Product Safety Assessment
Vinylidene Chloride

Printer-friendly version of this PSA (73KB PDF)

Select a Topic:

Names

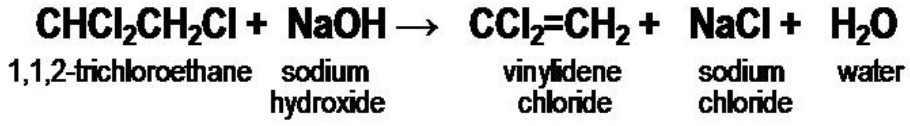
- CAS No. 75-35-4
- Vinylidene chloride
- VDC
- 1,1-Dichloroethene
- 1,1-Dichloroethylene
- Dichloroethylene

Product Overview

- Dow has produced vinylidene chloride (VDC) monomer for more than 40 years.[1] VDC is used to make various kinds of chemical intermediates, agricultural chemicals, SARAN™ polyvinylidene chloride (PVDC) resins and films, PVDC latex coatings, and photographic and X-ray films.[2] See Product Uses, Product Description and Manufacture of Product.
- Exposure to VDC may cause eye, skin, nose and throat irritation. Inhaling excessive amounts of VDC may cause adverse effects to the central nervous system, kidneys and liver. Its oral toxicity is low, and it has not been found to cause cancer, birth defects or other reproductive effects.[3] See Health Information.
- VDC is produced, distributed, stored and reacted in closed systems. Only trace amounts of VDC are found in finished consumer products.[4] However, those working with VDC in manufacturing operations could be exposed during sampling, testing or other procedures. See Exposure Potential.
- VDC is slightly toxic to aquatic organisms on an acute basis. It is expected to degrade in the atmospheric environment and not bioaccumulate.[5] See Environmental Information and Health Information.
- VDC is a flammable liquid and should be stored in closed, electrically grounded containers. Elevated temperatures can cause hazardous polymerization and contact with air can produce explosive peroxides. See Physical Hazard Information.

Manufacture of Product

- **Capacity –** Dow's Freeport, Texas, facility is the largest VDC plant in the world. It supplies Dow's internal product requirements (for SARAN resins) and customers in North America.[6] VDC is produced by companies other than Dow in Europe and Japan.[7]
- **Process –** VDC is prepared commercially by the dehydrochlorination of 1,1,2-trichloroethane using a slight excess of lime or caustic as shown in the reaction schematic.[8] About 200 ppm of monomethyl ether of hydroquinione (MEHQ) is added to prevent polymer formation and preserve product quality.[9]



Product Description

VDC is a colorless, highly flammable liquid with a "sweet" odor.[10] Because of its chemical structure, VDC is nearly insoluble in water,[11] but it is soluble in most polar and non-polar organic solvents.[12]

Product Uses

VDC is used to make various chemical intermediates, agricultural chemicals, SARAN resins and films, polyvinylidene chloride (PVDC) latex coatings, and photographic and X-ray films.[13]

Exposure Potential[14,15]

VDC is used in the production of industrial and consumer products. Based on the uses for VDC, the public could be exposed through:

