3140 Finley Road
Downers Grove, IL 60515
630.795.3200
Fax: 630.795.1130

Clayton
GROUP SERVICES

MEMORANDUM

US EPA RECORDS CENTER REGION 5
425595

To: Steve Faryan
Kevin McCarty

From: William Elwell

Date: September 22, 2004

Subject: LOCKFORMER AIR TREATMENT AND AIR MONITORING PROGRAM

This memo has been prepared to provide an evaluation of the Lockformer remediation air treatment system/air monitoring program to date, and to propose program revisions that would maximize efficiency (both operational and cost) without compromising the successful completion of the program's goals. The purpose of the Lockformer air treatment system and air monitoring program has been (and is) to provide an air treatment system and a method by which to document the performance of that system, that would achieve successful completion of two objectives:

- Compliance with the substantive requirements identified in the Illinois EPA Construction Permit I.D. No. 043055AAC dated December 18, 2002, which was revised and re-issued on May 13, 2003 (Attachment A), and

- Compliance with the ambient air screening standards provided by the USEPA (Table 1).

These objectives incorporate air treatment system emission standards, in addition to ambient air screening standards for inside the site building, the perimeter of the exterior electrical resistive heating (ERH) remediation area, the site perimeter, and the surrounding residential area to ensure that the required level of safety has been provided for the entirety of the area that might be affected by the Lockformer remediation activities.

The Lockformer remediation air treatment system design and air monitoring program was initially presented in the *Technical Memorandum Soil Remediation Design* dated October 31, 2002. The initial approach included a conservative program of air treatment system (two in-series vapor phase granular activated carbon [VPGAC] vessels) operation, maintenance and monitoring due to the potential of a "slug" of contamination possibly being discharged from the ERH system, given the uncertainty associated with the manner and rate at which the ERH system could liberate VOCs from the upper till/fill. The air treatment system maintenance schedule included the replacement of the primary VPGAC unit when the efficiency fell below 80%. Additionally, to provide another level of protection, the air treatment stream was continuously monitored (via total hydrocarbon analyzer) before and after each of the VPGAC treatment beds to ensure that the rate of volatile organic compound (VOC) loading to the air treatment system did

not exceed the concentrations for which it was designed. If the continuous monitoring identified such an occurrence, immediate measures of protection could be implemented.

On September 23, 2003, Lockformer submitted the initial evaluation conducted on the air treatment system/air monitoring program and recommended revisions based on the conditions observed during the first several months (June 27, 2003 [ERH startup] to that time) of ERH operations. The revisions (agreed to and implemented shortly after the September 23rd submittal) included a more consistent air treatment system monitoring via Tedlar bags (to improve data turnaround time), less stringent VPGAC maintenance standards (60% efficiency for the first treatment vessel, not to exceed 20 ppm after the first vessel), and more consistent ambient air monitoring. The primary conditions that led to the revisions to the initial program included a staggered application of the ERH heating approach (as opposed to applying the ERH process to the entire remediation area simultaneously) and a gradual rate of VOC recovery from the upper till/fill (as opposed to the VOC "slug" theory that provided the worst-case scenarios on which the system was designed). A summary of the initial air program and the September 2003 revisions to the air program is provided in Table 2.

Based on the data collected to date and the progress of the ERH remediation, it is Lockformer's opinion that any realistic potential for the ERH system to generate a slug of VOCs that would overwhelm the air treatment system, causing an exceedance of either the emission standards or ambient air screening standards, no longer exists. The primary information that led to this conclusion includes the following:

- The ERH process has been applied to the entirety of the remediation area, and operational temperatures have been reached and maintained for a significant period of time in the entirety of the ERH remediation area.

- The VOC mass removal rate information (based on the concentrations of TCE and cis-1,2-DCE in the air stream leading to the air treatment system) indicates the increased VOC removal rates that were anticipated to occur when Area 1 and Area 2 reached operational temperatures have occurred and are completed. Refer to Figure 1.

- Considering the most aggressive VOC mass removal rate identified in the *untreated* remediation air stream to date is less than 13 lbs/day (based on a Tedlar bag sample collected on June 9, 2004 at the peak of the Area 1 treatment)(Figure 1), it is reasonable to conclude that the most limiting Hazardous Air Pollutant (HAP) emission standard identified in the Illinois EPA Construction Permit I.D. No. 043055AAC (6.6 tons/year, equivalent to over 36 lbs/day) will not be exceeded, with or without air treatment.

- The most elevated ambient air sample concentrations for constituents of concern detected at the perimeter and residential sampling locations are less than 3% of their respective ambient air screening standards (Table 3). Ambient air screening around the perimeter of the exterior ERH remediation area has not indicated a detectable concentration using a photoionization detector.

- The most elevated concentration of VOCs that has been identified in the air treatment system emissions (4.7 ug/L in VPGAC03/062504) did not result in an ambient air concentration

exceeding 3% of any individual constituent standard. As a result, it is unlikely that the VOC concentration currently identified in the *untreated* air stream (<10 ug/L) would result in an ambient air VOC concentration increase that would approach the ambient air screening standards (which would require an increase of over a factor of 30), regardless of the air treatment efficiency.

Given the information provided above, and the absence of a potential for a VOC slug, it is reasonable to re-evaluate the necessity of those items that were incorporated into the air treatment program to protect against that possibility. Therefore, Lockformer recommends the following revisions to the air treatment and air monitoring program:

- Employ the use of one vapor phase carbon vessel to provide the air treatment instead of the two-vessel system currently being operated. The second vessel provides minor (single-digit ug/L) reductions in VOC concentrations that are not necessary to achieve the program objectives. Weekly air sampling (via Tedlar bags) along with accelerated data turnaround times (in the manner that is currently conducted) will be used to monitor the air stream. A fresh carbon vessel will be on standby at the site to ensure timely change-outs.

- While the *untreated* air stream concentrations remain below the emission standard, the carbon vessel change-out should occur before the point of apparent saturation (in accordance with the Illinois EPA Construction Permit I.D. No. 043055AAC, subsection 1a) instead of the 60% efficiency standard. However, no change-outs should occur until the *untreated* air stream exceeds 50% of the emission standard, because treatment would not be necessary to achieve air program goals. If ambient air sample concentrations increase above actions levels (set at 5% of the ambient air screening standards) during the implementation of this change-out schedule, the program will be re-evaluated to consider additional conservatism. Apparent saturated conditions will be determined using the air samples collected (via Tedlar bags) before and after the treatment vessel a weekly basis.

- Reduce the frequency of the ambient air sampling at the perimeter locations from twice per week to once per week. The perimeter sampling event would occur on the same day as the emission and residential sampling to allow for comparison study.

- Eliminate the air treatment system continuous monitoring via total hydrocarbon analyzer. The total hydrocarbon analyzer will continue the ambient air monitoring conducted inside the building. The air treatment system monitoring will continue using the information collected via photoionization detector, Tedlar bags, and summa canisters.

It is Lockformer's opinion that these revisions would increase the program efficiency and maintain a standard of performance that would achieve the program's goals. Lockformer is aware that Illinois EPA Construction Permit I.D. No. 043055AAC specifically references Application No. 02120050 (Attachment B), which describes a SVE/ERH system that includes a total hydrocarbon analyzer and two carbon vessels connected in series. However, given the information provided above, it is Lockformer's opinion that the recommendations are appropriate and would achieve the substantive requirements identified in the permit. Should the recommendations be considered counter to the permit requirements, it is Lockformer's intention to submit a revised permit application to reflect the pertinent recommendations.

MEMORANDUM
(Continued)

Upon approval, these revisions will be implemented immediately. Upon completion of the ERH remediation activities, another air program evaluation will be conducted to consider the additional changes in the system. If you have any questions, do not hesitate to contact Ron St. John at 630.795.3208 or myself at 630.795.3206.

FIGURES

TABLES

TABLE 1
Ambient Air Screening Standards

The Lockformer Company / Lisle, Illinois

PARAMETER	Maximum Annual Exposure (ppb)	Corresponding Maximum 1-hour Exposure (ppb)	*Corresponding Maximum 8-hour Exposure (ppb)	*Corresponding Maximum 24-hour Exposure (ppb)
Trichloroethene	100	1,250	875	500
1,1-Dichloroethene	20	250	175	100
1,2-Dichloroethene (cis + trans)	200	2,500	1,750	1,000
Vinyl chloride	30	375	263	150
1,1,1-Trichloroethane	700	8,750	6,125	3,500
1,1-Dichloroethane	N/A	N/A	N/A	N/A
Tetrachloroethene	40	500	350	200

NOTE:
* 1-hour, 8-hour, and 24-hour exposure standards were calculated from the maximum annual exposure values using the multiplication factors presented in Section 4.2 of *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised* , U.S. EPA Office of Air and Radiation, October 1992, for the correlation of various averaging time standards (1-, 3-, 8-, 24-hour, and annual).

TABLE 2
Summary of Proposed Routine Air Program Revisions

The Lockformer Company / Lisle, Illinois

SAMPLE LOCATION	EXISTING MONITORING SCHEDULE	PROPOSED MONITORING SCHEDULE
Air Treatment System		
Influent (VPGAC01)	2 Summas per week @ temp. <50 deg. C none @ temp. > 50	1 Tedlar Bag and Summa per week
Intermediate (VPGAC02)	2 Summas per week @ temp. <50 deg. C none @ temp. > 50	1 Tedlar Bag and Summa per week
Effluent/Stack (VPGAC03)	2 Summas per week @ <50 deg. C @ temp >50, 30 daily Summas, then 1 per week	3 Tedlar Bags and 1 Summa per week
Carbon Replacement	When intermediate VOC conc. > 20% of inlet conc.	When intermediate VOC conc. > 40% of influent w/ not to exceed 20 ppm
Liquid Treatment System		
Influent (LPGAC01)	1 VOC per month	Unchanged
Intermediate (LPGAC02)	1 VOC per month	Unchanged
Effluent/Stack (LPGAC03)	1 VOC per month	Unchanged
Ambient Air Monitoring		
Residential	1 Summa per day for 60 days, then 1 per week	Unchanged
Site Perimeter	2 Summas per week @ temp. <50 >50 deg C, daily Summas for 30 days, then 1 per week	2 Summa canisters per week
ERH Remediation Area Perimeter	temp. <50 deg. C, PID monitoring 3 times per week and 1/weekend day Results >25 ppm tested for TCE with Miran. temp. >50 deg. C, incorporate Miran 1 per weekday	Monitoring 3 times per weekday with PID Results >25 ppm tested for TCE with Miran.
Building Interior	1 time per week with PID	1 time per week with PID Results >25 ppm tested for TCE with Miran
Remediation System Monitoring		
SVE Wells	PID/Tedlar bag 1per week	Unchanged
Vacuum Piezometers	>50 deg. C, weekly monitoring for pressure and VOC (PID) Between 50 and 90 deg. C, daily monitoring for pressure and VOC (PID)	Unchanged

TABLE 3
Summary of Laboratory Analytical Results for Air Samples

The Lockformer Company / Lisle, Illinois

The Most Elevated Ambient Air Sample Results For Samples Collected From Perimeter Locations				
Compounds of Concern	**Sample ID**	**Concentration (ppmV)**	**Ambient Air Screening Standard (ppmV)**	**% of Standard**
Tetrachloroethene	PML04/082604	0.01	0.35	2.9
Trichloroethene	PML04/032904	0.018	0.875	2.1
cis-1,2-Dichloroethene	PML04/082004	0.0058	1.75	0.3
trans-1,2-Dichloroethene	PML01/041904	0.00048		0.0
Vinyl Chloride	NA	ND	0.263	NA
Chloroethane	PML03/09093	0.00097	NE	NA
1,1-Dichloroethene	PML01/041904	0.0011	0.175	0.6
1,1-Dichloroethane	PML01/041904	0.00051	NE	NA
1,1,1-Trichloroethane	PML01/041904	0.0036	6.125	0.1

The Most Elevated Ambient Air Sample Results For Samples Collected From Residential Locations				
Compounds of Concern	**Sample ID**	**Concentration (ppmV)**	**Ambient Air Screening Standard (ppmV)**	**% of Standard**
Tetrachloroethene	RSML03/082803	0.003	0.2	1.5
Trichloroethene	RSML04/040104	0.0087	0.5	1.7
cis-1,2-Dichloroethene	RSML06/041504	0.00051	1	0.1
trans-1,2-Dichloroethene	NA	ND		NA
Vinyl Chloride	NA	ND	0.15	NA
Chloroethane	NA	ND	NE	NA
1,1-Dichloroethene	NA	ND	0.1	NA
1,1-Dichloroethane	NA	ND	NE	NA
1,1,1-Trichloroethane	RSML03/011504	0.00052	3.5	0.0

The Most Elevated Total VOC Result For Samples Collected From The Effluent Of The Air Treatment System				
	Sample ID	**Concentration (ug/L)**	**Emission Standard (ug/L)**	**% of Standard**
	VPGAC03/062504	4.7	186	2.5

NOTES:
ppmV = part per million by volume
ug/L = micrograms per liter
NA = Not Applicable
NE = Not Established
ND = Not Detected

ATTACHMENT A

217/782-2113

CONSTRUCTION PERMIT - REVISED

PERMITTEE

The Lockformer Company
Attn: Rian Scheel
711 West Ogden Avenue
Lisle, Illinois 60532

Application No.: 02120050 I.D. No.: 043055AAC
Applicant's Designation: ERH-SVE Date Received: May 13, 2003
Subject: Soil Vapor Extractor controlled by carbon adsorption system
Date Issued: August 11, 2003 Expiration Date: See Condition 1.

This permit is hereby granted to the above-designated Permittee to CONSTRUCT emission unit(s) and/or air pollution control equipment consisting of:

1 Soil Vapor Extraction System with Electric Resistive Heating Controlled by a Carbon Adsorption System

pursuant to the above-referenced application. This permit is subject to standard conditions attached hereto and the following special condition(s):

1a. Prior to operating the soil vapor extraction system, the Permittee shall install a carbon adsorption system with a saturation indicator and recorder.

b. The Permittee shall change the carbon filters prior to when the saturation indicator has indicated that the carbon bed is fully saturated.

c. The Permittee shall keep records of the maintenance and operation of the carbon adsorption system including the replacement of the carbon filters. These records shall be retained for three years and shall be available for inspection by the Illinois EPA.

2. Pursuant to 35 Ill. Adm. Code Section 218.301, no person shall cause or allow the discharge of more than 3.6 kg/hour (8 lbs/hour) of organic material into the atmosphere from any emission unit, except as provided in Sections 218.302, 218.303, 218.304 and the following exception: If no odor nuisance exists the limitation of Subpart G shall apply only to photochemically reactive material.

3. In the event that the operation of this facility results in an odor nuisance or any other nuisance due to the operations described in the permit application, the Permittee shall take all appropriate and necessary actions, including but not limited to, changes in operating conditions or installation of controls, in order to eliminate the nuisance.

4. Emissions of volatile organic material (VOM) or Hazardous Air Pollutants (HAP) from the equipment shall not exceed the following limits:

Item of Equipment	Flow Rate (scfm)	VOM/HAP Emissions (Ton/Month)	(Tons/Year)
Soil Vapor Extractor	4,600	0.66	6.6

These limits are based on maximum values for vacuum rate of 4,600 cfm, a soil gas concentration of 90 ppmv, continuous operations (8,760 hours per year), and a control efficiency of 83.5% from the carbon adsorption system, and information provided in the permit application. Compliance with annual limits shall be determined from a running total of 12 months of data.

5. The emissions of Hazardous Air Pollutants (HAPs) as listed in Section 112(b) of the Clean Air Act shall not equal or exceed 10 tons per year of any single HAP or 25 tons per year of any combination of such HAPs, or such lesser quantity as USEPA may establish in rule which would require the Permittee to obtain a CAAPP permit from the Illinois EPA. As a result of this condition, this permit is issued based on the emissions of any HAP from this source not triggering the requirement to obtain a CAAPP permit from the Illinois EPA.

6. The soil vapor extraction system with electric resistive heating controlled by a carbon adsorption system may be operated under this construction permit until an application for Title V or a Federally Enforceable State Operating Permit (FESOP) has been issued incorporating these conditions, provided a timely application is submitted for a Title V permit or FESOP to incorporate these conditions.

7. The soil vapor extraction system with electric resistive heating controlled by a carbon adsorption system shall not begin operation until construction, including construction of any air pollution control equipment, is complete and reasonable measures short of actual operation have been taken to verify proper operation.

8. Within 60 days of initial startup, the volatile organic material emissions of the soil vapor extraction system with electric resistive heating controlled by a carbon adsorption system shall be measured during conditions which are representative of maximum emissions. A/27

9. The following methods and procedures shall be used for testing of emissions unless another method is approved by the Illinois EPA: Refer to 40 CFR 60, Appendix A, and 40 CFR 61, Appendix B, for USEPA test methods.

Location of Sample Points	USEPA Method 1
Gas Flow and Velocity	USEPA Method 2
Flue Gas Weight	USEPA Method 3
Moisture	USEPA Method 4

Volatile Organic Material	USEPA Method 25, or Method 25A if outlet VOM < 50 ppmv as non-methane carbon

10. Copies of the Final Report(s) for these tests shall be submitted to the Illinois EPA with 14 days after test results are compiled and finalized.

