

OHS Registration #: _____

Expiration Date: _____

**STANDARD OPERATING PROCEDURE/APPROVAL FORM
FOR TRICHLOROETHYLENE**

Instructions: Please complete this form to request approval to use and possess highly toxic or carcinogenic material from the University Chemical Hygiene Committee as required by Chapter 12 of the University Chemical Hygiene Plan and University Policy 7-37.

Submit a separate form for each chemical. Copies of the current guidelines and Chemical Hygiene Plan are available at the DOHS web site: <http://www.udel.edu/OHS/>. For questions, please contact the University Chemical Hygiene Officer at 831-2103.

Form Updated: January 2007

Please attach a detailed synopsis of how this material will be used in your research.

Section I – Information

1. Principal Investigator(s): _____
2. E-Mail Address: _____
3. Department: _____
4. Address: _____
5. Phone Number: _____
6. Fax Number: _____
7. Lab(s) to be Used: _____
8. Chemical: Trichloroethylene

Section II – Use and Storage

A. Purchasing

All purchases of this material must have approval from the Principal Investigator (PI) or authorized personnel before ordering. The user is responsible to ensure that a current Material Safety Data Sheet (MSDS) is obtained unless a current one is already available within the laboratory. Quantities of this material will be limited to _____, and/or the smallest amount necessary to complete the experiment.

B. Authorized personnel

Please select the general categories of personnel who could obtain approval to use this material:

1. Principal Investigator
2. Graduate Students
3. Undergraduates
4. Technical Staff
5. Post Doctoral Employees
6. Other (Describe): _____

Please list the specific personnel and their approval level (Attach an addendum to this form for additional personnel):

NOTE: The Principal Investigator must be aware of all purchases of this material. The Principal Investigator must assure there is not an exceedance of the quantity limits.

1. _____	<input type="checkbox"/> Purchase	<input type="checkbox"/> Use the Material
2. _____	<input type="checkbox"/> Purchase	<input type="checkbox"/> Use the Material
3. _____	<input type="checkbox"/> Purchase	<input type="checkbox"/> Use the Material
4. _____	<input type="checkbox"/> Purchase	<input type="checkbox"/> Use the Material
5. _____	<input type="checkbox"/> Purchase	<input type="checkbox"/> Use the Material

The Principal Investigator will update this section when any personnel changes occur. If changes occur, document the changes (include the record of training of additional personnel) in the laboratory's files and submit an addendum to the University Chemical Hygiene Officer with all training documentation.

C. Storage

Materials will be stored according to compatibility and label recommendations in a designated area.

- Please list compounds that this chemical is incompatible with:
 - Segregate from strong oxidizers, strong alkalis, aluminum and magnesium powdered metals and alkali metals e.g. sodium, potassium, lithium.
 - Segregate from alcohol, water.
 - Other: _____
- Please list special storage requirements (I.E.: Refrigerated, Inert Atmosphere, Desiccated, etc.):
 - Observe manufacturer's storing and handling recommendations.
 - Store in original containers.
 - Keep containers securely sealed.
 - Store in a cool, dry and well-ventilated area.
 - Store away from incompatible materials.
 - Store away from foodstuff containers.
 - Protect containers against physical damage.
 - Check regularly for spills and leaks.
 - Other: _____
- Please list specific storage area (This Area Must be Marked and Labeled): _____

Storage areas will be inspected by laboratory personnel on a regular basis. Personnel will check for safety concerns such as improper storage, leaking/damaged container(s), damaged labels, quantities in excess of approved limits, theft/disappearance of material, etc. The inspector will also determine if an inventory reduction is possible. The Principal Investigator will designate one individual to complete this inspection.

- Please select an inspection frequency:

- Weekly Biweekly
 Bimonthly Monthly

D. Use location:

Materials shall be used only in the following designated areas.

