Information
Handling of Reactive Chemicals

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Administrative Authority
Senior Associate Vice President for Operations

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History
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Categories

Statement:
Highly Reactive Chemicals Handling Procedures and Guidance

Introduction

Pyrophoric and highly reactive materials ignite spontaneously on contact with air. These chemicals react with oxygen, moisture in air, or both. Failure to follow proper handling procedures can result in fire or explosion, leading to serious injuries and

death. Pyrophorics must be handled under inert atmospheres and in such a way that rigorously excludes air/moisture since they ignite on contact with air and/or water. Many are toxic and may come dissolved in a flammable solvent. Other common hazards include corrosivity, teratogenicity, water reactivity, peroxide formation, and damage to the liver kidneys, and central nervous system. Be especially vigilant when working with tertiary butyl lithium which is extremely pyrophoric. Researchers working with pyrophoric and highly reactive materials must be proficient with the procedures and must not work alone.

Faculty/Researchers/Principal Investigators

1. Ensure that your Chemical Hygiene Plan (CHP) is specific for your lab, and has a current chemical inventory with Safety Data Sheets (SDSs) for all chemicals and/or hazardous materials and specifically address pyrophoric and highly reactive materials that could ignite spontaneously on contact with air, oxygen or moisture in the air.
2. Obtain and review (if available) the manufacturer or supplier Technical Bulletin for handling pyrophoric and other highly reactive chemicals.
3. Develop written standard operating procedures (SOPs) for the use of highly hazardous chemicals that include laboratory practices, engineering controls, personnel protective equipment and procedures for dealing with spills and accidents.
4. Confine operations to designated work area in the lab, with warning signs to indicate which areas are designated and the nature of the hazard. Limit access to such areas to appropriately trained and authorized personnel.
5. Procedures that can generate dust, vapors or aerosols must be conducted in a chemical fume hood, glove box or other suitable containment device. Secondary containment should be used to contain inadvertent spills and releases.
6. Enforce safety procedures to address possible hazards and unsafe conditions that may occur.
7. Provide or schedule employee training.
8. Report hazardous conditions to the Industrial Hygiene Manager.
9. Review lab-specific SOP's and the Chemical Hygiene Plan annually and update as necessary.
10. Contact the IH Lab Safety Coordinator if your work involves pyrophoric or highly reactive materials.

Department of Environmental Health & Safety (DEHS)

1. Review Chemical Hygiene Plan (CHP), chemical inventory and Standard Operating Procedures (SOPs) submitted by faculty, researchers or PIs to ensure that pyrophoric and other highly reactive chemicals are adequately addressed prior to use in a lab.
2. Ensure that handling procedures are adequate and that SOPs for researchers working with pyrophoric and highly reactive materials do not work alone.

Related Information:

Examples of Pyrophoric and Highly Reactive Materials

- Organometallic reagents (alkyllithiums, tert-butyllithium) Alkylzincs (diethylzinc)
- Alkylmagnesiums
- Group I metals (lithium, sodium, potassium, cesium, francium) Metal powders (calcium, zirconium, aluminum, magnesium)
- Metal hydrides or non-metal hydrides (arsine, diphosphine, diborane, germane, lithium aluminum hydride, sodium hydride)
- Phosphorous (white) Potassium
- Sodium
- Alkylated metal alkoxides or nonmetal halides (diethylethoxyaluminum, dichloro(methyl)silane)
- Metal carbonyls (pentacarbonyliron, nickel carbonyl) Grignard reagents: RMgX (R=alkyl, X=halogen)
- Gases: silane, dichlorosilane, diborane, phosphine, arsine

A more extensive list of pyrophoric compounds can be found in Bretherick's Handbook or Reactive Chemical Hazards. Contact the Lab Safety Coordinator if work involves pyrophoric or highly reactive materials.

Reasoning:

Pyrophorics must be handled under inert atmospheres and in such a way that rigorously excludes air/moisture since they ignite on contact with air and/or water. Failure to follow proper handling procedures can result in fire or explosion, leading to serious injury and death.

Definitions:

Pyrophoric and highly reactive materials - ignite spontaneously on contact with air; react with oxygen, moisture in air or both.