

[RETURN TO CH45 TABLE OF CONTENTS](#)

## Chapter 45

# CHEMICAL HYGIENE AND SAFETY PLAN

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### **Work Process N.1. Specific Controls and Procedures — Oxidizing Liquids and Solids**

#### **1. General Information**

- a. Oxidizing liquids and solids, while not necessarily combustible themselves, may cause or contribute to the combustion of other materials, generally through the release of oxygen or other gases. Strong oxidizers are capable of forming explosive mixtures if mixed with incompatible materials such as combustible, organic, or easily oxidized materials. Oxidizing gases are discussed in ESH Manual programs Chapter 7, [Pressure Safety](#), and Chapter 13, [Gas Safety](#). The emphasis of this section is on oxidizing liquids and solids.
- b. Oxidizing liquids and solids are classified by their burn rate when mixed with other compounds. Strong oxidizers have the potential to lead to an explosive oxidation when combined with other materials.
- c. Many oxidizers are also corrosive, for example, nitric acid and perchloric acid, which are oxidizing acids. See [Work Process L](#) for specific controls and procedures involving acids and bases (corrosives).

#### **2. NFPA Class 4 Oxidizers**

- a. Oxidizing liquids and solids are classified by the National Fire Protection Association (NFPA) and the California Fire Code (CFC) into 4 Classes.
- b. Class 4 oxidizers have the highest hazard. An NFPA Class 4 oxidizer meets the Class 3 burning rate plus it has the potential to have an explosive reaction due to contamination or exposure to thermal or physical shock. Some Class 4 oxidizers require additional review and approval (refer to [CHEMR](#), the list of restricted chemicals and gases).

Examples of Class 4 oxidizers include Guanidine Nitrate [506-93-4], Tetranitromethane [509-14-8], Ammonium Perchlorate [7790-98-9], and Hydrogen Peroxide >91% [7722-84-1].

### 3. GHS Oxidizing Liquids and Solids (Category 1 – 3)

- a. GHS, the Globally Harmonized System of Classification and Labeling of Chemicals, oxidizing liquids and solids are recognized with the “Flame Over Circle” hazard pictogram and are subdivided as follows, with Category 1 having the highest hazard:

Category	Description	Examples
1	H271: May cause fire or explosion; strong Oxidizer	Perchloric acid [7601-90-3], Sodium perchlorate [7601-89-0], Strontium nitrate [10042-76-9]
2, 3	H272: May intensify fire; oxidizer	70% Nitric acid [7697-37-2], 50% Hydrogen peroxide [7722-84-1], Potassium nitrate [7757-79-1]

### 4. Control Measures

- a. Work leads must identify oxidizing liquids and solids used in the work area. Review sources such as [SDSs](#) for specific compounds.
- b. An [assessment](#) of the hazards and controls in place is necessary to limit employee exposures to these agents. Contact an [EHS Health and Safety Representative](#) to provide assistance.
- c. Work involving these materials shall be added to a Work Planning and Control Activity. Consult the [Work Planning and Control](#) program (EHS Manual Chapter 6).

### 5. Training and Information

- a. Employees who either handle or who may be exposed to oxidizing liquids and solids are required to complete Chemical Hygiene and Safety Training ([EHS 0348](#); or [EHS 0345](#) for Facilities personnel).
- b. Activity leads are responsible for on-the-job training specific to hazards and controls of these materials for their work activities. Information on hazards and minimum PPE requirements must be available to workers

accessing work areas where these hazards are present such as through the entrance placard and co-located hazards in WPC activities. [EHS Health and Safety Representatives](#) are available to provide assistance.

- c. Consult [Work Process Y, Container Labeling](#), for labeling requirements for primary and secondary containers.
- d. The entrance to the work area should be posted with a [Caution Placard](#) depicting hazards and emergency contact information.

## **6. Substitution and Chemical Inventory Management**

- a. Identify and use [safer chemical alternatives](#) (e.g., less oxidizing materials) if possible.
- b. If a safer chemical can't be used, limit what you buy or borrow what you need from a colleague in your group or contact the Chemical Management System Coordinator (cms@lbl.gov) to assist you in finding a source of the chemical at Berkeley Lab.
- c. Conduct periodic cleanouts to prevent accumulating unneeded chemicals.
- d. Keep working quantities of chemicals to a minimum. Don't stockpile chemicals.
- e. Enter these materials into the [Chemical Management System \(CMS\)](#).