11. 60 days after completion of sampling, the Final Report shall include as minimum:

    a. A summary of results

    b. General information

    c. Description of test method(s), including description of sampling points, sampling train, analysis equipment, and test schedule

    d. Detailed description of test conditions, including

        i. Process information, i.e., mode(s) of operating process rate, e.g. fuel or raw material consumption

        ii. Control equipment information, i.e., equipment condition and operating parameters during testing, and

        iii. A discussion of any preparatory actions taken, i.e., inspections, maintenance and repair

    e. Data and calculations, including copies of all raw data sheets and records of laboratory analyses, sample calculations, and data on equipment calibration

    f. An explanation of any discrepancies among individual tests or anomalous data

    g. The results of all quality control evaluation, including a copy of all quality control data.

12. Two (2) copies of required reports and notifications concerning equipment operation or repairs, performance testing or a continuous monitoring system shall be sent to:

    Illinois Environmental Protection Agency
    Division of Air Pollution Control
    Compliance Section (#40)
    P.O. Box 19276
    Springfield, Illinois 62794-9276

    <u>and</u> one (1) copy shall be sent to the Illinois EPA's regional office at the following address unless otherwise indicated:

    Illinois Environmental Protection Agency

Division of Air Pollution Control
9511 West Harrison
Des Plaines, Illinois 61614

13. The Permittee shall maintain monthly records of the following items:

    a. Remediation system operating hours (hours/month and hours/year);

    b. Monitored soil gas/groundwater VOM and HAP concentrations (ppmv and µg/L, respectively);

    c. VOM and HAP emissions (lb/month and tons/year).

14. All records and logs required by this permit shall be retained at a readily accessible location at the source for at least three years from the date of entry and shall be made available for inspection and copying by the Illinois EPA upon request. Any records retained in an electronic format (e.g., computer) shall be capable of being retrieved and printed on paper during normal source office hours so as to be able to respond to an Illinois EPA request for records during the course of a source inspection.

15. If there is an exceedance of the requirements of this permit as determined by the records required by this permit, the Permittee shall submit a report to the Illinois EPA's Compliance Section in Springfield, Illinois within 30 days after the exceedance. The report shall include the emissions released in accordance with the recordkeeping requirements, a copy of the relevant records, and a description of the exceedance or violation and efforts to reduce emissions and future occurrences.

It should be noted that the issuance of this permit does not relieve the Permittee of the responsibility of complying with the provisions of the State of Illinois Rules and Regulations, Title 35: Subtitle C, Water Pollution Control, Chapter 1. The Permittee may need to obtain a permit from the Division of Water Pollution Control for operation of the wastewater pretreatment system and discharge tributary.

It should be noted that issuance of this permit does not relieve the Permittee form compliance with the 35 Ill. Adm. Code Part 731 Underground Storage Tanks or the permit requirements of Section 21 and 39 of the Environmental Protection Act with respect to a waste management operation, nor does it constitute a release from further responsibility for preventive or corrective action as defined under Section 4(y) of the Environmental Protection Act. Pursuant to 35 Ill. Adm. Code Part 731, approval may be required from the Bureau of Land - Leaking Underground Storage Tank Section (217/782-6761) prior to the installation of this equipment.

It should be noted that issuance of this permit does not relieve the Permittee from compliance with the permit requirements of Section 21 and 39 of the Environmental Protection Act with respect to a waste management operation, nor does it constitute a release from further responsibility for preventive or

correction action as defined under Section 4(y) of the Environmental Protection Act. The Bureau of Land, Division of Remediation Management (217/782-6760) should be contacted prior to the installation of this equipment.

Please note that this permit is revised to change the SVE operating parameters without any increase in emissions to the atmosphere.

If you have any questions on this permit, please contact John Blazis at 217/782-2113.

Donald E. Sutton, P.E.
Manager, Permit Section
Division of Air Pollution Control

DES:JPB:psj

cc: Region 1

ATTACHMENT B

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF AIR POLLUTION CONTROL
PERMIT SECTION
P. O. BOX 19506
SPRINGFIELD, ILLINOIS 62794-9506

This Agency is authorized to require and you must disclose this information under 415 ILCS 5/39. Failure to do so could result in the application being denied and penalties under 415 ILCS 5 et seq. It is not necessary to use this form in providing this information. This form has been approved by the forms management center.

APPLICATION FOR PERMIT (A)

[X] CONSTRUCT [X] OPERATE

NAME OF EQUIPMENT TO BE CONSTRUCTED OR OPERATED _____ (B)

FOR AGENCY USE ONLY

I.D. NO. _____

PERMIT NO. _____

DATE _____

1a. NAME OF OWNER: The Lockformer Company		2a. NAME OF OPERATOR: The Lockformer Company	
1b. STREET ADDRESS OF OWNER: 711 West Ogden Avenue		2b. STREET ADDRESS OF OPERATOR: 711 West Ogden Avenue	
1c. CITY OF OWNER: Lisle		2c. CITY OF OPERATOR: Lisle	
1d. STATE OF OWNER: Illinois	1e. ZIP CODE: 60532	2d. STATE OF OPERATOR: Illinois	2e. ZIP CODE: 60532

3a. NAME OF CORPORATE DIVISION OR PLANT: The Lockformer Company		3b. STREET ADDRESS OF EMISSION SOURCE: 711 West Ogden Avenue		
3c. CITY OF EMISSION SOURCE: Lisle	3d. LOCATED WITHIN CITY LIMITS: [X] YES [ ] NO	3e. TOWNSHIP: Lisle	3f. COUNTY: DuPage	3g. ZIP CODE: 60532

4. ALL CORRESPONDENCE TO: (TITLE AND/OR NAME OF INDIVIDUAL) Rian Scheel	5. YOUR DESIGNATION FOR THIS APPLICATION: (C) E R H - S V E
6. ADDRESS FOR CORRESPONDENCE: (CHECK ONLY ONE) [ ] OWNER [X] OPERATOR [ ] EMISSION SOURCE	7. WHO IS THE PERMIT APPLICANT? [ ] OWNER [X] OPERATOR

8. THE UNDERSIGNED HEREBY MAKES APPLICATION FOR A PERMIT AND CERTIFIES THAT THE STATEMENTS CONTAINED HEREIN ARE TRUE AND CORRECT, AND FURTHER CERTIFIES THAT ALL PREVIOUSLY SUBMITTED INFORMATION REFERENCED IN THIS APPLICATION REMAINS TRUE, CORRECT AND CURRENT. BY AFFIXING HIS/HER SIGNATURE HERETO THE UNDERSIGNED FURTHER CERTIFIES THAT HE/SHE IS AUTHORIZED TO EXECUTE THIS APPLICATION.

AUTHORIZED SIGNATURE(S): (D)

BY _____ SIGNATURE _____ DATE

Arthur Bourlard
TYPED OR PRINTED NAME OF SIGNER

Environmental Health and Safety Coordinator
TITLE OF SIGNER

BY _____ SIGNATURE _____ DATE

TYPED OR PRINTED NAME OF SIGNER

TITLE OF SIGNER

(A) THIS FORM IS TO PROVIDE THE ILLINOIS EPA WITH GENERAL INFORMATION ABOUT THE EQUIPMENT TO BE CONSTRUCTED OR OPERATED. THIS FORM MAY BE USED TO REQUEST A CONSTRUCTION PERMIT, AN OPERATING PERMIT, OR A JOINT CONSTRUCTION AND OPERATING PERMIT.

(B) ENTER THE GENERIC NAME OF THE EQUIPMENT TO BE CONSTRUCTED OR OPERATED. THIS NAME WILL APPEAR ON THE PERMIT WHICH MAY BE ISSUED PURSUANT TO THIS APPLICATION. THIS FORM MUST BE ACCOMPANIED BY OTHER APPLICABLE FORMS AND INFORMATION.

(C) PROVIDE A DESIGNATION IN ITEM 5 ABOVE WHICH YOU WOULD LIKE THE ILLINOIS EPA TO USE FOR IDENTIFICATION OF YOUR EQUIPMENT. YOUR DESIGNATION WILL BE REFERENCED IN CORRESPONDENCE FROM THIS AGENCY RELATIVE TO THIS APPLICATION. YOUR DESIGNATION MUST NOT EXCEED TEN (10) CHARACTERS. (*OPTIONAL*)

(D) THIS APPLICATION MUST BE SIGNED IN ACCORDANCE WITH 35 ILL. ADM. CODE 201.154 OR 201.159 WHICH STATES: "ALL APPLICATIONS AND SUPPLEMENTS THERETO SHALL BE SIGNED BY THE OWNER AND OPERATOR OF THE EMISSION SOURCE OR AIR POLLUTION CONTROL EQUIPMENT, OR THEIR AUTHORIZED AGENT, AND SHALL BE ACCOMPANIED BY EVIDENCE OF AUTHORITY TO SIGN THE APPLICATION."

IF THE OWNER OR OPERATOR IS A CORPORATION, SUCH CORPORATION MUST HAVE ON FILE WITH THE ILLINOIS EPA A CERTIFIED COPY OF A RESOLUTION OF THE CORPORATION'S BOARD OF DIRECTORS AUTHORIZING THE PERSONS SIGNING THIS APPLICATION TO CAUSE OR ALLOW THE CONSTRUCTION OR OPERATION OF THE EQUIPMENT TO BE COVERED BY THE PERMIT.

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF AIR POLLUTION CONTROL
2200 CHURCHILL ROAD
SPRINGFIELD, ILLINOIS 62706

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.

*DATA AND INFORMATION PROCESS EMISSION SOURCE	

*THIS INFORMATION FORM IS TO BE COMPLETED FOR AN EMISSION SOURCE OTHER THAN A FUEL COMBUSTION EMISSION SOURCE OR AN INCINERATOR. A FUEL COMBUSTION EMISSION SOURCE IS A FURNACE, BOILER, OR SIMILAR EQUIPMENT USED PRIMARILY FOR PRODUCING HEAT OR POWER BY INDIRECT HEAT TRANSFER. AN INCINERATOR IS AN APPARATUS IN WHICH REFUSE IS BURNED.

1. NAME OF PLANT OWNER: The Lockformer Company	2. NAME OF CORPORATE DIVISION OR PLANT (IF DIFFERENT FROM OWNER): Same
3. STREET ADDRESS OF EMISSION SOURCE: 711 West Ogden Avenue	4. CITY OF EMISSION SOURCE: Lisle, IL

GENERAL INFORMATION

5. NAME OF PROCESS: Soil Vapor Extracttion & Electrical Resistive Heating	6. NAME OF EMISSION SOURCE EQUIPMENT: Blower	
7. EMISSION SOURCE EQUIPMENT MANUFACTURER:	8. MODEL NUMBER: TBD	9. SERIAL NUMBER: TBD
10. FLOW DIAGRAM DESIGNATION(S) OF EMISSION SOURCE: See Figure 3		
11. IDENTITY(S) OF ANY SIMILAR SOURCE(S) AT THE PLANT OR PREMISES NOT COVERED BY THE FORM (IF THE SOURCE IS COVERED BY ANOTHER APPLICATION, IDENTIFY THE APPLICATION): N/A		
12. AVERAGE OPERATING TIME OF EMISSION SOURCE: 24 HRS/DAY 7 DAYS/WK 52 WKS/YR	13. MAXIMUM OPERATING TIME OF EMISSION SOURCE: 24 HRS/DAY 7 DAYS/WK 52 WKS/YR	
14. PERCENT OF ANNUAL THROUGHPUT: DEC-FEB 25 % MAR-MAY 25 % JUN-AUG 25 % SEPT-NOV 25 %		

INSTRUCTIONS

1. COMPLETE THE ABOVE IDENTIFICATION AND GENERAL INFORMATION SECTION.
2. COMPLETE THE RAW MATERIAL, PRODUCT, WASTE MATERIAL, AND FUEL USAGE SECTIONS FOR THE PARTICULAR SOURCE EQUIPMENT. COMPOSITIONS OF MATERIALS MUST BE SUFFICIENTLY DETAILED TO ALLOW DETERMINATION OF THE NATURE AND QUANTITY OF POTENTIAL EMISSIONS. IN PARTICULAR, THE COMPOSITION OF PAINTS, INKS, ETC., AND ANY SOLVENTS MUST BE FULLY DETAILED.
3. EMISSION AND EXHAUST POINT INFORMATION MUST BE COMPLETED, UNLESS EMISSIONS ARE EXHAUSTED THROUGH AIR POLLUTION CONTROL EQUIPMENT.
4. OPERATING TIME AND CERTAIN OTHER ITEMS REQUIRE BOTH AVERAGE AND MAXIMUM VALUES.
5. FOR GENERAL INFORMATION REFER TO "GENERAL INSTRUCTIONS FOR PERMIT APPLICATIONS," APC-201.

DEFINITIONS

AVERAGE - THE VALUE THAT SUMMARIZES OR REPRESENTS THE GENERAL CONDITION OF THE EMISSION SOURCE, OR THE GENERAL STATE OF PRODUCTION OF THE EMISSION SOURCE. SPECIFICALLY:

AVERAGE OPERATING TIME - ACTUAL TOTAL HOURS OF OPERATION FOR THE PRECEDING TWELVE MONTH PERIOD.

AVERAGE RATE - ACTUAL TOTAL QUANTITY OF "MATERIAL" FOR THE PRECEDING TWELVE MONTH PERIOD, DIVIDED BY THE AVERAGE OPERATING TIME.

AVERAGE OPERATION - OPERATION TYPICAL OF THE PRECEDING TWELVE MONTH PERIOD, AS REPRESENTED BY AVERAGE OPERATING TIME AND AVERAGE RATES.

MAXIMUM - THE GREATEST VALUE ATTAINABLE OR ATTAINED FROM THE EMISSION SOURCE, OR THE PERIOD OF GREATEST OR UTMOST PRODUCTION OF THE EMISSION SOURCE. SPECIFICALLY:

MAXIMUM OPERATING TIME - GREATEST EXPECTED TOTAL HOURS OF OPERATIONS FOR ANY TWELVE MONTH PERIOD.

MAXIMUM RATE - GREATEST QUANTITY OF "MATERIAL" EXPECTED PER ANY ONE HOUR OF OPERATION.

MAXIMUM OPERATION - GREATEST EXPECTED OPERATION, AS REPRESENTED BY MAXIMUM OPERATING TIME AND MAXIMUM RATES.

RAW MATERIAL INFORMATION		
NAME OF RAW MATERIAL	AVERAGE RATE PER IDENTICAL SOURCE	MAXIMUM RATE PER IDENTICAL SOURCE
20a.	b. LB/HR	c. LB/HR
21a.	b. LB/HR	c. LB/HR
22a.	b. LB/HR	c. LB/HR
23a.	b. LB/HR	c. LB/HR
24a.	b. LB/HR	c. LB/HR

PRODUCT INFORMATION		
NAME OF PRODUCT	AVERAGE RATE PER IDENTICAL SOURCE	MAXIMUM RATE PER IDENTICAL SOURCE
30a.	b. LB/HR	c. LB/HR
31a.	b. LB/HR	c. LB/HR
32a.	b. LB/HR	c. LB/HR
33a.	b. LB/HR	c. LB/HR
34a.	b. LB/HR	c. LB/HR

WASTE MATERIAL INFORMATION		
NAME OF WASTE MATERIAL	AVERAGE RATE PER IDENTICAL SOURCE	MAXIMUM RATE PER IDENTICAL SOURCE
40a.	b. LB/HR	c. LB/HR
41a.	b. LB/HR	c. LB/HR
42a.	b. LB/HR	c. LB/HR
43a.	b. LB/HR	c. LB/HR
44a.	b. LB/HR	c. LB/HR

*FUEL USAGE INFORMATION		
FUEL USED	TYPE	HEAT CONTENT
50a. NATURAL GAS ☐	b. _____	c. 1000 BTU/SCF
OTHER GAS ☐		BTU/SCF
OIL ☐		BTU/GAL
COAL ☐		BTU/LB
OTHER ☐		BTU/LB
d. AVERAGE FIRING RATE PER IDENTICAL SOURCE: BTU/HR	e. MAXIMUM FIRING RATE PER IDENTICAL SOURCE: BTU/HR	

*THIS SECTION IS TO BE COMPLETED FOR ANY FUEL USED DIRECTLY IN THE PROCESS EMISSION SOURCE, E.G. GAS IN A DRYER, OR COAL IN A MELT FURNACE.