Check all that apply:

1. Demarcated Area in Lab (Describe): _____
2. Fume Hood
3. Glove Box
4. Other (Describe): _____

Section III – Personnel Safety and Protection

A. Training requirements:

All users must demonstrate competency and familiarity regarding the safe handling and use of this material prior to purchase. The Principal Investigator is responsible for maintaining the training records for each user of this material. Training should include the following:

1. Review of current MSDS
2. Chemical Hygiene/Right-To-Know
3. Chemical Waste Management
4. Review of the OSHA Lab Standard
5. Review of the Chemical Hygiene Plan
6. Special training provided by the department/supervisor
7. Review of the departmental safety manual if applicable
8. Safety meetings and seminars
9. One-on-One hands-on training with the Principal Investigator or other knowledgeable laboratory personnel.
10. Other: _____

B. Personal Protective Equipment:

All personnel are required to wear the following personal protective equipment whenever handling this material:

1. Proper Laboratory Attire (Pants or dresses/shorts below the knees, sleeved shirt, closed-toe shoes)
2. Safety Glasses – **Researchers must upgrade to chemical safety splash goggles if a splash, spray or mist hazard exists. In general, safety glasses can be worn if the fume hood sash is properly positioned to provide the splash, spray and mist protection, otherwise indirect venting chemical safety splash goggles must be worn.**
3. Lab Coat
4. Chemical Protective Gloves (Describe): Silver Shield, Polyvinyl Alcohol, Polyethylene, Viton

Personnel may be required to wear other Personal Protective Equipment when working with this material. The Principal Investigator should contact the University Chemical Hygiene Officer to discuss the selection of chemical protective clothing (aprons, suits and gloves) and respirators. Please check all that apply:

1. <input type="checkbox"/> Chemical Safety Splash Goggles	2. <input type="checkbox"/> Face Shield
3. <input type="checkbox"/> Chemical Protective Clothing (Describe): _____	
4. <input type="checkbox"/> Chemical Protective Splash Apron (Describe): _____	
5. <input type="checkbox"/> Respirator (Type): _____	
6. <input type="checkbox"/> Other (Describe): _____	

C. Safe Work Practices

The following safe work practices should be employed when using this material:

1. Wear all required personal protective equipment
2. Cover open wounds
3. Wash hands thoroughly when work with the material is completed
4. No mouth pipetting
5. Use of sharps, such as glass Pasteur pipettes, needles, razor blades, etc. should be avoided or minimized
6. Must not work alone in the laboratory
7. Do not drink, eat or smoke in the laboratory
8. Keep containers securely sealed when not in use
9. Please list any other safe work practices: _____

D. Personnel Decontamination

For most exposures, decontamination should occur as follows:

1. Small Skin Exposures –
 - a. Wash contaminated skin in sink with tepid water for 15 minutes
 - b. Have buddy locate the MSDS
 - c. Wash with soap and water
 - d. Contact Occupational Health and Safety at 831-8475 for further direction
2. Eye Exposure –
 - a. Locate the emergency eye wash
 - b. Turn eye wash on and open eyelids with fingers
 - c. Rinse eyes for 15 minutes
 - d. Have buddy contact 911 for the Newark Campus, 911 for all others and locate the MSDS
 - e. Notify OHS
3. Large Body Area Exposure –

- a. Locate the emergency safety shower
- b. Stand under shower and turn it on
- c. Rinse whole body while removing all contaminated clothing
- d. Have buddy contact 911 for the Newark Campus, 911 for all others and locate the MSDS
- e. Rinse body for 15 minutes
- f. Notify OHS

