



### Chemical Standard Operating Procedure

All work involving materials classified as Particularly Hazardous requires the completion of Section 6.

<b>Procedure Name</b>		Thin Layer Chromatography (TLC)			
<b>Procedure Author</b>					
<b>Name of Responsible Person</b>					
<b>Location to be Performed</b>					
<b>Creation Date</b>			<b>Review Date(s)</b>		<b>Revision Date(s)</b>
1.	<b>THIS STANDARD OPERATING PROCEDURE (SOP) IS FOR A:</b>				
	<input type="checkbox"/> Specific laboratory procedure or experiment <ul style="list-style-type: none"> <li>Examples: synthesis of chemiluminescent esters</li> </ul> <input checked="" type="checkbox"/> Generic laboratory procedure that covers several chemicals <ul style="list-style-type: none"> <li>Examples: distillation, chromatography</li> </ul> <input type="checkbox"/> Generic use of a specific chemical or class of chemicals with similar hazards <ul style="list-style-type: none"> <li>Examples: Organic azides, mineral acids, hydrofluoric acid</li> </ul>				
2.	<b>DESCRIPTION:</b> <i>Briefly describe how the chemical will be used.</i>				
	Thin-layer chromatography (TLC) is a technique for identifying compounds, determining their purity and following the progress of a reaction.				
3.	<b>RISK IDENTIFICATION:</b> <i>Identify potential safety hazards – refer to Section 2 of the SDS.</i>				
	<input type="checkbox"/> Explosive <input type="checkbox"/> Pyrophoric <input checked="" type="checkbox"/> <b>Flammable (liquid, solid, gas or aerosol)</b> <input type="checkbox"/> Self-Reactive <input type="checkbox"/> Peroxide Forming <input type="checkbox"/> Organic Peroxide <input checked="" type="checkbox"/> <b>Oxidizing (liquid, solid or gas)</b> <input type="checkbox"/> Water-Reactive <input type="checkbox"/> Compressed Gases <input type="checkbox"/> Cryogen <input type="checkbox"/> Corrosion to Metals <input type="checkbox"/> Radionuclides <input type="checkbox"/> Other: Click or tap here to enter text.		<input type="checkbox"/> Carcinogen <input type="checkbox"/> Sensitizer (respiratory and/or skin) <input type="checkbox"/> Irritant (skin and/or eye) <input type="checkbox"/> Corrosive (skin and/or eye damage) <input checked="" type="checkbox"/> <b>Acute Toxicity (oral, dermal and/or inhalation)</b> <input type="checkbox"/> Germ Cell Mutagen <input type="checkbox"/> Reproductive Toxicity <input type="checkbox"/> Target Organ Systemic Toxicity: Single Exposure <input type="checkbox"/> Target Organ Systemic Toxicity: Repeated Exposure <input type="checkbox"/> Other: Click or tap here to enter text.		
	Notes (include chemicals that will be used, additional cautions, permissible exposure limits, etc.):				
	Specify hazards for each chemical and highlight any <b>Particularly Hazardous Chemicals.</b>				



Common hazardous solvents that may be used (not all inclusive):