*EMISSION INFORMATION			
51. NUMBER OF IDENTICAL SOURCES (DESCRIBE AS REQUIRED): Not Applicable			
AVERAGE OPERATION			
CONTAMINANT	CONCENTRATION OR EMISSION RATE PER IDENTICAL SOURCE		METHOD USED TO DETERMINE CONCENTRATION OR EMISSION RATE
PARTICULATE MATTER	52a. GR/SCF	b. LB/HR	c.
CARBON MONOXIDE	53a. PPM (VOL)	b. LB/HR	c.
NITROGEN OXIDES	54a. PPM (VOL)	b. LB/HR	c.
ORGANIC MATERIAL	55a. PPM (VOL)	b. <8.0 LB/HR	c. Will be determined during start-up,
SULFUR DIOXIDE	56a. PPM (VOL)	b. LB/HR	c. Flow rate and organic concentrations
**OTHER (SPECIFY)	57a. PPM (VOL)	b. LB/HR	c. will be determined (10-15 samples).
MAXIMUM OPERATION			
CONTAMINANT	CONCENTRATION OR EMISSION RATE PER IDENTICAL SOURCE		METHOD USED TO DETERMINE CONCENTRATION OR EMISSION RATE
PARTICULATE MATTER	58a. GR/SCF	b. LB/HR	c.
CARBON MONOXIDE	59a. PPM (VOL)	b. LB/HR	c.
NITROGEN OXIDES	60a. PPM (VOL)	b. LB/HR	c.
ORGANIC MATERIAL	61a. PPM (VOL)	b. <8.0 LB/HR	c. Proposed maximum emmission rate
SULFUR DIOXIDE	62a. PPM (VOL)	b. LB/HR	c.
**OTHER (SPECIFY)	63a. PPM (VOL)	b. LB/HR	c.

*ITEMS 52 THROUGH 63 NEED NOT BE COMPLETED IF EMISSIONS ARE EXHAUSTED THROUGH AIR POLLUTION CONTROL EQUIPMENT.
**"OTHER" CONTAMINANT SHOULD BE USED FOR AN AIR CONTAMINANT NOT SPECIFICALLY NAMED ABOVE. POSSIBLE OTHER CONTAMINANTS ARE ASBESTOS, BERYLLIUM, MERCURY, VINYL CHLORIDE, LEAD, ETC.

***EXHAUST POINT INFORMATION	
64. FLOW DIAGRAM DESIGNATION(S) OF EXHAUST POINT: See figure	
65. DESCRIPTION OF EXHAUST POINT (LOCATION IN RELATION TO BUILDINGS, DIRECTION, HOODING, ETC.): 2 feet South of the main building	
66. EXIT HEIGHT ABOVE GRADE: 30 feet	67. EXIT DIAMETER: 8 inches
68. GREATEST HEIGHT OF NEARBY BUILDINGS: 24 feet FT	69. EXIT DISTANCE FROM NEAREST PLANT BOUNDARY: 160 FT
AVERAGE OPERATION	MAXIMUM OPERATION
70. EXIT GAS TEMPERATURE: 90 °F	72. EXIT GAS TEMPERATURE: 110 °F
71. GAS FLOW RATE THROUGH EACH EXIT: 2800 ACFM	73. GAS FLOW RATE THROUGH EACH EACH EXIT: 2800 ACFM

***THIS SECTION SHOULD NOT BE COMPLETED IF EMISSIONS ARE EXHAUSTED THROUGH AIR POLLUTION CONTROL EQUIPMENT.

CONDENSER		
1. FLOW DIAGRAM DESIGNATION(S) OF CONDENSER: Not Applicable		
2. MANUFACTURER:	3. MODEL NAME AND NUMBER:	4. HEAT EXCHANGE AREA: FT^2

AVERAGE OPERATION OF SOURCE		MAXIMUM OPERATION OF SOURCE	
5. COOLANT FLOW RATE PER CONDENSER: WATER _____ GPM AIR _____ SCFM OTHER: TYPE _____, FLOW RATE _____		10. COOLANT FLOW RATE PER CONDENSER: WATER _____ GPM AIR _____ SCFM OTHER: TYPE _____, FLOW RATE _____	
6. GAS FLOW RATE: SCFM		11. GAS FLOW RATE: SCFM	
7. COOLANT TEMPERATURE: INLET_____°F OUTLET_____°F	8. GAS TEMPERATURE: INLET_____°F OUTLET_____°F	12. COOLANT TEMPERATURE: INLET_____°F OUTLET_____°F	13. GAS TEMPERATURE: INLET_____°F OUTLET_____°F
9. EFFICIENCY OF CONDENSER (SEE INSTRUCTION 4): %		14. EFFICIENCY OF CONDENSER (SEE INSTRUCTION 4): %	

*ELECTRICAL PRECIPITATOR	
1. FLOW DIAGRAM DESIGNATION(S) OF ELECTRICAL PRECIPITATOR: Not Applicable	
2. MANUFACTURER:	3. MODEL NAME AND NUMBER:
4. COLLECTING ELECTRODE AREA PER CONTROL DEVICE: FT^2	

AVERAGE OPERATION OF SOURCE	MAXIMUM OPERATION OF SOURCE
5. GAS FLOW RATE: SCFM	7. GAS FLOW RATE: SCFM
6. EFFICIENCY OF ELECTRICAL PRECIPITATOR(SEE INSTRUCTION 4): %	8. EFFICIENCY OF ELECTRICAL PRECIPITATOR(SEE INSTRUCTION 4): %

SUBMIT THE MANUFACTURER'S SPECIFICATIONS FOR THE ELECTRICAL PRECIPITATOR. REFERENCE THE INFORMATION TO THIS FORM.

*ELECTRICAL PRECIPITATORS VARY GREATLY IN THEIR DESIGN AND IN THEIR COMPLEXITY. THE ITEMS IN THIS SECTION PROVIDE A MINIMUM AMOUNT OF INFORMATION. THE APPLICANT MUST, HOWEVER, SUBMIT WITH THIS APPLICATION THE MANUFACTURER'S SPECIFICATIONS, INCLUDING ANY DRAWINGS, TECHNICAL DOCUMENTS, ETC. IF THE INFORMATION PROVIDED BY THE MANUFACTURER'S SPECIFICATIONS IS INSUFFICIENT FOR FULL AND ACCURATE ANALYSIS, THE AGENCY WILL REQUEST SPECIFIC ADDITIONAL INFORMATION.

FILTER UNIT	
1. FLOW DIAGRAM DESIGNATION(S) OF FILTER UNIT: Not Applicable	
2. MANUFACTURER:	3. MODEL NAME AND NUMBER:
4. FILTERING MATERIAL:	5. FILTERING AREA: FT^2
6. CLEANING METHOD: ☐ SHAKER ☐ REVERSE AIR ☐ PULSE AIR ☐ PULSE JET ☐ OTHER: SPECIFY _____	
7. GAS COOLING METHOD: ☐ DUCT WORK: LENGTH _____ FT., DIAM _____ IN. ☐ BLEED-IN AIR ☐ WATER SPRAY ☐ OTHER: SPECIFY _____	

AVERAGE OPERATION OF SOURCE	MAXIMUM OPERATION OF SOURCE
8. GAS FLOW RATE (FROM SOURCE): SCFM	12. GAS FLOW RATE (FROM SOURCE): SCFM
9. GAS COOLING FLOW RATE: BLEED-IN AIR _____ SCFM, WATER SPRAY _____ GPM	13. GAS COOLING FLOW RATE: BLEED-IN AIR _____ SCFM, WATER SPRAY _____ GPM
10. INLET GAS CONDITION: TEMPERATURE _____ °F DEWPOINT _____ °F	14. INLET GAS CONDITION: TEMPERATURE _____ °F DEWPOINT _____ °F
11. EFFICIENCY OF FILTER UNIT (SEE INSTRUCTION 4): %	15. EFFICIENCY OF FILTER UNIT (SEE INSTRUCTION 4): %

SCRUBBER	
1. FLOW DIAGRAM DESIGNATION(S) OF SCRUBBER: Not Applicable	
2. MANUFACTURER:	3. MODEL NAME AND NUMBER:
4. TYPE OF SCRUBBER: ☐ HIGH ENERGY: GAS STEAM PRESSURE DROP _____ INCH H_2O ☐ PACKED: PACKING TYPE _____, PACKING SIZE _____, PACKING HEIGHT _____ IN. ☐ SPRAY: NUMBER OF NOZZLES _____, NOZZLE PRESSURE _____ PSIG ☐ OTHER: SPECIFY _____ ATTACH DESCRIPTION AND SKETCH WITH DIMENSIONS	
5. TYPE OF FLOW: ☐ COCURRENT ☐ COUNTERCURRENT ☐ CROSSFLOW	
6. SCRUBBER GEOMETRY: LENGTH IN DIRECTION OF GAS FLOW _____ IN., CROSS-SECTIONAL AREA _____ SQUARE IN.	
7. CHEMICAL COMPOSITION OF SCRUBBANT:	
AVERAGE OPERATION OF SOURCE	MAXIMUM OPERATION OF SOURCE
8. SCRUBBANT FLOW RATE: GPM	12. SCRUBBANT FLOW RATE: GPM
9. GAS FLOW RATE: SCFM	13. GAS FLOW RATE: SCFM
10. INLET GAS TEMPERATURE: °F	14. INLET GAS TEMPERATURE: °F
11. EFFICIENCY OF SCRUBBER (SEE INSTRUCTION 4): _____ % PARTICULATE _____ % GASEOUS	15. EFFICIENCY OF SCRUBBER (SEE INSTRUCTION 4): _____ % PARTICULATE _____ % GASEOUS

OTHER TYPE OF CONTROL EQUIPMENT		
1. FLOW DIAGRAM DESIGNATION(S) OF "OTHER TYPE" OF CONTROL EQUIPMENT:		
2. GENERIC NAME OF "OTHER" EQUIPMENT:	3. MANUFACTURER:	4. MODEL NAME AND NUMBER:
5. DESCRIPTION AND SKETCH, WITH DIMENSIONS AND FLOW RATES, OF "OTHER" EQUIPMENT:		
AVERAGE OPERATION OF SOURCE		MAXIMUM OPERATION OF SOURCE
6. FLOW RATES: _____ GPM _____ SCFM		8. FLOW RATES: _____ GPM _____ SCFM
7. EFFICIENCY OF "OTHER" EQUIPMENT (SEE INSTRUCTION 4): %		9. EFFICIENCY OF "OTHER" EQUIPMENT (SEE INSTRUCTION 4): %

EMISSION INFORMATION			
1. NUMBER OF IDENTICAL CONTROL UNITS OR CONTROL SYSTEMS (DESCRIBE AS REQUIRED): 2 units in series			
AVERAGE OPERATION			
CONTAMINANT	CONCENTRATION OR EMISSION RATE PER IDENTICAL CONTROL UNITS OR CONTROL SYSTEM		METHOD USED TO DETERMINE CONCENTRATION OR EMISSION RATE
PARTICULATE MATTER	2a. GR/SCF	b. LB/HR	c.
CARBON MONOXIDE	3a. PPM (VOL)	b. LB/HR	c.
NITROGEN OXIDES	4a. PPM (VOL)	b. LB/HR	c.
ORGANIC MATERIAL	5a. PPM (VOL)	b. < 8 LB/HR	c. Will be determined through testing at startup
SULFUR DIOXIDE	6a. PPM (VOL)	b. LB/HR	c.
**OTHER (SPECIFY)	7a. PPM (VOL)	b. LB/HR	c.
MAXIMUM OPERATION			
CONTAMINANT	CONCENTRATION OR EMISSION RATE PER IDENTICAL CONTROL UNITS OR CONTROL SYSTEM		METHOD USED TO DETERMINE CONCENTRATION OR EMISSION RATE
PARTICULATE MATTER	8a. GR/SCF	b. LB/HR	c.
CARBON MONOXIDE	9a. PPM (VOL)	b. LB/HR	c.
NITROGEN OXIDES	10a. PPM (VOL)	b. LB/HR	c.
ORGANIC MATERIAL	11a. PPM (VOL)	b. < 8 LB/HR	c. Proposed maximum emission rate
SULFUR DIOXIDE	12a. PPM (VOL)	b. LB/HR	c.
**OTHER (SPECIFY)	13a. PPM (VOL)	b. LB/HR	c.

**"OTHER" CONTAMINANT SHOULD BE USED FOR AN AIR CONTAMINANT NOT SPECIFICALLY NAMED ABOVE. POSSIBLE OTHER CONTAMINANTS ARE ASBESTOS, BERYLLIUM, MERCURY, VINYL CHLORIDE, LEAD, ETC.

EXHAUST POINT INFORMATION	
1. FLOW DIAGRAM DESIGNATION(S) OF EXHAUST POINT: See Figure in original application	
2. DESCRIPTION OF EXHAUST POINT (LOCATION IN RELATION TO BUILDINGS, DIRECTION, HOODING, ETC.): 2 feet south of Main Building	
3. EXIT HEIGHT ABOVE GRADE: 30 feet	4. EXIT DIAMETER: 8 inches
5. GREATEST HEIGHT OF NEARBY BUILDINGS: 24 feet	6. EXIT DISTANCE FROM NEAREST PLANT BOUNDARY: 160 feet
AVERAGE OPERATION	MAXIMUM OPERATION
7. EXIT GAS TEMPERATURE: 90 °F	9. EXIT GAS TEMPERATURE: 110 °F
8. GAS FLOW RATE THROUGH EACH EXIT: 3000 ACFM	10. GAS FLOW RATE THROUGH EACH EXIT: 4500 ACFM

USFilter

Westates
11711 Reading Road
Red Bluff, CA 96080

Telephone (530) 527-2664
Facsimile (530) 527-8724

RB10 VAPOR FILTER

RB10 Vapor Phase Adsorption Filter is designed to treat a wide range of contaminated process streams. Filter is designed for Roll-Off Trailer Transportation. The adsorber is capable of maximum flow rate of 8,000 cfm.

EACH VESSEL:

Vessel Dimensions	48"
Total Empty Weight / Vessel	7500 lbs
Maximum Working Pressure	28" W.C.
Maximum Working Vacuum	15" W.C.
Rectangular Manways at Top	3@ 24"x 48"
Vessel Volume	822 cu-ft
Carbon Capacity	8,000 lbs.
Carbon Bed Volume-Typical	339 Ft^3
Maximum Flow	8000 cfm
Empty Bed Contact Time	2 sec @ 10000 cfm
Material	Carbon Steel
Supports	Steel Wheels
Lifting	Roll Off / Lifting Lugs
Interior Surface Prep	SSPC-SP10
Interior Surface Coating	Carboline 893 Rust Preventative Epoxy, 6mil min dft
Exterior Surface Primer	Carboline 893 Rust Preventative Epoxy 3 mil min dft
Exterior Surface Coating	Carboline 134 High Solids Urethane 3mil min dft
Standard Color	Blue (Federal Standard 15052)

SUPPORT SCREEN

Screen	Polypropylene over FRP Grrate

SYSTEM WEIGHT:

System Shipping weight (vessel)	7500 lb
Operating Weight (carbon one vessel)	17,500 lb

7-19-01

USFilter

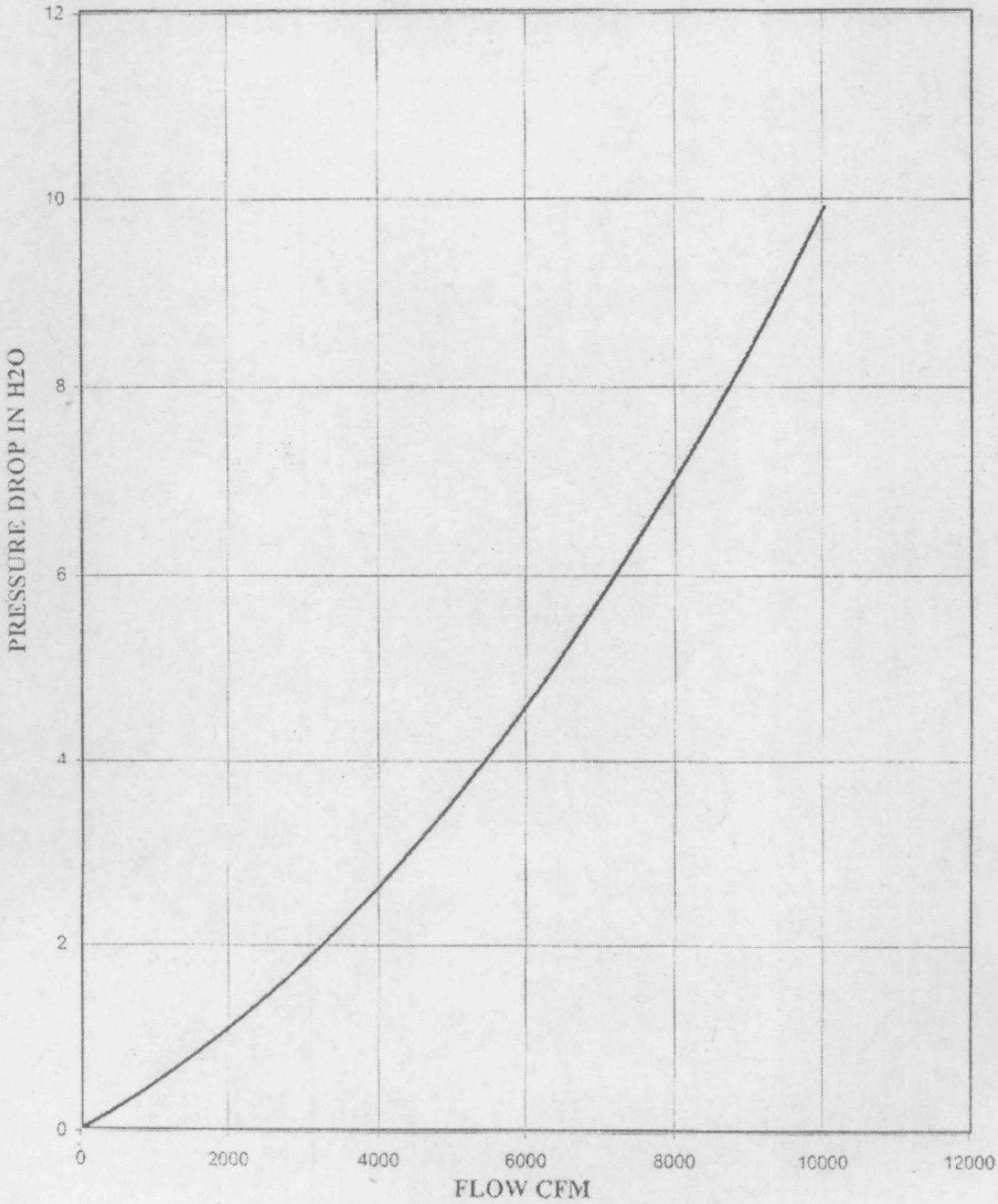
Westates
11711 Reading Road
Red Bluff, CA 96080

