

Respectfully submitted,

HOYER-SCHLESINGER-TURNER, INC.

Marie Vanagas

Marie Vanagas, PE
Illinois Licensed Professional Engineer
License No. 062-040801
Expiration Date: 11/30/95

MARIE VANAGAS
62-40801
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

SUMMARY OF INSPECTION

UNIT #43

Unit #43 - Fuels Blending Operation for blending hazardous wastes is authorized under the June 30, 1995 modified RCRA Part B permit issued to Clean Harbors of Chicago, Inc. (CHCI). The unit was originally approved under the November 1993 Part B permit and was intended to be placed inside a new building on the CHCI property. However, under the modified permit, the system was relocated to existing Building #43. Certification of Unit #43 includes the enclosure for the conveyor A1-A5 between Building #26 and Building #43.

Unit #43 - Fuels Blending Operation is located in an existing fully enclosed building. The building was modified to accommodate Fuels Blending Operation (also known as the Pegasus System) and to comply with the City of Chicago Building Code, Chapter 15-24. The building is 4-HR fire rated; a new fire suppression system was installed, fire vents and explosion vents were added to the roof structure. New concrete pads were added to support the equipment. The building was built in 1987. It has 6" thick reinforced concrete floor with 6" high containment curb all around the perimeter of the building. The entire secondary containment is topped with a non-absorbent chemically resistant coating, Protecto-Crete 900, 1/4 inch thick, unreinforced high density vinyl ester, trowel applied as manufactured by Dudick, Inc. The calculation of the secondary containment capacity are on CHCI Dwg. 4213, Rev. 0, dated 09/15/95.

The enclosure for the new conveyor A1-A5 is a new structure, with roof and siding. The secondary containment is a steel pan constructed from 3/16" thick carbon steel plate with 6" high sides all around, all welded construction. The pan is not coated.

The Pegasus System utilizes a mixing tank, overflow tank, magnetic separator, shredder, pump to mix organic-based solids, sludge and liquids to produce a low viscosity liquid hazardous waste fuel that can be burned for energy recovery. Containers of waste are fed to the Pegasus System by means of an enclosed, contained conveyor system from the adjacent Ignitable Container Storage Building (Unit #26). Finished liquid fuel product is pumped to the bulk liquid Tank Farm (Unit #16) for blending and eventual shipment offsite in bulk liquid highway vehicles or railcars. Emptied and crushed drums are accumulated/stored in rolloff container parked in Unit #60 located on the north side of Building #43.

The Fuels Blending Operation processing tanks are equipped with ultrasonic liquid level sensors to maintain proper liquid levels in the Dispersion Tank and in the Overflow Tank. The process tanks and equipment operates in fully-enclosed, nitrogen-blanketed atmosphere to prevent formation and ignition of vapors. The system is equipped with an emergency carbon dioxide deluge system in case of fire or excessive temperature within the unit. Exhaust from the unit is directed through an activated carbon air pollution control device.

Please refer to the following items in RCRA Log No. 16-M-2, Section II Conditions: D. General construction requirements for Fuels Blending Operation - Unit #43:

(D)(1)(a)(i) The protective coating of the secondary containment is non-absorbent chemically resistant Protecto-Crete 900 as manufactured by Dudick, Inc., trowel applied unreinforced high density vinyl ester topping 1/4" thick. For technical information, application instructions and Chemical Resistance Chart, see Appendix 43-1. The secondary containment was inspected on September 11, 1995 by HST engineer, Marie Vanagas.

The Dispersion Tank and Overflow Tank are new vessels. They are built in accordance with ASME Code, Section VIII, Division I, 1992/94 addendum. The internal inspection testing of the tanks was performed by manufacturers. See Appendix 43-10 for test results. The external inspection was performed and hydro testing of the tanks were witnessed by HST engineer, Marie Vanagas on September 15, 1995.

a) There was no evidence of weld breaks on tanks, ancillary equipment or on the steel secondary containment pan for conveyor A1-A5.
b) There was no evidence of punctures on tanks or on the steel secondary containment pan for conveyor A1-A5.
c) There was no evidence of scrapes of protective coating for the secondary containment inside Building #43. There is no protective coating on tanks or steel secondary containment pan for conveyor A1-A5.
d) There was no evidence of cracks in the tank's shell ancillary equipment concrete secondary containment or steel secondary equipment.
e) There was no evidence of corrosion on the tank, ancillary equipment or secondary steel containment pan for conveyor A1-A5.
f) There was no evidence of any other structural damage or inadequate construction/installation.
g) There was no evidence of cracks or gaps in the base slab of the secondary containment in Building #43 or in the steel secondary containment pan for conveyor A1-A5.

(D)(1)(a)(ii) The pressure testing of 3" Ø pipes was performed on August 31, 1995. For hydro testing test report and Dwg. No. PT-008 and PT-009 showing tested pipes, see Appendix 43-2. Major runs of pipes are installed over the secondary containment of Building #43 or Tank Farm Unit #16. The pipe is welded construction were running out of secondary containment.

(D)(1)(a)(iii) The structural integrity calculations are included in Appendix 43-3.

Calculations are reflecting the structural integrity of the existing reinforced concrete floor, new concrete pads and tanks supports.

The majority of the pipe racks are existing. The actual spacing of the pipe supports is per ASME B31.1 - 1989 Edition.

We expect no damage due to settlement, vibration expansion or contraction. The thermal stress of the pipes will be minimal. The pipes will be heat traced and insulated in the future.

(D)(1)(a)(iv) a) For location of all mechanical equipment and piping, see CHCI Dwg. No. 4258 (Dwg. No. 5404-M-02, Rev. 0, dated 09/15/95). This drawing is a first submission to IEPA. See Appendix 43-4.

b) The elevations of the pipe runs are shown on CHCI Dwg. No. 4258 (Dwg. No. 5404-M-02, Rev. 0, dated 09/15/95). This drawing is a first submission to IEPA. See Appendix 43-4.

c) d) Pipe dimensions, types of joints and material of construction are shown on CHCI Dwg. No. 4258 (Dwg. No. 5404-M-02, Rev. 0, dated 09/15/95) in Appendix 43-4 and on Dwg. PT-008 and PT-009 in Appendix 43-2. For information on material of pump construction, see Appendix 43-5.

(D)(1)(a)(v) The as-built P&ID for piping, CHCI Dwg. No. 4259 (Dwg. No. 5404-F-01, Rev. 0, dated 09/15/95) is included in Appendix 43-4. This drawing is a first submission to IEPA.

(D)(1)(a)(vi) The compatibility of the stored hazardous wastes with the material used for the Dispersion Tank, Overflow Tank and ancillary equipment is the same issue as we have on Unit #16 - Tank Farm. The Dispersion Tank and the Overflow Tank are both constructed from carbon steel plate, all welded construction. Tanks are not internally coated. They are painted on the outside to protect the surface against corrosion. The process of Fuel Blending is handling the same wastes as are stored in Unit #16 - Tank Farm. Therefore, for the issue of the compatibility between the hazardous wastes and material of the construction, I am referring to the letter from Mr. Lee F. Mount, PE to Mr. Paul Whiting of Clean Harbors, dated September 11, 1995. I have reviewed Mr. Mount's report and concurred with his conclusion that the construction material of the tanks and ancillary equipment is compatible with wastes to be processed.

(D)(1)(a)(vii) The entire secondary containment in Building #43 is topped with a non-absorbent chemically resistant coating, Protecto-Crete 900, 1/4 inch thick, unreinforced high density vinyl ester, trowel applied as manufactured by Dudick, Inc. The calculation of the secondary containment capacity are on CHCI Dwg. 4213, Rev. 0, dated 09/15/95. The technical information for the coating application instructions and chemical compatibility chart are included in Appendix 43-1.

The secondary containment for the conveyor A1-A5 is not coated. It is primed with rust preventing primer. The containment under the conveyor is a metal pan 25' long, 16' wide with 6" high sides all around. The pan is supported by structural steel.

The steel is sitting on top of new reinforced concrete pad. For compatibility of the spilled waste with the material of construction of the carbon steel pan, I am referring to the letter from Mr. Lee F. Mount, PE to Mr. Paul Whiting of Clean Harbors dated September 11, 1995. I have reviewed Mr. Mount's report and concurred with his conclusion that the wastes are compatible with the material of the construction for the intended use.

(D)(1)(a)(viii) The detail manufacturer's information (cut sheets) on all the instruments used for Fuel Blending Operation are included in Appendix 43-8.

(D)(1)(a)(ix) The 3" Ø pipe line from Tank Farm Pump House Pump P-163 to Building #43 Pegasus System and 3" Ø pipe from Pegasus System to Fill Manifold will be heat traced and insulated before winter. Per Clean Harbors agreement with the Agency, the heat tracing and insulation required by this condition is to be installed prior to November 15, 1995. Technical documentation will be submitted at that time.

(D)(1)(a)(x) Not applicable.

(D)(1)(a)(xi) The hazardous waste liquids which are processed in Fuel Blending system are the same as liquids stored in Unit #16 - Tank Farm. The issue of compatibility of the stored wastes with material of the storage tanks is discussed in the letter from Mr. Lee F. Mount, PE to Mr. Paul Whiting of Clean Harbors, dated September 11, 1995. Since the stored waste is a diverse mixture, the reasonable approach is to use previous experience and results from other Clean Harbors facilities at Braintree, MA which is storing wastes similar to wastes planned for the Clean Harbors facility in Chicago. The letter and information on the tanks from the Braintree plant are included in Appendix 4. The additional information on tanks was submitted in CCR dated July 25, 1995 - Storage Tanks Table. I have reviewed Mr. Mount's report and concurred with his conclusion that the wastes intended to be processed in the tanks and ancillary equipment are compatible with the material of construction and that the tanks and ancillary equipment are suitable for the intended use. For physical data and operations data, see Appendix 43-9.

(D)(1)(a)(xii) The entire secondary containment in Building #43 is topped with a non-absorbent chemically resistant coating, Protecto-Crete 900, 1/4 inch thick, unreinforced high density vinyl ester, trowel applied as manufactured by Dudick, Inc. For technical information, application instructions and chemical compatibility chart, see Appendix 43-1. The steel secondary containment pan for conveyor A1-A5 is not coated.

(D)(1)(a)(xiii) The engineering design calculations are provided in Appendix 43-3. The calculations provide information on the structural integrity of the existing concrete slab and concrete pads and tank support. We expect no damage due to settlement, compaction or uplift, climatic conditions, daily operation or vehicular traffic. The structural integrity of the supporting slab is adequate for its intended use.

(D)(1)(b) Not applicable. The system will not handle PCBs.

(D)(1)(c) No comment required.

There are the following deviations from Part B Approved and As-Built drawings:

Dwg. 2916-M-07 (CHCI Dwg. No. 4213, 2 of 3) - Equipment Layout Fuels Blending Operation, sheet 2 of 3

See Appendix 43-4

Rev. G - 01/17/95

Part B Approved	As-Built - Rev. 0 - 09/15/95
1. Plan	Revised equipment layout. Added doors, staircase, platforms and Containment Basin for pressure relief at the Dispersion Tank.
2. Sections	Revised cross-section and elevation for conveyor enclosure between Building #26 and Building #43.

Dwg. 5404-M-02 (CHCI Dwg. No. 4258) - Equipment & Piping Arrangement Fuels Blending System

See Appendix 43-4

As-Built - Rev. 0 - 09/15/95 - First submittal to IEPA.

Dwg. 5404-F-01 (CHCI Dwg. No. 4259) - Process Flow, Piping & Instrumentation Diagram - Fuels Blending System

See Appendix 43-4

As-Built - Rev. 0 - 09/15/95 - First submittal to IEPA.

Dwg. 2916-S-15 (CHCI Dwg. No. 4253) - Equipment Pads Layout - Fuels Blending Operation-Building #43

See Appendix 43-4

Rev. A - 11/01/94
Part B Approved

As-Built - Rev. 0 - 09/15/95

Changed drawing number from 2916-S-05 to 2916-S-15. Removed pedestals. Changed note 1, added notes 2, 3 and 4.

1. Plan

Revised concrete pads layout.
Added doors.
Removed equipment and platforms (for equipment and platforms, see CHCI Dwg. No. 4213, Rev. 0, dated 09/15/95 in Appendix 43-4).
Added additional concrete pads.

Dwg. 17-E05 (CHCI Dwg. No. 4235) - Control Panel Face Layout Drum Processing

See Appendix 43-7

Rev. B - 12/18/93
Part B Approved

As-Built - Rev. 0 - 09/15/95

Changed location and identification of buttons.
Deleted Warning Sign.
Added Danger Sign.

Dwg. 17-E06 (CHCI Dwg. No. 4236) - Control Panel Face Layout Drum Processing

See Appendix 43-7

Rev. C - 07/14/94
Part B Approved

As-Built - Rev. 0 - 09/15/95

Changed location and identification of buttons.
Deleted Warning Sign.
Added Danger Sign.

Dwg. 17-S01 (CHCI Dwg. No. 4237) - Drum Processing System Schematic
Rev. C - 07/06/94 - Part B Approved
Drawing is replaced by new drawing 5404-F-01, Rev. 0, dated September 15, 1995 (CHCI Dwg. No. 4259). See Appendix 43-4.

Dwg. 17-S02 (CHCI Dwg. No. 4238) - Enclosure Vacuum, Fire Prevention & Suppression
Rev. C - 07/06/94 - Part B Approved
Drawing is replaced by new drawing 5404-F-01, Rev. 0, dated September 15, 1995 (CHCI Dwg. No. 4259). See Appendix 43-4.

Dwg. 17-S03 (CHCI Dwg. No. 4239) - Drum Movement Schematic

See Appendix 43-7

Rev. C - 07/07/94
Part B Approved

As-Built - Rev. 0 - 09/15/95

Changed location and identification of limit swithces.
Added legend.
Added switches.

Dwg. 17-S05 (CHCI Dwg. No. 4240) - Simplified Process Flow & Material Balance

See Appendix 43-7

Rev. C - 07/07/94
Part B Approved

As-Built - Rev. 0 - 09/15/95

Changed capacity of storage tank from 8,000 gal. To 12,800 gal.

Dwg. 17-S06 (CHCI Dwg. No. 4241) - Waste Liquid Piping Schematic
Rev. C - 07/13/94 - Part B Approved
Drawing is replaced by new drawing 5404-F-01, Rev. 0, dated September 15, 1995 (CHCI Dwg. No. 4259, Rev. 0, dated 09/15/95). See Appendix 43-4.

CWM Chemical Services, Inc. drawings 5-F-001 Rev. 8 and 5-F-002 Rev. 4 for existing Building #43 are provided for reference only, see Appendix 43-6. Please note that drawing 5-F-001 and 5-F-002 were not prepared under HST supervision. For layout of the equipment pads and pedestals for Pegasus System, see CHCI Dwg. No. 4253 (2916-S-05, Rev. 0) in Appendix 43-4.

APPENDIX

43-1

Dudick Inc.

Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Streetsboro, Ohio 44241
216-562-1970
FAX No. 216-562-7638

Protecto-Crete 800/900

TROWEL-APPLIED, UNREINFORCED HIGH-DENSITY VINYL ESTER FLOOR TOPPING 1/4" (6.3 mm)

Protecto-Crete 800 is a high-performance vinyl ester floor topping designed for heavy truck traffic and abrasion resistance combined with excellent resistance to a variety of acids and caustics.

Protecto-Crete 900, in addition, will resist many of the organic solvents.

RECOMMENDED APPLICATIONS

- Food Processing Floors
- Plating Room Floors
- Pickling Room Floors
- Truck Loading Platforms
- Chemical Storage
- Dike Areas
- Aisleways
- Chemical Laboratories

CHEMICAL RESISTANCE

- Organic Acids
- Inorganic Acids
- Alkali Solutions
- Solvents (900 only)
- Oils
- Salts

A complete listing of substances and concentrations tested is available on request.

PHYSICAL PROPERTIES

Compressive Strength ASTM C579	11,000 PSI
Tensile Strength ASTM D638	1,800 PSI
Density	140 lbs./ft.^{3}
Flexural Strength ASTM C580	3,600 PSI
Thermal Shock Resistance	40°F-160°F

SPECIFICATIONS

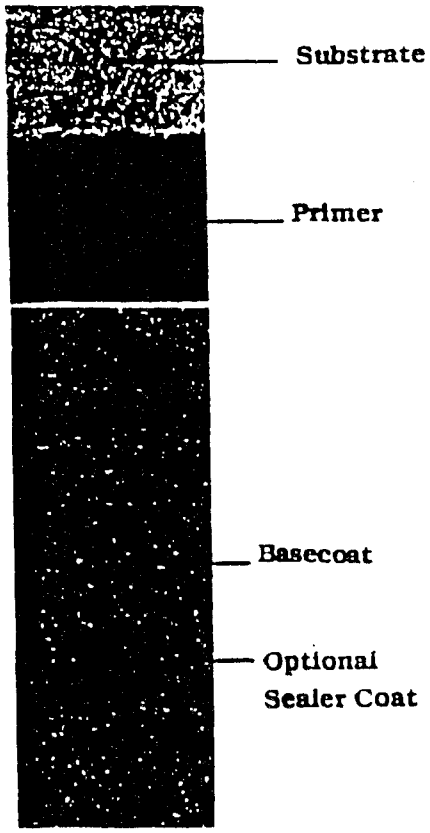
Topping shall be a 1/4" thick unreinforced Bisphenol-A/Novolac vinyl ester material as manufactured by Dudick Inc. applied over primed concrete using a plasterer's trowel or screed. Application and installation shall be according to the manufacturer's recommendations.

THE PROTECTO-CRETE 800/900 SYSTEM

The Protecto-Crete 800/900 System uses a primer and a heavily aggregate-filled vinyl ester topcoat to achieve a strongly bonded monolithic topping with excellent physical and mechanical strength and chemical resistance.

Primer: The blasted or etched concrete surface must be primed to provide the "wetting out" required for good bonding. Priming is achieved with Primer 27 and Protecto-Crete 800/900 should be applied while the primer is still tacky.

Topcoat: The aggregate-filled, Protecto-Crete 800/900 topcoat develops a cured strength two to three times that of the concrete base to which it is applied to provide exceptional durability and prolong the life of the substrate from corrosion and mechanical abuse.



ESTIMATING QUANTITIES AND ORDER BILL OF MATERIAL

Note: Resin includes 10 oz./unit hardener as standard.

SQUARE FEET PER GALLON		
CONCRETE		
Primer 27	150-200	
P-Crete 800/900		
Basecoat	58-66 sq. ft./unit	1/4"
S-10 Solvent	500	Clean-up

Quantities shown are for estimating purposes only. Actual field usage may vary.

APPLICATION INSTRUCTIONS

SURFACE PREPARATION

Concrete: Concrete must be abrasive-blasted or etched with muriatic acid (solution of 1 part 20° Be HCl and 1 part water) to remove surface laitance and other contaminants. Concrete must be dry and free of curing compounds and form release agents. Surface texture should be similar to 40-60 grit sandpaper.

The prepared surface should have a tensile strength of between 250 and 300 PSI per ASTM D4541.

Additional surface preparation will be required if a 40-60 grit texture is not achieved and the surface laitance not completely removed after a single application of acid or with the first mechanical preparation procedure.

Hardener Amount/Gal. or Unit of Resin:

Hardener	Substrate Temperature	Primer 27	Protecto-Crete 800/900
PH-1	60-70°F	3-4 oz.	10 fl. oz./unit
PH-1	70-90°F	2-3 oz.	10 fl. oz./unit

PRIMING

Concrete: Concrete must always be primed to aid in the "wetting out" required for good bonding. Mix Primer 27 with PH-1 Hardener for 2-3 minutes and apply with a brush, roller or sprayer. Do not allow the primer to puddle. We recommend the topcoat be applied over tacky primer.

Protector-Crete 800/900 Mix Ratio:

Protecto-Crete 800/900 Resin	**30 lbs.**
PH-1 Hardener (@75°F)	**10 fl. oz.**
G-4 Aggregate	**4-50 lb. bags**

TOPCOAT

Add the entire contents of the pre-measured PH-1 Hardener to Protecto-Crete 800/900 (pre-measured) Liquid and blend thoroughly. Add 4 bags of G-4 aggregate and mix well. Protecto-Crete ingredients may be mixed in a concrete mixer or mortar box. Liquid and Hardener must be thoroughly blended together before aggregate is added.

Pour the Protecto-Crete mix into a wheelbarrow and transport to each workman's area. Dump directly onto the primed concrete.

The mix should be spread with a plasterer's trowel or with (3-4 ft.) wood screeds. Final finish with a trowel.

To terminate work, square cut the topping and start with the next work period butting to this edge. Permanent terminating lines should be made into saw cuts in the concrete.

Allow Protecto-Crete to cure overnight before subjecting the area to foot traffic.

Allow to cure 1-2 days at 70°F before permitting truck traffic.

Pot Life and Cure Cycles:

Protecto-Crete 800/900		
Temperature	Pot Life	Cure Time
50°F	50-60 Min.	72 Hrs.
75°F	30-40 Min.	48 Hrs.
90°F	20-30 Min.	24 Hrs.

Do not attempt to store mixed material. Residual material should be properly disposed of at the end of each work period.

Recommended application temperatures should be between 50°F and 110°F substrate temperature.

Application of Protecto-Crete 800/900 in direct sunlight may lead to blistering, pinholes, or wrinkling in the floor topping due to outgassing of air in the concrete and high substrate temperatures.

CLEANING

Clean tools and equipment with S-10 Cleaning Solvent.

SHIPPING

The S-10 Cleaning Solvent is a red label item with a flash point of 52°F (PMCC). The Hardener is classified as Organic Peroxide and carries a yellow warning label. Protecto-Crete liquids are red label items and classified flammable.

STORAGE

Warning: All Dudick products classified by DOT labels as either white, yellow or red labels, must not mixed or stored together as an explosive reaction may occur.

Protecto-Crete Liquid and Hardener are flammable and an oxidizer, respectively, and should be stored in a cool, dry place, away from open flame, sparks and other hazards. Protecto-Crete 800/900 ingredients are stable for 3 months when properly stored under 75°F. Excessive heat may cause premature gelling and reduce available working time (pot life).

SAFETY

M.S.D.S. - Sheets must always be read before using products. Protecto-Crete systems are intended for application by experienced, professional personnel. Dudick Inc. can supply Protecto-Crete Systems supervision to help determine that the surface has been properly prepared, the ingredients correctly mixed, and the materials properly and safely applied.

If Protecto-Crete materials are to be applied by your own personnel or by a third-party contractor, please be sure that they are aware of the following safety precautions:

• Exposure to vinyl ester resins and hardeners may cause severe dermatitis reactions in some people. Cleanliness of the skin and clothing is critical and must be of paramount concern.

• Safety glasses, gloves, and suitable protective clothing must be worn at all times.

• Suitable respirators should be used.

• If contact with hardeners occurs, remove any clothing involved and wash the skin with large amounts of water. Discard the clothing. Do not attempt to wash and reuse it. Protecto-Crete Liquid may be washed off with S-10 Cleaning Solvent, MEK, or lacquer thinner. DO NOT USE ACETONE.

• Fumes are flammable and heavier than air. Proper ventilation should be maintained to minimize breathing of concentrated fumes.

• If a rash or dermatitis occurs, remove the individual from the work area and seek a doctor's care for dermatitis.

• Keep open flames and sparks away from the area where toppings are being mixed and applied.

• In case of eye contact, wash with water for at least 15 minutes and consult a physician. If swallowed, do not induce vomiting; call a physician immediately.

Note:

Dudick Inc. ("Dudick") warrants all goods of its manufacture to be as represented in its catalogs and that the application of its products by its employees or sub-contractors shall be performed in a workmanlike manner. Dudick's obligation under this warranty shall be the repair to and replacement of any applications which its examination shall disclose to be defective. Dudick makes no warranty concerning the suitability of its product for application to any surface, it being understood that the goods have been selected and the application ordered by the purchaser. DUDICK INC. MAKES NO WARRANTY, EXPRESS OR IMPLIED, THAT THE GOODS SHALL BE MERCHANTABLE OR THAT THE GOODS ARE FIT FOR ANY PARTICULAR PURPOSE. THE WARRANTY OF REPAIR OR REPLACEMENT SET FORTH HEREIN IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES ARISING BY LAW OR OTHERWISE; AND DUDICK INC. SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DOWN TIME, DAMAGES TO PROPERTY OF THE PURCHASER OR OTHER PERSONS, OR DAMAGES FOR WHICH THE PURCHASER MAY BE LIABLE TO OTHER PERSONS, WHETHER OR NOT OCCASIONED BY DUDICK'S NEGLIGENCE. This warranty shall not be extended, altered or varied except by written instrument signed by Dudick and Purchaser.

Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Streetsboro, Ohio 44241
(12-91)

Dudick

Chemical Resistance

Corrosion Resistant Monolithics

Introduction

Dudick Corrosion-Proof products are available in standard systems for use as floor toppings, vessel linings or equipment coatings. Each system is manufactured in a number of resin bases to provide corrosion protection over the entire range of chemical activity from pH 1 through pH 14. Depending on the system and the fillers and reinforcement chosen, protection can be maintained at elevated temperatures. Several fire retardant formulations are also available.

It should be noted that a prospective user is not limited to the basic environmental properties listed for each system. Any product in the Dudick Corrosion-Proof line can be modified to provide the moisture and chemical resistance required for a specific application.

To this end, Dudick Corrosion-Proof maintains a product testing laboratory which is completely equipped to evaluate the ability of our products to perform in actual end-use situations.

All testing is performed using the actual liquid or liquids which will be encountered in the field. These are usually supplied by the prospective customer to be sure that the concentrations involved and any possible combinations of chemicals are consistent with field conditions.

Perhaps the most significant aspect of our testing program is the use of Atlas Test Cells. These allow us to simulate factors such as stratification, agitation, volume variances and environmental factors (i.e temperature differences on the outside and inside of vessel walls) to achieve a more accurate and realistic evaluation than is possible with simple coupon tests.

The use of Atlas Test Cells also allows us to vary resins, fillers, and reinforcement materials separately to determine which can provide the best performance under the specified conditions.

Of course, appropriate physical and mechanical tests are also an important part of any product testing sequence.

How to Use the Corrosion Guide

The corrosion resistant properties described in this Guide have been determined either by analysis (the typical ability of a resin to resist attack by a specific chemical substance), by testing, or by actual field performance experience. Thus, the ratings shown are useful in helping a potential user make a preliminary evaluation for further investigation.

Since most installations involving hostile chemical environments also involve dynamic processes which can vary widely from industry to industry and plant to plant, it is always necessary to consult the Dudick Corrosion-Proof factory for guidance before making a final selection.

This is especially critical when a chemical is not listed or where a combination of chemicals are present. Thorough testing in the Dudick laboratory using the actual chemicals under simulated processing or storage conditions is the only way to assure satisfactory end-use performance.

To simplify the information presentation, this Guide provides temperature limit data (page 1) and Chemical performance characteristics in separate charts. If an anticipated condition is not covered, please consult a Dudick Corrosion-Proof representative or the factory for additional information or to arrange an appropriate performance test.

Special Note

All technical data and recommendations presented here are believed to be reliable at the time of publication. Because field conditions can vary significantly, all data should be considered only as suggestions of possible applications. Dudick Corrosion-Proof, Inc. assumes no responsibility for results obtained or damages incurred from any use whether or not the use resulted from the recommendations in this Guide. Any recommendations or technical advice rendered is not to be taken as a license to operate under or intended to suggest the infringement of any existing patent. Liability, if any, is limited to replacement of products.

Temperature/Chemical Resistance Key

Indicator	Definition	Indicator	Definition	Indicator	Definition
I	Material will withstand constant flow or Immersion service.	1	Good to the maximum temperature of the product	*NR*	Not recommended
S	Material is suitable for intermittent or Spillage service	2	High Temperature Service to 160° F (71° C)	*NI*	No information available
F	Material will tolerate Fumes only	3	Moderate Temperature Service to 140° F (60° C)	*PV*	Performance varies with conditions. Consult Dudick for recommendations or testing
		4	Warm Temperature Service to 100° F (37° C)		

Example	48. Boric Acid	14	14	14	14	14	13	11	11	S1	S1	S1	12	1:
		AID	AID	AID	AID	AID	AID	AID	AID	AID	AID	AID		C

Each grid block in the Guide shows all the information which is available on the product for the use shown. Thus, a block which shows I2, indicates that the product is capable of providing immersion service up to 160° F. Similarly, a block which shows F1 indicates the material will tolerate temperatures to the maximum capability shown in the Temperature Limits chart below, but that it is designed for exposure only to fumes.

Temperature Limits

Product	Substrate	Maximum Temperature	Notes
Protecto-Coat Series	*Metal* *Concrete/Steel*	130° F 54° C 130° F 54° C	[1] Steel: Constant Flow; Steel Dry or Intermittent Spills: 200°F (93°C) to 350°F (96°C) [2] Concrete: Constant Flow
Protecto-Crete Series	*Metal* *Concrete*	Not Recommended 250° F 120° C	[3] Intermittent Spills, otherwise maximum temperature is 150°F
Protecto-Flake Series	*Metal* [4] *Concrete*	180° F 83° C Not Applicable	[4] Steel: Immersion; Steel, Dry: 250°F (121°C)
Protecto-Glass Series	*Metal* [5] *Concrete*	160° F 71° C 160° F 71° C	[5] Steel: Constant Flow
Protecto-Line Series	*Metal* [6] *Concrete* [7]	160° F 71° C 160° F 71° C	[6] Steel: Constant Flow and Immersion [7] Concrete: Constant Flow
Protecto-Seal Series	*Metal* [8] *Tile/Concrete* [8]	Not Applicable 160° F 71° C	[8] Tile: Constant Flow and Immersion
Grout Series	*Metal* *Concrete*	Not Applicable 160° F 71° C	

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Key

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	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
1. Acetaldehyde	F4	NR	PV	PV	F4	F4	NR	NR	S4	S4	NR	NR	NR	NR
2. Acetic Acid (0-10%)	I3	F4	I4	I4	I4	I4	S1	S1	S1	S1	S1	I3	I3	I3
3. Acetic Acid (10-50%)	S4	NR	S1	S1	S1	S1	F1	F1	S4	S4	S3	I4	I4	I4
4. Acetic Acid (50-100%)	F4	NR	S3	S3	S3	S3	NR	NR	NR	NR	S3	PV	PV	S4
5. Acetic Anhydride	F4	NR	S4	S4	S4	S4	PV	PV	NR	NR	S4	S4	S4	S4
6. Acetone	S4	NR	NR	F4	NR	NR	NR	S3	S4	S4	s4	NR	NR	NR
7. Acetyl Chloride	F4	F4	PV	PV	PV	PV	PV	PV	S4	S4	S4	PV	PV	PV
8. Acrylic Acid	PV	F4	PV	PV	PV	PV	PV	PV	NR	NR	S4	I4	I4	I4
9. Acrylonitrile	NR	NR	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	PV
10. Adipic Acid	I4	I4	I4	I4	I4	I4	PV	PV	S4	S4	S4	I4	I4	I4
11. Alcohol (Ethyl)	S4	S4	I4	I4	I4	I4	I4	I4	S4	S4	S1	I1	I1	I1
12. Alcohol (Methyl)	S4	NR	PV	PV	F4	F4	S4	S4	S4	S4	S1	I4	I4	I4
13. Allyl Chloride	F4	NR	NR	NR	NR	NR	PV	PV	NR	S4	S1	PV	PV	S4
14. Alum	S4	I4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I3	I3	I2
15. Aluminum Bromide	S4	F4	I4	I4	I4	I4	F1	F1	S4	S4	S1	I1	I1	I1
16. Aluminum Chloride	I4	I4	I4	I4	I4	I4	I1	I1	S3	S3	S1	I1	I1	I1
17. Aluminum Fluoride*	S1	S4	S1	S1	S1	S1	NR	NR	S1	S1	S1	I4	I4	I4
18. Aluminum Hydroxide	I4	S4	F4	F4	S4	S4	S4	S4	S1	S1	S1	I4	I3	I3
19. Aluminum Sulfate	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S4	I3	I3	I2
20. Ammonia (Dry)	S4	S4	F1	F1	F1	F1	F1	F1	S1	S1	S1	I3	I3	I3
21. Ammonium Chloride	S1	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
22. Ammonium Fluoride*	S4	S4	I4	I4	I4	S4	NR	NR	S1	S1	S2	I3	I3	I3
23. Ammonium Hydroxide	I4	I4	F4	F4	S4	S4	I1	I1	S1	S1	S1	I2	I2	I2
24. Ammonium Nitrate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
25. Ammonium Persulfate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
26. Ammonium Sulfate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
27. Ammonium Sulfide	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
28. Ammonium Sulfite	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
29. Amyl Acetate	F4	NR	S4	S4	S4	S4	NR	NR	NR	NR	NR	PV	F4	F4
30. Amyl Alcohol	F4	F4	S1	S1	S1	I4	NR	NR	S3	S3	S3	I4	I4	I4
31. Aniline	NR	NR	S4	S4	S4	S4	NR	NR	NR	NR	NR	NR	I4	I4
32. Aniline Hydrochloride	F4	F4	S4	S4	S4	S4	F4	F4	S3	S3	S3	I4	I4	I4
33. Antimony Chloride	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
34. Aqua Regia	NR	NR	NR	NR	NR	F4	NR	NR	NR	NR	NR	NR	NR	NR
35. Arsenic Acid	F4	F4	I4	I4	I4	I3	S4	S4	S1	S1	S1	I3	I3	PV
36. Barium Acetate	S4	S4	S4	S4	S4	S4	F4	F4	S4	S4	S3	I4	I4	I4
37. Barium Chloride	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
38. Barium Hydroxide	I4	I4	S3	S3	S2	I4	I1	I1	S1	S1	S4	I4*	I4*	I3*
39. Barium Sulfide	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
40. Benzaldehyde	PV	PV	NR	NR	NR	NR	NR	S4	PV	PV	PV	PV	NR	PV
41. Benzene	F4	NR	PV	PV	NR	NR	NR	S4	S4	S4	S4	NR	NR	S4
42. Benzene Sulfonic Acid	F4	F4	I4	I4	I4	I4	F4	F4	S4	S4	S1	I1	I1	I1
43. Benzene Sulfonic Chloride	F4	F4	I4	I4	I4	I3	F4	F4	S4	S4	S1	I1	I1	I1
44. Benzoic Acid	S4	S4	I4	I4	I4	I3	F4	F4	S1	S1	S1	I1	I1	I1
45. Benzoyl Chloride	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	NR	NR	PV
46. Black Liquor*	S4	S4	S1	I4	I1	I1	I1	NR	S1	S1	S3	I3	I3	I3
47. Bleach (5.5%)*	S4	F4	PV	PV	I1	I1	F1	NR	NR	I3	S4	NR	NR	I1
48. Boric Acid	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I2	I2	I2
49. Bromine, Wet Gas	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	F4	F4	F4
50. Bromine Water (5%)	F4	NR	S4	S4	S4	S4	S4	S4	NR	S4	S4	I4	I4	I4
51. Butadiene	S4	PV	PV	PV	PV	PV	NR	NR	S4	S4	S4	PV	PV	PV
52. Butanol	F4	NR	S4	S4	S4	S4	NR	NR	S4	S4	S1	I3	I3	I3
53. Butyl Acetate	F4	NR	NR	NR	F4	F4	NR	S4	S4	S4	NR	NR	NR	PV
54. Butyl Carbitol	F4	PV	PV	PV	F4	F4	PV	PV	S4	S4	PV	I4	I4	I4
55. Butyl Cellosolve	F4	NR	PV	NR	S4	S4	NR	S4	S4	S4	S4	NR	NR	S4
56. Butyric Acid	F4	NR	F4	F4	F3	F3	NR	NR	NR	NR	NR	I3	I3	I3
57. Cadmium Plating (Cyanide)	S4	S4	S1	S1	S1	S1	S1	S1	S1	S1	S3	I3	I3	I3

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	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
58. Calcium Bisulfite	S4	S4	I4	I4	I3	I3	F1	F1	S3	S3	S1	I1	I1	I1
59. Calcium Carbonate (Soda Ash)	I4	I4	I4	I4	I3	I3	I1	NR	S1	S1	S4	I3	I3	I3
60. Calcium Chloride	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
61. Calcium Hydroxide*	I4	I4	I4	I4	I3	I4	I1	NR	S1	S1	S3	I3	I3	I3
62. Calcium Hypochlorite (5%)*	F4	F4	F4	F4	S4	S4	F4	NR	S4	S4	S3	NR	NR	NR
63. Calcium Nitrate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
64. Caprylic Acid	NR	NR	I4	I4	I4	I4	NR	NR	NR	NR	NR	I4	I4	I4
65. Carbon Disulfide	F4	NR	S4	S4	S4	S4	NR	NR	S4	S4	S4	F4	F4	F4
66. Carbon Tetrachloride	F4	F4	S4	S4	S3	S3	NR	NR	S3	S3	S3	NR	I4	I4
67. Castor Oil	I4	I4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
68. Chloracetic Acid	F4	NR	F4	F4	F4	F4	F1	F1	NR	S4	S4	F3	F3	F3
69. Chloral	NR	NR	NR	NR	NR	NR	NR	NR	S4	S4	NR	NR	NR	NR
70. Chlorine Dioxide	F4	NR	S4	S4	S3	S3	NR	NR	NR	S4	S3	I4	I4	I3
71. Chlorine Gas (Dry)	NR	NR	F4	F4	F3	F3	NR	NR	NR	NR	S4	I4	I4	I3
72. Chlorine Gas (Wet)	NR	NR	NR	NR	F4	F3	NR	NR	NR	S4	S2	F4	F4	F4
73. Chlorine Water (Saturated)	NR	NR	S4	S4	S3	S3	F4	F4	S4	S4	S2	I4	I4	I4
74. Chlorobenzene	F4	NR	NR	NR	S4	S4	NR	NR	S4	S4	NR	NR	NR	S4
75. Chloroform	F4	NR	NR	NR	NR	NR	NR	NR	S4	S4	NR	NR	NR	NR
76. Chlorophenol	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
77. Chlorosulfonic Acid	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
78. Chlorotoluene	F4	NR	S4	S4	S4	S4	NR	NR	NR	NR	S4	I4	NR	PV
79. Chromic Acid (10%)	F4	F4	S4	S4	S4	S4	S4	S4	S4	S4	S4	I4	I4	I4
80. Chromic Acid (40%)	F4	NR	S4	S4	S4	S4	S4	S4	S4	S4	S4	I4	I4	PV
81. Chromic Chloride	S4	S4	I4	I4	I4	I3	S1	S1	S1	S1	S1	I1	I1	I1
82. Citric Acid	S4	F4	I4	I4	I4	I3	S1	S1	S4	S4	S1	I1	I1	I1
83. Copper Plating (Cyanide)	S3	S3	S4	S4	S3	S3	S1	S1	S2	S2	S4	I4	I4	I3
84. Copper Plating (Acid)	S4	S4	S3	S3	S3	S3	S1	S1	S2	S2	S1	I1	I1	I1
85. Copper Salts	S3	S3	I4	I4	I4	I4	S1	S1	S1	S1	S1	I1	I1	I1
86. Corn Oil	S3	S3	I4	I4	I4	I3	I1	I1	S3	S3	S1	I1	I1	I1
87. Corn Starch	S1	S1	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
88. Corn Sugar	S1	S1	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
89. Cottonseed Oil	S3	S3	I4	I4	I4	I3	I1	I1	S3	S3	S1	I1	I1	I1
90. Cresol	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	NR	NR	PV
91. Cresylic Acid	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
92. Crude Oil	S4	PV	I4	I4	I4	I4	PV	PV	PV	I1	S1	I1	I1	I1
93. Detergent Sulfonated	S4	PV	I4	I4	I4	I4	PV	PV	PV	I1	PV	I1	I1	I1
94. Dextrose	I3	S3	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
95. Dibutyl Phthalate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I3	I3	I3
96. Dichloro Acetic Acid (20%)	F4	NR	I4	I4	I4	I4	F1	F1	NR	NR	S3	I4	I4	I4
97. Diesel Fuel	I4	S4	I4	I4	I4	I4	S3	S3	S1	S1	S1	I1	I1	I1
98. Diethylamine (100%)	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	NR	NR	PV
99. Dimethyl Formamide	F4	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	I4	NR	PV
100. Esters, Fatty Acids	S4	PV	I4	I4	I4	I4	PV	PV	PV	S4	PV	I3	I3	I3
101. Ethyl Acetate	F4	NR	NR	NR	NR	NR	F1	F1	S4	S4	S4	NR	NR	NR
102. Ethyl Alcohol	S4	S4	I4	I4	I4	I4	I4	I4	S4	S4	S4	I4	I4	I4
103. Ethylamine	NR	NR	NR	NR	PV	PV	NR	NR	PV	PV	PV	NR	NR	PV
104. Ethylchloroformate	F4	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	PV	NR	PV
105. Ethyl Ether	F4	NR	NR	NR	PV	PV	NR	F4	S4	S4	S4	PV	PV	PV
106. Ethylene Dichloride	F4	NR	NR	NR	NR	NR	NR	F4	NR	NR	NR	PV	NR	NR
107. Ethylene Glycol	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
108. Ethylene Oxide	F4	NR	PV	PV	PV	PV	PV	PV	PV	PV	S1	PV	PV	PV
109. Ethyl Sulfate	F4	PV	PV	PV	PV	PV	PV	PV	S4	S4	NR	I4	I4	I4
110. Ferric Chloride	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	NR	I1	I1	I1
111. Ferric Sulfate	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
112. Ferrous Chloride	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
113. Ferrous Sulfate	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
114. Fluoboric Acid*	F4	PV	S4	S4	S4	S4	PV	PV	S4	S4	S4	NR	PV	NR

