Syracuse University

Laboratory Guidance Document

Explosives

This Laboratory Guidance Document was created by Syracuse University Environmental Health & Safety Services (EHSS) to assist researchers in developing laboratory specific standard operating procedures for the storage, handling, and disposal of potentially explosive material.

Properties

An explosion occurs when a material undergoes a rapid reaction that results in a violent release of energy. Such reactions can happen spontaneously or be initiated and can produce pressures, gases, and fumes that are hazardous. Common initiators of explosions are light, heat, and mechanical shock.

The following Hazard Statements (H-Codes) may be found on a Safety Data Sheet (SDS) to determine the level of explosive hazard that is present.

H-Code	Hazard Statement
H200	Unstable explosive
H201	Explosive; mass explosion hazard
H202	Explosive; severe projection hazard
H203	Explosive; fire, blast, or projection hazard
H230	May react explosively even in the absence of air
H231	May react explosively even in the absence of air at elevated pressure and/or temperature
H240	Heating may cause an explosion
H241	Heating may cause a fire or explosion
H271	May cause fire or explosion; strong oxidizer
H280	Contains gas under pressure; may explode if heated

The following chemical nomenclature may alert you that you have a potentially explosive compound:

Peroxide	Perchlorate	Azide	Fulminate	Nitro
Nitrate	Azo	Picric	Picyrl	

A common property of nitrogen containing compounds that are potentially explosive are that they have a carbon-to-nitrogen ratio that is less than three.

- The carbon-to-nitrogen ratio can be calculated using:
  - $\frac{Number\ Carbons + Number\ Oxygens}{Number\ Nitrogens} \geq 3$

For example: Diazomethane has the chemical formula CH_2N_2 has a carbon-to-nitrogen ratio of 0.5, which aligns with experimental reality that it is an explosive compound.

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Potential Hazards

The main hazards of working with a potentially explosive compound is physical harm and the potential of a fire occurring.

- An explosion of an experiment can result in the scattering of shrapnel and debris that may result in lacerations or exposure to chemicals that may pose an additional hazard such as corrosive, irritant, or toxic.
- A common initiator of explosions is heat, the heat or the resulting explosion may result in a fire.

General Precautions:

Working with any potentially explosive material requires thorough planning and the consistent application of good work practices and skills to control the hazard while achieving the goal of the experiment.

1. **Training.**

   The Principal Investigator is responsible for ensuring all personnel under their supervision are made aware of hazards of potentially explosive materials, have received the appropriate hands-on training, adhere to the laboratory standard operating procedures, and are provided with the appropriate personal protective equipment.

2. **Awareness**

   Working with any potentially explosive material requires prior research of the chemical to determine the level of risk one will be exposed to while working with the chemical. This includes: the potentially explosive nature of the material, appropriate procedures for use, incompatibilities with other chemicals, and proper storage.

Personal Protective Equipment (PPE):

In addition to the standard laboratory attire (i.e., long pants and closed toe shoes), the following PPE is recommended:

- ANSI certified (Z87) chemical splash goggles
- Face shield
- Knee-length lab coat
  NOTE: A flame resistant (FR) lab coats should be worn when working with explosive material.
- Nitrile gloves

Best Practices for the Working with Potentially Explosive Material

- Calculate the carbon-to-nitrogen ratio for compounds that contain more nitrogen atoms than carbon atoms. If the number is less than 3, the material should be handled as potentially explosive.
- Identify potentially explosive products and by-products prior to beginning an experiment.
- Identify the steps in an experiment that may introduce explosion initiators into an experiment and develop a plan to reduce the risk of explosion.
- Use a Teflon coated spatula or other non-static electricity generating material when weighing and transferring of potentially explosive compounds.

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- Surround all experiments using potentially explosives materials with an additional barrier such as a blast shield.
- Post a sign on the entrance of the laboratory that includes contact information and indicates that an experiment that is potentially explosive is in progress.
- Consult with EHSS prior to purchasing and working with potentially explosive materials.
- Procure and store only the smallest practical quantities for the experiment performed.

Storage Considerations:

- Store away from sources of ignition such as heat, light, and mechanical shock.
- The location where potentially explosive compounds are stored should be designated with signage.

Disposal:

- Potentially explosive reagents should be handled as hazardous waste.
- Waste products from experiments that use potentially explosive reagents should be handled as hazardous waste.
- Waste that contains potentially explosive materials should be segregated away from sources of ignition, such as heat, light, static electricity, and mechanical shock.
- Place the waste container in the satellite accumulation area in secondary containment and notify the EHSS Hazardous Waste Group at 315.443.9132 for disposal.

First Aid:

The chemical's SDS should be readily available and used as a reference for determining appropriate first aid measures. The following information provides typical first aid measures recommended for chemical exposures.

1. **Skin Contact:** Remove all contaminated clothing and rinse affected area with water for at least 15 minutes.
2. **Eye Contact:** Flush with water at an emergency eyewash station for at least 15 minutes.
3. **Ingestion:** Seek medical attention immediately.
4. **Inhalation:** Move to fresh air and seek medical attention immediately.

Incident Response:

All laboratory emergencies must be reported to the Department of Public Safety at 315-443-2224.

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