Telephone (530) 527-2664
Facsimile (530) 527-8724

PRESSURE DROP

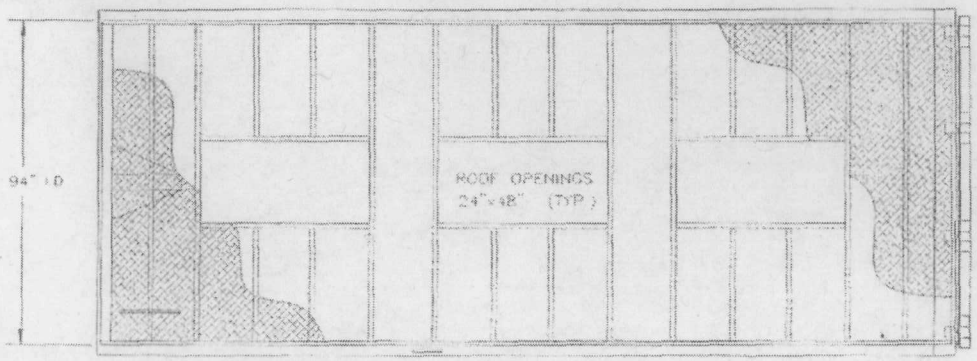
RB 10

4X8 CARBON 70°F



VIVENDI
water company

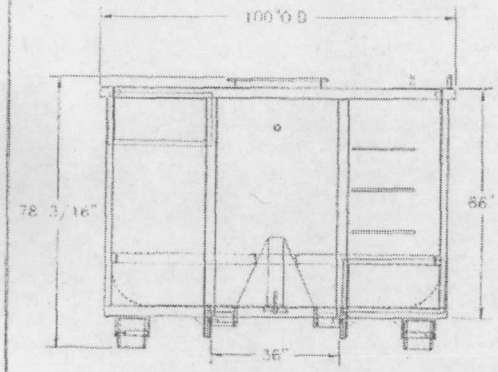
STD 2 0600-8X11A | INIL REF.



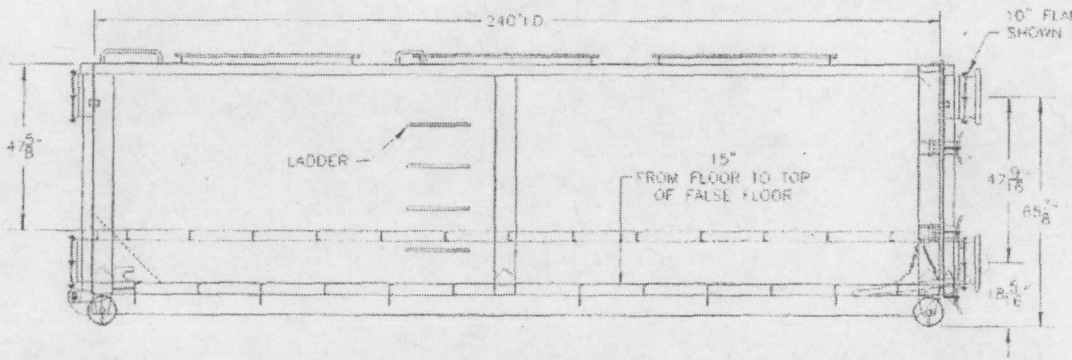
PLAN VIEW

NOTES:

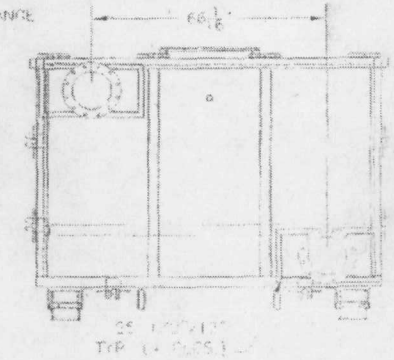
1. CONTINUOUS WELDED CONSTRUCTION
2. EPOXY PRIMED INTERIOR AND EXTERIOR PRIMED AND FINISHED WITH [illegible]
3. TOP HINGED TAILGATE
4. VESSEL WEIGHT [illegible] LBS
5. VESSEL WEIGHT W/ CAPPING [illegible] LBS



FRONT VIEW



SIDE VIEW



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DESIGNER LLR	DATE 5-9-01	TITLE RB10 GENERAL ASSEMBLY
CHECKER	DATE	
ENGINEER	DATE	CLIENT
MANAGER	DATE	USFILTER/WESTATES RED BLUFF, CA 1-800-795-2884
FILE		
SCALE NONE		PROJECT / DRAWING RB10GENASSY / SHEET OF / REV

USFilter

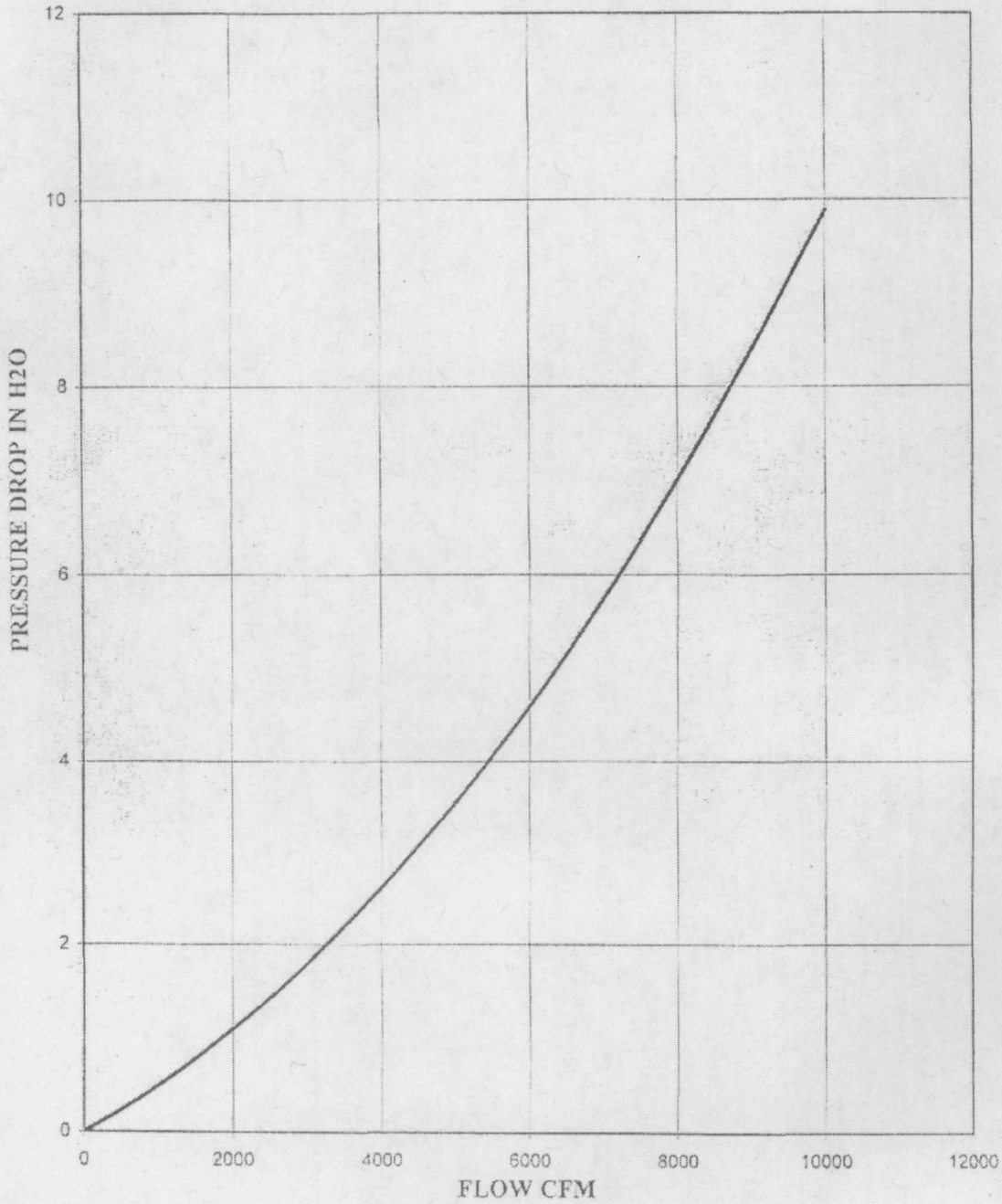
Westates
11711 Reading Road
Red Bluff, CA 96080

Telephone (530) 527-2564
Facsimile (530) 527-8724

PRESSURE DROP

RB 10

4X8 CARBON 70°F



VIVENDI water company

USFilter

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RB10 VAPOR FILTER

RB10 Vapor Phase Adsorption Filter is designed to treat a wide range of contaminated process streams. Filter is designed for Roll-Off Trailer Transportation. The adsorber is capable of maximum flow rate of 8,000 cfm.

EACH VESSEL:

Vessel Dimensions	48"
Total Empty Weight / Vessel	7500 lbs
Maximum Working Pressure	28" W.C.
Maximum Working Vacuum	15" W.C.
Rectangular Manways at Top	3@ 24"x 48"
Vessel Volume	822 cu-ft
Carbon Capacity	8,000 lbs.
Carbon Bed Volume-Typical	339 Ft^3
Maximum Flow	8000 cfm
Empty Bed Contact Time	2 sec @ 10000 cfm
Material	Carbon Steel
Supports	Steel Wheels
Lifting	Roll Off / Lifting Lugs
Interior Surface Prep	SSPC-SP10
Interior Surface Coating	Carboline 893 Rust Preventative Epoxy, 6mil min dft
Exterior Surface Primer	Carboline 893 Rust Preventative Epoxy 3 mil min dft
Exterior Surface Coating	Carboline 134 High Solids Urethane 3mil min dft
Standard Color	Blue (Federal Standard 15052)

SUPPORT SCREEN

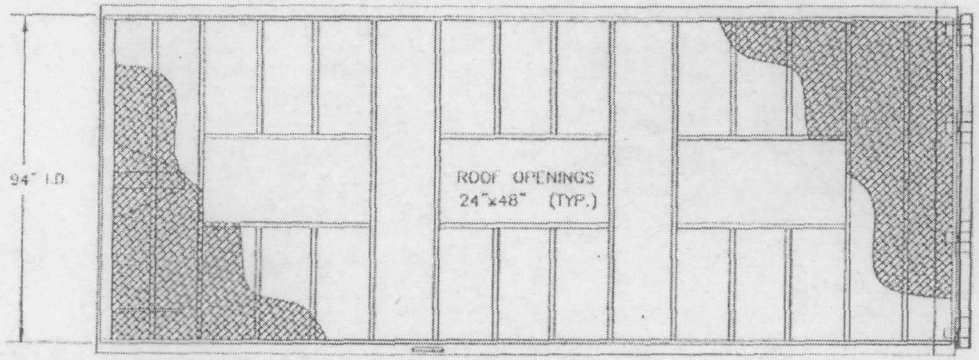
Screen	Polypropylene over FRP Grrate

SYSTEM WEIGHT:

System Shipping weight (vessel)	7500 lb
Operating Weight (carbon one vessel)	17,500 lb

7-19-01

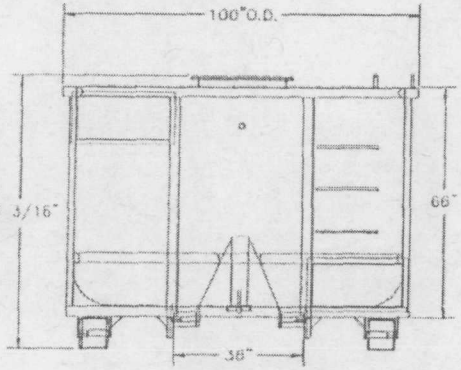
STD: 2-0600-8X11A | INTL REF:



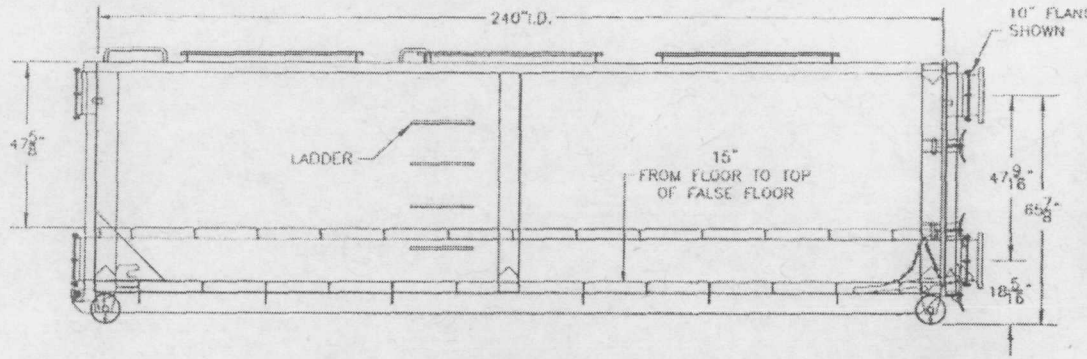
PLAN VIEW

NOTES:

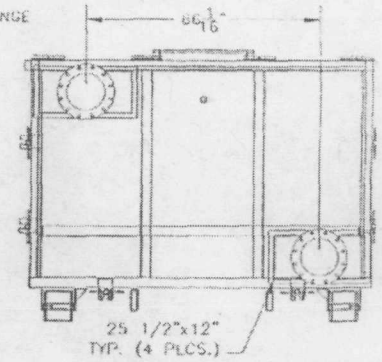
1. CONTINUOUS WELDED CONSTRUCTION.
2. EPOXY PRIMED INTERIOR AND EXTERIOR PRIMED AND FINISHED WITH POLYURETHANE.
3. TOP HINGED TAILGATE.
4. VESSEL WEIGHT: 7,500 LBS.
5. VESSEL WEIGHT W/ CARBON: 17,500 LBS



