

CONFIDENTIAL

*Tony Orlando*  
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## Administrative Record

COMMONWEALTH OF PENNSYLVANIA,  
Department of Environmental Resources

February 27, 1989

SUBJECT: Recommended Strategy: Vanport Groundwater Contamination

TO: Donald A. Brown, Director  
Bureau of Hazardous Sites and  
Superfund Enforcement

Bridget Hofman, Chief  
Division of Emergency and  
Remedial Response  
Bureau of Waste Management

FROM: Bill Bailey *WUB*  
Hazardous Sites Cleanup & Superfund  
Enforcement Program  
Bureau of Waste Management

Michael D. Buchwach *WUB*  
Assistant Counsel  
Pittsburgh Regional Office

The following is the recommended strategy for pursuing the cleanup of the Vanport Groundwater Contamination.

MDB/cb

Enclosure

DEA-477  
1989 FEB 28 AM 10:22  
SOUTHWESTERN REGION

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ATTORNEY CLIENT-PRIVILEGE  
ATTORNEY WORK PRODUCT - NON-DISCOVERABLE  
REQUEST FOR LEGAL SCREENING ANALYSIS

OUTLINE FOR SITE SPECIFIC STRATEGY  
HAZARDOUS SITES CLEANUP PROGRAM  
VANPORT GROUNDWATER CONTAMINATION

Technical Staff Evaluation

I. General Background

A. Site Name and Address

The Vanport Township Municipal Authority (VTMA) offices are located at 285 River Avenue in Vanport Township, Beaver County, Pennsylvania. Their well field is behind the office adjacent to the Ohio River, and consists of six wells, five of which are in production. The wells obtain their water from the alluvial sediments of the Ohio River aquifer.

B. History

Trichlorethylene (TCE) and 1,1,1-Trichloroethane were discovered in the Vanport water system in January 1988 following testing of the water subsequent to the Ashland Oil Company spill. At the present time the source of the contamination is unknown. Analysis of the Ohio River at the same time did not reveal TCE contamination of the river. This would indicate that the contamination of the VTMA well field is not caused by recharge of the aquifer by the Ohio River. Possible sources of the contamination include:

1. Westinghouse - The Westinghouse Electric Corporation Beaver Plant is located approximately 2,500 feet northeast of the site. Westinghouse is the only known large quantity user of TCE and 1,1,1-Trichloroethane in the vicinity. A groundwater evaluation is being conducted by Westinghouse on their property. On June 15, 1988 Department personnel obtained split samples from several Westinghouse wells. Analysis of these samples showed TCE concentrations as high as 48,000 ug/l.
2. Abandoned sand and gravel quarry - The Beaver sand and gravel quarry is located approximately 1,000 feet north of the VTMA well field. The quarry ceased operations in the mid-60's. A former quarry employe alleges that Westinghouse disposed large amounts of industrial waste in the quarry while it was in operation. The hydrogeological evaluation currently being conducted by the Department is focusing on the area around the quarry. An analysis of historical aerial photographs may be helpful in determining the extent of waste disposal in the quarry. EPA estimates the cost of the photo interpretation to be \$6,800. Present owners of the quarry include:

- a. Nick Crivelli Chevrolet, Inc., 294 State Street, Beaver, PA 15009.
  - b. Bell Telephone, One Parkway, Philadelphia, PA 19102.
  - c. Wyko Construction, Box 14, Sewickley, PA 15143.
3. Crivelli Chevrolet - While surveying the area for possible sources of TCE contamination a storm sewer pipe was discovered discharging into the quarry. The discharge had a distinct oily sheen. The Department discovered that the floor drain in Crivelli Chevrolet was connected into this storm sewer. Samples of the discharge were collected and analyzed; no TCE was detected, however, 1,1,1-Trichloroethane was discovered in the discharge. Based on the preliminary evidence thus far collected, it appears unlikely that Crivelli is a source of the TCE contamination.

C. Priority Within the Region

The VTMA site has been designated as the first priority in Region V. This is because of the high TCE levels discovered to be in the drinking water system. TCE is a class B2 carcinogen. Levels greater than 100 ug/l have been documented in the VTMA system. This is far in excess of the federal primary maximum contaminant levels (MCL) of 5 ug/l or the Department's action level of 26 ug/l. VTMA serves approximately 10,000 residents of Vanport and Brighton Townships. Within the service area are also a hospital and a school.