Please list any special decontamination procedures: _____

E. Exposure Symptoms

1. **Eye Contact Symptoms:** There is some evidence to suggest that this material can cause eye irritation and damage in some persons. The material may produce moderate eye irritation leading to inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
2. **Skin Contact Symptoms:** Skin contact with the material may damage the health of the individual; systemic effects may result following absorption. This material can cause inflammation of the skin on contact in some persons. Toxic effects may result from skin absorption. The material may cause severe skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin.
3. **Ingestion Symptoms:** Accidental ingestion of the material may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the individual. Ingestion may result in nausea, abdominal irritation, pain and vomiting. Considered an unlikely route of entry in commercial/industrial environments.
4. **Inhalation Symptoms:** Inhalation may produce health damage*. There is some evidence to suggest that this material, if inhaled, can irritate the throat and lungs of some persons. Anesthetics and narcotic effects (with dulling of senses and odor fatigue) are a consequence of exposure to chlorinated solvents. Individual response varies widely; odor may not be considered objectionable at levels which quickly induce central nervous system effects. High vapor concentrations may give a feeling of euphoria. This may result in reduced responses, followed by rapid onset of unconsciousness, possible respiratory arrest and death. Inhalation of high concentrations of gas/vapor causes lung irritation with coughing and nausea, central nervous depression with headache and dizziness, slowing of reflexes, fatigue and inco-ordination. If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death. At sufficiently high doses the material may be neurotoxic (i.e. poisonous to the nervous system). At sufficiently high doses the material may be nephrotoxic (i.e. poisonous to the kidney). At sufficiently high doses the material may be hepatotoxic (i.e. poisonous to the liver). Systemic effects of trichloroethylene (TCE) exposure involve the central nervous system and produce headache, light-headedness, dizziness, ataxia, euphoria, confusion, drowsiness, and coma. Other adverse findings include nausea, vomiting, hypotension, bradycardia or tachycardia and hepatitis. Deaths may occur from ventricular arrhythmias as a result of sensitization of the myocardium to adrenaline or other catecholamines. Recovery from narcotic effects is usually rapid following cessation of exposure. Trigeminal nerve impairment and peripheral neuropathy have been reported following TCE exposure. Evidence of acute human toxicity comes mainly from the use of TCE as an anesthetic. Tachypnea and ventricular arrhythmias are experienced at inhaled concentrations exceeding 15000 ppm. Systemic toxicity is low following anesthesia. Occasional hepatotoxicity (liver dysfunction) has been reported; this is probably due to the breakdown of TCE to dichloroacetylene and phosgene by soda-lime present in some anesthetic devices. The effects of TCE appear to be enhanced in some individuals by simultaneous exposure to

caffeine, ethanol and other drugs. "Degreaser's Flush" describes a reddening of facial, neck and back skin and is seen by certain individuals after exposure to TCE.

5. **Chronic Exposure Symptoms:** There is ample evidence that this material can be regarded as being able to cause cancer in humans based on experiments and other information. Principal routes of exposure are usually by inhalation of vapor, skin contact/absorption and eye contact. The carcinogenicity of halogenated oxiranes may lie in the reactivity of an epoxide intermediate. It is reported that 1,1-dichloroethylene, vinyl chloride, trichloroethylene, tetrachloroethylene and chloroprene, for example, are carcinogens in vivo. Symmetrically substituted oxiranes such as 1,2-dichloroethylene and 1,1,2,2-tetrachloroethylene are more stable and less mutagenic than unsymmetrical chlorinated oxiranes such as 1,1-dichloroethylene, 1,1,2-trichloroethylene and monochloroethylene (vinyl chloride). The carcinogenicity of 1,1-dichloroethylene has primarily been associated with inhalation exposure while that of vinyl chloride, trichloroethylene and tetrachloroethylene occurs following exposure by both inhalation and oral routes. National Toxicology Program Toxicity Report Series Number 55; April 2002. Various studies report an association between cancer and industrial exposure to tetrachloroethylene; IARC concluded that this evidence is sufficient to assign appropriate warnings. Similar warnings have been issued by IARC for vinyl fluoride. Vinyl bromide exhibited neoplastic and tumorigenic activity in rats exposed by inhalation and is classified by various bodies as potentially carcinogenic. Substances such as chloroprene (2-chloro-1,3-butadiene), are reported to produce an increased frequency of chromosomal aberrations in the lymphocytes of Russian workers. Russian epidemiological studies also suggest an increased incidence of skin and lung cancer following exposure to chloroprene, a result which is not supported by other studies. Generally speaking, the monohalogenated substances exhibit higher carcinogenic potential than their dihalogenated counterparts. Whether additional substitution lessens such hazard is conjectural. Tetrafluoroethylene, for example, produced clear evidence of carcinogenic activity in a two-year inhalation study in rats and mice. National Toxicology Program Technical Report Series 450, April 1997.

