

#### 4. Reactive Chemicals (Solids, Liquids, Water Sensitive)

Standard operating procedures (SOP) are intended to provide you with general guidance on how to safely work with a specific class of chemical or hazard. This SOP is generic in nature. It addresses the use and handling of substances by hazard class only. In some instances multiple SOPs may be applicable for a specific chemical (i.e., both the SOPs for flammable liquids and carcinogens would apply to benzene). If you have questions concerning the applicability of any item listed in this procedure, contact the Vanderbilt Environmental Health and Safety (615-322-2057) or the Principal Investigator of your laboratory. Specific written procedures are the responsibility of the principal investigator.

If compliance with all the requirements of this standard operating procedure is not possible, the principal investigator must develop a written procedure that will be used in its place. This alternate procedure must provide the same level of protection as the SOP it replaces. The Vanderbilt Environmental Health and Safety is available to provide guidance during the development of alternate procedures.

Reactives are chemicals that react vigorously with moisture and other substances. The most common reactive solids include sodium, potassium and lithium metals; acid anhydrides, acid chlorides and salt hydrides. Reactive liquids are chemicals that react vigorously with moisture, oxygen or other substances. Examples include organic halides, phosphorous trichloride, titanium tetrachloride, butyl lithium, and hydrazine.

##### **Training:**

All Vanderbilt employees who work with hazardous chemicals must be apprised of the hazards of chemicals present in their work area. This training must be provided before initial assignment and before new exposure situations. Before a lab worker may begin work with Reactive Chemicals they must be trained on the lab specific Standard Operating Procedure for these materials. The primary factor that lab workers need to be trained on in regard to reactive chemicals are the nature of their reactivity, the identity and location of the reactive chemicals in the lab, proper handling and storage of reactive chemicals and the specific factors for handling and storing for water reactive chemicals.

##### **Securing of gas cylinders:**

See Appendix O, section 10

##### **Decontamination procedures:**

**Personnel:** Wash hands and arms with soap and water immediately after handling reactive solids or liquids.

**Area:** Carefully clean work area after use.

##### **Designated area:**

Not applicable

##### **Emergency procedure:**

Emergency procedures, which address response actions to fires, explosions, spills, injury to staff, or the development of sign and symptom of overexposure, must be developed. The procedures should address as a minimum the following:

- Who to contact: University police, and Office of Vanderbilt Environmental Health and Safety, Principal investigator of the laboratory including evening phone number.
- The location of all safety equipment (showers, spill equipment, eye wash, fire extinguishers, etc.)
- The location and quantity of all reactive solids in the laboratory.
- The method used to alert personnel in nearby areas of potential hazards.
- Specific first aid treatment required by the type of reactive material handled in the laboratory (Student Health Clinic or Occupational Health Clinic should be consulted for first aid procedures.)

**Eye protection:**

Eye protection in the form of safety glasses must be worn at all times when handling reactive materials. Ordinary (street) prescription glasses do not provide adequate protection and cannot pass the rigorous test for industrial safety glasses. Adequate safety glasses must meet the requirements of the Practice for Occupational and Educational Eye and Face Protection (ANSI Z.87. 1 1989) and must be equipped with side shields. Safety glasses with side shields do not provide adequate protection from splashes; therefore, when the potential for splash hazard exists other eye protection and/or face protection must be worn.

**Eyewash:**

Where the eyes or body of any person may be exposed to reactive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use. Bottle type eyewash stations are not acceptable.

**Glove (dry) box:**

Glove boxes may be used to handle reactive materials if inert or dry atmospheres are required.

**Gloves:**

Gloves should be worn when handling reactive materials. Nitrile gloves provide adequate protection against accidental hand contact with small quantities of most laboratory chemicals. However, when larger quantities are handled or regular contact is involved more protective gloves should be used. Lab workers should contact VEHS for advice on chemical resistant glove selection when direct or prolonged contact with hazardous chemicals is anticipated. A glove assessment chart can be found in Appendix H.

**Hazard assessment:**

Hazard assessment of work involving reactive materials should address proper use and handling techniques, fire safety (including the need for Class D fire extinguishers), storage, potential peroxide formation, water and air reactivity, and waste disposal issues.

**Lab hood:**

Many reactive materials will liberate hydrogen when they react with water or acids. The use of a fume hood is recommended to prevent the buildup of combustible gases.

**Labels:**

All reactive materials must be clearly labeled with the correct chemical name. Handwritten labels are acceptable; chemical formulas and structural formulas or abbreviations are not acceptable.

**Notification:**

Not applicable.

**Protective apparel:**

Appropriate lab attire (lab coats, closed- toe shoes and long- sleeved clothing) should be worn when handling reactive chemicals. Additional protective clothing should be worn if the possibility of skin contact is likely.

**Safety shielding:**

Safety shielding is required any time there is a risk of explosion, splash hazard or a highly exothermic reaction. All manipulations of reactive materials, which pose this risk, should occur in a fume hood with the sash in the lowest feasible position. Portable shields, which provide protection to all laboratory occupants, are acceptable.

**Safety shower:**

A safety shower should be available in a nearby location where the reactive materials are used.

**Special storage:**

Reactive materials should be stored in a cool and dry location. Keep reactive materials segregated from all other chemicals in the laboratory. Minimize the quantities of reactive materials stored in the laboratory.

Date all containers upon receipt. Potassium will form peroxides and super-oxides when stored under oil at room temperature. Examine storage containers frequently. Dispose of any container that exhibits salt build up on its exterior. Dispose of all reactive materials whenever they are no longer required for current research.

Never return excess chemicals to the original container. Small amounts of impurities may be introduced into the container, which may cause a fire or explosion.

**Special ventilation:**

Special ventilation is required if these materials are used outside of a fume hood or glove box. If your research does not permit the handling of reactive materials in a fume hood or glove box you must contact the Vanderbilt Environmental Health and Safety to review the adequacy of all special ventilation.

**Spill response:**

Anticipate spills by having the appropriate clean up equipment on hand. The appropriate clean up supplies can be determined by consulting the material safety data sheet. This should occur prior to the use of any reactive chemicals. Spill control materials for reactive materials are designed to be inert and will not react with the reagent.

In the event of a spill alert personnel in the area that a spill has occurred. Do not attempt to handle a large spill of reactive materials. Turn off all ignition sources and vacate the laboratory immediately. Call for assistance.

- Vanderbilt University Police Department 1-1911 or 322-2745.

Remain on the scene, but at a safe distance, to receive and direct safety personnel when they arrive.

**Vacuum protection:**

Not applicable

**Waste disposal:**

Questions regarding reactive chemical waste disposal should be directed to Vanderbilt Environmental Health and Safety (VEHS).