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	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
115. Fluorine Gas*	NR	NR	NR	NR	NR	NR	NR	NR	PV	PV	PV	NR	PV	PV
116. Fluosilicic Acid*	F4	PV	S4	S4	S4	S4	PV	PV	S4	S4	S4	NR	PV	NR
117. Formaldehyde	F4	F4	I4	I4	I4	I4	F4	F4	S1	S1	S1	I1	I1	I1
118. Formic Acid	F4	NR	S4	S4	S4	I4	PV	PV	NR	NR	S4	I4	I4	I4
119. Fuel Oil 1 & 2	S1	S4	I4	I4	I4	I4	NR	NR	S1	S1	S1	I1	I1	I1
120. Furfural	F4	NR	S4	S4	S4	S4	PV	PV	PV	PV	PV	NR	PV	PV
121. Furfural Alcohol	S4	PV	S4	S4	S4	S4	S4	S4	S1	S1	S1	I4	I4	I4
122. Gasoline	I4	I4	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
123. Glucose	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
124. Gluconic Acid (50%)	PV	PV	F4	F4	S4	S4	PV	PV	PV	PV	S4	S4	S4	I4
125. Glycol	I4	I4	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
126. Glycolic Acid	NR	NR	S4	S4	S4	S4	F1	F1	S4	S4	S4	I3	I3	I3
127. Gold Plating (Cyanide)	S4	S4	S1	S1	S1	I3	S1	S1	S1	S1	S4	I4	I4	I3
128. Grape Juice	I3	I3	I3	I3	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
129. Green Liquor	S4	S4	I4	I4	I3	I3	I1	I1	S1	S1	S3	I1	I1	I1
130. Heptane	S4	S4	S1	S1	S1	S1	I4	I4	S1	S1	S1	I2	I2	I2
131. Heptanoic Acid	PV	PV	S4	S4	S4	S4	F1	F1	PV	PV	I3	I3	I3	I3
132. Hexane	F4	F4	S1	S1	S1	S1	I4	I4	S1	S1	S1	I2	I2	I2
133. Hydrazine (35%)	F4	PV	NR	NR	NR	NR	NR	NR	S4	S4	S4	NR	NR	NR
134. Hydraulic Fluid	S4	PV	PV	PV	I3	I3	PV	PV	S1	S1	S1	PV	PV	I1
135. Hydriodic Acid (20%)	F4	F4	S4	S4	S4	I4	S1	S1	PV	PV	S4	I4	I4	I4
136. Hydrobromic Acid (20%)	F4	F4	S4	S4	S4	S4	S1	S1	PV	S4	S4	I4	I4	I4
137. Hydrocarbons (Aliphatic)	S4	PV	I4	I4	I4	I4	I1	I4	S1	S1	S4	I1	I1	I1
138. Hydrocarbons (Aromatic)	S4	PV	PV	PV	F4	F4	NR	NR	S4	S4	S4	PV	PV	I1
139. Hydrochloric Acid (1-25%)	S4	F4	S3	S3	S3	I3	F1	F1	S4	S4	S4	I1	I1	I1
140. Hydrochloric Acid (25-37%)	F4	NR	F3	F3	F3	I4	F1	F1	S4	S4	S4	PV	PV	I2
141. Hydrofluoric Acid (1-10%)*	NR	NR	F3	NR	F3	F3	NR	NR	NR	NR	NR	NR	NR	NR
142. Hydrofluoric Acid (10-53%)*	NR	NR	F4	NR	F4	F4	NR	NR	NR	NR	NR	NR	NR	NR
143. Hyrofluosilicic Acid*	F4	F4	F3	NR	F3	F3	PV	PV	NR	NR	NR	I2	PV	NR
144. Hydrogen Bromide	F4	PV	PV	PV	F1	F1	PV	PV	PV	PV	S4	PV	PV	I4
145. Hydrogen Peroxide (30%)	S4	NR	PV	PV	F4	I4	PV	PV	NR	S4	S4	PV	PV	I4
146. Hydrogen Sulfide	S1	S4	I4	I4	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
147. Hypochlorous Acid	NR	NR	NR	NR	F3	F3	NR	NR	NR	S4	S4	NR	NR	NR
148. Iodine	NR	NR	F4	F4	F3	F3	F1	F1	PV	S4	S4	I4	I4	I3
149. Insecticides	S4	PV	PV	PV	F4	F4	PV	PV	PV	S4	S3	PV	PV	I3
150. Isophorone	S4	PV	PV	PV	PV	PV	PV	PV	S4	S4	PV	I4	I4	I4
151. Isopropyl Acetate	F4	NR	NR	NR	NR	NR	PV	PV	S4	S4	NR	PV	PV	S4
152. Isopropyl Alcohol	S4	S4	PV	PV	S4	S4	PV	PV	S1	S1	S1	I1	I1	I1
153. Isopropyl Amine	F4	PV	PV	PV	F4	F4	NR	NR	PV	PV	NR	PV	PV	S4
154. Isopropyl Ether	S4	S4	PV	PV	F4	F4	NR	NR	S4	S4	S4	I4	I4	I4
155. Jet Fuel	I4	I4	I4	I4	I4	I4	F1	F1	S1	S1	S1	I1	I1	I1
156. Kaolin	I1	I1	PV	PV	I1	I1	I1	I1	I1	I1	I1	PV	PV	I1
157. Kerosene	I4	I4	I4	I4	I4	I4	I1	I4	S1	S1	S1	I1	I1	I1
158. Lasso Herbicide (10%)	F4	PV	S4	S4	S4	S4	F4	F4	PV	S4	S4	I4	I4	I4
159. Lactic Acid (1-20%)	S4	F4	I4	I4	I4	I3	S1	S1	S4	S4	S1	I1	I1	I1
160. Lactic Acid (20%-Con)	S4	NR	S4	S4	I4	I3	S1	S1	NR	S4	S4	I4	I3	I3
161. Lauric Acid	F4	PV	I4	I4	I3	I3	S1	S1	NR	S3	S1	I1	I1	I1
162. Lead Acetate	I4	I4	I4	I4	I3	I3	F1	F1	S1	S1	S1	I1	I1	I1
163. Linseed Oil	S3	S3	I1	I1	I1	I1	I1	I1	S4	S4	S1	I1	I1	I1
164. Magnesium Sulfate	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
165. Maleic Acid	S3	S3	S3	S3	S1	I4	S1	S1	S1	S1	S4	I3	I3	I1
166. Manganese Salts	I4	I4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
167. Mercury Salts	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
168. Methyl Alcohol	S4	NR	PV	PV	F4	F4	NR	S4	S4	S4	S1	I4	I4	I4
169. Methyl Acetate	F4	NR	NR	NR	F4	F4	PV	PV	S4	S4	S4	PV	PV	PV
170. Methylene Chloride	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
171. Methyl Chloride	NR	NR	NR	NR	NR	NR	NR	S4	NR	NR	NR	NR	NR	NR

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	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
172. Methyl Ethyl Ketone	NR	NR	NR	NR	NR	NR	NR	NR	PV	S4	NR	PV	PV	NR
173. Methyl Isobutyl Ketone	F4	NR	NR	NR	NR	NR	NR	NR	S4	S4	S4	PV	PV	NR
174. Milk Products	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
175. Mineral Oil	I4	I4	I4	I4	I4	I4	S4	S4	S1	S1	S1	I1	I1	I1
176. Molasses	I4	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
177. Naphthalene	S4	S4	S4	S4	S3	S3	S4	S4	S4	S4	S4	I4	I4	I3
178. Naphtha	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I3	I1	I1
179. Naphthenic Acid	PV	PV	I4	I4	PV	PV	PV	PV	S4	S4	PV	I4	I4	PV
180. Nickel Chloride	S4	S4	S4	S4	S4	S4	S4	S4	S1	S1	S1	I1	I1	I1
181. Nickel Plating (Bright)	S4	S4	S4	S4	S4	I4	I4	I4	S1	S1	S1	I1	I1	I1
182. Nickel Salts	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
183. Nitric Acid (5%)	S4	S4	S3	S3	I3	I4	S4	S4	S4	S4	S1	I3	I3	I2
184. Nitric Acid (10%)	S4	S4	S3	S3	I3	I4	S4	S4	S4	S4	S1	I3	I3	I2
185. Nitric Acid (20%)	NR	NR	F4	F4	F4	F3	NR	NR	NR	S4	S2	I4	I4	I4
186. Nitric Acid (40%)	NR	NR	F4	F4	F4	F3	NR	NR	NR	S4	S4	I4	I4	I4
187. Nitric Acid (60%)	NR	NR	NR	NR	F4	F4	NR	NR	NR	NR	S4	S4	S4	S4
188. Nitric Acid (Conc.)*	NR	NR	NR	NR	F4	F4	NR	NR	NR	NR	NR	NR	NR	F4
189. Nitrobenzene	NR	NR	NR	NR	NR	NR	NR	S4	PV	PV	NR	PV	PV	PV
190. Nitrous Acid	NR	NR	PV	PV	PV	PV	PV	PV	PV	PV	S3	I3	I3	I2
191. Octanoic Acid	F4	F4	S4	S4	S3	I4	PV	PV	PV	PV	S3	I4	I4	I4
192. Oils (Animal)	I1	I1	I1	I1	S1	S1	I1	I1	S1	S1	S1	I1	I1	I1
193. Oils (Mineral)	I1	I1	I1	I1	S1	S1	I1	I1	S1	S1	S1	I1	I1	I1
194. Oils (Vegetable)	I1	I1	I1	I1	S1	S1	I1	I1	S1	S1	S1	I1	I1	I1
195. Oleic Acid	F4	NR	I4	I4	I3	I3	NR	NR	S4	S4	S1	I1	I2	I1
196. Oxalic Acid (Sat'd)	S4	S4	I4	I4	I3	I3	S1	S1	S1	S1	S1	I3	I1	I1
197. Ozone	S4	PV	PV	PV	I2	I2	S3	S3	S1	S1	S1	PV	PV	S4
198. Palmitic Acid	PV	PV	S4	S4	S3	S3	PV	PV	PV	PV	S4	I1	I1	I1
199. Pentachlorethane	PV	PV	PV	PV	S1	S1	PV	PV	S1	S1	S4	PV	PV	S1
200. Perchloric Acid	NR	NR	PV	PV	F4	F4	PV	PV	S1	S1	S1	PV	PV	PV
201. Perchlorethylene	F4	NR	NR	NR	F4	F4	NR	S4	S4	S4	S4	S4	PV	S4
202. Phenol (0%-10%)	NR	NR	PV	PV	F4	F4	NR	NR	S4	S4	S2	PV	PV	PV
203. Phenol (85%)	NR	NR	NR	NR	F4	F4	NR	NR	PV	S4	PV	NR	NR	PV
204. Phosphoric Acid (Conc.)	F4	NR	S3	S3	S1	I4	NR	NR	S4	S4	S1	I1	I1	I1
205. Phosphorous Oxychloride	NR	NR	PV	PV	F4	F4	PV	PV	S4	S4	S4	PV	PV	PV
206. Phosphorous Trichloride	NR	NR	PV	PV	F4	F4	PV	PV	S4	S4	PV	PV	PV	PV
207. Phthalic Acid	NR	PV	S1	S1	S1	S1	PV	PV	PV	PV	S1	I1	I1	I1
208. Potassium Bichromate	S4	S4	I4	I4	I4	I3	S4	S4	S4	S4	S1	I4	I4	I1
209. Potassium Bromate	S4	S4	I4	I4	I4	I4	I4	I4	S4	S4	S1	I4	I4	I4
210. Potassium Bromide	S4	S4	I4	I4	I4	I3	I4	I4	PV	S4	S1	I1	I1	I1
211. Potassium Carbonate	I4	I4	PV	PV	I4	I3	I4	NR	S1	S1	S1	I4	I4	I4
212. Potassium Chlorate	S4	S4	I4	I4	I4	I3	I4	NR	S1	S1	S1	I1	I1	I1
213. Potassium Chloride	I4	I1	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
214. Potassium Cyanide	S4	S4	I4	I4	PV	I4	I4	I4	S1	S1	S1	I1	I1	I1
215. Potassium Hydroxide (10%)*	I4	S4	S1	S1	I4	I4	I4	NR	S1	S1	S1	I4	I4	I4
216. Potassium Hydroxide (Conc.)*	I4	S4	NR	S4	S4	S4	S1	NR	S1	S1	S1	NR	NR	NR
217. Potassium Nitrate	I4	I4	I4	I4	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
218. Potassium Permanganate	I4	I4	I4	I4	I3	I3	S1	S1	S1	S1	S1	PV	I1	I1
219. Potassium Peroxide	S4	S4	S4	S4	PV	PV	F4	F4	S1	S1	PV	I4	I4	I4
220. Potassium Persulfate	S4	S4	I4	I4	I3	I3	S1	S1	S1	S1	S1	I1	I1	I1
221. Potassium Sulfate	S4	S4	I4	I4	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
222. Pulpstock Chlorinated	NR	NR	S4	S3	S3	S3	NR	NR	NR	S3	S4	S4	S4	S4
223. Propionic Acid	NR	NR	NR	NR	F4	F4	NR	NR	PV	PV	PV	PV	NR	PV
224. Propylene Glycol	S4	NR	I3	I3	I3	I3	I4	I4	S4	S4	S4	I4	I4	I3
225. Pyridine	NR	NR	NR	NR	F4	F4	NR	NR	NR	NR	NR	NR	NR	NR
226. Salicylic Acid	S1	S1	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
227. Seawater	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
228. Silver Nitrate	S1	S1	S1	S1	S1	S1	PV	PV	S1	S1	S1	I1	I1	I1

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	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
229. Sodium Acetate	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
230. Sodium Bicarbonate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
231. Sodium Bisulfate	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
232. Sodium Bisulfite	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
233. Sodium Bromate	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
234. Sodium Carbonate (see soda ash)	I4	I4	I4	I4	I3	I3	I1	NR	S1	S1	S4	I1	I1	I1
235. Sodium Chlorate	NR	PV	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
236. Sodium Chloride	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1
237. Sodium Chlorite (50%)	NR	NR	S4	S4	S3	S3	S4	S4	S4	S4	S4	I4	I4	I3
238. Sodium Chromate	S4	S4	I4	I4	I3	I3	S4	S4	S1	S1	S1	PV	PV	I1
239. Sodium Cyanide	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
240. Sodium Dichromate	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	PV	I4	I3
241. Sodium Fluoride*	S4	S4	NR	NR	I4	I4	PV	PV	S4	S4	S4	NR	NR	NR
242. Sodium Hydroxide (10%)*	I4	S4	S1	S1	I1	I1	I1	NR	S1	S1	S1	NR	NR	NR
243. Sodium Hydroxide (50%)*	I4	S4	S1	S1	I1	I4	I1	NR	S1	S1	S4	NR	NR	NR
244. Sodium Hypochlorite (3%)*	F4	F4	NR	S4	S4	S4	F1	NR	S3	S3	S1	NR	I4	I4
245. Sodium Hypochlorite (17%)	NR	NR	NR	PV	S4	S4	NR	NR	S4	S4	S4	NR	PV	S4
246. Sodium Peroxide	S4	S4	I4	I4	I4	I4	I1	I1	S4	S4	NR	PV	PV	S4
247. Sodium Phosphate	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
248. Sodium Sulfate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
249. Sodium Sulfide	S4	S4	PV	PV	I4	I3	I1	I1	S1	S1	S1	I4	I4	I4
250. Sodium Sulfite	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
251. Sodium Tartrate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
252. Sodium Thiosulfate (Hypo)	I4	S4	I4	I4	I3	I3	S1	NR	S1	S1	S1	I1	I1	I1
253. Soybean Oil	PV	PV	I4	I4	I3	I3	I1	I1	PV	S1	S1	I1	I1	I1
254. Stearic Acid	S4	S4	PV	PV	I4	I4	PV	PV	S4	S4	S1	I2	I2	I2
255. Succinic Acid	S4	F4	PV	PV	I4	I4	PV	PV	S3	S3	S3	I4	I4	I4
256. Sugar	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
257. Sulfite Liquor (Paper)	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
258. Sulfur Dioxide	F1	F1	S4	I4	I4	I4	I1	I1	S1	S1	S1	F4	I1	I1
259. Sulfur Trioxide	F4	F4	PV	PV	S4	S3	S1	S1	S1	S1	S1	I4	I4	I4
260. Sulfuric Acid (2%-20%)	S1	S4	S1	S1	S1	S1	S1	S1	S3	S3	S1	I1	I1	I1
261. Sulfuric Acid (20%-60%)	S1	F4	S1	S1	S1	S1	F1	F1	S4	S4	S1	I3	I3	I2
262. Sulfuric Acid (50%-70%)	S1	F4	F3	F3	F1	F1	F4	F4	NR	S4	NR	I4	I4	I2
263. Sulfuric Acid (70%-80%)	S1	NR	NR	NR	NR	NR	NR	NR	NR	S4	NR	PV	PV	PV
264. Sulfuric Acid (80%-98%)	S1	NR	NR	NR	NR	NR	NR	NR	NR	S4	NR	NR	NR	NR
265. Sulfurous Acid	S4	S4	I4	I4	I4	I3	S4	S4	S4	S4	S1	I1	I1	I1
266. Tall Oil	I4	S4	I4	I4	I4	I3	I1	I1	S4	S4	S1	I1	I1	I1
267. Tannic Acid	S4	PV	I4	I4	I4	I4	PV	PV	S4	S4	S4	I1	I1	I1
268. Tartaric Acid	U4	I4	I4	I4	I3	I3	S1	S1	S1	S1	S1	I1	I1	I1
269. Tetrachlorethane	F4	PV	NR	NR	F4	F4	NR	S4	S4	S4	NR	PV	PV	PV
270. Thionyl Chloride	NR	NR	NR	NR	NR	NR	NR	S4	NR	NR	NR	NR	NR	NR
271. Titanium Tetrachloride	S4	F4	I4	I4	I3	I3	S4	S4	S1	S1	S1	I1	I1	I1
272. Toluene	F4	NR	NR	NR	F4	F4	NR	S4	S4	S4	NR	S4	S4	S4
273. Toluene Sulfonic Acid	S3	S3	I4	I4	I3	I3	S4	S4	S1	S1	S1	I1	I1	I1
274. Trichloroacetic Acid (20%)	NR	NR	F4	F4	I4	I3	F4	F4	NR	NR	S1	I4	I4	I4
275. Trichloroethylene	NR	PV	NR	NR	F4	F4	NR	S4	S4	S4	NR	PV	PV	PV
276. Trisodium Phosphate	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S4	I3	I3	I3
277. Turpentine	S4	S4	PV	PV	I4	I4	NR	I1	S1	S1	NR	PV	PV	PV
278. Tween Surfactants	PV	PV	I4	I4	I4	I4	PV	PV	S1	S1	S1	I1	I1	I1
279. Urea Solutions	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
280. Vinegar	S4	F4	I1	I1	I1	I1	I4	I4	S1	S1	S1	I1	I1	I1
281. Water, distilled & demineralized	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
282. White Liquor (Paper)	I4	I4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
283. Xylene (Xylol)	S4	NR	NR	NR	NR	NR	NR	I1	S4	S4	NR	I4	I4	I4
284. Zinc Salt	I4	I4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
285. Zinc Plating (Acid Sulfate)	S3	S3	I4	I4	I3	I3	S1	S1	S1	S1	S1	I1	I1	I1

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Products

There is a Dudick Corrosion-Proof product to protect virtually any area of a plant and any piece of production, storage or handling equipment from the corrosive effects of moisture and chemical attack.

Eight standard product lines are available and each offers a range of products developed to meet the special requirements encountered in most manufacturing or processing environments. However, any product in any system can be modified to tailor the physical, mechanical, environmental or application properties to the unique needs of a specific application.

A series of catalogs is available describing the specific properties of each product in each of these systems. Of course, our factory personnel are available to work with your architect, plant management, engineering, and maintenance personnel to recommend a standard or custom formulated Dudick Corrosion-Proof product that meets your exact performance and durability requirements.

Floor Toppings/Linings

Designed for:

- Heavy Traffic
- New Concrete
- Existing & Eroded Concrete
- Full Range of Chemical Spills
- Conductivity
- Light Duty
- Cleanability
- Colors/Appearance

Tank Linings

Designed for:

- Concrete or Steel
- Process Vessels
- "E" Coat Tanks
- Holding Tanks
- Sumps, Pits, Trenches

Secondary Containment Linings

Designed for:

- Tank Farms
- Holding Pits

Coatings

Designed for:

- Tank Exteriors
- Structural Steel

Corrosion System Designs

The Dudick Systems are designed with:

- Heavy Aggregate for High Impact & Abuse
- Glass Reinforcement for Expansion & Contraction
- Epoxy, Polyester, Vinylester, Urethane & Acrylic Resins

Services Offered:

- Concrete Specifications
- Steel Specifications
- Lining & Topping Specifications
- Installation Detail Drawings
- Field Tech Service
- Application Recommendations

Experience

Dudick Corrosion-Proof products have been used in nearly every type of manufacturing and processing operation where chemical environments or high moisture conditions present a constant corrosion problem.

Our products are protecting the plants and equipment of most of the Fortune 500 companies and hundreds of smaller, local firms. They are used at major U.S. government installations and in many municipal water and sewage treatment plants.

They have been installed in every geographic area of the United States and have been exported to many European countries.

While our experience covers nearly every type of industrial environment, a few specific examples deserve special mention because they help demonstrate many of the special capabilities of Dudick Corrosion-Proof, Inc. products and people.

Pulp and Paper Industry

Dudick Corrosion-Proof, Inc. developed a special series of products to reline the interiors of the tile chests used in pulp and paper manufacturing operations. Installed by Dudick personnel under tight turnaround schedules, these relining systems have demonstrated their ability to eliminate leaking problems and to stand up to the severe chemical environments involved. Many of these installations have already endured more than seven years of constant service without a single failure.

Chemical Processing Industry

Dudick Corrosion-Proof products are used extensively to protect vulnerable equipment and structures in chemical processing and petroleum refining operations. Our systems have achieved excellent service records in chemical environments ranging from pH 1 to pH 14, including extended exposures to high concentrations at elevated temperature.

Power and Energy

Dudick Corrosion-Proof materials are used extensively in coal and oil powered electrical generating plants including trenches, waste water treatment tanks, and the severe environment of flue gas desulfurization systems (ducts and scrubbers).

Food Processing

Several Dudick Corrosion-Proof products are available in special formulations which meet FDA requirements for food proximity and food contact. Our Protecto-Line and Protecto-Crete floor toppings, for example, provide important resistance to both accidental spills and the harsh chemical cleaning agents required to maintain sanitation. In addition, our lining systems provide important protection for storage vats and processing equipment where chemically active ingredients are involved.

Metal Working

Dudick Corrosion-Proof products are used in many areas in both primary metals manufacturing and metals finishing operations. These include pickling lines, waste water treatment facilities, stack emission control systems and etching and plating rooms.

Waste Water Treatment

Dudick Corrosion-Proof products effectively protect the major components of waste water treatment facilities such as settling tanks, aeration units, retention tanks, activated carbon pits and oil skimmers.

Exotic Metals

Occasionally, plants or equipment built with exotic metal vessels and piping systems will be converted to other production uses where even they are susceptible to corrosion. Dudick Corrosion-Proof, Inc. has successfully lined stainless steel, Inconel, aluminum, as well as the soft metals, with specially designed protective systems appropriate to their new missions.

Aerospace

Dudick Corrosion-Proof lined the entire interior of the building (big enough to hold a 747) where the reusable space shuttle fuel tanks are sandblasted and cleaned with an acid spray. We also provided the corrosion protection for several small aluminum plates essential for the function of the air regeneration systems aboard the Enterprise and Columbia shuttles.

Electronics

Dudick Corrosion-Proof products are used in many electronic component manufacturing and assembly areas. They provide both resistance to the acids used in manufacturing processes and provide the cleanability essential to the maintenance of a clean-room environment.

Composite Flooring

In many industrial plants service requirements will vary significantly from one area to another. Rather than recommend a single floor topping designed to meet the most severe requirements, Dudick Corrosion-Proof will develop a more cost-effective composite system with performance tailored to the actual needs of specific production zones.

APPENDIX

43-2

HYDROSTATIC TEST RECORD

Date 8-31-95

Clean Harbors of Chicago
11700 S. Stoney Island Ave
Chicago Il

Tank/line/valve tested:

Tank # OVERFLOW TANK Valve # (s) closed: Air valve V-815 V-817, V-819

Process Line # (s) From Overflow tank to intermediat shreader

Description: 6"ϕ SCH 40, ASTM S3A

Drawing # ~~P 009~~ CHCI DWG. No. 4245 REV 0

Applicable Specification

TEST PREPARATION:

YES Joints Accessible

NA Expansion Joints Restrained

NA Relief Valves/Rupture discs isolated

YES Low Press Equipment Isolated

___ System Supports Sufficient

YES System Vented

YES Connections Checked

YES Test Gauges in Place

___ Recorder Serial #

TEST PARAMETERS:

Guage Range 0 PSIG to 160 PSIG (1-1/2 to 4 x test press)

Guage Calibration 1. I.D.# N/A Due Date

Test Pressure - Internal 99 PSIG External ATM PSIG

Test Medium - ~~W~~ AIR Condition From existing Air compressor

Test Temperature AMB F (70F min Sec I/60F min Sec 8, 11 & 831.1)

Ambient Temperature 86 F 68% RH

HYDROSTATIC TEST RECORD

Date 8-31-95

Clean Harbors of Chicago
11700 S. Stoney Island Ave
Chicago Il

closed: Air valve
V-800 V-822 V-519
~~[illegible]~~ V-574
V-803 V-514
V-804 V-534
~~[illegible]~~ V-529

Tank/line/valve tested:

Tank # N/A Valve # (s)

Process Line # (s) 3"-P-167-DI, 3"-P-163-DI

Description: 3"ϕ SCH40, ASTM 53A from Pump 163 in pump House to Pegasus System & from Pump 167 in bldg #43 to fill manifold in bldg #43

Drawing # P-008 REV 0

Applicable Specification ASTM 53A

TEST PREPARATION:

YES Joints Accessible

NA Expansion Joints Restrained

YES Relief Valves/Rupture discs isolated Removed

YES Low Press Equipment Isolated

YES System Supports Sufficient

YES System Vented

YES Connections Checked

YES Test Gauges in Place

N/A Recorder Serial #

TEST PARAMETERS:

Guage Range 0 PSIG to 150 PSIG (1-1/2 to 4 x test press)

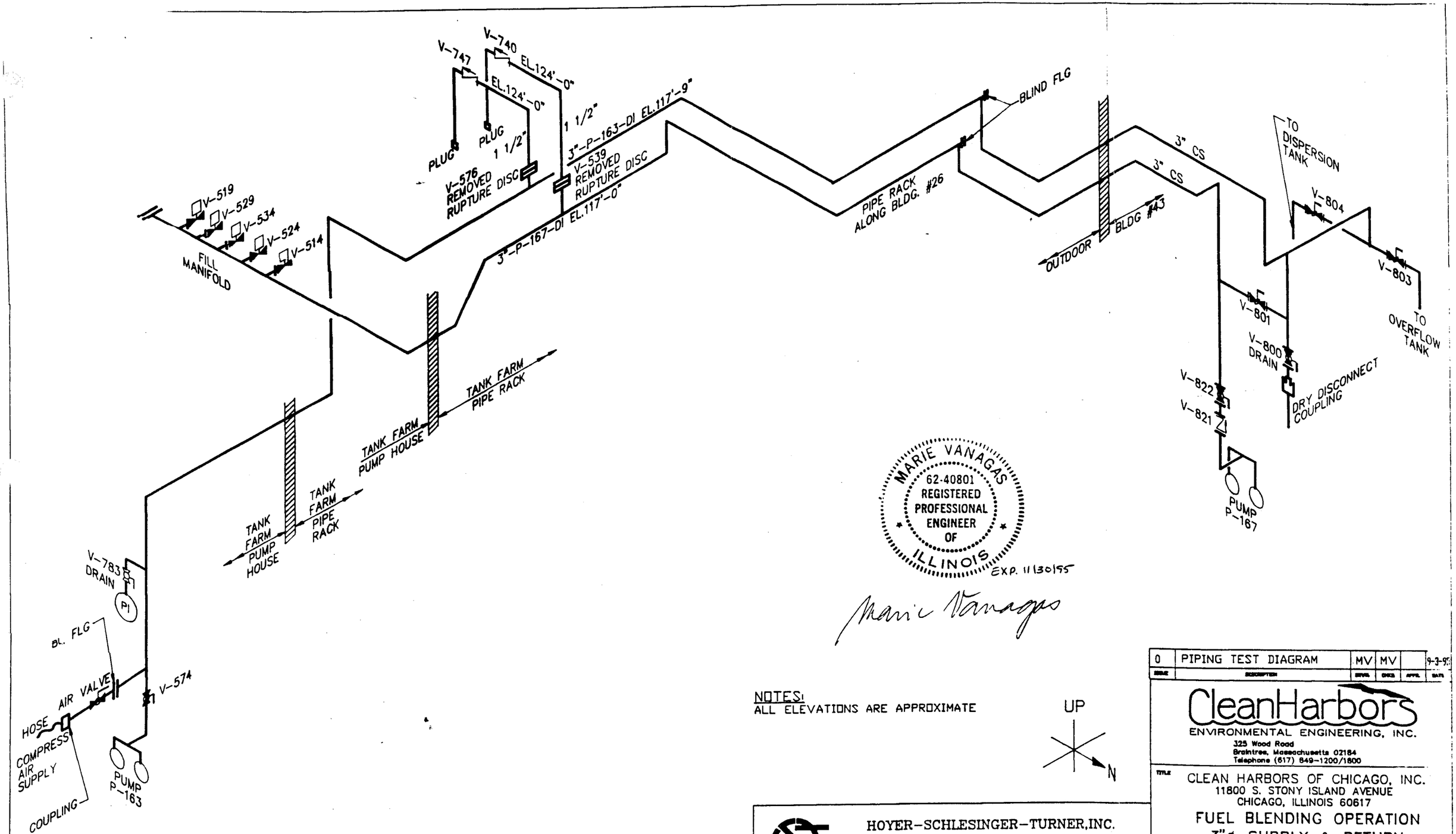
Guage Calibration 1. I.D.# NA Due Date

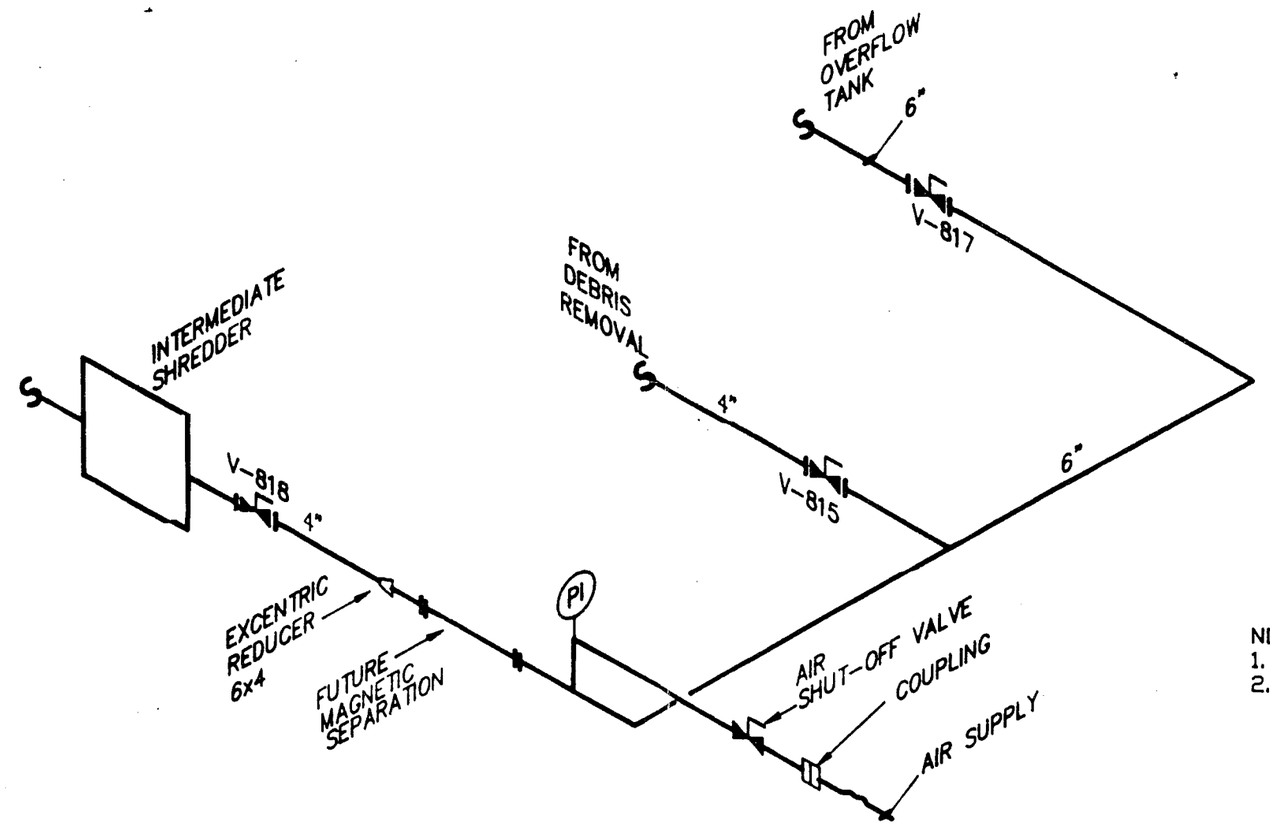
Test Pressure - Internal 100 PSIG External ATM PSIG

Test Medium - WATER Condition City of Chicago water piping filled with water and pressurized with air

Test Temperature F (70F min Sec I/60F min Sec 8, 11 & B31.1)

Ambient Temperature 86 F 68% RH


V-747
V-740
EL.124'-0"
EL.124'-0"
1 1/2"
1 1/2"
PLUG
PLUG
V-576
REMOVED
RUPTURE DISC
V-539
REMOVED
RUPTURE DISC
3"-P-163-DI EL.117'-9"
3"-P-167-DI EL.117'-0"
BLIND FLG
PIPE RACK
ALONG BLDG. #26
3" CS
3" CS
TO
DISPERSION
TANK
V-804
V-803
TO
OVERFLOW
TANK
OUTDOOR
BLDG #43
V-519
V-529
V-534
V-524
V-514
FILL
MANIFOLD
V-801
V-800
DRAIN
DRY DISCONNECT
COUPLING
V-822
V-821
PUMP
P-167
TANK FARM
PIPE RACK
TANK FARM
PUMP HOUSE
TANK
FARM
PIPE
RACK
TANK
FARM
PUMP
HOUSE
V-783
DRAIN
P1
BL. FLG
AIR VALVE
V-574
HOSE
COMPRESS
AIR
SUPPLY
COUPLING
PUMP
P-163
MARIE VANAGAS
62-40801
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS
EXP. 11/30/95
Marie Vanagas
NOTES:
ALL ELEVATIONS ARE APPROXIMATE
UP
N
HOYER-SCHLESINGER-TURNER, INC.
CONSULTING-ENGINEERS
300 WEST ADAMS STREET CHICAGO, ILLINOIS 60606
PROJECT 1785-1
0 PIPING TEST DIAGRAM MV MV 9-3-95
ISSUE DESCRIPTION DRWN CHKD APPR. DATE
CleanHarbors
ENVIRONMENTAL ENGINEERING, INC.
325 Wood Road
Braintree, Massachusetts 02184
Telephone (617) 849-1200/1800
TITLE
CLEAN HARBORS OF CHICAGO, INC.
11800 S. STONY ISLAND AVENUE
CHICAGO, ILLINOIS 60617
FUEL BLENDING OPERATION
3"ø SUPPLY & RETURN
PROJECT NO.
SCALE NONE
DRAWING NO.
PT-008



MARIE VANAGAS
62-40801
REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS
EXP. 11/30/95

Marie Vanagas

NOTE:
1. LOCATED IN BUILDING #43
2. ELEVATION OF PIPE IS 14' ABOVE FLOOR

ISSUE	DESCRIPTION	DRWN.	CHKD.	APPR.	DATE
0	PIPING TEST DIAGRAM	LRG	MV		9-15-95

UP

N

CleanHarbors
ENVIRONMENTAL ENGINEERING, INC.
325 Wood Road
Braintree, Massachusetts 02184
Telephone (617) 849-1200/1800

TITLE
CLEAN HARBORS OF CHICAGO, INC.
11800 S. STONY ISLAND AVENUE
CHICAGO, ILLINOIS 60617
FUELS BLENDING OERATION
TANKS DISCHARGE PIPE

PROJECT NO. 1785
SCALE NONE
DRAWING NO. PT-009

HOYER-SCHLESINGER-TURNER, INC.
CONSULTING-ENGINEERS
300 WEST ADAMS STREET CHICAGO, ILLINOIS 60606
PROJECT 1785-1

APPENDIX

43-3

HOYER-SCHLESINGER-TURNER, INC.

SHEET 1 OF 5
PROJECT NO. 1785-1
DATE 9.10.95
BY C.K.

PROJECT CLEAN HARBORS - CHICAGO, IL.
SUBJECT SHREDDER FACILITIES - BLDG. #4-3

FOR CERTIFICATION

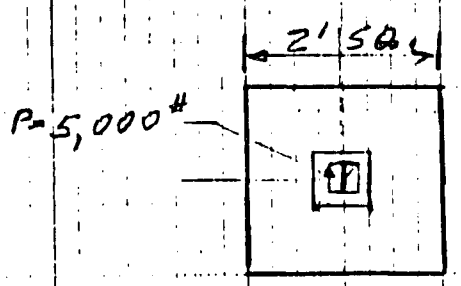
REF. DWGS: CLEAN HARBORS - STRUCTURAL SUPPORTS DWG. NO. 2916-S-15 (SHEET #2)

1. CONTAINMENT CALCULATIONS:
FOR SECONDARY CONTAINMENT CALCULATIONS SEE DWG. 2916-M-07 BY CLEAN HARBORS
REQUIRED = 1,800 GALS < 4,127 GALS. PROVIDED O.K.

2. STRUCTURAL ANALYSIS OF EXIST. 6" CONC. SLAB REINF. WITH #5 @ 12" EACH WAY IS EQUIVALENT TO 7" CONC. SLAB REINFORCED WITH 2 LAYERS OF #4 @ 12" C/C EACH WAY TOP & BOTTOM, WHICH IS CLASSIFIED AS INDUSTRIAL SLAB LOADED WITH 1500 PSF.

3. COLUMN LOADS AND PAD SIZES ARE TAKEN FROM CLEAN HARBORS DWG. 2916-S-15 AND RECHECKED. (PLAN ATTACHED SHT. #2)

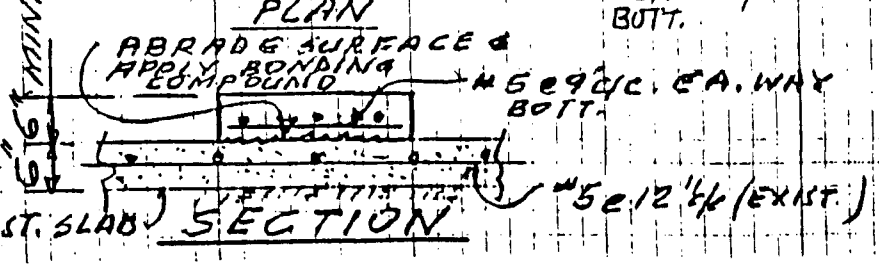
4. DRUM LIFT ASSEMBLE SUPPORTED ON 4 COLS WITH LOAD OF 5000 LBS. EACH AND HAVE ADDITIONAL 2' x 2' x 6" HIGH REINF. PADS ON TOP OF EXIST. 6" CONC. SLAB REINF. WITH #5 @ 12" EACH WAY



PLAN

P = 5000#
AREA = 4 F.S.
ALL = 1,500 x 4
= 6,000# > 5000#
O.K.

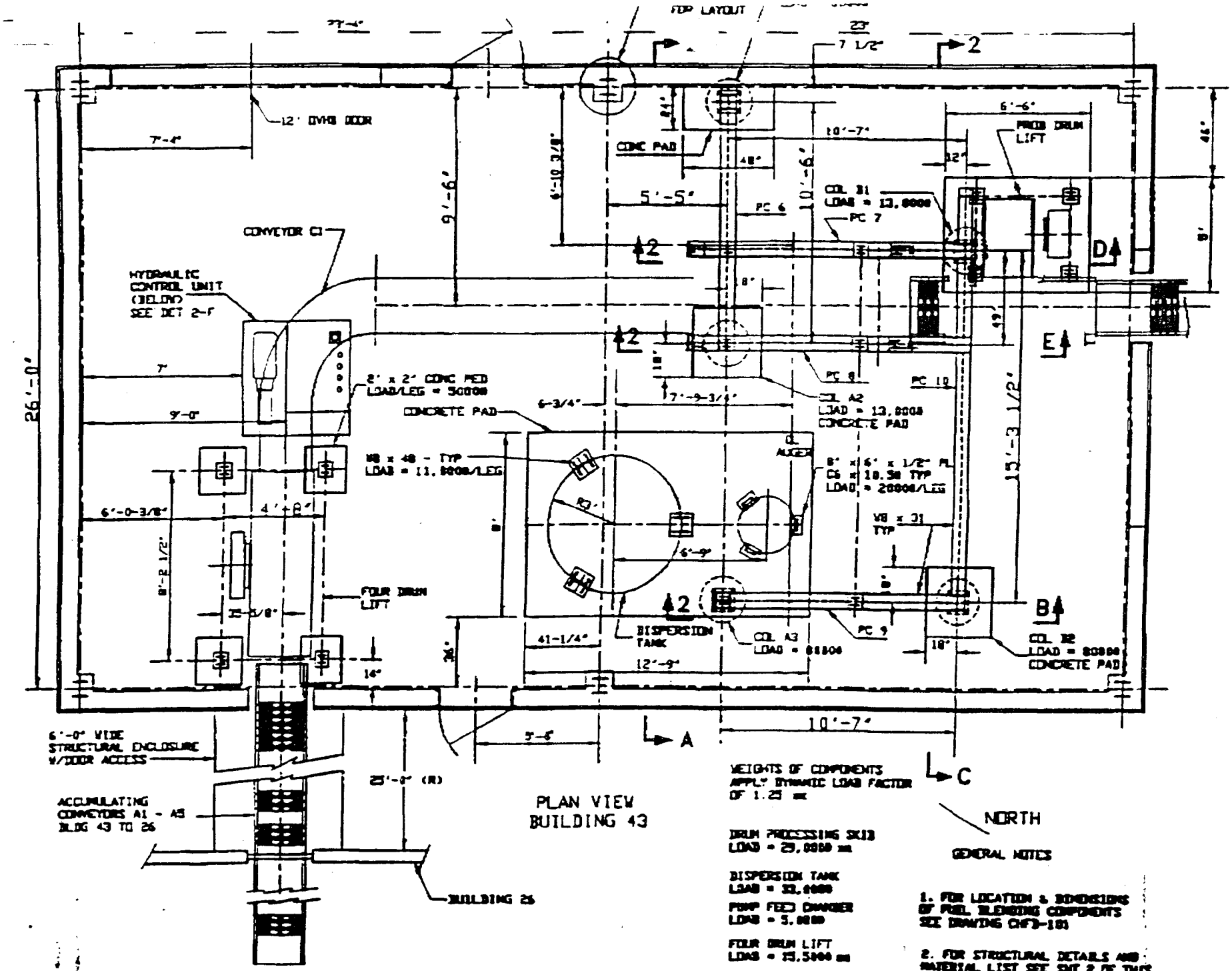
REINFORCE NEW PAD WITH #5 @ 9" C/C EACH WAY BOTT.



SECTION

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes
PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11-30-96



PLAN VIEW
BUILDING 43

WEIGHTS OF COMPONENTS APPLY DYNAMIC LOAD FACTOR OF 1.25 mx

DRUM PROCESSING SKID LOAD = 29,0000 mx

DISPERSION TANK LOAD = 33,0000

PUMP FEED CHAMBER LOAD = 5,0000

FOUR DRUM LIFT LOAD = 15,5000 mx

PROBLEM DRUM LIFT LOAD = 9,5000 mx

HYDRAULIC CONTROL UNIT LOAD = 3,0000

GENERAL NOTES

1. FOR LOCATION & DIMENSIONS OF FUEL BLENDING COMPONENTS SEE DRAWING CHFB-101

2. FOR STRUCTURAL DETAILS AND MATERIAL LIST SEE SHT 2 OF THIS DRAWING. CHFB-103

3. CONCRETE PADS REINFORCED WITH A SINGLE LAYER OF #4 REBAR, 12" ON CTR. EACH WAY

NOTER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS- CHICAGO, ILL.

SUBJECT SHREDDER FACILITIES - BLDG. #43

SHEET 2 OF

PROJECT NO. 1785-1

DATE 9.10.85

BY C.K.

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, IL.