FRONT VIEW



SIDE VIEW



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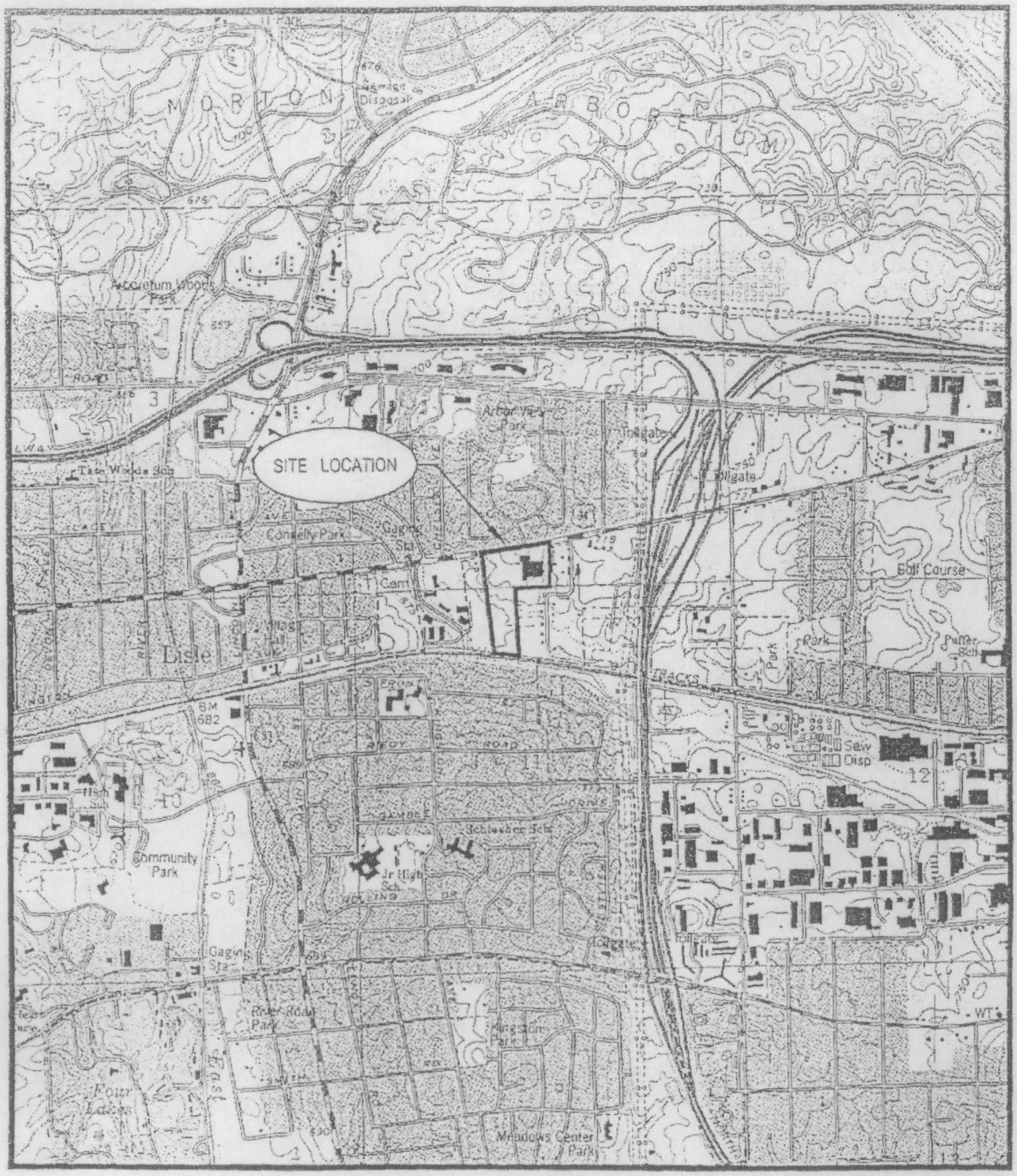
DESIGNER	DATE	TITLE RB10 GENERAL ASSEMBLY
LLR	5-9-01	
CHECKER	DATE	
ENGINEER	DATE	CLIENT
MANAGER	DATE	USFILTER/WESTATES RED BLUFF, CA 1-800-795-2664
FILE:		
SCALE: NONE		PROJECT / DRAWING: RB10CENASSY / SHEET: OF



Scale 1:24000

0 1/2 1 MILE

1000 0 1000 2000 3000 FEET

QUADRANGLE LOCATION

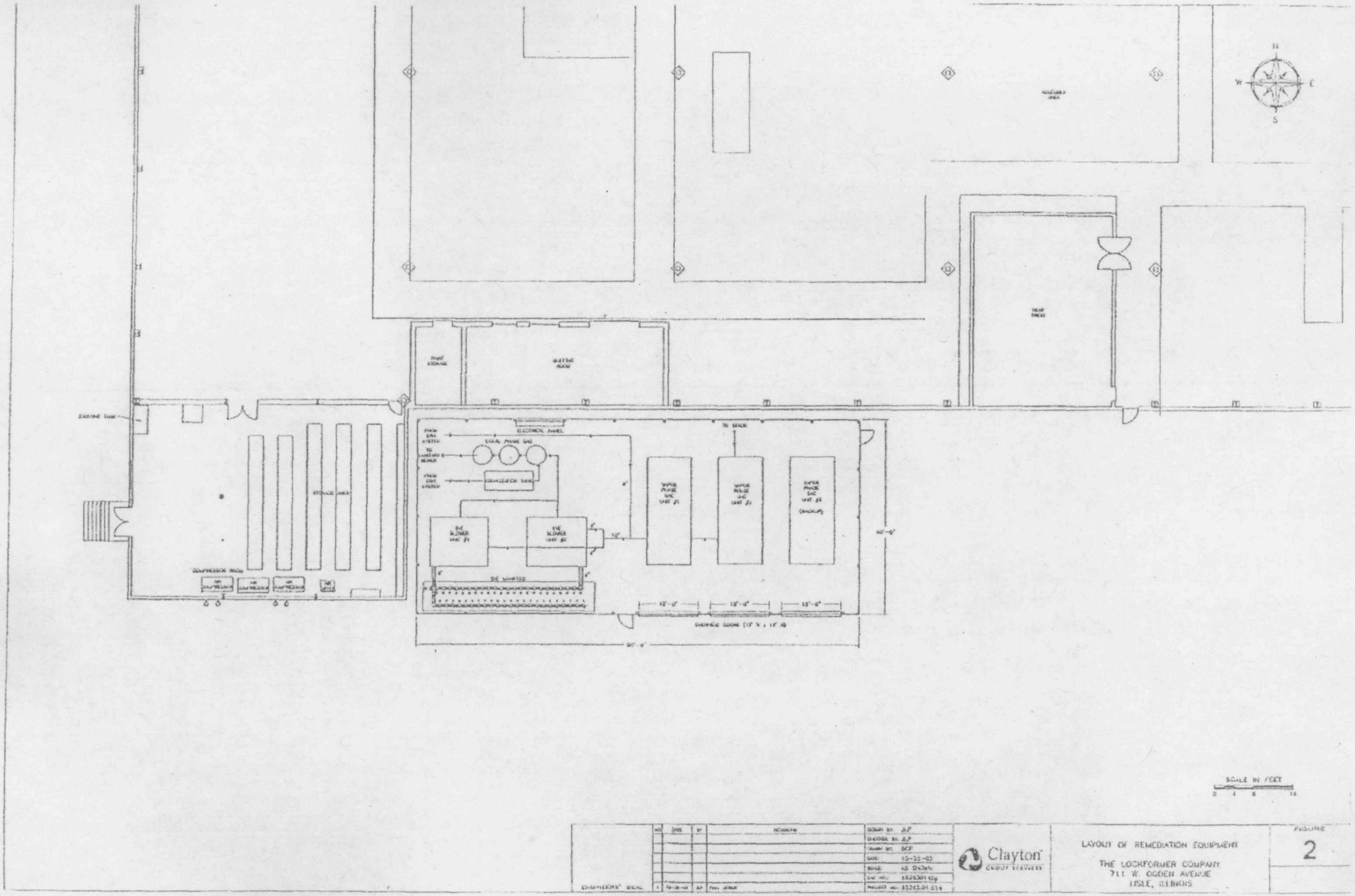
FIGURE 1

SITE LOCATION MAP

THE LOCKFORMER COMPANY
711 OGDEN AVENUE
LISLE, ILLINOIS

CAD NO.: 65253010F

(SOURCE OF MAP IS USGS 7.5 MINUTE QUADRANGLE MAP, WHEATON, ILLINOIS)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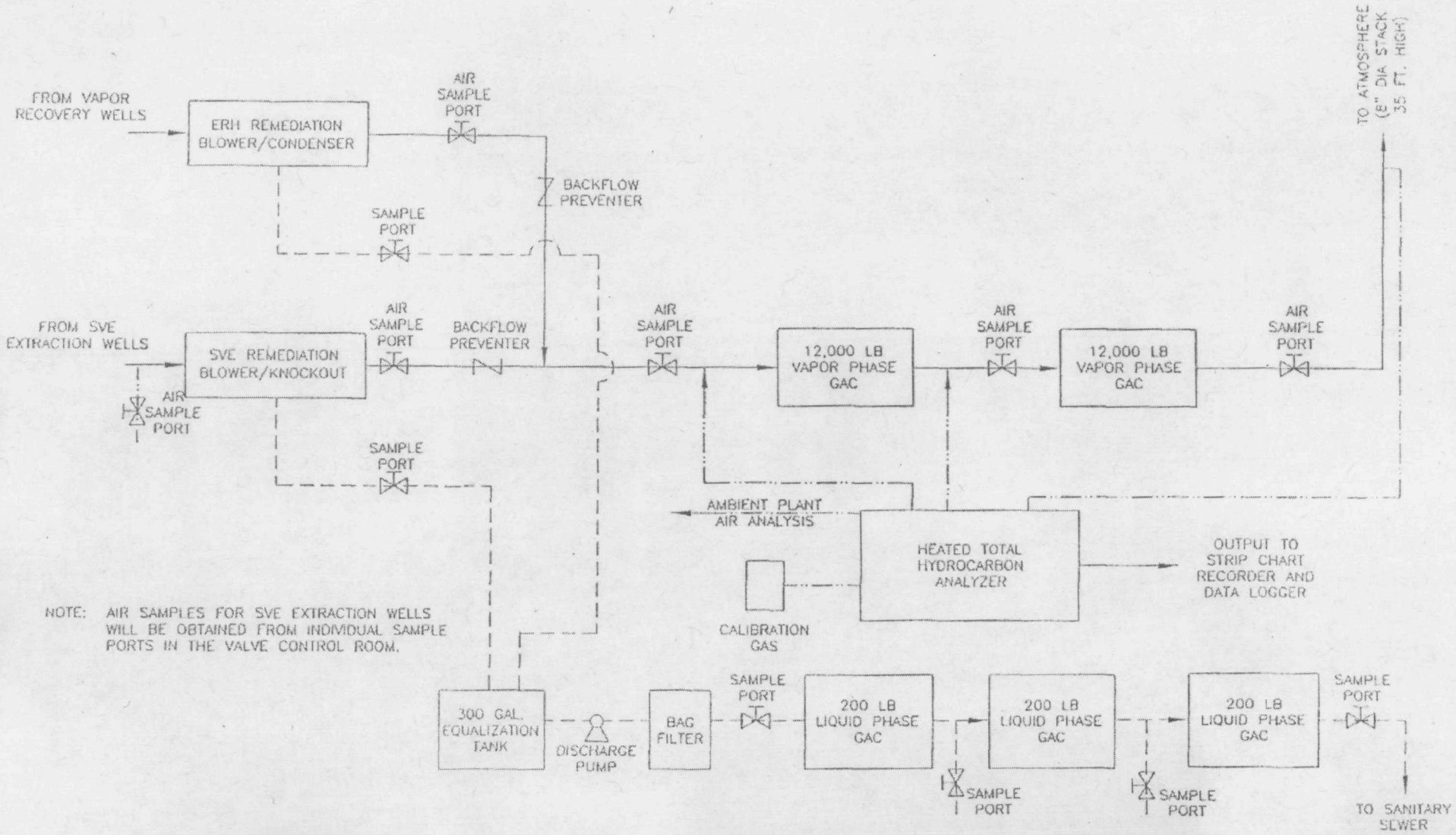
SCALE IN FEET
0 4 8 16
Clayton
GROUP SERVICES
LAYOUT OF REMEDIATION EQUIPMENT
THE LOCKFORMER COMPANY
711 W. OGDEN AVENUE
LISLE, ILLINOIS
FIGURE
2



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DWN BY	OS/BCP
DATE	10-25-02
SCALE	NONE
CAD NO.	FIG 3
PRJ NO.	15-65263

SOIL REMEDIATION PROCESS FLOW DIAGRAM

THE LOCKFORMER COMPANY
711 W. OGDEN AVENUE
LISLE, ILLINOIS

Clayton GROUP SERVICES

FIGURE 3

TRICHLOROETHYLENE

TCL

CAUTIONARY RESPONSE INFORMATION

Common Synonyms	Watery liquid	Colorless	Sweet odor
Chlorylen Gemalgene Trethylene Trichloran Triclene; Algylen Trilene	Sinks in water. Irritating vapor is produced.		

Keep people away.
Avoid contact with liquid and vapor.
Call fire department.
Notify local health and pollution control agencies.
Protect water intakes.

Fire	Combustible. POISONOUS GASES ARE PRODUCED IN FIRE. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, carbon dioxide, or foam.
Exposure	CALL FOR MEDICAL AID VAPOR Irritating to eyes, nose and throat. If inhaled, will cause nausea, vomiting, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Irritating to skin and eyes. If swallowed, will cause nausea, vomiting, difficult breathing, or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.
Water Pollution	Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.

1. CORRECTIVE RESPONSE ACTIONS

Stop discharge
Contain
Collection Systems: Pump

2. CHEMICAL DESIGNATIONS

2.1 CG Compatibility Group: 36; Halogenated hydrocarbon
2.2 Formula: $CHCl=CCl_2$
2.3 IMO/UN Designation: 3.0/1710
2.4 DOT ID No.: 1710
2.5 CAS Registry No.: 79-01-6
2.6 NAERG Guide No.: 160
2.7 Standard Industrial Trade Classification: 51132

3. HEALTH HAZARDS

3.1 **Personal Protective Equipment:** Organic vapor-acid gas canister; self-contained breathing apparatus for emergencies; neoprene or vinyl gloves; chemical safety goggles; face-shield; neoprene safety shoes; neoprene suit or apron for splash protection.
3.2 **Symptoms Following Exposure:** INHALATION: symptoms range from irritation of the nose and throat to nausea, an attitude of irresponsibility, blurred vision, and finally disturbance of central nervous system resulting in cardiac failure. Chronic exposure may cause organic injury. INGESTION: symptoms similar to inhalation. SKIN: defatting action can cause dermatitis. EYES: slightly irritating sensation and lachrymation.
3.3 **Treatment of Exposure:** Do NOT administer adrenalin or epinephrine; get medical attention for all cases of overexposure. INHALATION: remove victim to fresh air; if necessary, apply artificial respiration and/or administer oxygen. INGESTION: have victim drink water and induce vomiting; repeat three times; then give 1 tablespoon epsom salts in water. EYES: flush thoroughly with water. SKIN: wash thoroughly with soap and warm water.
3.4 **TLV-TWA:** 50 ppm
3.5 **TLV-STEL:** Not listed
3.6 **TLV-Ceiling:** 100 ppm
3.7 **Toxicity by ingestion:** Grade 3; LD_{50} = 50 to 500 mg/kg
3.8 **Toxicity by inhalation:** Currently not available
3.9 **Chronic Toxicity:** Currently not available
3.10 **Vapor (Gas) Irritant Characteristics:** Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
3.11 **Liquid or Solid Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
3.12 **Odor Threshold:** 50 ppm
3.13 **IDLH Value:** 1,000 ppm
3.14 **OSHA PEL-TWA:** 100 ppm
3.15 **OSHA PEL-STEL:** 300 ppm, 5 minute peak in any 2 hours.
3.16 **OSHA PEL-Ceiling:** 200 ppm
3.17 **EPA AEGL:** Not listed

4. FIRE HAZARDS

4.1 **Flash Point:** 90°F C.C. practically nonflammable
4.2 **Flammable Limits in Air:** 8.0%-10.5%
4.3 **Fire Extinguishing Agents:** Water fog
4.4 **Fire Extinguishing Agents Not to Be Used:** Not pertinent
4.5 **Special Hazards of Combustion Products:** Toxic and irritating gases are produced in fire situations
4.6 **Behavior in Fire:** Not pertinent
4.7 **Auto Ignition Temperature:** 770°F
4.8 **Electrical Hazards:** Not pertinent
4.9 **Burning Rate:** Not pertinent
4.10 **Adiabatic Flame Temperature:** Currently not available
4.11 **Stoichometric Air to Fuel Ratio:** 9.5 (calc.)
4.12 **Flame Temperature:** Currently not available
4.13 **Combustion Molar Ratio (Reactant to Product):** 4.0 (calc.)
4.14 **Minimum Oxygen Concentration for Combustion (MOCC):** N_2 diluent: 9.0% at 100°C

5. CHEMICAL REACTIVITY

5.1 **Reactivity with Water:** No reaction
5.2 **Reactivity with Common Materials:** No reaction
5.3 **Stability During Transport:** Stable
5.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
5.5 **Polymerization:** Not pertinent
5.6 **Inhibitor of Polymerization:** Not pertinent

6. WATER POLLUTION

6.1 **Aquatic Toxicity:**
660 mg/l/48 hr/daphnia/kill/fresh water
6.2 **Waterfowl Toxicity:** Currently not available
6.3 **Biological Oxygen Demand (BOD):** Currently not available
6.4 **Food Chain Concentration Potential:** None
6.5 **GESAMP Hazard Profile:**
Bioaccumulation:
Damage to living resources:
Human Oral hazard:
Human Contact hazard:
Reduction of amenities:

7. SHIPPING INFORMATION

7.1 **Grades of Purity:** Technical; dry cleaning; degreasing; extraction
7.2 **Storage Temperature:** Ambient
7.3 **Inert Atmosphere:** No requirement
7.4 **Venting:** Pressure-vacuum
7.5 **IMO Pollution Category:** C
7.6 **Ship Type:** 3
7.7 **Barge Hull Type:** 3

8. HAZARD CLASSIFICATIONS

8.1 **49 CFR Category:** Keep Away From Food
8.2 **49 CFR Class:** 6.1
8.3 **49 CFR Package Group:** III
8.4 **Marine Pollutant:** No
8.5 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	1
Instability (Yellow)	0

8.6 **EPA Reportable Quantity:** 100 pounds
8.7 **EPA Pollution Category:** B
8.8 **RCRA Waste Number:** U228
8.9 **EPA FWPCA List:** Yes

