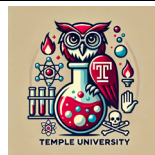


CHEMICAL SAFETY GUIDE

EXPLOSIVE CHEMICALS



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A laboratory -specific SOP is required for *particularly hazardous substance (PHS)* and/or any operation involving a High-Risk chemical. PI approval of a lab specific SOP is required for all PHS and/or high-risk chemicals

1. DESCRIPTION:

Explosives are materials that can cause a sudden, almost instantaneous release of pressure, gas, or heat when subjected to sudden shock, pressure, or high temperature. Due to the potential for serious injury and property damage, work with any reagent known to be explosive or suspected to be explosive must be performed with great care. Some examples of these types of materials are:

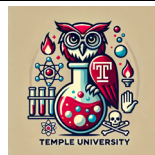
- Compounds containing the functional groups azide, acetylide, diazo, nitroso, haloamine, peroxide, and ozonide.
- Nitrocellulose
- Di- and Tri-nitro compounds
- Picric acid (dry)
- 2,4-Dinitrophenylhydrazine (dry)
- Benzoyl peroxide (dry)

Safety Data Sheets (SDS) use numbered hazard statements to communicate hazards, although the number may not always be present. The presence of the following hazard information indicates the chemical is a explosive chemical.

GHS Pictogram	TU Hazard Category	GHS Category	GHS H-Code	Signal Word
	High-Risk Chemical	Explosives (Cat. Unstable Explosive, Div 1.1, 1.2, 1.3 & 1.5)	H200, H201, H202, H203, & H205	Danger
	Hazardous Chemical	Explosive (Cat. 2B & 2C)	H204	Warning

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Contact EHRS via ehrschem@temple.edu for questions on the safe management of Explosive chemicals.

2. 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. Explosive compounds can create dangers from lacerations due to shrapnel (metal, glass, ceramic, etc.) and burns due to fires that might accompany or follow an explosion. An explosion might also lead to exposure to toxic chemicals.

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.

Check the Safety Data Sheet (SDS) to determine the specific hazard of the substance, including route of exposure and other hazard classifications, such as flammable, corrosive, etc. Follow other hazard specific guidelines as appropriate.

3. REQUIRED TRAININGS & INFORMATION:

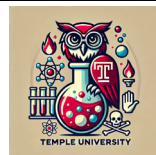
Before beginning work with Explosive chemicals, all laboratory personnel must have completed the following:

- TU Required Trainings (available at [TU-EHSA](#))
 - Initial Safety Training for Researchers
 - Regulated Chemical Waste Management for Laboratories-Annual
- Review the Temple University [Chemical Hygiene Program \(CHP\)](#)
- Review any required Laboratory-specific Standard Operating Procedures (SOPs)
- Review any relevant Safety Data Sheets (SDS) available from the manufacturer or from [TU-EHSA-Search for Safety Data Sheets](#)
- Review the online section on Laboratory Emergencies
- Complete any laboratory-specific training necessary to perform the procedures.
- Place signature on the [Laboratory-Specific Training Checklist](#) to indicate review.

4. HAZARD CONTROLS

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Purchasing:

- Federally regulated explosives are strictly controlled. Consult with EHRS and the University Fire Marshall prior to purchasing explosives and fireworks.
- When possible, look for alternative procedures or reagents that will eliminate the need for the explosive chemical, or substitute for a less hazardous chemical.

Engineering Controls:

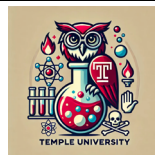
- All reactions involving explosives, potentially explosive reagents, intermediates, or products must be conducted in a fume hood, isolator, or glove box.
- The use of a portable blast shield inside the fume hood is highly recommended, in the event of an explosion the fume hood safety glass may shatter and blow outward. Place the blast shield between yourself and the reaction so you can reach around. 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 conducted on a larger than usual scale (i.e., 5-10 times more material).
 - Operations are conducted under non-ambient conditions.