SUBJECT SHREDDER FACILITIES - BLDG. # 43

SHEET 3 OF

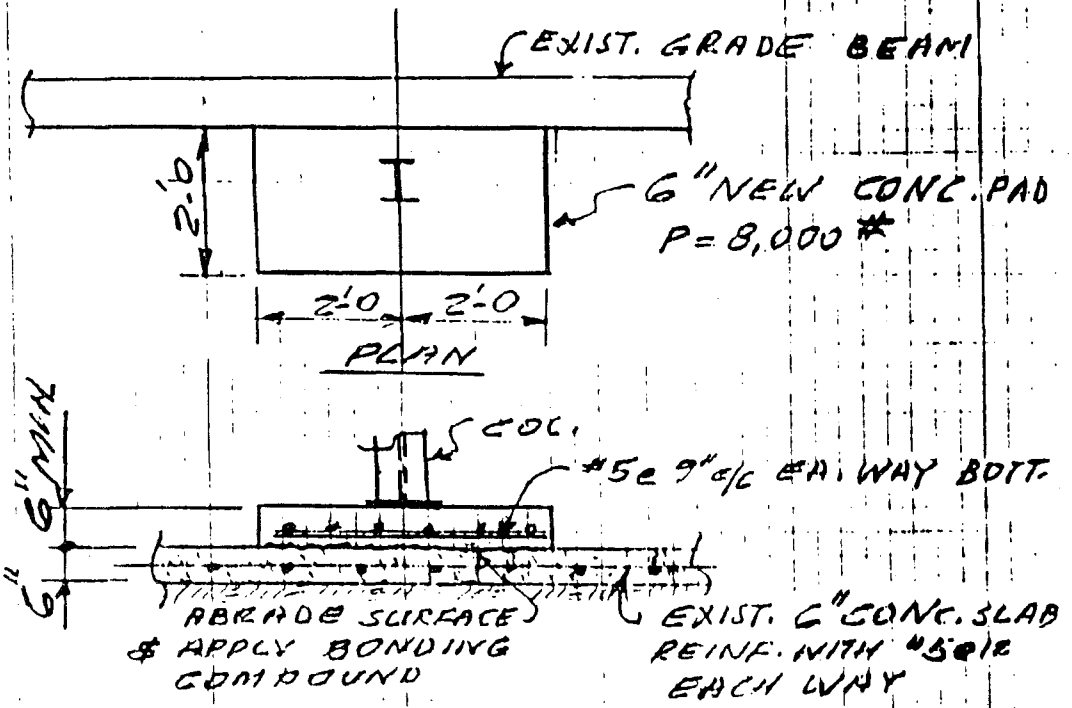
PROJECT NO. 1985-1

DATE 9.10.95

BY C.K.

FOR CERTIFICATION

5. COLUMN A1 LOAD ON COL. 8,000 LBS.
CONC. PAD 2'x4'x6" HIGH REINFORCED WITH
#5 @ 9" c/c EACH WAY BOTTOM. COL. LOAD = 8,000#



AREA: 4'x2' = 8 S.F. 8x1500 = 12,000# > 8,000#
O.K.

6. COL. B2.

COL. LOAD = 8,000#; NEW CONC. PAD
3'-0 SQ. AREA x 6" HIGH

AREA 3'x3' = 9 S.F.

ALLOWABLE LOAD = 1,500 x 9 = 13,500# > 8,000#
O.K.

REINF. IN NEW CONC.
PAD #5 @ 9" c/c EACH WAY BOTT.

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, IL.
SUBJECT SHREDDER FACILITIES - BLDG. #43

SHEET 4 OF
PROJECT NO. 1785-1
DATE 9.10.95
BY C.K.

FOR CERTIFICATION

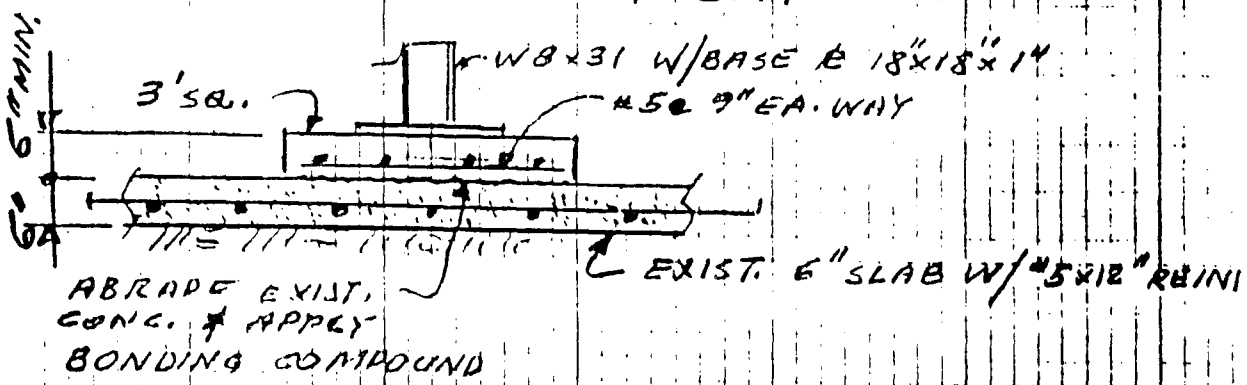
7. COL. A2

COL. LOAD = 13,000#; 4000 PSI CONC. MIX.
NEW CONC. PAD = 3'x3'x6" HIGH

AREA = 9 S.F.

ALLOWABLE LOAD = 9x1500# = 13,500#
O.K.

REINF. NEW CONC. PAD
WITH #5 @ 9" EACH WAY BOTTOM



SECTION

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS – CHICAGO, IL.

SUBJECT SHREDDER FACILITIES – BLDG. #43

SHEET 5 OF

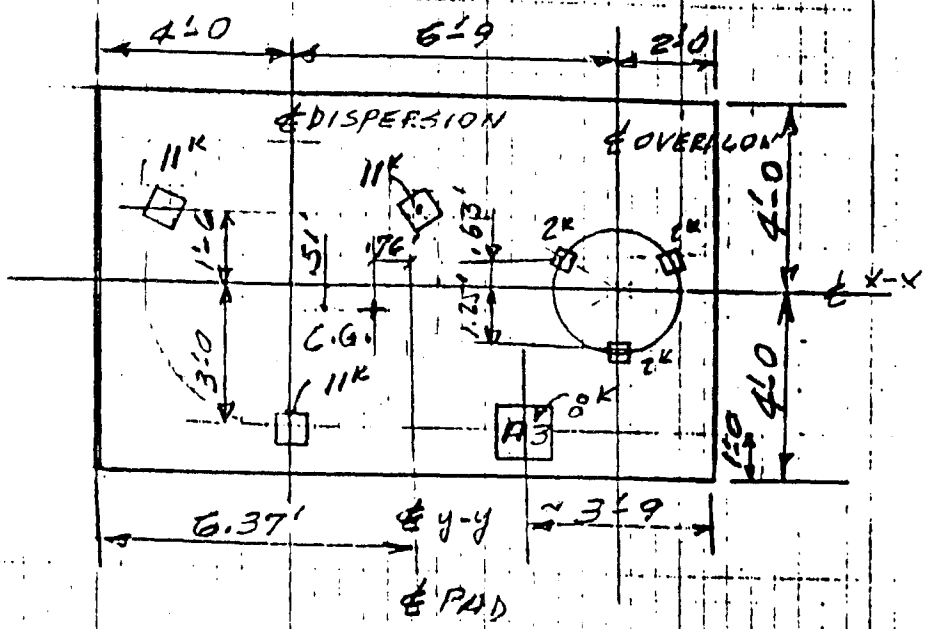
PROJECT NO. 1785-1

DATE 9.19.95

BY C.K.

FOR CERTIFICATION

8. NEW COMMON CONC. PAD FOR DISPERSION TANK, OVERFLOW TANK & COL. A3 = 8,000#

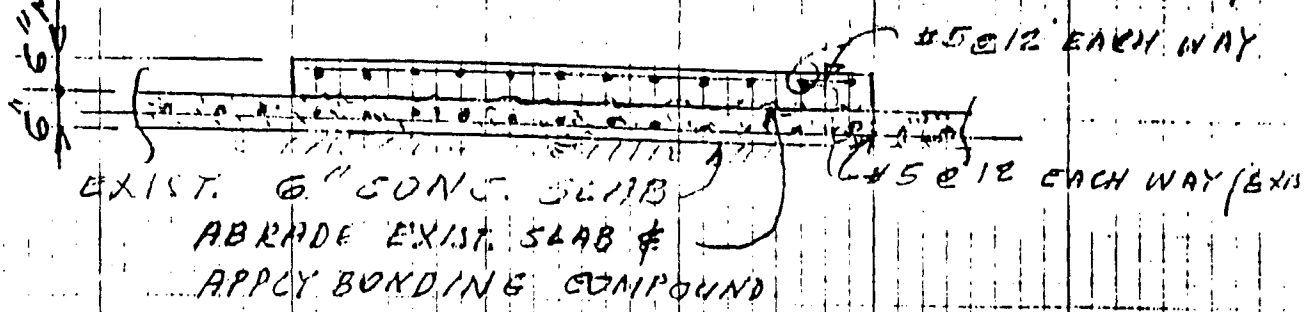


PLAN

$$P_s = \frac{47^k}{8 \times 12.75} + \frac{47 \times .76 \times 6}{8 \times 12.75^2} + \frac{47 \times .51 \times 6}{12.75 \times 8^2} = .46 + .16 + .18 = .80 \text{ k/s}$$

$= 880^{\#}/\text{SF} < 1500$ OK.

REINF. NEW 6" PAD WITH #5 x 12" c/c TOP EACH WAY



SECTION

CLEAN HARBORS
ENVIRONMENTAL SERVICES, INC.
GENERAL WELDING & DESIGN
609 Pleasant Street P.O. Box 22
WEYMOUTH, MASSACHUSETTS 02189
(617) 331-5600 FAX (617) 335-2675

JOB GW5384
SHEET NO. _____ OF _____
CALCULATED BY L. SPAZIANI DATE 1-27-94
CHECKED BY _____ DATE _____
SCALE —

VERIFICATION OF LEG SUPPORTS — DISPERSION TANK

REF: SHAR, INC DRWG CC12331A (94-31-M16)

WEIGHT OF TANK —

TANK —	3340#	
NOZ —	800#	
MTR/DRIVES	3650#	
SCREW CONVR	2000#	(END SUPPORT)
	9790#	
WT LIQ @ 100%	22,440#	(1493 GAL @ 1.8 SD)
	32,230#	
MARGIN — 5%+ =	2000	
	34230#	

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes
PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11-30-96

TOTAL CAP. ~ 1493 GAL
ASSUME 4500 GALS.

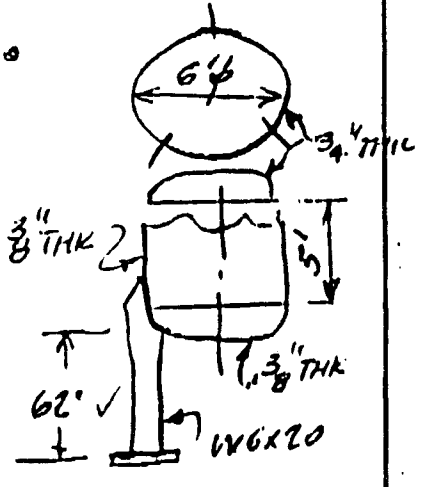
LEGS — W6 x 20 C.S. POSITIONED @ 120°

HEIGHT = 62' F_y = 36 KSI

ALLOWABLE LOAD - AISC — COL TABLES —

6'-HT = 109 KIPS EACH LEG.

W6 x 20 OK



$f_{act} = \frac{P}{A} = \frac{34,230^{+}(.33)}{5.87\ IN^2}$ 1924#/IN² EA LEG — OK

CLEAN HARBORS
ENVIRONMENTAL SERVICES, INC.
GENERAL WELDING & DESIGN
609 Pleasant Street P.O. Box 22
WEYMOUTH, MASSACHUSETTS 02189
(617) 331-5600 FAX (617) 335-2675

JOB GW5304
SHEET NO. ____ OF ____
CALCULATED BY L. SAZIANI DATE 6-16-94
CHECKED BY ____ DATE ____
SCALE ____

VERIFICATION OF LEG SUPPORTS — PUMP FEED CHAMBER

REF: DWG 94-31-M28 —

WT TANK —	1200#
NOZ	400#
ATTACHMENTS	600#
	2200#
WT LIQ-300g —	4500#
	6700#
≈	7500#

3 LEGS @ 120° — 6" × 8.2# [A = 2.40 IN² Fy = 36 KSI

HEIGHT = 41"

$$f_{act} = \frac{P}{A} = \frac{7500^{\#}(3.3)}{2.40\ IN^2} = 1031\ \#/IN^2 \text{ OK}$$

APPENDIX

43-4

APPENDIX

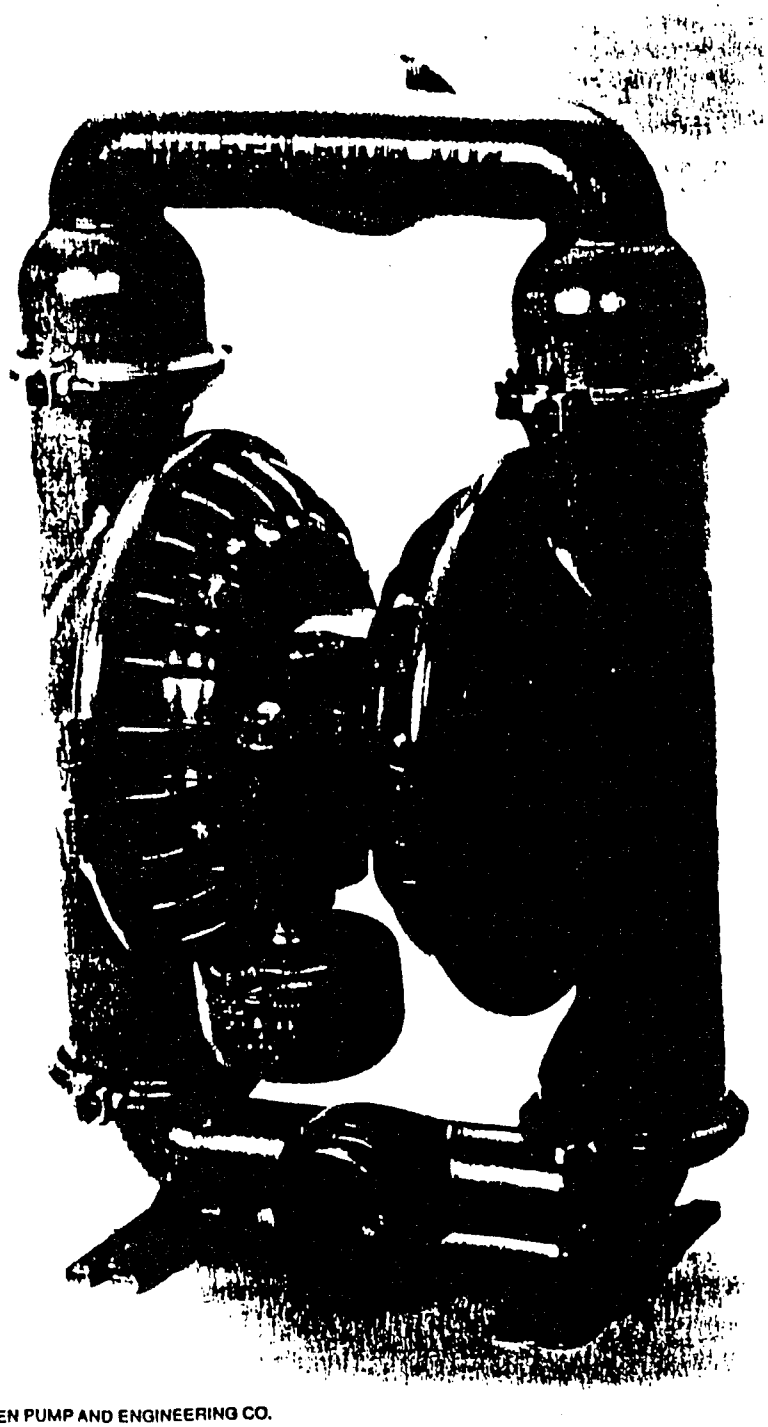
43-5

IF IT POURS IT PUMPS

DIRECTIONS FOR INSTALLATION AND MAINTENANCE

WILDEN MODEL M15

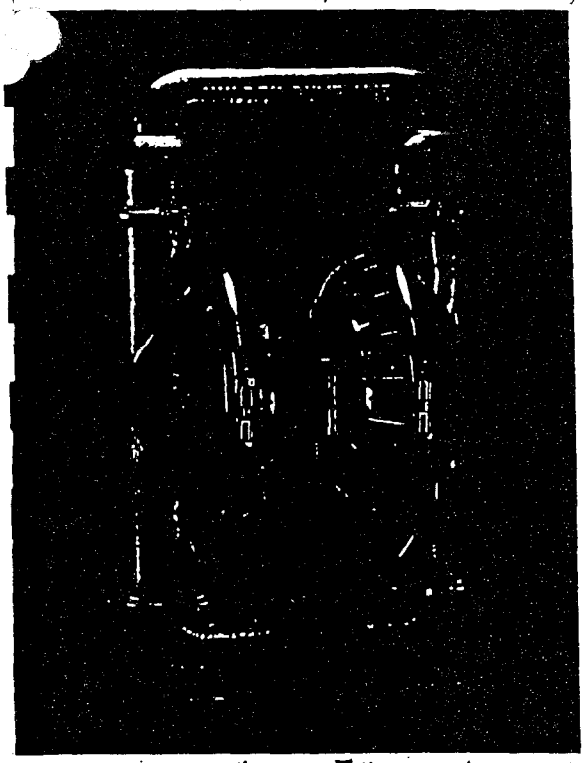
MODEL M15/OO, BO, WO, WW, WS, SO, SW, SS, TO, ST, SV, SG, SN HO, HW HS, HV



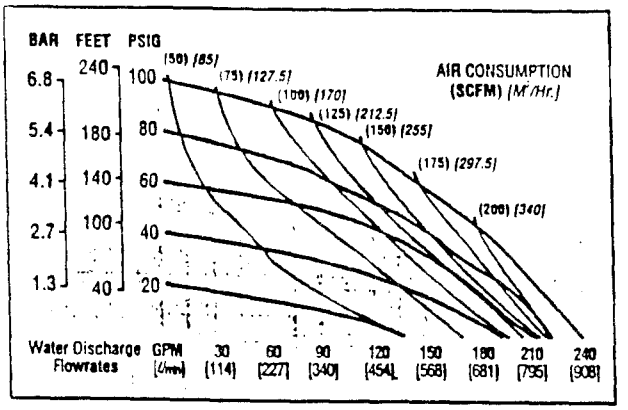
COPYRIGHT 1986 WILDEN PUMP AND ENGINEERING CO.

RBG-P/3-5
9/86

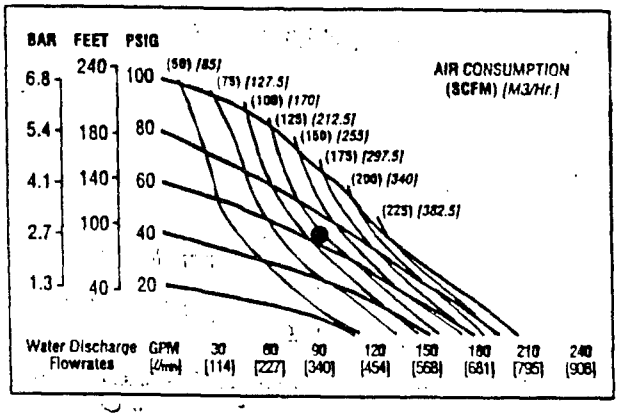
M15 METAL PUMP



RUBBER/TPE-FITTED M15 PUMP



TEFLON®-FITTED M15 PUMP



M15 Metal Pump Flows up to 240 G.P.M.

Maximum pump operating pressures should not exceed 125 psig (8.62 Bar).

Volumes indicated on charts were determined by actually pumping water into calibrated tanks.

Example:

To pump 90 gpm against a discharge head of 40 psig requires 65 psig and 125 scfm air consumption. (See dot on Teflon-fitted chart.)

P.160, P.163

SPECIFICATIONS

Materials of Construction, Wetted Housings
(Air Chambers, Inlet/Discharge Manifolds)

MATERIAL	SHP. WT.	MATERIAL	SHP. WT.
Aluminum	110 lbs.	316 Stainless Steel	165 lbs.
Hastelloy C	218 lbs.	Cast Iron	181 lbs.

Materials of Construction, Non-Wetted Housings

DESCRIPTION	MATERIAL
Center Block	Aluminum or Aluminum, Nickel-Plated or Stainless Steel or Polypropylene
Air Chambers	Aluminum or Aluminum, Nickel-Plated or Stainless Steel or Cast Iron
Air Valve	Brass or Brass, Nickel-Plated or Stainless Steel

Suction Lift Capability

DRY LIFT	PRIMED LIFT
17' (5.18m)	25' (7.62m)

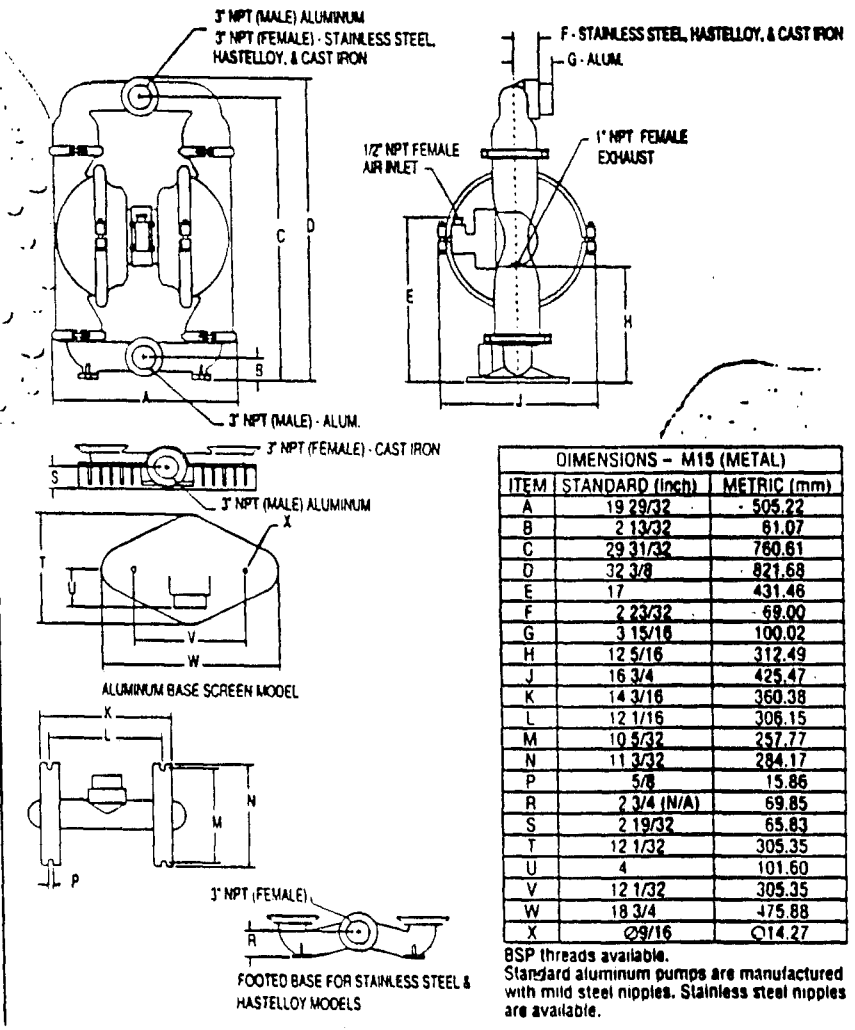
The above figures represent rubber-fitted pump capabilities. Consult your distributor for TPE and/or Teflon®-fitted pump data.

Maximum Diameter Solids
⅜" (9.52mm) Diameter

Elastomer Options

MATERIAL	TEMPERATURE LIMITS
Polyurethane	+10 (−12.2) to +150 (65.6) F° (C°)
Neoprene	0 (−17.8) to +200 (93.3) F° (C°)
Buna-N	+10 (−12.2) to +180 (82.2) F° (C°)
Nordel	−60 (−51.1) to +280 (137.8) F° (C°)
Viton	−40 (−40.0) to +350 (176.7) F° (C°)
Saniflex™	−20 (−28.9) to +220 (104.4) F° (C°)
Teflon® PTFE	+40 (4.4) to +220 (104.4) F° (C°)
Wil-Flex™	−40 (−40.0) to +225 (107.2) F° (C°)

DIMENSIONAL DRAWING



DIMENSIONS – M15 (METAL)		
ITEM	STANDARD (inch)	METRIC (mm)
A	19 29/32	505.22
B	2 13/32	61.07
C	29 31/32	760.61
D	32 3/8	821.68
E	17	431.46
F	2 23/32	69.00
G	3 15/16	100.02
H	12 5/16	312.49
J	16 3/4	425.47
K	14 3/16	360.38
L	12 1/16	306.15
M	10 5/32	257.77
N	11 3/32	284.17
P	5/8	15.86
R	2 3/4 (N/A)	69.85
S	2 19/32	65.83
T	12 1/32	305.35
U	4	101.60
V	12 1/32	305.35
W	18 3/4	475.88
X	Ø9/16	Ø14.27

BSP threads available.
Standard aluminum pumps are manufactured with mild steel nipples. Stainless steel nipples are available.

APPENDIX

43-6

APPENDIX

43-7

APPENDIX

43-8

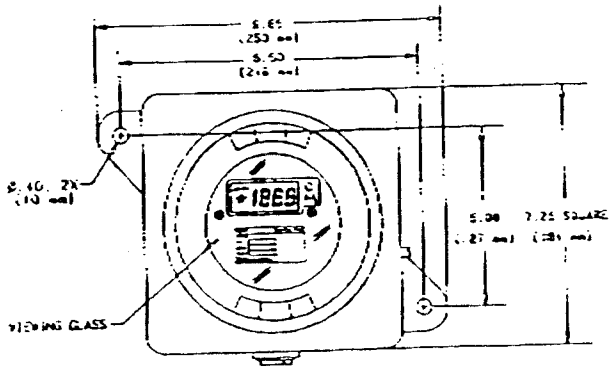
REPEATABILITY	±1% full scale			
DRIFT	Short-Term Wander	Zero / Span	±1% full-scale in 24 hrs.	
	Long-Term Drift	Zero	2% full-scale in 1 month	
		Span	Carbon Monoxide	10% of reading in 1 month
			All Others	2% of reading in 1 month
NOISE	±1% full-scale			
LINEARITY	Hydrogen Sulfide	10% full-scale		
	All Others	2% full-scale		
OUTPUT SIGNAL GENERATED BY SENSING HEAD	4 to 20 mA *(Conforming to ISA-550.1 Standard as a Class 2U Transmitter)*			

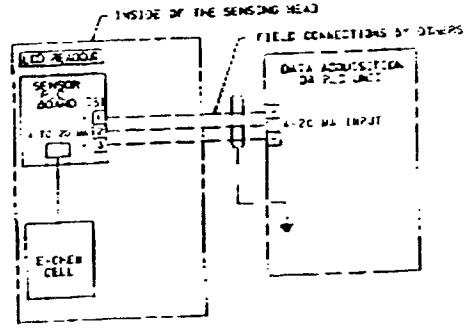
Table 1-3. Performance Specifications for Sensor/Transmitters

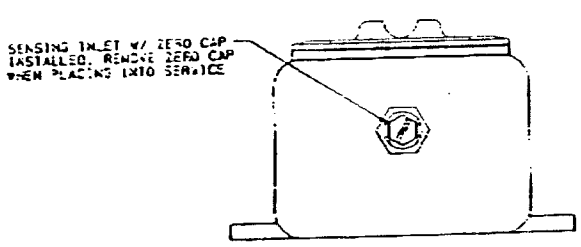
GAS	RANGE FULL SCALE	USABLE TEMPERATURE RANGE	FULL-SCALE % ERROR PER °F		MAXIMUM RESPONSE TIME TO 90% OF STEP CHANGE SECONDS
			TEMP ZERO	EFFECT SPAN	
Carbon Monoxide	0 - 100 ppm	-10 to 120°F	±.05	±.08	90
	0 - 500 ppm				
Hydrogen Sulfide	0 - 50 ppm	-10 to 120°F	±.05	±.08	60
Nitrogen Dioxide	0 - 10 ppm				
Oxygen	0 - 25%	0 to 120°F	±.05	±.08	20
	0 - 10%				
Chlorine	0 - 10 ppm	0 to 110°F	±.05	±.08	90
POWER REQUIREMENTS		9 to 35 VDC			
POWER CONSUMPTION		Approximately 1 Watt			
CABLE REQUIREMENTS		Two Conductor			

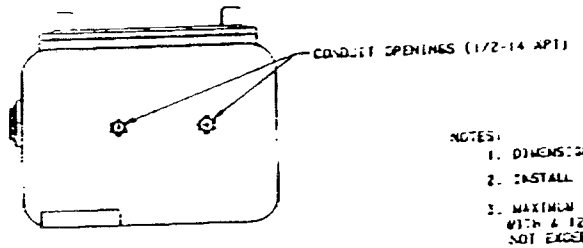
Table 1-4. Physical Characteristics for Sensor/Transmitters

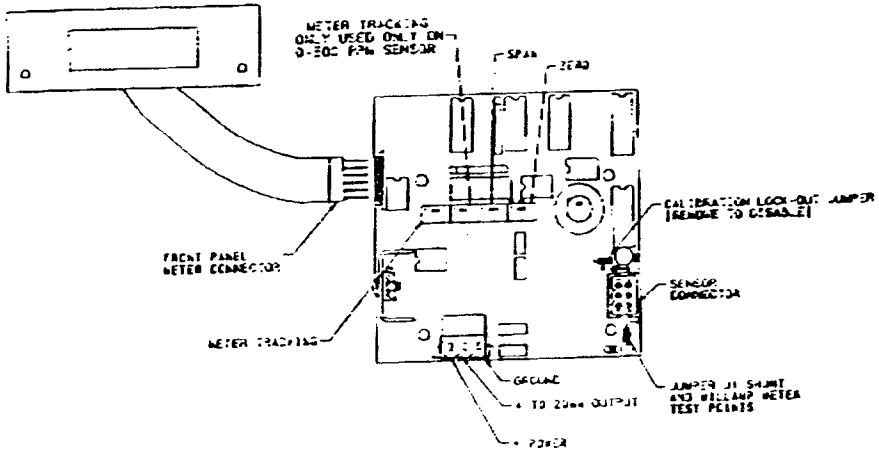
GENERAL-PURPOSE ENCLOSURE MODELS	
DIMENSIONS	6-1/4 x 7-1/2 x 4-5/16 inches (159 x 190 x 110 mm)
WEIGHT	4 pounds (1.8 Kg)
RATING	General-Purpose
EXPLOSION-PROOF ENCLOSURE MODELS	
DIMENSIONS	7-1/4 x 7-1/4 x 6-1/16 inches (184 x 184 x 154 mm)
WEIGHT	12 pounds (7.2 kg)
RATING	Explosion-proof; suitable for Class I, Groups C, D, Division 1, Hazardous Locations
NEMA 4X ENCLOSURE MODELS	
DIMENSIONS	11-1/2 x 4-1/2 x 7-3/4 inches (292 x 114 x 197 mm)
WEIGHT	3.75 pounds (1.7 kg)
RATING	NEMA 4X











NOTES:

1. DIMENSIONS SHOWN IN INCHES (MILLIMETERS).
2. INSTALL AS SHOWN W/ SENSING INLET DOWN.
3. MAXIMUM CABLE LENGTH FROM SENSOR TO CONTROL UNIT WITH 4 12 VDC SUPPLY VOLTAGE. CABLE LENGTH SHOULD NOT EXCEED 10,500 FEET.

		MSA P/N	MFG. P/N
700 FT.	#20 AWG.	603080	ALPHA 2256/3
1100 FT.	#18 AWG.	603081	ALPHA 2256/3
1800 FT.	#16 AWG.	603082	ALPHA 2260/3
2900 FT.	#14 AWG.	603083	ALPHA 2265/3
4700 FT	#12 AWG	603084	ALPHA 2236/3

THE SENSOR MUST HAVE AT LEAST 9 VOLTS DC BETWEEN THE INTERFACE BOARD TERMINALS 1(+) AND 3(-) AT THE SENSING HEAD FOR PROPER OPERATION.

MAXIMUM LOAD RESISTANCE FOR THE SOURCING CURRENT LOOP OUTPUT IS CALCULATED AS FOLLOWS:

$$R_L = \frac{|\text{SUPPLY VOLTAGE}| - 3.5V}{.02 \text{ AMPS}}$$

4. FOR CALIBRATION, USE MSA CALIBRATOR P/N 485925.

QTY.

- ☐ 497524 CARBON MONOXIDE 0-500 PPM, 4-20 mA
- ☐ 497525 CARBON MONOXIDE 0-100 PPM, 4-20 mA
- ☐ 497526 OXYGEN 0-25%, 4-20 mA
- ☐ 497527 HYDROGEN SULFIDE 0-50 PPM, 4-20 mA

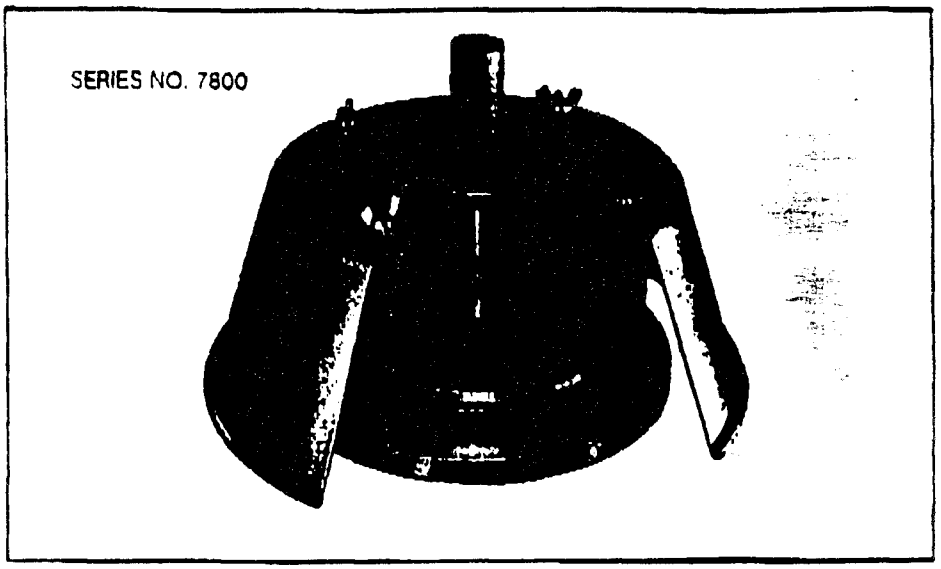
INSTRUMENT WEIGHT: 13.0 LBS. (5.9 KG.)
ENCLOSURE MATERIAL: CAST ALUMINUM, NEMA 7-9
RATING: CLASS I DIV I GROUP C & D

SAFETY WITHOUT COMPROMISE

No. 7800

Emergency Pressure Vent

Emergency Vent for Pressure Relief



OBJECTIVE

Protectoseal Series No. 7800 Emergency Relief Pressure Vents are designed to provide emergency relief capacity beyond that furnished by the operating vent on tanks, low pressure vessels and piping. Series No. 7800 Emergency Vents do not provide vacuum relief. Vacuum relief must be supplied by the operating vent with which the tank is equipped. (See Protectoseal Series Nos. 830, 8540, 6240, 18540, 16240.)

TECHNIQUE

Under normal operating conditions, the pallet assembly is closed providing a vapor-tight seal. In the event of an emergency (fire involvement of the tank) the pallet lifts to vent excess vapors thereby protecting tank from dangerous over-pressurization. Pallet automatically closes and reseals when the pressure is reduced.

CONSTRUCTION

Standard: 2-inch through 12-inch sizes—Aluminum base, hood and pallet assembly, Stainless Steel guides. 16-inch through 24-inch sizes—Steel flange with Stainless Steel seat, Steel hood, Aluminum pallet assembly, Stainless Steel guides. All sizes feature Protectoseal's unique FEP Teflon® Air Cushioned Seating.

Custom: Steel flange with Stainless steel seat, Steel hood, Stainless Steel pallet assembly and guides. Aluminum base and hood, Stainless Steel pallet assembly and guides (available in 2-inch through 12-inch sizes only). All Stainless Steel construction. All feature Teflon® Air Cushioned Seating. Other materials available upon request. Rubber or metal-to-metal seating also available.

SPECIAL FEATURES

Easy Inspection and Maintenance. Design and light weight of unit permit easy, convenient handling for inspection and maintenance. Coarse mesh screen prevents entry of foreign matter into seating area.

Maintains Accurate Settings. Factory testing prior to shipment assures every unit meets Protectoseal's stringent requirements for accuracy. Standard setting of 1 oz./sq. in. on all units. Higher settings are also available upon request.

Air-Cushioned Seating. A Protectoseal patented design. Unique vent seat incorporates a flat, smooth film of FEP Teflon® to form a floating air seal. Featuring peripheral guiding and center stabilizing stems to insure proper alignment and tight seating. Tested to insure low leak rates. Leakage rate at standard settings is no more than 1 cu. ft. of standard air per hour at 90% of the set point.

Numerous Sizes Available. 2-inch through 12-inch vents mate with standard A.N.S.I. flanged connections. 16-inch through 24-inch mate with applicable A.P.I. or A.N.S.I. bolting specifications. Other drilling patterns available on special request. See chart on reverse side for specific data.

Quality Assurance. Prior to shipment, each unit is factory tested for leakage and correct settings to meet Protectoseal's high standards.

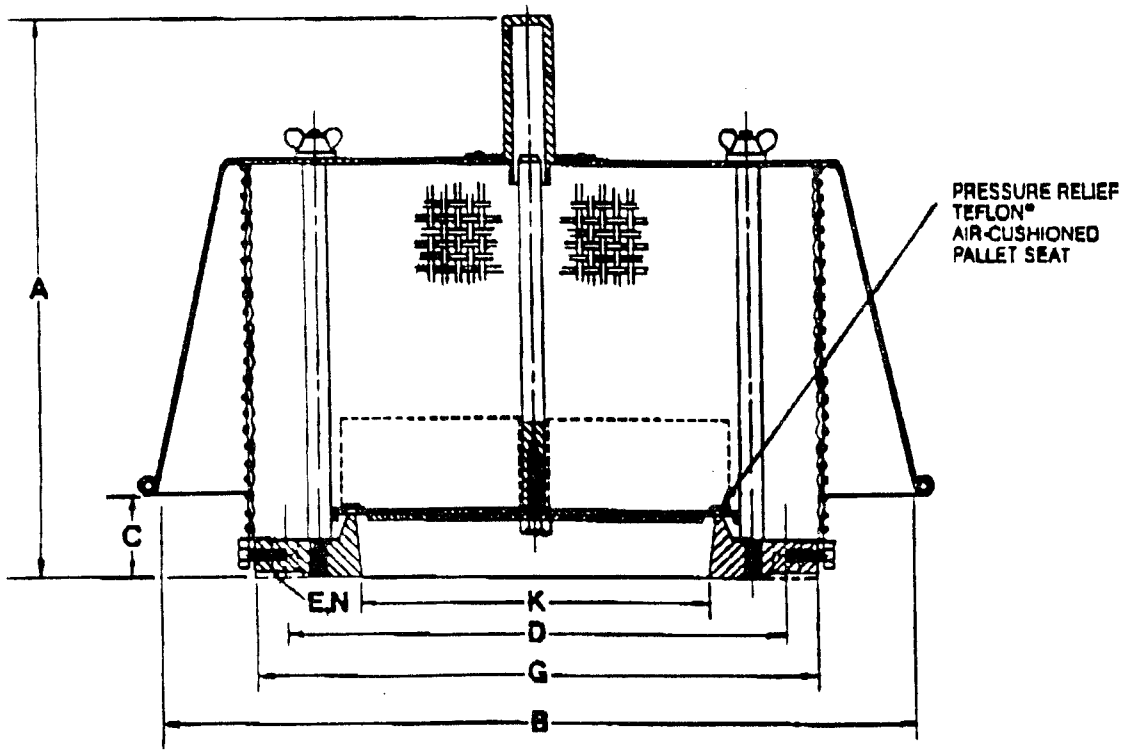
MATERIALS OF CONSTRUCTION

Series	Sizes	Base Flange/Seat	Hood	Pallet	Pallet Diaphragm
7800	2"-12"	Alum./Alum.	Aluminum	Aluminum	Teflon®
7800	16"-24"	Steel/316 S.S.	Steel	Aluminum	Teflon®
C7800	2"-12"	Steel/316 S.S.	Steel	316 S.S.	Teflon®
C7800	16"-24"	Steel/316 S.S.	Steel	316 S.S.	Teflon®
E7800	2"-12"	Alum./Alum.	Aluminum	316 S.S.	Teflon®
F7800	2"-12"	316 S.S./316 S.S.	316 S.S.	316 S.S.	Teflon®
F7800	16"-24"	316 S.S./316 S.S.	316 S.S.	316 S.S.	Teflon®

*On Steel and Aluminum vents weights are Steel or Lead. On Stainless Steel vents weights are Stainless Steel or Lead. 2"-12" Aluminum vents flanged to mate with 125# FF A.N.S.I., Steel and Stainless Steel units flanged to mate with 150# RF A.N.S.I. 16"-24" vents flanged to mate with applicable A.N.S.I. or A.P.I. FF flange connections.

Emergency Pressure Vent

SIDE VIEW



SERIES NO. 7800

DIMENSIONS

			Standard Construction					
[illegible]	[illegible]	[illegible]	B Width	C	D B.C.	E Dia.	G Dia.	No. N Holes
7802H	2"	8¼"	8½"	¾"	4¾"	⅝-11	6"	Stud
7803H	3"	10¼"	12¼"	2⅛"	6"	¾"	7½"	4
7804H	4"	10 9/16"	12¼"	2⅜"	7½"	¾"	9"	8
7806H	6"	13⅛"	14½"	2 11/16"	9½"	⅞"	11"	8
7808H	8"	15¼"	17"	3⅜"	11¾"	⅞"	13½"	8
7810H	10"	16⅝"	22¾"	2¼"	14¼"	1"	16"	12
7812H	12"	18⅝"	25⅛"	2¾"	17"	1"	19"	12
7816ASA	16"	20"	26¾"	6⅝"	21¼"	1⅛"	23½"	16
7820ASA	20"	20"	32"	6⅝"	25"	1¼"	27½"	20
7820API	20"	20"	32"	6⅝"	23½"	¾"	26"	16
7824ASA	24"	21"	40"	6⅝"	29½"	1⅜"	32"	20
7824API	24"	21"	40"	6⅝"	27½"	¾"	30"	20

Add prefix "C", "E" or "F" for other materials of construction. See chart on reverse side for material specifications.
Check with Sales Department for availability and scheduled delivery.