Recommended Medical Treatment

The ChemWatch MSDS, which is available at <http://www.udel.edu/OHS/> oftentimes, has treatment information for Emergency Room Personnel and Doctors to follow. Please list any information that can be provided to assist with the treatment:

Treat symptomatically.

DO NOT administer sympathomimetic drugs as they may cause ventricular arrhythmias.

Following acute or short-term continued exposures to trichloroethylene:

- Trichloroethylene concentration in expired air correlates with exposure. 8 hours exposure to 100 ppm produces levels of 25 ppm immediately and 1 ppm 16 hours after exposure.
- Most mild exposures respond to removal from the source and supportive care. Serious toxicity most often results from hypoxemia or cardiac dysrhythmias so that oxygen, intubation, intravenous lines and cardiac monitoring should be started initially as the clinical situation dictates.
- Ipecac syrup should be given to alert patients who ingest more than a minor amount and present within 2 hours.
- The efficacy of activated charcoal and cathartics is unclear.
- The metabolites, trichloroacetic acid, trichloroethanol and to a lesser degree, chloral hydrate, may be detected in the urine up to 16 days postexposure.

[Ellenhorn and Barceloux; Medical Toxicology]

BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
1. Trichloroacetic acid in urine	10 mg/gm creatinine	End of work-week	NS
2. Trichloroacetic acid AND Trichloroethanol in urine	300mg/mg creatinine	End of shift at end of work-week	NS
3. Free Trichlorethanol in blood	4 mg/L	End of shift at end of work-week	NS
4. Trichloroethylene in end-exhaled air			SQ
5. Trichloroethylene in blood			SQ

NS: Non-specific determinant; also seen after exposure to other materials

SQ: Semi-quantitative determinant - Interpretation may be ambiguous; should be used as a screening test or confirmatory test.

F. Spills

The laboratory should be prepared to clean up minor spills (25 ml/25 g or less) of highly toxic/carcinogenic materials should they occur in a properly operating fume hood. Chemical spill clean up guidance can be found at <http://www.udel.edu/OHS/chemspillkit/chemspillkit.html>. Laboratory personnel cleaning up a spill will wear all personal protective equipment listed above and manage all cleanup debris according the waste disposal section. Notify OHS of any spills, even if the lab staff handled the clean-up.

Please list the following:

1. Location of Spill Cleanup Materials for a small spill: _____
2. Any special measures/cleanup material required to cleanup a spill:
 - a. Clean up all spills immediately. Avoid breathing vapors and contact with skin and eyes. Wear protective clothing, impervious gloves and safety glasses. Wipe up and absorb small quantities with vermiculite or other absorbent material. Place spilled material in clean, dry, sealable, labeled container. Manage through the chemical waste program
 - b. Other: _____

If a spill is large or occurs outside of a fume hood, the laboratory occupants should immediately vacate the laboratory, close all doors and contact Occupational Health & Safety at 831-8475 during working hours or 911 after hours. If the laboratory personnel determine that the spill is not contained to the lab or could cause harm to people outside the laboratory, they should pull the building fire alarm and go to the Emergency Gathering Point to await the University Police and Emergency Responders. The responsible/knowledgeable person should provide the University Police and the Emergency Responders with the following:

1. Common Name of the Material Involved
2. A copy of a MSDS, if possible
3. Any pertinent information related to the emergency, such as location in the lab, other hazards in the lab, etc.

G. Emergency Phone Numbers:

Below are a list of emergency numbers to contact in the event of an emergency:

1. Police, Fire or Medical Emergency, call – 911 on the Newark Campus, 9-911 for all others
2. Occupational Health & Safety – X8475

Please provide a list of other emergency phone numbers, such as after hour contacts for laboratory personnel or any other important phone number, to be used in the event of an emergency: _____

H. Other Special precautions

Please list any other special precautions or procedures not listed in the above sections. Please be as specific as possible: _____

Section VI – Waste Disposal

The authorized person using this material is responsible for the safe collection, preparation and proper disposal of waste unless otherwise stated below. Waste shall be disposed of as soon as possible and in accordance with all laboratory and University procedures. All personal must obtain chemical waste disposal training via DOHS.

