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| **Brueckner Lab-Specific Standard Operating Procedure (LSOP):****Thiophosgene (CSCl2)** |
| **Principal Investigator(PI):** Christian Brueckner |
| **Building:** Chemistry | **Lab(s) Covered by LSOP:** R413/R415 |
| **Department:** Chemistry | **Lab Phone Number(s):** 6-6596/6-6598 |
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| **Chemical** | **GHS Pictograms** | **Definitions** |
| **Thiophosgene** |  | **Severe Toxicity.** May cause severe injury or death. |
| **SECTION 1 – CHEMICAL and HAZARDS**  |
| Thiophosgene is a deep red, volatile liquid of strong smell that is toxic if inhaled, harmful if ingested, and may be harmful if absorbed through the skin. It causes burns by all exposure routes. It can cause skin irritation and serious ocular damage. Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract. Symptoms of exposure include nausea, vomiting, diarrhea, shortness of breath, coughing, pulmonary edema, and excessive tearing.  |
| **SECTION 2 – ADMINISTRATIVE CONTROLS** |
| * Anyone using the chemicals and procedures described herein needs to have undergone the annual EH&S [Chemical Hygiene Training](http://www.ehs.uconn.edu/Chemical/?p=training).
* Lab-specific safety training must be provided by the principal investigator (PI) or other qualified personnel to all researchers working with hydrazine; documentation of training is required.
* Read the safety data sheet (SDS) for thiophosgene prior to use: <http://www.msds.com>
* Researchers must not work alone with thiophosgene.
* Experiments must be performed during normal business hours.
* An eyewash and safety shower must be in the immediate work area where hydrazine is used.
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| **SECTION 3 – ENGINEERING CONTROLS** |
| * All work with thiophosgene must be conducted in a chemical fume hood, under dry conditions, with the sash at the lowest working height and with sliding sash panels (if applicable) aligned to form a barrier between the researcher and the experiment.
* Chemical fume hoods must have been tested by EHS within the last year. If the hood is not working properly, contact Facilities (486-3113) to repair the hood or EHS to retest (486-3613).
* Use of thiophosgene outside of chemical fume hoods is not permitted.
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| **SECTION 4 – WORK PRACTICES** |
| * Thiophosgene must be handled and stored in a dry place. Keep away from incompatible materials (water, alcohols) and conditions. Keep cool.
* All containers of thiophosgene must be clearly labeled with the chemical name and hazard classes and kept tightly-sealed.
* Empty containers of thiophosgene must be handled carefully since product residues (vapors, liquid) are still harmful. Empty containers must be rinsed before the bottle is submitted for disposal.
* Do not recycle solvents coming from reactions that involved thiophosgene.
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| **SECTION 5 – PERSONAL PROTECTIVE EQUIPMENT** |
| At a minimum, a closed-up lab coat, closed-toed footwear and chemical safety glasses that meet ANSI standard Z-87.1 must be worn. Nitrile gloves must be worn. When handling larger than 20 mL of thiophosgene, the use of a face shield is recommended. |
| **SECTION 6 – STORAGE** |
| * Store thiophosgene stored in a dry, cool, well-ventilated, and dark place (acid chloride cabinet in R415).
* May be stored in a dedicated desiccator; unopened can may be stored in chemical fridge.
* Ensure labels on original bottles remain legible and prominently displayed to identify contents and that both original and secondary containers remain intact and are stored with tight-fitting caps or lids.
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| **SECTION 7 – SPILLS AND ACCIDENTS PROCEDURES** |
| * Evacuate the laboratory if a > 2 mL spill of thiophosgene has occurred outside the fume hood.
* Close door(s) to lab and post a “NO ENTRY” sign spelling out the origin of the danger.
* In case of large (>50 mL) spill, activate the fire alarm and call **911** and inform the first responders of the nature of the chemical spill.
* Do not re-enter area until instructed to do so by UCFD or other emergency personnel.

**Report any incident to the PI and fill out the** [**accident form**](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwiF3bPe1dPXAhVRRN8KHX4wDf4QFggmMAA&url=https%3A%2F%2Fchemistry.uconn.edu%2Fwp-content%2Fuploads%2Fsites%2F1259%2F2015%2F09%2FIncident-Report-Form.doc&usg=AOvVaw3Uov8IQ2Z-Kan)**.** |
| **SECTION 8 – FIRST AID PROCEDURES** |
| *Eyes** Immediately move to the eyewash station, hold eyelids open and flush with water. Remove contact lenses while flushing (if applicable).
* Have another person from the lab dial **911** and specifically mention thiophosgene exposure.
* Continue flushing the eyes until emergency personnel arrive.

*Skin** Immediately move to safety shower or other water source and begin rinsing affected area(s). Remove contaminated clothing (if applicable) while flushing.
* Have another person from the lab dial **911** if intense skin irritation and specifically mention thiophosgene exposure. Flush affected area(s) under safety shower for at least 15min.
* Keep applying rinsing affected area(s) until emergency personnel arrive.

