

Vinyl Chloride

Chemicals

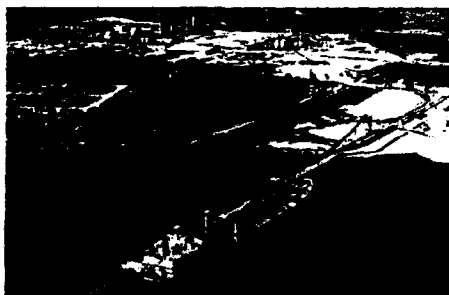


INDUSTRIES

BFG38205

In keeping with its position as a leading producer of vinyl chloride monomer for the merchant market only, PPG Industries expanded its Lake Charles, Louisiana, vinyl chloride plant in 1969. The Guayanilla, Puerto Rico plant, built in 1971, greatly increased PPG's capacity for making vinyl chloride monomer.

A new large tanker, the S.S. Puerto Rican, transports refrigerated vinyl chloride monomer to a newly built terminal at Paulsboro, New Jersey, where it is stored under refrigeration.



At the PPG plant in Guayanilla, Puerto Rico, the company's modern 34,000-ton chemical tanker, S.S. Puerto Rican, receives a load of vinyl chloride monomer.



At the Paulsboro, New Jersey terminal, the S.S. Puerto Rican's load of vinyl chloride monomer is transferred to the refrigerated storage tanks in the background.

PPG produces vinyl chloride monomer by the oxychlorination of ethylene and holds more than 400 domestic and foreign patents on this process.

Uninhibited VCM is quite stable and can be routinely shipped, handled and stored provided proper procedures, outlined below, are followed. To prevent polymerization in transit or storage, it is essential that the monomer be protected at all times from contact with air, oxygen, moisture, catalytic impurities, and light.

PPG normally supplies VCM uninhibited. The use of uninhibited VCM eliminates the need for subsequent processing to remove the inhibitor. If required, suitable inhibitors will be added.

GRADES

PPG Industries produces polymer-grade vinyl chloride monomer.

USES

Most vinyl chloride is polymerized to polyvinyl chloride (PVC) or copolymerized with other monomers such as PPG's vinylidene chloride.

PROPERTIES

Chemical Names:

Vinyl chloride; vinyl chloride monomer; chloroethylene; chloroethene

Chemical Formula:

CH_2CHCl

Molecular Weight:

62.5

Description:

At ordinary temperatures and pressures, vinyl chloride is a colorless gas with a mild, sweet odor. But as supplied in tank cars and trucks under pressure, it is a liquid. Vinyl chloride is highly volatile and its vapor is extremely flammable.

Boiling Point, °C

-13.8

Autoignition Temperature, °C

472

°F

+7.0

°F

882

Freezing Point, °C

-153.7

Liquid Density at 60°F

0.9192

°F

-245

Vapor Density, air =1

2.15

Flash Point, open cup, °C

-78

Vapor Pressure, psia at 0°C

25.1

°F

-108.4

20°C

49.2

40°C

87.6

Explosive Limits, volume %

Solubility, water in monomer,

in air at 25°C (77°F)

3.6 to 33

at 25°C (77°F), weight %

0.11

Solubility: Vinyl chloride is relatively insoluble in water but soluble in most organic solvents.

Reactivity: Vinyl chloride polymerizes exothermically in the presence of light, air, oxygen or catalysts. Heat alone will not initiate polymerization. Vinyl chloride is thermally stable to quite high temperatures. Although peroxide formation due to air exposure is a slow reaction, certain peroxide products are shock-sensitive. Vinyl chloride is noncorrosive to metals when dry at normal temperatures, but water and elevated temperatures accelerate corrosion. The double bond behaves as in other unsaturated compounds. The chlorine atom is relatively inactive and is more stable than in saturated or allylic compounds.

	clear, free of suspended matter, colorless, water-white
HCl, maximum ppm	5
Aluminum, maximum ppm	0.5
Acetylene residue, maximum weight %	0.05
Acetylene, maximum ppm	100
O ₂ , maximum ppm	5
Hydrogen sulfide, maximum ppm	5
Carbon monoxide, maximum ppm	5
Carbon dioxide, maximum ppm	5
The maximum is an industry standard; however, the PPG product contains no detectable amount of acetylene.	

