

# PYROPHORIC CHEMICALS: HANDLING & USE



## OVERVIEW

Pyrophoric liquids, solids, and gasses are materials that may ignite or react violently when exposed to air. Many pyrophoric chemicals are also water reactive. Pyrophoric chemicals will ignite spontaneously in air at a temperature of 130° Fahrenheit (54.4° Celsius) or below. This update, along with the Aldrich Technical Bulletins AL-134: Handling Air Sensitive Reagents and AL-164: Handling Pyrophoric Materials, provides general guidance on how to safely work with pyrophoric chemicals.

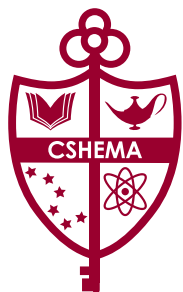
## APPLICABILITY

All laboratories that store or use pyrophoric chemicals must develop standard operating procedures that, at a minimum, incorporate the handling and storage requirements listed in this update. In addition, this update provides general hazard warning and safety precaution information to users of pyrophoric chemicals. All laboratory personnel who work with or otherwise handle pyrophoric chemicals must be familiar with these guidelines.

## PROCEDURES

### 1. Training

All employees who work in a laboratory must complete the laboratory safety training. In addition, the principal investigator will ensure that any person handling pyrophoric materials receives appropriate hands-on instruction prior to the start of any work with these materials. This instruction must include information on the identity, location, and hazards of pyrophoric chemicals in the laboratory, as well as all requirements for the safe handling, storage, and use of pyrophoric chemicals. These requirements include proper personal protective equipment selection and use, transfer techniques, and storage and disposal methods.



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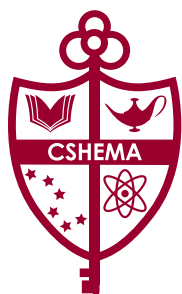
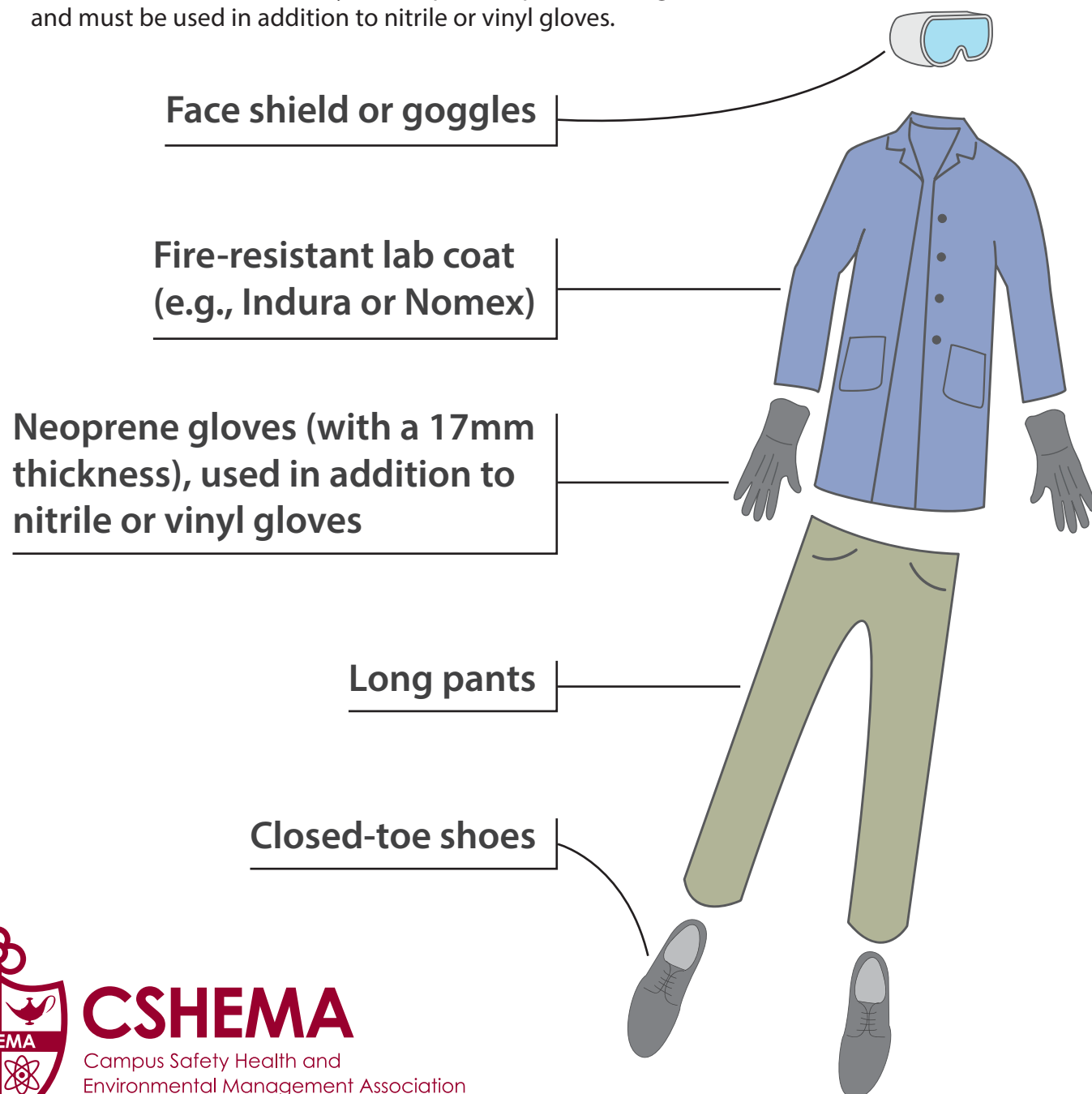


