

Standard Operating Procedure

Carbon tetrachloride

This SOP is not complete until it has been signed and dated by the PI and relevant lab personnel.

Print a copy and insert into your
Laboratory Safety Manual and Chemical Hygiene Plan.
Refer to instructions for assistance.

Department:	Chemistry & Biochemistry - Chemical Engineering
Date SOP was written:	December 14, 2012
Date SOP was approved by PI/lab supervisor:	January 18, 2013
Principal Investigator:	Prof. Susannah Scott
Internal Lab Safety Coordinator/Lab Manager:	Stephanie Goubert-Renaudin
Lab Phone:	805-893-8941
Office Phone:	805-893-7403
Emergency Contact:	EH&S 24 hour line: 805-893-3194 (Name and Phone Number)
Location(s) covered by this SOP:	ESB 3324 and 3328 (Building/Room Number)

Type of SOP: ☐ Process ☒ Hazardous Chemical ☐ Hazardous Class

Purpose

Carbon tetrachloride (CCl₄) is a **carcinogen**. Hence, it is important to follow safety protocols to handle this chemical.

Uses: It is used as a solvent in synthetic chemistry research, but because of its adverse health effects, it is no longer commonly used, and chemists generally try to replace it with other solvents. It is sometimes useful as a solvent for infrared spectroscopy, because there are no significant absorption bands > 1600 cm⁻¹. Because carbon tetrachloride does not have any hydrogen atoms, it was historically used in proton NMR spectroscopy. However, carbon tetrachloride is toxic, and its dissolving power is low. Its use has been largely superseded by deuterated solvents. Use of carbon tetrachloride in determination of oil has been replaced by various other solvents, such as tetrachloroethylene. In organic chemistry, carbon tetrachloride serves as a source of chlorine in the Appel reaction. It is a useful solvent for halogenations either by the elemental halogen, or by a halogenation reagent such as *N*-bromosuccinimide (these conditions are known as Wohl-Ziegler Bromination).

Physical & Chemical Properties/Definition of Chemical Group

IUPAC Name: Carbon tetrachloride and Tetrachloromethane

CAS # 56-23-5

Carbon tetrachloride has practically no flammability at lower temperatures. Under high temperatures in air, it forms poisonous phosgene.

Appearance

Form: Liquid

Color: No data available

Safety data

pH: No data available

Melting point/freezing point - Melting point/range: -23 °C (-9 °F) - lit.

Boiling point: 76 - 77 °C (169 - 171 °F) - lit.

Flash point: Not applicable

Ignition temperature: No data available

Auto-ignition temperature: No data available

Lower explosion limit: No data available

Upper explosion limit: No data available

Vapor pressure 121.3 hPa (91.0 mmHg) at 20.0 °C (68.0 °F)

190.7 hPa (143.0 mmHg) at 30.0 °C (86.0 °F)

Density: 1.594 g/cm³ at 25 °C (77 °F)

Water solubility: No data available

Relative vapor density: No data available

Odor: No data available

Odor Threshold no data available

Evaporation rate: No data available

Potential Hazards/Toxicity

Emergency Overview

OSHA Hazards

Carcinogen, Target Organ Effect, Toxic by inhalation, Toxic by ingestion, Toxic by skin absorption

Target Organs

Liver, Kidney, Eyes, Nerves & Heart.

Other hazards which do not result in classification

Rapidly absorbed through skin

GHS Label elements, including precautionary statements

Pictogram



Signal word: Danger

HMIS Classification

Health hazard: 2

Flammability: 0

Physical hazards: 0

NFPA Rating

Health hazard: 3

Fire: 0

Reactivity Hazard: 0

Potential Health Effects

Inhalation Toxic if inhaled. May cause respiratory tract irritation.

Skin Toxic if absorbed through skin. May cause skin irritation.

Eyes May cause eye irritation.

Ingestion Toxic if swallowed.

