|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Lab-Specific Standard Operating Procedure (LSOP)- Pyrophoric Chemicals** | | | | | | | | |
| Principal Investigator (PI)/Laboratory Manager: | | | | | | | | |
| Building: | | | | | | Lab(s) Covered by LSOP: | | |
| Department: | | | | | | Lab Phone Number(s): | | |
| **Chemical** | | | **GHS Pictogram** | | | **Definition** | | |
| **Pyrophoric**  **Liquids and Solids** | | |  | | | **Pyrophoric liquids** or ***solids*** means a liquid or solid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air. | | |
| **Hazard Awareness** | | | | | | | | |
| Pyrophoric liquids and solids are mainly used in laboratories to catalyze chemical reactions. The primary hazard associated with pyrophoric chemicals is fire upon contact with oxygen (air) or water (moisture). Many pyrophoric chemicals are also stored in highly flammable solvents, which increases the risk and severity of fires. The high risk of spontaneous ignition requires pyrophoric chemicals to be handled in inert atmospheres, free of ignition sources.  In addition to fires, many pyrophoric chemicals are also classified as acutely toxic, corrosive, reproductive toxicants, and capable of damaging the liver, kidneys, central nervous system, and other body systems. Lab personnel must review safety data sheets to identify the specific hazard classes of each pyrophoric chemical in the lab. | | | | | | | | |
| **SECTION 1. PYROPHORIC CHEMICALS USED IN THE LAB (*Attach or insert more lines as necessary*)** | | | | | | | | |
| **Chemical Name** | | | | **Additional Hazards** | | | | |
|  | | | |  | | | | |
|  | | | |  | | | | |
|  | | | |  | | | | |
| **SECTION 2. ADMINISTRATIVE CONTROLS** | | | | | | | | |
| 2.1 | Principal investigators (PIs) or other qualified persons must provide lab-specific safety training to ensure lab personnel understand the hazards, work practices, and emergency procedures associated pyrophoric chemicals. [Documentation](http://media.ehs.uconn.edu/Chemical/LabTrainingDocumentationForm.docx) of the training is required. | | | | | | | |
| 2.2 | Read the **safety data sheet (SDS)** for each pyrophoric chemical prior to use. | | | | | | | |
| 2.3 | Substitute safer alternatives or reduce the quantities of pyrophoric chemicals, if feasible. | | | | | | | |
| 2.4 | Do not work alone with pyrophoric chemicals. | | | | | | | |
| 2.5 | Perform experiments during normal business hours (i.e., 8:00 am-5:00 pm Mon-Fri), if feasible. | | | | | | | |
| 2.6 | Transfer multiple small volumes/quantities of pyrophorics instead of a single transfer of larger volumes/quantities. | | | | | | | |
| 2.7 | Ensure that a functional eyewash and safety shower are located in the immediate work area where pyrophorics are used. | | | | | | | |
| 2.8 | *Add additional administrative controls if required.* | | | | | | | |
| **SECTION 3. ENGINEERING CONTROLS** | | | | | | | | |
| 3.1 | Handle solid pyrophoric chemicals in an inert atmosphere glove box. Inert atmosphere glove bags can be used as an alternative, if approved by the PI. | | | | | | | |
| 3.2 | If a glove box is not available, handle pyrophoric liquids via syringe or cannula in a properly-functioning chemical fume hood, over a spill tray if feasible, and with the sash at the lowest working height to form a barrier between the person and the experiment. | | | | | | | |
| 3.3 | Ensure chemical fume hoods are running between 80-120 linear feet/minute and have been tested within the last year. If the hood is not working, contact [Facilities Operations](https://fo.uconn.edu/) for repairs or [EHS](https://ehs.uconn.edu/ehs-contacts/chemical-health-and-safety-contacts/) for retesting. | | | | | | | |
| 3.4 | Ensure needles are equipped with locking mechanisms (e.g., Luer lock needles) to prevent accidental disconnection and release of reagents. | | | | | | | |
| 3.5 | Place portable blast shields inside the fume hood, if required by the PI. | | | | | | | |
| 3.6 | *Add additional engineering controls if required.* | | | | | | | |
| **SECTION 4. WORK PRACTICES** | | | | | | | | |
| 4.1 | * Inspect containers and reaction vessels for signs of degradation prior to use. Replace if damaged. | | | | | | | |
