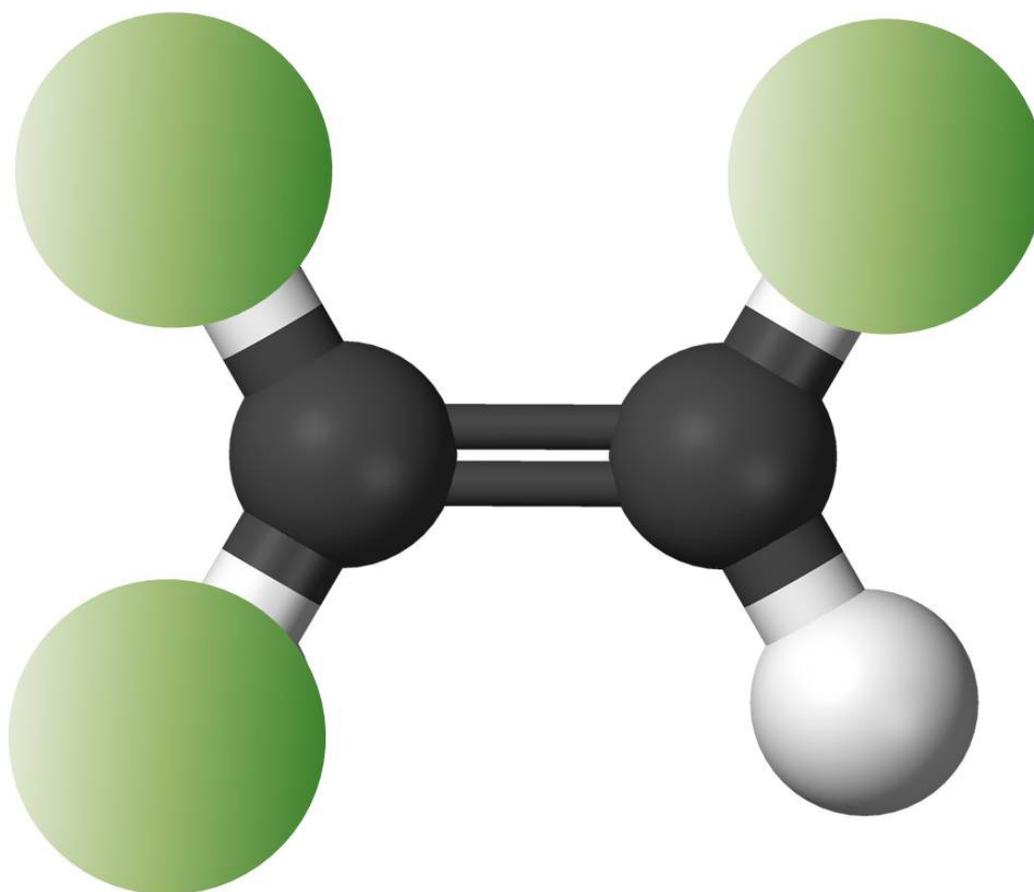




December 2015

Product Safety Summary on Trichloroethylene



Trichloroethylene (1,1,2-Trichloroethene)

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy supported by CEFIC. The information in the summary is basic information and is not intended to provide detailed emergency response, medical or treatment information. In-depth safety and health information can be found in the (extended) Safety Data Sheet (e)SDS for the chemical substance.

GENERAL STATEMENT

Trichloroethylene (TRI) is a chlorinated hydrocarbon used a) as feedstock to produce fluorinated hydrocarbons and fluorinated polymers and b) as an industrial solvent in various applications. It is a clear non-flammable liquid with a low boiling point, has good chemical stability, is non-miscible with water and has a low evaporation energy, which makes TRI well-suited for recycling and constant re-use.