THE PROTECTOSEAL COMPANY
228 Foster Ave., Bensenville, IL 60106-1690
Phone 1-312-595-0800 Telex 28-2549

SAFETY WITHOUT COMPROMISE

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HP 7.5 KFY

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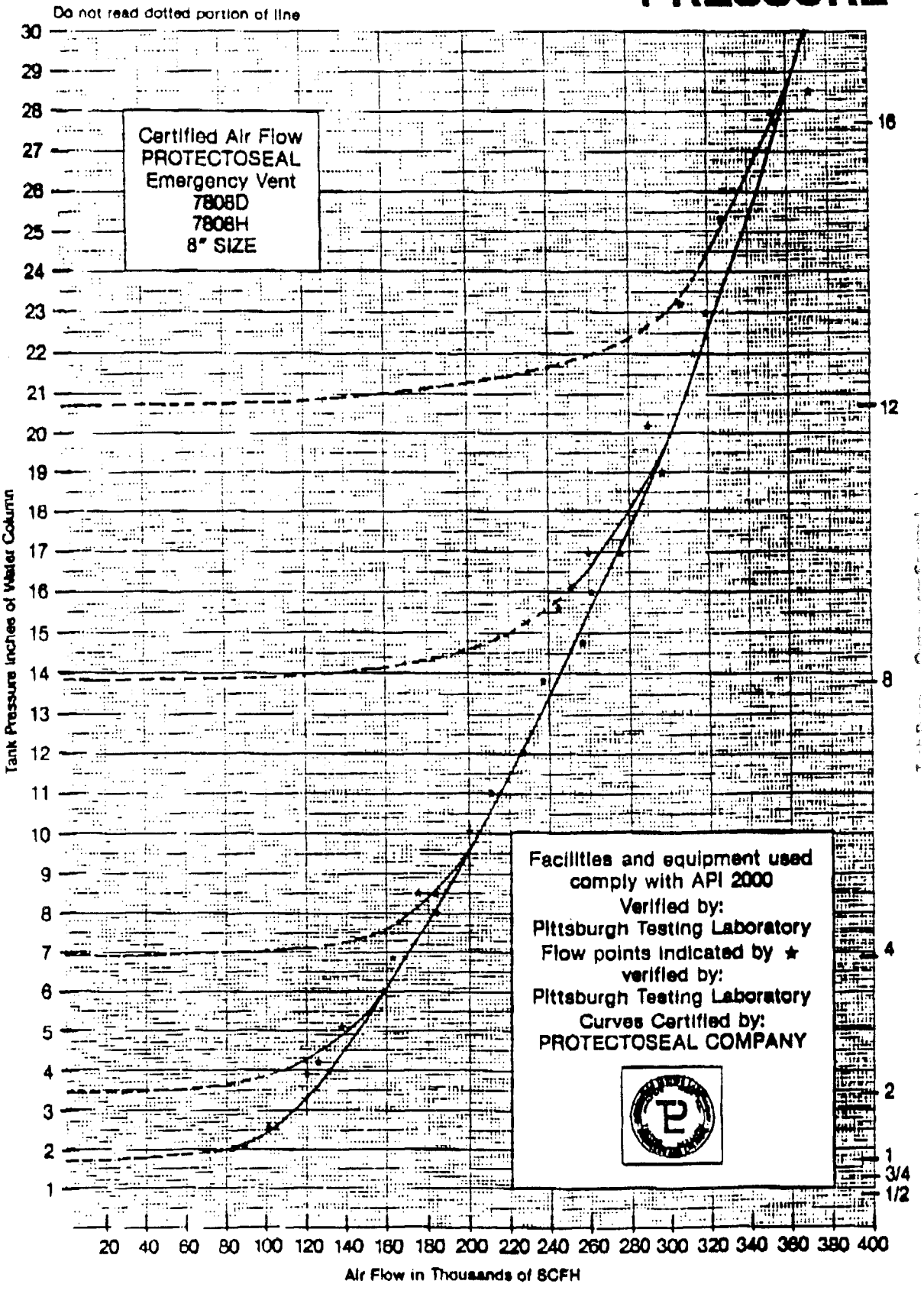
SAFETY WITHOUT COMPROMISE

No. 7000

Emergency Pressure Vent
Certified Air Flow Curves

PRESSURE



(06/94)

PyroMATION,® INC.

R. T. D.

Temperature Transmitter
Instruction Manual

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1. Limited Warranty

THE MODEL 401-185 RTD TRANSMITTER SOLD BY OR PURCHASED FROM PYROMATION, INC. OR FROM AN AUTHORIZED PYROMATION DISTRIBUTOR, OR AGENT IS SUBJECT TO THE FOLLOWING LIMITED WARRANTY.

This product is warranted to be free from functional defects in materials and workmanship at the time the product leaves the Pyromation, Inc. factory, and to conform at that same time to the specifications set forth in the relevant Pyromation, Inc. installation, wiring, operation manual for this product for a period of one year after shipment from the Pyromation, Inc. factory.

Pyromation's exclusive and sole obligation, and Buyer's exclusive and sole remedy under the above Limited Warranty is limited to either repair or replacement of such product, at Pyromation's option, free of charge to Buyer. Pyromation shall have no obligation to repair or replace unless the claimed defect in material or workmanship is reported in writing to Pyromation at 5211 Industrial Road, Fort Wayne, Indiana 46825 within ten (10) days after delivery to the Buyer from Pyromation or an authorized Pyromation distributor, representative or reseller. If so requested by Pyromation, the product shall be returned to a designated facility during normal business hours, transportation prepaid.

Any action for breach of this warranty or other action arising out of this contract must be commenced within one year after delivery.

Pyromation shall not be liable for any warranty, express or implied, other than the warranty stated above, and in the event of a breach of the above stated warranty, Pyromation shall not be liable for any incidental, consequential, special, or other damages, costs, or expenses other than repair or replacement as described above. Pyromation excludes any and all warranties of merchantability or fitness for a particular purpose. The above stated warranty extends only to the original Buyer from Pyromation, Inc. or from an authorized Pyromation distributor or agent, and may not be transferred or assigned.

2. General Information

The Pyromation RTD transmitter is designed to accept an input signal from an RTD sensing element, and to provide a linearized 4 to 20 mA output current. The output current is directly proportional to the temperature of the RTD temperature sensor.

Since the temperature is 'encoded' as current, voltage drops in the power-supply leads to the transmitter have no effect on the integrity of the signal. As long as the transmitter receives a DC voltage of 11 to 40 volts at its terminals, it will produce a current linearly proportional to temperature. This means that the transmitter may be remote mounted but should be near the sensor, reducing the effects of noise and minimizing errors due to long leads on the RTD sensor.

3. Features

- Small size allows universal mounting inside Series 300 Screw Cover Heads, Series 200 Explosion-Proof and Polypropylene Heads, Thermostat Housings, Electrical Handibox Enclosures, and Panel Surface Mounting
- Linearized 4 - 20 mA output
- Spring Loading Capability
- Screw Terminal Connections
- Accepts 2 or 3 wire RTD's *
- High Resolution 24 Turn Zero and Span Potentiometers
- **Each Unit Calibrated After a Minimum of 48 Hours Burn-in and Checkout Time**

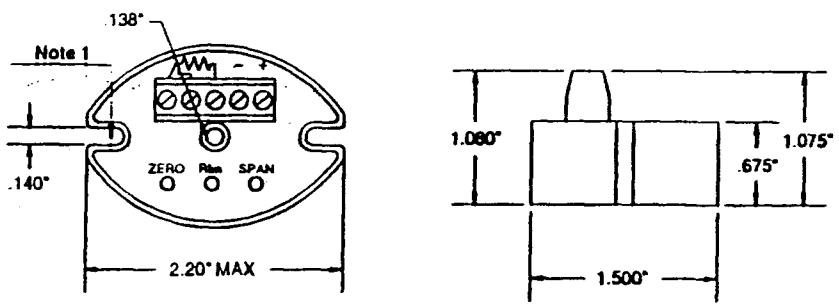
**** Three wire RTD's compensate for leadwire resistance***

4. *Standard Model 401-185 Specifications*

	SPECIFICATIONS
Sensor Input	Platinum RTD
Output Span	4 - 20 mA
Loop Powered Supply Voltage	11 VDC Min. to 40 VDC Max.
Minimum Temperature Span	50°F (28°C)
Maximum Temperature Span	1000°F (556°C)
Calibrated Accuracy	.1%
Conformity	.1% of Span
Ambient Temperature Limits	-30 to 165°F (-34 to 74°C)
Power Supply Effect	.001%/Volt
Minimum Current	3.4mA
Maximum Current	30mA
Upscale Burnout	Standard
Reverse Polarity Protection	Standard
Nominal Zero Adjustment	+/- 10%
Nominal Span Adjustment	+/- 10%
Connections	Screw Terminal
Dimensions (figure 1)	See Below

5. *Dimensions*

Figure 1



6. *Power Supply*

Transmitters are designed for a nominal 24 VDC power supply. The transmitters will operate with an 11 to 40 VDC supply at the transmitter power supply terminals. Use the following formulas to determine the maximum resistive loading (RL) allowed for the power supply used, or to determine minimum supply voltage (V) required for fixed resistive loads. The formulas assume a maximum current of 20 mA.

POWER SUPPLY VOLTAGE
(Minimum)

V = (.02 A x RL) + 11V

Example:
650 Ohm Load
.02A x 650 Ohm = 13 Volts
V = 24 VDC Minimum Power Supply

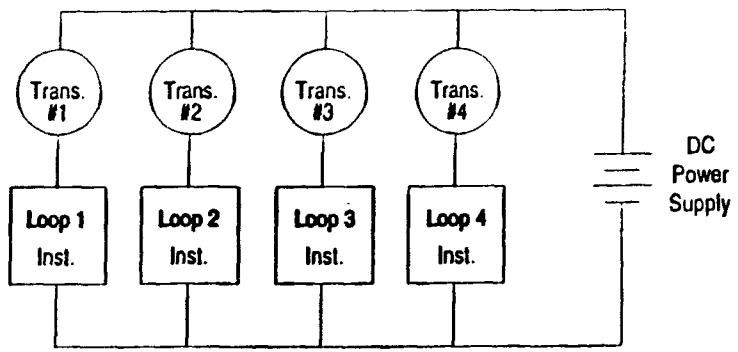
RESISTIVE LOAD
(Maximum)

RL = (V - 11) / .02A

Example:
24 VDC Power Supply
RL = (24 V - 11 V) / .02A
RL = 650 Ohms Maximum

One power supply can be used for several transmitter loops. Each loop must have only one transmitter in it and all loops must be wired in parallel. Do not forget to observe the maximum current rating for your power supply (4 loops each running with open RTD's results in 100mA of current - see Figure 2 below).

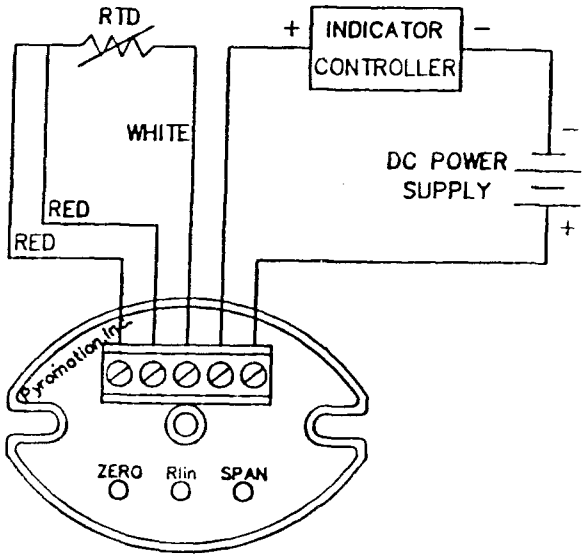
Figure 2



7. *Wiring*

The terminal strip on the transmitter can accept wire gauges from 14 to 22. Copper wire is to be used since special compensation wire is not required. All transmitter wiring should be run in separate conduit to isolate from high voltage or high current carrying lines.

Figure 3
Model 401 - 185

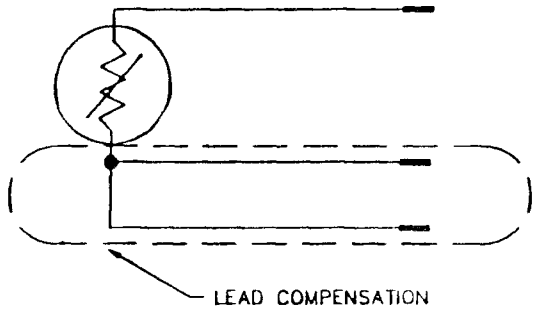


8. *Open Sensor Indication*

When an RTD has failed due to an open sensor (broken path in the element), the transmitter will indicate an error. The way the error is produced is by either driving the current low, under 4mA **(downscale burnout)** or by driving the current high, above 20mA **(upscale burnout)**. Upscale burnout is standard for all Pyromation transmitters.

However, the burnout indication does not apply to a break in the lead compensation loop. In this case, the burnout signal will drive the transmitter either high or low depending upon which lead has been broken.

Figure 4



9. *Model Number*

Example Order Number:

401 - 1 8 5 - (Range Code From Page 8) F - 01

Table 1

Transmitter Style	
ORDER CODE	DESCRIPTION
1	Non Programable - Linearized Non Isolated - .1% Accuracy

Table 2

Input Sensor	
ORDER CODE	DESCRIPTION
85	100 Ohm Platinum .00385
91	100 Ohm Platinum .00392

Table 3

Range Code Unit	
ORDER CODE	DESCRIPTION
F	Degrees F
C	Degrees C

Table 4

Options	
ORDER CODE	DESCRIPTION
00	Upscale Burnout 4 - 20 mA Output
01	Downscale Burnout 4 - 20 mA Output

Range Codes

Select Desired Range
From
Range Codes on Page 8

10. *RTD Range Codes*
(100 Ohm Platinum)

RANGE CODES			
RANGE CODE	TEMPERATURE RANGE	RANGE CODE	TEMPERATURE RANGE
1110	-100 to 100° F or C	3065	20 to 120° F or C
1380	- 50 to 50° F or C	3115	30 to 230° F or C
1725	0 to 50° F or C	3200	50 to 100° F or C
1750	0 to 100° F or C	3208	50 to 150° F or C
1775	0 to 150° F or C	3213	50 to 200° F or C
1800	0 to 200° F or C	3218	50 to 250° F or C
1825	0 to 250° F or C	3224	50 to 300° F or C
1850	0 to 300° F or C	3505	100 to 200° F or C
1875	0 to 350° F or C	3515	100 to 300° F or C
1900	0 to 400° F or C	3520	100 to 400° F or C
1925	0 to 450° F or C	3568	150 to 250° F or C
1950	0 to 500° F or C	3573	150 to 300° F or C
2000	0 to 600° F or C	*Consult factory for temperature ranges not listed*	
2100	0 to 800° F or C		
2200	0 to 1000° F or C		

Consult factory for specifications and availability of other ranges

11. Troub. ıooting

Problem	Possible Causes
No Current Flow in Signal Loop	• Current loop may be open at some point
	• No voltage out at power supply
	• Wrong polarity on loop connection
Current Over 20mA	• RTD is open
	• Current loop connections shorted
Erratic Readings	• Loose connection in RTD or signal loop
	• Damaged RTD
	• AC noise on loop connections
	• Exceeds loop resistance R_L

12. Possible Wiring Errors

Destructive Errors

- Do not connect power to the RTD input; this could destroy the transmitter
- Do not connect power to the RTD itself
- Do not use AC line power

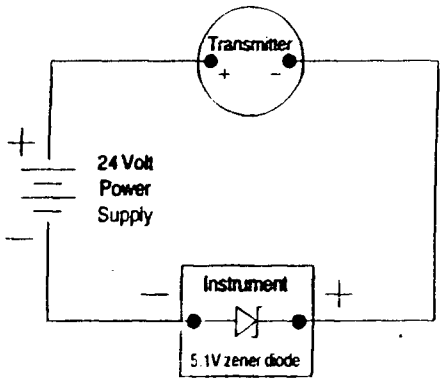
Non-Destructive Errors

- Reversing the polarity off the power supply
- Do not connect multiple transmitters in series

13. Application Hints

The calibrated output of the Pyromation transmitter is 4.0 to 20.0 mA. However, the lower and upper limit of output current is approximately 2.8 and 25mA respectively. This means that for a system using a 250 ohm resistor (1 to 5V), the maximum voltage could be as high as 6.25 volts (25mA x 250 ohms) in the case of an open RTD. Some computer-based systems will not tolerate input voltages greater than approximately 5.5 volts. Instead of selecting a different scaling resistor (200 ohms for example gives 5V for an open RTD), a 5.1V zener diode in parallel with the scaling resistor will clamp the voltage across the scaling resistor to 5.1V while still allowing the calibrated range to remain 1 to 5 volts. See figure 5 below.

Figure 5



The transmitters dissipate power according to the formula:

Power = Volts x Amps

The dissipated power is equal to the voltage at the transmitter's terminals multiplied by the operating current. A transmitter with 20 volts at its terminals and with maximum current (25 mA for an open RTD) will dissipate 0.5 watts of power. This can be significant if the RTD sensor can be affected by thermal gradients from the transmitter.

Pyromation RTD transmitter modules are factory calibrated. If recalibration is necessary, a **zero** **Rlin**, and **span** adjustment can be made from the top of the unit. If it is inconvenient to use an RTD sensing element to calibrate the transmitter, fixed resistors or a decade box of suitable accuracy may be substituted. Adjustment of the unit is as follows:

1} With a resistance value corresponding with the temperature at 4.0mA, adjust the **zero** potentiometer for 4.0mA output.

2} With a resistance value corresponding with the temperature at 12.0mA, adjust the **Rlin** potentiometer for 12.0mA output. Refer to Example 1.

3} With a resistance value corresponding with the temperature at 20.0mA, adjust the **span** potentiometer for 20.0mA output

4} The **zero**, **Rlin**, and **span** adjustments are interactive. Repeat steps 1,2, and 3 as necessary.

Example 1: Determining calibration points

1} If range equals 50-250°, then span equals 200°
2} Divide 200° by 2 — 200° ÷ 2 = 100°
3} Add 100° to lower end of range — 50° + 100° = 150°
4} 50° equals the **zero** point (4mA)
5} 150° equals 50% of the **span** (12mA) (Rlin)
6} 250° equals the **span** point (20mA)

Example 2: To calibrate 4 - 20mA for a range of -100 to 100°F

(Span equals 200°F)

1} Set **zero** at 4.0mA for -100°F (70.95Ω)
2} Set **Rlin** at 12.0mA for 0°F (93.01Ω)
3} Set **span** at 20.0mA for 100°F (114.68Ω)

Resistance (Ω)

100 ohm Platinum, α = .00385

°F	0	- 20	- 40	- 60	- 80	- 100	Ω / °F *
-400	4.49	2.30	——	——	——	——	——
-300	25.10	20.33	15.65	11.21	7.42	4.49	0.206
-200	48.38	43.80	39.18	34.54	29.87	25.10	0.233
-100	70.95	66.49	62.00	57.49	52.95	48.38	0.226
0	93.01	88.61	84.21	79.81	75.39	70.95	0.221
°F	**0**	**20**	**40**	**60**	**80**	**100**	**Ω / °F ***
0	93.01	97.38	101.74	106.06	110.38	114.68	0.217
100	114.68	118.97	123.24	127.48	131.74	135.97	0.213
200	135.97	140.18	144.38	148.57	152.74	156.90	0.209
300	156.90	161.04	165.17	169.29	173.39	177.48	0.206
400	177.48	181.55	185.61	189.65	193.68	197.69	0.202
500	197.69	201.69	205.68	209.65	213.61	217.55	0.199
600	217.55	221.48	225.40	229.30	233.19	237.06	0.195
700	237.06	240.92	244.76	248.59	252.40	256.20	0.191
800	256.20	259.99	263.76	267.52	271.26	274.99	0.188
900	274.99	278.71	282.41	286.10	289.77	293.43	0.184
1000	293.43	297.07	300.70	304.32	307.92	311.50	0.181
1100	311.50	315.07	318.63	322.18	325.71	329.22	0.177
1200	329.22	332.72	336.21	339.68	343.14	346.58	0.174
1300	346.58	350.01	353.43	356.83	360.21	363.59	0.170
1400	363.59	366.95	370.29	373.62	376.93	380.23	0.167
1500	380.23	383.52	386.79	390.05	——	——	0.164

** Average value for 100° range*

16. Temperature (°C) vs. Resistance (Ω)

100 ohm Platinum, α = .00385

° C	0	- 20	- 40	- 60	- 80	- 100	Ω / °C *
-200	18.44	10.35	4.49	——	——	——	——
-100	60.20	52.04	43.80	35.28	27.03	18.44	0.418
0	100.0	92.13	84.21	76.28	68.28	60.20	0.398
° C	**0**	**20**	**40**	**60**	**80**	**100**	**Ω / °C ***
0	100.00	107.79	115.54	123.24	130.89	138.50	0.385
100	138.50	146.06	153.57	161.04	168.47	175.84	0.373
200	175.84	183.17	190.46	197.70	204.88	212.03	0.361
300	212.03	219.13	226.18	233.19	240.15	247.06	0.350
400	247.06	253.93	260.75	267.52	274.25	280.93	0.338
500	280.93	287.57	294.16	300.70	307.20	313.65	0.327
600	313.65	320.05	326.41	332.72	338.99	345.21	0.315
700	345.21	351.38	357.51	363.59	369.62	375.61	0.304
800	375.61	381.55	387.45	———	———	———	0.295

** Average value for 100° range*

17. Notes

APPENDIX

43-9

TANK ASSESSMENT

OPERATIONS DATA	TANK IDENTIFICATION		
	DISPERSION TANK	OVERFLOW TANK (PUMP FEED CHAMBER)	REMARKS
PRIMARY USE	Mixing tank compatible flammable wastes	Pump feed chamber	
OPERATING TEMPERATURE	Ambient	Ambient	
OPERATING PRESSURE	ATM	ATM	
TANK VENT & SIZE	Vented thru Drum Scraping Chamber and carbon bed to atmosphere, 2" Ø	Vented thru Drum Scraping Chamber and carbon bed to atmosphere, 2" Ø	Emergency vent located on Dispersion Tank, set at 1 PSI
WASTE pH	4 to 10	4 to 10	
WASTE SPECIFIC GRAVITY	1.8	1.8	
FEED SYSTEM	By screw conveyor from drum scraping chamber and by pumps 163 - automatic	By overflow drain from Dispersion Tank	
SAFETY CUT-OFF	Thru overflow tank	Automatic/manual	Automatic for pumps #167 & 163. Manual for drums feed.

TANK ASSESSMENT

PHYSICAL DATA	TANK IDENTIFICATION		
	DISPERSION TANK	OVERFLOW TANK (PUMP FEED CHAMBER)	REMARKS
DESIGN CAPACITY	1493 gal.	311 gal.	
TANK SHAPE	Vertical cylindrical with dish top and bottom, supported by legs	Vertical cylindrical with dish top and cone bottom supported by legs	
DIAMETER X HEIGHT	6' Ø x 5' straight, shell and bottom dish is 3/8" tk. Top dish is 3/4" tk.	3' Ø x 90" straight, shell cone and dish are 3/8" tk.	
TANK DESIGN CODE	In accordance with ASME Boiler & Pressure Vessel Code, Sec. VII, Div. I, 1992 Edition, 1993 Addendum	In accordance with ASME Boiler & Pressure Vessel Code, Sec. VII, Div. I, 1992 Edition, 1993 Addendum	
OPERATING CAPACITY	1195 gal.	243 gal.	
MATERIAL OF DESIGN CONSTRUCTION	Carbon steel	Carbon steel	
INTERNAL CORROSION PROTECTION	None	None	Externally painted
YEAR BUILT	1995	1995	
TYPE OF FOUNDATION	Concrete slab	Concrete slab	

APPENDIX

43-10

Clean Harbors Environmental Services, Inc.
609 PLEASANT STREET
WEYMOUTH, MA 02189

CUSTOMER
CLEAN HARBORS/CHICAGO/CWM
11700 SOUTH STONY ISLAND AVENUE
CHICAGO, ILLINOIS 60617

PROJECT
FUELS BLENDING/PUMP FEED CHAMBER

VESSEL DESCRIPTION
VERTICAL PRESSURE VESSEL
Vessel Number: -
Drawing Number: 94-31-M28
ASME Code stamped: No
Vessel designed per the ASME Boiler & Pressure Vessel Code, Section VIII, Division 1. 1992 Edition, 1993 Addenda

JOB NUMBER
GW5537

NAMEPLATE INFORMATION
MAWP: 15.00 PSI at 150xF
MDMT: -20xF at 15.00 PSI

Serial Number(s): NONE
National Board Number(s): _____

Year built: 1995
Radiography: None
Postweld heat treated: No
Lethal service: No

1. Vessel designed, constructed, inspected and tested in accordance with ASME CODE but not stamped.

Q.C. Manager _____ date: 4/6/9

Authorized Inspector _____ date: ___/___/__

ENVIRONMENTAL SERVICES, INC.

HYDROSTATIC/PNEUMATIC TEST RECORD

Job #GW5537 Date 5-9-95

Customer GH/CHICAGO/CWM
11700 S. STONY ISLAND AVE

Test Item PUMP FEED CHAMBER Drawing #9931-M28 Rev 2

Applicable Specification ASME CODE, SECTION VIII, DIV 1, 1992/94 APPENDIX

TEST PREPARATION:

- ✓ Joints Accessible
- — Relief valves (press & liq)
- ✓ Test Boundaries (valve/blank)
- ✓ System Vented
- ✓ Test Gauges in place
- — Expansion Joints Restrained
- — Low Press Equipment Isolated
- ✓ System supports sufficient
- ✓ Connections Checked
- — Recorder Serial #_____

TEST PARAMETERS:

Gauge Range 0 PSIG to 100 PSIG (1-1/2 to 4 X test press)

Gauge Calibration
1. I.D.# PG 45 Due Date_____
2. I.D.#_____ Due Date_____
3. I.D.#_____ Due Date_____

Test Pressure - Internal 25 PSIG - External — PSIG

Test Medium --- WATER Condition TAP

Test Temperature 70 'F (70'F min Sec I/60'F min Sec 8,11 & B31.1)

Ambient Temperature 70 'F

TEST PROCEDURE:

- ✓ Venting open during filling
- ✓ Venting closed after filling
- ✓ Preliminary Pressure test for leaks (5/10 PSIG)
- ✓ Time at test pressure (9:00AM)
- ✓ Hold for — Hours 10 Minutes
- ✓ Drop in pressure Allowable — Observed 0
- ✓ Decrease test pressure and Hold @ — and/or release
- ✓ Tank vented prior to draining (prevention of tank collapse)

RESULTS:

Retest_____ Reject_____ Accept ✓

Test conducted by: JOHN PANDERGAST QC Witness L. SPAZIANI QCM

SMAK INC
FT WAYNE, IN

OB# _____ DATE 5-12-95
CUSTOMER CLEAN HARBORS

TEST ITEM 1125 GALLON TANK DRAWING# CC123318 REV 10-6-94
APPLICABLE SPECIFICATION _____

TEST PREPARATION:

- X JOINTS ACCESSIBLE
- ____ RELIEF VALVES (PRESS & LIQ)
- ____ VALVE BOUNDRIES
- ____ SYSTEM VENTED
- X TEST GAUGES IN PLACE
- ____ EXPANSION JOINT RESTRAINED
- X LOW PRESSURE EQUIPMENT ISOLATED
- X SYSTEM SUPPORT SUFFICIENT
- X CONNECTIONS CHECKED
- ____ RECORDER SERIAL #

TEST PARAMETERS:

GAUGE RANGE 0 PSIG TO 100 PSIG (1-1/2 TO 4 X TEST PRESS)
GAUGE CALIBRATION
1. I.D.# _____ DUE DATE _____
2. I.D.# _____ DUE DATE _____
3. I.D.# _____ DUE DATE _____

TEST PRESSURE-INTERNAL 25 PSIG-EXTERNAL 0 PSIG
TEST MEDIUM— AIR CONDITION _____
TEST TEMPERATURE 80 DEG F (70 DEG F MIN SEC I/60 F MIN SEC 8,11 & B 31.1
AMBIENT TEMPERATURE 80 DEG F

TEST PROCEDURE

- ____ VENTING OPEN DURING FILLING
- ____ VENTING CLOSED AFTER FILLING
- X PELIMINARY PRESSURE TEST FOR LEAKS (30 PSIG)
- ____ TIME AT TEST PRESSURE (_____)
- X HOLD FOR 0 HOURS 20 MINUTES
- ____ DROP IN PRESSURE ALLOWABLE 1 OBSERVED 1
- X DECREASE TEST PRESSURE AND HOLD @ 25 AND/OR RELEASE
- ____ TANK VENTED PRIOR TO DRAINING (PREVENTION OF TANK COLLAPSE)

RESULTS:

RETEST _____ REJECT _____ ACCEPT X

TEST CONDUCTED BY: DAVE MOCK QC WITNESS TIM DELONG

TOTAL P.02

UNIT #60

Unit #60 - Roll-Off Pad for Fuels Blending is a new concrete structure covered by an overhead canopy to prevent accumulation of precipitation. The pad is adjacent to the north side of Building #43. This area is used for the accumulation/storage of crushed, RCRA empty drums from the Pegasus System.

Unit #60 - Roll-Off Pad for Fuels Blending is a crushed drums storage unit authorized under the June 30, 1995 modified RCRA Part B issued to CHCI.

The storage pad is constructed of a 10-inch thick reinforced concrete slab with a side curb. The curb minimum height is 3 inches. The concrete pad is sloped to a collection sump.

For construction details, see CHCI Dwg. No. 4213 (Dwg. No. 2916-M-07 Rev. 0, dated 09/15/95) in Appendix 60-1. For calculations of the structural integrity, see Appendix 60-2. The containment calculations are on Dwg. CHCI 4213.

The entire concrete secondary containment is topped with the chemically resistant Protecto-Coat 900 coating system, 30 mils thick, as manufactured by Dudick, Inc. For technical information and application instructions on coating, see Appendix 60-3. For Chemical Resistance Chart, see Appendix 43-1.

There are the following deviations from Part B Approved and As-Built condition shown on CHCI Dwg. No. 4213 (Dwg. No. 2916-M-07):

Rev. G - 01/19/95 Part B Approved	As-Built - Rev. 0 - 09/15/95
1. Section D-D	Added roof plan for Roll-off Pad. Added steel sizes.

During the visual inspection on September 12, 1995, the Roll-Off Pad was in good condition. There were no scrapes of the protective coating. There were no cracks, gaps or any other structural damage or inadequate construction/installation of the concrete secondary containment.

Therefore, the structure is suitable for intended use.

APPENDIX

60-1

APPENDIX

60-2

State of Illinois
ENVIRONMENTAL PROTECTION AGENCY

Mary A. Gade, Director

2200 Churchill Road, Springfield, IL 62794-9276

217-524-3300

CHCI

November 7, 1995

Mr. Paul A. Ahearn
Manager, Regulatory Compliance
Clean Harbors Environmental Services, Inc.
1200 Crown Colony Drive
P.O. Box 9137
Quincy, MA 02269-9137

Re: 0316000051 -- Cook County
Clean Harbors of Chicago, Inc.
Log No. 16-TA-2, B-16-M-2
Administrative Record

Dear Mr. Ahearn:

The Agency has completed its review of the Construction Certification Report for the Ignitable Container Management Building (Unit 26) dated September 9, 1995 and the additional information provided on the following dates:

October 6, 1995:	As-built drawings of the fume hood in Building 26,
October 23, 1995:	Response to Agency comments dated 10-17-95 that were faxed to CHCI on 10-20-95,
October 23, 1995:	Photographs of the labpack operations in Building 26 (included with the review notes for the Tank Farm - Unit 16 CCR),
November 1, 1995:	P.E. certification for the dry chemical fire extinguisher system installed above the labpack consolidation area in Building 26.

The Agency inspected this unit on September 12, 1995. The unit was not constructed in accordance with the approved plans because the ramps on the south wall of the building were not removed. This resulted in the ramps extending into the area that is used for container storage. As a result, the Agency has approved the unit subject to the following condition:

> The permittee shall not place containers of waste on the ramps inside Building 26. If the permittee modifies the existing ramps to comply with the approved RCRA permit application, they must submit a Construction Certification Report as specified in Attachment C of the RCRA Permit and receive the Agency's approval of the Report prior to placing containers of waste in this area.

If you have any questions regarding this letter, please feel free to call Rob Watson, P.E. at 217/524-3265.

Sincerely,

Edwin C. Bakowski, P.E.
Manager Permit Section,
Bureau of Land

ECB:WRW:bjh\95591.WPD
JK

cc: Matt Dunn, IAG
George Hamper, USEPA - Region V
Tony Martig, USEPA - Region V, TSCA
Jim Laubstead, CHCI

State of Illinois
ENVIRONMENTAL PROTECTION AGENCY

CHCI

Mary A. Gade, Director

2200 Churchill Road, Springfield, IL 62794-9276

217/524-3300

November 7, 1995

Mr. Paul A. Ahearn
Manager, Regulatory Compliance
Clean Harbors Environmental Services, Inc.
1200 Crown Colony Drive
P.O. Box 9137
Quincy, MA 02269-9137

Re: 0316000051 -- Cook County
Clean Harbors, Inc.
Log No. 16-TA-2, B-16-M-2
Administrative Record

Dear Mr. Ahearn:

The Agency has completed its review of the Construction Certification Report (CCR) for Unit 16 - Flammable Storage Tank Farm and Unit 25 - Container Management Building. The CCR for these units was dated July 25, 1995. Additional information submitted for this CCR was dated:

August 29, 1995	- List of changes to the drawings approved in the Permit;
September 12, 1995	- Response to verbal Agency comments made on 9-8-95;
September 13, 1995	- Sketch of the fume hoods in Buildings 25 and 26;
October 6, 1995	- As-built drawings of the fume hoods in Buildings 25 & 26;
October 19, 1995	- Response to Agency comments faxed to CHCI on 10-10-95;
October 23, 1995	- Photographs of the Tank Farm and Building 26;
November 2, 1995	- Description of the low pressure switch for T-250, (associated with the fire protection system);
November 3, 1995:	- Revised P.E. Certification for hydrostatic test of tanks.

The Agency inspected these units on September 12, 1995. Pursuant to the Agency's review and inspection, the Construction Certification Report for Unit 16 - Flammable Storage Tank Farm and Unit 25 - Container Management Building is approved subject to the following conditions:

1. The permittee shall not pump waste through Pumps 173, 176, or 188 until the permittee installs and tests these pumps and pipe connections to comply with the approved RCRA permit application. The permittee shall submit a Construction Certification Report as specified in Attachment C of the RCRA Permit and receive the Agency's approval of the Report prior to pumping waste through these pumps.

2. The permittee shall not operate any heat tracing that is on a pipeline used to transport wastes at the facility until the permittee submits as-built P & ID drawings of the heat tracing and groundfault interruption circuits on the waste pipelines to comply with the approved RCRA permit application. The permittee shall submit a Construction Certification Report as specified in Attachment C of the RCRA Permit and receive the Agency's approval of the Report prior to operating the heat tracing systems on the pipes.

3. The permittee shall color code all valves, piping, pumps and flexible hoses that are used for PCB wastes prior to placing wastes in the tank farm. This color coding system shall be maintained such that it is clearly visible at all times.

If you have any questions regarding this letter, please feel free to call Rob Watson, P.E. at 217/524-3265.

Sincerely,

Edwin C. Bakowski, P.E.
Manager Permit Section,
Bureau of Land

ECB:WRW:bjh:95589.WPD

cc: Matt Dunn, IAG
George Hamper, USEPA - Region V
Tony Martig, USEPA - Region V, TSCA
Jim Laubstead, CHCI

State of Illinois
ENVIRONMENTAL PROTECTION AGENCY

Mary A. Gade, Director

2200 Churchill Road, Springfield, IL 62794-9276

217/524-3300

November 7, 1995

Paul A. Ahearn
Clean Harbors Environmental Services, Inc.
325 Wood Road
Braintree, Massachusetts 02184

Re: 0316000051 -- Cook County
Clean Harbors of Chicago, Inc.
ILD000608471
Log No. B-16-M-2
RCRA Permit File

Dear Mr. Ahearn:

The Agency has completed its review of the Construction Report dated September 15, 1995 for the Fuels Blending Operation (Unit #43) and the Roll-Off Pad for Fuels Blending (Unit #60). The Agency inspected these units on October 13, 1995. Pursuant to the Agency's review and inspection, the Construction Certification Report for the above units is approved.

Should you have any questions or comments regarding the contents of this letter, please contact Mark A. Schollenberger, P.E. of my staff at 217/524-3307.

Sincerely,

Edwin C. Bakowski, P.E.
Manager, Permit Section
Bureau of Land

ECB:MAS\mls\95552.WPD

cc: USEPA, Region V
Clean Harbors of Chicago, Inc.

Printed on Recycled Paper

APPENDIX

60-3

Dudick Inc.

Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Streetsboro, Ohio 44241
216-562-1970
FAX No. 216-562-7638

Protecto-Coat 800/900/ 805/905

FLAKE-FILLED HIGH PERFORMANCE VINYL ESTER COATING, 30-40 MILS (1.0 mm)

Protecto-Coat Systems are designed to protect concrete and steel from splash and spills and mild immersion exposures of organic, inorganic acids, alkalies and solvents. The 805/905 adds fluoride protection.

RECOMMENDED APPLICATIONS

- Structural Steel
- Elevated Water Storage Towers
- Plating Lines, Exterior
- Pickling Lines, Exterior
- SO_2 Scrubber Duct Work
- Spent Carbon Storage
- Floors (Spillage)
- Steel Pump Supports
- Thickener Mechanisms
- Underground Tanks and Piping
- Catwalks
- Interiors of Chemical Storage Tanks

CHEMICAL RESISTANCE

- Organic Acids
- Inorganic Acids
- Alkali Solutions
- Solvents (900 only)
- Oils
- Salts

A complete listing of substances and concentrations tested is available on request.

Temperature Limits:
Immersion up to 120°F
Dry — 250°F – Continuous
300°F – Intermittent

PHYSICAL PROPERTIES

Tensile Strength ASTM C307	2,500-2,800 PSI
Flexural Strength ASTM C790	5,000-5,200 PSI
Adhesion to Steel	2,000 PSI
Barcol Hardness	35-40
P-Coat 805/905 Electrical Properties	1.5-2.0 Megaohms
Color	White, Gray
Solids	100% Reactive

SPECIFICATIONS

Coating shall be 30-40 mils thick, flake-filled vinyl ester based resin, consisting of a base and topcoat of 15-20 mils each, as manufactured by Dudick, Inc. Materials shall be brush, roller, or spray applied in accordance with manufacturer's recommended practices.

OTHER PROTECTO-COAT 800/900 COATINGS AVAILABLE

Protecto-Coat 800 and 900 coatings are two distinct formulations designed to offer a wide range of high performance coatings suitable for many different industrial and manufacturing applications. In turn, each coating may be chosen with flake or graphite fillers to enhance the protection necessary for a specific chemical environment, and is available in formulations for either brush, roller or spray application. All Protecto-Coat 800 and 900 coatings (except graphite filled) are available in white or gray.

Protecto-Coat 800 is a thermosetting vinyl ester coating which utilizes a flake filler for resistance to a wide variety of acids, caustics, salts, oils and mild alkali solutions, and offers superior protection against organic acids and caustics. The 800 series offers the most versatile protection in the Protecto-Coat line and is the most widely used vinyl ester.

Protecto-Coat 801 is Protecto-Coat 800 formulated for two component spray application.

Protecto-Coat 805 is a Protecto-Coat 800 coating with graphite flake fillers for improved protection against fluorides and higher caustic concentrations or where conductive properties are needed.

Protecto-Coat 900 is a higher cross link density coating and offers the highest solvent and acid resistance.

Protecto-Coat 901 is Protecto-Coat 900 for two component spray application.

Protecto-Coat 905 is Protecto-Coat 900 with graphite flake fillers for improved protection against fluorides and higher caustic concentrations or where conductive properties are needed.

THE PROTECTO-COAT SYSTEM

The Protecto-Coat System uses two layers of thermosetting flake-filled vinyl ester resins to build up the protection that vulnerable steel and concrete need in chemically oriented manufacturing or processing operations. When fully cured, the separate elements lose their individual identity and become a single, monolithic coating.

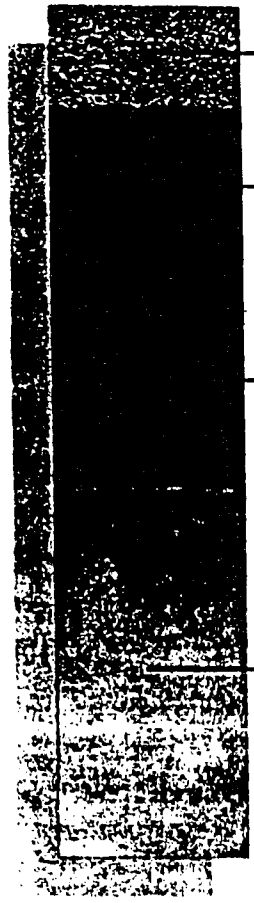
Primer 27 is designed to prevent abrasive-blasted steel from developing rust bloom prior to the application of a Protecto-Coat coating. For maximum performance all steel surfaces should be primed, but primer may not be needed for mild, non-immersion service. Concrete, however, must always be primed to aid in the "wetting out" required for good bonding.

Basecoat/Topcoat: Protecto-Coat resins are filled with flakes or graphite flakes to reduce the coefficient of expansion. Protecto-Coat 800/900 resins, filled with flakes or graphite flakes, provide a chemical resistant outer barrier. Overlapping leaf arrangement of flakes reduces water vapor permeation and permits chemical exposures at higher temperatures without increasing the thickness of the coating.

ESTIMATING QUANTITIES AND ORDER BILL OF MATERIAL

Note: Resins include 3 oz. hardener as standard.

SQUARE FEET PER GALLON		
	CONCRETE	STEEL
Primer 27	150-200	250-300
P-Coat 800/900/805/905		
Actual 30-40 Mil. DFT	30	30
Theoretical 30-40 Mil. DFT	45	45
S-10 Solvent	500	500



Quantities shown are for estimating purposes only. Actual field usage may very.

APPLICATION INSTRUCTIONS

SURFACE PREPARATION

Metal: For immersion service, abrasive blast to a white metal finish and a 2-3 mils minimum profile according to SSPC 5 or NACE #1. For fume or splash service, abrasive blast to a near white metal finish according to SSPC 10.

Concrete: Concrete must be abrasive blasted or etched with muriatic acid (Solution of 1 part 20° Be HCl and 1 part water) to remove surface laitance and other contaminants. Concrete must be free of curing compounds and form release agents. Surface texture should be similar to 40-60 grit sandpaper. Additional surface preparation will be required if a 40-60 grit texture is not achieved and the surface laitance not completely removed after a single application of acid or with the first mechanical preparation procedure.

If after abrasive blasting, honeycombs/voids appear on the concrete or steel, these have to be filled with a suitable material. Contact a Dudick Representative for this information.

Hardener Amount/Gal. Resin.

HARDENER	SUBSTRATE TEMPERATURE	PRIMER 27	P-C 800/900 BASECOAT/ TOPCOAT	P-C 805/905 BASECOAT/ TOPCOAT
PH-1	60°-70°F	3-4 oz.	3-4 oz.	3-4 oz.
PH-1	70°-90°F	2-3 oz.	2-3 oz.	2-3 oz.

Recommended application temperatures should be between 50°F and 110°F substrate temperature.

PRIMING

Metal: For maximum performance, prime all steel surfaces with Primer 27 3-4 mil. WFT, mixed with appropriate amount of PH-1 Hardener. For mild non-immersion service, priming of steel may be omitted.

Concrete: Concrete surfaces must be primed using Primer 27 and the appropriate amount of PH-1 Hardener. Concrete must be thoroughly dry before application of primer by spray, roller, or brush. Do not allow the primer to puddle.

BASECOAT

Add appropriate amount of PH-1 Hardener for each gallon of Protecto-Coat Liquid and mix thoroughly until uniform color is achieved. Apply a 15-20 mils thick basecoat using spray, brush or roller. Apply to an even, smooth finish.

Allow basecoat application to cure to at least a "firm" or slightly "tacky" feel before applying the topcoat.

TOPCOAT

Add appropriate amount of PH-1 Hardener for each gallon of Protecto-Coat Liquid and mix thoroughly until a uniform color is achieved. Apply a 15-20 mils thick topcoat using a spray brush or roller. Apply to an even, smooth finish.

