

Occupational Uses

- Used as a solvent to remove grease from metal parts; also used in production of other chemicals.
- An extraction solvent for greases, oils, fats, waxes, tars in the textile industry
- Dry cleaning operations
- Components of adhesives, lubricants, paint strippers, pesticides, and cold metal cleaners.

Occupational Exposure

- Humans can be exposed to trichloroethylene by inhalation, ingestion, and dermal absorption.
- Workers the metal-degreasing and dry-cleaning operations have the largest exposure rates to Trichloroethylene.
- Members of the general population can also be exposed through contamination of air, food, and water.
- Other occupations include:
 - Manufacturing pharmaceuticals and chemical workers

Toxicological Data

- Can enter the body from contaminated air, water, food, and soil via ingestion, inhalation, and dermal absorption.
- It is a known carcinogen
- People exposed at small amounts may experience dizziness, headaches, sleepiness.
- People exposed to larger amounts may experience coma and even death.
- Can have harmful effects on nervous system, respiratory system, kidneys, immune system, and heart.
- Does not occur naturally

Epidemiological Studies

- TCE exposure is associated with several types of cancers including kidney, liver, cervix, and lymphatic system
- There are consistent studies with a strong association of TCE exposure and kidney cancer. Results are supported by studies showing specific renal cell mutations found in renal carcinoma patients exposed to TCE.

Sampling Methods

- Trichloroethylene is collected using a solid sorbent tube (coconut shell charcoal) at 100mg/50mg.
- Flow rate of 0.01 to 0.2 liters per minute
- A volume min of 1 liter at 100 ppm, and volume max at 30 liters
- Air, water, and soil samples can be the source of sampling.



Figure 1. Sorbent Tube for sampling
<https://www.skinc.com/products/sorbent-tubes-anasorb-csc-coconut-charcoal-1>

Analytical Methods

- The most common methods include:
 - Gas chromatography (best option)
 - NIOSH reference 1994a
 - Sample detection limit 27 ppm
 - Hall's electrolytic conductivity detector
 - Flame ionization detector



Figure 2. Trichloroethylene Product
<https://buygreenchem.com/products/trichloroethylene-tce-solvent-for-professional-cleaning-paint-mixing-hazmat-free-shipping>