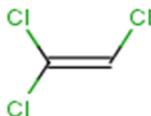
TRI provides excellent solubility for oils, greases and resins combined with the non-flammability, easy drying and low surface tension which have made TRI a widely used solvent for range applications such as surface cleaning, process and extraction solvent and special uses in adhesives. TRI is classified as carcinogen cat. 1B (may cause cancer) therefore should be carefully handled to avoid exposure to humans. TRI is prohibited for consumer use.

TRI is manufactured using oxi-chlorination or non-catalytic chlorination processes starting from ethylene dichloride (EDC) or other chlorinated C2-hydrocarbons. It can also be produced by catalytic hydrogenation starting from Perchloroethylene.

CHEMICAL IDENTITY

Name:	Trichloroethylene
Brand names:	NEU-Tri, Hi-Tri, TRICLONE, Trichloroethylene
Chemical name (IUPAC):	1,1,2-trichloroethene
CAS number:	79-01-6
EC number:	201-167-4
Molecular formula:	C ₂ HCl ₃

Structure:



USES AND APPLICATIONS

The majority of the Trichloroethylene volume produced today is used as a chemical intermediate in the synthesis of hydrofluorocarbons (HFC) for refrigerants, blowing agents and flame retardants, or certain polychlorinated aliphatics, as well as some agricultural chemicals.

Trichloroethylene is an excellent solvent for greases, oils, fats, waxes, and tars and is used for vapour degreasing of metal and other substrates. It is also used as a process or extraction solvent. Its low boiling point, good chemical stability and low evaporation energy (about 9 times lower than water) makes TRI well-suited for recycling and re-use.

Minor uses are the use as a solvent in some non-flammable adhesive formulations and as a low-temperature heat-transfer medium. Trichloroethylene is used by the textile processing industry to scour cotton, wool, and other fabrics, and as a solvent in waterless dyeing and finishing operations. TRI is used as an extraction and process solvent in some specialised processes such as the production of battery separators. TRI is still in use as heat transfer fluid although this use has stopped; at end of service life systems are dismantled.

For more information on uses that have been safety assessed under REACH, please visit the [ECSA Product & Application Toolbox](#).

PHYSICAL/CHEMICAL PROPERTIES

TRI is a clear non-flammable liquid with a sweet odour, low boiling point and is non-miscible with water

Physical state	Liquid
Colour	characteristic
Odour	sweet
Relative Density	1.465 at 20 °C
Vapour Pressure	9.9 kPa at 25 °C
Melting temperature	-84.8 °C
Boiling temperature	86.7 °C
Molecular weight	131.38 g/mol
Self-ignition temperature	410 °C at 101.3 kPa
Flash point	The substance is non-flammable.
Partition coefficient n-octanol/water (Log Kow)	2.53 at 20 °C
Water Solubility	1.1 g/l at 20 °C



HEALTH EFFECTS

Trichloroethylene is moderately toxic if swallowed and may cause skin (H 315) and even serious eye irritation (H 319). But Inhalation is the principal route of exposure. Excessive inhalation exposure may affect the central nervous system (H336); initial effects are dizziness, loss of coordination, sleepiness, and symptoms of anaesthesia and can result in systemic injury (even death). Effects reported at high levels include liver and kidney damage and changes in heartbeat. Several studies with mice and rats have suggested that high doses of trichloroethylene may cause liver, kidney, or lung cancer (Carc. Class 1b, H 350)) TRI is suspected to cause genetic defects (H 341). TRI has demonstrated the potential for contact allergy in mice and guinea pigs.

Effects	Result
Acute toxicity: oral/ inhalation/dermal	No acute toxic effects
Irritation/corrosion	Causes skin irritation, causes serious eye irritation
Sensitization	May cause an allergic skin reaction.
Toxicity after repeated exposure: oral/ inhalation/dermal	May cause drowsiness or dizziness.
Genotoxicity/ mutagenicity	Suspected of causing genetic defects
Carcinogenicity	May cause cancer
Toxicity for reproduction	Not toxic to reproduction.