II. Technical Issues

A. Technical Background

1. A preliminary HRS scoring was performed on the site. The REP score is 46.04. The HRS score would be similar except that the analytical data was not from an EP contract lab and therefore cannot be used to document an observed release. As more data about the site becomes available, both the HRS and REP scores will likely be higher than that mentioned above.
2. Pathways/Receptors - The Vanport Township Municipal Authority serves Vanport and Brighton Townships. VTMA distributes an average of 1.55 MGD to approximately 10,000 residents in the two communities. The system also serves a school and hospital. In addition to ingestion through the drinking water, exposure through direct contact and inhalation is also possible while bathing and cooking.

B. Response Decision - At the present time enough information is available to consider various interim actions, however more data is needed to assess any remediation.

C. Data Gaps

Separate hydrogeologic investigations are being conducted by the Department, Westinghouse and VTMA. Hopefully, enough information will be obtained from these studies to determine:

1. The source of the contamination.
2. The extent of the contamination.
3. Groundwater flow conditions and quality in the vicinity of the well field, quarry, and Westinghouse plant.
4. The most appropriate technology to base a response decision on.

D. Likely Responses

1. Interim responses include:
  - a. No response.
  - b. Groundwater study.
  - c. Groundwater collection and treatment.
  - d. Provide alternate water supply from another system.
  - e. Provide bottled water or water buffaloes.
  - f. Provide temporary treatment of the drinking water.

Of the alternatives listed above, the most reasonable and effective at the present time would be to provide temporary treatment of the drinking water. VTMA is currently investigating various systems to eliminate TCE from the finished water supply. However, installation of the permanent system may not be accomplished for a year or more. Installation of a temporary system, as an HSCA Interim Action, could provide a safe water supply to VTMA customers while a permanent system is being developed. The most cost effective temporary system appears to be a portable air stripper. A portable air stripper could remove TCE from the water with a greater than 99.9% efficiency. Informal quotes obtained by telephone inquiry have stated that a portable air stripper could be on-line and operational within one week of approval of the project. Of course the individual characteristics of the VTMA system would affect installation time. Evaluation by the GTAC contractor may be helpful in determining installation details.

2. Possible remedial responses include:

- a. No response.
- b. Source controls.
- c. Groundwater collection and treatment.
- d. Provide permanent alternate water supply.

More data must be obtained to assess any remedial responses.

E. Cost Estimates

The estimated cost of installing a portable air stripper at VTMA for one year is \$100,000 to \$200,000. This estimate is based on a quote of

\$1,500 a week rental x 52 weeks	\$78,000
Mobilization and demobilization	10,000
Contingencies	\$12,000 to 112,000
Total	<u>\$100,000 to 200,000</u>

Note: The contingencies include but are not limited to plumbing the air stripper into the VTMA supply system. Before a more precise cost estimate can be determined, an assessment of the VTMA system must take place.