Administrative Controls-General:

- All work with explosives and potential explosives must be pre-approved by the PI, EHRS and University fire Marshall.
- Always follow a published procedure, if the procedure is over 20 years old, find a more recent related procedure that more adequately addresses safety issues.
- Explore alternative strategies with your PI before working with explosives and potentially explosives.
- The PI must communicate and enforce clear limits on the quantity of each explosive and potentially explosive that can be used in a single experiment.
- Prior to beginning work, determine the initiating mechanism that could lead to an explosion such as friction, impact, catalysts, light, or heat. Refer to the SDS for this information.
- Never work alone with explosives and potentially explosives. Inform all other personnel in the laboratory before working with these chemicals.
- Use equipment that cannot generate static electricity or sparks.
- 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 must be

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retained. This may be accomplished in several ways, such as marking a secondary container. At the end of the workday, a properly completed label must 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, except for sample weighing, will be conducted 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.
- 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.
- If explosive or potentially explosive compounds are to be used in research animals, ensure that they are listed on the laboratory's IACUC protocol.

Administrative Controls-Chemicals Categorized as a Particularly Hazardous Substance (PHS) or a "High-Risk" Chemical:

These chemicals require the following to reduce the risk of exposure to laboratory personnel:

- Development of a laboratory-specific Standard Operating procedure (SOP)
- Establishments of a designated area. A designated area may be the entire laboratory, an area of a laboratory, or a device such as a laboratory hood.
- Use of a containment device such as chemical fume hoods or glove boxes.
- Procedures on the safe removal of contaminated waste.
- Decontamination procedures.
- Restrictions on working alone with explosive chemicals.
- Required PI approval before starting use.
- Special laboratory specific signs or labels indicating warnings or work practices to be followed.
 - A "High Hazard Substance Sign" must be posted in the designated area. Signs are available via EHRS.

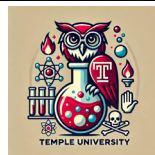
Designated area locations, applicable work practices, and information regarding the general handling must be included in the laboratory-specific SOP and be communicated to laboratory personnel through laboratory specific training provided by the PI prior to beginning work.

5. PERSONAL PROTECTIVE EQUIPMENT (PPE)

Follow the PPE recommendations listed in this guideline, Safety Data Sheets (SDS) and/or any

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required laboratory-specific SOPs for specific PPE recommendations. This should include at a minimum:

Skin and Body Protection:

Long pants (or equivalent) completely covering legs, closed toed shoes, and a flame resistant Nomex® lab coat when working with explosive material or performing any reactions that may lead to an explosion. A blast shield should be used. Consider blast protective clothing, depending on amounts and stability of compounds used.

Hand Protection:

Gloves must be worn when handling explosives. Disposable nitrile gloves provide adequate protection against accidental contact with small quantities of most laboratory chemicals. However, the handling of some chemicals will require specific chemical resistant gloves. Many chemicals, including acetone and methylene chloride, easily penetrate common laboratory gloves.

If direct or prolonged contact is anticipated, consult the SDS, glove manufacturers compatibility charts and/or the laboratory specific SOP to determine whether the material or process requires alternative hand protection. Additional protective clothing should be worn if the possibility of skin contact is likely.

Eye Protection:

Eye protection in the form of ANSI Z87.1-compliant safety glasses with side shields and a full-face shield must be always worn when handling explosive chemicals. Safety goggles and/or face protection must be worn when there is the potential for a splash hazard or working with large quantities.

Additional Hygiene Measures:

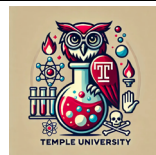
If hazardous chemicals come into contact with gloves, immediately dispose of the affected gloves as hazardous waste. If hazardous chemicals come into contact with reusable PPE (lab coat, etc.) immediately remove the affected PPE, then dispose of it or submit it for laundering.

Additional PPE may be required depending on the specific operations involving your experimental procedures.

6. STORAGE, HANDLING & TRANSPORTATION

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Always follow the manufacturer's recommendations for storage and handling.