| 4.2 | * Remove all non-essential chemicals and materials from the fume hood or glove box. Only chemicals involved in the experiment must be present. | | | | | | | |
| 4.3 | * Remove moisture from glassware (e.g., heating) prior to introducing pyrophoric chemicals. Ensure glassware is rated for the pressures generated during reactions. | | | | | | | |
| 4.4 | * Visually confirm that glassware is dry prior to introducing pyrophoric chemicals. | | | | | | | |
| 4.5 | * Purge air from equipment with a specified inert gas such as nitrogen or argon prior to introducing pyrophoric chemicals. | | | | | | | |
| 4.6 | Do not transfer large volumes (>20 mL) using a syringe. | | | | | | | |
| 4.7 | Use containers with transfer septa for liquid reagents to prevent exposure to air and moisture. | | | | | | | |
| 4.8 | Do not tip reagent bottles to extract pyrophorics. Tipping can cause the liquid to contact the septum, causing deterioration. | | | | | | | |
| 4.9 | Use mineral oil bubblers to release excess pressure from the reagent or reaction vessels. | | | | | | | |
| 4.10 | Maintain reagent containers and reaction vessels under slight positive pressure (as visually indicated by a mineral oil bubbler) to prevent pressure reversals. | | | | | | | |
| 4.11 | Do not use balloons for pyrophoric chemicals. | | | | | | | |
| 4.12 | Never add excess pyrophorics back to the original container. | | | | | | | |
| 4.13 | *Add additional work practices if required.* | | | | | | | |
| **SECTION 5. PERSONAL PROTECTIVE EQUIPMENT** | | | | | | | | |
| 5.1 | Chemical splash goggles (recommended) or safety glasses that meet *American National Standards Institute* (ANSI) standard Z-87.1 must be worn when handling pyrophoric chemicals. PIs must determine if full-face shields are required. | | | | | | | |
| 5.2 | Gloves indicated in the safety data sheet (SDS) must be worn while handling of pyrophoric chemicals. PIs must determine whether Nomex, Kevlar, or other related aramid fiber gloves are required. | | | | | | | |
| 5.3 | A flame-resistant lab coat must be worn when working with pyrophoric chemicals. Lab coats must be buttoned, fit properly, and cover as much skin as possible. PIs must determine if chemical-resistant aprons are required. | | | | | | | |
| 5.4 | Shirts, long pants and other clothing worn underneath fire-resistant lab coats should be cotton or wool. Synthetic clothing (e.g., polyester, nylon, acetate, rayon, acrylic, etc.) should be avoided. | | | | | | | |
| 5.5 | Closed-toed footwear, which covers the entire foot, must be worn when working with pyrophorics. Leather footwear is preferable. | | | | | | | |
| 5.6 | *Add additional personal protective equipment requirements if required.* | | | | | | | |
| **SECTION 6. STORAGE** | | | | | | | | |
| 6.1 | Store pyrophoric chemicals as indicated in safety data sheets (SDSs). An inert gas-filled desiccator or glove box may be suitable, if indicated by the manufacturer. | | | | | | | |
| 6.2 | Pyrophoric liquids should only be stored in sealed containers with PTFE-lined septa to prevent air exposure. | | | | | | | |
| 6.3 | Do not store pyrophoric chemicals near flammable chemicals, combustible materials, oxidizers, or water sources. | | | | | | | |
| 6.4 | Ensure that sufficient protective solvent, oil, or inert gas remains in the container while the material is stored. | | | | | | | |
| 6.5 | If pyrophoric reagents are received in a specially designed shipping, storage, or dispensing container, ensure that the integrity of that container is maintained. | | | | | | | |
| 6.6 | *Add additional lines for storage requirements if required.* | | | | | | | |
| **SECTION 7. SPILLS AND ACCIDENTS PROCEDURES** | | | | | | | | |
| 7.1 | Evacuate the laboratory. | | | | | | | |
| 7.2 | Close door(s) to lab and post an “Emergency Hangtag” or other warning information on the door to prevent re-entry by others. | | | | | | | |
| 7.3 | Call **911**. | | | | | | | |
| 7.4 | Do not re-enter the area until instructed to do so by UCFD or other emergency personnel. | | | | | | | |
| 7.5 | Report the accident to the PI/Lab Manager and EHS. | | | | | | | |
| **SECTION 8. FIRST AID PROCEDURES** | | | | | | | | |