- **Methanol (particularly hazardous)**
  - Highly flammable liquid and vapor, toxic if swallowed, toxic in contact with skin, toxic if inhaled, causes damage to organs.
- Ethanol
  - Highly flammable liquid and vapor, causes serious eye irritation, causes damage to organs.
- Isopropanol
  - Highly flammable liquid and vapor, causes serious eye irritation, may cause drowsiness or dizziness.
- Acetic acid
  - Flammable liquid and vapor, causes severe skin burns and eye damage, may be harmful if swallowed, toxic if inhaled, harmful in contact with skin.
- Acetone
  - Highly flammable liquid and vapor, causes serious eye irritation, may cause drowsiness or dizziness, may cause damage to organs through prolonged or repeated exposure.
- Acetonitrile
  - Highly flammable liquid and vapor, toxic in contact with skin.
- Ethyl Acetate
  - Highly flammable liquid and vapor, may cause drowsiness or dizziness, causes serious eye irritation.
- **Chloroform (particularly hazardous)\***
  - Harmful if swallowed, causes skin irritation, causes serious eye irritation, toxic if inhaled, suspected of causing cancer, suspected of damaging fertility or the unborn child. OSHA PEL Ceiling = 50 ppm, ACGIH 8-hour TWA = 10ppm
- **Dichloromethane (particularly hazardous)\***
  - Causes skin irritation, causes eye irritation, may cause drowsiness or dizziness, may cause cancer, may cause damage to organs through prolonged or repeated exposure. OSHA PEL TWA (8-hour) = 25 ppm.
- Diethyl ether
  - Extremely flammable liquid and vapor, may be fatal if swallowed and enters airways, causes serious eye irritation, may cause drowsiness or dizziness, may form explosive peroxides.
- Toluene
  - Highly flammable liquid and vapor, may be harmful if swallowed and enters airways, causes skin irritation, may cause drowsiness or dizziness, suspected of damaging fertility or the unborn child, may cause damage to organs through prolonged or repeated exposure.
- Cyclohexane
  - Highly flammable liquid and vapor, causes skin irritation, may cause drowsiness or dizziness, may be fatal if swallowed and enters airways.



	<ul style="list-style-type: none"> <li>• <b>Petroleum ether (particularly hazardous)*</b> <ul style="list-style-type: none"> <li>○ Highly flammable liquid and vapor, may be fatal if swallowed and enters airways, may cause genetic defects, may cause cancer.</li> </ul> </li> <li>• Hexane           <ul style="list-style-type: none"> <li>○ Highly flammable liquid or vapor, may be fatal if swallowed and enters airways, causes skin irritation, suspected of damaging fertility or the unborn child, may cause damage to organs through prolonged or repeated exposure.</li> </ul> </li> <li>• Pentane           <ul style="list-style-type: none"> <li>○ Extremely flammable liquid and vapor, may be fatal if swallowed and enters airways, may cause drowsiness or dizziness.</li> </ul> </li> </ul> <p>Common hazardous detection reagents that may be used (not all inclusive):</p> <ul style="list-style-type: none"> <li>• Iodine           <ul style="list-style-type: none"> <li>○ Harmful in contact with skin or if inhaled, causes skin irritation, causes serious eye irritation, may cause respiratory irritation, causes damage to organs through prolonged or repeated exposure if swallowed.</li> </ul> </li> <li>• Ceric ammonium sulfate           <ul style="list-style-type: none"> <li>○ Causes skin irritation, causes serious eye irritation, may cause respiratory irritation.</li> </ul> </li> <li>• Cerium sulfate           <ul style="list-style-type: none"> <li>○ Causes skin irritation, causes serious eye irritation.</li> </ul> </li> <li>• Ferric chloride           <ul style="list-style-type: none"> <li>○ May be corrosive to metals, harmful if swallowed, causes severe skin burns and eye damage.</li> </ul> </li> <li>• Morin hydrate           <ul style="list-style-type: none"> <li>○ Causes skin irritation, causes serious eye irritation, may cause respiratory irritation.</li> </ul> </li> <li>• Ninhydrin           <ul style="list-style-type: none"> <li>○ Harmful if swallowed, causes skin irritation, causes serious eye irritation.</li> </ul> </li> <li>• Dinitrophenylhydrazine (DNP)           <ul style="list-style-type: none"> <li>○ Flammable solid, harmful if swallowed, causes eye irritation.</li> </ul> </li> <li>• Vanillin           <ul style="list-style-type: none"> <li>○ May form combustible dust in air, causes serious eye irritation</li> </ul> </li> <li>• Potassium permanganate           <ul style="list-style-type: none"> <li>○ May intensify fire; oxidizer, harmful if swallowed, causes severe skin burns and eye damage, causes serious eye damage.</li> </ul> </li> <li>• Phosphomolybdic acid           <ul style="list-style-type: none"> <li>○ May intensify fire; oxidizer, causes severe skin burns and eye damage.</li> </ul> </li> </ul> <p>* In identifying PHC for a laboratory, it is necessary to consider the nature of the hazard. Check SDS – particularly hazardous characteristics may vary based on form and concentration</p>
4.	<p><b>WHAT ENGINEERING CONTROLS WILL BE USED TO MINIMIZE EXPOSURES TO THESE HAZARDS?</b> <i>select all that apply</i></p>