III. Government Involvement

A. DER

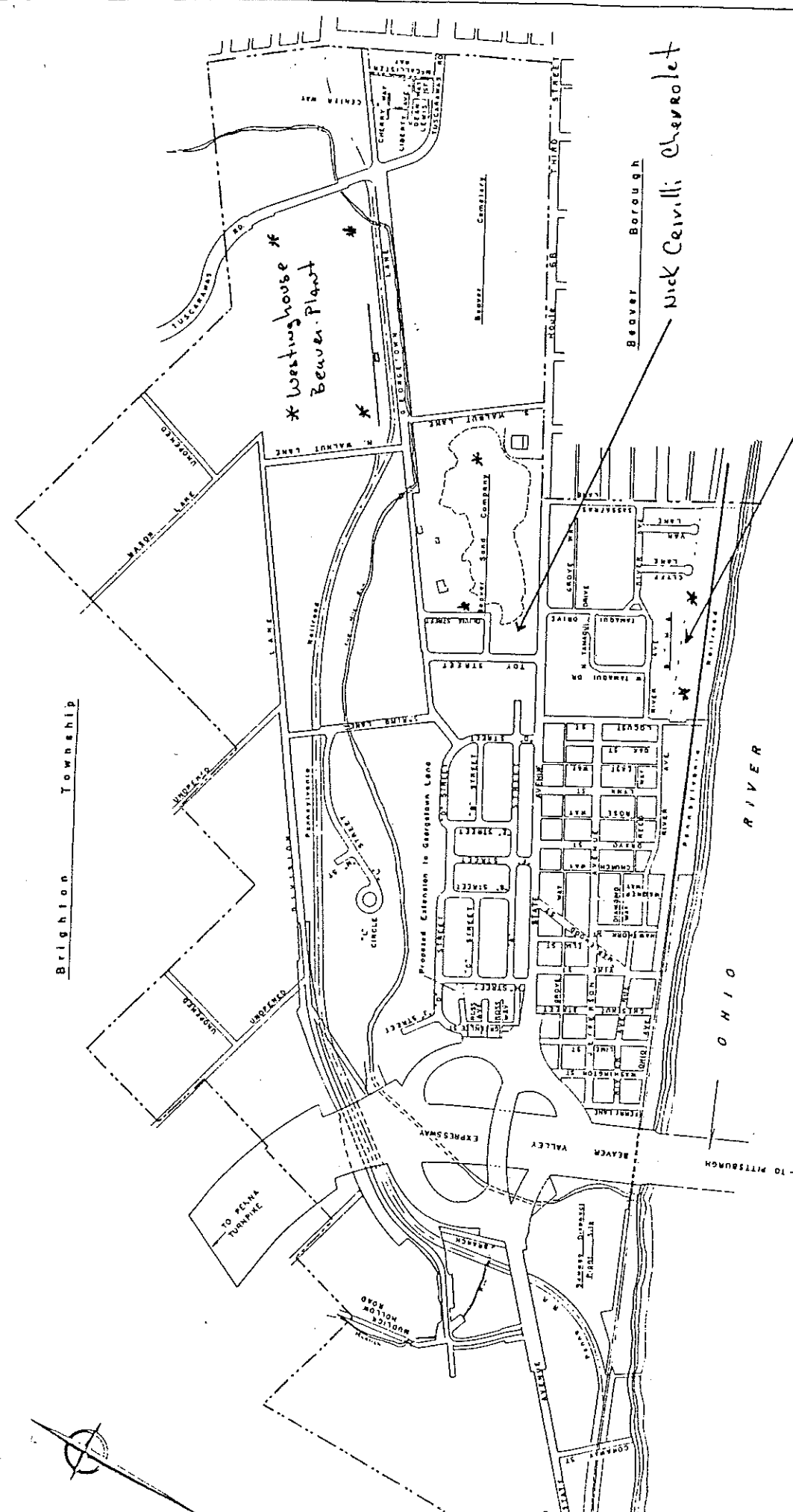
1. Westinghouse - At one time electroplating operations were conducted at the plant that utilized a series of inground dip tanks that contained a variety of chemicals in both acid and basic solutions. In October 1983 a fluid seep was discovered near these storage tanks. As a result a groundwater investigation was conducted which included the installation of numerous monitoring wells. The main contaminants identified during the investigation were cyanide and silver. The groundwater was not analyzed for volatile organic compounds (VOC's) at that time. Based on the findings of that initial investigation, Westinghouse submitted a groundwater assessment and abatement plan entitled "Revised Remedial Action Plan - Westinghouse Plant" dated March 1987. Implementation of that plan was delayed after the discovery of high levels of VOC's in the area. Since then Westinghouse has begun a groundwater assessment to address the VOC contamination. That investigation is based on the March 1987 plan, with revisions requested by the Department. On February 9, 1989 the Department issued an NOV to Westinghouse because of the high levels of TCE and 1,1,1-Trichloroethane found in Westinghouse's wells.

2. Crivelli Chevrolet - While surveying the quarry area on April 28, 1988 for possible sources of TCE contamination, it was discovered that the floor drains of Crivelli were connected to a storm sewer which discharged into the quarry. Analysis of the discharge revealed contamination with various organic compounds. The compounds found are typical constituents of gasoline and cleaning solvents. A Notice of Violation was sent to Crivelli Chevrolet on July 1, 1988 by the Bureau of Water Quality Management.
3. VTMA - No enforcement action has been initiated against VTMA.

