**General Use Standard Operating Procedure (SOP)**

**Flammable Solids**

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*Globally Harmonized System Hazard Class: Flammable solids*

*Examples: flammable metals (e.g. phosphorus, sodium, lithium, magnesium, aluminum), flammable metallic compounds (e.g. butyllithium, diethylzinc), flammable nonmetallic compounds (e.g. nitrocellulose, activated carbon, sulfur, paraformaldehyde, sodium dodecyl sulfate, camphor)*

**Note**: This SOP is intended to provide general guidance on how to safely work with flammable solid chemicals and only addresses safety issues specific to flammable solid chemicals. Other hazard classes may also apply. Review Safety Data Sheets (SDS) and refer to other general use SOPs relevant to the chemical you are working with. Contact the Principal Investigator/ Laboratory Supervisor or the WSU Chemical Hygiene Officer for questions concerning the applicability of any item listed in this SOP (OEHS: 313-577-1200).

**If the chemical of interest is a particularly hazardous substance or a high risk chemical a lab specific SOP is required.**

# **Hazard Description**

A flammable solid is a solid which is readily combustible, or may cause or contribute to a fire through friction. Readily combustible solids are powdered, granular, or pasty substances which are dangerous if they can be easily ignited by brief contact with an ignition source and the resulting flame spreads rapidly. Flammable solids are more hazardous the finer the particle size and when widely dispersed in a confined space (e.g. finely divided metal powders). Some inorganic flammable solids (e.g. activated carbon, iron powder) have no flash point as they do not produce vapor at any realistic temperature. Due to the absence of vapor, solids of this type produce no flame, instead undergoing glow-type combustion.

* May ignite or react explosively on contact with heat, shock, friction, sparks, flame, or other sources of ignition.
* May react violently or explosively on contact with water.
* May also be pyrophoric – spontaneously reacting with oxygen in air to ignite.
* Ignite readily, burn fiercely, and can be difficult to impossible to extinguish.
* Powders, dusts, shavings, borings, turnings or cuttings may explode or burn with explosive violence.
* May re-ignite after fire is extinguished.
* Harmful if ingested, inhaled, or absorbed through the skin.
* Fires involving flammable solids may produce irritating/corrosive or toxic gasses and combustion products.
* Contact may cause burns to skin and eyes.

# **Control of Hazards – General**

* Conduct a hazard assessment to identify proper use and handling techniques, fire safety, storage, and waste disposal issues specific to the chemical being used.
* Eliminate high hazard chemicals or substitute with a less hazardous alternative whenever possible.
* Purchase the most stable chemical that will do the job.
* Purchase, store, and use the smallest quantities of flammable materials consistent with need.
* Containers of flammable materials shall be kept tightly closed when not in use.
* For metals, purchase the largest mesh size that will do the job. Do not order powders if granules will work.
* Keep amounts on-hand to a minimum.
* Handle and open container with care. Never work alone with flammable solid materials.
* Identify and eliminate sources of static discharge as some flammable solids can be ignited in this manner. Sources of static include clothing, the use of plastic, and the transfer of materials between containers. Low humidity environments (i.e., dry rooms) also increase the potential for static. Use anti-static mats and/or consider electrical bonding and grounding of equipment to reduce the possibility of static sparks.
* Use an anti-static gun when handling flammable solids to minimize chance of static discharge ignition.
* Avoid working at elevated temperature if at all possible.
* Avoid formation and accumulation of dust.
* Do not attempt to crush or grind a flammable solid. Keep the threads of containers clean for the same reason.
* Keep the work area, tools and equipment scrupulously clean. Do not allow flammable solids to build up. Use non-static wipes or wet methods, as appropriate, to clean use areas.
* Work areas shall be free of flammable and combustible materials not required for immediate use.
* For metallic flammable solids (metals and metal compounds) do not use water, foam, or carbon dioxide as a fire suppressant. Dousing metallic fires with water may generate hydrogen gas, an extremely dangerous explosion hazard, particularly if fire is in a confined environment. Additionally, fires caused by flammable metallic solids can be fueled by using water or carbon dioxide fire extinguishers. You must have a class D extinguisher on hand if you are using these materials.

# **Engineering/Ventilation Controls**

* Conduct work in a chemical fume hood, including weighing flammable solids, to prevent buildup of a flammable or explosive atmosphere.
* Depending upon the level of flammability involved with specific chemicals, engineering control requirements may increase (e.g., use of inert atmospheres, glove boxes, special detection and/or extinguishing systems, etc.). Consult the SDS for hazardous properties and OEHS for specific requirements.
* Fire extinguishers shall be easily accessible in flammable storage and work areas. Ensure the fire extinguisher is appropriate for the chemicals used; the wrong fire extinguisher may not work against a fire, or worse, may fuel the fire. Type ABC fire extinguishers are appropriate for most laboratory settings, but a Class D fire extinguisher is required for fires involving flammable metals and metallic compounds. Consult OEHS or WSU Fire Marshal for fire extinguisher selection.