Signs and Symptoms of Exposure

- Vomiting, Diarrhea, Abdominal pain, Nausea, Dizziness, Headache, Damage to the eyes, Liver injury may occur, Kidney injury may occur.
- Exposure to and/or consumption of alcohol may increase toxic effects.
- Contact with skin can cause Pain, Erythema, hyperemia

NOTE: Exposure to high concentrations of carbon tetrachloride (including vapor) can affect the Central Nervous System – CNS, degenerate the liver and kidneys and may result (after prolonged exposure) in coma and even death. Chronic exposure to carbon tetrachloride can cause liver and kidney damage and could result in cancer.

Personal Protective Equipment (PPE)

Respiratory protection

General guidelines: Respirators should be used only under any the following circumstances:

- As a last line of defense (i.e., after engineering and administrative controls have been exhausted).
- When Permissible Exposure Limit (PEL) has exceeded or when there is a possibility that PEL will be exceeded.
- Regulations require the use of a respirator.
- An employer requires the use of a respirator.
- There is potential for harmful exposure due to an atmospheric contaminant (in the absence of PEL)
- As PPE in the event of a chemical spill clean-up process

Lab personnel intending to use/wear a respirator mask must be trained and fit-tested by EH&S. This is a regulatory requirement.

Hand protection

Handle with **Nitrile** or **Supported PolyVinyl Alcohol (PVA)**.

http://www.ansellpro.com/download/Ansell_8thEditionChemicalResistanceGuide.pdf

Gloves must be inspected prior to use.

Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with Carbon tetrachloride.

Wash and dry hands.

Eye protection

Safety goggles.

Skin and body protection

- ✓ lab coat
- ✓ Full length pants or equivalent
- ✓ Close toed shoes

Hygiene measures

Avoid contact with skin, eyes and clothing.

Wash hands before breaks and immediately after handling Carbon tetrachloride.

Engineering Controls

- ✓ All operations involving Carbon tetrachloride must be carried out in a certified chemical fume hood (certified once every year by EH&S).
- ✓ Chemical fume hoods used as containment areas for Particularly Hazardous Substances (Select Carcinogens, Regulated Carcinogens, Reproductive Toxins and Acute Toxins) must have a face velocity of 100 ft/min averaged over the face of the fume hood.
- ✓ Laboratory rooms must be at negative pressure with respect to the corridors and external environment. To achieve this, the laboratory/room door must be kept closed at all times.

First Aid Procedures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

Special Handling and Storage Requirements

Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapor or mist.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Spill and Accident Procedure

Chemical Spill Dial **9-911** and EH&S (805-893-3194)

Spill – Assess the extent of danger. Help contaminated or injured persons. Evacuate the spill area. Avoid breathing vapors. If possible, confine the spill to a small area using a spill kit or absorbent material. Keep others from entering contaminated area (e.g., use caution tape, barriers, etc.).

Small (<1 L) – If you have training, you may assist in the clean-up effort. Use appropriate personal protective equipment and clean-up material for chemical spilled. Double bag spill waste in clear plastic bags, label and take to the next chemical waste pick-up.

Large (>1 L) – Dial **9-911** from campus phones (and **805-893-3446** from a cell phone) and EH&S (893-3194) for assistance.

Chemical Spill on Body or Clothes – Remove clothing and rinse body thoroughly in emergency shower for at least 15 minutes. Seek medical attention. *Notify supervisor and EH&S immediately.*

Chemical Splash Into Eyes – Immediately rinse eyeball and inner surface of eyelid with water from the emergency eyewash station for 15 minutes by forcibly holding the eye open. Seek medical attention. *Notify supervisor and EH&S immediately.*

Medical Emergency Dial **9-911**

Life Threatening Emergency, After Hours, Weekends and Holidays – Dial **9-911** (or 805-893-3446 from a cell phone) or go to the Emergency Room of Goleta Valley Cottage Hospital at 351 South Patterson Avenue, Goleta (Phone number: 805-967-3411) *Note: All Serious injuries must be reported to EH&S within 8 hours.*