B. EPA

The EPA Drinking Water Section has been advised of the situation at Vanport. They have identified 11 sets of historical area photographs and prepared a cost estimate worksheet for a photo interpretation of the quarry area. Otherwise EPA involvement has been minimal.

BB:jc



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 OF THE  
**TOWNSHIP OF VANPORT**  
**BEAVER CO., PENNSYLVANIA**  
 1949

Michael Baker Jr. Inc.  
 Consulting Engineers  
 Rochester, Pa.



# TRICHLOROETHYLENE

TCL

Common Synonyms Trichloroethylene Triclene, Aigynel Chlorylene Germoxene Tredylene Trichloran, Triene	Watery liquid Colorless Sweet odor	Sinks in water. Irritating vapor is produced.
<p>Stop discharge if possible. Keep people away. Avoid contact with liquid and vapor. Call fire department. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>		
Fire	<p>Combustible <b>POISONOUS GASES ARE PRODUCED IN FIRE.</b> Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, carbon dioxide, or foam.</p>	
Exposure	<p><b>CALL FOR MEDICAL AID.</b> <b>VAPOR</b> 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. <b>LIQUID</b> 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.</p>	
Water Pollution	<p>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.</p>	
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Should be removed Chemical and physical treatment</p>		<p><b>2. LABEL</b> 2.1 Category: None 2.2 Class: Not pertinent</p>
<p><b>3. CHEMICAL DESIGNATIONS</b> 3.1 CQ Compatibility Class: Halogenated hydrocarbon 3.2 Formula: <math>CH_2=CCl_2</math> 3.3 IMO/IUN Designator: 9.0/1710 3.4 DOT ID No.: 1710 3.5 CAS Registry No.: 79-01-8</p>		<p><b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Chloroform-like; ethereal</p>
<p><b>5. HEALTH HAZARDS</b></p> <p>5.1 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.</p> <p>5.2 Symptoms Following Exposure: <b>INHALATION:</b> 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. <b>INGESTION:</b> symptoms similar to inhalation. <b>SKIN:</b> detaching action can cause dermatitis. <b>EYES:</b> slightly irritating sensation and lachrymation.</p> <p>5.3 Treatment of Exposure: Do NOT administer adrenalin or epinephrine; get medical attention for all cases of overexposure. <b>INHALATION:</b> remove victim to fresh air; if necessary, apply artificial respiration and/or administer oxygen. <b>INGESTION:</b> have victim drink water and induce vomiting; repeat three times; then give 1 tablespoon epsom salts in water. <b>EYES:</b> flush thoroughly with water. <b>SKIN:</b> wash thoroughly with soap and warm water.</p> <p>5.4 Threshold Limit Value: 50 ppm 5.5 Short Term Inhalation Limits: 200 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 3; LD<sub>50</sub> = 50 to 500 mg/kg 5.7 Late Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight stinging of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause stinging and reddening of the skin. 5.10 Odor Threshold: 50 ppm 5.11 IDLH Value: 1,000 ppm</p>		