Cure cycles for Protecto-Coat Coatings are:

Temperature	Recoat Time	Cure Time
50°F	12 Hours	96 Hours
75°F	4 Hours	48 Hours
90°F	3 Hours	24 Hours

Protecto-Coat 900 must be recoated within 8 hours when exposed to direct sunlight.

If these recoat times are exceeded, consult a Dudick representative. Sanding or abrasive blasting may be required before the next coat. Recoat times are dramatically reduced when the coating is exposed to direct sunlight.

Application of Protecto-Coat 800/900 in direct sunlight may lead to blistering, pinholes, or wrinkling in the copating due to outgassing of air in the concrete and high substrate temperatures.

Standard Formulation: (Brush, Roller or Pressure Pot) Spray applications can be made with conventional air spray equipment with a pressure pot. Binks #18 spray gun with #68 fluid nozzle and 68 air nozzle, or Binks #62 spray gun with #68 fluid nozzle and #68 air nozzle are recommended.

Plural component spray applications can be made with a Binks 8-to-1 Pump. A Binks Model 18 NC spray gun 59BSSX9-47 with a 102-3430 ACI valve. Catalyst would need to be supplied by a 101-5202 catalyst tank. 1/2" ID material supply hose is recommended.

Brush or roller application may require additional coats to meet specified dry film thickness.

Pot Life of the opened and mixed Protecto-Coat 800/900, 805/905 will depend on the temperature at the work site. To prevent material waste and avoid damage to equipment, do not open and mix more material than can be used according to the following table:

TEMPERATURE	POT LIFE
50°F	1 Hour
75°F	40 Min.
90°F	25 Min.

Do not attempt to store mixed material. Residual material should be properly disposed of at the end of each work period. Where immersion service is required, spark test the coating with a 5,000 volt AC spark tester. Mark and repair all pinholes. Use Protecto-Coat Liquid mixed with the amount of hardener appropriate for the substrate temperature. Retest only the repairs.

CLEANING

Use S10 Cleaning Solvent to clean tools and equipment.

SHIPPING

Protecto-Coat Liquids are red label items with flash points of 73°F (PMCC), classified "Flammable Liquid." Hardener PH-1 is classified as an Organic Peroxide and a yellow label item. S-10 Cleaning Solvent is a flammable liquid with a flash point of 52°F (PMCC).

STORAGE

Warning: All Dudick products classified by DOT labels as either white, yellow or red labels, must not be mixed or stored together as an explosive reaction may occur.

When stored in a cool and dry location, Protecto-Coat 800/900/805/905 ingredients have a 3-month shelf life. Exposure to excessive heat may cause premature gelling and reduce working time.

SAFETY

M.S.D.S. - Sheets must always be read before using products. Protecto-Coat coatings are intended for application by experienced, professional personnel. Dudick Inc. can supply Protecto-Coat coatings supervision to help determine that the surface has been properly prepared, the ingredients correctly mixed, and the materials properly and safely applied.

If Protecto-Coat materials are to be applied by your own personnel or by a third-party contractor, please be sure that they are aware of the following safety precautions:

• Exposure to resins, solvents and hardeners may cause severe dermatitis reactions in some people. Cleanliness of the skin and clothing is critical and must be of paramount concern.

• Safety glasses, gloves and suitable protective clothing must be worn at all times during application.

• Suitable respirators should be used during application.

• If contact with hardeners occurs, remove any clothing involved and wash the skin with water. Discard the clothing. Do not attempt to wash and reuse it. Protecto-Coat Liquid may be washed off with S-10 Cleaning Solvent, MEK, or lacquer thinner.

• DO NOT USE ACETONE. Acetone forms a potentially explosive mixture with peroxides.

•Fumes are flammable and heavier than air. Proper ventilation should be maintained to minimize breathing of concentrated fumes

• If a rash or dermatitis occurs, remove the individual from the work area and seek a physicians care for dermatitis.

• Keep open flames and sparks away from the area where toppings are being mixed and applied.

• In case of eye contact, wash with water for at least 15 minutes and consult a physician. If swallowed, do not induce vomiting; call a physician immediately.

Note:

Dudick Inc. ("Dudick") warrants all goods of its manufacture to be as represented in its catalogs and that the application of its products by its employees or sub-contractors shall be performed in a workmanlike manner. Dudick's obligation under this warranty shall be the repair to and replacement of any applications which its examination shall disclose to be defective. Dudick makes no warranty concerning the suitability of its product for application to any surface, it being understood that the goods have been selected and the application ordered by the purchaser. DUDICK INC. MAKES NO WARRANTY, EXPRESS OR IMPLIED, THAT THE GOODS SHALL BE MERCHANTABLE OR THAT THE GOODS ARE FIT FOR ANY PARTICULAR PURPOSE. THE WARRANTY OF REPAIR OR REPLACEMENT SET FORTH HEREIN IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES ARISING BY LAW OR OTHERWISE; AND DUDICK INC. SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DOWN TIME, DAMAGES TO PROPERTY OF THE PURCHASER OR OTHER PERSONS, OR DAMAGES FOR WHICH THE PURCHASER MAY BE LIABLE TO OTHER PERSONS, WHETHER OR NOT OCCASIONED BY DUDICK'S NEGLIGENCE. This warranty shall not be extended, altered or varied except by written instrument signed by Dudick and Purchaser.

Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Streetsboro, Ohio 44241
(12-91)

Appendix D-49

Engineering Certifications Units 13, 15, 59, 61, 62

CleanHarbors®
ENVIRONMENTAL SERVICES, INC.
1200 CROWN COLONY DRIVE, P.O. BOX 9137 • QUINCY, MA 02269-9137
(617) 849-1800

Alan M. copy

Via Federal Express

July 3, 1995

Mr. Robert Watson, P.E.
Illinois Environmental Protection Agency
Division of Land Pollution Control -- #24
Permit Section
2200 Churchill Road
Post Office Box 19276
Springfield, IL 62794-9276

Re: Clean Harbors of Chicago, Inc.
Log No. B-16-M-2
Construction Certification Report - Units 13, 15, 59, 61, & 62

Dear Mr. Watson:

In accordance with the provisions of Conditions 3, 8, and 9 of the Temporary Authorization to Construct dated November 22, 1994 and the Draft RCRA Part B Permit issued March 17, 1995, Clean Harbors of Chicago, Inc. (CHCI) is pleased to submit this Construction Certification Report (CCR) for certain units at the modified CHCI facility located at 11800 South Stony Island Avenue in Chicago, IL.

Please note that this CCR is intended to cover the following units:

1. Unit 13, the new rail car loading/offloading area and secondary containment basin;

2. Unit 15, the tank truck loading/offloading platform;

3. Unit 59, the new ignitable tank truck staging/storage area;

4. Unit 61, the new Container Handling Dock; and

5. Unit 62, the new truck storage pad serving Unit 61.

CHCI notes that a CCR for the remaining units (e.g., Unit 16, the bulk liquid tank farm) shall be submitted to the Agency within the next week or so when the final construction and certifications are completed.

CleanHarbors

Today's submittal includes one (1) original and two (2) copies of the CCR as prepared by Hoyer Schlesinger Turner, Inc. The CCR includes the detailed engineering design calculations, as-built drawings, and coating information required by the TA. The report also includes the required independent professional engineer (PE) certification statement and seal.

If you have any questions, please feel free to contact me at (617) 849-1800, extension 4473.

Sincerely,

Paul A. Ahearn

Paul A. Ahearn
Manager, Regulatory Compliance

Enclosures

CERTIFICATION

This statement is to be completed by both the responsible officer and the registered professional engineer upon completion of construction in accordance with 35 IAC Section 702.126. Submit one copy of the certification with original signatures and two additional copies (four additional copies for UIC wells). Forward these certification statements and any information required by the permit to the following address:

Illinois Environmental Protection Agency
Bureau of Land - #33
Permit Section
2200 Churchill Road, P.O. Box 19276
Springfield, Illinois 62794-9276

FACILITY NAME: CLEAN HARBORS OF CHICAGO, INC.

IEPA SITE CODE: 0 3 1 6 0 0 0 0 5 1

U.S. EPA ID NO.: ILD 0 0 0 6 0 8 4 7 1

PART B PERMIT LOG #/UIC PERMIT #: 16

PERMIT (OR MODIFICATION) ISSUANCE DATE: _____

PERMIT CONDITION NO. REQUIRING CERTIFICATION: _____

The Units #13, 15, 59, 61 & 62 has been constructed in accordance with the specifications in the Part B/UIC Permit. Documentation that the construction was in accordance with the permit is contained in the enclosed report. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Alan S. McKim, Director
Clean Harbors of Chicago, Inc.

Signature of Owner/Operator

Name and Title

Marie Vanagas
62--40801
HOYER-SCHLESINGER-TURNER IN.

Signature of Registered P.E.

Name of Registered P.E. and Illinois Registration Number

July 3, 1995

Date

(P.E. SEAL)

MARIE VANAGAS
62-40801
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

Exp. date 11-30-95

This Agency is authorized to require this information under Illinois Revised Statutes, 1979, Chapter 111 1/2, Section 1039. Disclosure of this information is required under that Section. Failure to do so may prevent this form from being processed and could result in your application being denied. This form has been approved by the Forms Management Center.

Printed on Recycled Paper

CONSTRUCTION CERTIFICATION REPORT

UNIT #13

UNIT #15

UNIT #59

UNIT #61

UNIT #62

Prepared for:

CLEAN HARBORS OF CHICAGO, INC.
11800 S. Stony Island Avenue
Chicago, Illinois 60617

Prepared by:

HOYER-SCHLESINGER-TURNER, INC.
Consulting Engineers
300 West Adams Street, Suite 630
Chicago, Illinois 60606

HST PROJECT No. 17851

June, 1995

HOYER-SCHLESINGER-TURNER inc.
ENGINEERS - CONSTRUCTORS
300 west adams street chicago illinois 60606 telephone 263-0556 area code 312

June 30, 1995

Mr. Paul Ahearn
Manager, Regulatory Compliance
CLEAN HARBORS OF CHICAGO, INC.
11800 S. Stony Island Avenue
Chicago, Illinois 60617

Re: Construction Certification Report
Unit #13, #15, #59, #61 & #62
11700 S. Stony Island Avenue
Chicago, IL 60617
HST Project No. 17851

Gentlemen:

This report presents the results of Hoyer-Schlesinger-Turner, Inc.'s (HST) involvement in construction and construction modification of the units listed above.

The construction documents were prepared under HST supervision, except as noted. HST engineers made numerous field trips to observe construction. The repair of cracks in the existing concrete slab of Unit #15 and application of coating and topping in all the areas was witnessed by HST Licensed Structural Engineer, Peter Bernes. The final inspection of Units #13, #15, #59, #61 and #62 was performed by HST engineer, Marie Vanagas, PE, on June 27, 1995.

The secondary containment system is designed and constructed to prevent any migration of wastes or accumulated liquid out to the soil, ground water or surface water at any time.

The base of each secondary containment system is sloped to a sump to collect liquids from spills, leaks or precipitation. No mechanical or automatic leak-detection system is provided or operated. The presence of a release of hazardous waste or accumulated liquid in the system is monitored through daily visual plant inspections. Any accumulated liquids will be removed within 24 hours of detection and properly disposed of.

Respectfully submitted,

HOYER-SCHLESINGER-TURNER, INC.

Marie Vanagas

Marie Vanagas, PE
Illinois Licensed Professional Engineer
License No. 062-040801

MARIE VANAGAS
62-40801
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

MV/ar

SUMMARY OF INSPECTION

UNIT #13

Unit #13 - Rail Car Unloading Area is a new structure and was constructed as shown on CHCI Dwg. No. 4217, Sheet 1 of 3, 2 of 3 and 3 of 3 (dwg. 5404-S-01, 5404-S-02 and 5404-S-03). As-built drawings are included in Appendix 13-3.

Engineering design calculations are included in Appendix 13-1.

The secondary containment is covered by a canopy. The containment calculations are on drawing 5404-S-01.

The visual inspection of the secondary containment found to be satisfactory. The entire concrete structure is coated by Protecto-Coat 900 as manufactured by Dudick Incorporated. The coat is 30 mils thick and was applied per manufacturer's recommendations. See Appendix 13-2 for technical information, application instructions and Chemical Resistance Chart. The coated surface was free of cracks, gaps, scratches or any other damage.

This certification does not include piping. The piping for loading/unloading railcars was partially installed at the time of inspection. The piping certification will be included as a part of the Unit #16 package at a later date. Grating over open areas will be installed at a later date.

APPENDIX

13-1

HOYER-SCHLESINGER-TURNER, INC.

SHEET 1 OF 4
PROJECT NO. 1785-1
DATE 7.14.94
BY BERNES, S.E.

PROJECT CLEAN HARBORS OF CHICAGO
SUBJECT RTR CNR UNLOADING AREA FOUNDATION #13

TOTAL LOAD PER 40' LENGTH

CNR WEIGHT = 72,000 # (EMPTY)

VOLUME = 30,000 GAL

MAX. SPECIFIC GRAVITY = 1.5

a) 72,000# + 30,000 × 8.35#/GAL = 322,500#

SUPERSTRUCTURE D.L. + L.L. (40 #/S.F)

b) 30' × 40' × 40 #/S.F = 48,000#

CONC. CONTAINMENT WALLS

c) 6.33' × 4.0' × 40' × 150# = 151,900#

TOTAL 522,400#

MAX. SOIL PRESSURE = 522,400#/40×18 + 190# = 916 #/S.

$M_{MAX} = \frac{(916 - 190) \times 5.5^2}{2} - 527^{\#} \times 4.33' = 8.70^{'k}$

$A_s = \frac{8.70^{'k}}{1.76 \times 12} = .41 \text{ IN}^2$

USE #6 @ 12" C-C

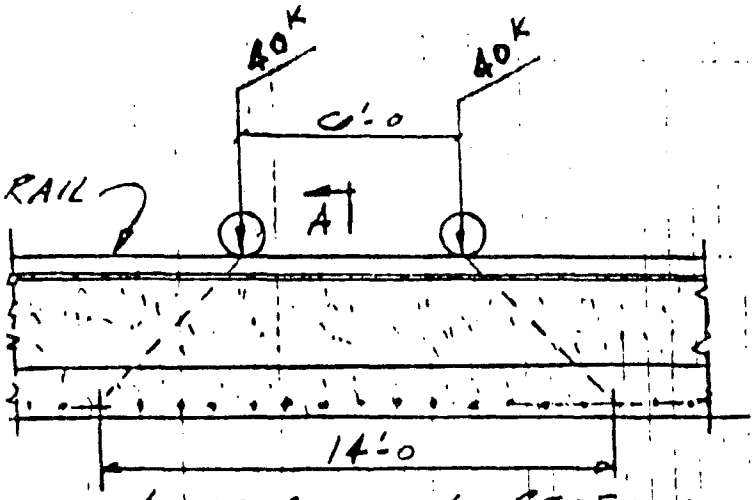
STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes
PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11-30-9

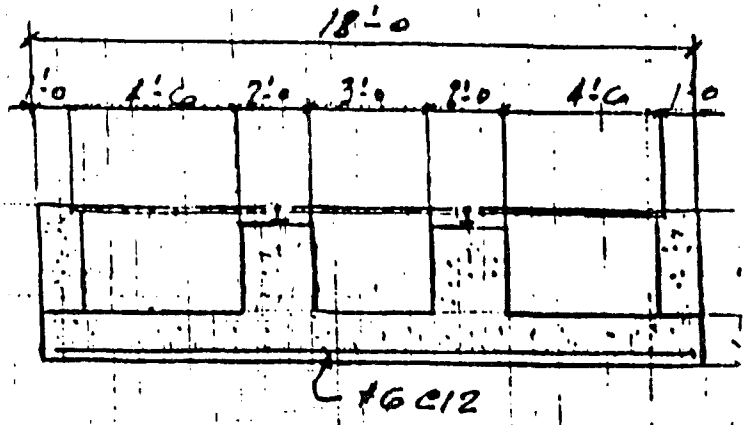
HOYER-SCHLESINGER-TURNER, INC.

SHEET 2 OF 4
PROJECT NO. 17851
DATE 6.23.95
BY BERNES, S.G.

PROJECT CLEAN HARBORS OF CHICAGO
SUBJECT R/R CAR UNLOADING AREA FDN. #13



LONGITUDINAL SECTION A



TYP. CROSS SECTION "A"

WHEEL LOAD DISTRIBUTION IS CONSIDERED IN SHORT DIRECTION ONLY, BECAUSE AXLE LOAD DISTANCE BEING 50' C-C SHALLOW BEAMS BECOME INEFFECTIVE

TOTAL LOAD ON 14'x18' AREA

4-WHEELS @ 40K/EACH	= 160K
2-CENTER WALLS 2'x 8.5'x14'x.15K	= 21K
2-OUTSIDE " 1.17'x3'x14'x.15K	= 15K
GRATING 16'x14'x.014	= 3K
2-RAILS 14'x.050K	= 2K
TOTAL	= 201K

NET SOIL PRESSURE =
= 201K/14'x18' = .80 KSF

WEIGHT OF OUTSIDE WALL PLUS GRATING (KLF)

WALL = 1.17'x 3' x .15 KCF = .53 KLF
GRATING 2.25' x .014 KSF = .02 "

TOTAL = .56 KLF

LOAD FOR LONGITUDINAL BEAM KLF =
= 9' x .80 KSF + .56K = 6.64 KLF

$M_{CANT} = .80 \times 5.5^2/2 - .56^K \times 5' = 9.3^{'K}$

$A_{s\,REQ'D} = \frac{9.3}{1.76 \times 12} = .44 \text{ IN}^2$

#6 @ 12" o.c. .44 IN² FURNISHED o.k.

$M_{POS.} = WL^2/24 = \frac{6.64 \times 6^2}{24} = 9.96^{'K}$

$A_{s\,REQ'D} = 9.96/1.76 \times 12 = .13 \text{ IN}^2$

2-#5 = .62 IN² > .13 IN² o.k.

HOYER-SCHLESINGER-TURNER, INC.

SHEET 3 OF 4
PROJECT NO. 1785-1
DATE 7.15.94
BY BERNES

PROJECT GLEAN HARBORS OF CHICAGO, INC.
SUBJECT R/R CAR UNLOADING AREA SUPERSTRUCTURE #13

PURLIN

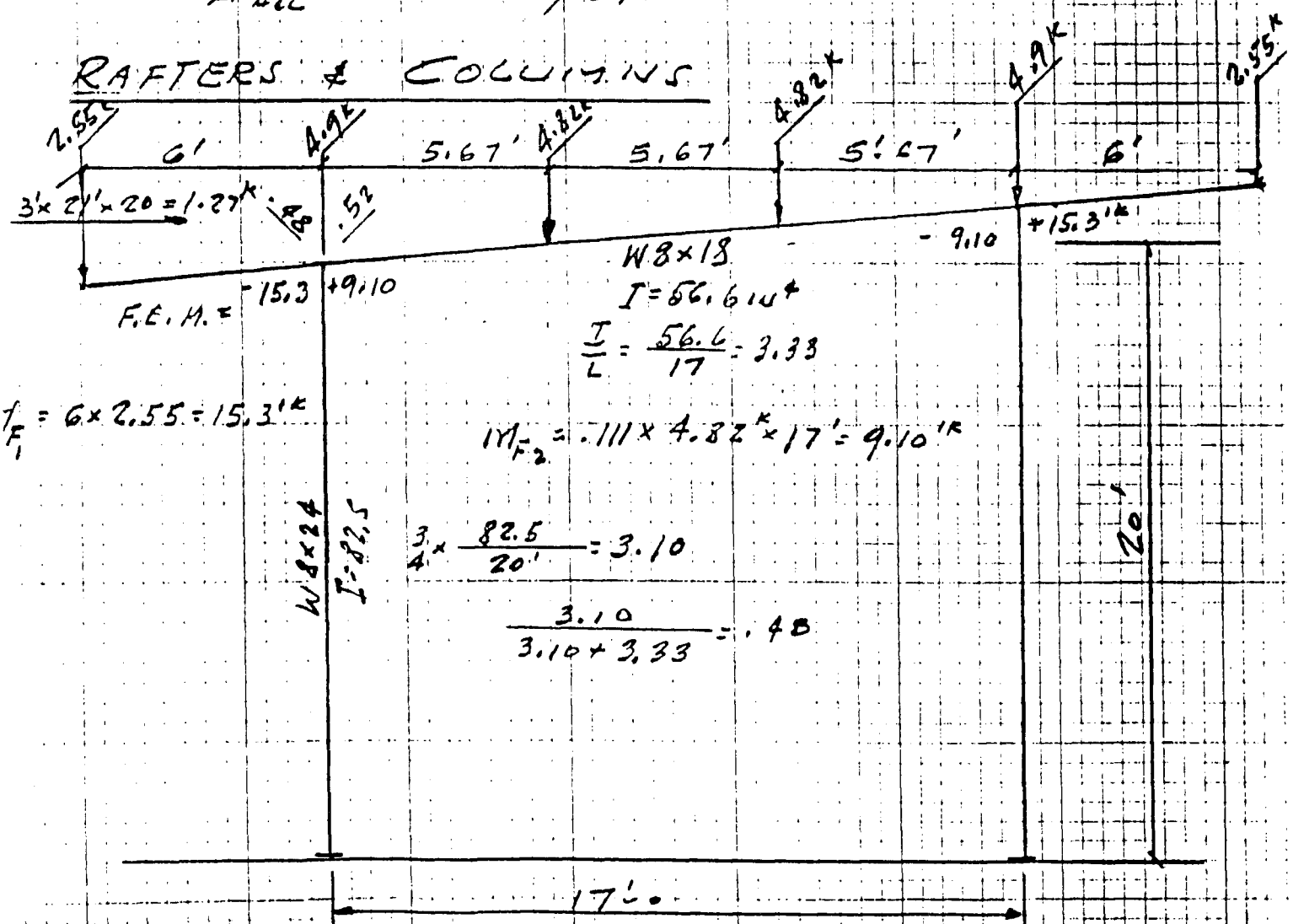
L.L. = 25 PSF
D.L. = 15 "
TOTAL = 40 PSF

PURLIN SPACING = 5.67'
LOAD ON PURLIN = 5.67 x 40 PSF = .23 KLF
$M = .23 \times 21.25^2/8 = 12.80$ 'K
$S_{REQ'D} = 12.80 \times .5 = 6.4$ IN³
USE W 8x10 (S = 7.81 IN³ > 6.4 IN³) o.k.

$$\Delta_{MAX} = \frac{5 \times 4.82^K \times (21.25 \times 12)^3}{384 \times 29{,}000 \times 30.8} = 1.17 \text{ IN}$$

$\Delta_{ALL} = 21.25 \times 12/240 = 1.07$ IN ≈ 1.17 o.k.

RAFTERS & COLUMNS



$$\frac{3}{4} \times \frac{82.5}{20'} = 3.10$$

$$\frac{3.10}{3.10 + 3.33} = .48$$

$$\frac{I}{L} = \frac{56.6}{17} = 3.33$$

HOYER-SCHLESINGER-TURNER, INC.

SHEET 4 OF 4
PROJECT NO. 1785-1
DATE 7.15.94
BY BERNE

PROJECT CLEAN HARBORS OF CHICAGO, INC
SUBJECT R/R CAR UNLOADING AREA SUPERSTRUCTURE

MOMENT DISTRIBUTION #13

RAFTER

$M = 1.27^k \times 20'/2 = 12.7'^k$

	.48	.52
CANT.	-15.3	+9.10
		+3.22
		+12.3'k BM
	+3.0 COL.	

D.L. + L.L

-12.7	
+6.1	+6.6
-6.6 COL.	+6.6'k BM

WIND

RAFTER MOMENT D.L. + L.L. + WIND = 18.9'k

$S_{REQ'D} = 18.9'^k \times .75 \times .5 = 7.09\ IN^3$

W 8x18 ($S = 14.1\ IN^3 > 7.09\ IN^3$ O.K.)

CANTILEVER MOMENT = $2.55^k \times 6 = 15.3'^k$

$S_{REQ'D} = 15.3'^k \times .5 = 7.65\ IN^3 < 14.1\ IN^3$ O.K.

COLUMN

W8x24
$A = 7.06\ IN^2$
$S = 20.8\ IN^3$

VERTICAL LOAD = $4.82^k + 4.9^k + 2.55^k = 12.27^k$

COL. MOMENT = $9.6'^k$

$\frac{KL}{R} = \frac{2 \times 20' \times 12}{3.42} = 140 \quad F_a = 7.62\ KSI$

$f_a = \frac{12.27^k}{7.06} = 1.74\ KSI \quad f_b = \frac{9.6'^k \times 12}{20.8} = 5.54\ KSI$

$f_a/F_a + f_b/F_b = \frac{1.74}{7.62} + \frac{5.54}{22} = .23 + .25 = .48 < 1.33$ O.

APPENDIX

13-2

Dudick Inc.

Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Streetsboro, Ohio 44241

216-562-1970
FAX No. 216-562-7638

Protecto-Coat 800/900/ 805/905

FLAKE-FILLED HIGH PERFORMANCE VINYL ESTER COATING, 30-40 MILS (1.0 mm)

Protecto-Coat Systems are designed to protect concrete and steel from splash and spills and mild immersion exposures of organic, inorganic acids, alkalies and solvents. The 805/905 adds fluoride protection.

RECOMMENDED APPLICATIONS

- Structural Steel
- Elevated Water Storage Towers
- Plating Lines, Exterior
- Pickling Lines, Exterior
- SO_2 Scrubber Duct Work
- Spent Carbon Storage
- Floors (Spillage)
- Steel Pump Supports
- Thickener Mechanisms
- Underground Tanks and Piping
- Catwalks
- Interiors of Chemical Storage Tanks

CHEMICAL RESISTANCE

- Organic Acids
- Inorganic Acids
- Alkali Solutions
- Solvents (900 only)
- Oils
- Salts

A complete listing of substances and concentrations tested is available on request.

Temperature Limits:
Immersion up to 120°F
Dry — 250°F – Continuous
300°F – Intermittent

PHYSICAL PROPERTIES

Tensile Strength ASTM C307	2,500-2,800 PSI
Flexural Strength ASTM C790	5,000-5,200 PSI
Adhesion to Steel	2,000 PSI
Barcol Hardness	35-40
P-Coat 805/905 Electrical Properties	1.5-2.0 Megaohms
Color	White, Gray
Solids	100% Reactive

SPECIFICATIONS

Coating shall be 30-40 mils thick, flake-filled vinyl ester based resin, consisting of a base and topcoat of 15-20 mils each, as manufactured by Dudick, Inc. Materials shall be brush, roller, or spray applied in accordance with manufacturer's recommended practices.

OTHER PROTECTO-COAT 800/900 COATINGS AVAILABLE

Protecto-Coat 800 and 900 coatings are two distinct formulations designed to offer a wide range of high performance coatings suitable for many different industrial and manufacturing applications. In turn, each coating may be chosen with flake or graphite fillers to enhance the protection necessary for a specific chemical environment, and is available in formulations for either brush, roller or spray application. All Protecto-Coat 800 and 900 coatings (except graphite filled) are available in white or gray.

Protecto-Coat 800 is a thermosetting vinyl ester coating which utilizes a flake filler for resistance to a wide variety of acids, caustics, salts, oils and mild alkali solutions, and offers superior protection against organic acids and caustics. The 800 series offers the most versatile protection in the Protecto-Coat line and is the most widely used vinyl ester.

Protecto-Coat 801 is Protecto-Coat 800 formulated for two component spray application.

Protecto-Coat 805 is a Protecto-Coat 800 coating with graphite flake fillers for improved protection against fluorides and higher caustic concentrations or where conductive properties are needed.

Protecto-Coat 900 is a higher cross link density coating and offers the highest solvent and acid resistance.

Protecto-Coat 901 is Protecto-Coat 900 for two component spray application.

Protecto-Coat 905 is Protecto-Coat 900 with graphite flake fillers for improved protection against fluorides and higher caustic concentrations or where conductive properties are needed.

THE PROTECTO-COAT SYSTEM

The Protecto-Coat System uses two layers of thermosetting flake-filled vinyl ester resins to build up the protection that vulnerable steel and concrete need in chemically oriented manufacturing or processing operations. When fully cured, the separate elements lose their individual identity and become a single, monolithic coating.

Primer 27 is designed to prevent abrasive-blasted steel from developing rust bloom prior to the application of a Protecto-Coat coating. For maximum performance all steel surfaces should be primed, but primer may not be needed for mild, non-immersion service. Concrete, however, must always be primed to aid in the "wetting out" required for good bonding.

Basecoat/Topcoat: Protecto-Coat resins are filled with flakes or graphite flakes to reduce the coefficient of expansion. Protecto-Coat 800/900 resins, filled with flakes or graphite flakes, provide a chemical resistant outer barrier. Overlapping leaf arrangement of flakes reduces water vapor permeation and permits chemical exposures at higher temperatures without increasing the thickness of the coating.

ESTIMATING QUANTITIES AND ORDER BILL OF MATERIAL

Note: Resins include 3 oz. hardener as standard.

SQUARE FEET PER GALLON		
	CONCRETE	STEEL
Primer 27	150-200	250-300
P-Coat 800/900/805/905		
Actual 30-40 Mil. DFT	30	30
Theoretical 30-40 Mil. DFT	45	45
S-10 Solvent	500	500

Quantities shown are for estimating purposes only. Actual field usage may very.

APPLICATION INSTRUCTIONS

SURFACE PREPARATION

Metal: For immersion service, abrasive blast to a white metal finish and a 2-3 mils minimum profile according to SSPC 5 or NACE #1. For fume or splash service, abrasive blast to a near white metal finish according to SSPC 10.

Concrete: Concrete must be abrasive blasted or etched with muriatic acid (Solution of 1 part 20° Be HCl and 1 part water) to remove surface laitance and other contaminants. Concrete must be free of curing compounds and form release agents. Surface texture should be similar to 40-60 grit sandpaper. Additional surface preparation will be required if a 40-60 grit texture is not achieved and the surface laitance not completely removed after a single application of acid or with the first mechanical preparation procedure.

If after abrasive blasting, honeycombs/voids appear on the concrete or steel, these have to be filled with a suitable material. Contact a Dudick Representative for this information.

Hardener Amount/Gal. Resin.

HARDENER	SUBSTRATE TEMPERATURE	PRIMER 27	P-C 800/900 BASECOAT/ TOPCOAT	P-C 805/905 BASECOAT/ TOPCOAT
PH-1	60°-70°F	3-4 oz.	3-4 oz.	3-4 oz.
PH-1	70°-90°F	2-3 oz.	2-3 oz.	2-3 oz.

Recommended application temperatures should be between 50°F and 110°F substrate temperature.

PRIMING

Metal: For maximum performance, prime all steel surfaces with Primer 27 3-4 mil. WFT, mixed with appropriate amount of PH-1 Hardener. For mild non-immersion service, priming of steel may be omitted.

Concrete: Concrete surfaces must be primed using Primer 27 and the appropriate amount of PH-1 Hardener. Concrete must be thoroughly dry before application of primer by spray, roller, or brush. Do not allow the primer to puddle.

BASECOAT

Add appropriate amount of PH-1 Hardener for each gallon of Protecto-Coat Liquid and mix thoroughly until uniform color is achieved. Apply a 15-20 mils thick basecoat using spray, brush or roller. Apply to an even, smooth finish.

Allow basecoat application to cure to at least a "firm" or slightly "tacky" feel before applying the topcoat.

TOPCOAT

Add appropriate amount of PH-1 Hardener for each gallon of Protecto-Coat Liquid and mix thoroughly until a uniform color is achieved. Apply a 15-20 mils thick topcoat using a spray brush or roller. Apply to an even, smooth finish.

Cure cycles for Protecto-Coat Coatings are:

Temperature	Recoat Time	Cure Time
50°F	12 Hours	96 Hours
75°F	4 Hours	48 Hours
90°F	3 Hours	24 Hours

Protecto-Coat 900 must be recoated within 8 hours when exposed to direct sunlight.

If these recoat times are exceeded, consult a Dudick representative. Sanding or abrasive blasting may be required before the next coat. Recoat times are dramatically reduced when the coating is exposed to direct sunlight.

Application of Protecto-Coat 800/900 in direct sunlight may lead to blistering, pinholes, or wrinkling in the copating due to outgassing of air in the concrete and high substrate temperatures.

Standard Formulation: (Brush, Roller or Pressure Pot) Spray applications can be made with conventional air spray equipment with a pressure pot. Binks #18 spray gun with #68 fluid nozzle and 68 air nozzle, or Binks #62 spray gun with #68 fluid nozzle and #68 air nozzle are recommended.

Plural component spray applications can be made with a Binks 8-to-1 Pump. A Binks Model 18 NC spray gun 59BSSX9-47 with a 102-3430 ACI valve. Catalyst would need to be supplied by a 101-5202 catalyst tank. 1/2" ID material supply hose is recommended.

Brush or roller application may require additional coats to meet specified dry film thickness.

Pot Life of the opened and mixed Protecto-Coat 800/900, 805/905 will depend on the temperature at the work site. To prevent material waste and avoid damage to equipment, do not open and mix more material than can be used according to the following table:

TEMPERATURE	POT LIFE
50°F	1 Hour
75°F	40 Min.
90°F	25 Min.

Do not attempt to store mixed material. Residual material should be properly disposed of at the end of each work period. Where immersion service is required, spark test the coating with a 5,000 volt AC spark tester. Mark and repair all pinholes. Use Protecto-Coat Liquid mixed with the amount of hardener appropriate for the substrate temperature. Retest only the repairs.

CLEANING

Use S10 Cleaning Solvent to clean tools and equipment.

SHIPPING

Protecto-Coat Liquids are red label items with flash points of 73°F (PMCC), classified "Flammable Liquid." Hardener PH-1 is classified as an Organic Peroxide and a yellow label item. S-10 Cleaning Solvent is a flammable liquid with a flash point of 52°F (PMCC).

STORAGE

Warning: All Dudick products classified by DOT labels as either white, yellow or red labels, must not be mixed or stored together as an explosive reaction may occur.

When stored in a cool and dry location, Protecto-Coat 800/900/805/905 ingredients have a 3-month shelf life. Exposure to excessive heat may cause premature gelling and reduce working time.

SAFETY

M.S.D.S. - Sheets must always be read before using products. Protecto-Coat coatings are intended for application by experienced, professional personnel. Dudick Inc. can supply Protecto-Coat coatings supervision to help determine that the surface has been properly prepared, the ingredients correctly mixed, and the materials properly and safely applied.

If Protecto-Coat materials are to be applied by your own personnel or by a third-party contractor, please be sure that they are aware of the following safety precautions:

- Exposure to resins, solvents and hardeners may cause severe dermatitis reactions in some people. Cleanliness of the skin and clothing is critical and must be of paramount concern.

- Safety glasses, gloves and suitable protective clothing must be worn at all times during application.

- Suitable respirators should be used during application.

- If contact with hardeners occurs, remove any clothing involved and wash the skin with water. Discard the clothing. Do not attempt to wash and reuse it. Protecto-Coat Liquid may be washed off with S-10 Cleaning Solvent, MEK, or lacquer thinner.

- DO NOT USE ACETONE. Acetone forms a potentially explosive mixture with peroxides.

- Fumes are flammable and heavier than air. Proper ventilation should be maintained to minimize breathing of concentrated fumes

- If a rash or dermatitis occurs, remove the individual from the work area and seek a physicians care for dermatitis.

- Keep open flames and sparks away from the area where toppings are being mixed and applied.

- In case of eye contact, wash with water for at least 15 minutes and consult a physician. If swallowed, do not induce vomiting; call a physician immediately.

Note:

Dudick Inc. ("Dudick") warrants all goods of its manufacture to be as represented in its catalogs and that the application of its products by its employees or sub-contractors shall be performed in a workmanlike manner. Dudick's obligation under this warranty shall be the repair to and replacement of any applications which its examination shall disclose to be defective. Dudick makes no warranty concerning the suitability of its product for application to any surface, it being understood that the goods have been selected and the application ordered by the purchaser. DUDICK INC. MAKES NO WARRANTY, EXPRESS OR IMPLIED, THAT THE GOODS SHALL BE MERCHANTABLE OR THAT THE GOODS ARE FIT FOR ANY PARTICULAR PURPOSE. THE WARRANTY OF REPAIR OR REPLACEMENT SET FORTH HEREIN IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES ARISING BY LAW OR OTHERWISE; AND DUDICK INC. SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DOWN TIME, DAMAGES TO PROPERTY OF THE PURCHASER OR OTHER PERSONS, OR DAMAGES FOR WHICH THE PURCHASER MAY BE LIABLE TO OTHER PERSONS, WHETHER OR NOT OCCASIONED BY DUDICK'S NEGLIGENCE. This warranty shall not be extended, altered or varied except by written instrument signed by Dudick and Purchaser.

Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Streetsboro, Ohio 44241
(12-91)

Temperature/Chemical Resistance Key

Indicator	Definition	Indicator	Definition	Indicator	Definition
I	Material will withstand constant flow or Immersion service.	1	Good to the maximum temperature of the product	*NR*	Not recommended
S	Material is suitable for intermittent or Spillage service	2	High Temperature Service to 160° F (71° C)	*NI*	No information available
F	Material will tolerate Fumes only	3	Moderate Temperature Service to 140° F (60° C)	*PV*	Performance varies with conditions. Consult Dudick for recommendations or testing
		4	Warm Temperature Service to 100° F (37° C)		

Example

48. Boric Acid	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I2	I:
[illegible]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR		

Each grid block in the Guide shows all the information which is available on the product for the use shown. Thus, a block which shows I2, indicates that the product is capable of providing immersion service up to 160° F. Similarly, a block which shows F1 indicates the material will tolerate temperatures to the maximum capability shown in the Temperature Limits chart below, but that it is designed for exposure only to fumes.