ENVIRONMENTAL EFFECTS

Trichloroethylene is used to a white extent as chemical intermediate. Use as solvent e.g. for metal degreasing is mainly occurring in closed systems. If released to the environment, the major release is likely to be to the atmosphere where trichloroethylene has a lifetime of about one week and therefore is not likely to enter the stratosphere (no significant ozone depleting potential).

TRI is harmful to aquatic life with long lasting aquatic environmental effects (H 412). Trichloroethylene that reaches groundwater may be difficult to remediate.

Trichloroethylene is not considered readily biodegradable, although biodegradation may occur slowly under both aerobic and anaerobic conditions. The potential mobility of trichloroethylene in the soil is high. Very little trichloroethylene breaks down in soil, and it can pass through the soil into underground water. It does not bioaccumulate (build up in the food chain).

Effect assessment	Result
Aquatic toxicity	Harmful to aquatic life with long lasting effects



EXPOSURE

Human health

TRI should be preliminary used in closed systems or under well controlled conditions to minimize exposure. If exposure occurs the most likely route of human exposure to TRI is through inhalation or to less extent dermal contact. worker exposure can occur in trichloroethylene manufacturing facilities or industrial facilities mainly during material transfer and maintenance activities. Since mainly undertaken in closed systems, but exposure should be fairly low. Higher worker exposures can occur in applications as industrial metal cleaning and use as a process chemical. In case of unintended exposure during production and use, maintenance, sampling, testing, or other procedures workers should follow the recommended safety measures in the Extended Safety Data Sheet (eSDS) and use respective personal protective equipment and/or apply relevant risk management measures such as extract ventilation.

Consumer: Regulation 552/2009 amending Regulation 1907/2006 prohibits Trichloroethylene for supply to the general public (consumer use) when the individual concentration in the substance or mixture is equal to or greater than 0.1%

Worker: When used as intermediate Workers will not come into contact with TRI, as the substance is manufactured and handled in industrial settings in closed systems.

For solvent use TRI should be produced, distributed, stored, and used in closed systems preferably using closed loop safety containers. Those working with trichloroethylene in manufacturing operations could be exposed during maintenance, sampling, testing, or other procedures. Each manufacturing facility should have a thorough training program for employees and appropriate work processes and safety equipment in place to limit unnecessary trichloroethylene exposure. Persons working with trichloroethylene should be provided with and instructed in the use of appropriate personal protective clothing and equipment, as required. Adequate ventilation should be provided in the workplace to minimize the possibility of an inhalation hazard in case of unintended exposure during maintenance, sampling, testing, or other procedures workers should follow the recommended safety measures in the Extended Safety Data Sheet (eSDS).

Environment

Trichloroethylene is manufactured within a closed and automated process with no intentional release of aqueous effluent neither gaseous effluent to the environment. The major use of Trichloroethylene is the use as chemical intermediate in closed systems.

Use as solvent e.g. for metal degreasing is mainly occurring in closed systems. Emission to air is regulated for the use as surface cleaning (metal degreasing) by the Industrial Emission Directive EC 2010/75 with a maximum release of 2mg/m³. If released to the environment, the major release is likely to be to the atmosphere where trichloroethylene has a lifetime of about one week and therefore is not likely to enter the stratosphere. Release to

water should be avoided as Trichloroethylene is not considered readily biodegradable, although biodegradation may occur slowly under both aerobic and anaerobic conditions. Very little trichloroethylene breaks down in soil, and it can pass through the soil into underground water. Therefore special ground water protection is always recommended for material handled in bulk and closed loop safety containers for handling drum quantities. TRI does not bio-accumulate (build up in the food chain).