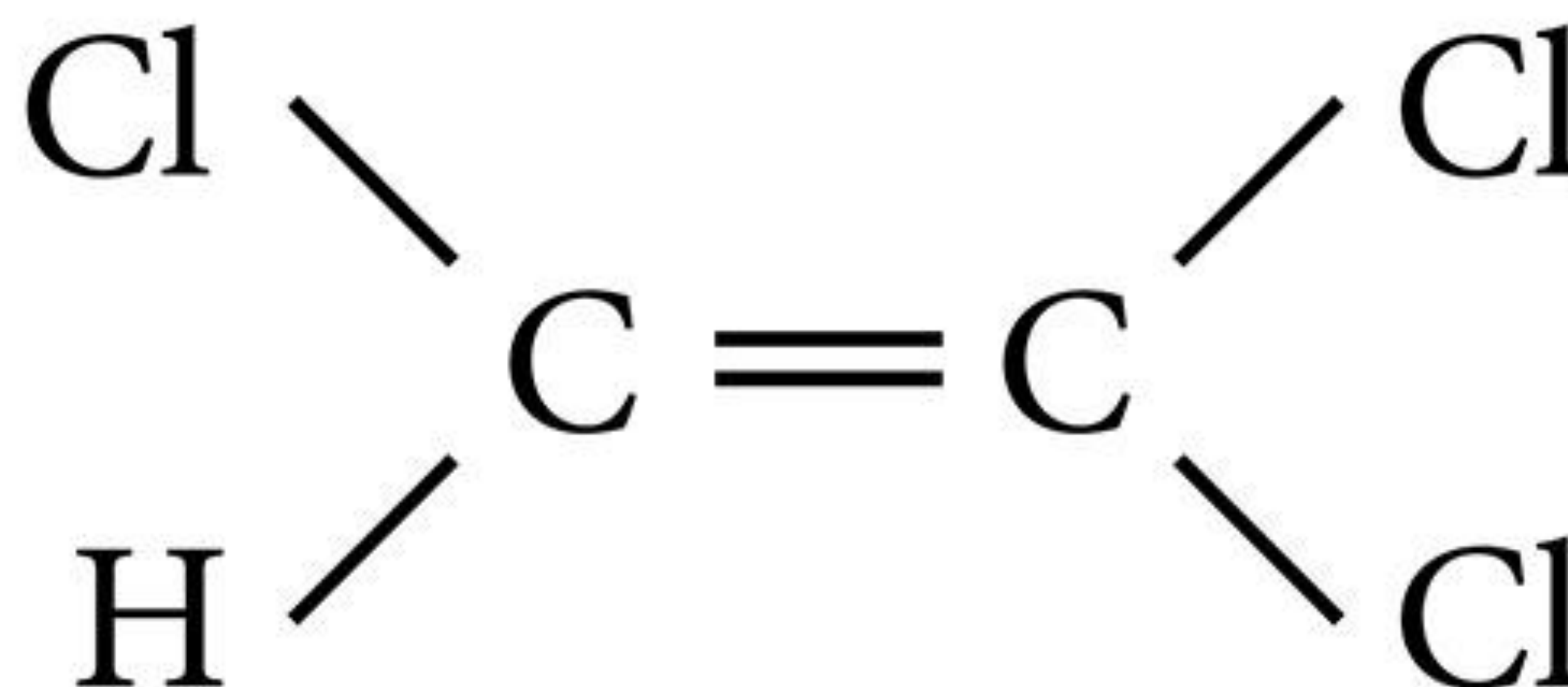


Figure 3. Trichloroethylene Chemical Composition
<https://www.ncbi.nlm.nih.gov/books/NBK138713/>

Occupational Exposure Limits (OELs)

- OSHA Permissible Exposure Limit (PEL)
 - 8-hr TWA – 100 ppm
- OSHA Action Level
 - 8-hr TWA – 8.8 $\mu\text{g}/\text{m}^3$
- NIOSH Recommended Exposure Limit (REL)
 - (Reduce exposure to lowest feasible concentration)
- ACGIH Threshold Limit Value (TLV)
 - 8-hr TWA – 10 ppm

Case Study

- NIOSH investigators visited the Superior Tube Company in Collegeville, Pennsylvania.
- It was a steel manufacturer where they used trichloroethylene has a degreasing solvent in their operation.
- The concentration of TCE in the air was 117-357 mg/m^3 with short term exposure as high as 2000 mg/m^3 .
- Urine samples collected from exposed workers before the shift contained an average of 298 mg/L of total TCE metabolites. The mean at 480 mg/L .

Control Measures

- Engineering control measures
 - Elimination or substitution of trichloroethylene. Also, the enclosure of the area in which it is used, and increased ventilation systems within the building area.
- Administrative controls measures
 - Work process training, job rotation, employee breaks, and limiting access to trichloroethylene.
- Personal protective equipment measures
 - The use of improved respirators, gloves to prevent skin contact, and the use of eye protection.

References

- <https://www.osha.gov/chemicaldata/684>
- <https://www.ncbi.nlm.nih.gov/books/NBK138713/>
- https://www.atsdr.cdc.gov/csem/trichloroethylene/who_is_at_risk.html
- <https://www.cdc.gov/niosh/topics/trichloroethylene/default.html>
- <https://www.cdc.gov/niosh/topics/hierarchy/default.html>
- <https://www.atsdr.cdc.gov/toxprofiles/tp19.pdf>
- <https://www.cdc.gov/niosh/hhe/reports/pdfs/80-49-808.pdf>
- <https://www.atsdr.cdc.gov/ToxProfiles/tp19-c7.pdf>
- <https://www.epa.gov/sites/default/files/2016-09/documents/trichloroethylene.pdf>