Non-Life Threatening Emergency – Go to the Student Health Building, Building 588 (phone number: 893-5361, hours: M, T, R, F 8am-4.30pm, W 9am - 4.30pm, R 5pm to 7pm by appointment). After hours go to the Emergency Room of Goleta Valley Cottage Hospital at 351 South Patterson Avenue, Goleta (Phone number: 805-967-3411) *Note: All serious injuries must be reported to EH&S within 8 hours.*

Needle stick/puncture exposure (as applicable to chemical handling procedure) – Wash the affected area with antiseptic soap and warm water for 15 minutes. For mucous membrane exposure, flush the affected area for 15 minutes using an eyewash station. Page the needle stick nurse \ and then enter your extension. After hours go to the nearest emergency room: the Emergency Room of Goleta Valley Cottage Hospital at 351 South Patterson Avenue, Goleta (Phone number: 805-967-3411). *Note: All needle stick/puncture exposures must be reported to EH&S within 8 hours.*

Decontamination/Waste Disposal Procedure

Wearing the appropriate PPE, dispose of the used tetrachloride and disposables contaminated with it as hazardous waste in the appropriate containers.

Label Waste

- Affix an on-line hazardous waste tag on all waste containers using UCSB EH&S website as soon as the first drop of waste is added to the container

Store Waste

- Store hazardous waste in closed containers, in secondary containment and in a designated location
- Waste must be under the control of the person generating & disposing of it

Dispose of Waste

- Dispose of regularly generated chemical waste within 90 days
 - Call EH&S at x-3194 for questions
 - Empty Containers
 - Dispose as hazardous waste if it once held extremely hazardous waste (irrespective of the container size)
 - Consult waste pick-up schedule
- Prepare for transport to pick-up location
- Check on-line waste tag
 - Write date of pick-up on the waste tag
 - Use secondary containment

Material Safety Data Sheet (MSDS) Location

SDS can be found online: <http://ehs.ucsb.edu/units/labsfty/labrsc/chemistry/lchemmsdsacc.htm>

Protocol/Procedure

In the laboratory, carbon tetrachloride is stored in a ventilated cabinet or in the glove box. It is used as a solvent or a chlorinating agent of inorganic supports.

Due to its toxicity, when handling carbon tetrachloride, nitrile or polyvinyl alcohol gloves have to be worn at all time, in addition to a lab coat and safety goggles. Gloves have to be changed as soon as contaminated.

Due to its toxicity by inhalation, when not handled in a glove box, carbon tetrachloride is always used within a ventilated fume hood, and has to be kept inside a sealed container (in our lab, typically a Schlenk flask) to avoid contact with air when moved to the bench.

When used on vacuum line, it is typically degassed through freeze-pump thaw and stored under inert atmosphere. The Schlenk flask containing carbon tetrachloride is then never open at the atmosphere outside the glove box or the ventilated fume hood.

Glassware having contained carbon tetrachloride has to be rinsed within the fume hood before being moved out of it. Carbon tetrachloride has to be disposed as hazardous waste in the appropriate organic waste container, which has to be kept closed at all time.

NOTE: Any deviation from this SOP requires approval from PI.

Documentation of Training *(signature of all users is required)*

- ✓ Prior to conducting any work with carbon tetrachloride, designated personnel, i.e. approved users listed below, must provide training to his/her laboratory personnel specific to the hazards involved in working with this substance, work area decontamination, and emergency procedures.
- ✓ The Principal Investigator must provide his/her laboratory personnel with a copy of this SOP and a copy of the Carbon tetrachloride MSDS provided by the manufacturer.
- ✓ The Principal Investigator must ensure that his/her laboratory personnel have attended appropriate laboratory safety training or refresher training as required by EH&S.

I have read and understand the content of this SOP:

Name	Signature	Trainer	Date
Prof. Susannah Scott			
Stephanie Goubert-Renaudin			
Gary Kwanyi Ng			
Alessandro Gallo			
Anthony Crisci			
Haibo Yu			
Taeho Hwang			
Bethany Wigington			
Daniel Coller			
Zachary Jones			
Youhong Wang			
Jinghong Zhou			
Jason Fendi			