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Safety in High School and College Laboratories

Part I Laboratory Safety

General Safety Guidelines

- Post laboratory rules, including these safety guidelines, in a conspicuous place in the laboratory.
- Before beginning an experiment, review specific safety rules with the class and demonstrate proper procedures.
- Students should be supervised at all times when working in the lab. No unauthorized investigations should ever be conducted and no unauthorized materials should ever be brought into the laboratory.
- Never leave the lab unattended. Lock the laboratory (and storeroom) when you are not present.
- Mark locations of eyewash stations, safety shower, fire extinguishers (ABC tri-class), chemical spill kit, first aid kit, and fire blanket in the laboratory and storeroom. Make sure all safety equipment is present and in good working order before beginning a lab.
- Post an evacuation diagram and established evacuation procedure by every entrance to the laboratory.
- Outfit your lab with labeled disposal containers for glass, sharp objects, and waste chemical reagents.
- No food or beverages should be allowed in the laboratory. Instruct students to keep their hands away from their faces and to wash their hands with soap and water before leaving the laboratory.
- Know the location of the master shut-off for laboratory circuits.
- Follow prescribed procedures for any safety incident—including fully documenting every incident. Remind students that any safety incident, no matter how minor, must be reported.

Regulations (OSHA Laboratory Standard)

- Occupational Exposures to Hazardous Chemicals in Laboratories (OSHA Laboratory Standard) was published in January 1990. It requires a written Chemical Hygiene Plan (CHP) describing procedures for handling hazardous chemicals in the laboratory and training of laboratory employees. (Although students are not laboratory employees, they do carry out "laboratory work" while in the laboratory and therefore fall under the laboratory standard) The CHP must cover each of the following topics in detail with emphasis on minimizing the hazards of laboratory work:
    - Standard Operating Procedures
    - Criteria for implementing specific controls
    - Routine testing and certification of fume hoods
    - Information and training requirements

- Laboratory operations that require approval of the employer
- Provisions for medical consultation and exams
- Designation of a chemical hygiene officer
- Requirements for additional protection when working with select carcinogens, mutagens, teratogens and substances with a high degree of acute toxicity.

Academic laboratories in elementary, high schools and colleges should have had their CHP in place by 1/1/1991.

- Other regulatory requirements include proper disposal of hazardous chemical waste under EPA guidelines. The chemicals that are classified as hazardous wastes are listed under CERCLA(Title 40 CFR302) and RCRA (Title 40 CFR261). See Disposal of chemicals in Part II.

Personal Protective Equipment

- Chemical goggles [meeting ANSI Standard Z87.1] should be worn when working with any chemical or chemical solution other than water, open flame, or mechanical device or physical process that could eject an object. If a student must wear contact lenses to correct his or her vision, the student should wear eye-cup safety goggles meeting the same ANSI safety standard.
- Face shield [meeting ANSI Standard Z87.1] should be worn in addition to goggles when working with corrosives.
- Eyewash station [meeting ANSI Standard Z358.1] must be capable of delivering a steady, gentle flow of water to both eyes for at least 15 minutes and must be within a 10-second walking distance from any spot in the room. A plumbed-in fixture or a perforated spray head on the end of a hose, attached to a plumbed-in outlet designed for use as an eyewash fountain, is suitable if it meets the ANSI safety standard. Portable liquid supply devices are not satisfactory and should not be used.
- Safety shower [meeting ANSI Standard Z358.1] should be within a 10-second walking distance from any spot in the room. Students should be instructed in the use of the safety shower in the event of a fire or chemical splash.
- Gloves made of polyethylene, neoprene rubber, or disposable plastic should be worn. Students should wear nitrile or butyl rubber gloves when handling corrosives.
- An apron, gray or black rubber-coated cloth or vinyl (nylon-coated) halter style, is recommended.

Good Laboratory Practices

Safety with Chemicals

- Do not store bulk quantities of chemicals in the storeroom or the laboratory. Store them in well-ventilated, dry areas protected from sunlight and localized heat. Store by similar hazard characteristics—"flammables", "reactives", "corrosives", "toxins", etc.—not alphabetically. Follow specific storage recommendations for each hazard class.
- Label student reagent containers with the substance's name and hazard class(es).
- Have a chemical spill kit immediately available. Know the procedures for handling a spill for any chemical used when preparing reagents or during an investigation. Never allow students to clean up hazardous chemical spills.
- Remove all ignition sources from the laboratory when any flammable material is used.