<p><b>6. FIRE HAZARDS</b></p> <p>6.1 Flash Point: 90°F D.C., practically nonflammable 6.2 Flammable Limits in Air: 8.0%-10.5% 6.3 Fire Extinguishing Agents: Water fog 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion: Products: Toxic and irritating gases are produced in fire situations 6.6 Behavior in Fire: Not pertinent 6.7 Ignition Temperature: 770°F 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: Not pertinent 6.10 Autobaric Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>	<p><b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-X-Y</p>																																		
<p><b>7. CHEMICAL REACTIVITY</b></p> <p>7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerizability: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 36</p>	<p><b>11. HAZARD CLASSIFICATIONS</b></p> <p>11.1 Code of Federal Regulations: OSHA 11.2 NAS Hazard Rating for Bulk Water Transportation:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td>1</td> </tr> <tr> <td>Vapor Irritant</td> <td>1</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td>1</td> </tr> <tr> <td>Poisons</td> <td>2</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity</td> <td>1</td> </tr> <tr> <td>Aquatic Toxicity</td> <td>2</td> </tr> <tr> <td>Aesthetic Effect</td> <td>2</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals</td> <td>1</td> </tr> <tr> <td>Water</td> <td>0</td> </tr> <tr> <td>Self Reaction</td> <td>1</td> </tr> </tbody> </table> <p>11.3 NFPA Hazard Classification:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>2</td> </tr> <tr> <td>Flammability (Red)</td> <td>1</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>0</td> </tr> </tbody> </table>	Category	Rating	Fire	1	Vapor Irritant	1	Liquid or Solid Irritant	1	Poisons	2	Water Pollution		Human Toxicity	1	Aquatic Toxicity	2	Aesthetic Effect	2	Reactivity		Other Chemicals	1	Water	0	Self Reaction	1	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	1	Reactivity (Yellow)	0
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<p><b>8. WATER POLLUTION</b></p> <p>8.1 Aquatic Toxicity: 660 mg/140 hr/daphnia/xxl/fresh water 8.2 Waterway Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: None</p>	<p><b>12. PHYSICAL AND CHEMICAL PROPERTIES</b></p> <p>12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 131.39 12.3 Boiling Point at 1 atm: 169°F = 87°C = 360°K 12.4 Freezing Point: -123.5°F = -86.4°C = 186.8°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 1.46 at 20°C (liquid) 12.8 Liquid Surface Tension: 29.3 dynes/cm = 0.0293 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 34.5 dynes/cm = 0.0345 N/m at 24°C 12.10 Vapor (Gas) Specific Gravity: 4.5 12.11 Ratio of Specific Heats of Vapor (Gas): 1.116 12.12 Latent Heat of Vaporization: 103 Btu/lb = 57.2 cal/g = 2.4 x 10<sup>4</sup> J/kg 12.13 Heat of Combustion: Not pertinent 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: Data not available 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 2.5 psia</p>																																		
<p><b>9. SHIPPING INFORMATION</b></p> <p>9.1 Grades of Purity: Technical; dry cleaning, degreasing, extraction 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum</p>	<p><b>NOTES</b></p>																																		



TCL

## TRICHLOROETHYLENE

12.17 SATURATED LIQUID DENSITY		12.18 LIQUID HEAT CAPACITY		12.19 LIQUID THERMAL CONDUCTIVITY		12.20 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	94.669	0	.220		N	15	.800
5	94.410	10	.221		O	20	.775
10	94.150	20	.223		T	25	.750
15	93.889	30	.225			30	.727
20	93.629	40	.226		P	35	.705
25	93.370	50	.228		E	40	.684
30	93.110	60	.230		R	45	.664
35	92.849	70	.231		T	50	.645
40	92.589	80	.233		I	55	.627
45	92.330	90	.235		N	60	.610
50	92.070	100	.236		E	65	.593
55	91.809	110	.238		N	70	.577
60	91.549	120	.240		T	75	.562
65	91.290	130	.241			80	.548
70	91.030	140	.243			85	.534
75	90.770	150	.245			90	.521
80	90.509	160	.246			95	.508
85	90.250	170	.248			100	.496
90	89.990					105	.485
95	89.730					110	.474
100	89.469					115	.463
105	89.209					120	.453
110	88.950						
115	88.690						
120	88.429						
125	88.169						

12.21 SOLUBILITY IN WATER		12.22 SATURATED VAPOR PRESSURE		12.23 SATURATED VAPOR DENSITY		12.24 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
77.02	.110	40	.508	40	.01245	0	.136
		50	.678	50	.01628	25	.139
		60	.894	60	.02105	50	.143
		70	1.166	70	.02695	75	.146
		80	1.507	80	.03418	100	.149
		90	1.929	90	.04296	125	.152
		100	2.448	100	.05354	150	.155
		110	3.081	110	.06619	175	.157
		120	3.846	120	.08120	200	.160
		130	4.765	130	.09891	225	.162
		140	5.862	140	.11960	250	.165
		150	7.163	150	.14380	275	.167
		160	8.695	160	.17180	300	.169
		170	10.490	170	.20390	325	.172
		180	12.580	180	.24080	350	.174
		190	15.010	190	.28280	375	.176
		200	17.810	200	.33040	400	.177
		210	21.020	210	.38420	425	.179
						450	.181
						475	.182
						500	.184
						525	.185
						550	.186
						575	.187
						600	.188