Temperature Limits

Product	Substrate	Maximum Temperature	Notes
Protecto-Coat Series	*Metal* *Concrete/Steel*	130° F 54° C 130° F 54° C	[1] Steel: Constant Flow; Steel Dry or Intermittent Spills: 200°F (93°C) to 350°F (96°C) [2] Concrete: Constant Flow
Protecto-Crete Series	*Metal* *Concrete*	Not Recommended 250° F 120° C	[3] Intermittent Spills, otherwise maximum temperature is 150°F
Protecto-Flake Series	*Metal* [4] *Concrete*	180° F 83° C Not Applicable	[4] Steel: Immersion; Steel, Dry: 250°F (121°C)
Protecto-Glass Series	*Metal* [5] *Concrete*	160° F 71° C 160° F 71° C	[5] Steel: Constant Flow
Protecto-Line Series	*Metal* [6] *Concrete* [7]	160° F 71° C 160° F 71° C	[6] Steel: Constant Flow and Immersion [7] Concrete: Constant Flow
Protecto-Seal Series	*Metal* [8] *Tile/Concrete* [8]	Not Applicable 160° F 71° C	[8] Tile: Constant Flow and Immersion
Grout Series	*Metal* *Concrete*	Not Applicable 160° F 71° C	

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	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
1. Acetaldehyde	F4	NR	PV	PV	F4	F4	NR	NR	S4	S4	NR	NR	NR	NR
2. Acetic Acid (0-10%)	I3	F4	I4	I4	I4	I4	S1	S1	S1	S1	S1	I3	I3	I3
3. Acetic Acid (10-50%)	S4	NR	S1	S1	S1	S1	F1	F1	S4	S4	S3	I4	I4	I4
4. Acetic Acid (50-100%)	F4	NR	S3	S3	S3	S3	NR	NR	NR	NR	S3	PV	PV	S4
5. Acetic Anhydride	F4	NR	S4	S4	S4	S4	PV	PV	NR	NR	S4	S4	S4	S4
6. Acetone	S4	NR	NR	F4	NR	NR	NR	S3	S4	S4	s4	NR	NR	NR
7. Acetyl Chloride	F4	F4	PV	PV	PV	PV	PV	PV	S4	S4	S4	PV	PV	PV
8. Acrylic Acid	PV	F4	PV	PV	PV	PV	PV	PV	NR	NR	S4	I4	I4	I4
9. Acrylonitrile	NR	NR	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	PV
10. Adipic Acid	I4	I4	I4	I4	I4	I4	PV	PV	S4	S4	S4	I4	I4	I4
11. Alcohol (Ethyl)	S4	S4	I4	I4	I4	I4	I4	I4	S4	S4	S1	I1	I1	I1
12. Alcohol (Methyl)	S4	NR	PV	PV	F4	F4	S4	S4	S4	S4	S1	I4	I4	I4
13. Allyl Chloride	F4	NR	NR	NR	NR	NR	PV	PV	NR	S4	S1	PV	PV	S4
14. Alum	S4	I4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I3	I3	I2
15. Aluminum Bromide	S4	F4	I4	I4	I4	I4	F1	F1	S4	S4	S1	I1	I1	I1
16. Aluminum Chloride	I4	I4	I4	I4	I4	I4	I1	I1	S3	S3	S1	I1	I1	I1
17. Aluminum Fluoride*	S1	S4	S1	S1	S1	S1	NR	NR	S1	S1	S1	I4	I4	I4
18. Aluminum Hydroxide	I4	S4	F4	F4	S4	S4	S4	S4	S1	S1	S1	I4	I3	I3
19. Aluminum Sulfate	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S4	I3	I3	I2
20. Ammonia (Dry)	S4	S4	F1	F1	F1	F1	F1	F1	S1	S1	S1	I3	I3	I3
21. Ammonium Chloride	S1	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
22. Ammonium Fluoride*	S4	S4	I4	I4	I4	S4	NR	NR	S1	S1	S2	I3	I3	I3
23. Ammonium Hydroxide	I4	I4	F4	F4	S4	S4	I1	I1	S1	S1	S1	I2	I2	I2
24. Ammonium Nitrate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
25. Ammonium Persulfate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
26. Ammonium Sulfate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
27. Ammonium Sulfide	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
28. Ammonium Sulfite	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
29. Amyl Acetate	F4	NR	S4	S4	S4	S4	NR	NR	NR	NR	NR	PV	F4	F4
30. Amyl Alcohol	F4	F4	S1	S1	S1	I4	NR	NR	S3	S3	S3	I4	I4	I4
31. Aniline	NR	NR	S4	S4	S4	S4	NR	NR	NR	NR	NR	NR	I4	I4
32. Aniline Hydrochloride	F4	F4	S4	S4	S4	S4	F4	F4	S3	S3	S3	I4	I4	I4
33. Antimony Chloride	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
34. Aqua Regia	NR	NR	NR	NR	NR	F4	NR	NR	NR	NR	NR	NR	NR	NR
35. Arsenic Acid	F4	F4	I4	I4	I4	I3	S4	S4	S1	S1	S1	I3	I3	PV
36. Barium Acetate	S4	S4	S4	S4	S4	S4	F4	F4	S4	S4	S3	I4	I4	I4
37. Barium Chloride	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
38. Barium Hydroxide	I4	I4	S3	S3	S2	I4	I1	I1	S1	S1	S4	I4*	I4*	I3*
39. Barium Sulfide	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
40. Benzaldehyde	PV	PV	NR	NR	NR	NR	NR	S4	PV	PV	PV	PV	NR	PV
41. Benzene	F4	NR	PV	PV	NR	NR	NR	S4	S4	S4	S4	NR	NR	S4
42. Benzene Sulfonic Acid	F4	F4	I4	I4	I4	I4	F4	F4	S4	S4	S1	I1	I1	I1
43. Benzene Sulfonic Chloride	F4	F4	I4	I4	I4	I3	F4	F4	S4	S4	S1	I1	I1	I1
44. Benzoic Acid	S4	S4	I4	I4	I4	I3	F4	F4	S1	S1	S1	I1	I1	I1
45. Benzoyl Chloride	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	NR	NR	PV
46. Black Liquor*	S4	S4	S1	I4	I1	I1	I1	NR	S1	S1	S3	I3	I3	I3
47. Bleach (5.5%)*	S4	F4	PV	PV	I1	I1	F1	NR	NR	I3	S4	NR	NR	I1
48. Boric Acid	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I2	I2	I2
49. Bromine, Wet Gas	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	F4	F4	F4
50. Bromine Water (5%)	F4	NR	S4	S4	S4	S4	S4	S4	NR	S4	S4	I4	I4	I4
51. Butadiene	S4	PV	PV	PV	PV	PV	NR	NR	S4	S4	S4	PV	PV	PV
52. Butanol	F4	NR	S4	S4	S4	S4	NR	NR	S4	S4	S1	I3	I3	I3
53. Butyl Acetate	F4	NR	NR	NR	F4	F4	NR	S4	S4	S4	NR	NR	NR	PV
54. Butyl Carbitol	F4	PV	PV	PV	F4	F4	PV	PV	S4	S4	PV	I4	I4	I4
55. Butyl Cellosolve	F4	NR	PV	NR	S4	S4	NR	S4	S4	S4	S4	NR	NR	S4
56. Butyric Acid	F4	NR	F4	F4	F3	F3	NR	NR	NR	NR	NR	I3	I3	I3
57. Cadmium Plating (Cyanide)	S4	S4	S1	S1	S1	S1	S1	S1	S1	S1	S3	I3	I3	I3

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	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
58. Calcium Bisulfite	S4	S4	I4	I4	I3	I3	F1	F1	S3	S3	S1	I1	I1	I1
59. Calcium Carbonate (Soda Ash)	I4	I4	I4	I4	I3	I3	I1	NR	S1	S1	S4	I3	I3	I3
60. Calcium Chloride	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
61. Calcium Hydroxide*	I4	I4	I4	I4	I3	I4	I1	NR	S1	S1	S3	I3	I3	I3
62. Calcium Hypochlorite (5%)*	F4	F4	F4	F4	S4	S4	F4	NR	S4	S4	S3	NR	NR	NR
63. Calcium Nitrate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
64. Caprylic Acid	NR	NR	I4	I4	I4	I4	NR	NR	NR	NR	NR	I4	I4	I4
65. Carbon Disulfide	F4	NR	S4	S4	S4	S4	NR	NR	S4	S4	S4	F4	F4	F4
66. Carbon Tetrachloride	F4	F4	S4	S4	S3	S3	NR	NR	S3	S3	S3	NR	I4	I4
67. Castor Oil	I4	I4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
68. Chloracetic Acid	F4	NR	F4	F4	F4	F4	F1	F1	NR	S4	S4	F3	F3	F3
69. Chloral	NR	NR	NR	NR	NR	NR	NR	NR	S4	S4	NR	NR	NR	NR
70. Chlorine Dioxide	F4	NR	S4	S4	S3	S3	NR	NR	NR	S4	S3	I4	I4	I1
71. Chlorine Gas (Dry)	NR	NR	F4	F4	F3	F3	NR	NR	NR	NR	S4	I4	I4	I3
72. Chlorine Gas (Wet)	NR	NR	NR	NR	F4	F3	NR	NR	NR	S4	S2	F4	F4	F4
73. Chlorine Water (Saturated)	NR	NR	S4	S4	S3	S3	F4	F4	S4	S4	S2	I4	I4	I4
74. Chlorobenzene	F4	NR	NR	NR	S4	S4	NR	NR	S4	S4	NR	NR	NR	S4
75. Chloroform	F4	NR	NR	NR	NR	NR	NR	NR	S4	S4	NR	NR	NR	NR
76. Chlorophenol	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
77. Chlorosulfonic Acid	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
78. Chlorotoluene	F4	NR	S4	S4	S4	S4	NR	NR	NR	NR	S4	I4	NR	PV
79. Chromic Acid (10%)	F4	F4	S4	S4	S4	S4	S4	S4	S4	S4	S4	I4	I4	I4
80. Chromic Acid (40%)	F4	NR	S4	S4	S4	S4	S4	S4	S4	S4	S4	I4	I4	PV
81. Chromic Chloride	S4	S4	I4	I4	I4	I3	S1	S1	S1	S1	S1	I1	I1	I1
82. Citric Acid	S4	F4	I4	I4	I4	I3	S1	S1	S4	S4	S1	I1	I1	I1
83. Copper Plating (Cyanide)	S3	S3	S4	S4	S3	S3	S1	S1	S2	S2	S4	I4	I4	I3
84. Copper Plating (Acid)	S4	S4	S3	S3	S3	S3	S1	S1	S2	S2	S1	I1	I1	I1
85. Copper Salts	S3	S3	I4	I4	I4	I4	S1	S1	S1	S1	S1	I1	I1	I1
86. Corn Oil	S3	S3	I4	I4	I4	I3	I1	I1	S3	S3	S1	I1	I1	I1
87. Corn Starch	S1	S1	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
88. Corn Sugar	S1	S1	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
89. Cottonseed Oil	S3	S3	I4	I4	I4	I3	I1	I1	S3	S3	S1	I1	I1	I1
90. Cresol	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	NR	NR	PV
91. Cresylic Acid	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
92. Crude Oil	S4	PV	I4	I4	I4	I4	PV	PV	PV	I1	S1	I1	I1	I1
93. Detergent Sulfonated	S4	PV	I4	I4	I4	I4	PV	PV	PV	I1	PV	I1	I1	I1
94. Dextrose	I3	S3	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
95. Dibutyl Phthalate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I3	I3	I3
96. Dichloro Acetic Acid (20%)	F4	NR	I4	I4	I4	I4	F1	F1	NR	NR	S3	I4	I4	I4
97. Diesel Fuel	I4	S4	I4	I4	I4	I4	S3	S3	S1	S1	S1	I1	I1	I1
98. Diethylamine (100%)	NR	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	NR	NR	PV
99. Dimethyl Formamide	F4	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	I4	NR	PV
100. Esters, Fatty Acids	S4	PV	I4	I4	I4	I4	PV	PV	PV	S4	PV	I3	I3	I3
101. Ethyl Acetate	F4	NR	NR	NR	NR	NR	F1	F1	S4	S4	S4	NR	NR	NR
102. Ethyl Alcohol	S4	S4	I4	I4	I4	I4	I4	I4	S4	S4	S4	I4	I4	I4
103. Ethylamine	NR	NR	NR	NR	PV	PV	NR	NR	PV	PV	PV	NR	NR	PV
104. Ethylchloroformate	F4	NR	NR	NR	PV	PV	NR	NR	NR	NR	NR	PV	NR	PV
105. Ethyl Ether	F4	NR	NR	NR	PV	PV	NR	F4	S4	S4	S4	PV	PV	PV
106. Ethylene Dichloride	F4	NR	NR	NR	NR	NR	NR	F4	NR	NR	NR	PV	NR	NR
107. Ethylene Glycol	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
108. Ethylene Oxide	F4	NR	PV	PV	PV	PV	PV	PV	PV	PV	S1	PV	PV	PV
109. Ethyl Sulfate	F4	PV	PV	PV	PV	PV	PV	PV	S4	S4	NR	I4	I4	I4
110. Ferric Chloride	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	NR	I1	I1	I1
111. Ferric Sulfate	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
112. Ferrous Chloride	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
113. Ferrous Sulfate	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
114. Fluoboric Acid*	F4	PV	S4	S4	S4	S4	PV	PV	S4	S4	S4	NR	PV	NR

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	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
115. Fluorine Gas*	NR	NR	NR	NR	NR	NR	NR	NR	PV	PV	PV	NR	PV	PV
116. Fluosilicic Acid*	F4	PV	S4	S4	S4	S4	PV	PV	S4	S4	S4	NR	PV	NR
117. Formaldehyde	F4	F4	I4	I4	I4	I4	F4	F4	S1	S1	S1	I1	I1	I1
118. Formic Acid	F4	NR	S4	S4	S4	I4	PV	PV	NR	NR	S4	I4	I4	I4
119. Fuel Oil 1 & 2	S1	S4	I4	I4	I4	I4	NR	NR	S1	S1	S1	I1	I1	I1
120. Furfural	F4	NR	S4	S4	S4	S4	PV	PV	PV	PV	PV	NR	PV	PV
121. Furfural Alcohol	S4	PV	S4	S4	S4	S4	S4	S4	S1	S1	S1	I4	I4	I4
122. Gasoline	I4	I4	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
123. Glucose	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
124. Gluconic Acid (50%)	PV	PV	F4	F4	S4	S4	PV	PV	PV	PV	S4	S4	S4	I4
125. Glycol	I4	I4	I4	I4	I4	I4	I4	I4	S1	S1	S1	I1	I1	I1
126. Glycolic Acid	NR	NR	S4	S4	S4	S4	F1	F1	S4	S4	S4	I3	I3	I3
127. Gold Plating (Cyanide)	S4	S4	S1	S1	S1	I3	S1	S1	S1	S1	S4	I4	I4	I3
128. Grape Juice	I3	I3	I3	I3	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
129. Green Liquor	S4	S4	I4	I4	I3	I3	I1	I1	S1	S1	S3	I1	I1	I1
130. Heptane	S4	S4	S1	S1	S1	S1	I4	I4	S1	S1	S1	I2	I2	I2
131. Heptanoic Acid	PV	PV	S4	S4	S4	S4	F1	F1	PV	PV	I3	I3	I3	I3
132. Hexane	F4	F4	S1	S1	S1	S1	I4	I4	S1	S1	S1	I2	I2	I2
133. Hydrazine (35%)	F4	PV	NR	NR	NR	NR	NR	NR	S4	S4	S4	NR	NR	NR
134. Hydraulic Fluid	S4	PV	PV	PV	I3	I3	PV	PV	S1	S1	S1	PV	PV	I1
135. Hydriodic Acid (20%)	F4	F4	S4	S4	S4	I4	S1	S1	PV	PV	S4	I4	I4	I4
136. Hydrobromic Acid (20%)	F4	F4	S4	S4	S4	S4	S1	S1	PV	S4	S4	I4	I4	I4
137. Hydrocarbons (Aliphatic)	S4	PV	I4	I4	I4	I4	I1	I4	S1	S1	S4	I1	I1	I1
138. Hydrocarbons (Aromatic)	S4	PV	PV	PV	F4	F4	NR	NR	S4	S4	S4	PV	PV	I1
139. Hydrochloric Acid (1-25%)	S4	F4	S3	S3	S3	I3	F1	F1	S4	S4	S4	I1	I1	I1
140. Hydrochloric Acid (25-37%)	F4	NR	F3	F3	F3	I4	F1	F1	S4	S4	S4	PV	PV	I2
141. Hydrofluoric Acid (1-10%)*	NR	NR	F3	NR	F3	F3	NR	NR	NR	NR	NR	NR	NR	NR
142. Hydrofluoric Acid (10-53%)*	NR	NR	F4	NR	F4	F4	NR	NR	NR	NR	NR	NR	NR	NR
143. Hyrofluosilicic Acid*	F4	F4	F3	NR	F3	F3	PV	PV	NR	NR	NR	I2	PV	NR
144. Hydrogen Bromide	F4	PV	PV	PV	F1	F1	PV	PV	PV	PV	S4	PV	PV	I4
145. Hydrogen Peroxide (30%)	S4	NR	PV	PV	F4	I4	PV	PV	NR	S4	S4	PV	PV	I4
146. Hydrogen Sulfide	S1	S4	I4	I4	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
147. Hypochlorous Acid	NR	NR	NR	NR	F3	F3	NR	NR	NR	S4	S4	NR	NR	NR
148. Iodine	NR	NR	F4	F4	F3	F3	F1	F1	PV	S4	S4	I4	I4	I3
149. Insecticides	S4	PV	PV	PV	F4	F4	PV	PV	PV	S4	S3	PV	PV	I3
150. Isophorone	S4	PV	PV	PV	PV	PV	PV	PV	S4	S4	PV	I4	I4	I4
151. Isopropyl Acetate	F4	NR	NR	NR	NR	NR	PV	PV	S4	S4	NR	PV	PV	S4
152. Isopropyl Alcohol	S4	S4	PV	PV	S4	S4	PV	PV	S1	S1	S1	I1	I1	I1
153. Isopropyl Amine	F4	PV	PV	PV	F4	F4	NR	NR	PV	PV	NR	PV	PV	S4
154. Isopropyl Ether	S4	S4	PV	PV	F4	F4	NR	NR	S4	S4	S4	I4	I4	I4
155. Jet Fuel	I4	I4	I4	I4	I4	I4	F1	F1	S1	S1	S1	I1	I1	I1
156. Kaolin	I1	I1	PV	PV	I1	I1	I1	I1	I1	I1	I1	PV	PV	I1
157. Kerosene	I4	I4	I4	I4	I4	I4	I1	I4	S1	S1	S1	I1	I1	I1
158. Lasso Herbicide (10%)	F4	PV	S4	S4	S4	S4	F4	F4	PV	S4	S4	I4	I4	I4
159. Lactic Acid (1-20%)	S4	F4	I4	I4	I4	I3	S1	S1	S4	S4	S1	I1	I1	I1
160. Lactic Acid (20%-Con)	S4	NR	S4	S4	I4	I3	S1	S1	NR	S4	S4	I4	I3	I3
161. Lauric Acid	F4	PV	I4	I4	I3	I3	S1	S1	NR	S3	S1	I1	I1	I1
162. Lead Acetate	I4	I4	I4	I4	I3	I3	F1	F1	S1	S1	S1	I1	I1	I1
163. Linseed Oil	S3	S3	I1	I1	I1	I1	I1	I1	S4	S4	S1	I1	I1	I1
164. Magnesium Sulfate	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
165. Maleic Acid	S3	S3	S3	S3	S1	I4	S1	S1	S1	S1	S4	I3	I3	I1
166. Manganese Salts	I4	I4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
167. Mercury Salts	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
168. Methyl Alcohol	S4	NR	PV	PV	F4	F4	NR	S4	S4	S4	S1	I4	I4	I4
169. Methyl Acetate	F4	NR	NR	NR	F4	F4	PV	PV	S4	S4	S4	PV	PV	PV
170. Methylene Chloride	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
171. Methyl Chloride	NR	NR	NR	NR	NR	NR	NR	S4	NR	NR	NR	NR	NR	NR

*May need synthetic fabric, or carbon fillers. Consult a Dudick Corrosion-Proof, Inc. technical representative for more complete information on these products.

Dudick

Key

I Material will withstand constant flow or immersion service
S Material is suitable for intermittent or Spillage service
F Material will tolerate fumes only

	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
172. Methyl Ethyl Ketone	NR	NR	NR	NR	NR	NR	NR	NR	PV	S4	NR	PV	PV	NR
173. Methyl Isobutyl Ketone	F4	NR	NR	NR	NR	NR	NR	NR	S4	S4	S4	PV	PV	NR
174. Milk Products	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
175. Mineral Oil	I4	I4	I4	I4	I4	I4	S4	S4	S1	S1	S1	I1	I1	I1
176. Molasses	I4	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
177. Naphthalene	S4	S4	S4	S4	S3	S3	S4	S4	S4	S4	S4	I4	I4	I3
178. Naphtha	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I3	I1	I1
179. Naphthenic Acid	PV	PV	I4	I4	PV	PV	PV	PV	S4	S4	PV	I4	I4	PV
180. Nickel Chloride	S4	S4	S4	S4	S4	S4	S4	S4	S1	S1	S1	I1	I1	I1
181. Nickel Plating (Bright)	S4	S4	S4	S4	S4	I4	I4	I4	S1	S1	S1	I1	I1	I1
182. Nickel Salts	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
183. Nitric Acid (5%)	S4	S4	S3	S3	I3	I4	S4	S4	S4	S4	S1	I3	I3	I2
184. Nitric Acid (10%)	S4	S4	S3	S3	I3	I4	S4	S4	S4	S4	S1	I3	I3	I2
185. Nitric Acid (20%)	NR	NR	F4	F4	F4	F3	NR	NR	NR	S4	S2	I4	I4	I4
186. Nitric Acid (40%)	NR	NR	F4	F4	F4	F3	NR	NR	NR	S4	S4	I4	I4	I4
187. Nitric Acid (60%)	NR	NR	NR	NR	F4	F4	NR	NR	NR	NR	S4	S4	S4	S4
188. Nitric Acid (Conc.)*	NR	NR	NR	NR	F4	F4	NR	NR	NR	NR	NR	NR	NR	F4
189. Nitrobenzene	NR	NR	NR	NR	NR	NR	NR	S4	PV	PV	NR	PV	PV	PV
190. Nitrous Acid	NR	NR	PV	PV	PV	PV	PV	PV	PV	PV	S3	I3	I3	I2
191. Octanoic Acid	F4	F4	S4	S4	S3	I4	PV	PV	PV	PV	S3	I4	I4	I4
192. Oils (Animal)	I1	I1	I1	I1	S1	S1	I1	I1	S1	S1	S1	I1	I1	I1
193. Oils (Mineral)	I1	I1	I1	I1	S1	S1	I1	I1	S1	S1	S1	I1	I1	I1
194. Oils (Vegetable)	I1	I1	I1	I1	S1	S1	I1	I1	S1	S1	S1	I1	I1	I1
195. Oleic Acid	F4	NR	I4	I4	I3	I3	NR	NR	S4	S4	S1	I1	I2	I1
196. Oxalic Acid (Sat'd)	S4	S4	I4	I4	I3	I3	S1	S1	S1	S1	S1	I3	I1	I1
197. Ozone	S4	PV	PV	PV	I2	I2	S3	S3	S1	S1	S1	PV	PV	S4
198. Palmitic Acid	PV	PV	S4	S4	S3	S3	PV	PV	PV	PV	S4	I1	I1	I1
199. Pentachlorethane	PV	PV	PV	PV	S1	S1	PV	PV	S1	S1	S4	PV	PV	S1
200. Perchloric Acid	NR	NR	PV	PV	F4	F4	PV	PV	S1	S1	S1	PV	PV	PV
201. Perchlorethylene	F4	NR	NR	NR	F4	F4	NR	S4	S4	S4	S4	S4	PV	S4
202. Phenol (0%-10%)	NR	NR	PV	PV	F4	F4	NR	NR	S4	S4	S2	PV	PV	PV
203. Phenol (85%)	NR	NR	NR	NR	F4	F4	NR	NR	PV	S4	PV	NR	NR	PV
204. Phosphoric Acid (Conc.)	F4	NR	S3	S3	S1	I4	NR	NR	S4	S4	S1	I1	I1	I1
205. Phosphorous Oxychloride	NR	NR	PV	PV	F4	F4	PV	PV	S4	S4	S4	PV	PV	PV
206. Phosphorous Trichloride	NR	NR	PV	PV	F4	F4	PV	PV	S4	S4	PV	PV	PV	PV
207. Phthalic Acid	NR	PV	S1	S1	S1	S1	PV	PV	PV	PV	S1	I1	I1	I1
208. Potassium Bichromate	S4	S4	I4	I4	I4	I3	S4	S4	S4	S4	S1	I4	I4	I1
209. Potassium Bromate	S4	S4	I4	I4	I4	I4	I4	I4	S4	S4	S1	I4	I4	I4
210. Potassium Bromide	S4	S4	I4	I4	I4	I3	I4	I4	PV	S4	S1	I1	I1	I1
211. Potassium Carbonate	I4	I4	PV	PV	I4	I3	I4	NR	S1	S1	S1	I4	I4	I4
212. Potassium Chlorate	S4	S4	I4	I4	I4	I3	I4	NR	S1	S1	S1	I1	I1	I1
213. Potassium Chloride	I4	I1	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
214. Potassium Cyanide	S4	S4	I4	I4	PV	I4	I4	I4	S1	S1	S1	I1	I1	I1
215. Potassium Hydroxide (10%)*	I4	S4	S1	S1	I4	I4	I4	NR	S1	S1	S1	I4	I4	I4
216. Potassium Hydroxide (Conc.)*	I4	S4	NR	S4	S4	S4	S1	NR	S1	S1	S1	NR	NR	NR
217. Potassium Nitrate	I4	I4	I4	I4	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
218. Potassium Permanganate	I4	I4	I4	I4	I3	I3	S1	S1	S1	S1	S1	PV	I1	I1
219. Potassium Peroxide	S4	S4	S4	S4	PV	PV	F4	F4	S1	S1	PV	I4	I4	I4
220. Potassium Persulfate	S4	S4	I4	I4	I3	I3	S1	S1	S1	S1	S1	I1	I1	I1
221. Potassium Sulfate	S4	S4	I4	I4	I3	I3	I1	I1	S1	S1	S1	I1	I1	I1
222. Pulpstock Chlorinated	NR	NR	S4	S3	S3	S3	NR	NR	NR	S3	S4	S4	S4	S4
223. Propionic Acid	NR	NR	NR	NR	F4	F4	NR	NR	PV	PV	PV	PV	NR	PV
224. Propylene Glycol	S4	NR	I3	I3	I3	I3	I4	I4	S4	S4	S4	I4	I4	I3
225. Pyridine	NR	NR	NR	NR	F4	F4	NR	NR	NR	NR	NR	NR	NR	NR
226. Salicylic Acid	S1	S1	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
227. Seawater	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
228. Silver Nitrate	S1	S1	S1	S1	S1	S1	PV	PV	S1	S1	S1	I1	I1	I1

*May need synthetic fabric, or carbon fillers. Consult a Dudick Corrosion-Proof, Inc. technical representative for more complete information on these products.

Dudick

Key

- I — Material will withstand constant flow or immersion service
- S — Material is suitable for intermittent or Spillage service
- F — Material will tolerate fumes only

	Light Duty Linings/Coatings								Toppings			Heavy Duty Linings		
	Protecto-Coat 100XT	300	600	800	900	900HT	990	1000	Protecto-Crete 110,120,130	140	800	Protecto-Flake 600	800	900
229. Sodium Acetate	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
230. Sodium Bicarbonate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
231. Sodium Bisulfate	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
232. Sodium Bisulfite	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
233. Sodium Bromate	S4	S4	I4	I4	I4	I4	I1	I1	S1	S1	S1	I1	I1	I1
234. Sodium Carbonate (see soda ash)	I4	I4	I4	I4	I3	I3	I1	NR	S1	S1	S4	I1	I1	I1
235. Sodium Chlorate	NR	PV	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
236. Sodium Chloride	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1
237. Sodium Chlorite (50%)	NR	NR	S4	S4	S3	S3	S4	S4	S4	S4	S4	I4	I4	I3
238. Sodium Chromate	S4	S4	I4	I4	I3	I3	S4	S4	S1	S1	S1	PV	PV	I1
239. Sodium Cyanide	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
240. Sodium Dichromate	S4	S4	I4	I4	I3	I3	I4	I4	S1	S1	S1	PV	I4	I3
241. Sodium Fluoride*	S4	S4	NR	NR	I4	I4	PV	PV	S4	S4	S4	NR	NR	NR
242. Sodium Hydroxide (10%)*	I4	S4	S1	S1	I1	I1	I1	NR	S1	S1	S1	NR	NR	NR
243. Sodium Hydroxide (50%)*	I4	S4	S1	S1	I1	I4	I1	NR	S1	S1	S4	NR	NR	NR
244. Sodium Hypochlorite (3%)*	F4	F4	NR	S4	S4	S4	F1	NR	S3	S3	S1	NR	I4	I4
245. Sodium Hypochlorite (17%)	NR	NR	NR	PV	S4	S4	NR	NR	S4	S4	S4	NR	PV	S4
246. Sodium Peroxide	S4	S4	I4	I4	I4	I4	I1	I1	S4	S4	NR	PV	PV	S4
247. Sodium Phosphate	S4	S4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
248. Sodium Sulfate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
249. Sodium Sulfide	S4	S4	PV	PV	I4	I3	I1	I1	S1	S1	S1	I4	I4	I4
250. Sodium Sulfite	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
251. Sodium Tartrate	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
252. Sodium Thiosulfate (Hypo)	I4	S4	I4	I4	I3	I3	S1	NR	S1	S1	S1	I1	I1	I1
253. Soybean Oil	PV	PV	I4	I4	I3	I3	I1	I1	PV	S1	S1	I1	I1	I1
254. Stearic Acid	S4	S4	PV	PV	I4	I4	PV	PV	S4	S4	S1	I2	I2	I2
255. Succinic Acid	S4	F4	PV	PV	I4	I4	PV	PV	S3	S3	S3	I4	I4	I4
256. Sugar	I1	I1	I1	I1	I1	I1	I1	I1	S1	S1	S1	I1	I1	I1
257. Sulfite Liquor (Paper)	I4	I4	I4	I4	I4	I3	I1	I1	S1	S1	S1	I1	I1	I1
258. Sulfur Dioxide	F1	F1	S4	I4	I4	I4	I1	I1	S1	S1	S1	F4	I1	I1
259. Sulfur Trioxide	F4	F4	PV	PV	S4	S3	S1	S1	S1	S1	S1	I4	I4	I4
260. Sulfuric Acid (2%-20%)	S1	S4	S1	S1	S1	S1	S1	S1	S3	S3	S1	I1	I1	I1
261. Sulfuric Acid (20%-50%)	S1	F4	S1	S1	S1	S1	F1	F1	S4	S4	S1	I3	I3	I2
262. Sulfuric Acid (50%-70%)	S1	F4	F3	F3	F1	F1	F4	F4	NR	S4	NR	I4	I4	I2
263. Sulfuric Acid (70%-80%)	S1	NR	NR	NR	NR	NR	NR	NR	NR	S4	NR	PV	PV	PV
264. Sulfuric Acid (80%-98%)	S1	NR	NR	NR	NR	NR	NR	NR	NR	S4	NR	NR	NR	NR
265. Sulfurous Acid	S4	S4	I4	I4	I4	I3	S4	S4	S4	S4	S1	I1	I1	I1
266. Tall Oil	I4	S4	I4	I4	I4	I3	I1	I1	S4	S4	S1	I1	I1	I1
267. Tannic Acid	S4	PV	I4	I4	I4	I4	PV	PV	S4	S4	S4	I1	I1	I1
268. Tartaric Acid	U4	I4	I4	I4	I3	I3	S1	S1	S1	S1	S1	I1	I1	I1
269. Tetrachlorethane	F4	PV	NR	NR	F4	F4	NR	S4	S4	S4	NR	PV	PV	PV
270. Thionyl Chloride	NR	NR	NR	NR	NR	NR	NR	S4	NR	NR	NR	NR	NR	NR
271. Titanium Tetrachloride	S4	F4	I4	I4	I3	I3	S4	S4	S1	S1	S1	I1	I1	I1
272. Toluene	F4	NR	NR	NR	F4	F4	NR	S4	S4	S4	NR	S4	S4	S4
273. Toluene Sulfonic Acid	S3	S3	I4	I4	I3	I3	S4	S4	S1	S1	S1	I1	I1	I1
274. Trichloroacetic Acid (20%)	NR	NR	F4	F4	I4	I3	F4	F4	NR	NR	S1	I4	I4	I4
275. Trichloroethylene	NR	PV	NR	NR	F4	F4	NR	S4	S4	S4	NR	PV	PV	PV
276. Trisodium Phosphate	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S4	I3	I3	I3
277. Turpentine	S4	S4	PV	PV	I4	I4	NR	I1	S1	S1	NR	PV	PV	PV
278. Tween Surfactants	PV	PV	I4	I4	I4	I4	PV	PV	S1	S1	S1	I1	I1	I1
279. Urea Solutions	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
280. Vinegar	S4	F4	I1	I1	I1	I1	I4	I4	S1	S1	S1	I1	I1	I1
281. Water, distilled & demineralized	I4	I4	I4	I4	I4	I3	I4	I4	S1	S1	S1	I1	I1	I1
282. White Liquor (Paper)	I4	I4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
283. Xylene (Xylol)	S4	NR	NR	NR	NR	NR	NR	I1	S4	S4	NR	I4	I4	I4
284. Zinc Salt	I4	I4	I4	I4	I3	I3	I4	I4	S1	S1	S1	I1	I1	I1
285. Zinc Plating (Acid Sulfate)	S3	S3	I4	I4	I3	I3	S1	S1	S1	S1	S1	I1	I1	I1

*May need synthetic fabric, or carbon fillers. Consult a Dudick Corrosion-Proof, Inc. technical representative for more complete information on these products.

APPENDIX

13-3

UNIT #15

Unit #15 - Truck Unloading Platform is an existing structure. There is no change in usage. The secondary containment is covered by a canopy. The canopy roof was modified to accommodate new railcar unloading facilities. For existing structure, see Foundation Drawing 1-F-003 and Steel Canopy drawings 1-S-010, 1-S-111 and 1-S-112 in Appendix 15-1. These drawings were not prepared under HST supervision.

The secondary containment calculations are included in Appendix 15-1.

The structure was built in 1982. Previous inspections reveal numerous cracks in the concrete secondary containment slab. The cracks appear to be shrinkage type. This type of cracks typically do not continue to expand after original stress from shrinkage has been relieved. The cracks were routed and filled with Protecto-Crete 900 prior to the application of Primer 27. The entire surface was cleaned and the existing coating was mechanically removed. The final coating is Protecto-Coat 900, 30 mils thick. Primer 27, Protecto-Coat are as manufactured by Dudick, Inc.

The penetrations through the west wall are sealed with Link-Seal. Link-Seal material is EPDM rubber. The selection was based on the Owner's previous good experience with the material.

The visual inspection of the containment did not reveal any cracks, gaps, scratches or other damage.

This certification does not include piping. The loading/unloading piping will be pressure tested at a later date and certification will be included as a part of Unit #16 certification at a later date.

APPENDIX

15-1

HOYER-SCHLESINGER-TURNER, INC.

PROJECT: CLEAN HARBORS

SUBJECT: SECONDARY CONTAINMENT FOR TRUCK UNLOADING PLATFORM #15

SHEET 1 OF 1
PROJECT NO. 1385
DATE 6-28-95
BY M.V.

A) AVAILABLE VOLUME

T/SLAB AT HEIGH POINT = 102'-3"
— " — LOW — " — = 100'-3"
DEPT = 2'-0 AT LOW POIN

VOLUME = 2' x 60.17 x 29' x 1/2 = 1745 ft³
= 13,054 gal

B) VOLUME OF REQUIRED CONTAINMENT

2- TANKERS EACH OF 6,000 GAL = 12,000 G

ADD PRECIPITATION

AREA: (29-4') x 17.67' = 442 ft²

RAIN FALL 4.7"

442 ft² x 4.7"/12 = 173 ft³ = 1,294 gal

TOTAL 13,294 GAL

Marie Vanagas
Exp. date
11-30-95

MARIE VANAGAS
62140801
REGISTERED
PROFESSIONAL
ENGINEER
OF
ILLINOIS

CONCLUSION:

AVAILABLE CONTAINMENT VOLUME
BY 240 gal ≐ 32 ft³ = 1.8% of REQUIR
VOLUME

2" HIGH CONCRETE BUMPER CAN BE ADDED
TO THE ENTRANCE OF THE SECONDARY CONTAINM
TO INCREASE CONT. VOLUME

APPENDIX

15-2

UNIT #59

Unit #59 - Truck Staging Area is a new concrete pad without a canopy. For construction details, see CHCI Dwg. No. 4247 (Dwg. 2916-S-14) in Appendix 59-1.

For calculations of structural integrity, see Appendix 59-1. The containment calculations are on the drawing.

The entire secondary containment was coated with Protecto-Coat 900, 30 mils thick, as manufactured by Dudick Inc. For technical data, application and Chemical Resistance Chart, see Appendix 13-2.

During the visual inspection, the Truck Staging Area was in excellent condition. There were no cracks, gaps, scratches or other damage. No penetrations are present within the containment structure.

APPENDIX

59-1

LOADING: ILLINOIS DEPARTMENT OF TRANSPORTATI
STANDARD HIGHWAY LOADING
OF H20-S16-44

a) DATA FOR TRAILER
AXLE LOAD = 42^k - DUAL WHEEL LOADING
WHEEL SPACING 18"x56"x18"
NO. OF WHEELS ON AXLE = 4
TIRE INFLATION PRESSURE = 100 PSI
TIRE CONTACT AREA = $\frac{42{,}000^{\#}}{4 \times 100}$ = 105 SQ. IN.

b) SUBGRADE & CONCRETE DATA:
CONCR FLEXURAL STRENGTH MR = 640 PSI @ 28 DAYS

DESIGN

1.) SAFETY FACTOR = 2.0

2.) CONC. WORKING STRESS (WS)
$WS = \frac{MR}{SF} = 640/2 = 320$ PSI

3.) EQUIVALENT SINGLE-WHEEL LOAD
FROM FIG. 4 (SEE SHEET #2)
$= .775 \times 42^k = 32.55^k$

4.) SLAB STRESS PER 1,000# OF AXLE LOAD =
$= WS/\text{AXLE LOAD} = 320/32.55 = 9.83$ PSI

5.) FROM FIG. 3 (SEE SHEET #3)
SLAB THICKNESS REQ'D = 8.75" < 10" O.K.

6.) REINFORCEMENT
$A_s = \frac{2 \times L \times w}{2 \times f_s} = \frac{2 \times 80 \times 125}{2 \times 24{,}000} = .42 \text{ IN}^2$

USE #4@12" C-C TOP & BOTT.

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes

PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11+30

SHEET 2 OF 3
PROJECT No. 17851
DATE 6.30.95
BY BERNES, S.C.

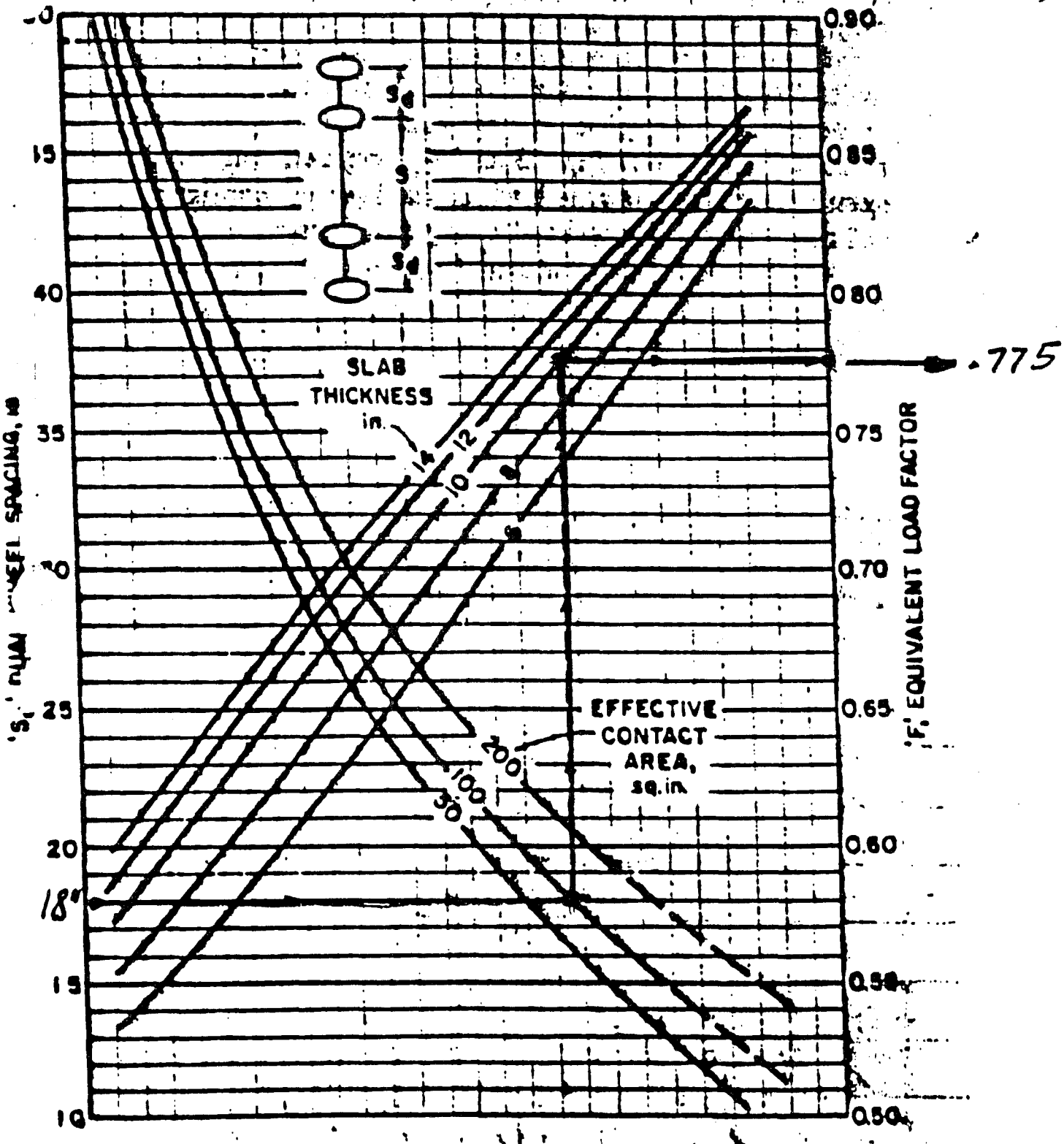


Fig. 4. Design chart for axles with dual wheels

PROJECT No. 17851
DATE 6.30.95
By BERNES, S.E.

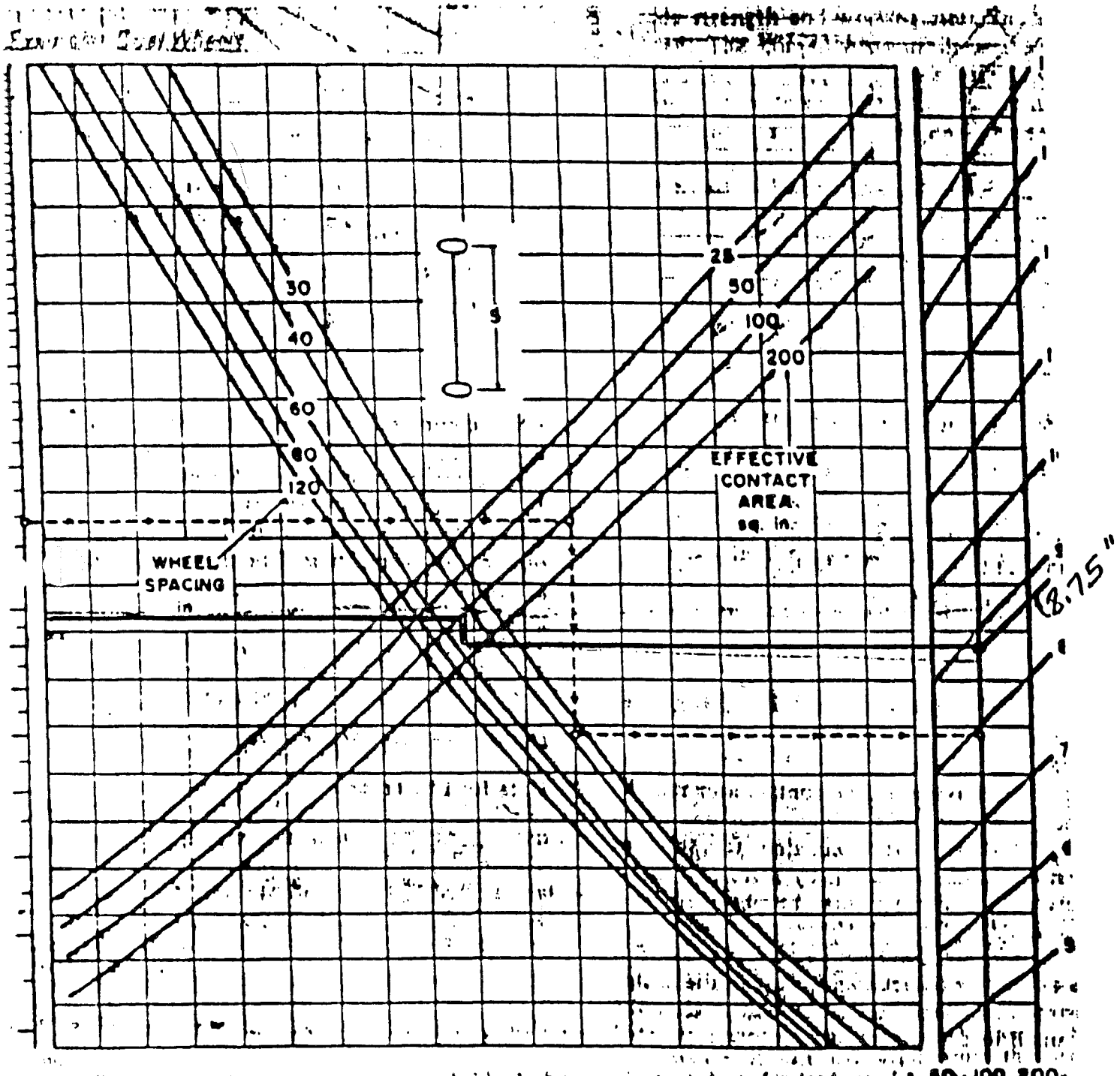


chart for axles with single wheels.

APPENDIX

59-2

UNIT #61

Unit #61 - Container Handling Dock in new structure. The secondary containment concrete pad is enclosed on three sides with concrete block walls and the structure has a roof. The structure is 4 HR Fire Rated. For construction details, see Drawing CHCI Dwg. No. 4245 (Dwg. 2916-S-12) in Appendix 61-3.

For structural calculations, see Appendix 61-1. The containment calculations are on the drawing.

The floor is coated with Protecto-Crete 900, trowel-applied, high density vinyl ester, 1/4" thick. For technical information and application instructions, see Appendix 61-2. For chemical resistance chart, see Appendix 13-2.

The dike walls are coated with Protecto-Coat 900. For technical information, application instructions and chemical resistance chart, see Appendix 13-2.

The visual inspection of Unit #61 was satisfactory. There were no cracks, gaps, scratches or other damage to the floor or dike wall coating. The roof structure had missing the cementous spray to bring the structure to 4 HR Fire Rating. Also missing was the metal ramps on the north side of the dock as shown on the drawing. The personal fire rated door in the west wall of the structure was not installed. The personal door in the east wall is under construction.

All missing items shall be done within the next ten (10) days. The items will be re-inspected by Ms. Marie Vanagas, PE, during a visit on July 7, 1995.