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## 2. Personal Protective Equipment

- All laboratory personnel are required to wear a fire-resistant lab coat, closed-toe shoes, and long pants when handling pyrophoric chemicals. Fire-resistant lab coats (e.g., Indura or Nomex) may be purchased through lab safety supply companies.
- Eye protection in the form of a face shield or goggles must be worn at all times when handling pyrophoric chemicals.
- Neoprene gloves (with a 17mm thickness) should be worn when handling pyrophoric chemicals. Neoprene gloves are more flame retardant than the thin millimeter nitrile or latex gloves that are typically used in laboratories. As an alternative, Nomex gloves offer excellent protection from flash and flame hazards. However, they do not provide protection against chemicals and must be used in addition to nitrile or vinyl gloves.



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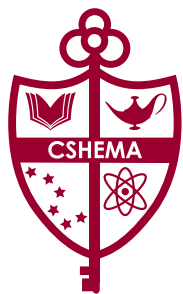
## 3. Handling and Storage

- Laboratory personnel are prohibited from working alone when handling pyrophoric chemicals.
- Use a glove box or AtmosBag to handle pyrophorics if an inert or dry atmosphere is required.
- All handling and use of pyrophoric chemicals must be performed inside a chemical hood, as many pyrophoric chemicals can release noxious or flammable gases. Additionally, some pyrophoric materials are stored under flammable solvents; therefore, the use of a chemical hood is required to prevent the release of flammable vapors into the laboratory.
- Safety shielding is required any time there is a risk of explosion, a splash hazard, or a highly exothermic reaction. All manipulations of pyrophoric chemicals that pose this risk should occur in a chemical hood with the sash in the lowest feasible position. Portable shields, which provide protection to all laboratory occupants, are available.
- Evacuated glassware can implode and eject flying glass and splattered chemicals. Vacuum work involving pyrophoric chemicals must be conducted in a chemical hood or isolated in an acceptable manner. Mechanical vacuum pumps must be protected using cold traps and, where appropriate, filtered to prevent particulate release. The exhaust for the pumps must be vented into an exhaust hood. Vacuum pumps should be rated for use with pyrophoric chemicals.
- Refer to the **Sigma-Aldrich Technical Bulletin AL-134 Handling Air-Sensitive Reagents** and **AL-164 Handling Pyrophoric Reagents** for proper selection of equipment and safe handling techniques.
- All containers (both primary and secondary) holding pyrophoric chemicals must be clearly labeled with the chemical name and hazard warning.
- The laboratory's door sign must contain appropriate warning information.
- All pyrophoric chemicals should be stored under an atmosphere of inert gas or under the solvent that shipped with the pyrophoric chemicals. Avoid storing pyrophoric chemicals near an area with **heat/ flames, oxidizers, or water sources**.
- Never return excess chemicals to the original container. If small amounts of impurities are introduced into the container, it may cause a fire or explosion.