TOXICITY

Uninhibited monomer is not absorbed through the skin, but the liquid may cause frostbite because it evaporates so fast. If an inhibitor is included, it may cause local skin burns.

Vapor concentrations in work areas should not exceed 200 ppm as a time-weighted average atmospheric concentration for an 8-hour day to avoid adverse effects on workmen. High vapor concentrations can cause dizziness and anesthesia. More information appears in Chemical Safety Data Sheet SD-56, "Vinyl Chloride," published by the Manufacturing Chemists Association, 1825 Connecticut Avenue, N.W., Washington, D.C. 20009.

HANDLING AND STORAGE

Aluminum and its alloys must not be used in equipment to store or handle vinyl chloride because explosive aluminum chloroalkyls can be formed. PPG's vinyl chloride is made from ethylene and contains no detectable amount of acetylene. Vinyl chloride made from acetylene by an older process contains traces of acetylene that could react explosively with copper or its alloys to form copper acetylides. It is not safe to use such vinyl chloride in processing equipment containing copper or brass.

Exposure of vinyl chloride to oxygen and air results, after a time, in polymer formation. This can cause problems in equipment used for storage and transfer of monomer. Vinyl chloride should be stored under a blanket of nitrogen with a maximum oxygen content of 10 ppm.

Fire hazard

Vinyl chloride vapor is extremely flammable. Its explosive limits are between 3.6 and 33% by volume in air. Proper ventilation and the elimination of ignition sources are mandatory in areas where vapor concentrations may reach a flammable level. When a tank car is unloaded, both the car tank and the unloading pump should be electrically grounded.

The major products of combustion include toxic and corrosive hydrogen chloride as well as carbon monoxide, and less than 10 ppm of phosgene. Only in the very near vicinity of a vinyl chloride monomer fire could detectable amounts of phosgene be present.

Carbon dioxide or dry chemical agents extinguish small fires effectively, but no extinguisher is known for large fires. Streams of water cannot extinguish a liquid vinyl chloride fire because the monomer does not mix with water and will float on top. Water may be sprayed to cool equipment. If the source of the vinyl chloride monomer leak has not been closed off, do not attempt to extinguish a large fire because hot metal can re-ignite an unburned vapor cloud. No one without proper protective respiratory equipment should enter an area where there has been a fire until the area has been adequately ventilated.

Unloading tank cars

If tank car valves are defective or leaky, do not unload. Telephone the PPG Chemicals plant at Lake Charles, Louisiana, 318-882-1200. Information on un-

loading tank cars and trucks appears in the PPG manual, "Vinyl Chloride Monomer Handling and Properties, form A-994."

Warning: Air should never be permitted to enter vinyl chloride tank cars or other containers during or after unloading. Close and seal all openings. Leave at least 10 psig of vinyl chloride vapor pressure in empty tank car being returned.

PACKAGING AND SHIPPING

PPG Industries delivers vinyl chloride by ship, barge, tank car and tank truck. There are 3 shipping points: Lake Charles, Louisiana; Guayanilla, Puerto Rico; and Paulsboro, New Jersey.

PPG maintains a fleet of tank cars for vinyl chloride service. All cars are equipped for top unloading. There are three car sizes: 100,000-pound, 180,000-pound and 220,000-pound net weight. Tank trucks hold up to 40,000 pounds. Ships and barges hold up to several million pounds.

SAMPLES AND SERVICE

Samples of vinyl chloride are available on special request in returnable laboratory-size steel cylinders holding 5 pounds or in cylinders holding 200 pounds.

The technical service staff of PPG Industries Chemical Division is available for consulting on handling, storage and use.



Storage spheres at PPG's Lake Charles, Louisiana plant hold thousands of gallons each of liquid vinyl chloride monomer under pressure. Horizontal storage tanks at right serve as day tanks.



PPG INDUSTRIES, Inc.
Chemical Division
One Gateway Center
Pittsburgh, Pa. 15222

Statements and methods presented are based upon the best information and practices known to PPG Industries, Inc. but are not representations or warranties of performance or result nor do they imply any recommendation to infringe any patent or in effect of license under any patent. With respect to its products PPG Industries, Inc. warrants only that they conform to its quality standards.