	<input checked="" type="checkbox"/> Fume Hood <input type="checkbox"/> Snorkel <input type="checkbox"/> Glove Box <input type="checkbox"/> Clean Room <input type="checkbox"/> Explosion Shielding <input type="checkbox"/> Splash Shielding <input type="checkbox"/> Beta Shielding <input checked="" type="checkbox"/> Safety Storage Cabinet <input type="checkbox"/> Flammable Storage Refrigerator <input type="checkbox"/> Other: Click or tap here to enter text.
5.	<p><b>WHAT PERSONAL PROTECTIVE EQUIPMENT IS REQUIRED TO MINIMIZE THESE HAZARDS?</b>  <i>select all that apply</i></p> <input checked="" type="checkbox"/> Safety Glasses <input checked="" type="checkbox"/> Lab Coat <input type="checkbox"/> Fire-Resistant Lab Coat <input checked="" type="checkbox"/> Gloves - specify type: Check glove compatibility charts based on solvent <input type="checkbox"/> Acid Resistant Gloves <input type="checkbox"/> Acid Resistant Apron <input type="checkbox"/> Face shield <input type="checkbox"/> Other: Click or tap here to enter text.
6.	<p><b>STEP-BY-STEP OPERATING PROCEDURE</b></p> <p><i>Provide a sequential description of work, including as much detail as possible such as designated work area(s), chemical concentrations ranges and amount used (mass, volume) and when special safety equipment is to be utilized. Include temperature, pressure, and other experimental conditions if possible. Pictures and schematics are recommended for complex setups. <b>Highlight the steps with the highest hazards.</b></i></p> <p>Keep ignition sources (eg. Bunsen burners) at least 10 ft away from TLC apparatus and the solvents used.</p> <ol style="list-style-type: none"> <li>1. Using scissors or paper cutter, cut TLC plate to appropriate size.</li> <li>2. Using a ruler and pencil (do not use a pen), draw a line 1 cm above and parallel to the TLC plate bottom.</li> <li>3. Mark and label spots for the application of the target compound.</li> <li>4. Using a 10 uL glass capillary tube in a 10 uL glass capillary pipettor, add target compounds(s) to TLC plate.</li> </ol> <p><b>Target compounds may be TOXIC or BIOHAZARD. Please note the associated hazards.</b></p> <ol style="list-style-type: none"> <li>5. Let all compounds applied to TLC plate dry completely.</li> <li>6. Thoroughly wash TLC tank using mild detergent soap. Rinse each side three times with hot water, three times with deionized water, once with HPLC-grade methanol and</li> </ol>