| First Aid- Eyes | | | 1. Forcibly hold eyelids open and flush both eyes under an emergency eyewash. 2. Remove contact lenses while flushing (if applicable).   3. Dial 911 or have someone else from the lab dial 911.  4. Keep flushing eyes until emergency personnel arrive.  5. Report the incident to PI/Lab Manager and EHS. | | | | | |
| First Aid- Skin | | | 1. Flush affected area(s) under the safety shower. 2. Remove or cut off contaminated clothing while rinsing. Do not pull contaminated clothing over the head. 3. Dial 911 or have someone else from the lab dial 911. 4. Keep rinsing the affected area until emergency personnel arrive. 5. Report the incident to PI/Lab Manager and EHS. | | | | | |
| First Aid- Inhalation | | | 1. Move to fresh air. 2. Dial **911.** 3. Report the incident to PI/Lab Manager and EHS. | | | | | |
| First Aid- Other | | | *Describe additional first aid procedures based on hazards if required.* | | | | | |
| **SECTION 9A. PYROPHORIC WASTE MANAGEMENT** | | | | | | | | |
| 9A.1 | Unused or unwanted pyrophorics involved in experiments must be destroyed by transferring the materials to an appropriate reaction flask for hydrolysis and/or neutralization. Complete the decontamination procedures listed in **Section 10** for methods specific to the lab. | | | | | | | |
| 9A.2 | Empty containers must be properly rinsed with inert, dry compatible solvents; this rinse solvent must also be neutralized or hydrolyzed. Follow decontamination procedures listed in Section 10 for methods specific to the lab/experiment. | | | | | | | |
| 9A.3 | The solvent rinses used to quench residual pyrophoric chemicals must be disposed of as hazardous wastes and must not be mixed with incompatible waste streams. | | | | | | | |
| 9A.4 | Containers with pyrophoric waste residues must never be left open to the atmosphere. | | | | | | | |
| 9A.5 | *Describe additional waste management procedures for pyrophoric chemicals if required.* | | | | | | | |
| **SECTION 9B. HAZARDOUS WASTE MANAGEMENT** | | | | | | | | |
| 9B.1 | All hazardous wastes must be labeled with “Hazardous Waste” stickers or tags, use full chemical names to describe the waste (i.e., no chemical abbreviations or symbols), be stored in containers with tight-fitting caps or lids, and be stored alone or with other compatible chemicals. | | | | | | | |
| 9B.2 | Hazardous wastes must be stored at or near a green “Satellite Accumulation Area” sign prior to disposal by EHS. | | | | | | | |
| **SECTION 10. DECONTAMINATION PROCEDURES (*Attach or insert steps. Add more lines as necessary).*** | | | | | | | | |
| Pyrophorics | | *Describe how residual pyrophoric chemicals will be quenched after use (e.g. hydrolysis and/or neutralization procedures, etc.).* | | | | | | |
| Equipment | | *Describe how equipment will be decontaminated after use.* | | | | | | |
| Glassware | | *Describe how glassware contaminated with pyrophoric chemicals will be decontaminated after use.* | | | | | | |
| Work Area | | *Describe how the work area (e.g. fume hoods, trays, etc.) will be decontaminated after use.* | | | | | | |
| Personal Hygiene | | *Describe how the researchers will decontaminate after procedure.* | | | | | | |
| **SECTION 11. SPECIFIC PROCEDURE** | | | | | | | | |
| *Optional- List or attach a copy of the steps and appropriate safety controls for procedures using pyrophoric chemicals.* | | | | | | | | |
| **SECTION 12A. APPROVAL** | | | | | | | | |
| I have reviewed, understand, and agree to follow this lab-specific standard operating procedure for pyrophoric chemicals. Further approval from the PI is required if any of the following events occur:   * A change in amount (***Add quantity and/or volume***) or substitution of the chemicals in the procedure is planned * A change in the agreed-upon experimental set-up is planned * Signs of a failure in safety design or equipment are observed * 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.) | | | | | | | | |
| **Researcher Signature** | | | | | **Date** | **Trainer Signature** | | **Training Date** |
|  | | | | |  |  | |  |
|  | | | | |  |  | |  |
|  | | | | |  |  | |  |
|  | | | | |  |  | |  |
|  | | | | |  |  | |  |
|  | | | | |  |  | |  |
|  | | | | |  |  | |  |
|  | | | | |  |  | |  |
|  | | | | |  |  | |  |
| **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 OF EACH LAB-SPECIFIC STANDARD OPERATING PROCEDURE**  **MUST BE READILY AVAILBALE IN THE LAB.** | | | | | | | | |