APPENDIX

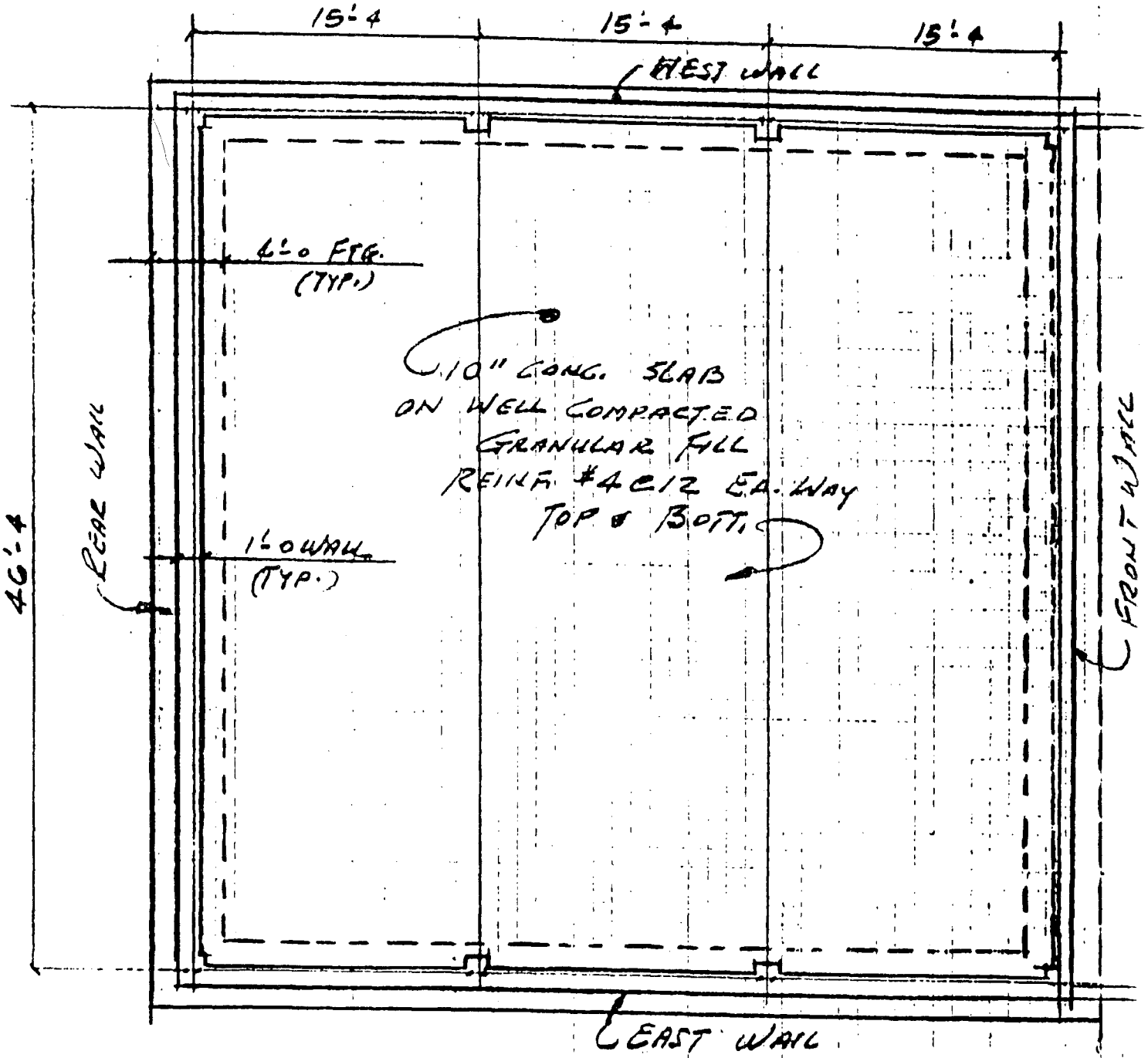
61-1

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, IL

SUBJECT CONTAINER HANDLING DOCK FOUNDATIONS
UNIT #61

SHEET 1 OF 6
PROJECT NO. 17851
DATE 7.1.95
BY BERNES, S.



PLAN
1/8" = 1'-0

N

Peter J. Bernes
PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11-30-96

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, IL

SUBJECT CONTAINER HANDLING DOCK FOUNDATIONS

SHEET 2 OF 6
PROJECT NO. 12851
DATE 7.1.95
BY BERNES, J.C

UNIT #61

ALLOWABLE SOIL PRESSURE = 2000 PSF

A) TOTAL LOAD (DL+LL) FOR EAST & WEST WALLS

1) SUPERSTRUCTURE = 50 PSF (DL+LL)
48' x 24' x 50 PSF = 57.6 K

2) FOUNDATION WALL, FTG & 12" CONC. BLOCK WALL

12" CMU = 1' x 20' x 48' x .080 KSF = 76.8 K
FDN. WALL = 1' x 6' x 48' x .150 KCF = 43.2 K
FTG. = 1' x 4' x 48 x .150 " = 28.8 K
SOIL = 4' x 3' x 48 x .100 " = 57.6 K

TOTAL = 206.4 K

SUPERSTRUCTURE + FOUNDATIONS = 206.4 + 57.6 K
= 264 K

ACTUAL SOIL PRESSURE = $\frac{264 K}{4' \times 48'}$ = 1375 < 2000
OK.

(3') INVESTIGATION OF EAST & WEST FOUNDATION WALL DUE TO COLUMN CONCENTRATED LOAD

COL. LOAD = D.L. + L.L = 50 PSF x 24' x 15' = 18 K
COL. + RAFTER = 2 K

20 K

UNIFORM LOAD DISTRIBUTION = 20 K / 15 = 1.33 KLF

$M = 1.33 \times 15^2 / 10 = 29.93$ 'K

$A_s = 29.93 / 1.76 \times 70 = .24$ IN²
LEG'D

2-#4 = .40 IN² > .24 IN² OK

HOYER-SCHLESINGER-TURNER, INC.

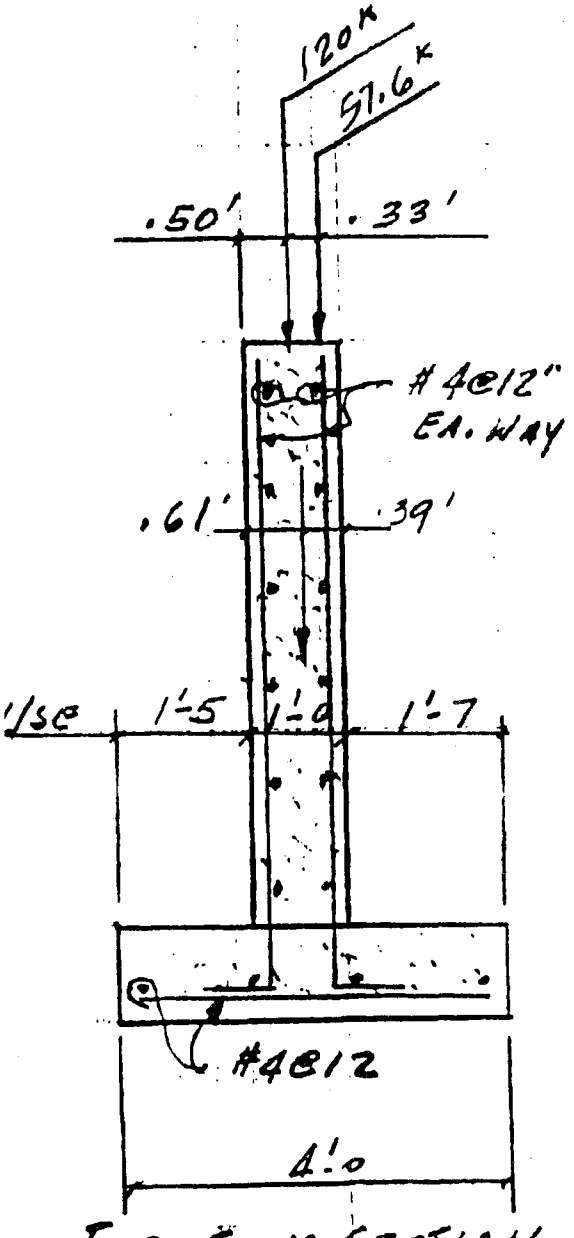
SHEET 3 OF 6
PROJECT NO. 1785
DATE 7.1.95
BY BERNES, S.C

PROJECT CLEAN HARBORS - CHICAGO, IL

SUBJECT CONTAINER HANDLING DOCK FOUNDATIONS
UNIT #61

C) CENTER LINE OF GRAVITY FOR ALL COMBINED LOA

1.) SUPERSTRUCTURE LOAD = 57.6^k (SEE SH #2)
2) 12" CMU WALL + FDN WALL = 76.8^k + 43.2^k = 120^k



TYP. CROSS SECTION
1/2" = 1'-0

$120^k \times .5 = 60.$
$57.6^k \times .83 = 47.81$
$177.6 \qquad 107.81$

$X = \frac{107.81}{177.6} = .61'$

NET SOIL PRESSURE

$\frac{177.6^k}{4' \times 48'} = .925$ KSF

$M = .925 \times 1.58^2/2 = 1.15'^k$

$A_s = \frac{1.15}{1.76 \times 9} = .07$ IN^2

4/SE #4@12

B) FRONT WALL (OPEN)

TOTAL LOAD (DL+LL) FOR FRONT WALL SIMULTANEOUS LOADING OF 4-LIFT TRU EACH OF 25^k AXLE LOAD.

4-LIFT TRUCKS =	4 x 25^k	= 100.
FDN. WALL 6' x 48' x 1' x .15 KCF		= 43.
CONC. SLAB 4' x 48 x .83' x .15 KCF		= 23.
FTG. 1' x 4' x 48' x .15 KCF		= 28.
SOIL 4' x 3' x 48' x .10 KCF		= 57.
TOTAL		= 253.

ACTUAL SOIL PRESSURE
$= \frac{253.5^k}{4' \times 48'} = 1320$ PSF < 2000 PSF O

CONT. SH. #4

UNIT #61

FRONT WALL - CONT. FROM SH. #3

NET SOIL PRESSURE =

$= \frac{100 + 43.2 + 23.9}{4' \times 48'} = .87$ KSF

$M = .87 \times 1.58^2/2 = 1.09^{'k}$

$A_s = 1.09 / 1.76 \times 9 = .07 \text{ IN}^2$

USE #4 @ 12"

C) REAR WALL

TOTAL LOAD DL ONLY

12" CONC. BLOCK WALL = 1' x 20' x 48' x .08k = 76.8k
12" FOUNDATION WALL = 1' x 6' x 48' x .15k = 43.2k
SOIL 4' x 3' x 48' x .10 = 57.6k

TOTAL = 177.6k

ACTUAL SOIL PRESSURE =

$= \frac{177.6^k}{4' \times 48'} = 925$ PSF < 2000 PSF o.k.

DUE TO SIMPLICITY OF CONSTRUCTION
USE SAME WIDTH OF FOOTING
AND SAME TYPE OF REINFORCEMENT

PROJECT CLEAN HARBORS - CHICAGO, IL

SUBJECT CONTAINER HANDLING DOCK FOUNDATIONS

UNIT #61

D.) FLOOR SLAB DESIGN

1.) DATA FOR LIFT TRUCK

AXLE LOAD = 25K - SINGLE WHEEL AXLE
WHEEL SPACING = 34"
NO. OF WHEELS = 2
TIRE INFLATION PRESSURE = 100 PSI
TIRE CONTACT AREA = $\frac{25{,}000}{2 \times 100}$ = 125 SQ. IN.

2) SUBGRADE MODULUS K = 100
CONCRETE FLEXURAL STRENGTH - MR = 640 PSI

3) SAFETY FACTOR = 2.0

4) CONCRETE WORKING STRESS
$WS = \frac{MR}{SF} = \frac{640}{2.0} = 320$ PSI

5) SLAB STRESS PER 1000# OF AXLE LOAD
$WS/\text{AXLE LOAD} = 320/25 = 12.8$ PSI PER 1000#

6) FROM FIG. 3 (SEE SHEET #6)
SLAB THICKNESS REQ'D = 9" < 10" O.K.

7) REINFORCEMENT
$A_s = \frac{2 \times C \times W}{2 \times f_s} = \frac{2 \times 48 \times 125}{2 \times 24{,}000} = .25 \text{ IN}^2$

USE #4 @ 12" TOP & BOTT. - EA. WAY

PROJECT No. 17851
DATE 7.1.96
By BERNEI, S.E.

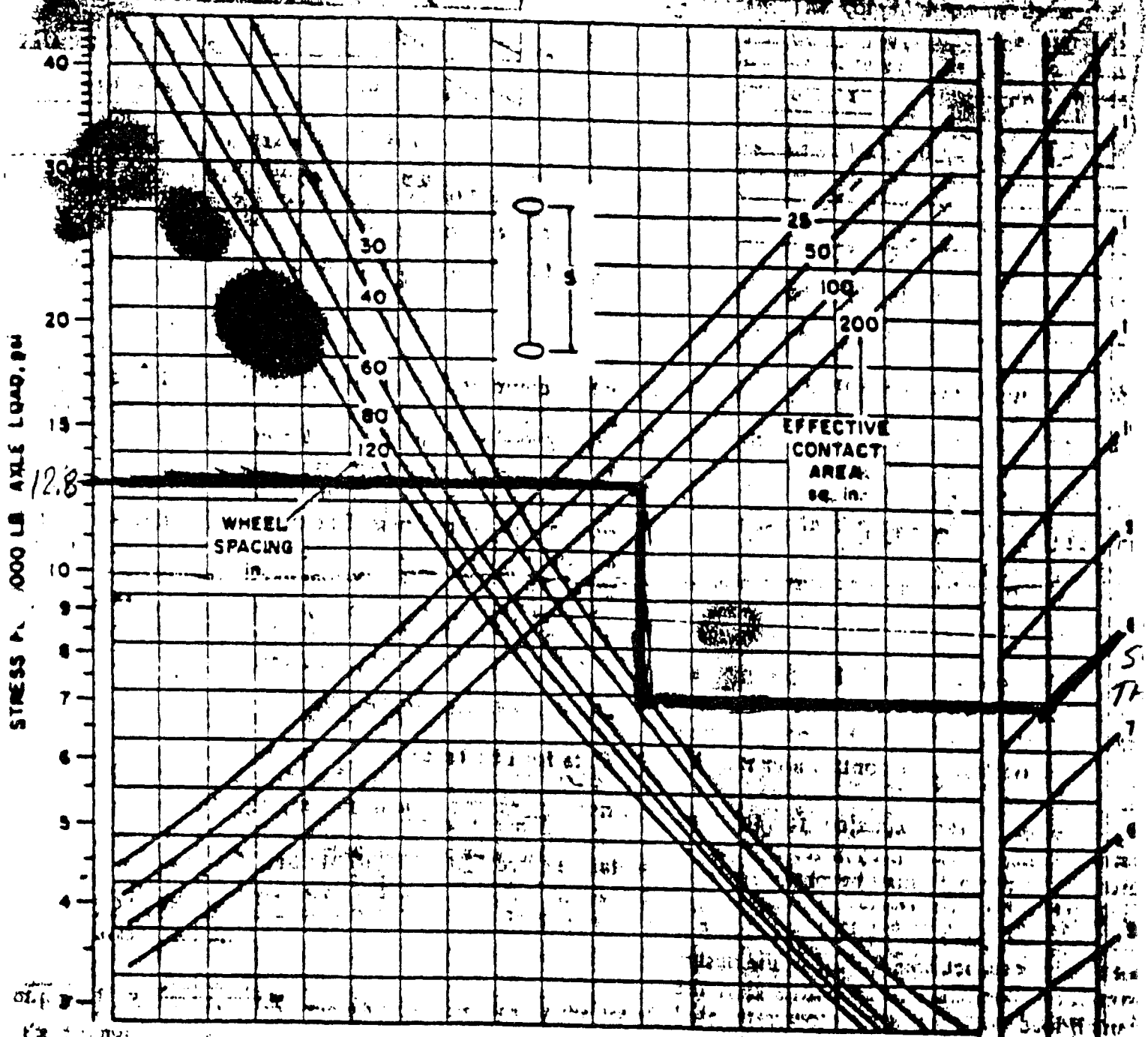


Fig. 9. Design chart for axles with single wheels.

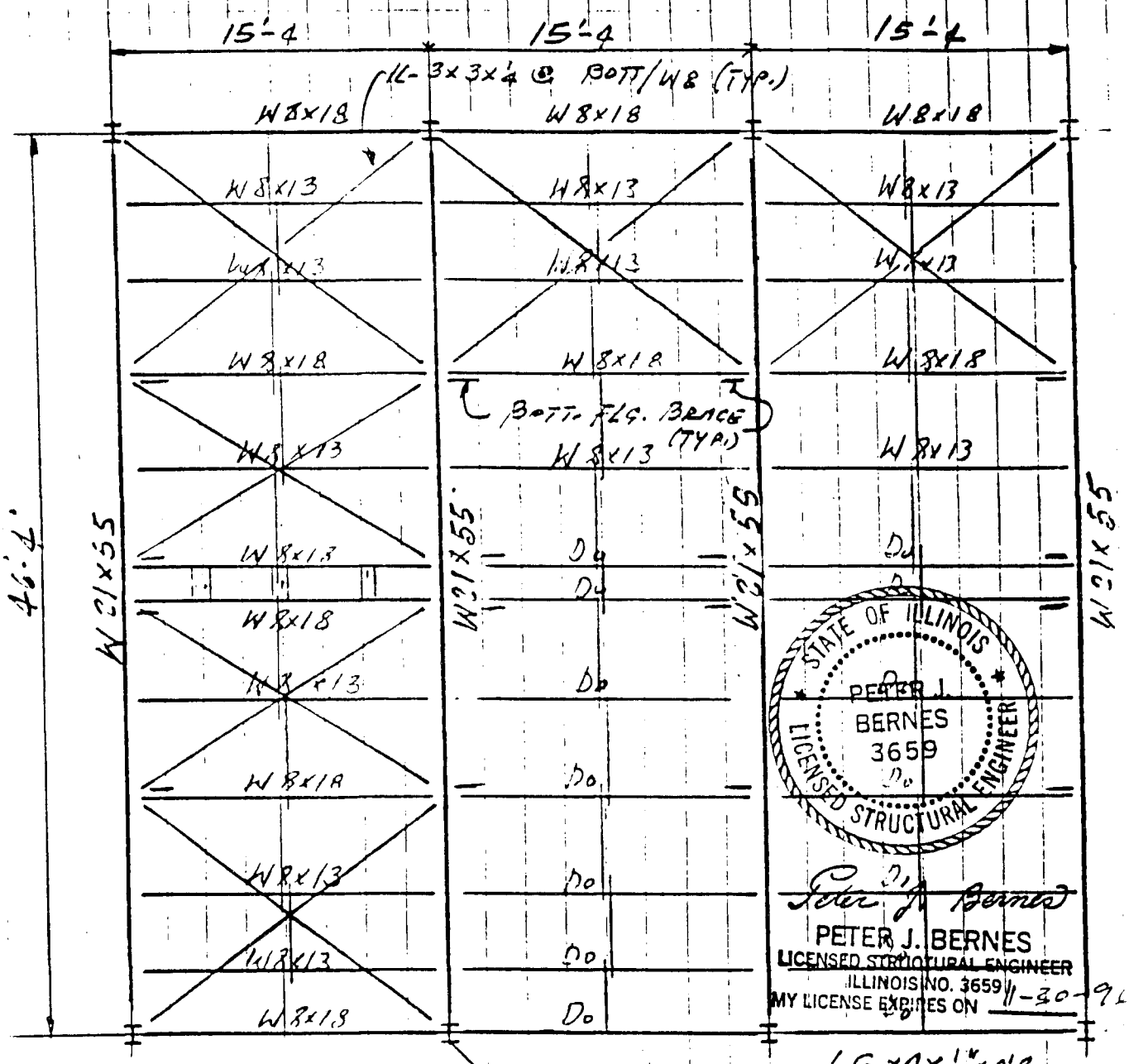
HOYER-SCHLESINGER-TURNER, INC.

SHEET 1 OF 4
PROJECT NO. 1785-1
DATE 1.15.95
BY BERNES

PROJECT GREAT HARBORS OF CHICAGO

SUBJECT CONTAINER HANDLING DOCK SUPERSTRUCTURE
BLDG. #61

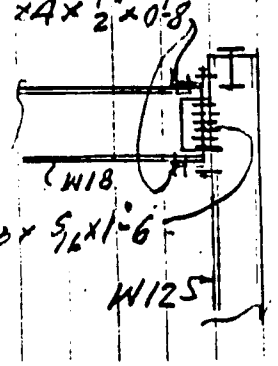
TYPE 2 CONSTRUCTION W/WIND MOMENT CONNECTIONS, BRACING SYSTEM AND ROOF SHEAR DIAPHRAM ACTION COMBINED TOGETHER TO HAVE SIMPLE SHEAR CONNECTION



ALL COLUMNS ARE W12x26

ROOF FRAMING PLAN

DESIGN LOADS:
D.L. = 20 PSF
L.L. = 30 "
TOTAL D.L.+L.L. = 50 PSF
WIND = 20 PSF



HOYER-SCHLESINGER-TURNER, INC.

SHEET 2 OF 4
PROJECT NO. 1785
DATE 1.21.95
BY BERNES

PROJECT CLEAN HARBORS OF CHICAGO
SUBJECT DESIGN CALCULATIONS FOR CONTAINER

HANDLING DOCK BLDG. #61

1. STEEL PURLINS

PURLIN SPACING = 5'-0 c.c

D.L. + L.L

INSULATION	= 3 "	ROOFING	= 6 PSF
STEEL DECK	= 2 "	INSUL.	= 3 "
PURLINS	= 2 "	STEEL DK	= 2 "
CEILING & MECH.	= 5 "	MECH	= 5 "
LIVE	= 25 "	SPRAY	= 3 "
			19 PSF
		L.L.	= 25 "
			44 PSF

TOTAL = 37 PSF

$M = \frac{37^{\#} \times 5 \times 15.33^2}{8} = 5.43^{'K}$

$M = \frac{44 \times 5 \times 15.33^2}{8} = 6.47$

$M = \frac{.124 \times 15.33^2}{8} = .70$

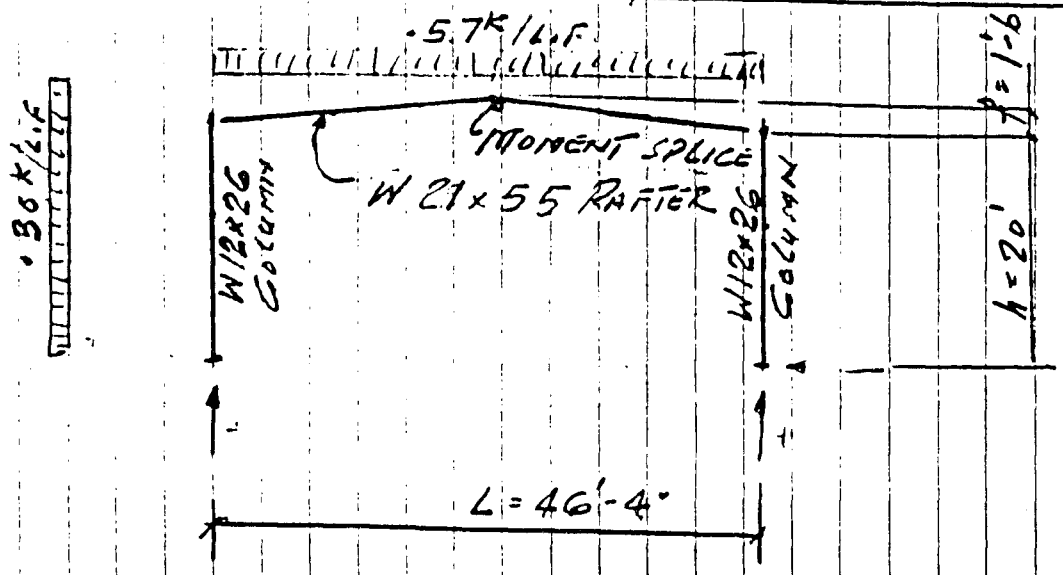
7.17'

$S_{REQ'D} = \frac{5.43^{'K} \times 12}{20} = 3.27 \text{ IN}^3$

W8x18 : M_R = 30"

USE W 8 x 13 S = 9.91 > 3.27 IN³ O.K.

2. STEEL FRAME W/ WIND MOMENT CONNECTION



RAFTER SPACING = 15'-4" c.c

193
14
217

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS OF CHICAGO

SUBJECT CONTAINER HANDLING DOCK SUPERSTRUCTURE

SHEET 3 OF 4
PROJECT NO. 1785
DATE 1.22.95
BY BERNEI

46' RAFTER

$M = .57^k \times 46^2/8 = 151^{'k}$

W 21 x 55 $M_R = 220^{'k} > 151^{'k}$ o.k

COLUMN (CONDERED W 12 x 26)

VERTICAL LOAD = 37 PSF x 15.33' x 23.17' = 13.14^k

WIND LOAD MOMENT =

.30 KLF x 20'/4 x 20' = 30^k

W 12 x 26 $A = 7.95\ in^2$ $S = 34.2\ in^3$ $r_{xx} = 5.07$

$KL/r = 2 \times 20 \times 12/5.07 = 94$ $F_a = 13.72$ ksi

$F_b = 24$ ksi

$f_a = 13.14/7.95 = 1.65$ ksi. $\frac{f_a}{F_a} = \frac{1.65}{13.72} = 12 < .15$

$f_b = 30^{'k} \times 12/34.2 = 10.53$ ksi

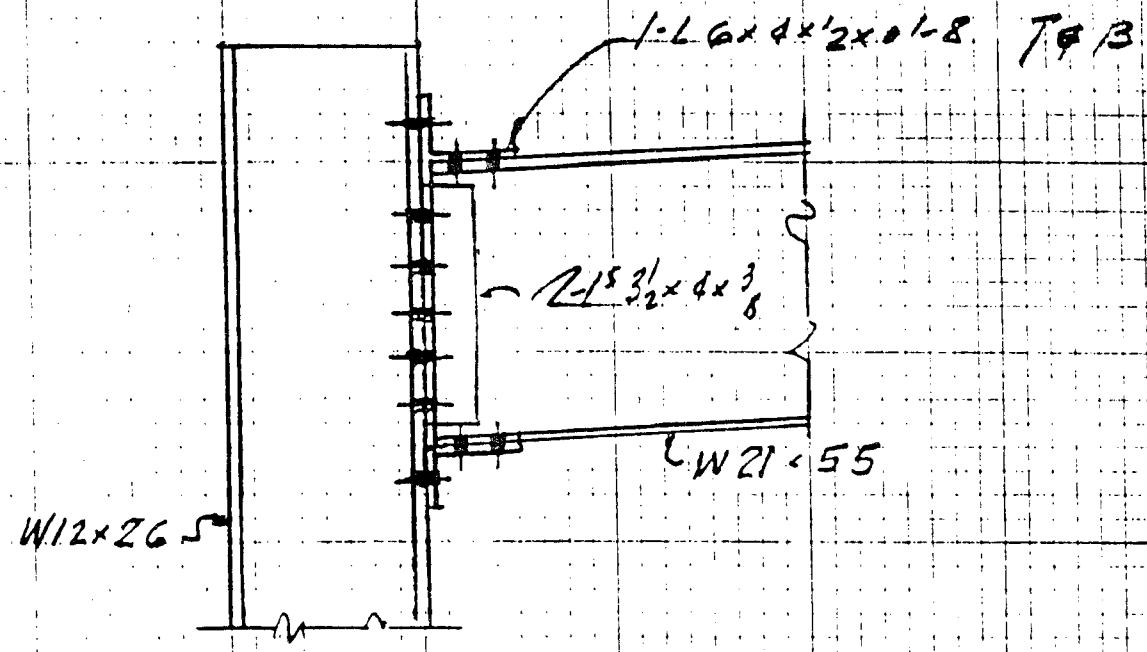
$f_a/F_a + f_b/F_b = 1.65/13.72 + 10.53/24 =$

$= .12 + .44 = .56 < 1.33$ o.k.

PROJECT CLEAN HARBORS OF CHICAGO

SUBJECT CONTAINER HANDLING DOCK SUPERSTRUCTURE

WIND MOMENT CONNECTION DETAIL



TENSION TOP ANGLE = 30K/1.5 x .75 = 15K

¾" HSB TENSION = 17.67K SHEAR = 6.63

TRY L 6x4x½x0'-8

YIELD = M = Fy S = 36 x 8 x (.5)²/6 = 12 K-IN

$M_{BENDING}$ = 15K x .5 x (2.5 - .5) = 15 K-IN O.K.

HOYER-SCHLESINGER-TURNER, INC.

SHEET 1 OF 1

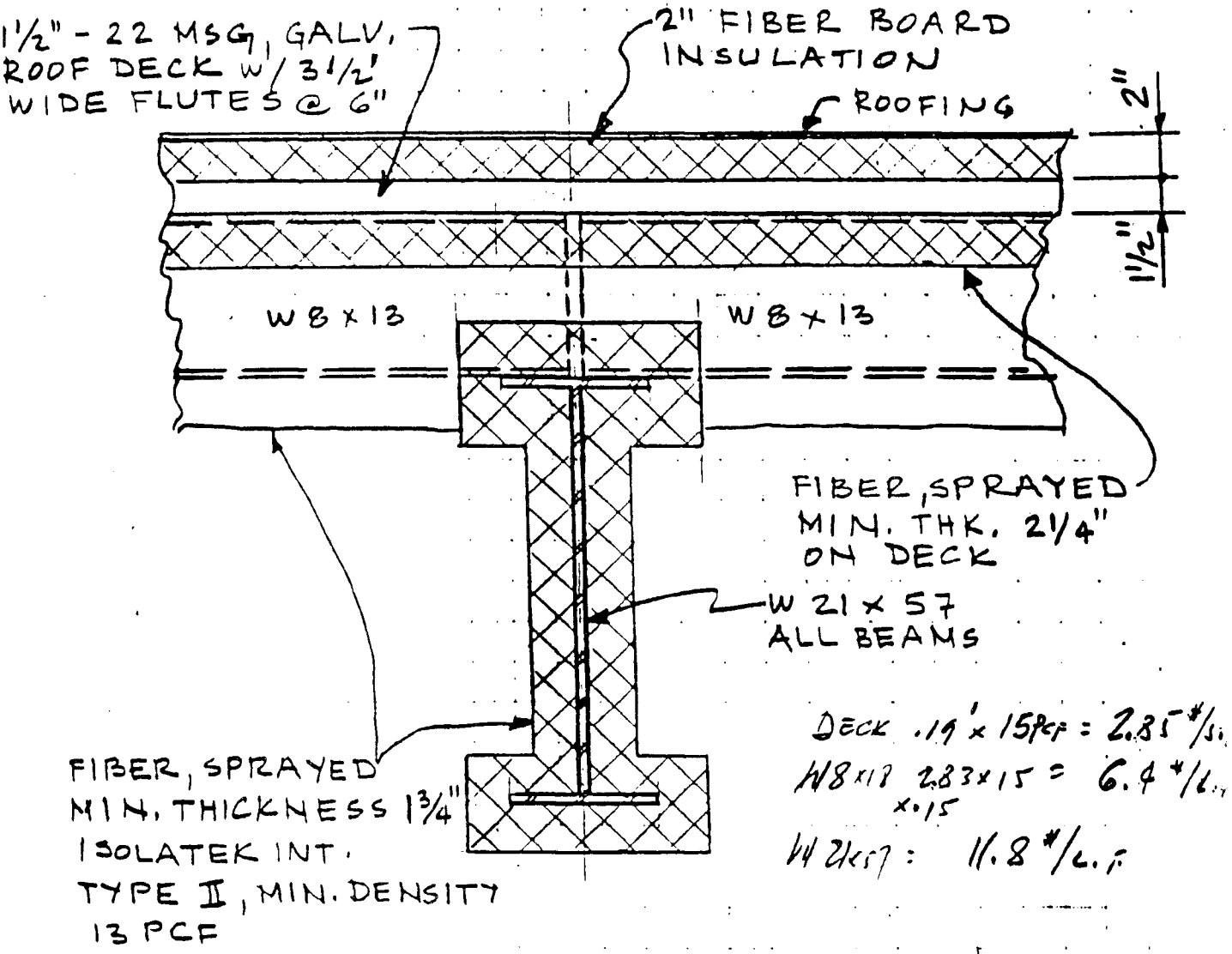
PROJECT CLEAN HARBORS

PROJECT NO. 1785

SUBJECT BLDG #61 - 4 HR FIRE RATED ROOF

DATE 3-6-95

BY MV



DECK .19' x 15PCF = 2.85 #/s.f.

W8x13 2.83x15 x.15 = 6.4 #/l.f.

W 21x57 : 11.8 #/l.f.

ROOF SECTION

SCALE 1½" = 1'-0"

7' 42

7 21

7 63 x.15

UL DESIGN NO. S805

16

13

34

2.83 x 15

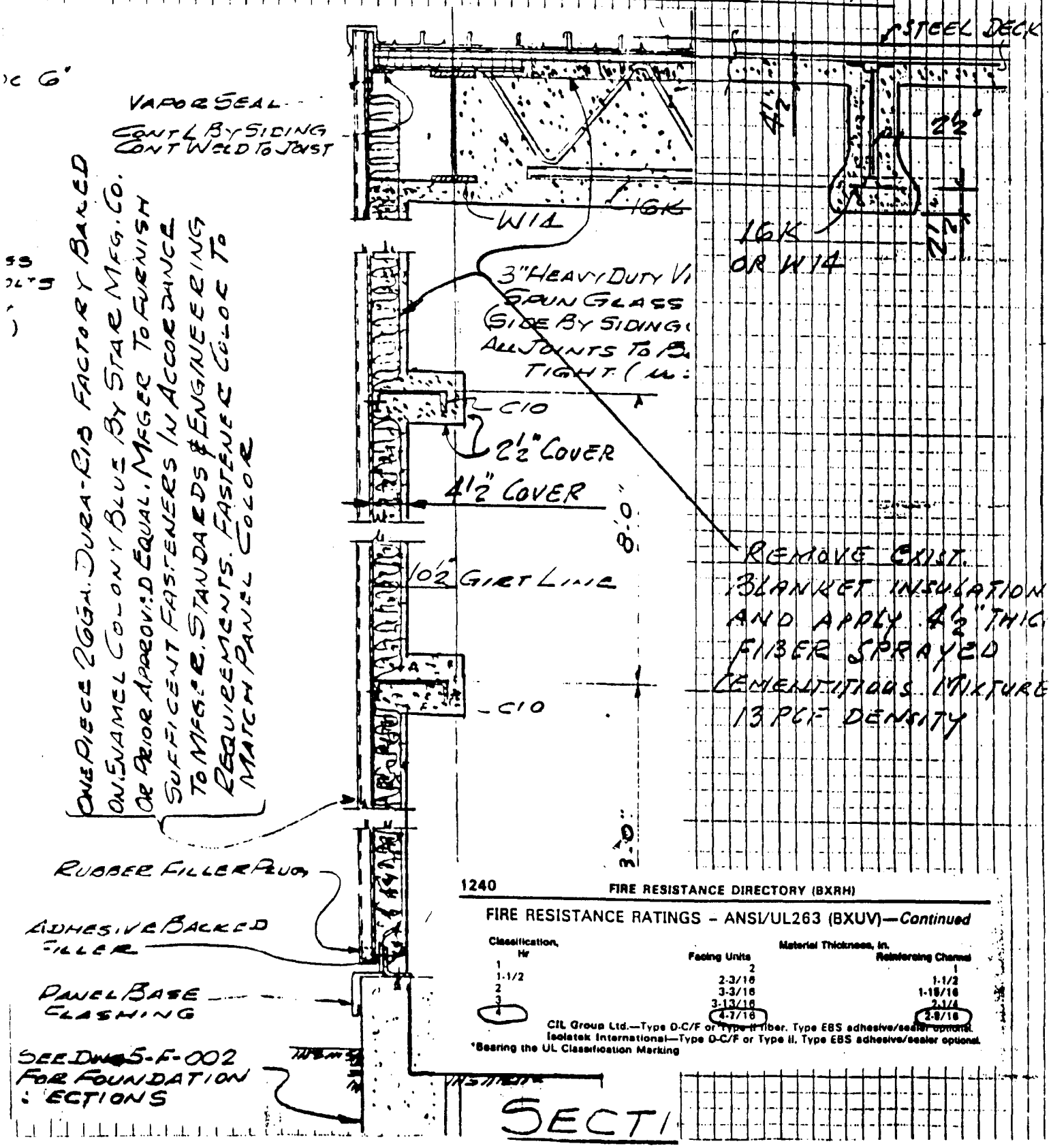
HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS, CHICAGO, ILLINOIS

SUBJECT FIREPROOFING FOR SHREDDER FACILITIES BLDG #43

SHEET 1 OF 1
PROJECT NO. 17851
DATE 3. 31. 95
BY BERNES

FIRE RESISTANCE RATING ANSI/UL263
DESIGN NO. U 804 - 4 HR
NON BEARING WALL & ROOF



1240 FIRE RESISTANCE DIRECTORY (BXRH)

FIRE RESISTANCE RATINGS – ANSI/UL263 (BXUV)—*Continued*

Classification, Hr	Material Thickness, In. Facing Units	Material Thickness, In. Reinforcing Channel
1	2	1
1-1/2	2-3/16	1-1/2
2	3-3/16	1-15/16
3	3-13/16	2-1/4
4	4-7/16	2-9/16

CIL Group Ltd.—Type D-C/F or Type II fiber. Type EBS adhesive/sealer optional.
Isolatek International—Type D-C/F or Type II. Type EBS adhesive/sealer optional.
*Bearing the UL Classification Marking

HOYER-SCHLESINGER-TURNER, INC.

SHEET 1 OF 1

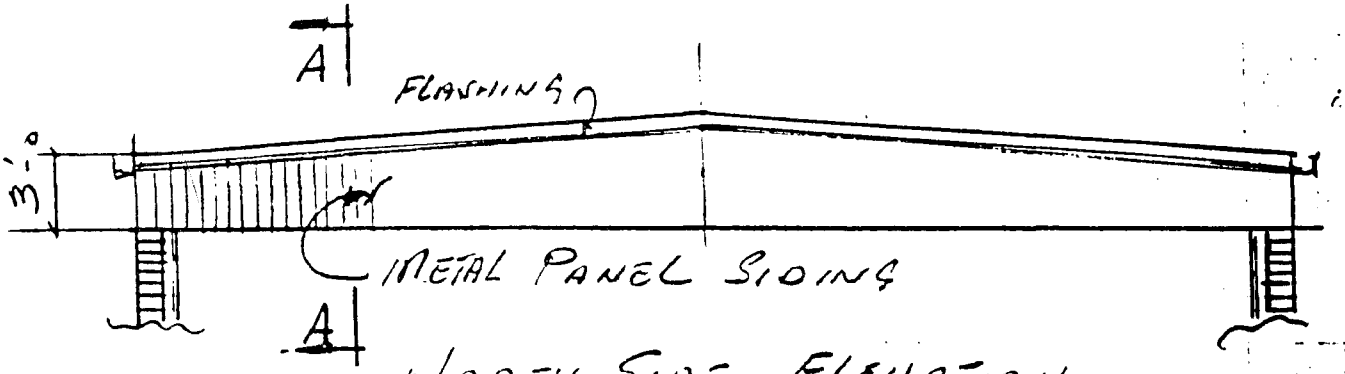
PROJECT CLEAN HARBORS - CHICAGO ILLINOIS

PROJECT NO. 17851

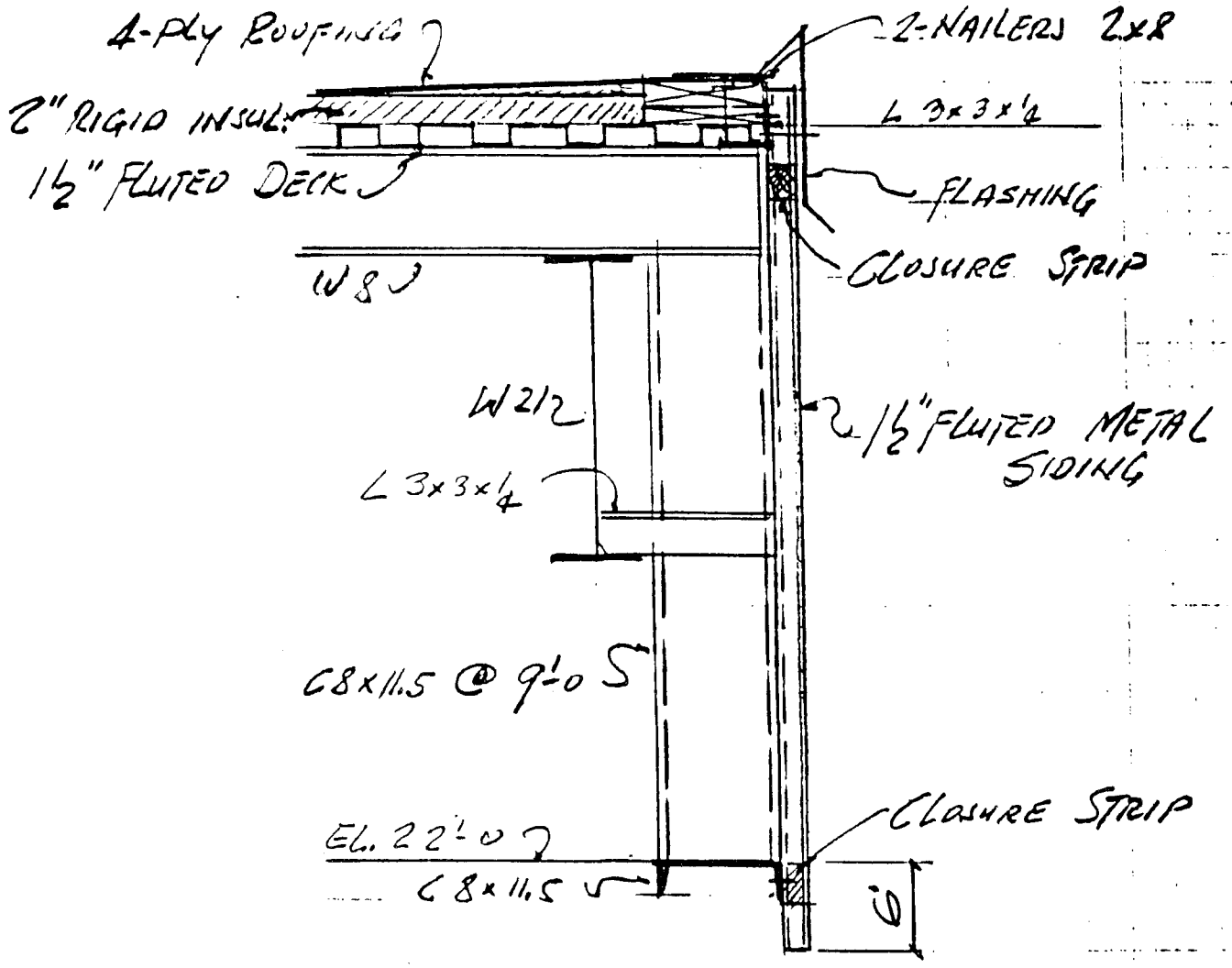
DATE 3.14.95

SUBJECT BLDG. #61 - ARCHITECTURAL DETAILS

BY BERNES



NORTH SIDE ELEVATION



SECTION "A-A"

HOYER-SCHLESINGER-TURNER, INC.