Some of the materials mentioned above may be hazardous in nature and should be handled with care. Read the label carefully and observe and comply with all the label warnings and precautionary directions. Although these materials are not intended for household use, they, as all potentially hazardous materials, must be kept out of the reach of children.

The BFGoodrich Company
Chemical Group
6100 Oak Tree Boulevard
Cleveland, Ohio 44131
216-447-6000

MATERIAL SAFETY DATA SHEET

VINYL CHLORIDE MONOMER

ISSUED: AUGUST, 1983*
Doc. 83102

SECTION I

<u>Manufacturer's Name</u> The BFGoodrich Company Chemical Group	<u>Telephone Number</u> (216) 447-6000	<u>Transportation Emergency Telephone</u> CHEMTREC: (800)424-9300
<u>Address</u> 6100 Oak Tree Blvd. Cleveland, Ohio 44131	<u>Chemical Family</u> Vinyl Halide	<u>Trademark</u> None
<u>Chemical Name/Synonyms</u> Vinyl chloride. VCM. VCl. Chloroethylene. Chloroethene.		<u>Formula</u> CH ₂ CHCl

SECTION II - HAZARDOUS INGREDIENTS

	<u>C.A.S. Number</u>	<u>Amount in Product</u>	<u>ACGIH TLV-TWA</u>	<u>OSHA PEL</u>
Vinyl Chloride	75-01-4	100%	5 ppm, Ala	0.5 ppm "Action Level" 1.0 ppm TWA 5.0 ppm Ceiling

See Section V for further information. Vinyl chloride is a CANCER SUSPECT AGENT.

- Notes: • TLV-TWA: Threshold Limit Value - Time Weighted Average for concentration of the chemical substance in the ambient workplace air. American Conference of Governmental Industrial Hygienists, 1982 Edition.
- OSHA PEL: OSHA Permissible Exposure Limit, 29CFR1910.1017.
 - Ala means "human carcinogen with assigned TLV", ACGIH.

*Supersedes 7/80

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SECTION III - PHYSICAL DATA (Typical data, not specifications)

<u>Boiling Point</u> 7°F (-13.8°C)	<u>Solubility in Water</u> 0.25 @ 68°F (20°C) @ 7 in. H ₂ O pressure	<u>Specific Gravity (H₂O=1)</u> 0.97 @ -13°C (liquid)
<u>Vapor Pressure (mm Hg)</u> @ 32°F (0°C): 1300 @ 68°F (20°C): 2500	<u>% Volatile by Volume</u> 100	<u>Vapor Density (Air = 1)</u> 2.15 @ 15°C
<u>Appearance and Odor</u> Colorless gas. Mild, sweet odor. (Transported as a liquid under pressure)	<u>Molecular Weight</u> 62.5	

SECTION IV - FIRE AND EXPLOSION HAZARD DATA (Vinyl Chloride is EXTREMELY FLAMMABLE)

<u>Flash Point</u> -108°F (-78°C) Cleveland Open Cup	<u>Ignition Temperature</u> 882°F (472°C)	<u>Flammable Limits in Air</u> (% by volume) Lower: 3.6% Upper: 33.0%
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National Fire Protection Association Hazard Identification (NFPA 704)

Health: 2

Flammability: 4

Self-Reactivity (Stability): 1

Extinguishing Media

For Small Fire: CO₂ or ABC dry powder.

For Large Fire: Water spray (fog) can be used to absorb heat and cool and protect surrounding exposed materials. Shut off source of fuel if safe to do so.

Note: Streams of water cannot extinguish a vinyl chloride fire. Vinyl chloride liquid floats and boils on top of water.

Special Fire Fighting Procedure

- Whenever possible, let fire burn itself out. Keep away.
- Keep upwind. Isolate hazard area (evacuate unnecessary people at least 2,000 feet if there is danger of exploding containers).
- Cool containers with water sprayed from maximum distance. Use unmanned hose holder or monitor nozzle.
- Wear positive pressure self-contained breathing apparatus and full protective gear to prevent all body contact. Personnel not having suitable respiratory protection must leave the area to prevent exposure to toxic and corrosive combustion gases, including hydrogen chloride.