## 4. Emergency Safety Equipment

An eyewash, safety shower, and ABC fire extinguisher must be available within the work area for immediate emergency use, and all personnel must be aware of their locations prior to working with pyrophoric chemicals.



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## 5. Emergency Procedures and Spill Response

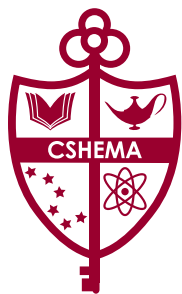
- If a person is on fire, walk the individual calmly to the nearest emergency shower, as running may cause the fire to grow or spread more rapidly. Instruct the individual to cover their face and use the shower to extinguish the fire. If a person cannot be led to the emergency shower safely, douse the person with water or instruct the individual to stop, drop, and roll, and then extinguish any small, still-burning flames by patting them out using an available lab coat. Activate the nearest fire alarm pull station and call for medical assistance. Remove any contaminated clothing and place clean, wet cloths on the burn areas. Wrap the individuals to avoid shock and exposure.
- In the event of a spill, call your safety office immediately for assistance in cleaning up the spill. Do not attempt to handle a spill of pyrophoric chemicals. Turn off all ignition sources and evacuate the laboratory immediately.
- In the event of a fire, activate the nearest alarm pull station and implement the R.A.C.E Procedure.

## 6. Waste Disposal

- All materials contaminated with pyrophoric chemicals must be disposed of as hazardous waste.
- Any unused or unwanted pyrophoric chemicals must be completely quenched as part of the reaction or stabilized by transferring the materials to an appropriate reaction flask for hydrolysis and/or neutralization with adequate cooling.
- Empty containers should be rinsed three times with an inert dry solvent; this rinse solvent must also be neutralized or hydrolyzed and collected and disposed via the safety office.
- After the container is triple-rinsed, it should be left open in the back of a chemical hood for at least one week.
- Alert your safety office of any wastes contaminated by pyrophoric chemicals when disposing of them.

## REFERENCES

- Sigma-Aldrich Technical Bulletins: Sigma-Aldrich Technical Bulletin AL-134 Handling Air-Sensitive Reagents and AL-164 Handling Pyrophoric Reagents.
- University of Rochester, EHS, "SOP FOR PYROPHORIC CHEMICALS," <http://www.safety.rochester.edu/ih/standops/standops8.html>
- San Diego State University, EHS, "Standard Operating Procedures Pyrophoric Chemicals," <http://bfa.sdsu.edu/ehs/pdf/SOPPyro.doc>.
- University of California, EHS, "Procedures for Safe Use of Pyrophoric Organolithium Reagents," <http://www.ehs.ucr.edu/resources/SOPs/Procedures%20for%20Safe%20Use%20of%20Pyrophoric%20Organolithium%20Reagents.pdf>
- SIGMA CHEMICAL COMPANY—230707 BUTYLLITHIUM, 2.5M SOLUTION IN HEXANES: <http://www.sigmaaldrich.com/catalog/product/aldrich/230707?lang=en&region=US>



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