Chemical Labeling

Before preparing or disposing of any hazardous chemical materials, familiarize yourself with safety and handling procedures, hazards and precautions, and storage information listed on individual reagent labels and Material Safety Data Sheets.
Make sure that each container is properly labeled with:

1. The name of the material and, if it is a solution, its concentration.
2. The names of individual components and, if it is a mixture, their respective concentrations.
3. The appropriate signal word:

Caution: low level of risk associated with use or misuse
Warning: moderate level of risk associated with use or misuse
Danger: high level of risk associated with use or misuse

4. Storage codes:
   Green – General Storage
   Yellow – Oxidizer
   Red – Flammable
   Blue – Toxic or Poison
   White – Corrosive

5. A declarative statement of potential hazard(s)

6. Immediate first aid measures
   Example:
   Lugol's Iodine Solution
      WARNING: Poison if Ingested/Irritant
      Do Not Ingest. Avoid Skin/Eye Contact.
      If contact with eyes: Flush with water for 15 minutes.
      Get medical attention.

Storing Chemicals

- Never store chemicals alphabetically. This greatly increases the risk of promoting a violent reaction. Store by storage code on the label.
- Store acids, flammables, toxins, and oxidizers in separate, specifically designated storage cabinets.
- Do not store chemicals on the floor.
- Do not store chemicals above eye level or on a top shelf.
- Store chemicals on wooden shelves if possible.
    - Make sure shelf assemblies are firmly secured to walls.
    - Make sure all shelves have anti-roll lips.
    - Avoid metal, adjustable shelf supports and clips.

Safety with Microbes

- Pathogenic (disease-causing) microorganisms should never be used in a high school laboratory.
- Students who receive immuno-suppressive drug therapy that could lower immune response are extraordinarily sensitive to potential infection from generally harmless microorganisms. These students should not participate in laboratory investigations unless permitted to do so by a physician.
- Do not allow students with cuts, abrasions, or open sores to work with pathogenic microorganisms.
- Demonstrate correct aseptic technique before students begin the lab. Never transfer liquid media by mouth. Wherever possible, use sterile cotton applicator sticks in place of inoculating loops and Bunsen burner flames for culture inoculation.
- Treat all microbes as pathogenic. Seal all petri dishes containing bacterial cultures with tape. Do not use blood agar plates, and never attempt to cultivate flora from a human or animal source.
- Never allow students to clean up bacteriological spills. Have a spill kit on hand, containing 500ml Clorox ® (full strength), autoclavable biohazard bags, forceps, and paper towels. In the event of a bacteriological spill, cover the area with a layer of paper towels. Wet the paper towels with the Clorox ® solution; allow to stand for 15 to 20 minutes. Wearing gloves and using

forceps, place the residue in the biohazard bag. Use a brush and dustpan to collect broken glass and place in a suitably marked container.

- Sterilize all microbe cultures before disposing of them. Autoclave all used cultures and any materials that have come in contact with them at 120°C 15 psi for 15 to 20 minutes. If these devices are not available, flood or immerse the articles in Clorox ® (full-strength) for 30 minutes, then discard. Wash the lab surface with a disinfectant solution before and after handling bacterial cultures.

Part II Understanding Chemical Hazards

Material Safety Data Sheets (MSDS)

Material Safety Data Sheets (MSDS) provide readily accessible information on chemical substances commonly used in the laboratory. The MSDS should be kept on file and referred to before handling any chemical. The MSDS can also be used to instruct students on chemical hazards, spill and disposal procedures, and incompatibilities with other chemicals or mixtures.

Types of Chemical Hazards

Chemicals are grouped into the following categories:

Flammables
Corrosives
Toxins
Reactives

It is important to keep in mind that a particular chemical may be hazardous in more than one category. Chemicals that do not possess any of the above properties, such as water, are “low hazard” materials.

Flammables

Flammable substances are solids, liquids, or gases that will burn when three components are present: fuel, an oxidizer, and an ignition source. To control the danger of flammable substances, remove at least one of these components.

- Flammable Liquid: Liquid having a flashpoint less than 100°F
- Combustible Liquid: Liquid having a flashpoint equal to or greater than 100°F but less than 200°F
- Flammable Solid: Solid that ignites through friction, absorption of moisture, sublimation, or spontaneous chemical change
- Flammable Gas: Forms flammable mixtures with air

Control Measures

- Store away from oxidizers and reactives.