9. PHYSICAL & CHEMICAL PROPERTIES

9.1 **Physical State at 15° C and 1 atm:** Liquid
9.2 **Molecular Weight:** 131.39
9.3 **Boiling Point at 1 atm:** 189°F = 87°C = 360°K
9.4 **Freezing Point:** −123.5°F = −86.4°C = 186.8°K
9.5 **Critical Temperature:** Not pertinent
9.6 **Critical Pressure:** Not pertinent
9.7 **Specific Gravity:** 1.46 at 20°C (liquid)
9.8 **Liquid Surface Tension:** 29.3 dynes/cm = 0.0293 N/m at 20°C
9.9 **Liquid Water Interfacial Tension:** 34.5 dynes/cm = 0.0345 N/m at 24°C
9.10 **Vapor (Gas) Specific Gravity:** 4.5
9.11 **Ratio of Specific Heats of Vapor (Gas):** 1.116
9.12 **Latent Heat of Vaporization:** 103 Btu/lb = 57.2 cal/g = 2.4 X 10^5 J/kg
9.13 **Heat of Combustion:** Not pertinent
9.14 **Heat of Decomposition:** Not pertinent
9.15 **Heat of Solution:** Not pertinent
9.16 **Heat of Polymerization:** Not pertinent
9.17 **Heat of Fusion:** Currently not available
9.18 **Limiting Value:** Currently not available
9.19 **Reid Vapor Pressure:** 2.5 psia

NOTES

TRICHLOROETHYLENE

TCL

9.20 SATURATED LIQUID DENSITY	
Temperature (degrees F)	Pounds per cubic foot
0	94.569
5	94.419
10	94.159
15	93.889
20	93.629
25	93.179
30	93.119
35	92.849
40	92.589
45	92.339
50	92.079
55	91.809
60	91.549
65	91.299
70	91.039
75	90.779
80	90.509
85	90.259
90	89.999
95	89.739
100	89.469
105	89.209
110	88.959
115	88.699
120	88.429
125	88.169

9.21 LIQUID HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
0	0.222
10	0.221
20	0.223
30	0.225
40	0.226
50	0.228
60	0.230
70	0.231
80	0.233
90	0.235
100	0.236
110	0.238
120	0.240
130	0.241
140	0.243
150	0.245
160	0.246
170	0.248

9.22 LIQUID THERMAL CONDUCTIVITY	
Temperature (degrees F)	British thermal unit inch per hour-square foot-F
N	
O	
T	
P	
E	
R	
T	
I	
N	
E	
N	
T	

9.23 LIQUID VISCOSITY	
Temperature (degrees F)	Centipoise
15	0.800
20	0.775
25	0.750
30	0.727
35	0.705
40	0.684
45	0.664
50	0.645
55	0.627
60	0.610
65	0.593
70	0.577
75	0.562
80	0.548
85	0.534
90	0.521
95	0.508
100	0.496
105	0.485
110	0.474
115	0.463
120	0.453

9.24 SOLUBILITY IN WATER	
Temperature (degrees F)	Pounds per 100 pounds of water
77	0.110

9.25 SATURATED VAPOR PRESSURE	
Temperature (degrees F)	Pounds per square inch
40	0.508
50	0.673
60	0.894
70	1.196
80	1.597
90	1.329
100	2.448
110	3.091
120	3.846
130	4.753
140	5.862
150	7.183
160	8.695
170	10.490
180	12.580
190	15.018
200	17.819
210	21.029

9.26 SATURATED VAPOR DENSITY	
Temperature (degrees F)	Pounds per cubic foot
40	0.01245
50	0.01628
60	0.02105
70	0.02695
80	0.03418
90	0.04296
100	0.05354
110	0.06619
120	0.08120
130	0.09891
140	0.11960
150	0.14380
160	0.17150
170	0.20330
180	0.24080
190	0.28280
200	0.33040
210	0.38425

9.27 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
0	0.136
25	0.139
50	0.143
75	0.146
100	0.149
125	0.152
150	0.155
175	0.157
200	0.160
225	0.162
250	0.165
275	0.167
300	0.169
325	0.172
350	0.174
375	0.176
400	0.177
425	0.179
450	0.181
475	0.182
500	0.184
525	0.185
550	0.186
575	0.187
600	0.188

TETRACHLOROETHYLENE

TTE

CAUTIONARY RESPONSE INFORMATION

Common Synonyms			
Perchloroethylene Perclene Perc Tetracap	Watery liquid Sinks in water. Irritating vapor is produced.	Colorless	Sweet odor

Avoid contact with liquid and vapor.
Notify local health and pollution control agencies.
Protect water intakes.

Fire	Not flammable. Poisonous gases are produced when heated.
Exposure	CALL FOR MEDICAL AID. VAPOR Irritating to eyes, nose and throat. If inhaled, will cause difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
Water Pollution	Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.

1. CORRECTIVE RESPONSE ACTIONS

Stop discharge
Contain
Collection Systems: Pump
Clean shore line

2. CHEMICAL DESIGNATIONS

2.1 CG Compatibility Group: Not listed.
2.2 Formula: $ClCH=CCl_2$
2.3 IMO/UN Designation: 6.1/1897
2.4 DOT ID No.: 1897
2.5 CAS Registry No.: 127-18-4
2.6 NAERG Guide No.: 160
2.7 Standard Industrial Trade Classification: 51133

3. HEALTH HAZARDS

3.1 Personal Protective Equipment: For high vapor concentrations use approved canister or air-supplied mask; chemical goggles or face shield; plastic gloves.
3.2 Symptoms Following Exposure: Vapor can affect central nervous system and cause anesthesia. Liquid may irritate skin after prolonged contact. May irritate eyes but causes no injury.
3.3 Treatment of Exposure: INHALATION: If illness occurs, remove patient to fresh air, keep him warm and quiet, and get medical attention. INGESTION: Induce vomiting only on physician's recommendation. EYES AND SKIN: Flush with plenty of water and get medical attention if irritation or injury occurs.
3.4 TLV-TWA: 25 ppm
3.5 TLV-STEL: 100 ppm
3.6 TLV-Ceiling: Not listed.
3.7 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg
3.8 Toxicity by Inhalation: Currently not available.
3.9 Chronic Toxicity: None
3.10 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or throat if present in high concentrations. The effect is temporary.
3.11 Liquid or Solid Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
3.12 Odor Threshold: 5 ppm
3.13 IDLH Value: 150 ppm
3.14 OSHA PEL-TWA: 100 ppm
3.15 OSHA PEL-STEL: 300 ppm, 5 minute peak in any 3 hours
3.16 OSHA PEL-Ceiling: 200 ppm
3.17 EPA AEGL: Not listed

4. FIRE HAZARDS

4.1 Flash Point: Not flammable
4.2 Flammable Limits in Air: Not flammable
4.3 Fire Extinguishing Agents: Not pertinent
4.4 Fire Extinguishing Agents Not to Be Used: Not pertinent
4.5 Special Hazards of Combustion Products: Toxic, irritating gases may be generated in fires.
4.6 Behavior in Fire: Not pertinent
4.7 Auto Ignition Temperature: Not flammable
4.8 Electrical Hazards: Not pertinent
4.9 Burning Rate: Not flammable
4.10 Adiabatic Flame Temperature: Currently not available
4.11 Stoichometric Air to Fuel Ratio: Not pertinent.
4.12 Flame Temperature: Currently not available
4.13 Combustion Molar Ratio (Reactant to Product): Not pertinent.
4.14 Minimum Oxygen Concentration for Combustion (MOCC): Not listed

5. CHEMICAL REACTIVITY

5.1 Reactivity with Water: No reaction
5.2 Reactivity with Common Materials: No reaction
5.3 Stability During Transport: Stable
5.4 Neutralizing Agents for Acids and Caustics: Not pertinent
5.5 Polymerization: Not pertinent
5.6 Inhibitor of Polymerization: Not pertinent

6. WATER POLLUTION

6.1 Aquatic Toxicity: Currently not available
6.2 Waterfowl Toxicity: Currently not available
6.3 Biological Oxygen Demand (BOD): None
6.4 Food Chain Concentration Potential: None
6.5 GESAMP Hazard Profile: Not listed

7. SHIPPING INFORMATION

7.1 Grades of Purity: Dry cleaning and industrial grades: 95+%
7.2 Storage Temperature: Ambient
7.3 Inert Atmosphere: No requirement
7.4 Venting: Pressure-vacuum
7.5 IMO Pollution Category: B
7.6 Ship Type: 3
7.7 Barge Hull Type: 3

8. HAZARD CLASSIFICATIONS

8.1 49 CFR Category: Keep Away From Food
8.2 49 CFR Class: 6.1
8.3 49 CFR Package Group: III
8.4 Marine Pollutant: Yes
8.5 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue).....	2
Flammability (Red).....	0
Instability (Yellow).....	0

8.6 EPA Reportable Quantity: 100 pounds
8.7 EPA Pollution Category: B
8.8 RCRA Waste Number: U210/D039
8.9 EPA FWPCA List: Not listed

9. PHYSICAL & CHEMICAL PROPERTIES

9.1 Physical State at 15° C and 1 atm: Liquid
9.2 Molecular Weight: 165.83
9.3 Boiling Point at 1 atm: 250°F = 121°C = 394°K
9.4 Freezing Point: -6.3°F = -22.4°C = 250.8°K
9.5 Critical Temperature: 656.6°F = 347°C = 620.2°K
9.6 Critical Pressure: Not pertinent
9.7 Specific Gravity: 1.63 at 20°C (liquid)
9.8 Liquid Surface Tension: 31.3 dynes/cm = 0.0313 N/m at 20°C
9.9 Liquid Water Interfacial Tension: 44.4 dynes/cm = 0.0444 N/m at 25°C
9.10 Vapor (Gas) Specific Gravity: Not pertinent
9.11 Ratio of Specific Heats of Vapor (Gas): 1.116
9.12 Latent Heat of Vaporization: 90.2 Btu/lb = 50.1 cal/g = 2.10 X 10⁵ J/kg
9.13 Heat of Combustion: Not pertinent
9.14 Heat of Decomposition: Not pertinent
9.15 Heat of Solution: Not pertinent
9.16 Heat of Polymerization: Not pertinent
9.17 Heat of Fusion: Currently not available
9.18 Limiting Value: Currently not available
9.19 Reid Vapor Pressure: Currently not available

NOTES

TETRACHLOROETHYLENE

TTE

9.20 SATURATED LIQUID DENSITY	
Temperature (degrees F)	Pounds per cubic foot
35	103.400
40	103.099
45	102.900
50	102.599
55	102.299
60	102.000
65	101.700
70	101.400
75	101.099
80	100.799
85	100.500
90	100.200
95	99.910
100	99.610
105	99.320
110	99.020
115	98.730
120	98.429
125	98.139
130	97.839
135	97.549
140	97.250
145	96.959
150	96.660
155	96.370
160	96.080

9.21 LIQUID HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
0	0.198
10	0.200
20	0.201
30	0.202
40	0.203
50	0.204
60	0.205
70	0.206
80	0.207
90	0.208
100	0.210
110	0.211
120	0.212
130	0.213
140	0.214
150	0.215
160	0.216
170	0.217
180	0.218
190	0.220
200	0.221
210	0.222

9.22 LIQUID THERMAL CONDUCTIVITY	
Temperature (degrees F)	British thermal unit inch per hour-square foot-F
NOT PERTINENT	

9.23 LIQUID VISCOSITY	
Temperature (degrees F)	Centipoise
55	0.958
60	0.929
65	0.900
70	0.872
75	0.848
80	0.822
85	0.800
90	0.777
95	0.756
100	0.736
105	0.716
110	0.698
115	0.680
120	0.663
125	0.647
130	0.631
135	0.616
140	0.601
145	0.588
150	0.574
155	0.561
160	0.549
165	0.537
170	0.526
175	0.515

9.24 SOLUBILITY IN WATER	
Temperature (degrees F)	Pounds per 100 pounds of water
68	0.016

9.25 SATURATED VAPOR PRESSURE	
Temperature (degrees F)	Pounds per square inch
60	0.236
70	0.318
80	0.425
90	0.561
100	0.732
110	0.948
120	1.217
130	1.548
140	1.953
150	2.445
160	3.042
170	3.756
180	4.607
190	5.616
200	6.805
210	8.199
220	9.824
230	11.710
240	13.899
250	16.356
260	19.260
270	22.520
280	26.230

9.26 SATURATED VAPOR DENSITY	
Temperature (degrees F)	Pounds per cubic foot
60	0.00702
70	0.00929
80	0.01216
90	0.01575
100	0.02022
110	0.02571
120	0.03242
130	0.04055
140	0.05032
150	0.06199
160	0.07583
170	0.09215
180	0.11130
190	0.13360
200	0.15940
210	0.18910
220	0.22320
230	0.26220
240	0.30660
250	0.35680
260	0.41230
270	0.47580
280	0.54790

9.27 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
0	0.108
25	0.110
50	0.113
75	0.116
100	0.118
125	0.120
150	0.122
175	0.125
200	0.127
225	0.129
250	0.131
275	0.132
300	0.134
325	0.136
350	0.138
375	0.139
400	0.141
425	0.142
450	0.143
475	0.144
500	0.146
525	0.147
550	0.148
575	0.148
600	0.149

VINYL CHLORIDE

VCM

CAUTIONARY RESPONSE INFORMATION

Common Synonyms	Gas	Colorless	Sweet odor
Chloroethylene VCL VCM Vinyl C monomer	Liquid floats and boils on water. Flammable. Irritating visible vapor cloud is produced.		

Keep people away.
Evacuate.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Evacuate area in case of large discharge.
Avoid contact with liquid and vapor.
Notify local health and pollution control agencies.
Protect water intakes.

Fire	FLAMMABLE. POISONOUS GAS IS PRODUCED IN FIRE. Flashback along vapor trail may occur. May explode if ignited in an enclosed area. *Wear self-contained breathing apparatus.* Cool exposed containers and protect men attending shutoff with water. Stop flow of gas if possible. Let fire burn. Extinguish small fires with dry chemical.
Exposure	CALL FOR MEDICAL AID. VAPOR Irritating to eyes, nose, and throat. If inhaled, will cause dizziness or difficult breathing. Move to fresh air. *If breathing has stopped, give artificial respiration.* If breathing is difficult, give oxygen. LIQUID Will cause frostbite. Flush affected areas with plenty of water. DO NOT RUB AFFECTED AREAS.
Water Pollution	Not harmful to aquatic life.

1. CORRECTIVE RESPONSE ACTIONS

Dilute and disperse
Stop discharge

2. CHEMICAL DESIGNATIONS

2.1 CG Compatibility Group: 35; Vinyl halides
2.2 Formula: CH_2CHCl
2.3 IMDG/UN Designation: 2.0/1086
2.4 DOT ID No.: 1086
2.5 CAS Registry No.: 75-01-4
2.6 NAERG Guide No.: 116P
2.7 Standard Industrial Trade Classification: 51139

3. HEALTH HAZARDS

3.1 Personal Protective Equipment: Rubber gloves and shoes; gas-tight goggles; organic vapor canister or self-contained breathing apparatus.
3.2 Symptoms Following Exposure: INHALATION: high concentrations cause dizziness, anesthesia, lung irritation. SKIN: may cause frostbite; phenol inhibitor may be absorbed through skin if large amounts of liquid evaporate.
3.3 Treatment of Exposure: INHALATION: remove patient to fresh air and keep him quiet and warm; call a doctor; give artificial respiration if breathing stops. EYES AND SKIN: flush with plenty of water for at least 15 min., for eyes, get medical attention; remove contaminated clothing.
3.4 TLV-TWA: 5 ppm
3.5 TLV-STEL: Not listed.
3.6 TLV-Ceiling: Not listed.
3.7 Toxicity by Ingestion: Not pertinent
3.8 Toxicity by Inhalation: Currently not available.
3.9 Chronic Toxicity: Chronic exposure may cause liver damage.
3.10 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.
3.11 Liquid or Solid Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of skin. May cause frostbite.
3.12 Odor Threshold: 260 ppm
3.13 IDLH Value: Not listed.
3.14 OSHA PEL-TWA: 1 ppm
3.15 OSHA PEL-STEL: 5 ppm average not exceeding any 15 min.
3.16 OSHA PEL-Ceiling: Not listed.
3.17 EPA AEGL: Not listed

4. FIRE HAZARDS

4.1 Flash Point: −110°F C.C.
4.2 Flammable Limits in Air: 3.6 - 33%
4.3 Fire Extinguishing Agents: For small fires use dry chemical or carbon dioxide. For large fires stop flow of gas. Cool exposed containers with water.
4.4 Fire Extinguishing Agents Not to Be Used: Not pertinent
4.5 Special Hazards of Combustion Products: Forms highly toxic combustion products such as hydrogen chloride, phosgene, and carbon monoxide.
4.6 Behavior in Fire: Container may explode in fire. Gas is heavier than air and may travel considerable distance to a source of ignition and flash back.
4.7 Auto Ignition Temperature: 882°F
4.8 Electrical Hazards: Class I, Group D
4.9 Burning Rate: 4.3 mm/min.
4.10 Adiabatic Flame Temperature: Currently not available
4.11 Stoichometric Air to Fuel Ratio: 11.9 (calc.)
4.12 Flame Temperature: Currently not available
4.13 Combustion Molar Ratio (Reactant to Product): 4.5 (calc.)
4.14 Minimum Oxygen Concentration for Combustion (MOCC): Ne diluent: 10.0-13.4%

5. CHEMICAL REACTIVITY

5.1 Reactivity with Water: No reaction
5.2 Reactivity with Common Materials: No reaction
5.3 Stability During Transport: Stable
5.4 Neutralizing Agents for Acids and Caustics: Not pertinent
5.5 *Polymerization:* Polymerizes in presence of air, sunlight, or heat unless stabilized by inhibitors.
5.6 Inhibitor of Polymerization: Not normally used except when high temperatures are expected. Then 40-100 ppm of phenol used.