Unusual Fire and Explosion Hazards

- Vapors are heavier than air and may travel along the ground or may be moved by ventilation and ignited by flame, sparks, heaters, or other ignition sources at distant locations (flashback potential).
- BLEVE potential (container explosion potential)
- If the source of a vinyl chloride leak has not been closed off, do not attempt to extinguish a large fire as hot metal may reignite the invisible vapor cloud.
- Vapors can form flammable mixtures with air.

SECTION V - HEALTH HAZARD DATA

Permissible Exposure Limit (29CFR1910.1017.)

-Eight Hour TWA: 1.0 ppm

- "Action Level": 0.5 ppm

-No employee may be exposed to vinyl chloride at concentrations greater than 5.0 ppm averaged over any period not exceeding 15 minutes.

-No employee may be exposed to direct contact with liquid vinyl chloride.

Effects of Overexposure

-Prolonged exposure may cause cancer.

-Direct contact with liquid causes freeze burns (irritation, frostbite, freezing).

-Prolonged exposure to high concentrations may cause degeneration of the ends of finger bones.

-Exposure to concentrations of 7,500 ppm may cause asphyxiation, persistent irregular heartbeat, narcosis, nausea, or dizziness.

-NOTE: The odor threshold for vinyl chloride is about 4,000 ppm.

Odor does not provide an adequate warning for hazardous exposure.

Emergency and First Aid Procedure

IN CASE OF EYE CONTACT: (Liquid). Immediately flush eyes with plenty of water for an extended time, not less than five (5) minutes. Flush longer if there is any indication of residual chemical in the eye. See a physician.

IN CASE OF SKIN CONTACT: Immediately remove contaminated clothing. Wash the affected area with plenty of soap and water. If irritation, freezing or frostbite occur, see a physician at once.

IN CASE OF INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician immediately.

SECTION VI - REACTIVITY DATA

Stability

Thermally stable.

Hazardous Polymerization

Will occur

Conditions/Materials to Avoid

Exposure to air (oxygen), sunlight, heat, oxidizing materials, copper, contamination with polymerization catalysts and alkali metals and their alloys may result in the formation of vinyl peroxides. This may cause heat generation (exothermic polymerization) and vaporization resulting in high pressure within vessels and potential release into the environment. Vinyl chloride is noncorrosive to metals when dry at normal ambient temperatures, but moisture at elevated temperatures accelerates corrosion.

Hazardous Decomposition Products

CO, CO₂, HCl and, in small amounts, phosgene on combustion.

SECTION VII - SPILL OR LEAK PROCEDURE

Steps to be taken in case material is released or spilled

Issue warning: Extreme fire danger and toxic hazard. Flammable vapors may spread from the spill. Eliminate all ignition sources. Ventilate the area. Isolate the hazard area. Do not purposely ignite a leak.

Do not flush chemical into public sewer or water system because of the explosion/toxicity hazard. Shut off leak if safe to do so. Let small spills evaporate. For large spills, dike or flush to ground and let evaporate. Remove contaminated soil.

Personal protective equipment and clothing should be utilized by persons performing this work. All unnecessary personnel and individuals without proper personal protective equipment should leave the area. Be prepared to evacuate all individuals within at least 2,000 feet when danger of exploding large vessels is possible.

Waste Disposal Method

HAZARDOUS WASTE.* If burned, incinerator should be equipped with an HCl scrubber. Contaminated soil and containers must be managed as a hazardous waste.

*EPA Hazardous Waste Number (RCRA): U043. 40CFR261.33(f)

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation

Efficient exhaust ventilation should always be provided to draw vapors away from workers to prevent routine inhalation. Ventilation should be adequate to maintain the ambient workplace atmosphere below the limits listed in Section II and Section V.