**7. Ventilation.** A fume hood or other appropriate exhaust ventilation system must be used when handling oxidizing liquids and solids in a manner that may produce an airborne hazard such as fumes, gases, vapors, and mists. This includes procedures such as transfer operations, preparation of mixtures, blending, sonification, spraying, heating, and distilling.

## **8. Work Practices**

- a. Prepare your workstation prior to using strong oxidizers (e.g. remove any solvent/flammable squirt bottles and flammable materials such as Kimwipes and paper towels).
- b. Control all ignition sources when handling oxidizing liquids and solids. Sources of ignition include open flames, smoking, hot surfaces, electrical and mechanical sparks, cutting and welding, static electricity, heat-producing chemical reactions, and anything that closes an electrical circuit (e.g., opening/closing a switch, plugging/unplugging a power cord, electrical motor or compressor switching on/off, etc.).

Contact your [EHS Health and Safety Representative](#) or the [Fire Marshal](#) for assistance in identifying ignition sources.

- c. Keep containers closed when not in use.
- d. Storing and consumption of food is permitted in designated areas only. See [Work Process J, Work Practice Controls](#) for additional information.
- e. Open bottles or carboys slowly and carefully and wear protective equipment to guard hands, face, and body from splashes and vapors/gases.
- f. Wipe drips/residues from containers and work surfaces.
- g. Wash hands before leaving the work area and prior to consuming food/beverages.

**9. Personal Protective Equipment (PPE).** Skin and eye contact must be prevented. The following PPE must be worn when handling these materials. Additional information may be found in [Work Process I, Personal Protective Equipment](#).

- a. At a minimum, safety glasses with side shields, laboratory coats (coveralls are acceptable in shop settings), long pants, and closed-toe shoes will be worn when handling these materials. This is to be considered as minimum protection and must be upgraded if necessary.
- b. Additional PPE such as chemical goggles, face shields, chemical aprons, disposable coveralls, [chemically resistant gloves](#) and respiratory protection must be worn if there is a greater chance of chemical exposure. An [EHS Health and Safety Representative](#) may be contacted for assistance in selecting appropriate gloves and respiratory protection. The use of respiratory protection requires an industrial-hygiene hazard evaluation and a medical clearance followed by a fit test and training by the Industrial Hygiene Group.
- c. Consult [Work Process I.6, Eye and Face Protection](#), for guidance on the selection, uses, and limitations of safety glasses, chemical goggles, and face shields.
- d. Gloves must be selected on the basis of their chemical resistance to the material(s) being handled, their suitability for the procedures being conducted, and their resistance to wear as well as temperature extremes. Improper selection may result in glove degradation, permeation of the chemical through the glove, and ultimately personal

exposure to the chemical. This is a potentially serious situation.

Consult [Work Process I.5, Gloves](#), for guidance on the selection, uses, limitations, and disposal of chemically resistant gloves.

An [EHS Health and Safety Representative](#) may also be contacted for assistance in selecting appropriate gloves.

## 10. Storage

- a. Consult [Work Process K, Chemical Storage](#), for hazardous-materials storage requirements, recommendations, and information on chemical incompatibility. Additional requirements are provided below.
- b. Store oxidizing liquids and solids away from ignition sources. Sources of ignition include open flames, smoking, hot surfaces, electrical and mechanical sparks, cutting and welding, static electricity, heat-producing chemical reactions, and anything that closes an electrical circuit (e.g., opening/closing a switch, plugging/unplugging a power cord, electrical motor or compressor switching on/off, etc.). Contact your [EHS Health and Safety Representative](#) for assistance in identifying ignition sources.
- c. Segregate oxidizing acids and oxidizers from flammable and combustible liquids.
- d. Store nitric acid in its own secondary containment trays. Nitric acid can combine with other acids to form nitrogen oxides and nitrosyl halide gases.

## 11. Emergency Procedures

- a. Consult [Work Process V, Emergency Procedures and Equipment](#), for emergency actions regarding chemical spill and personal exposure to chemicals.
- b. In addition to these requirements, the following applies to oxidizing liquid and solid spills:
  - i. Never use combustible or reactive materials (such as paper towels) to clean up or absorb spills of oxidizing liquids and solids. Keep an adequate number of appropriate spill kits to meet anticipated needs. These are commercially available through VWR Scientific.
  - ii. An emergency eyewash and safety shower must be located in all areas where flammable or combustible liquids are used. In

the event of skin or eye contact, flush the affected area for at least 15 minutes and report to [Health Services](#) for evaluation and treatment. 🚒 🚒

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