6. WATER POLLUTION

6.1 Aquatic Toxicity: None
6.2 Waterfowl Toxicity: None
6.3 Biological Oxygen Demand (BOD): None
6.4 Food Chain Concentration Potential: None
6.5 GESAMP Hazard Profile:
Bioaccumulation: 0
Damage to living resources: MA
Human Oral hazard: MA
Human Contact hazard: II
Reduction of amenities: XXX

7. SHIPPING INFORMATION

7.1 Grades of Purity: Commercial or technical 99+%
7.2 Storage Temperature: Under pressure; Ambient. At atm. pressure, low
7.3 Inert Atmosphere: No requirement
7.4 Venting: Under pressure: safety relief. At atm. pressure: pressure-vacuum
7.5 IMO Pollution Category: Currently not available
7.6 Ship Type: 2
7.7 Barge Hull Type: 2

8. HAZARD CLASSIFICATIONS

8.1 49 CFR Category: Flammable gas
8.2 49 CFR Class: 2.1
8.3 49 CFR Package Group: Not pertinent.
8.4 Marine Pollutant: No
8.5 *NFPA Hazard Classification:*

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	4
Instability (Yellow)	2

8.6 EPA Reportable Quantity: 1 pound
8.7 EPA Pollution Category: X
8.8 RCRA Waste Number: U043/D043
8.9 EPA FWPCA List: Not listed

9. PHYSICAL & CHEMICAL PROPERTIES

9.1 Physical State at 15° C and 1 atm: Gas
9.2 Molecular Weight: 62.50
9.3 Boiling Point at 1 atm: 7.21°F = 13.8°C = 259.4°K
9.4 Freezing Point: −244.8°F = −153.8°C = −119.4°K
9.5 Critical Temperature: 317.1°F = 158.4°C = 431.6°K
9.6 Critical Pressure: 775 psia = 52.7 atm = 5.34 MN/m²
9.7 Specific Gravity: 0.969 at −13°C (liquid)
9.8 Liquid Surface Tension: 15.0 dynes/cm = 0.0150 N/m at 25°C
9.9 Liquid Water Interfacial Tension: (est.) 30 dynes/cm = 0.03 N/m at 20°C
9.10 Vapor (Gas) Specific Gravity: 2.2
9.11 Ratio of Specific Heats of Vapor (Gas): 1.185
9.12 Latent Heat of Vaporization: 160 Btu/lb = 88 cal/g = 3.7 X 10⁵ J/kg
9.13 Heat of Combustion: −8126 Btu/lb = −4520 cal/g = −189.1 X 10⁵ J/kg
9.14 Heat of Decomposition: Not pertinent
9.15 Heat of Solution: Not pertinent
9.16 Heat of Polymerization: −728 Btu/lb = −405 cal/g = 16.9 X 10⁵ J/kg
9.17 Heat of Fusion: 18.14 cal/g
9.18 Limiting Value: Currently not available
9.19 Reid Vapor Pressure: 75 psia

NOTES

VINYL CHLORIDE

VCM

9.20 SATURATED LIQUID DENSITY		9.21 LIQUID HEAT CAPACITY		9.22 LIQUID THERMAL CONDUCTIVITY		9.23 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit inch per hour-square foot-F	Temperature (degrees F)	Centipoise
0	61.000	-30	0.259		N	-10	0.287
5	60.710	-20	0.265		O	-5	0.281
		-10	0.272		T	0	0.276
		0	0.279			5	0.271
					P		
					E		
					R		
					T		
					I		
					N		
					E		
					N		
					T		

9.24 SOLUBILITY IN WATER		9.25 SATURATED VAPOR PRESSURE		9.26 SATURATED VAPOR DENSITY		9.27 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
68	0.600	-50	2.384	-50	0.04810	0	0.185
		-40	4.381	-40	0.06245	25	0.192
		-30	5.948	-30	0.08005	50	0.198
		-20	7.658	-20	0.10140	75	0.205
		-10	9.814	-10	0.12710	100	0.211
		0	12.446	0	0.15760	125	0.217
		10	15.510	10	0.19350	150	0.224
		20	19.470	20	0.23580	175	0.230
		30	23.325	30	0.28440	200	0.235
		40	28.220	40	0.34050	225	0.241
		50	35.420	50	0.40470	250	0.247
		60	42.630	60	0.47760	275	0.252
		70	50.540	70	0.56000	300	0.257
		80	60.480	80	0.65250	325	0.263
		90	71.349	90	0.75570	350	0.264
		100	83.663	100	0.87050	375	0.273
		110	97.560	110	0.99740	400	0.277
		120	113.290	120	1.13700	425	0.282
						450	0.286
						475	0.291
						500	0.295
						525	0.299
						550	0.303
						575	0.307
						600	0.311

1,2-DICHLOROETHYLENE

DEL

CAUTIONARY RESPONSE INFORMATION

Common Synonyms			
Acetylene dichloride trans-1,2-Dichloroethylene cis-1,2-Dichloroethylene sym-Dichloroethylene Dioform	Liquid	Colorless	Sweet pleasant odor
	Sinks in water. Flammable, irritating vapor is produced.		

Evacuate
Keep people away
Wear goggles and self-contained breathing apparatus.
Shut off ignition sources. Call fire department.
Notify local health and pollution control agencies.
Protect water intakes.

Fire	FLAMMABLE. POISONOUS GASES MAY BE PRODUCED IN FIRE. Containers may explode in fire. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Extinguish with dry chemicals, foam or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.
Exposure	Call for medical aid. VAPOR If inhaled will cause dizziness, nausea, vomiting, or difficult breathing. Move victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Harmful if swallowed. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
Water Pollution	Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.

1. CORRECTIVE RESPONSE ACTIONS

Stop discharge
Collection Systems: Pump
Collection Systems: Dredge
Do not burn

2. CHEMICAL DESIGNATIONS

2.1 CG Compatibility Group: Not listed
2.2 Formula: $CHCl = CHCl$
2.3 IMO/UN Designation: 3.2/1150
2.4 DOT ID No.: 1150
2.5 CAS Registry No.: 540-59-0
2.6 NAERG Guide No.: 132P
2.7 Standard Industrial Trade Classification: 5113a

3. HEALTH HAZARDS

3.1 Personal Protective Equipment: Rubber gloves; safety goggles; air supply mask or self-contained breathing apparatus.
3.2 Symptoms Following Exposure: Inhalation causes nausea, vomiting, weakness, tremor, epigastric cramps, central nervous depression. Contact with liquid causes irritation of eyes and (on prolonged contact) skin. Ingestion causes slight depression to deep narcosis.
3.3 Treatment of Exposure: INHALATION: remove from further exposure; if breathing is difficult, give oxygen; if victim is not breathing, give artificial respiration, preferably mouth-to-mouth; give oxygen when breathing is resumed; call a physician. EYES: flush with water for at least 15 min. SKIN: wash well with soap and water. INGESTION: give gastric lavage and cathartics.
3.4 TLV-TWA: 200 ppm
3.5 TLV-STEL: Not listed.
3.6 TLV-Ceiling: Not listed.
3.7 Toxicity by Ingestion: Grade 2; oral LD_{50} = 770 mg/kg (rat)
3.8 Toxicity by Inhalation: Currently not available.
3.9 Chronic Toxicity: Produces liver and kidney injury in experimental animals.
3.10 Vapor (Gas) Irritant Characteristics: Currently not available
3.11 Liquid or Solid Characteristics: Currently not available
3.12 Odor Threshold: Currently not available
3.13 IDLH Value: 1,000 ppm
3.14 OSHA PEL-TWA: 200 ppm
3.15 OSHA PEL-STEL: Not listed.
3.16 OSHA PEL-Ceiling: Not listed.
3.17 EPA AEGL: Not listed

4. FIRE HAZARDS

4.1 Flash Point: 37°F C.C.
4.2 Flammable Limits in Air: 9.7%-12.8%
4.3 Fire Extinguishing Agents: Dry chemical, foam, carbon dioxide
4.4 Fire Extinguishing Agents Not to Be Used: Water may be ineffective.
4.5 Special Hazards of Combustion Products: Phosgene and hydrogen chloride fumes may form in fires.
4.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back.
4.7 Auto Ignition Temperature: 860°F
4.8 Electrical Hazards: Currently not available
4.9 Burning Rate: 2.6 mm/min.
4.10 Adiabatic Flame Temperature: Currently not available
4.11 Stoichiometric Air to Fuel Ratio: 9.5 (calc.)
4.12 Flame Temperature: Currently not available
4.13 Combustion Molar Ratio (Reactant to Product): 4.0 (calc.)
4.14 Minimum Oxygen Concentration for Combustion (MOCC): Not listed

5. CHEMICAL REACTIVITY

5.1 Reactivity with Water: No reaction
5.2 Reactivity with Common Materials: No reaction
5.3 Stability During Transport: Stable
5.4 Neutralizing Agents for Acids and Caustics: Not pertinent
5.5 Polymerization: Will not occur under ordinary conditions of shipment. The reaction is not vigorous.
5.6 Inhibitor of Polymerization: None used

6. WATER POLLUTION

6.1 Aquatic Toxicity: Currently not available
6.2 Waterfowl Toxicity: Currently not available
6.3 Biological Oxygen Demand (BOD): Currently not available
6.4 Food Chain Concentration Potential: None
6.5 GESAMP Hazard Profile:
Bioaccumulation: 0
Damage to living resources: 1
Human Oral hazard: 1
Human Contact hazard: 1
Reduction of amenities: X

7. SHIPPING INFORMATION

7.1 Grades of Purity: Commercial
7.2 Storage Temperature: Ambient
7.3 Inert Atmosphere: No requirement
7.4 Venting: Pressure-vacuum
7.5 IMO Pollution Category: Currently not available
7.6 Ship Type: Currently not available
7.7 Barge Hull Type: Currently not available

8. HAZARD CLASSIFICATIONS

8.1 49 CFR Category: Flammable liquid
8.2 49 CFR Class: 3
8.3 49 CFR Package Group: II
8.4 Marine Pollutant: No
8.5 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue).....	2
Flammability (Red).....	3
Instability (Yellow).....	2

8.6 EPA Reportable Quantity: 1000 pounds
8.7 EPA Pollution Category: C
8.8 RCRA Waste Number: U079
8.9 EPA FWPCA List: Not listed

9. PHYSICAL & CHEMICAL PROPERTIES

9.1 Physical State at 15° C and 1 atm: Liquid
9.2 Molecular Weight: 97.0
9.3 Boiling Point at 1 atm: cis: 140°F = 60°C = 333°K trans: 118°F = 48°C = 321°K
9.4 Freezing Point: cis: -114°F = -81°C = 192°K trans: -58°F = -50°C = 223°K
9.5 Critical Temperature: Not pertinent
9.6 Critical Pressure: Not pertinent
9.7 Specific Gravity: 1.27 at 25°C (liquid)
9.8 Liquid Surface Tension: 24 dynes/cm = 0.024 N/m at 20°C
9.9 Liquid Water Interfacial Tension: (est.) 39 dynes/cm = 0.039 N/m at 20°C
9.10 Vapor (Gas) Specific Gravity: 3.34
9.11 Ratio of Specific Heats of Vapor (Gas): 1.1468
9.12 Latent Heat of Vaporization: 130 Btu/lb = 72 cal/g = 3.0 X 10^5 J/kg
9.13 Heat of Combustion: -4,847.2 Btu/lb = -2,692.9 cal/g = -112.67 X 10^5 J/kg
9.14 Heat of Decomposition: Not pertinent
9.15 Heat of Solution: Not pertinent
9.16 Heat of Polymerization: Not pertinent
9.17 Heat of Fusion: Currently not available
9.18 Limiting Value: Currently not available
9.19 Reid Vapor Pressure: Currently not available

NOTES

1,2-DICHLOROETHYLENE

DEL

9.20 SATURATED LIQUID DENSITY	
Temperature (degrees F)	Pounds per cubic foot
35	81.020
40	80.820
45	80.610
50	80.400
55	80.190
60	79.980
65	79.760
70	79.570
75	79.360
80	79.150
85	78.940
90	78.740
95	78.530
100	78.320
105	78.110
110	77.900
115	77.690
120	77.490
125	77.280
130	77.070
135	76.860
140	76.650

9.21 LIQUID HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
35	0.193
40	0.195
45	0.198
50	0.200
55	0.202
60	0.204
65	0.207
70	0.209
75	0.211
80	0.213
85	0.216
90	0.218
95	0.220
100	0.222
105	0.224
110	0.227
115	0.229
120	0.231
125	0.232
130	0.235
135	0.238
140	0.240

9.22 LIQUID THERMAL CONDUCTIVITY	
Temperature (degrees F)	British thermal unit inch per hour-square foot-F
65	0.907
70	0.894
75	0.882
80	0.869
85	0.857
90	0.844
95	0.832
100	0.819
105	0.807
110	0.794
115	0.782
120	0.769
125	0.757
130	0.744

9.23 LIQUID VISCOSITY	
Temperature (degrees F)	Centipoise
40	0.474
50	0.454
60	0.432
70	0.411
80	0.393
90	0.376
100	0.360
110	0.345
120	0.331
130	0.313
140	0.307
150	0.296
160	0.286
170	0.276
180	0.267
190	0.259
200	0.251
210	0.244

9.24 SOLUBILITY IN WATER	
Temperature (degrees F)	Pounds per 100 pounds of water
68	0.630

9.25 SATURATED VAPOR PRESSURE	
Temperature (degrees F)	Pounds per square inch
55	3.009
60	3.396
65	3.824
70	4.297
75	4.817
80	5.389
85	6.016
90	6.702
95	7.453
100	8.272
105	9.164
110	10.130
115	11.180
120	12.330
125	13.580
130	14.900
135	16.240
140	17.690

9.26 SATURATED VAPOR DENSITY	
Temperature (degrees F)	Pounds per cubic foot
55	0.05284
60	0.05906
65	0.06587
70	0.07330
75	0.08141
80	0.09023
85	0.09980
90	0.11020
95	0.12140
100	0.13360
105	0.14680
110	0.16070
115	0.17590
120	0.19220
125	0.20960
130	0.22830
135	0.24829
140	0.26960

9.27 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
0	0.150
20	0.153
40	0.156
60	0.159
80	0.162
100	0.165
120	0.167
140	0.173
160	0.173
180	0.176
200	0.179
220	0.182
240	0.185
260	0.188
280	0.191
300	0.194
320	0.197
340	0.200
360	0.203
380	0.205
400	0.208
420	0.211
440	0.214

TRICHLOROETHANE

TCE

CAUTIONARY RESPONSE INFORMATION

Common Synonyms	Watery liquid · Colorless · Sweet odor
Aerothene Chloroform Methylchloroform 1,1,1-Trichloroethane	Sinks in water. Irritating vapor is produced.

Keep people away.
Avoid contact with liquid and vapor.
Call fire department.
Notify local health and pollution control agencies.
Protect water intakes.

Fire	Combustible. POISONOUS GASES ARE PRODUCED IN FIRE. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, carbon dioxide, or foam.
Exposure	CALL FOR MEDICAL AID. VAPOR Irritating to eyes, nose and throat. If inhaled, will cause dizziness or difficult breathing. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Irritating to skin and eyes. If swallowed, may produce nausea. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.
Water Pollution	Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.

1. CORRECTIVE RESPONSE ACTIONS

Stop discharge
Contain
Collection Systems: Pump
Do not burn

2. CHEMICAL DESIGNATIONS

2.1 CG Compatibility Group: 38; Halogenated hydrocarbon
2.2 Formula: CH_3CCl_3
2.3 IMO/UN Designation: Not listed
2.4 DOT ID No.: 2831
2.5 CAS Registry No.: 71-55-6
2.6 NAERG Guide No.: 160
2.7 Standard Industrial Trade Classification: 51134

3. HEALTH HAZARDS

3.1 Personal Protective Equipment: Organic vapor-acid gas canister; self-contained breathing apparatus for emergencies; neoprene or polyvinyl-alcohol-type gloves; chemical safety goggles and face shield; neoprene safety shoes (or leather safety shoes plus neoprene footwear); neoprene or polyvinyl alcohol suit or apron for splash protection.

3.2 Symptoms Following Exposure: INHALATION: symptoms range from loss of equilibrium and incoordination to loss of consciousness; high concentration can be fatal due to simple asphyxiation combined with loss of consciousness. INGESTION: produces effects similar to inhalation and may cause some feeling of nausea. EYES: slightly irritating and lachrymatory. SKIN: defatting action may cause dermatitis.