# **Personal Protective Equipment**

In addition to proper street clothing (long pants or equivalent that cover legs and ankles, close-toed non-perforated shoes that completely cover the feet), wear the following Personal Protective Equipment (PPE) when performing lab operations/tasks:

* Safety glasses (If splash potential exists, use goggles + face shield instead)
* Flame retardant (FR) treated cotton or Nomex lab coat.
* Appropriate chemical‐resistant gloves.
  + Refer to Section 8 “Exposure controls/personal protection” of SDS or a glove selection guide (e.g. [Ansell Chemical Protection Guide](https://www.ansellguardianpartner.com/chemical/home#hp)) to identify appropriate glove type.
  + Additional fire resistant gloves may be necessary depending on the task.
* Respiratory protection
* If the airborne concentrations are elevated and engineering controls are not feasible wear a NIOSH-approved respiratory protection devices. Contact OEHS to choose appropriate respirators and training.

# **Special Handling Procedures and Storage Requirements**

* Follow any substance-specific storage guidance provided in SDS documentation.
* Flammable solids should be stored in a cool, dry location and separated from incompatibles such as oxidizers, corrosives and combustibles materials (e.g. paper, card board, etc.).
* It is advisable to store in a flammable cabinet or in a refrigerator rated for flammables storage.

# **Decontamination Procedures**

* Eliminate all ignition sources and clean using spark proof tools.
* Decontamination methods vary based on the materials handled and equipment being used. Please review the chemical Safety Data Sheet for guidance on cleaning materials.

# **Waste Disposal**

Flammable solids should be disposed of as hazardous chemical waste.

Do not dispose of waste by dumping down a drain or discarding in regular trash containers, unless authorized in writing by OEHS. [Submit requests to OEHS](https://research.wayne.edu/oehs/forms/chem-waste) for waste containers, labels, and waste collection. Also, refer to the [OEHS Hazardous Waste Management web page](http://research.wayne.edu/oehs/hazardous/index.php) and [WSU Chemical Hygiene Plan](http://research.wayne.edu/oehs/pdf/chemical-hygiene-plan.pdf) for more information.

# **Spill procedures**

1. **Spills**

For hazardous material spills or releases which have impacted the environment (via the storm drain, soil, or air outside the building) or which cannot be cleaned up by local personnel due to size of spill, hazard level, or hazards are unknown:

* 1. Call WSU Police (313) 577-2222. Available 24 hours a day, 7 days a week.
  2. Evacuate the spill area
  3. Post someone or mark-off the hazardous area with tape and warning signs to keep other people from entering.
  4. Remain in the vicinity until emergency personnel arrive and provide them with information on the chemicals involved.

For additional information regarding spill response procedures, refer to the [OEHS chemical spill response guidelines](http://research.wayne.edu/oehs/chemical/spills), [WSU Chemical Hygiene Plan](http://research.wayne.edu/oehs/pdf/chemical-hygiene-plan.pdf) and [American Chemical Society (ACS) guide for chemical spill response](https://www.acs.org/content/acs/en/about/governance/committees/chemicalsafety/publications/guide-for-chemical-spill-response.html).

1. **Small Spills**

In the event of a minor spill or release that can be safely cleaned up by local personnel using readily available equipment (e.g. absorbent materials) and appropriate PPE:

* 1. Alert personnel in the immediate area of spill and restrict access.
  2. Eliminate all sources of ignition.
  3. Increase ventilation in area of spill (turn on fume hood and open sash, open windows). Vent vapors to outside of building only.
  4. Review the SDS for the spilled material, or use your knowledge, to assess the hazards and to determine the appropriate level of protection.
     1. **DO NOT** clean up spills requiring respiratory protection. Contact OEHS for help (313-577-1200).
  5. Choose appropriate personal protective equipment (e.g. goggles, face shield, chemical resistant gloves, lab coat or apron).
  6. Protect floor drains, sinks or other potential avenues of environmental release as much as possible. Make a dike around the outside edges of the spill using absorbent materials.
  7. For solid spills: Use a scoop and brush or other suitable non-combustible items to collect spilled material. Minimize dust generation.
  8. For liquid spills: Cover the liquid with appropriate non-combustible absorbent material (NO paper towel), working from the spill's outer edges toward the center.
  9. Collect spill cleanup materials using a scoop or other suitable items and place in a tightly closed hazardous waste container.
  10. After spilled material is removed, decontaminate surfaces with water or other appropriate solvent.
  11. Place all contaminated materials, including contaminated items such as gloves, in the hazardous waste container.
  12. Label waste container with completed hazardous waste tag (available from OEHS).
  13. Submit online [waste pickup request](https://research.wayne.edu/oehs/hazardous/chemical-waste.php) to OEHS.