RISK MANAGEMENT RECOMMENDATIONS

Handling in closed systems is strongly recommended. Avoid breathing vapour and do not swallow. Avoid contact with eyes, skin, and clothing. Do not eat, drink, or smoke where chemicals are handled, processed, or stored. Wash hands and skin following contact. If the substance gets into your eyes, rinse eyes thoroughly for at least 15 minutes with tap water and seek medical attention. When using Trichloroethylene make sure that there is adequate ventilation. Always use appropriate chemical resistant gloves to protect your hands and skin and always wear eye protection such as chemical goggles.

Those working with trichloroethylene in manufacturing operations could be exposed during maintenance, sampling, testing, or other procedures. Each manufacturing facility should have a thorough training program for employees and appropriate work processes and safety equipment in place to limit unnecessary trichloroethylene exposure.

Keep containers closed. Containers, even those that have been emptied, can contain vapours. Do not cut, drill, grind, weld, or perform similar operations on or near empty containers. Do not enter confined spaces unless adequately ventilated. To avoid uncontrolled emissions, vent vapour from container to storage tank. Vapours of this product are heavier than air and lethal concentrations of vapours can collect in low, confined and unventilated spaces such as tanks, pits, small rooms and even in equipment (degreasers) that is used for degreasing metal parts. Do not enter these confined spaces where vapours of this product are suspected unless special breathing apparatus is used and an observer is present for assistance. When using TRI do not eat, drink or smoke.

All effluent releases that may contain the substance must be directed to a waste water treatment plant that removes the substance from the final releases to the receiving water.

For further information please consult the safety datasheet. Consult section 7 and 8 of Safety Data Sheet for further information on handling and storage. In case of accidental release consult section 6; for first aid measures consult section 4. For information on disposal consult section 13 and for firefighting measures consult section 5. Consult the specific exposure scenarios within the SDS for your use/application for specific guidance and risk reduction measure for this particular use.



Existing Regulation

TRI is generally regulated under REACH and the Carcinogens & Mutagens Directive and the Water Framework Directive. TRI has been registered in the EU under REACH (Regulation (EC) 1907/2006) in 2010 as a full substance >1000 t/a (full data set),

TRI under Authorisation

The most recent inclusion of TRI into ANNEX XIV of REACH as a substance of very high concern in April 2013 defines a sunset date of 21st of April 2016 for solvent uses in Europe. After this date TRI can only continued to be used with an authorization acc. to the REACH authorization process

Other regulations and evaluation documents of TRI

The use of TRI in surface cleaning is regulated under the Industrial Emission Directive 2010/75 EC which requires closed systems. For the use of TRI under 1mt/year Industry has set up a voluntary commitment (via ECSA) which forces customer to only use TRI in closed or enclosed systems as of end of 2010.

- The International Agency on Research on Cancer (IARC) published the re-evaluation of TRI in 2014 (carcinogenic to humans (Group 1)).
- According to the German TRGS 910 the Exposure Risk Relationship (ERB) for potentially genotoxic substances has been applied to TRI in 2013, with an acceptance level (latest to be applied as of 2018) of 0.6 ppm.
- The European Scientific Committee on Occupational Exposure Limits (SCOEL) has published in 2009 the Recommendation from the Scientific Committee on Occupational Exposure Limits for TRI (SCOEL/SUM/142) Occupational Exposure Limit (OEL) (as a precursor for inclusion into EU law) of 10 ppm (8 h time weighted average), (STEL 15 min: 30 ppm). TRI is considered by SCOEL as a genotoxic carcinogen with a threshold.
- A risk assessment on Trichloroethylene has been done based on Council Regulation (EEC) 793/93 and a RAR report has been published in 2004.
- A Risk Assessment for the Marine Environment (OSPARCOM Region - North Sea) has been published by Euro Chlor in 1999.