	<p>dry under compressed air. Then, rinse each surface with HPLC-grade acetone and dry under compressed air</p> <p>7. Make fresh TLC solvent and add to tank.</p> <p><b>Solvents used as mobile phases may be TOXIC (eg. chloroform, hexane, butanol) and/or FLAMMABLE (eg. hexane, butanol, ethyl acetate). Please note the associated hazards. Do not allow skin to come into contact with TLC solvents and do not breathe the fumes of these solvents.</b></p> <p>8. Cover tank opening with plastic wrap, followed by tank lid and place lead weight on top. Allow tank to equilibrate for 5-10 minutes. Tank should be sealed as best as possible to minimize leakage of solvent fumes. Ideally, tank should be placed in the fume hood.</p> <p>9. Place plate(s) in equilibrated TLC tank.</p> <p>10. Let plate(s) sit in tank until solvent reaches top of the plate.</p> <p>11. Remove plate and let dry completely on foil in the fume hood or well-ventilated area.</p> <p>12. Place plate in TLC spraying area.</p> <p>13. Thoroughly spray TLC plate with desired detection reagent in fume hood and use appropriate PPE.</p> <p><b>Reagents used for detection may be toxic or corrosive.</b></p> <p>14. If using UV light for detection, wear UV-blocking eyewear or a full-face shield that is rated as UV-proof, long-sleeve protective clothing and gloves. Always aim the UV lamp away from your body, minimize the amount of time you need to have the UV turned on.</p> <p>15. If necessary, heat TLC plate with heat gun to complete plate development.</p> <p><b>CAUTION, HOT! Use necessary steps to prevent burns.</b></p> <p>16. Immediately scan developed TLC plate to preserve results.</p>				
7.	<p><b>TRANSPORT, RECEIVING AND STORAGE REQUIREMENTS</b> <i>Describe transport, receiving and storage requirements. Include secondary containment, transport devices (carts, carriers, etc.), segregation requirements, any special temperature or atmospheric requirements, and container compatibility requirements. Information may be included in Section 6.</i></p> <table border="1" data-bbox="321 1690 1377 1900"> <thead> <tr> <th data-bbox="321 1690 852 1743">Chemical name</th> <th data-bbox="852 1690 1377 1743">Storage location/requirement</th> </tr> </thead> <tbody> <tr> <td data-bbox="321 1743 852 1900">Flammable Solvent – specify</td> <td data-bbox="852 1743 1377 1900"> <p><b>Storage location</b></p> <p>Store in approved flammable cabinet or safety storage container. Keep away from oxidizers and combustible materials.</p> </td> </tr> </tbody> </table>	Chemical name	Storage location/requirement	Flammable Solvent – specify	<p><b>Storage location</b></p> <p>Store in approved flammable cabinet or safety storage container. Keep away from oxidizers and combustible materials.</p>
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		Refer to SDS for specific storage information.						
	Chloroform	<b>Storage location</b> Do not store with acetone, alkalis, chemically-active metals (such as aluminum magnesium, sodium, or potassium), dinitrogen tetroxide, fluorine, triisopropylphosphine, and solid potassium tert-butoxide. Do not mix or store with acids; may form toxic gas.						
	Diethyl ether	<b>Storage location</b> Store in approved flammable cabinet or safety storage container. Keep away from oxidizers and combustible materials. Store in amber glass or metal bottle. Containers must be labeled with dates of receipt and opening. Containers must be disposed of 12 months after receiving or 6 months after opening, whichever happens first to prevent explosive peroxide formation. If there are any crystals (especially near the neck or cap threads), liquid separation, or discoloration, contact EHS for hazardous waste removal. Do not move or attempt to open the container.						
	<b>Detection reagent – specify</b>	<b>Storage location</b> Refer to SDS for specific storage information						
8.	<b>WASTE DISPOSAL</b>							
	Type of waste generated by this procedure/process ( <i>check all that apply</i> ): <input type="checkbox"/> Solid <input type="checkbox"/> Liquid							
	Waste hazard determination ( <i>check all that apply</i> ):							
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	<div data-bbox="548 302 1378 338" style="border: 1px solid black; padding: 2px;"><input type="checkbox"/> Biological    <input type="checkbox"/> Radioactive</div> <p>Expected waste generation per experimental run (mass/volume): Click or tap here to enter text.</p> <p>The SAA is located #####</p> <p>Waste TLC solvents need to be disposed of as hazardous waste. NOT DOWN THE SINK!:</p> <ul style="list-style-type: none"><li>• Segregate from oxidizers within SAA (separate secondary containment)</li><li>• Do not mix halogenated solvent waste with non-halogenated waste</li><li>• Ensure area free of heat or open flame</li><li>• <a href="#">Label</a> all containers appropriately.</li><li>• When ready, <a href="#">submit a chemical waste pickup request</a>.</li></ul> <p>Dispose of excess detection reagents <a href="#">identified as hazardous waste</a>:</p> <ul style="list-style-type: none"><li>• Segregate from solvents</li><li>• Segregate acidic wastes from alkaline wastes within SAA (separate secondary containment).</li><li>• Never use metal containers for acidic wastes.</li><li>• <a href="#">Label</a> all containers appropriately.</li><li>• When ready, <a href="#">submit a chemical waste pickup request</a>.</li></ul> <p>Non-hazardous reagents may be disposed down the drain. If unsure, check the SDS or consult with EHS.</p> <p>If target compound is biohazardous, dispose of additional sample and tubes/pipette tips according to <a href="#">requirements</a> as long as no other hazardous materials are also present in the waste.</p>
9.	<div data-bbox="321 1318 1438 1423" style="background-color: #e6f2ff; padding: 5px;"><b>EMERGENCY PROCEDURES</b> <i>Indicate how spills, personnel exposure/injury, and other accidents should be handled and by whom.</i></div> <p>Refer to Emergency Information Sheet</p> <p><b>Life-threatening emergencies</b> (<i>fire, explosion, large-scale spill or release, compressed</i>)</p> <ul style="list-style-type: none"><li>• <b>ACTIVATE THE BUILDING'S FIRE ALARM SYSTEM IF THE SPILL REPRESENTS A THREAT TO HUMAN LIFE OR MAY CAUSE A FIRE OR EXPLOSION.</b></li><li>• Notify all persons in the workspace that a spill has occurred and evacuate all personnel from the workspace to a safe location.</li><li>• Isolate the work space to prevent inadvertent entry: lock any access doors, place signs on doors reading "DO NOT ENTER-CHEMICAL SPILL"</li><li>• <b>Call EHS at 392-8400 for clean-up assistance. If the emergency occurs outside of normal work hours, contact the University Police Department at 392-1111.</b></li></ul>



