Laboratory Standard Operating Procedure for:

Explosives

Principal Investigator (PI) Approval is Required Prior to Performing this Procedure

Description

This standard operating procedure outlines the handling and use of explosive materials. Review this document and supply the information required in order to make it specific to your laboratory. In accordance with this document, laboratories should use appropriate controls, personal protective equipment, and disposal techniques when handling explosive materials.

An explosive chemical is, according to *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards,* "any chemical compound or mechanical mixture that, when subjected to heat, impact, friction, detonation, or other suitable initiation, undergoes rapid chemical change, evolving large volumes of highly heated gases that exert pressure on the surrounding medium." Some examples of these types of materials are:

- Compounds containing the functional groups azide, acetylide, diazo, nitroso, haloamine, peroxide, and ozonide
- Nitrocellulose
- Di- and Tri-nitro compounds
- Picric acid (dry)
- 2,4-Dinitrophenylhydrazine (dry)
- Benzoyl peroxide (dry)

Potential Hazards

Explosives are solid or liquid substances which are capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. Pyrotechnic chemicals are included even when they do not evolve gases. By definition, a pyrotechnic substance is a chemical designed to produce an effect by heat, light, sound, gas or smoke or a combination of these as the result of non-detonative self-sustaining exothermic chemical reactions. See Sections 4.D and 6.G of *Prudent Practices in the Laboratory* (National Research Council) for a discussion of some explosive hazards that may be encountered in the laboratory.

Refer to the Safety Data Sheet (SDS) for more information. When planning a reaction, consider the potential for explosion and plan accordingly.

Engineering Controls

Safety shielding shall be used for any operation having the potential for explosion, including the following situations:

- When a reaction is attempted for the first time (small quantities of reactants should be used to minimize hazards);
- When a familiar reaction is carried out on a larger than usual scale (i.e., 5-10 times more material);
- Operations are carried out under non-ambient conditions.
- Utilize fume hood, isolator, or glove box if necessary to keep material stable.
- Shields must be placed so that all personnel in the area are protected from hazard.

Work Practice Controls

- Designate areas where explosives are stored or manipulated. Include signage that indicates explosion risk.
- When explosive compounds are removed from a container for use, their identity shall be retained. This may be accomplished in various ways, such as marking a secondary container. At the end of the workday, a properly completed label shall be placed clearly in view on or adjacent to the material.
- Containers are empty when no visible explosives residue remains. Explosives labels should be removed or marked over to indicate that the container is empty.
- All laboratory manipulations of explosives, with the exception of sample weighing, will be carried out on quantities of less than one gram and more typically less than 100 mg.
- The amount of explosives used in all experiments and disposed of will be tracked to the nearest milligram.
- No person shall work alone when working with explosives chemicals.
- Use the minimum amount of explosives necessary for the operation. Limit, and keep to a minimum, the number of personnel involved in an explosives operation.
- Regularly collect and remove waste explosives, and material contaminated with explosives, from the facility.
- Keep explosives work areas clean and neat. Clean up explosives spills as they occur.
- All workers who handle explosives shall work within the guidelines of this SOP.

Personal Protective Equipment

- Always wear lab coat, safety glasses and full face shield when working with explosive materials or performing any reactions that may lead to explosion. A blast shield should be used.
- Consider blast protective clothing, depending on amounts and stability of compounds used.

Transportation and Storage

The following requirements shall be adhered to when storing explosives:

- Storage of the material is to be maintained in an area that provides two lockable doors (insert room number here). Access to this area will be restricted to appropriate (PI's name here) lab personnel.
- Each container of explosives will be properly labeled.
- The material will be properly labeled at all times and never left unsecured without direct supervision in its original form.
- The storage locations and explosives containers will be inspected by lab staff and EHS at least once a year to ensure continued safe storage.

Upon delivery receipt of material dock personnel will contact staff in the PI's lab to ensure appropriate lab personnel are available to receive the material. Once availability is confirmed the material will be transferred to the PI's lab and properly inventoried and secured. No samples will be shipped from the University of Michigan-Dearborn.