3.3 Treatment of Exposure: Get medical attention for all eye exposures and any other serious over-exposures. Do NOT administer adrenalin or epinephrine; otherwise, treatment is symptomatic. INHALATION: remove victim to fresh air; if necessary, apply artificial respiration and/or administer oxygen. INGESTION: have victim drink water and induce vomiting. EYES: flush thoroughly with water. SKIN: remove contaminated clothing and wash exposed area thoroughly with soap and warm water.

3.4 TLV-TWA: 350 ppm
3.5 TLV-STEL: Not listed
3.6 TLV-Ceiling: 450 ppm
3.7 Toxicity by Ingestion: Grade 1; LD_{50} = 5 to 15 g/kg (rat, mouse, rabbit, guinea pig)
3.8 Toxicity by Inhalation: Currently not available.
3.9 Chronic Toxicity: Currently not available
3.10 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
3.11 Liquid or Solid Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
3.12 Odor Threshold: 100 ppm
3.13 IDLH Value: 700 ppm
3.14 OSHA PEL-TWA: 350 ppm
3.15 OSHA PEL-STEL: Not listed
3.16 OSHA PEL-Ceiling: Not listed
3.17 EPA AEGL: Not listed

4. FIRE HAZARDS

4.1 Flash Point: Currently not available
4.2 Flammable Limits in Air: 7%-16%
4.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide
4.4 Fire Extinguishing Agents Not to Be Used: Not pertinent
4.5 Special Hazards of Combustion Products: Toxic and irritating gases are generated in fires.
4.6 Behavior in Fire: Not pertinent
4.7 Auto Ignition Temperature: 932°F
4.8 Electrical Hazards: Not pertinent
4.9 Burning Rate: (est.) 2.0 mm/min
4.10 Adiabatic Flame Temperature: Currently not available
4.11 Stoichometric Air to Fuel Ratio: 9.5 (calc.)
4.12 Flame Temperature: Currently not available
4.13 Combustion Molar Ratio (Reactant to Product): 5.0 (calc.)
4.14 Minimum Oxygen Concentration for Combustion (MOCC): *No diluent*: 14.0%

5. CHEMICAL REACTIVITY

5.1 Reactivity with Water: Reacts slowly, releasing corrosive hydrochloric acid.
5.2 Reactivity with Common Materials: Corrodes aluminum, but reaction is not hazardous.
5.3 Stability During Transport: Stable
5.4 Neutralizing Agents for Acids and Caustics: Not pertinent
5.5 Polymerization: Not pertinent
5.6 Inhibitor of Polymerization: Not pertinent

6. WATER POLLUTION

6.1 Aquatic Toxicity: 75-150 ppm/96hr/fish/TL_m/salt water *Time period not specified.
6.2 Waterfowl Toxicity: Currently not available
6.3 Biological Oxygen Demand (BOD): Currently not available
6.4 Food Chain Concentration Potential: None
6.5 GESAMP Hazard Profile:
Bioaccumulation: 0
Damage to living resources: 2
Human Oral Hazard: 1
Human Contact Hazard: 0
Reduction of amenities: 0

7. SHIPPING INFORMATION

7.1 Grades of Purity: Uninhibited; inhibited; industrial; inhibited; white room; cold cleaning
7.2 Storage Temperature: Ambient
7.3 Inert Atmosphere: No requirement
7.4 Venting: Pressure-vacuum
7.5 IMO Pollution Category: C
7.6 Ship Type: 3
7.7 Barge Hull Type: Currently not available

8. HAZARD CLASSIFICATIONS

8.1 49 CFR Category: Keep Away From Food
8.2 49 CFR Class: 6.1
8.3 49 CFR Package Group: III
8.4 Marine Pollutant: Yes
8.5 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	1
Instability (Yellow)	0

8.6 EPA Reportable Quantity: 1000 pounds
8.7 EPA Pollution Category: C
8.8 RCRA Waste Number: U226
8.9 EPA FWPCA List: Not listed

9. PHYSICAL & CHEMICAL PROPERTIES

9.1 Physical State at 15° C and 1 atm: Liquid
9.2 Molecular Weight: 133.41
9.3 Boiling Point at 1 atm: 165°F = 74°C = 347°K
9.4 Freezing Point: <-38°F = <-39°C = <234°K
9.5 Critical Temperature: Not pertinent
9.6 Critical Pressure: Not pertinent
9.7 Specific Gravity: 1.31 at 20°C (liquid)
9.8 Liquid Surface Tension: 25.4 dynes/cm = 0.0254 N/m at 20°C
9.9 Liquid Water Interfacial Tension: (est.) 45 dynes/cm = 0.045 N/m at 20°C
9.10 Vapor (Gas) Specific Gravity: 4.5
9.11 Ratio of Specific Heats of Vapor (Gas): 1.104
9.12 Latent Heat of Vaporization: 100 Btu/lb = 58 cal/g = 2.4 X 10^5 J/kg
9.13 Heat of Combustion: (est.) 4700 Btu/lb = 2600 cal/g = 110 X 10^6 J/kg
9.14 Heat of Decomposition: Not pertinent
9.15 Heat of Solution: Not pertinent
9.16 Heat of Polymerization: Not pertinent
9.17 Heat of Fusion: Currently not available
9.18 Limiting Value: Currently not available
9.19 Reid Vapor Pressure: 4.0 psia

NOTES

TRICHLOROETHANE

TCE

9.20 SATURATED LIQUID DENSITY	
Temperature (degrees F)	Pounds per cubic foot
0	85.419
10	84.870
20	84.309
30	83.739
40	83.200
50	82.550
60	82.089
70	81.540
80	80.981
90	80.429
100	79.873
110	79.320
120	78.759
130	78.209
140	77.650
150	77.099
160	76.540

9.21 LIQUID HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
55	0.240
60	0.242
65	0.244
70	0.246
75	0.248
80	0.250
85	0.252
90	0.254
95	0.256
100	0.258
105	0.260
110	0.262
115	0.264
120	0.266
125	0.268
130	0.270
135	0.272
140	0.274

9.22 LIQUID THERMAL CONDUCTIVITY	
Temperature (degrees F)	British thermal unit inch per hour-square foot-F
	N
	O
	T
	P
	E
	R
	T
	I
	N
	E
	N
	T

9.23 LIQUID VISCOSITY	
Temperature (degrees F)	Centipoise
15	1.363
20	1.295
25	1.231
30	1.172
35	1.117
40	1.065
45	1.017
50	0.972
55	0.929
60	0.889
65	0.852
70	0.817
75	0.784
80	0.753
85	0.723

9.24 SOLUBILITY IN WATER	
Temperature (degrees F)	Pounds per 100 pounds of water
68	0.070

9.25 SATURATED VAPOR PRESSURE	
Temperature (degrees F)	Pounds per square inch
70	2.099
75	2.364
80	2.657
85	2.980
90	3.335
95	3.725
100	4.152
105	4.619
110	5.120
115	5.666
120	6.252
125	6.884
130	7.563
135	8.437
140	9.273
145	10.180
150	11.150
155	12.200
160	13.330
165	14.540
170	15.840
175	17.245
180	18.730
185	20.330
190	22.030

9.26 SATURATED VAPOR DENSITY	
Temperature (degrees F)	Pounds per cubic foot
70	0.04825
75	0.05495
80	0.06119
85	0.06799
90	0.07540
95	0.08246
100	0.09220
105	0.10178
110	0.11190
115	0.12300
120	0.13490
125	0.14770
130	0.16150
135	0.17630
140	0.19220
145	0.20920
150	0.22730
155	0.24670
160	0.26730
165	0.28930
170	0.31270
175	0.33760
180	0.36390
185	0.39160
190	0.42140

9.27 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
0	0.146
25	0.150
50	0.152
75	0.159
100	0.163
125	0.167
150	0.171
175	0.175
200	0.179
225	0.183
250	0.186
275	0.190
300	0.193
325	0.196
350	0.199
375	0.202
400	0.205
425	0.208
450	0.210
475	0.212
500	0.215
525	0.217
550	0.219
575	0.220
600	0.223

1,1,2-TRICHLOROETHANE

TCM

CAUTIONARY RESPONSE INFORMATION

Common Synonyms			
Ethane, 1,1,2-trichloro- beta-trichloroethane Vinyl trichloride	Liquid Sinks in water.	Colorless	Sweet, chloroform like odor

KEEP PEOPLE AWAY. AVOID CONTACT WITH LIQUID AND VAPOR.
Wear self-contained positive pressure breathing apparatus and full protective clothing.
Shut off ignition sources and call fire department.
Evacuate area in case of large discharge.
Stay upwind and use water spray to "knock down" vapor.
Notify local health and pollution control agencies.
Protect water intakes.

Fire	POISONOUS GASES ARE PRODUCED IN FIRE. Container may explode in fire. Wear self-contained positive pressure breathing apparatus, impervious clothing and gloves. Extinguish fires with water spray, fog or foam, carbon dioxide, or dry chemical.
Exposure	CALL FOR MEDICAL AID. VAPOR Irritating to eyes, nose, throat, lungs and skin; may cause defatting dermatitis. Highly toxic; death may result from respiratory failure. If inhaled, anesthetic or narcotic effect may occur. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Irritating to skin and eyes; severe irritant to gastrointestinal tract. Highly toxic. If swallowed, may cause liver or kidney damage and may increase myocardial irritability. May cause chemical pneumonia if aspirated into lungs. IF IN EYES OR ON SKIN, hold eyelids open and flush with water for at least 15 minutes; hold eyelids open if necessary. Remove and isolate contaminated clothing and shoes at the site. IF SWALLOWED, and victim is CONSCIOUS, have victim drink water and induce vomiting. IF SWALLOWED AND VICTIM UNCONSCIOUS OR HAVING CONVULSIONS, just keep victim warm.
Water Pollution	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.

1. CORRECTIVE RESPONSE ACTIONS

Stop discharge
Contain
Collection Systems: Pump; Dredge

2. CHEMICAL DESIGNATIONS

2.1 CG Compatibility Group: 38; Halogenated hydrocarbon
2.2 Formula: $CHCl_2CH_2Cl$
2.3 IMO/UN Designation: Currently not available
2.4 DOT ID No.: Not listed
2.5 CAS Registry No.: 79-00-5
2.6 NAERG Guide No.: Not listed.
2.7 Standard Industrial Trade Classification: 51134

3. HEALTH HAZARDS

3.1 Personal Protective Equipment: Self-contained positive pressure breathing apparatus and full protective clothing.
3.2 Symptoms Following Exposure: Inhalation causes irritation of the nose, throat, and lungs. High concentrations may cause death by respiratory failure. Highly toxic by ingestion; may cause liver or kidney damage or myocardial irritability. Causes severe irritation of the gastrointestinal tract. Vapor may produce superficial skin burns or defatting type dermatitis, and may irritate the eyes.
3.3 Treatment of Exposure: INHALATION: Move to fresh air; call emergency medical care. If breathing stops, give artificial respiration. If breathing is difficult, give oxygen. INGESTION: If victim is conscious get victim to induce vomiting by touching the back of the throat with his finger or by taking syrup of ipecac. If victim is unconscious or having convulsions, do nothing except keep victim warm. EYES OR SKIN: Flush with running water for at least 15 minutes; hold eyelids open if necessary. Clean skin with soap or mild detergent. Remove and isolate contaminated clothing and shoes at the site.
3.4 TLV-TWA: 10 ppm (skin)
3.5 TLV-STEL: Not listed
3.6 TLV-Ceiling: Not listed.
3.7 Toxicity by Ingestion: Grade 2; LD_{50} = 580 mg/kg (rat)
3.8 Toxicity by Inhalation: Currently not available
3.9 Chronic Toxicity: Causes liver and kidney damage; may increase myocardial irritability. It is a central nervous system depressant. It is carcinogenic. May cause chemical pneumonia if aspirated into the lungs.
3.10 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will not tolerate moderate or high concentrations.
3.11 Liquid or Solid Characteristics: Minimum hazard. If spilled on skin and allowed to remain, may cause smarting and reddening of the skin.
3.12 Odor Threshold: Currently not available
3.13 IDLH Value: 100 ppm (skin)
3.14 OSHA PEL-TWA: 10 ppm (skin)
3.15 OSHA PEL-STEL: Not listed.
3.16 OSHA PEL-Ceiling: Not listed.
3.17 EPA AEGL: Not listed

4. FIRE HAZARDS

4.1 Flash Point: None
4.2 Flammable Limits in Air: 8.4% - 15.6%
4.3 Fire Extinguishing Agents: Small fires: dry chemical or CO_2. Large fires: water spray, fog or foam.
4.4 Fire Extinguishing Agents Not to Be Used: Not pertinent
4.5 Special Hazards of Combustion Products: Toxic gases including hydrogen chloride and very small amounts of phosgene and chlorine are produced.
4.6 Behavior in Fire: Forms a flammable vapor-air mixture at 109°F and higher.
4.7 Auto Ignition Temperature: Not pertinent
4.8 Electrical Hazards: Currently not available
4.9 Burning Rate: Currently not available
4.10 Adiabatic Flame Temperature: Currently not available
4.11 Stoichometric Air to Fuel Ratio: 9.5 (calc.)
4.12 Flame Temperature: Currently not available
4.13 Combustion Molar Ratio (Reactant to Product): 5.0 (calc.)
4.14 Minimum Oxygen Concentration for Combustion (MOCC): Not listed

5. CHEMICAL REACTIVITY

5.1 Reactivity with Water: No reaction
5.2 Reactivity with Common Materials: Incompatible with oxidizing material or aluminum. Will attack some forms of plastics, rubber and coatings.
5.3 Stability During Transport: Stable
5.4 Neutralizing Agents for Acids and Caustics: Not pertinent
5.5 Polymerization: Not pertinent
5.6 Inhibitor of Polymerization: Not pertinent

6. WATER POLLUTION

6.1 Aquatic Toxicity: 18 mg/48 hr/daphnia magna/Cu/fresh water.
6.2 Waterfowl Toxicity: Currently not available
6.3 Biological Oxygen Demand (BOD): Currently not available
6.4 Food Chain Concentration Potential: Currently not available
6.5 GESAMP Hazard Profile:
Bioaccumulation: 0
Damage to living resources: 2
Human Oral hazard: 1
Human Contact hazard: 0
Reduction of amenities: 0

7. SHIPPING INFORMATION

7.1 Grades of Purity: Technical grade; stabilized: 95%
7.2 Storage Temperature: Currently not available
7.3 Inert Atmosphere: Currently not available
7.4 Venting: Currently not available
7.5 IMO Pollution Category: C
7.6 Ship Type: 3
7.7 Barge Hull Type: 3

8. HAZARD CLASSIFICATIONS

8.1 49 CFR Category: Not listed
8.2 49 CFR Class: Not pertinent
8.3 49 CFR Package Group: Not listed.
8.4 Marine Pollutant: No
8.5 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	1
Instability (Yellow)	0

8.6 EPA Reportable Quantity: 100 pounds
8.7 EPA Pollution Category: B
8.8 RCRA Waste Number: U227
8.9 EPA FWPCA List: Not listed

9. PHYSICAL & CHEMICAL PROPERTIES

9.1 Physical State at 15° C and 1 atm: Liquid
9.2 Molecular Weight: 133.41
9.3 Boiling Point at 1 atm: 236.6°F = 113.7°C = 386.9°K
9.4 Freezing Point: -31/-34.1°F = -35/-36.7°C = 238.2/236.5°K
9.5 Critical Temperature: Currently not available
9.6 Critical Pressure: Currently not available
9.7 Specific Gravity: 1.44 at 20°C (liquid)
9.8 Liquid Surface Tension: 33.75 dynes/cm = 0.0338 N/m at 20°C
9.9 Liquid Water Interfacial Tension: Currently not available
9.10 Vapor (Gas) Specific Gravity: 4.5
9.11 Ratio of Specific Heats of Vapor (Gas): Currently not available
9.12 Latent Heat of Vaporization: Currently not available
9.13 Heat of Combustion: Currently not available
9.14 Heat of Decomposition: Not pertinent
9.15 Heat of Solution: Not pertinent
9.16 Heat of Polymerization: Not pertinent
9.17 Heat of Fusion: Currently not available
9.18 Limiting Value: Currently not available
9.19 Reid Vapor Pressure: Currently not available

NOTES

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9.20 SATURATED LIQUID DENSITY		9.21 LIQUID HEAT CAPACITY		9.22 LIQUID THERMAL CONDUCTIVITY		9.23 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit inch per hour-square foot-F	Temperature (degrees F)	Centipoise
68	89.900		CURRENTLY NOT AVAILABLE		CURRENTLY NOT AVAILABLE		CURRENTLY NOT AVAILABLE

9.24 SOLUBILITY IN WATER		9.25 SATURATED VAPOR PRESSURE		9.26 SATURATED VAPOR DENSITY		9.27 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	INSOLUBLE	0	0.049	0	0.00130		CURRENTLY NOT AVAILABLE
		25	0.093	25	0.00239		
		50	0.179	50	0.00439		
		75	0.244	75	0.00805		
		100	0.660	100	0.01478		
		125	1.255	125	0.02712		
		150	2.427	150	0.04976		
		175	4.656	175	0.09130		
		200	8.933	200	0.16753		