Respiratory Protection*

ATMOSPHERIC CONCENTRATION OF VINYL CHLORIDE

REQUIRED APPARATUS

- | | |
|--|--|
| 1) Unknown, or above 3,600 ppm | Open-circuit, self-contained breathing apparatus, pressure demand type, with full facepiece. |
| 2) Not over 1,000 ppm. | Type C, supplied air respirator, continuous flow type, with full or half facepiece, helmet or hood. |
| 3) Not over 10 ppm | Any chemical cartridge respirator with an organic vapor cartridge which provides a service of life of at least 1 hour for concentrations of vinyl chloride up to 10 ppm. |

*NIOSH/MSHA jointly approved respirators under the provisions of 30CFR Part 11. Read 29CFR Part 1910.1017(g)4 for complete details for selection of respirators for vinyl chloride.

Protective Equipment

In regulated areas wear protective gloves, footwear, headgear, and chemical goggles where exposure to liquid is likely. Wear other protective clothing as required to prevent body contact.

SECTION IX - SPECIAL PRECAUTIONS

- Open, handle and use under well-ventilated conditions.
- Wash thoroughly after handling. Always wash-up before eating, smoking or using toilet facilities.
- Keep away from heat, sparks and flame of any sort.
- Do not get in eyes, on skin or on clothing.
- Do not breathe vapors.
- All wiring and electrical equipment should be Class 1, Group D
- Do not store or consume food or beverage in regulated areas.
- Do not smoke in areas where vinyl chloride is used or stored.
- Keep container closed.
- Bond and ground all containers when transferring chemical.
- Emptied container may contain residual liquid or vapors which may ignite or explode. Do not cut, puncture or weld on or near the container.
- Prior to loading, the vapor space of tankcar, vessel, etc. should be analyzed for oxygen content; maximum limit is 500 ppm.

SECTION X - TRANSPORTATION

For domestic transportation purposes, the proper U.S. Department of Transportation shipping description and hazard class is VINYL CHLORIDE, FLAMMABLE GAS, UN1086. (49CFR, 1982 edition.) NOTE: Uninhibited vinyl chloride monomer is not acceptable for international shipments.

SECTION XI - PRECAUTIONARY LABELING

Containers of vinyl chloride shall be legibly labeled either "VINYL CHLORIDE: EXTREMELY FLAMMABLE GAS UNDER PRESSURE: CANCER SUSPECT AGENT" or "CANCER SUSPECT AGENT". 29CFR1910.1017(1)(5)

USER'S RESPONSIBILITY

A bulletin such as this cannot be expected to cover all possible individual situations. As the user has the responsibility to provide a safe workplace, all aspects of an individual operation should be examined to determine if, or where, precautions, in addition to those described herein, are required. Any health hazard and safety information contained herein should be passed on to your customers or employees, as the case may be. BFGoodrich must rely on the user to utilize the information we have supplied to develop work practice guidelines and employee instructional programs for the individual operation.

DISCLAIMER OF LIABILITY

As the conditions or methods of use are beyond our control, we do not assume any responsibility and expressly disclaim any liability for any use of this material. Information contained herein is believed to be true and accurate but all statements or suggestions are made without warranty, express or implied, regarding accuracy of the information, the hazards connected with the use of the material or the results to be obtained from the use thereof. Compliance with all applicable federal, state and local laws and regulations remains the responsibility of the user.

VINYL CHLORIDE MONOMER

MATERIAL SAFETY DATA SHEET

ISSUED: AUGUST, 1983
Doc. 83124

SECTION I

<u>Manufacturer's Name</u> LaPorte Chemicals Corp. A subsidiary of The BFGoodrich Company	<u>Telephone Number</u> (216) 447-6490	<u>Transportation Emergency Telephone</u> CHEMTREC: (800)424-9300
<u>Address</u> 6100 Oak Tree Blvd. Cleveland, Ohio 44131	<u>Chemical Family</u> Vinyl Halide	<u>Trademark</u> None
<u>Chemical Name/Synonyms</u> Vinyl chloride. VCM. VCl. Chloroethylene. Chloroethene.		<u>Formula</u> CH ₂ CHCl

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	<u>C.A.S. Number</u>	<u>Amount in Product</u>	<u>ACGIH TLV-TWA</u>	<u>OSHA PEL</u>
Vinyl Chloride	75-01-4	100%	5 ppm, Ala	0.5 ppm "Action Level" 1.0 ppm TWA 5.0 ppm Ceiling

See Section V for further information. Vinyl chloride is a CANCER SUSPECT AGENT.