Waste Disposal

In order to minimize potential detonation, there will be no solid waste generated. Limited amounts of organic waste containing explosives at a concentration of <1g/gallon will be generated. There is no sensitivity toward detonation of such a solution. A hazardous waste bottle label must be affixed to each bottle with the name of a person familiar with the waste, room number and building. The bottle label must identify all constituents in the mixture. A waste

accumulation date must be recorded on the bottle label after waste is first placed in the container and waste will not be kept in excess of three months. The container must be stored in secondary containment. The waste will be packaged separately from other waste by (name of lab person responsible).

Do not dispose of chemical wastes by dumping them down a sink, flushing in a toilet or discarding in regular trash containers. Contact EHS at (313) 593-0921 for waste containers, labels, manifests, waste collection and for any questions regarding proper waste disposal. Also, refer to EHS's Hazardous Waste Webpage for more information.

Exposures/Unintended contact

 ***If the employee is in need of emergency medical attention, call 911 immediately.*** 

For an actual chemical exposure/injury:

- Remove contaminated clothing. Flush exposed eyes or skin with water for at least 15 minutes. Seek medical attention (see below).
- For situations with risk of inhalation exposure (including spills of powder outside of a chemical fume hood), remove all persons from the contaminated area.
- If an ambulance is needed, call Public Safety at (313) 593-5333 or 911 from a campus phone to request assistance.

Report all work related accidents, injuries, illnesses or exposures to WorkConnections within 24 hours by completing and submitting the Illness and Injury Report Form. Follow the directions on the WorkConnections website Forms Instructions to obtain proper medical treatment and follow-up.

Complete the EHS Laboratory Incident and Near-Miss Report form.

TREATMENT FACILITIES:

Midwest Medical Center -- *Campus Employees (including student employees)*
Mon-Fri 7:30 am - 4:30 pm
9301 Middlebelt Road
Romulus, MI 48174
Phone: 734-941-1000

After hours - go to:

Midwest Medical Center
Open 24/7
4700 Schaefer
Dearborn, MI 48126
Phone: 313-581-2600

Henry Ford Medical Center-Fairlane -- *University students (non-life threatening conditions)*
19401 Hubbard Drive
Dearborn, MI 48126
Phone: 313-928-8278

Click here for more information.

Spill Procedure

Please refer to SDSs for specific guidelines for responding to spills. If uncertain, contact your lab supervisor/manager for assistance. The following spill procedures may not apply to all explosive materials.

- When a spill occurs, ***personal safety should always come first***.
- Alert and clear everyone in the immediate area where the spill occurred.

A **minor (small) chemical spill** is one that the laboratory staff is capable of handling safely without the assistance of safety and emergency personnel, i.e., less than 1 liter. A **major/large chemical spill** requires active assistance from emergency personnel.

Spill Response Steps:

MINOR CHEMICAL SPILL

- Alert people in immediate area of spill.
- If spilled material is flammable, turn off ignition and heat sources. Don't light Bunsen burners or turn on other switches.
- Open outside windows, if possible.
- Wear protective equipment, including safety goggles, gloves and long-sleeve lab coat.
- Avoid breathing vapors from spill.
- Confine spill to as small an area as possible.
- **Do not wash spill down the drain**.
- If appropriate, use spill kits/sorbents to absorb spill. Collect contaminated materials and residues and place in container. Contact EHS at (313) 593-0921 for proper disposal.
- Clean spill area with water.

MAJOR CHEMICAL SPILL

- Attend to injured or contaminated persons and remove them from exposure.
- Alert people in the laboratory to evacuate.
- If spilled material is flammable, turn off ignition and heat sources. Don't light Bunsen burners or turn on other switches.
- **Call Public Safety at (313) 593-5333 or 911 from a campus phone immediately for assistance.**
- Close doors to affected area.
- Post warnings to keep people from entering the area.
- Have person available that has knowledge of incident and laboratory to assist emergency personnel.

Additional Spill Links:

- Chemical Spill Control Information

Report all emergencies, suspicious activity, injuries, spills, and fires to Public Safety by calling at (313) 593-5333 or 911 from a campus phone. Register with the University of Michigan-Dearborn Emergency Alert System.

Training of personnel

All personnel are required to complete the ***Comprehensive Laboratory Safety*** session (**BLS009** *or equivalent*) via MyLINC. Furthermore, all personnel shall read and fully adhere to this SOP when handling explosive materials.

Certification

I have read and understand the above SOP. I agree to contact my Supervisor or Lab manager if I plan to modify this procedure.

Name	Signature	UM ID #	Date

Principal Investigator _____ **Revision Date** _____