- Store only in approved containers in an approved storage cabinet.
- Keep containers closed when not in use.
- Remove lighted burners; spark sources, including static charge, friction, electrical equipment; and hot objects, such as hot plates or incandescent bulbs, from the work area.
- Ground all bulk metal containers when dispensing flammable liquids.
- Minimize the quantities available in the laboratory—usually 100ml.
- Make sure there is adequate ventilation in the lab.
- Flammable vapors are usually heavier than air and can travel considerable distances before being diluted below ignitable concentrations. Have Class B fire extinguishers present in the laboratory and storeroom.
- Students should be familiar with the proper safety procedures in the event that their clothes or hair catch fire. Practice “drop and roll” techniques.
- Keep a safety shower and fire blankets available in the lab.
- Conduct a fire inspection with members of the local fire department at least once a year. Practice fire drills regularly.
- Have enough absorbent, vapor-reducing materials, available commercially, close at hand for fast spill cleanup of the maximum volume of flammable materials in the lab.

Protective Equipment
- Approved storage cabinet for flammables
- Approved storage containers
- Safety shower
- Fire blanket
- Fire extinguishers (Class B)
- Goggles
- Face shields (recommended)
- Nitrile or butyl rubber gloves
- Aprons

Corrosives

Corrosives are solids, liquids, or gases that harm body tissue by direct chemical action. Corrosive injury may range from sensitization/irritation to actual physical destruction of body tissue.
- Sensitizer: Causes allergic reaction in normal tissue of a substantial number of individuals after repeated exposure
- Irritant: Causes reversible inflammation in living tissue
- Corrosive Liquid, Solid, or Gas: Causes visible destruction or irreversible alterations in living tissue.

Control Measures
- Store only in approved containers, away from sunlight and drastic temperature changes.

- Store containers below eye level.
- Keep containers closed when not in use.
- Do not wear cloth-covered or open-toed shoes.
- Always wear goggles and face shield when handling solutions of any corrosive material above 1 molar.
- Always wash hands with soap and water after working with corrosives.
- Have an eyewash station in close proximity.
- Wear gloves impervious to the corrosive being handled. Disposable polyethylene gloves are recommended for most general lab activities. Nitrile gloves are recommended when working with acids or bases.
- Make sure there is adequate ventilation in the lab.
- Have enough neutralizing reagents close at hand for fast spill cleanup. Be sure there is enough to clean up the quantity of materials in the lab.

Protective Equipment
- Approved storage cabinet for corrosives
- Approved storage containers
- Eyewash station
- Safety shower
- Goggles
- Face shields
- Corrosive-resistant gloves
- Sleeve gauntlets

Toxins and Poisons

All chemicals are toxic if they exceed tolerable limits, injuring a body through direct contact, inhalation, ingestion, penetration, and entrance through body orifices other than the nose or mouth. A chemical's toxicity is detailed in its Material Safety Data Sheet, Section V, "Health Hazard Data".

Control Measures
- Treat all chemicals as toxic until proven otherwise.
- Wear protective equipment over exposed skin areas and eyes.
- Handle all contaminated glass and metal, especially sharp objects, carefully.
- Make sure there is adequate ventilation in the lab. Use a chemical fume hood if required.
- Recognize different means of overexposure and symptoms of each.
- Become familiar with immediate first aid measures for each chemical used.
- Be scrupulous in housekeeping and in personal hygiene.
- Never consume food or beverages in the laboratory.
- Wash hands thoroughly, including under fingernails, following use or handling of any chemical.
- Post the phone number of the Poison Control Center on your phone.

Protective Equipment

- Approved storage cabinet for toxins
- Approved storage containers
- Container for disposal of sharp objects
- Chemical fume hood
- Goggles
- Respirator
- Gloves
- Apron

Reactives

Reactives are chemical substances that react violently, generating heat, light, flammable and nonflammable gases, or toxicants under certain ambient or induced conditions such as mixing, shock, or disturbance.

- Acid Sensitive: Reacts with acids or acid fumes
- Water Sensitive: Reacts with moisture
- Oxidizer: Promotes combustion in other materials through release of oxygen or other gases

Control Measures

- Store in a cool, dry place, away from sunlight and localized heat.
- Keep chemicals of different hazard classes separate.
- Protect containers from physical shock.
- Provide a ready water source for dilution not involving water-sensitives.
- Keep water away from water-sensitives.
- Familiarize yourself with any incompatibility issues present for all chemicals used in an investigation, no matter how remote.