- Notes: • TLV-TWA: Threshold Limit Value - Time Weighted Average for concentration of the chemical substance in the ambient workplace air. American Conference of Governmental Industrial Hygienists, 1982 Edition.
- OSHA PEL: OSHA Permissible Exposure Limit, 29CFR1910.1017.
- Ala means "human carcinogen with assigned TLV", ACGIH.

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SECTION III - PHYSICAL DATA (Typical data, not specifications)

<u>Boiling Point</u> 70°F (-13.8°C)	<u>Solubility in Water</u> 0.25 @ 68°F (20°C) @ 7 in. H ₂ O pressure	<u>Specific Gravity (H₂O=1)</u> 0.97 @ -13°C (liquid)
<u>Vapor Pressure (mm Hg)</u> @ 32°F (0°C): 1300 @ 68°F (20°C): 2500	<u>% Volatile by Volume</u> 100	<u>Vapor Density (Air = 1)</u> 2.15 @ 15°C
<u>Appearance and Odor</u> Colorless gas. Mild, sweet odor. (Transported as a liquid under pressure)	<u>Molecular Weight</u> 62.5	

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Self-Reactivity (Stability): 1

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Note: Streams of water cannot extinguish a vinyl chloride fire. Vinyl chloride liquid floats and boils on top of water.

Special Fire Fighting Procedure

- Whenever possible, let fire burn itself out. Keep away.
- Keep upwind. Isolate hazard area (evacuate unnecessary people at least 2,000 feet if there is danger of exploding containers).
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- Vapors are heavier than air and may travel along the ground or may be moved by ventilation and ignited by flame, sparks, heaters, or other ignition sources at distant locations (flashback potential).
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- Do not breathe vapors.
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- Do not smoke in areas where vinyl chloride is used or stored.
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- Bond and ground all containers when transferring chemical.
- Emptied container may contain residual liquid or vapors which may ignite or explode. Do not cut, puncture or weld on or near the container.
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DISCLAIMER OF LIABILITY

As the conditions or methods of use are beyond our control, we do not assume any responsibility and expressly disclaim any liability for any use of this material. Information contained herein is believed to be true and accurate but all statements or suggestions are made without warranty, express or implied, regarding accuracy of the information, the hazards connected with the use of the material or the results to be obtained from the use thereof. Compliance with all applicable federal, state and local laws and regulations remains the responsibility of the user.

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BFG38218

The BFGoodrich Company
Chemical Group

6100 Oak Tree Boulevard
Cleveland, Ohio 44131
216-447-6000

BFGOODRICH CHEMICAL GROUP
LAPORTE, TEXAS PLANT
SPECIFICATIONS FOR
VINYL CHLORIDE MONOMER

Vinyl Chloride	99.96% wt. minimum	Difference
Acidity (as HCl)	1 ppm by wt. maximum	Indirect Titration
Acetylene	1.0 ppm by wt. maximum	Gas Chromatograph
Acetaldehyde	1.0 ppm by wt. maximum	Idometric
Water	100 ppm by wt. maximum	Karl-Fischer Titration
Sulfur	1.0 ppm by wt. maximum	Turbimetric
Iron	0.4 ppm by wt. maximum	Colorimetric
Non-Volatiles	50.0 ppm by wt. maximum	Residue at 105°C
Methyl Chloride	60 ppm by wt. maximum	Gas Chromatograph
Butadiene	8 ppm by wt. maximum	Gas Chromatograph
Color	Colorless	Visual
Appearance	Clear and free from suspended matter	Visual
Stabilizer	None added	
*Receiving Vessel Vapor Space	1000 ppm oxygen by wt. maximum	
**Heavy Ends	50 ppm by wt. maximum	Gas Chromatograph

**Consisting of chloroprene, ethyl chloride, vinylidene chloride, cis and trans dichloroethylene, 1,1 and 1,2 dichloroethane, trichloroethylene, perchloroethylene, mono- and di- chloropropane, and vinyl bromide.

*Empty receiving vessels shall contain only VCM and oxygen, but no more oxygen than would result in 1000 ppm of oxygen in the vapor space in a full receiving vessel.

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