- **Workplace exposure** – Exposure can occur either in a VDC manufacturing facility or in the various industrial or manufacturing facilities that use VDC. It is produced, distributed, stored and consumed in closed systems.[16] Those working with VDC in manufacturing operations could be exposed during maintenance, sampling, testing or other procedures. Each manufacturing facility should have a thorough training program for employees, appropriate work processes and safety equipment in place to limit unnecessary VDC exposure. See Health Information.
- **Consumer exposure to products containing VDC** – Dow does not sell VDC for direct consumer use, but it is used as a raw material to make food packaging materials. Residual or unreacted quantities of VDC monomer in SARAN resins are analyzed and tightly controlled. Only trace amounts of VDC are found in finished consumer products. Groundwater exposure assessments have been done as part of the Voluntary Children's Chemical Evaluation Program (VCCEP). The VCCEP assessment also considered potential exposures of children to VDC from its use in food wrap, carpet backing, and air and drinking water sources, and deemed there was an adequate margin of safety to protect children. The risk assessment was reviewed by a 3rd party expert panel and is publicly available.[17] See Health Information.
- **Environmental releases** – In the event of a spill, the focus is on containing the spill to prevent contamination of soil, surface or ground water. Respiratory protection is necessary for cleaning up spills and leaks. Eliminate all sources of ignition immediately. For small spills, VDC should be absorbed with materials such as sand. This material is considered slightly toxic to aquatic organisms on an acute basis. Due to the high vapor pressure and low solubility in water, VDC tends to accumulate (partition) into the air, which creates an inhalation risk. Consult the relevant SDS for more information about protective equipment and procedures. See Environmental, Health and Physical Hazard Information.
- **Large release** – Industrial spills or releases are infrequent and are generally contained. If a large spill does occur, the material should be captured, collected and re-processed, or disposed of according to applicable governmental requirements. If possible, sufficient water should be added to the containment area to establish a "water cap" over the VDC spill. This water cap will dramatically reduce the release of flammable/toxic vapors to the atmosphere and the potential for a fire/explosion. A positive pressure, self-contained breathing apparatus (SCBA) with a full-face mask approved by NIOSH is recommended for emergency work. Eliminate all sources of ignition immediately. Use only explosion-proof equipment; ground and bond all containers and handling equipment. In case of fire, deny any unnecessary entry into the area and consider the use of unmanned hose holders. Use of a direct water stream may spread fire. The public should be warned of down-wind vapor explosion hazards. Vapors are heavier than air and may travel a long distance and accumulate in low lying areas. Keep vapors out of sewers. Immediately withdraw all personnel from the area in case of rising sounds from venting safety device or discolorations of the container. Follow emergency procedures carefully. See Environmental, Health and Physical Hazard Information.

Health Information[18,19]

Many toxicological studies have been conducted on VDC. These studies indicate VDC does not represent a significant cancer risk in humans, but it is fairly toxic to the liver and kidneys of some animals. A health survey of 138 employees exposed to up to 70 ppm of VDC over a 28-year period showed no adverse health effects from the VDC exposure.

VDC is highly volatile and its odor is not adequate as a warning characteristic. VDC vapors may present an inhalation hazard. Excessive inhalation may cause irritation to the upper respiratory tract. A single, brief exposure to a high VDC vapor concentration (2,000 ppm for example) rapidly produces a state of apparent drunkenness that may progress to unconsciousness if the exposure continues. Animal experiments and

human experience show that workers will recover promptly and completely from anesthetic effects when they are removed from exposure.

Animal studies suggest either a single, prolonged exposure or repeated, short-term exposures to concentrations above the recommended levels may result in toxic effects. At vapor concentrations below levels that can cause anesthetic effects or nausea (warning signs), exposure may still injure the liver and kidneys.

VDC is moderately irritating to the eyes and skin. Permanent damage to the eye is unlikely though contact can cause pain, irritation of the eyelids, iritis and slight corneal injury. Liquid VDC is irritating to the skin. Prolonged or repeated contact may cause burns.

VDC is unlikely to be ingested during normal industrial handling, and it has a relatively low order of acute oral toxicity (1500 milligrams/kilogram – the equivalent of 3.6 ounces or 102 grams for a 150-pound or 68-kilogram adult). However, if it is ingested, obtain medical attention immediately. Do not induce vomiting.

VDC is unlikely to cause birth defects. Exposures having no effect on the mother should have no effect on the fetus. Effects were seen in the fetus only at doses which caused toxic effects to the mother. In animal studies, VDC has been shown not to interfere with reproduction.

For specific health information, review the Safety Data Sheet (SDS).

Environmental Information[20,21]

VDC is nearly insoluble in water and has a high vapor pressure. It will vaporize into the air when released. Because VDC is heavier than air, it may accumulate in low lying areas. VDC is not likely to decompose via photodegradation, but indirect photolysis (hydroxyl radicals) is possible.

Although VDC does not pass the test for readily biodegradable materials, there is evidence of biodegradation under aerobic conditions. It is considered to be inherently biodegradable, which means that it would not persist indefinitely in the environment. The atmospheric life of VDC is four days.