Protective Equipment

- Approved storage cabinet for reactives
- Approved storage containers
- Goggles
- Gloves
- Apron

Disposal of Chemicals

You should be aware of local, state and federal regulations governing disposal of hazardous materials. Contact a licensed Treatment/Storage/Disposal (TSD) facility for disposal of bulk or large quantities of hazardous chemicals. Disposal protocols outlined here are only for the substances and quantities specified.

Never pour chemicals down the drain unless the drains are connected to a sanitary sewer system. Even if the drains are connected to a sanitary sewer, do not pour any chemical down the drain until you are certain it is safe and you are permitted to do so. Never pour chemicals or reagents down the drain if you have a septic system.

The hazard class of chemicals and reagents are indicated by a color code. Remember to store chemicals of different hazard classes away from each other.
Flammables: Red
Corrosives: White
Toxins and Poisons: Blue
Oxidizers: Yellow
Low Hazard: Green

Disposal Method A—Inert Solid Waste, Low Hazard
Low hazard items, with a Green storage code for general storage, can be considered low hazard as long as they remain in the laboratory. Check local, state, and federal regulations to be sure that these items may be disposed of in landfills.
Disposal Method B—Small Quantities of Liquid Waste, Low Hazard
Low hazard items, with a Green storage code for general storage, can be considered low hazard as long as they remain in the laboratory. Generally, volumes less than 250ml should be disposed of by diluting in tap water, 1:20. Place a large beaker in a sink, pour the solution into the beaker, and run water to overflowing for 10 minutes, flushing to a sanitary sewer.

All other chemical waste must be handled by a licensed chemical waste contractor. Contact your local EPA office for names of licensed contractors in your area.

Part III Safety with Glassware and Equipment

Bunsen Burner Safety

Bunsen burners come in various configurations, but they all operate in the same fashion. Most have a valve to control gas flow and air inlets to control the amount of oxygen the flame receives. By varying these two controls the proper flame can be obtained. It should be blue with a light blue inner cone. If the flame is yellow, increase the airflow. The height on the flame can be varied with the gas control valve. Always check the gas hose to make sure it fits securely on the gas outlet as well as the Bunsen burner. Inspect the hose for cuts or cracks and replace if it appears worn.

Flammable liquids

Special care must be taken when working with flammable liquids. Alcohols, ketones and other volatile organic liquids give off flammable vapors. Never use an open flame when working with these materials. To heat volatile liquids, use a water bath. Heat the water to the desired temperature, extinguish the flame and place the test tube or beaker containing the volatile liquid in the water bath.

Heating Glassware

Before heating any glassware it should be closely inspected for chips or cracks. Never heat a closed container. Flasks and beakers should be heated on a wire screen or in a sand bath. Tall narrow-necked flasks should be secured to a ring stand with a clamp. A water bath works well for heating glassware up to 100º C. Tongs or insulated mitts must be used to handle hot glassware.

Glass Tubing Safety

Cutting and inserting

Improperly cutting and inserting glass tubing in stoppers is a common cause of injuries in the lab. To cut glass tubing, use a file to score the tubing at the desired length. Wrap the tubing in a towel and place your thumbs behind and on either side of the score mark. Use your fingers to gently put pressure on the tubing until it breaks at the score mark. Polish the ends of the tubing by slowly turning the tubing in the flame of a Bunsen burner until it turns red. Place tubing on a wire gauze pad to cool. Inserting the cooled tubing in a stopper is done by lubricating the tubing and stopper with glycerin. Leather gloves should be use to protect the hands from possible cuts, Slowly and carefully insert the tubing while turning the stopper. Once the tubing is in place, wash off the excess glycerin. The same technique should be employed when inserting a thermometer in to a stopper.

Bending

Bending glass tubing to make various pieces of lab equipment can be easily done using a Bunsen burner. Carefully place the part of the tube you want to bend at the tip of the light blue inner cone of the flame. Rotate the tube to heat all sides evenly. Apply light pressure to the tube until it starts to bend. Once the proper angle is achieved, place tube on a wire screen to cool.