Storage:

- Explosives and potentially explosives must be used and stored in designated area(s). All containers and storage locations must be clearly labeled with a sign that at a minimum state **"EXPLOSION RISK."**
- Store of explosives and potentially explosives compounds must be stored in an area that provides two lockable doors. Access to this area must be restricted to authorized laboratory personnel designated by the PI.
- All explosives must be clearly labeled with the correct chemical name, hazard warning, and never left unsecured without direct supervision in its original form. Handwritten labels are acceptable; chemical formulas and structural formulas are not acceptable.
- Keep and store away from all ignition sources such as heat, sparks, light, incompatible materials, and any potential initiators.
- Store in secondary containment in an explosion-proof refrigerator/freezer or an explosion-proof cabinet that does not contain flammables or incompatible materials.
- It is best to store newly synthesized explosives and potentially explosives in an explosion-proof refrigerator or freezer.
- Limit the amount stored to only the amount needed for planned experiments.
- Always use compatible materials for storage, transfer, etc.

Handling:

- Consult with your PI the first time you run a reaction or anytime you make a change.
- If using a chemical fume hood, Keep the sash closed while the reaction is in progress. Do not linger unnecessarily in front of the fume hood where explosives are in use.
- Always run the first reaction on a small scale.
- Allow for gas evolution. Never seal explosives in a closed metal vessel.
- Add potential explosives to solutions of catalysts (not the reverse). Be cautious when mixing explosive reagents or potentially explosive reagents and potential catalysts.
- Run reactions at the lowest temperature possible. If a reaction requires heat, slowly increase the temperature.
- Handle explosives, explosive intermediates, and potential explosives behind a blast shield.
- Do not work up the reaction in a manner that will concentrate explosives and potentially explosives.
- Never put solutions of explosives and potentially explosives on a rotary evaporator.

Common triggers for chemical explosions:

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- Keep explosives and potentially explosives away from all triggers and incompatible materials.
- **Heat:** consult your PI before conducting any reaction that involves heating explosives and potentially explosives.
- **Shock:** shock-sensitive materials include metal acetylides, azides, nitrogen triiodide, nitrate esters, nitro compounds, metal perchlorates, many organic peroxides, and compounds containing diazo, halamine, nitroso, and ozonide functional groups.
- **Metal ions:** many metal ions, including the iron in rust, can catalyst the violent decomposition of peroxides. Do not transfer peroxides with metal spatulas or syringes.
- **Incompatible Chemicals:** acids, bases, and other substances catalyze the explosive polymerization of acrolein.
- **Light:** hydrogen and chloride react explosively in the presence of light.
- **Concentration:** concentrating chemicals will increase the risk of explosion.

Transportation:

- Transport explosives in secondary containment, preferably a polyethylene or other non-reactive acid/solvent bottle carrier.
- No explosive sample will be shipped from Temple University.

7. WASTE DISPOSAL PROCEDURES

All spent, unused, expired and materials contaminated with explosive chemicals must be disposed of as a *regulated chemical waste* through EHRS.

Accumulation Limits:

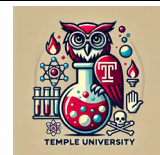
A maximum of 1 gallons of organic liquid waste containing explosives and no solid waste may be accumulated in a laboratory (Satellite Accumulation Area (SAA)).

Specific Instructions:

1. Do not dispose of chemical waste by dumping down a sink or discarding in regular trash.
2. Contact EHRS prior to working with explosive compounds as extra precautions may be required to safely dispose of these chemicals.
3. **Stabilization of explosives (dilution):**
 - a. Any formulation of explosive molecules farther apart will reduce the potential for an explosion. The more unstable the molecule, the more dilution is required to render it safe.

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4. Decontamination:

- a. Decontamination methods will vary based on the materials being handled and the equipment being used. Please review the SDS for guidance on decontamination.

Removal:

1. Ensure that a properly completed "Hazardous Waste" tag is affixed to the container. Tag must include the following:
 - a. Generator information is accurate.
 - b. Applicable Waste Stream is checked:
 - c. Applicable Hazards are identified: **Ignitable, Corrosive, Toxic or Reactive (as applicable)**
 - d. All chemical constituents and amounts (%) are included on the tag.
2. Submit a Chemical Waste Pickup Request Form prior to exceeding the accumulation limits.
3. EHRS will typically process a completed and accurate waste request within 3 days.