Physical Hazard Information[22]

VDC is chemically stable under recommended storage conditions, which include minimizing oxygen content and maintaining an appropriate level of inhibitor. Hazardous polymerization can occur if improperly stored. The uninhibited monomer vapors can polymerize and plug relief devices. Elevated temperatures can cause hazardous polymerization.

Avoid contact with oxidizing materials, strong bases and metals. Do not store VDC in containers made of copper, aluminum or their alloys.[23] Avoid moisture. Avoid direct sunlight or ultraviolet sources. Polymerization can be catalyzed by air, ferric chlorides, oxygen, rust and sunlight.

Keep containers closed. To prevent oxygen contamination, use nitrogen gas for blanketing vapor spaces. Prolonged exposure to air can form shock sensitive peroxides.[24] Avoid unintended contact with peroxides. Monomer contaminated with peroxides can form polymer at ambient conditions. Dry polymer containing peroxides at greater than 15% concentration can be detonated by slight mechanical shock or heat. A sharp, acrid odor indicates oxygen exposure and probable presence of peroxides.[25] Peroxide decomposition products of VDC are formaldehyde, phosgene and hydrochloric acid.[26]

VDC is a flammable liquid and should be stored in closed, electrically grounded containers. If VDC is present in a fire situation, the smoke may contain the original material in addition to combustion products which may be toxic or irritating. Combustion products may include and are not limited to hydrogen chloride, carbon monoxide and carbon dioxide, along with trace amounts of phosgene and chlorine. Containers may rupture from gas generated by decomposition in a fire situation. Use water spray to cool fire-exposed containers until danger of re-ignition has passed.

Exposure to elevated temperatures can cause VDC to decompose. Generation of gas during decomposition can cause pressure in closed systems. Avoid open flames, welding arcs, or other high temperature sources which induce thermal decomposition.

Additional physical property information for VDC is available on the SDS.

Regulatory Information

Regulations may exist that govern the manufacture, sale, transportation, use and/or disposal of VDC. These regulations may vary by city, state, country or geographic region. Information may be found by consulting the relevant Safety Data Sheet or Contact Us.

Additional Information

- Safety Data Sheet (http://www.dow.com/webapps/msds/msdssearch.asp)
- *Vinylidene Chloride Monomer Safe Handling Guide*, Dow Form No. 103-00147 (www.dow.com/gco/na/prod/v_chlor.htm)
- Dow's "Report of the Peer Consultation Meeting on Vinylidene Chloride" for the Voluntary Children's Chemical Evaluation Program (VCCEP) (www.epa.gov/chemrtk/vccep/chem3.htm)
- Vinylidene Chloride Monomer and Polymers: A Technical Report on VDC and PVDC (www.dow.com/PublishedLiterature/dh_0458/09002f1380458ac4.pdf?filepath=/PublishToInternet/InternetDOWCOM/plastics_ap/pdfs/noreg/190-00347,/PublishToInternet/InternetDOWCOM/plastics_eur/pdfs/noreg/190-00347,/PublishToInternet/InternetDOWCOM/plastics_l)

For more business information about VDC, visit Dow's Global Chlorinated Organics Business web site.