Collect solid waste material in a 7mil polyethylene bag and label with an orange chemical waste label. Collect liquid waste in a "Justrite" container provided by DOHS. Label with a hazardous waste label. Use proper laboratory ventilation such as a fume hood to manage both liquid and solid wastes. Contact DOHS for removal. Do not put in the normal trash or pour any solutions down the drain.

Addition Instructions: _____

Section V – Signature and Verification

Your signature below indicates that you have completed this form accurately to the best of your knowledge, you acknowledge all requirements and restrictions of this form and that you accept responsibility for the safe use of the material.

1. Prepared By: _____

Date: _____

Signature: _____

2. Principal Investigator: _____

Date: _____

Signature: _____

Section VI – Approval Process

A. University Chemical Hygiene Officer Approval

The Principal Investigator should have this form completed as accurately as possible. Please e-mail or fax this form to the University Chemical Hygiene Officer at eich@udel.edu or 831-1528. The Chemical Hygiene Officer will review and verify the form and make any necessary changes or updates.

1. University CHO: _____ Date: _____

Signature: _____

B. Conditional Approval to Purchase and Use

This form will then be e-mailed or faxed to a member of the University Chemical Hygiene Committee (CHC), usually from the same department as the requesting PI. The Committee Member will meet with the Principal Investigator or designee and discuss the form and the use of the material. If the Committee Member finds the procedure acceptable, they can offer a conditional approval for purchase and use of this material.

2. CHC Member: _____ Date: _____

Signature: _____

C. Full Approval

A signed copy of the form will be sent, via campus mail, to the University Chemical Hygiene Officer, who will bring it up at the next Chemical Hygiene Committee Meeting for full approval. All approvals will be good for two years. The complete, signed approval form will be kept on file with Occupational Health & Safety and a copy will be sent to the Principal Investigator to keep on file.

3. Acceptance: _____ Date: _____

CHC Chair: _____

Signature: _____

D. Approval Expiration

The approval for use and purchase of this material will expire should any of the approved information change, with the exception of Section II, B and C, Authorized Personnel and Storage Location, or two years after CHC approval. If, at the end of two years, the procedure is substantially the same, the Principal Investigator can complete a renewal form and send it to the University CHO, who can approve the renewal for an additional two years.

CHECKLIST FOR POSSESSION AND USE OF CARCINOGENS AND HIGHLY TOXIC MATERIALS

The checklist is provided to assist a researcher with the approval process for possession and use of carcinogens and highly toxic materials. This form may be kept on file in the laboratory with the SOP to serve as documentation. The complete procedure can be found in the University Chemical Hygiene Plan in Chapter 12.

Date and Initial	
_____	1. Complete a Standard Operating Procedure/Approval Form For Carcinogens and Highly Toxic Materials and submit this form to OHS for review
_____	2. Review and make OHS's changes and recommendations
_____	3. Meet with a member of the University Chemical Hygiene Committee to review the approval form and the use of the material.
_____	4. Submit (via campus mail) the completed and signed form back to the University Chemical Hygiene Officer for conditional approval to purchase and use the material. The University Chemical Hygiene Committee will review this form at the next scheduled meeting for full approval.
_____	5. Complete a Job Hazard Analysis (JHA) for each experiment in which this compound is used. These JHAs must be kept on file in the laboratory and updated every 5 years or when a process changes.
_____	6. Provide and document training for every worker who will use the material. Training shall include hands-on instruction as well as review of the JHA, SOP and the University Chemical Hygiene Plan; specifically Chapter 12.
_____	7. Conduct a trial run with OHS present.
_____	8. Have OHS present the first time a process using this material occurs.