Part IV Fire Safety

Fire Extinguishers

A portable fire extinguisher can save lives and property by putting out a small fire or containing it until the fire department arrives; but portable extinguishers have limitations. Because fire grows and spreads so rapidly, the number one priority for occupants is to get out safely.

Safety Tips:

- Use a portable fire extinguisher when the fire is confined to a small area, such as a wastebasket, and is not growing; everyone has exited the building; the fire department has been called or is being called; and the room is not filled with smoke.
    - To operate a fire extinguisher, remember the word PASS.
      - **P**ull the pin. Hold the extinguisher with the nozzle pointing away from you, and release the locking mechanism.
      - **A**im low. Point the extinguisher at the base of the fire.
      - **S**queeze the lever slowly and evenly.
      - **S**weep the nozzle from side-to-side.
- For the classroom, select a multi-purpose extinguisher (Type ABC) that is large enough to put out a small fire, but not so heavy as to be difficult to handle.
- If flammable metals such as calcium or magnesium are used in the classroom, a type D extinguisher must be installed.
- Choose a fire extinguisher that carries the label of an independent testing laboratory.
- Read the instructions that come with the fire extinguisher and become familiar with its parts and operation before a fire breaks out. Local fire departments or fire equipment distributors often offer hands-on fire extinguisher training.
- Install fire extinguishers close to an exit and keep your back to a clear exit when you use the device so you can make an easy escape if the fire cannot be controlled. If the room fills with smoke, leave immediately.
- Know when to go. Fire extinguishers are one element of a fire response plan, but the primary element is safe escape. Every building should have a fire escape plan.

Fire Escape Plan

Every classroom needs an evacuation plan posted. A floor plan showing two exits from every room as well as exits from the building should be included. If fire escapes are installed in the building, everyone needs to be trained on how to access and use the fire escapes.

An assembly point outside the building should be identified and head counts taken as soon as the building is evacuated to assure everyone made it out of the building. Once the fire escape plan is in place, fire drills should be held twice a year.

Part V Emergency Response Team

Personnel, students and teachers, need to be trained on how to handle a chemical or biological emergency before an accident or release occurs. Take preventative measures to ensure the utmost safety in your lab; know how to act effectively before a safety incident occurs. The appropriate equipment to contain spills should be available in every laboratory.

Emergency Preparedness

- Post the phone numbers of the Poison Control Center, fire, police, and nearest hospital on your telephone.
- Practice fire and evacuation drills as well as what students must do if a fire occurs, or if they come in contact with or are exposed to dangerous chemicals.
- Be sure that all personal and other safety equipment is easily accessible and in operating order. Test equipment if appropriate.
- Compile a file of Material Safety Data Sheets for all chemicals, and be sure it is readily accessible in the event of a chemical spill or other emergency.
- Know the variations in chemical spill severity. Handle only those incidents you feel comfortable with. Situations of greater severity should be handled by a trained Haz-Mat team.
- Never allow students to fight fires or handle spills.
- Have a working knowledge of first aid and basic life support (CPR) procedures. Keep first aid kits and spill kits readily available.
- Fully document any incident that occurs. It provides for the best defense against liability and is a critical tool in helping to identify area(s) of laboratory safety that need improvement.

Release of Biological Organisms

It is the instructor's responsibility to ensure that each life-form brought into the classroom receives adequate care in the lab as well as when it is released or disposed of. Microbes—bacteria, fungi, yeasts, growth media or materials that have come into contact with these organisms should not be discarded without prior decontamination (sterilization).

Appendix

Chemicals that are inappropriate for School Laboratories

- Peroxides and peroxide formers, i.e. diethyl ether, p-dioxane and cyclohexane.
- Extreme Poisons, i.e. cyanides
- Extremely reactive chemicals, i.e. sodium or potassium metal, white or yellow phosphorus
- Carcinogens, i.e. formaldehyde, benzene
- Picrates, i.e. picric acid