REGULATORY INFORMATION/ CLASSIFICATION AND LABELLING

The substance is subject to harmonized classification under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008. Industry has adopted a more stringent self-classification, as follows:

Skin corrosion/ irritation Cat 2	H315		Causes skin irritation
Skin sensitization Cat 1	H317		May cause an allergic skin reaction
Serious eye da- mage/eye irrita- tion Cat 2	H319		Causes serious eye irritation
Carcinogenicity	H350		May cause cancer
Germ cell muta- genicity Cat 2	H341		Suspected of causing genetic defects.
Specific target organ toxicity - single exposure- Route of exposure (Narcotic effects.) Route of exposure (Inhalation) Cat 3	H336		May cause drowsiness or dizziness
Chronic aquatic toxicity Cat 3	H412		Harmful to aquatic life with long lasting ef- fects.

(Please note that specific labels may differ from the classification above. For complete de-
tails on the classification and labeling of trichloroethylene, consult the SDS.)



Conclusion

Trichloroethylene is used as an intermediate in the production of fluorinated compounds and within this application is used under controlled conditions in closed systems.

It's physical properties (non-flammable liquid, low boiling point, good chemical stability, low evaporation energy) makes it very suitable for the use as solvent for greases, oils, fats, waxes, and tars and the respective use as surface cleaning agent. Due to its specific properties TRI is easy to recycling and re-use. TRI is classified as a carcinogen cat. 1B (may cause cancer) and exposure primarily occurs by inhalation. Therefore TRI is mainly used in closed or enclosed systems to minimize emissions to humans. The risk of TRI uses has been assessed as part of the dossier creation and registration under REACH. Related exposure scenarios for each use with risk measurement measures can be found as part of suppliers extended safety datasheets. After the sunset date of 21st of April 2016, as set in ANNEX XIV of REACH TRI can only be used as intermediate or in uses and by downstream users, who have a granted authorisation in place. Suppliers might also hold authorisations for certain uses, so TRI can be used under these authorisations by their downstream users. Details concerning the authorisation process can be found on the ECHA webpage (<http://echa.europa.eu/regulations/reach/authorisation>) or for ex. under www.chemware.org

Contact Information

For further information on this substance please contact ECSA.

Information about applications can be found at the ECSA website <http://www.chlorinated-solvents.eu/toolbox/>

For information on the Global Product Strategy please see the ICCA portal: <http://www.icca-chem.org/en/Home/Global-Product-Strategy/>

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Additional Information

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GLOSSARY

Acute toxicity	Harmful or dangerous effect resulting from a single exposure to a substance
Biodegradation	Decomposition or breakdown of a substance under natural conditions (actions of microorganisms etc.)
Bioaccumulation	Progressive accumulation in living organisms of a chemical substance present in the environment
Carcinogenicity	Substance causing cancer
Chronic toxicity	Adverse effect after repeated exposure to a substance
Clastogenicity	Substance that causes breaks in chromosomes
Embryotoxicity	Adverse effect on foetal health
Flash point	The lowest temperature at which vapour of the substance may form an ignitable mixture with air
Genotoxicity	Substance that causes damage to genetic material; it is a broader term and besides mutagenicity, it refers to potentially harmful effects on genetic material which are not necessarily associated with mutagenicity (such as unscheduled DNA synthesis, sister chromatid exchange, DNA strand breaks, DNA adduct formation or mitotic recombination).
GHS	Global Harmonized System of chemicals classification
Hazard	Inherent substance property bearing a threat to health or environment
Mutagenicity	Substance that causes mutation(s), i.e. permanent transmissible changes in the amount or structure of the genetic material (such as direct effect on genes, and structural and numerical changes
Persistence	Refers to the length of time a compound stays in the environment, once introduced
Reproduction toxici-	Includes teratogenicity, embryotoxicity and/or adverse effects
Sensitising	May cause allergy
Sediment	Topsoil, sand and minerals washed from land into water finally forming a layer at the bottom of rivers and sea
Teratogenicity	Substance effect on foetal morphology
Vapour pressure	A measure of a substance's property to evaporate
Volatile substance	Substance that evaporates readily at ambient conditions

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