# **Emergency Procedures**

**\*\*If medical attention required, call WSU police (313-577-2222) immediately\*\***

* **Fire Extinguishers** – Refer to section 5 of the SDS for chemical specific firefighting measures. Both ABC dry powder and carbon dioxide extinguishers are appropriate for most fires.
* **Eyewash/Safety Showers** – Depending on the chemical hazard type, an ANSI approved eyewash station and safety shower may be required, easily accessed, and available within 10 seconds travel time for emergency use. Instruct personnel on the locations of eyewashes and safety showers, and how to activate them, prior to an emergency. Refer to [MIOSHA Fact Sheet: Eyewashes and Safety Showers](https://www.michigan.gov/documents/lara/lara_miosha_cet0199_628109_7.doc) to determine if an eyewash/safety shower is required for your specific chemical.

Please note: Additional hazards present in the laboratory may require that an eyewash or safety shower be present. This emergency equipment is required for treating exposures to workplace hazards such as chemical splashes, biological agents, welding sparks, metal shavings, or fine particulates like dust, dirt and sand.

1. **Health Threatening Emergencies**
   1. **Fire, explosion, health threatening hazardous material spill or release, compressed gas leak, or valve failure.**
      1. Call WSU Police (313) 577-2222.
      2. Alert people in the vicinity and activate the local alarm systems.
      3. Evacuate the area and go to your Emergency Assembly Point.
      4. Remain nearby to advise emergency responders.
      5. Once personal safety is established, call OEHS at (313) 577-1200.

Note: For compressed gas leaks, shut off gas supply only if this can be done safely, without risk to personnel.

* 1. **Injuries and Exposures:** 
     1. Remove the injured/exposed individual from the area, unless it is unsafe to do so because of the medical condition of the victim or the potential hazard to rescuers.
     2. Call WSU Police (313) 577-2222.
     3. Administer first aid as appropriate.
        1. Eye contact: Promptly flush eyes with copious amounts of water for a prolonged period (at least 15 minutes). Seek medical attention.
        2. Ingestion: Seek medical attention IMMEDIATELY. See first aid section of chemical Safety Data Sheet.
        3. Skin contact: Remove any contaminated clothing. IMMEDIATELY flush contamination from skin using the nearest emergency shower for a minimum of 15 minutes. Seek medical attention.
        4. Inhalation: Get to a source of fresh air. Seek medical attention.
     4. Call OEHS (313) 577-1200, to report the exposure and complete [Report of Injury](https://risk.wayne.edu/files/rofi.pdf) form.
     5. Bring to the hospital copies of the Safety Data Sheets for all chemicals to which the victim was exposed.

1. **Non-Health Threatening Emergencies**
   1. **Injuries and Exposures**

For injuries and exposures that are not considered serious or a medical emergency, visit:

Henry Ford Occupational Health – Harbortown

3300 East Jefferson, Suite 100

Detroit MI 48207

(313) 656-1618

Monday – Friday 8:00 AM to 6:30 PM

If Henry Ford Occupational Health Center is closed or for serious injuries, visit:

Henry Ford Hospital – Emergency Room

2799 W. Grand Blvd.

Detroit MI 48202

(313) 916-8742

OR

Detroit Receiving Hospital - Emergency Room

4201 St. Antoine St, Detroit, MI 48201

Phone: (313) 745-3000

# **Minimum Training Requirements**

1. **General Training:**

* Online through the [Collaborative Institutional Training Initiative (CITI)](https://about.citiprogram.org/en/homepage/).
  + Laboratory Safety Training (general lab & chemical safety issues) and Hazard Communication
* [Fire Safety](https://risk.wayne.edu/fire-safety).

1. **Laboratory Specific Safety Training:**

* [Laboratory-Specific Safety Training](https://research.wayne.edu/oehs/docs/lab-safety-training-checklist.doc) checklist
* Review of SDS for chemicals involved in process/experiment.
* Review of this SOP.
* Review [WSU Hazardous Waste Management](https://research.wayne.edu/oehs/hazardous/chemical-waste) guidelines.
* Other: \_\_\_\_\_\_\_\_\_

# **Laboratory Personnel Review**

Prior to initiating work, lab personnel using these types of chemicals must complete the table below confirming that they have read and understood the above SOP and the associated hazards.

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| **Name** | **Signature** | **Date** |
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