**Personnel exposure (refer to SDS):**

- BBP Needlestick & BBP Splash Exposures: call Needlestick Hotline at 1-866-477-6824 (OUCH). Immediately after evaluation/treatment, employees should contact AmeriSys at 1-800-455-2079. Report incident to EHS.
- Chemical contact with skin: Remove contaminated clothing and jewelry and wash affected area with plenty of soap and water. The emergency shower is located XX. If skin irritation or rash occur get medical advice. Report to EHS.
- Chemical contact with eyes: Remove contact lenses. Flush with water for 15 min in eyewash station located XX. Irrigate eyes thoroughly while lifting eyelids. Seek medical advice if necessary. Report to EHS.
- Chemical ingestion: Rinse mouth with water (do not swallow). Never make an unconscious person vomit or drink fluids. Call poison control center and obtain medical assistance if you feel unwell. Report to EHS.
- Chemical inhalation: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a poison control center and obtain medical assistance if you feel unwell. Report to EHS.

**In the event of a spill that can be cleaned up by local personnel:**

- Notify personnel in the area and restrict access. Eliminate all sources of ignition.
- Review the SDS for the spilled material to determine the appropriate level of protection. Minimum protection should include gloves, safety glasses and lab coat.
- Wearing appropriate personal protection equipment, clean up spill using the lab's spill kit located at XX. Collect spill cleanup materials in a tightly closed container and label appropriately as hazardous waste.
- Wipe area with soap and water.
- NEVER use a vacuum cleaner or Shop-Vac to clean up flammable material spills.

Emergency contact numbers:

Lab Manager	xxx-xxx-xxxx
Building Manager	xxx-xxx-xxxx
Principal Investigator	xxx-xxx-xxxx
Poison Control Center	800-222-1222
Emergency	911
EHS	352-392-1591