References

[1] *Vinylidene Chloride Monomer Safe Handling Guide*, Dow Form No. 103-00147, November, 1998, page 4.
[2] http://www.dow.com/gco/na/app/chemical.htm
[3] *Vinylidene Chloride, MEHQ Inhibited Safety DataSheet*, No. 200, June 18, 2002, pages 1-2.
[4] The Dow Chemical Company, "Report of the Peer Consultation Meeting on Vinylidene Chloride," Voluntary Children's Chemical Evaluation Program (VCCEP), January 29-30, 2003, page 2.
[5] *Vinylidene Chloride, MEHQ Inhibited Safety Data Sheet*, No. 200, June 18, 2002, page 7.
[6] *Vinylidene Chloride Monomer Safe Handling Guide*, Dow Form No. 103-00147, November, 1998, page 4.
[7] K*irk-Othmer: Encyclopedia of Chemical Technology,* Fourth Edition, Vol. 24 (New York: John Wiley & Sons, Inc. 1997, "Vinylidene Chloride Monomer and Polymers," page 910.
[8] K*irk-Othmer: Encyclopedia of Chemical Technology,* Fourth Edition, Vol. 24 (New York: John Wiley & Sons, Inc. 1997, "Vinylidene Chloride Monomer and Polymers," page 884.
[9] *Vinylidene Chloride Monomer Safe Handling Guide*, Dow Form No. 103-00147, November, 1998, page 10.
[10] http://www.dow.com/gco/na/prod/v_chlor.htm
[11] HPV Challenge Program Test Plan for Vinylidene Chloride, submitted December 14, 2004, page 2.
[12] K*irk-Othmer: Encyclopedia of Chemical Technology,* Fourth Edition, Vol. 24 (New York: John Wiley & Sons, Inc. 1997, "Vinylidene Chloride Monomer and Polymers," page 882.
[13] http://www.dow.com/gco/na/app/chemical.htm
[14] *Vinylidene Chloride, MEHQ Inhibited Safety Data Sheet*, No. 200, June 18, 2002, pages 4 and 7.
[15] *Vinylidene Chloride Monomer Safe Handling Guide*, Dow Form No. 103-00147, November, 1998, page 8.
[16] The Dow Chemical Company, "Report of the Peer Consultation Meeting on Vinylidene Chloride," Voluntary Children's Chemical Evaluation Program (VCCEP), January 29-30, 2003, page 2.
[17] The Dow Chemical Company, "Report of the Peer Consultation Meeting on Vinylidene Chloride," Voluntary Children's Chemical Evaluation Program (VCCEP), January 29-30, 2003, page 2. http://www.epa.gov/chemrtk/vccep/pubs/chem3.htm
[18] *Vinylidene Chloride, MEHQ Inhibited Safety Data Sheet*, No. 200, June 18, 2002, pages 1,2, 6 and 7.
[19] *Vinylidene Chloride Monomer Safe Handling Guide*, Dow Form No. 103-00147, November, 1998, pages 6-7.
[20] *Vinylidene Chloride, MEHQ Inhibited Safety Data Sheet*, No. 200, June 18, 2002, page 7.
[21] HPV Challenge Program Test Plan for Vinylidene Chloride, submitted December 14, 2004, pages 2, 4-6.
[22] *Vinylidene Chloride, MEHQ Inhibited Safety Data Sheet*, No. 200, June 18, 2002, pages 5-6.
[23] K*irk-Othmer: Encyclopedia of Chemical Technology,* Fourth Edition, Vol. 24 (New York: John Wiley & Sons, Inc. 1997, "Vinylidene Chloride Monomer and Polymers," page 885.
[24] http://www.dow.com/gco/na/prod/v_chlor.htm
[25] K*irk-Othmer: Encyclopedia of Chemical Technology,* Fourth Edition, Vol. 24 (New York: John Wiley & Sons, Inc. 1997, "Vinylidene Chloride Monomer and Polymers," page 885.
[26] *Vinylidene Chloride Monomer Safe Handling Guide*, Dow Form No. 103-00147, November, 1998, page 10.

NOTICE: Although the information and recommendations in this document or at a related Internet Web site (hereinafter "Information") are presented in good faith and believed to be correct, The Dow Chemical Company and its consolidated subsidiaries ("Dow") makes no representations or warranties as to the completeness or accuracy of Information.

Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Dow be responsible for damages of any nature whatsoever resulting from the use of or reliance upon Information or the product to which Information refers.

Nothing contained herein is to be construed as a recommendation to use any product, process, equipment or formulation in conflict with any patent, and Dow makes no representation or warranty, express or implied, that the use thereof will not infringe any patent.

NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.

Dow makes no commitment to update or correct any information that appears on the Internet or on its World-Wide Web server.

The information contained in this document is supplemental to the Internet Disclaimer <http://www.dow.com/homepage/disclosure.html> and is not intended to be all-inclusive as it relates to use, handling, storage, disposal and all other described activities. Recipients must make their own determination of suitability and are responsible for compliance with all applicable governmental regulations. This information is offered solely for your consideration and verification and in no event will Dow be responsible for damages of any nature whatsoever resulting from the use or reliance upon this information or the product to which this information pertains.

Form No. 233-00264-MM-1006