*Ingestion** Immediately rinse the mouth with cold water. Do NOT induce vomiting.
* Have another person from the lab dial 911 and specifically mention thiophosgene exposure.

*Inhalation** Move to fresh air.
* Dial **911** and inform emergency responders that the accident involved thiophosgene.

**Report any incident to the PI and fill out the** [**accident form**](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwiF3bPe1dPXAhVRRN8KHX4wDf4QFggmMAA&url=https%3A%2F%2Fchemistry.uconn.edu%2Fwp-content%2Fuploads%2Fsites%2F1259%2F2015%2F09%2FIncident-Report-Form.doc&usg=AOvVaw3Uov8IQ2Z-Kan) |
| **SECTION 9 – HAZARDOUS WASTE MANAGEMENT** |
| * All thiophosgene waste must be labeled with “Hazardous Waste” stickers or tags, use full chemical names to describe the waste, be stored in sturdy, plastic containers with tight-fitting caps or lids, and be stored alone or with other compatible chemicals.
* Hazardous wastes must be stored at or near a green “Satellite Accumulation Area” sign prior to disposal by EHS. Once the containers are 80% filled, fill our EH&S chemical [waste pickup form](http://ehs.uconn.edu/Regulated%20Waste%20Management/index.php)
* The [Chemical Waste Disposal Manual](http://ehs.uconn.edu/Chemical/ChemWasteDisp.pdf) must be used as a reference.
* Be aware that a strong smell might emanate from the thiophosgene waste streams!
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| **SECTION 10 – DECONTAMINATION PROCEDURES (*Attach or insert steps. Add more lines as necessary).*** |
| Work Area | Removal - Equipment can be decontaminated through rinse with copious amounts of water with surfactants, ethanol, or acetone is recommended. |
| Personal Hygiene | * Use standard chemical hygiene practices regarding PPE (see above).
* Upon contamination, wash affected areas immediately.
* Working with thiophosgene readily leaves one with a heavy, bad smell; a change of clothing before returning home is recommended.
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| **SECTION 11 – SPECIFIC PROCEDURE**  |
| A typical use of thiophosgene in our laboratories (Brückner, C.; Rettig, S. J.; Dolphin, D. ‘2-Pyrrolylthiones as Monoanionic Bidentate N,S-Chelators: Synthesis and Molecular Structure of 2-Pyrrolylthionato-Complexes of Nickel(II), Cobalt(III) and Mercury(II)’ *Inorg. Chem.* **2000**, *39*, 6100–6106.) is fully described in: PS Clezy, P.S.; Smythe, G. A. ‘The chemistry of pyrrolic compounds. VIII. Dipyrrylthiones’ *Australian J. Chem.* **1969**, *22*(1), 239 – 249.A solution of pyrrole (2.5 g) in dry ether (25 ml) was added dropwise to a vigorously stirred solution of thiophosgene (2.1 g) in benzene (50 ml) at 0°C.After 10 mL aqueous methanol (80%; 60 ml) was added, the mixture stirred for 30 min more at room temperature, the solvents removed and the residue, dissolved in benzene : chloroform (9 : 1; 50 ml) chromatographed on alumina. The first fraction (bright orange-red band) was collected, the solvent removed under pressure, and the residue further purified by recrystallization from aqueous ethanol to give 2,2'-dipyrrylthione (2.0 g), as lustrous red needles. |

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| **SECTION 12A. APPROVAL** |
| I have reviewed, understand and agree to follow this lab-specific standard operating procedure (LSOP) for thiophosgene*.* Failure to follow this LSOP or lab-specific training guidelines is a violation of the [*University Health & Safety Policy*](http://policy.uconn.edu/2011/05/19/health-and-safety-policy/) and [*University Code of Conduct*](http://policy.uconn.edu/2011/05/17/employee-code-of-conduct/).Further approval and/or review of this LSOP by the PI/Supervisor is required if any of the following events occur:* A significant change in amount (i.e., doubling of the scale of reaction) or substitution of the chemicals in the procedure is planned
* A major change in the agreed-upon experimental set-up is planned (heating instead of room temp, etc.)
* Any signs of a failure in safety design or equipment are observed
* Any signs or symptoms of a chemical exposure to any personnel are observed
* Unexpected and/or potentially dangerous experimental results occur (e.g., fire, uncontrolled buildup of heat and/or pressure, etc.)
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| **Researcher Name/Signature** | **Trainer Name/Signature** | **Training Date** |
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| **SECTION 12B. PRINCIPAL INVESTIGATOR CERTIFICATION** |
| I approve the contents of the lab-specific standard operating procedure listed above. |
| **PI Signature:** | **Date:** |
| **A HARD OR ELECTRONIC COPY (https://bruckner.research.uconn.edu/safety-resources/) OF EACH LAB-SPECIFIC STANDARD OPERATING PROCEDURE MUST BE READILY AVAILBALE IN THE LAB.** |