PROJECT: CLEAN HARBORS - CHICAGO, IL

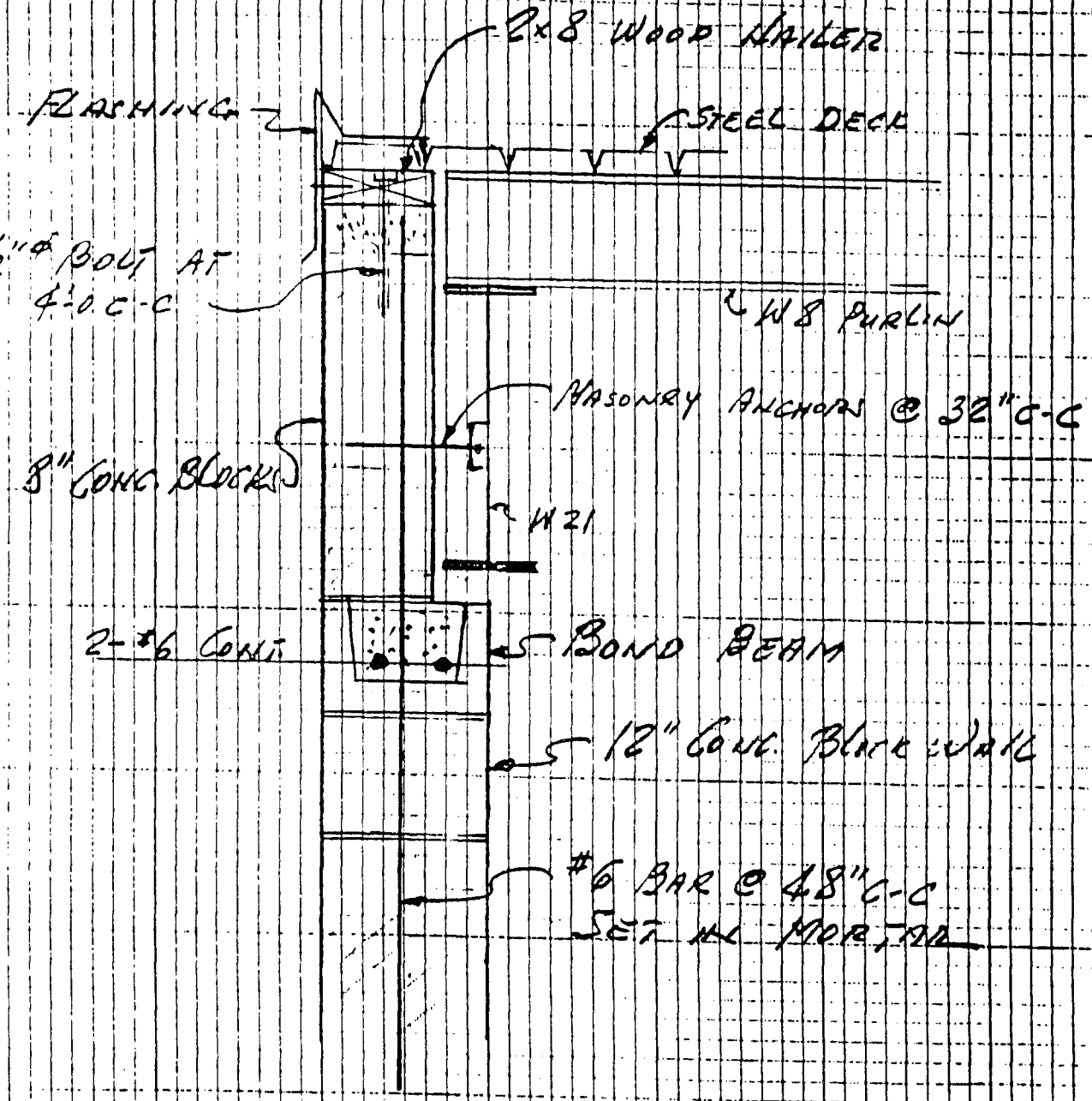
SUBJECT: CONTAINER HANDLING DOCK SUPERSTR. BLDG #61

SHEET 1 OF 2

PROJECT NO. 1785

DATE 2-8-95

BY BERNES



SECTION AT SOUTH WALL

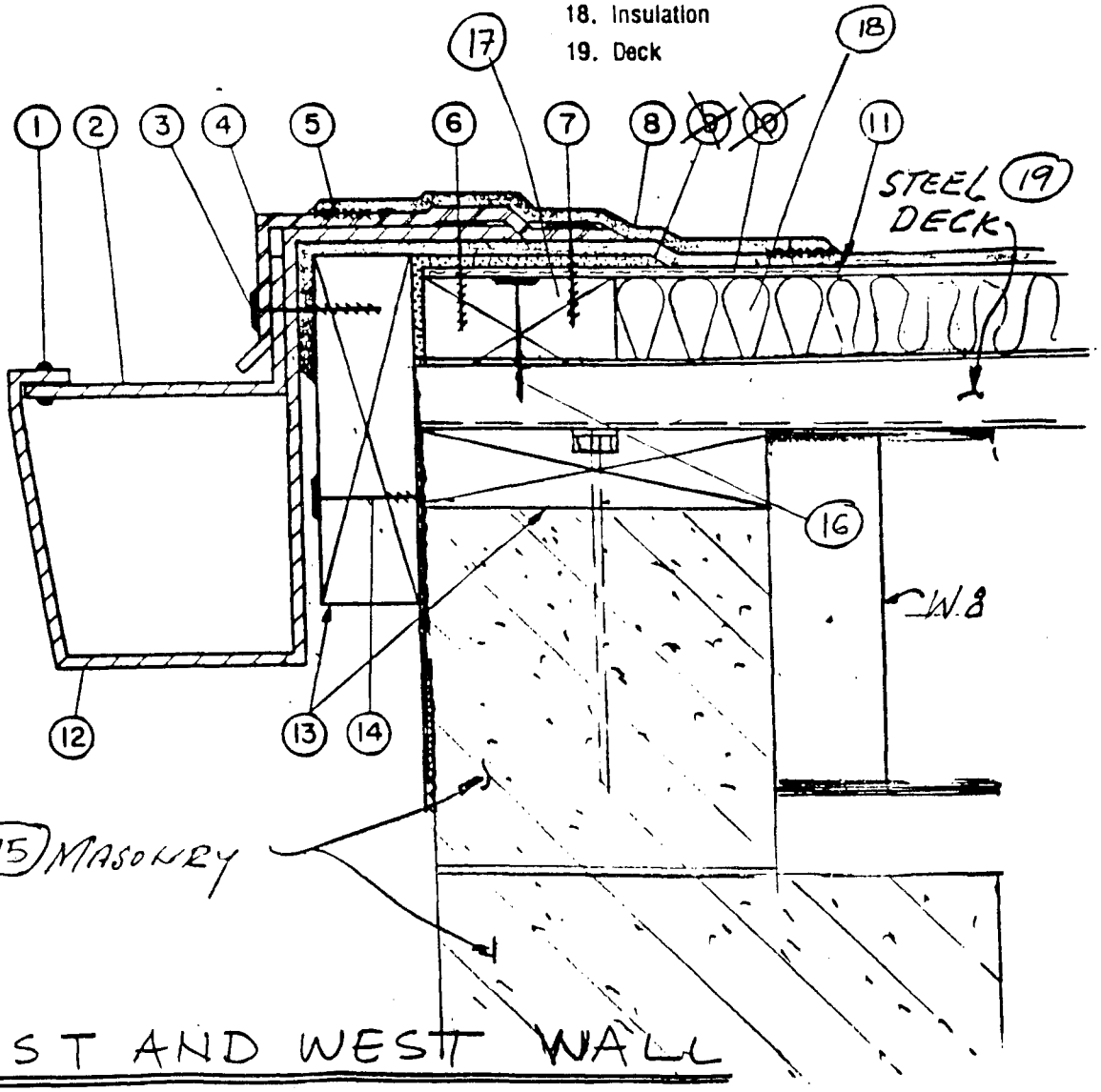
FiberTite
SINGLE PLY ROOF

GUTTER FLASHING

1. Fastener
2. Gutter Strap
3. Approved Fastener with Metal Sealing Washer
4. Fiberclad™ Metal
5. Hot Air Weld
6. Approved Fastener
7. Approved Fastener
8. FTR Flashing
9. ~~Vapor Retarder*~~
10. ~~Separation Layer*~~
11. FTR Perimeter Sheet
12. Metal Apron Gutter
13. Wolmanized Wood Blocking
14. Approved Fastener
15. Wall
16. Approved Fastener
17. Wolmanized Wood Nailer
18. Insulation
19. Deck

BUILDING #61

60MIL SINGLE PLY ROOFING



EAST AND WEST WALL

APPENDIX

61-2

Dudick Inc.

Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Streetsboro, Ohio 44241

216-562-1970
FAX No. 216-562-7638

Protecto-Crete 800/900

TROWEL-APPLIED, UNREINFORCED HIGH-DENSITY VINYL ESTER FLOOR TOPPING 1/4" (6.3 mm)

Protecto-Crete 800 is a high-performance vinyl ester floor topping designed for heavy truck traffic and abrasion resistance combined with excellent resistance to a variety of acids and caustics.

Protecto-Crete 900, in addition, will resist many of the organic solvents.

RECOMMENDED APPLICATIONS

- Food Processing Floors
- Plating Room Floors
- Pickling Room Floors
- Truck Loading Platforms
- Chemical Storage
- Dike Areas
- Aisleways
- Chemical Laboratories

CHEMICAL RESISTANCE

- Organic Acids
- Inorganic Acids
- Alkali Solutions
- Solvents (900 only)
- Oils
- Salts

A complete listing of substances and concentrations tested is available on request.

PHYSICAL PROPERTIES

Compressive Strength ASTM C579	11,000 PSI
Tensile Strength ASTM D638	1,800 PSI
Density	140 lbs./ft.^{3}
Flexural Strength ASTM C580	3,600 PSI
Thermal Shock Resistance	40°F-160°F

SPECIFICATIONS

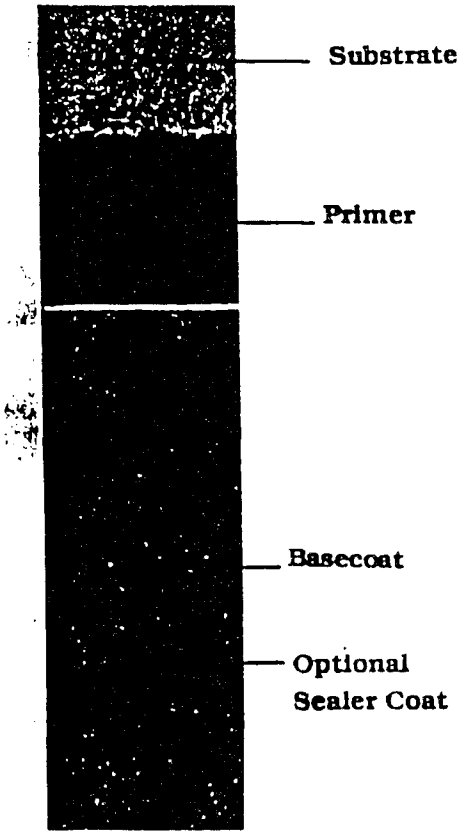
Topping shall be a 1/4" thick unreinforced Bisphenol-A/Novolac vinyl ester material as manufactured by Dudick Inc. applied over primed concrete using a plasterer's trowel or screed. Application and installation shall be according to the manufacturer's recommendations.

THE PROTECTO-CRETE 800/900 SYSTEM

The Protecto-Crete 800/900 System uses a primer and a heavily aggregate-filled vinyl ester topcoat to achieve a strongly bonded monolithic topping with excellent physical and mechanical strength and chemical resistance.

Primer: The blasted or etched concrete surface must be primed to provide the "wetting out" required for good bonding. Priming is achieved with Primer 27 and Protecto-Crete 800/900 should be applied while the primer is still tacky.

Topcoat: The aggregate-filled, Protecto-Crete 800/900 topcoat develops a cured strength two to three times that of the concrete base to which it is applied to provide exceptional durability and prolong the life of the substrate from corrosion and mechanical abuse.



ESTIMATING QUANTITIES AND ORDER BILL OF MATERIAL

Note: Resin includes 10 oz./unit hardener as standard.

SQUARE FEET PER GALLON		
CONCRETE		
Primer 27	150-200	
P-Crete 800/900		
Basecoat	58-66 sq. ft./unit	1/4"
S-10 Solvent	500	Clean-up

Quantities shown are for estimating purposes only. Actual field usage may vary.

APPLICATION INSTRUCTIONS

SURFACE PREPARATION

Concrete: Concrete must be abrasive-blasted or etched with muriatic acid (solution of 1 part 20° Be HCl and 1 part water) to remove surface laitance and other contaminants. Concrete must be dry and free of curing compounds and form release agents. Surface texture should be similar to 40-60 grit sandpaper.

The prepared surface should have a tensile strength of between 250 and 300 PSI per ASTM D4541.

Additional surface preparation will be required if a 40-60 grit texture is not achieved and the surface laitance not completely removed after a single application of acid or with the first mechanical preparation procedure.

Hardener Amount/Gal. or Unit of Resin:

Hardener	Substrate Temperature	Primer 27	Protecto-Crete 800/900
PH-1	60-70°F	3-4 oz.	10 fl. oz./unit
PH-1	70-90°F	2-3 oz.	10 fl. oz./unit

PRIMING

Concrete: Concrete must always be primed to aid in the "wetting out" required for good bonding. Mix Primer 27 with PH-1 Hardener for 2-3 minutes and apply with a brush, roller or sprayer. Do not allow the primer to puddle. We recommend the topcoat be applied over tacky primer.

Protector-Crete 800/900 Mix Ratio:

Protecto-Crete 800/900 Resin	**30 lbs.**
PH-1 Hardener (@75°F)	**10 fl. oz.**
G-4 Aggregate	**4-50 lb. bags**

TOPCOAT

Add the entire contents of the pre-measured PH-1 Hardener to Protecto-Crete 800/900 (pre-measured) Liquid and blend thoroughly. Add 4 bags of G-4 aggregate and mix well. Protecto-Crete ingredients may be mixed in a concrete mixer or mortar box. Liquid and Hardener must be thoroughly blended together before aggregate is added.

Pour the Protecto-Crete mix into a wheelbarrow and transport to each workman's area. Dump directly onto the primed concrete.

The mix should be spread with a plasterer's trowel or with (3-4 ft.) wood screeds. Final finish with a trowel.

To terminate work, square cut the topping and start with the next work period butting to this edge. Permanent terminating lines should be made into saw cuts in the concrete.

Allow Protecto-Crete to cure overnight before subjecting the area to foot traffic.

Allow to cure 1-2 days at 70°F before permitting truck traffic.

Pot Life and Cure Cycles:

Protecto-Crete 800/900		
Temperature	Pot Life	Cure Time
50°F	50-60 Min.	72 Hrs.
75°F	30-40 Min.	48 Hrs.
90°F	20-30 Min.	24 Hrs.

Do not attempt to store mixed material. Residual material should be properly disposed of at the end of each work period.

Recommended application temperatures should be between 50°F and 110°F substrate temperature.

Application of Protecto-Crete 800/900 in direct sunlight may lead to blistering, pinholes, or wrinkling in the floor topping due to outgassing of air in the concrete and high substrate temperatures.

CLEANING

Clean tools and equipment with S-10 Cleaning Solvent.

SHIPPING

The S-10 Cleaning Solvent is a red label item with a flash point of 52°F (PMCC). The Hardener is classified as Organic Peroxide and carries a yellow warning label. Protecto-Crete liquids are red label items and classified flammable.

STORAGE

Warning: All Dudick products classified by DOT labels as either white, yellow or red labels, must not mixed or stored together as an explosive reaction may occur.

Protecto-Crete Liquid and Hardener are flammable and an oxidizer, respectively, and should be stored in a cool, dry place, away from open flame, sparks and other hazards. Protecto-Crete 800/900 ingredients are stable for 3 months when properly stored under 75°F. Excessive heat may cause premature gelling and reduce available working time (pot life).

SAFETY

M.S.D.S. - Sheets must always be read before using products. Protecto-Crete systems are intended for application by experienced, professional personnel. Dudick Inc. can supply Protecto-Crete Systems supervision to help determine that the surface has been properly prepared, the ingredients correctly mixed, and the materials properly and safely applied.

If Protecto-Crete materials are to be applied by your own personnel or by a third-party contractor, please be sure that they are aware of the following safety precautions:

- Exposure to vinyl ester resins and hardeners may cause severe dermatitis reactions in some people. Cleanliness of the skin and clothing is critical and must be of paramount concern.

- Safety glasses, gloves, and suitable protective clothing must be worn at all times.

• Suitable respirators should be used.

• If contact with hardeners occurs, remove any clothing involved and wash the skin with large amounts of water. Discard the clothing. Do not attempt to wash and reuse it. Protecto-Crete Liquid may be washed off with S-10 Cleaning Solvent, MEK, or lacquer thinner. DO NOT USE ACETONE.

• Fumes are flammable and heavier than air. Proper ventilation should be maintained to minimize breathing of concentrated fumes.

• If a rash or dermatitis occurs, remove the individual from the work area and seek a doctor's care for dermatitis.

• Keep open flames and sparks away from the area where toppings are being mixed and applied.

• In case of eye contact, wash with water for at least 15 minutes and consult a physician. If swallowed, do not induce vomiting; call a physician immediately.

Note:

Dudick Inc. ("Dudick") warrants all goods of its manufacture to be as represented in its catalogs and that the application of its products by its employees or sub-contractors shall be performed in a workmanlike manner. Dudick's obligation under this warranty shall be the repair to and replacement of any applications which its examination shall disclose to be defective. Dudick makes no warranty concerning the suitability of its product for application to any surface, it being understood that the goods have been selected and the application ordered by the purchaser. DUDICK INC. MAKES NO WARRANTY, EXPRESS OR IMPLIED, THAT THE GOODS SHALL BE MERCHANTABLE OR THAT THE GOODS ARE FIT FOR ANY PARTICULAR PURPOSE. THE WARRANTY OF REPAIR OR REPLACEMENT SET FORTH HEREIN IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES ARISING BY LAW OR OTHERWISE; AND DUDICK INC. SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DOWN TIME, DAMAGES TO PROPERTY OF THE PURCHASER OR OTHER PERSONS, OR DAMAGES FOR WHICH THE PURCHASER MAY BE LIABLE TO OTHER PERSONS, WHETHER OR NOT OCCASIONED BY DUDICK'S NEGLIGENCE. This warranty shall not be extended, altered or varied except by written instrument signed by Dudick and Purchaser.

Dudick Incorporated
Corrosion-Proof Products
1818 South Wason Drive
Streetsboro, Ohio 44241
(12-91)

APPENDIX

61-3

APPENDIX

62-2

UNIT #62

Unit #62 - Truck Pad is a new structure adjacent to the north side of Unit #61. The secondary containment is without a canopy. For construction details, see Drawing CHCI Dwg. No. 4246 (2916-S-13) in Appendix 62-3.

For calculations of structural integrity, see Appendix 62-1. The containment calculations are on the drawing.

The entire secondary containment was coated with Protecto-Coat 900, 30 mils thick, as manufactured by Dudick Inc. For technical data, application and Chemical Resistance Chart, see Appendix 13-2.

Visual inspection of the Truck Pad indicated an excellent condition. There were no cracks, gaps, scratches or other damage. No penetrations are present within the containment structure.

The horizontal joint between Unit #62 floor and Unit #61 foundation wall was built without water stop or any other joint protection. Also, the vertical joint between dike wall of Unit #62 and foundation wall of Unit #61 was not provided with water stop or other joint protection. The joints will have to be inspected on a regular basis during plant operation for any signs of cracks.

APPENDIX

62-1

HOYER-SCHLESINGER-TURNER, INC.

PROJECT CLEAN HARBORS - CHICAGO, IL

SUBJECT TRUCK PAD DESIGN FOR UNIT #62

SHEET 1 OF 3
PROJECT NO. 17851
DATE 6.30.95
BY BERNES, S.E.

LOADING: ILLINOIS DEPARTMENT OF TRANSPORTATION STANDARD HIGHWAY LOADING OF H20-S16-44

a) DATA FOR TRAILER

AXLE LOAD = 42^k - DUAL WHEEL LOADING

WHEEL SPACING 18" x 56" x 18"

NO. OF WHEELS ON AXLE = 4

TIRE INFLATION PRESSURE = 100 PSI

TIRE CONTACT AREA = $\frac{42{,}000\#}{4 \times 100}$ = 105 SQ. IN.

b) SUBGRADE & CONCRETE DATA:

CONCR FLEXURAL STRENGTH MR = 640 PSI

DESIGN

1.) SAFETY FACTOR = 2.0

2.) CONC. WORKING STRESS (WS)

$WS = \frac{MR}{SF} = 640/2 = 320$ PSI.

3.) EQUIVALENT SINGLE-WHEEL LOAD FROM FIG. 4 (SEE SHEET #2)

$= .775 \times 42^k = 32.55^k$

4.) SLAB STRESS PER 1,000# OF AXLE LOAD =

$= WS/\text{AXLE LOAD} = 320/32.55 = 9.83$ PSI

5.) FROM FIG. 3 (SEE SHEET #3)

SLAB THICKNESS REQ'D = 8.75" < 10" O.K.

6.) REINFORCEMENT

$A_s = \frac{2 \times L \times W}{2 \times f_s} = \frac{2 \times 55 \times 125}{2 \times 24{,}000} = .29$ IN^2

USE #4 @ 12" C-C TOP & BOTT.

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes

PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11-30-

SHEET 2 OF 3
PROJECT No. 17851
DATE 6.30.95
BY BERNES, S.E.

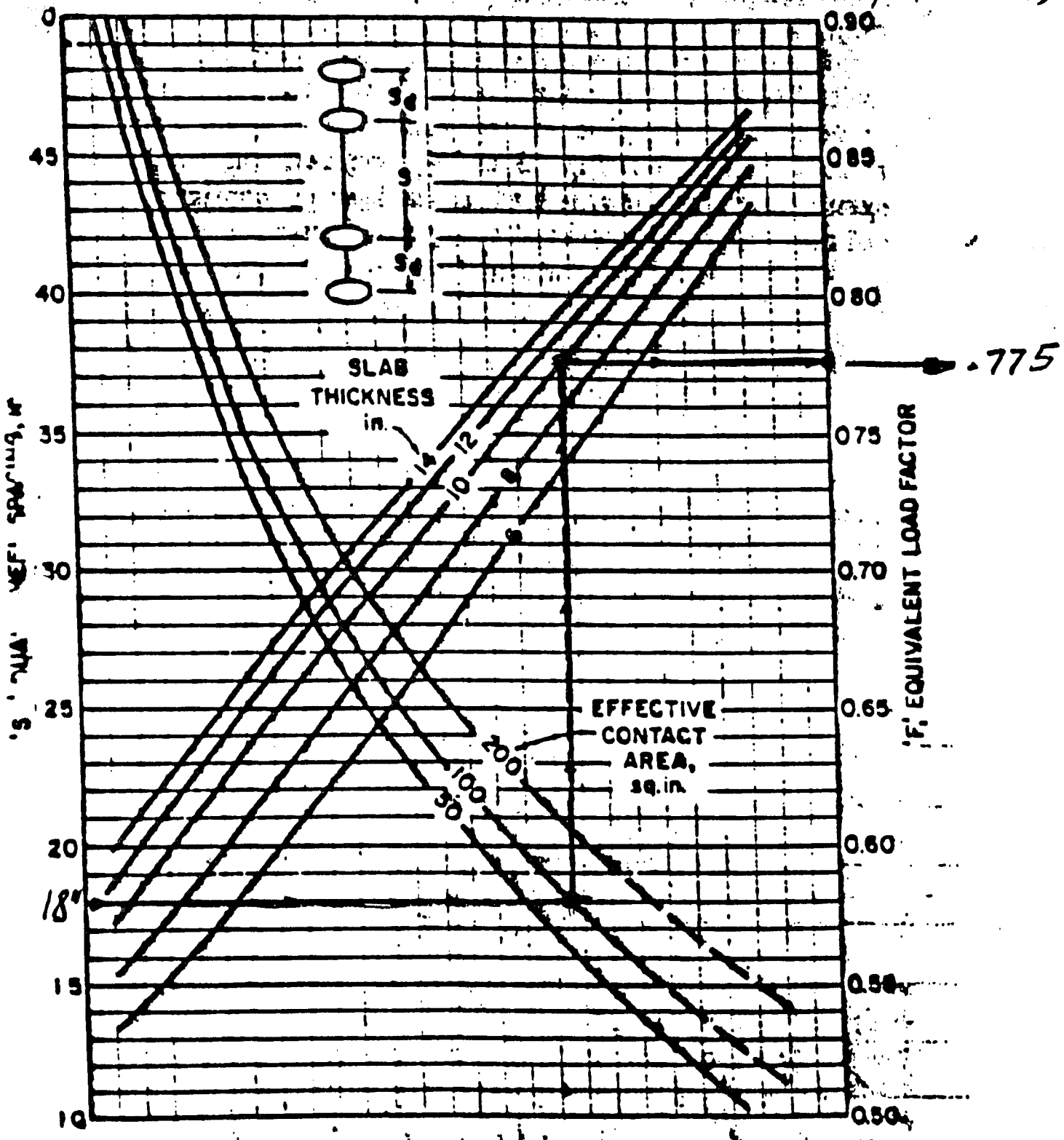
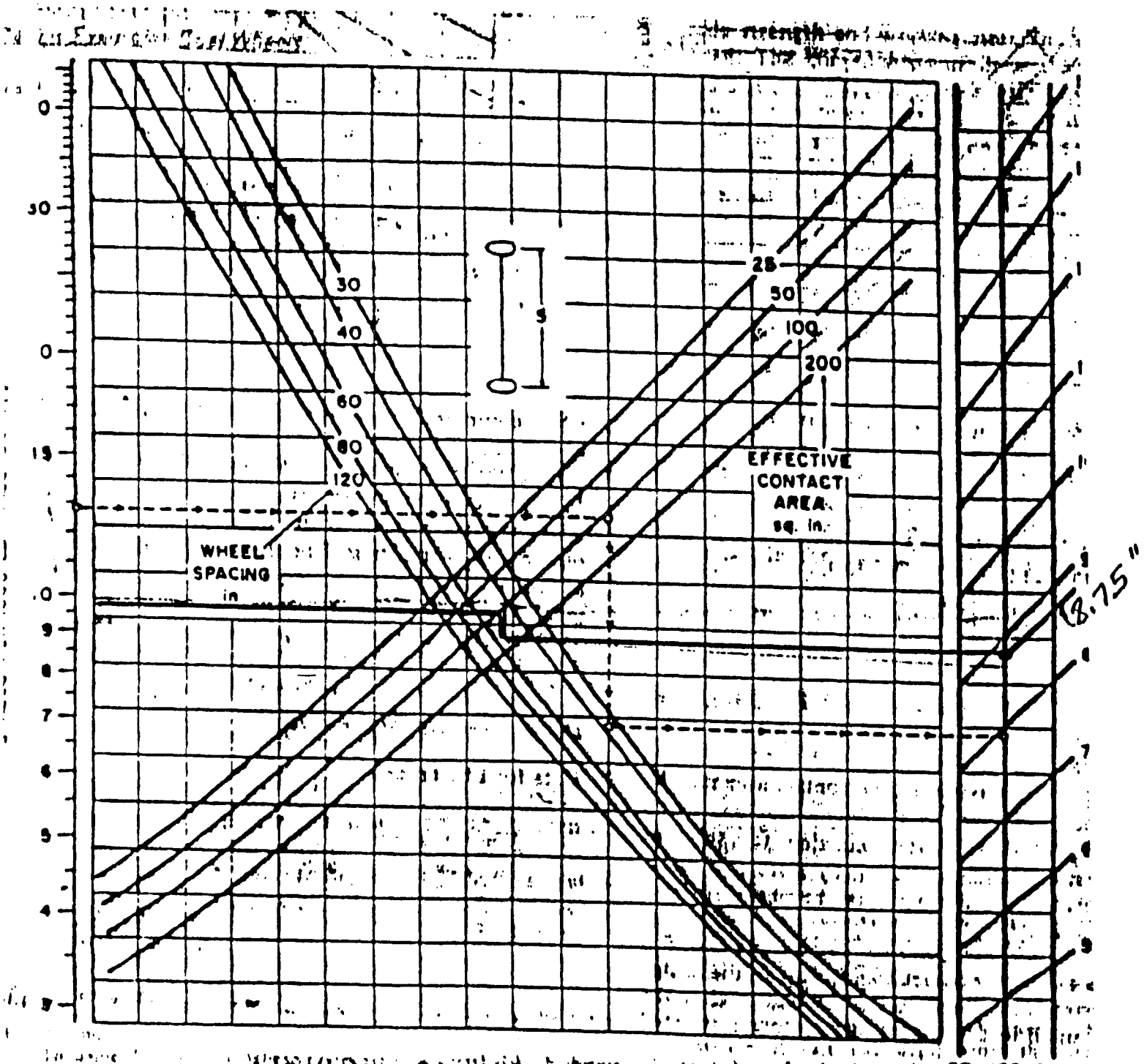


Fig. 4. Design chart for axles with dual wheels

PROJECT No. 17851
DATE 6.30.95
BY BERNES, S.E.



1. Design chart for axles with single wheels.

State of Illinois
ENVIRONMENTAL PROTECTION AGENCY

Mary A. Gade, Director
217-524-3300

2200 Churchill Road, Springfield, IL 62794-9276

September 20, 1995

Mr. Paul A. Ahearn
Manager, Regulatory Compliance
Clean Harbors Environmental Services, Inc.
1200 Crown Colony Drive
P.O. Box 9137
Quincy, MA 02269-9137

0316000051 -- Cook County
Clean Harbors, Inc.
Log No. 16-TA-2, B-16-M-2
Administrative Record

Dear Mr. Ahearn:

The Agency has completed its review of the Construction Certification Report dated July 3, 1995 and the supplemental information dated August 29, 1995 for the following units:

1. Unit 13 - Rail Car Loading/Off-loading Area,
2. Unit 15 - Tank Truck Loading/Off-loading platform,
3. Unit 59 - New Ignitable Tank Truck Staging/Storage Area,
4. Unit 61 - New Container Handling Dock, and
5. Unit 62 - New Truck Storage Pad serving Unit 61.

The Agency inspected these units on September 12, 1995. Pursuant to the Agency's review and inspection, the Construction Certification Report for the above units is approved.

If you have any questions regarding this letter, please feel free to call Rob Watson, P.E. at 217-524-3265.

Sincerely,

Edwin C. Bakowski, P.E.
Manager Permit Section,
Bureau of Land

ECB:WRW:chi\letter95\09ccr195.ecb

cc: Matt Dunn, IAG
George Hamper, USEPA - Region V
Tony Martig, USEPA - Region V, TSCA
Jim Laubstead, CHCI

CONSULTING ENGINEER TURNER, INC.

SHEET 1 OF 2

PROJECT CLEAN HARBORS - CHICAGO, IL

PROJECT NO. 17851

DATE 7.20.95

SUBJECT ROLL-OFF PAD FOR FUEL BLENDING #60

BY BERNES, SE

a) DATA FOR ROLL-OFF CONTAINER

LARGEST CONTAINER = 6000 GALS

TOTAL LOAD = 6000 GAL × 1.2 SP.GR. × 8.35 #/GAL = 60.0 KIP

AXLE LOAD = 30 K

WHEEL SPACING = 72"

NO. OF WHEELS ON AXLE = 2

SOLID TIRES 8" WIDE

LOAD CONTACT AREA PER TIRE = 4 × 8 = 32 IN.²

b) SUBGRADE AND CONCRETE DATA

CONCRETE FLEXURAL STRENGTH MR = 640 PSI @ 28 DAYS

K-VALUE = 100 PCI

DESIGN

1.) SAFETY FACTOR = 2.0

2.) CONCRETE WORKING STRESS $WS = \frac{MR}{SF} = 640/2 = 320$ PSI

3.) SLAB STRESS PER 1,000 # OF AXLE LOAD

$= \frac{WS}{\text{AXLE LOAD}} = 320/30 = 10.67$ PSI

4.) FROM FIG. 5 (SEE SHEET #2)

SLAB THICKNESS REQ'D = 9" < 10" PROVIDED O.K.

5.) REINFORCEMENT

$A_s = \frac{2 \times L \times W}{2 \times f_s} = \frac{2 \times 50.0' \times 12.5'}{2 \times 24{,}000} = .21$ IN²

#4 @ 12 T & B > .21 IN² O.K.

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes

PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11-30-96

PROJECT CLEAN HARBORS - CHICAGO, IL

SUBJECT ROLL-OFF PAD FOR FUEL BLENDING #60

SHEET 6 OF 6

PROJECT NO. 17851

DATE 7.20.95

BY BERNES, S.G.

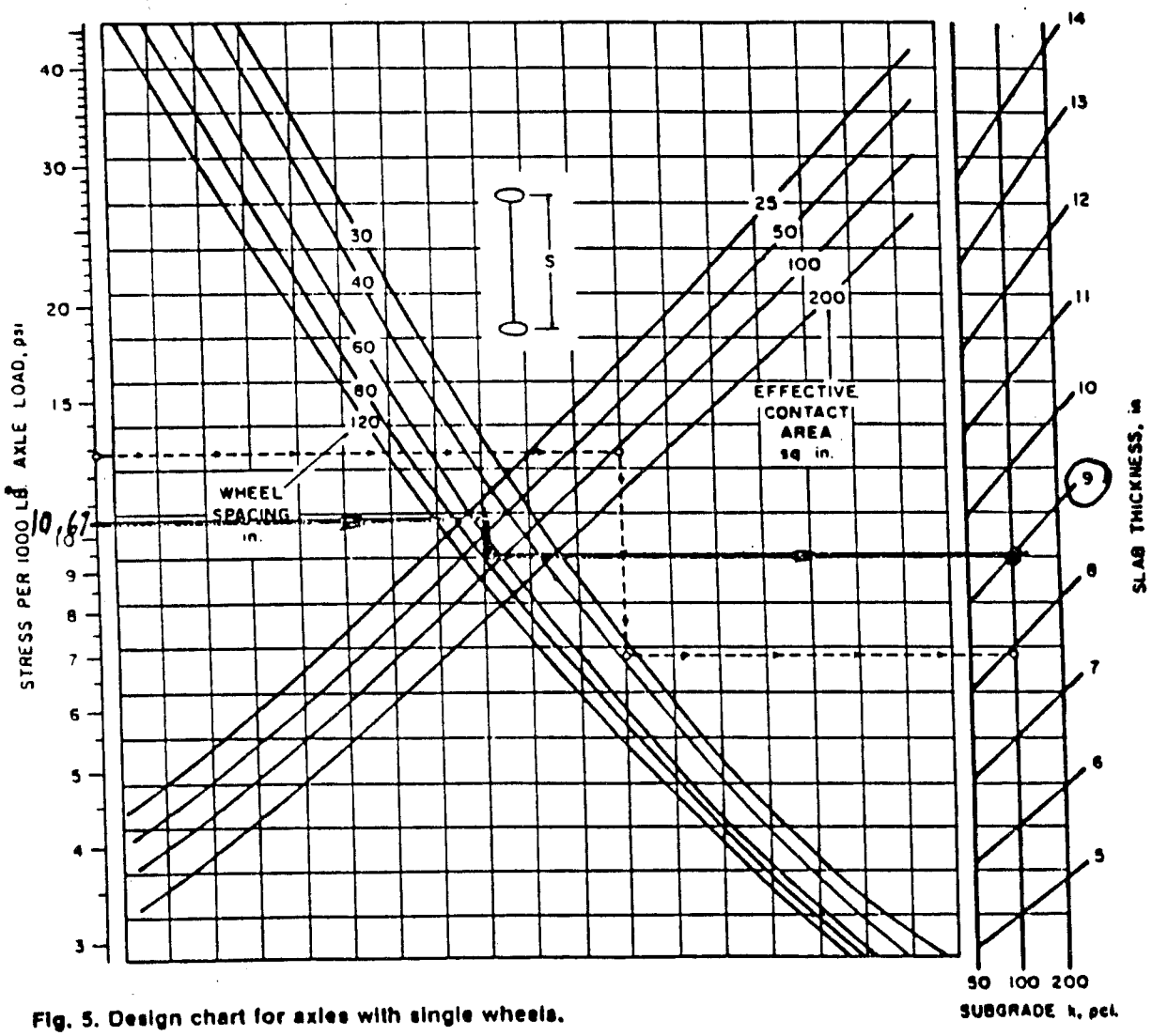
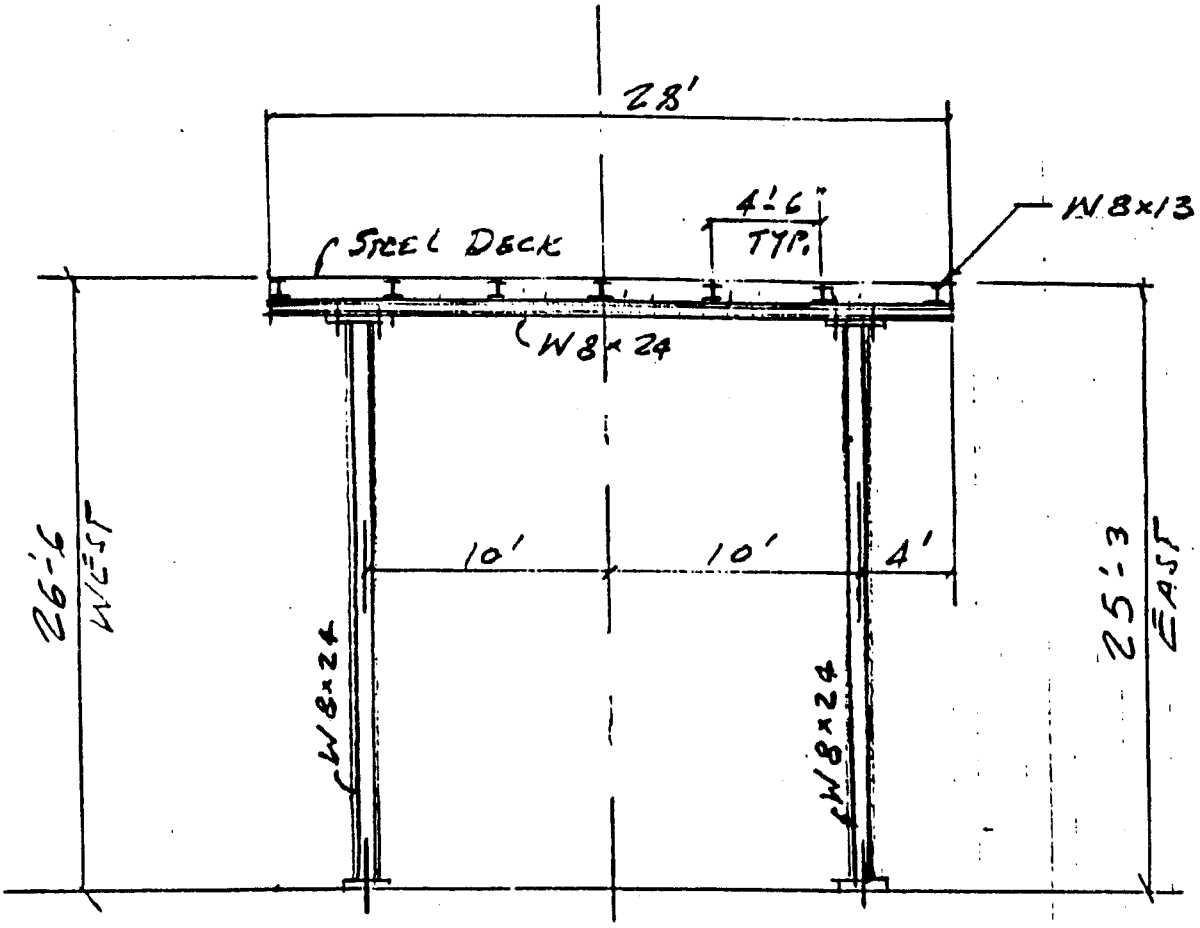


Fig. 5. Design chart for axles with single wheels.

HOYER-SCHLESINGER-TURNER, INC.

SHEET 1 OF 3
PROJECT NO. 1785
DATE 1.23.95
BY BERNES

PROJECT CLEAN HARBORS - CHICAGO, ILLINOIS
SUBJECT ROLL-OFF PAD CANOPY COMPUTATIONS #60



TYP. FRAME @ 16'-4 SPACING

1/8" = 1'-0

LOADING = L.L. = 25 PSF
D.L. = 5 "
TOTAL = 30 PSF

PURLINS

LOAD = 4.5' × 30 PSF = 135 #/L.F.
PURLIN = 15 #/L.F.
TOTAL = 150 #/L.F.

$M = .15^k \times 16.33^2/8 = 5^{'k}$

W8x13 $M_R = 20^{'k} > 5^{'k}$ O.K

STATE OF ILLINOIS
PETER J. BERNES
3659
LICENSED STRUCTURAL ENGINEER

Peter J. Bernes
PETER J. BERNES
LICENSED STRUCTURAL ENGINEER
ILLINOIS NO. 3659
MY LICENSE EXPIRES ON 11-30

HOYER-SCHLESINGER-TURNER, INC.

SHEET 2 OF 3

PROJECT CLEAN HARBORS - CHICAGO, ILLINOIS

PROJECT NO. 1785

SUBJECT ROLL-OFF PAD CANOPY #60

DATE 1.23.95

BY BERNES

RAFTER

LOAD = 16.33' × 30 PSF ≈ .5 K/L.F.

$M = .5^k \times 20^2/8 = 25'^k$

W8×24 $M_R = 42'^k > 25'^k$ o.k.

COLUMNS

r_{x-x} REQUIRED $= KL/r_{x-x} = 200$

$r_{x-x} = \frac{2 \times 25' \times 12}{200} = 3$ IN

$r_{y-y} = 3/2 = 1.5$ IN

USE W8×24 $A = 7.04$, $S = 20.8$, $r_{x-x} = 3.42$, $r_{y-y} = 1.61$

VERTICAL LOAD =

$= 14' \times 16.33 \times 30 PSF = 6.86^k$

$+ COL = .60^k$

TOTAL $= 7.46^k$

WIND LOAD =

$= 1' \times 30 PSF \times 16.33 = .5^k$

COLUMN WIND MOMENT $M_W =$

$= .25^k \times 25' = 6.25'^k$

$KL/r_{x-x} = 2 \times 25' \times 12/3.42 = 175$

$F_a = 6.73$ KSI $\quad F_b = 24$ KSI

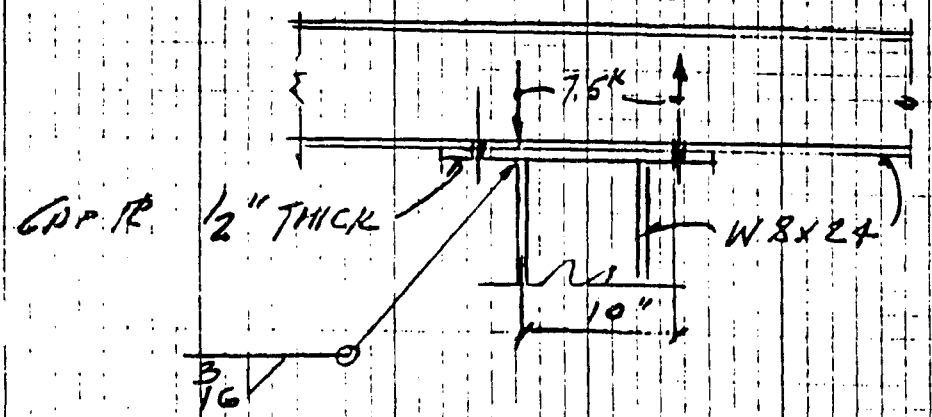
$f_a = 7.46/7.04 = .15 \leq .15$

$f_b = 6.2^k \times 12 / 20.8 = 3.61$ ksi

$f_a/F_a + f_b/F_b = 1.05/6.73 + 3.61/27 =$

$= .15 + .15 = .30 < 1.33$ o.k.

CAP PLATE

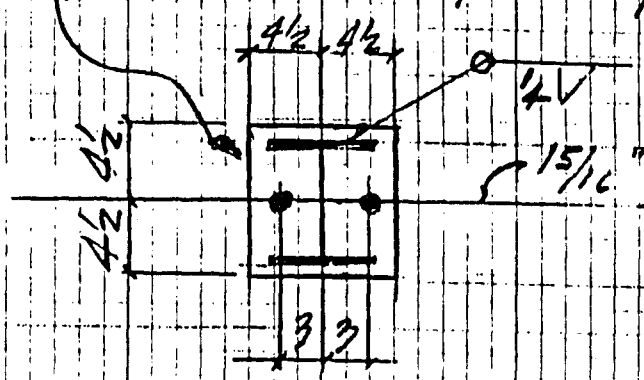


$\frac{6.25^k \times 12}{10''} = 7.5^k$

UPLIFT

$14' \times 16.33' \times 70$ psf $\times .75 = 3360^\#$

USE 2 - 3/4" ANCHOR BOLTS



COLUMN BASE DETAIL