# TRICHLOROETHANE

TCE

<p><b>Common Synonyms</b></p> <p>1,1,1-Trichloroethane Methylchloroform Aeroflome Chlorothene</p>		<p>Watery liquid</p> <p>Colorless</p> <p>Sweet odor</p>
<p>Skin in water. Irritating vapor is produced.</p>		
<p>Stop discharge if possible. Keep people away. Avoid contact with liquid and vapor. Call fire department. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>		
<p><b>Fire</b></p>	<p>Combustible <b>POISONOUS GASES ARE PRODUCED IN FIRE.</b> Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, carbon dioxide, or foam.</p>	
<p><b>Exposure</b></p>	<p><b>CALL FOR MEDICAL AID.</b> <b>VAPOR</b> 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. <b>LIQUID</b> 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.</p>	
<p><b>Water Pollution</b></p>	<p>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.</p>	
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Should be removed. Chemical and physical treatment.</p>		<p><b>2. LABEL</b></p> <p>2.1 Category: None 2.2 Class: Not pertinent</p>
<p><b>3. CHEMICAL DESIGNATIONS</b></p> <p>3.1 CG Compatibility Class: Halogenated hydrocarbon 3.2 Formula: CH<sub>2</sub>Cl<sub>3</sub> 3.3 IMO/UN Designation: Not listed 3.4 DOT ID No.: 2831 3.5 CAS Registry No.: 71-55-8</p>		<p><b>4. OBSERVABLE CHARACTERISTICS</b></p> <p>4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Chloroform-like, sweetish</p>
<p><b>5. HEALTH HAZARDS</b></p> <p>5.1 Personal Protective Equipment: Organic vapor-acid gas cartridge, 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.</p> <p>5.2 Symptoms Following Exposure: <b>INHALATION:</b> 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. <b>INGESTION:</b> produces effects similar to inhalation and may cause some feeling of nausea. <b>EYES:</b> slightly irritating and lachrymatory. <b>SKIN:</b> debiting action may cause dermatitis.</p> <p>5.3 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. <b>INHALATION:</b> remove victim to fresh air; if necessary, apply artificial respiration and/or administer oxygen. <b>INGESTION:</b> have victim drink water and induce vomiting. <b>EYES:</b> flush thoroughly with water. <b>SKIN:</b> remove contaminated clothing and wash exposed area thoroughly with soap and warm water.</p> <p>5.4 Threshold Limit Value: 350 ppm 5.5 Short Term Inhalation Limit: 1,000 ppm for 60 min in man 5.6 Toxicity by Ingestion: Grade 1; LD<sub>50</sub> = 5 to 15 g/kg (rat, mouse, rabbit, guinea pig) 5.7 Late Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight stinging of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause stinging and reddening of the skin. 5.10 Odor Threshold: 100 ppm 5.11 IDLH Value: 1,000 ppm</p>		