Contact EHRS via ehrschem@temple.edu for tags, collection containers and for any questions regarding proper waste disposal. Refer to Chemical Waste Management Program (CWMP) for more information.

8. EMERGENCIES

In the event of an emergency – Call Temple University Public Safety (TUPS) at (215) 214-1234 & EHRS at (215) 707-2520.

Health-Threatening Emergencies

1. Contact TUPS at 1-1234 from a campus landline phone or 215-203-1234 from a cell phone.
2. Go to the Temple University Hospital or nearest emergency room. Bring a copy of the SDS for the chemical.

Temple University Hospital Emergency Department
Broad & Ontario Streets
Philadelphia, PA 19140

3. Notify your PI and Temple University-Human Resources-Absence Management
4. Notify EHRS at 215-707-2520 or ehrs@temple.edu as soon as possible, but within 8 hours of the incident.

Non-Health-Threatening Emergencies

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1. Notify your PI and Temple University-Human Resources-Absence Management.
2. If necessary, go to Temple University Employee Health Services. Bring a copy of the SDS for the chemical.

Temple University Employee Services on Main Campus
1700 N. Broad Street, 4th floor
Philadelphia, PA 19122
Tel:215-204-2679

Additional Instructions:

Skin Contacts

Rinse body thoroughly using a safety shower for at least 15 minutes. If feasible, remove any contaminated or potentially contaminated clothing and/or jewelry.

Eye Contact

Rinse eyes thoroughly using an eyewash station for at least 15 minutes, occasionally lifting up the upper and lower eyelids to allow rinsing of the area beneath the eyelids. Remove contact lenses if possible.

Ingestion of chemical

Do not induce vomiting unless directed otherwise by the SDS or Poison Control (800-222-1222), Rinse mouth with water.

Inhalation of chemical

Move into fresh air.

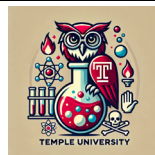
Needle stick/puncture exposure.

Wash the affected area with soap and water for 15 minutes. Contact Poison Control 800-222-1222

Fires:

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If a small fire occurs, you are trained in the use of fire extinguishers, and you feel safe doing so, use a fire extinguisher to put out the fire. If a single extinguisher cannot put out the fire, activate a fire alarm and evacuate the area. Wait for emergency responders to arrive so that you can provide information about the fire.

Refer to Laboratory Emergencies for additional information.

9. SPILL RESPONSE

1. Notify your PI and all individuals in the general vicinity that a spill has occurred.
2. Isolate the area and keep other personnel from
3. Evacuate the spill area. Avoid breathing vapors, dusts, or aerosols from the spill.
4. If safe to do so, help contaminated or injured persons evacuate.
5. If possible, confine the spill to a small area using a spill kit or absorbent material.
6. Keep others from entering the contaminated area (e.g. use caution tape, barriers, etc.)

Minor Spill

If the amount and type of chemical spilled presents no potential for a hazardous chemical exposure and if you are trained to do so, wear appropriate PPE and clean up the spill. Double bag any contaminated cleaning materials and manage as a regulated chemical waste. Contact EHRS at 2-2520 to report the spill if you are not trained and/or there is a risk of chemical exposure.

Major Spill

Defined as any hazardous chemical spill that:

- would result in chemical exposure during cleanup,
- due to its size and/or hazards, requires capabilities beyond your training, or
- results in a release into the environment (e.g. a spill goes down a drain).

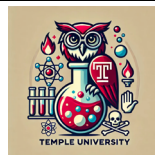
Call TUPS at 215-204-1234 from a cell phone or 1-1234 from a campus phone for assistance.

Refer to Laboratory Emergencies for additional information.

10. REFERENCES

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1. Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards.
National Research Council, Updated Version-2011
2. 29 CFR 1910.1250-Occupational Exposure to hazardous chemicals in laboratories.