<p><b>6. FIRE HAZARDS</b></p> <p>6.1 Flash Point: Data not available 6.2 Flammable Limits in Air: 7%-16% 6.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion Products: Toxic and irritating gases are generated in fires. 6.6 Behavior in Fire: Not pertinent 6.7 Ignition Temperature: 932°F 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: (est.) 2.9 mm/min 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>	<p><b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) <b>A-X-Y</b></p>																																				
<p><b>7. CHEMICAL REACTIVITY</b></p> <p>7.1 Reactivity With Water: Reacts slowly, releasing corrosive hydrochloric acid. 7.2 Reactivity With Common Materials: Corrodes aluminum, but reaction is not hazardous. 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 36</p>	<p><b>11. HAZARD CLASSIFICATIONS</b></p> <p>11.1 Code of Federal Regulations: OSHA 11.2 NIOSH Hazard Rating for Bulk Water Transportation</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td>1</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant</td> <td>1</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td>1</td> </tr> <tr> <td>Poison</td> <td>2</td> </tr> <tr> <td>Water Poison</td> <td></td> </tr> <tr> <td>Human Toxicity</td> <td>1</td> </tr> <tr> <td>Aquatic Toxicity</td> <td>3</td> </tr> <tr> <td>Aesthetic Effect</td> <td>2</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals</td> <td>1</td> </tr> <tr> <td>Water</td> <td>0</td> </tr> <tr> <td>Salt Reaction</td> <td>0</td> </tr> </tbody> </table> <p>11.3 NFPA Hazard Classification:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>2</td> </tr> <tr> <td>Flammability (Red)</td> <td>1</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>0</td> </tr> </tbody> </table>	Category	Rating	Fire	1	Health		Vapor Irritant	1	Liquid or Solid Irritant	1	Poison	2	Water Poison		Human Toxicity	1	Aquatic Toxicity	3	Aesthetic Effect	2	Reactivity		Other Chemicals	1	Water	0	Salt Reaction	0	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	1	Reactivity (Yellow)	0
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<p><b>8. WATER POLLUTION</b></p> <p>8.1 Aquatic Toxicity: 75-150 ppm*/(p/fish/TL<sub>50</sub>)/salt water *Time period not specified. 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: None</p>	<p><b>12. PHYSICAL AND CHEMICAL PROPERTIES</b></p> <p>12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 133.41 12.3 Boiling Point at 1 atm: 165°F = 74°C = 347°K 12.4 Freezing Point: &lt;-35°F = &lt;-39°C = &lt;234°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 1.31 at 20°C (liquid) 12.8 Liquid Surface Tension: 25.4 dynes/cm = 0.0254 N/m at 20°C 12.9 Liquid Water Interfacial Tension (est.): 45 dynes/cm = 0.045 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: 4.6 12.11 Ratio of Specific Heats of Vapor (Gas): 1.104 12.12 Latent Heat of Vaporization: 100 Btu/lb = 58 cal/g = 2.4 X 10<sup>4</sup> J/kg 12.13 Heat of Combustion (est.): 4700 Btu/lb = 2600 cal/g = 110 X 10<sup>4</sup> J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: Data not available 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 4.0 psia</p>																																				
<p><b>9. SHIPPING INFORMATION</b></p> <p>9.1 Grades of Purity: Uninhibited; inhibited; industrial inhibited; white room; cold cleaning 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum</p>	<p><b>NOTES</b></p>																																				

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## TRICHLOROETHANE

12.17 SATURATED LIQUID DENSITY		12.18 LIQUID HEAT CAPACITY		12.19 LIQUID THERMAL CONDUCTIVITY		12.20 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	85.419	55	.240		N	15	1.363
10	84.870	60	.242		O	20	1.295
20	84.309	65	.244		T	25	1.231
30	83.759	70	.246			30	1.172
40	83.200	75	.248		P	35	1.117
50	82.650	80	.250		E	40	1.065
60	82.089	85	.252		R	45	1.017
70	81.540	90	.254		T	50	.972
80	80.981	95	.256		I	55	.929
90	80.429	100	.258		N	60	.889
100	79.870	105	.260		E	65	.852
110	79.320	110	.262		N	70	.817
120	78.759	115	.264		T	75	.784
130	78.209	120	.266			80	.753
140	77.650	125	.268			85	.723
150	77.099	130	.270				
160	76.540	135	.272				
		140	.274				

12.21 SOLUBILITY IN WATER		12.22 SATURATED VAPOR PRESSURE		12.23 SATURATED VAPOR DENSITY		12.24 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
68.02	.070	70	2.099	70	.04925	0	.146
		75	2.364	75	.05495	25	.150
		80	2.657	80	.06119	50	.155
		85	2.980	85	.06799	75	.159
		90	3.335	90	.07540	100	.163
		95	3.725	95	.08346	125	.167
		100	4.152	100	.09220	150	.171
		105	4.619	105	.10170	175	.175
		110	5.130	110	.11190	200	.179
		115	5.686	115	.12300	225	.183
		120	6.292	120	.13490	250	.186
		125	6.950	125	.14770	275	.190
		130	7.663	130	.16150	300	.193
		135	8.437	135	.17630	325	.196
		140	9.273	140	.19220	350	.199
		145	10.180	145	.20920	375	.202
		150	11.150	150	.22730	400	.205
		155	12.200	155	.24670	425	.208
		160	13.330	160	.26730	450	.210
		165	14.540	165	.28930	475	.213
		170	15.840	170	.31270	500	.215
		175	17.240	175	.33760	525	.217
		180	18.730	180	.36390	550	.219
		185	20.330	185	.39180	575	.222
		190	22.030	190	.42140	600	.223

The legal staff evaluation portion of this memorandum has been redacted.