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Glossary

ACGIH: American Conference of Governmental Industrial Hygienists; organization of health/safety professionals.
Acute Effect: An adverse physical effect on a human or animal; severe symptoms develop rapidly and reach critical level quickly. See also “Chronic Effect”.
Acute Toxicity: Acute adverse effects resulting from a single dose or exposure to a substance. Ordinarily used to denote effects in animal test subjects.
CAS: Chemical Abstract Service; organization affiliated with the American Chemical Society which abstracts and indexes chemical literature by assigned CAS number. Publishes Chemical Abstracts.
Ceiling: Maximum allowable human exposure or limit for an airborne substance; not to be exceeded, even momentarily.
Chemical Family: Group of single elements or compounds with a common general name.
CHEMTREC: Chemical Transportation Emergency Center; national center established by the Chemical Manufacturers Association in Washington, D.C., to relay pertinent information concerning specific chemicals. CHEMTREC can be reached 24 hours a day, toll free: 1-800-424-9300.
Chronic Effect: Adverse physical effect on a human or animal; symptoms develop slowly over a period of time, or recur frequently. See also “Acute Effect”.
Combustible: Term used to classify certain liquids that will burn, on the basis of flashpoints. NFPA, OSHA, and DOT generally define “combustible liquids” as having a flashpoint of 100°F (37.8°C) or higher. See also “Flammable”.
Concentration: The relative amount of a substance when combined or mixed with
other substances.
Corrosive: Term defined by DOT as a liquid or solid that causes visible destruction of, or irreversible alterations in, human skin tissue at the site of contact, or a liquid that has a severe corrosive effect upon steel.
Decomposition: Breakdown of a material or substance, by heat, chemical reaction, decay, or other processes, into parts, elements, or simpler compounds.
Dermal: Of or applied to the skin.
Dermal Toxicity: Adverse effects resulting from skin exposure to a substance. Ordinarily used to denote effects in animal test subjects.
DOT: Department of Transportation.
EPA: Environmental Protection Agency.
Evaporation Rate: The rate at which a material vaporizes (evaporates) compared to the rate of vaporization of a known material, usually butyl acetate, with a rate designated as 1.0. Rate examples: Fast—greater than 3.0, Medium—0.8 to 3.0, Slow—less than 0.8.
Flammable liquid: A liquid with a flashpoint below 100°F (37.8°C).
Flashpoint: Temperature at which a liquid will give off enough flammable vapor to ignite.

General Exhaust: System for exhausting air, which contains contaminants, from a general work area.
g/kg: Grams per kilogram; used in oral and dermal toxicology testing to indicate grams of substance dosed per kilogram of animal body weight.
Hazard Communication Standard: Federal "right-to-know" standard administered
by OSHA regulating communication of substance hazard information to employees.
Hazardous Material: Any substance or mixture of substances having properties capable of producing adverse effects on the health and safety of a human being. A material that has one or more of the following characteristics is considered to be a hazardous material

- Flashpoint below 140°F.
- TLV below 500 ppm for gases and vapors, below 500mg/m for fumes, and below 25 mppcf for dust.
- Single oral dose (LD-50) below 500mg/kg.
- Subject to polymerization.
- Is a strong oxidizing or reducing agent.
- Causes first degree burns to skin in short exposure time, or is systematically toxic by skin contact.
- In the course of normal operations, may produce smoke, dust, gases, fumes, vapors, and/or mist which have one or more of the above characteristics.

Incompatible: Materials which, through direct contact with one another, could cause a dangerous reaction.
Ingestion: Taking in a substance through the mouth.
Inhalation: Breathing in a substance in the form of gas, vapor, fume, mist, or dust.
Irritant: Substance which, by contact in sufficient concentration for a sufficient period of time, will cause inflammatory responses or reaction in the eye, skin, or respiratory system.
LD-50: Lethal Dose—50; single dose of a material which, on the basis of laboratory tests, is expected to kill 50% of a group of animal test subjects.
Local Exhaust: System for capturing and exhausting contaminated air where the contaminants are produced.
Mechanical Exhaust: Powered device, such as motor-driven fan, for exhausting contaminants from the workplace.
mg/kg: Milligrams per kilogram; a toxicological dose.
Olfactory: Relating to the sense of smell.
Oral: Used or taken into the body through the mouth.
OSHA: Occupational Safety and Health Administration.
Oxidation: Reaction in which a substance combines with oxygen provided by an oxidizer or oxidizing agent.
Oxidizer: Substances such as chlorates, permanganates, and nitrates that yield oxygen readily, to stimulate the combustion (oxidation) of organic matter.

Oxidizing Agent: Chemical or substance which brings about an oxidizing reaction.
PEL: Permissible Exposure Level; exposure limit established by OSHA.
Poison, Class A: As defined by DOT, extremely dangerous poisons.
Poison, Class B: As defined by DOT, substances which are known or presumed to be toxic enough to pose a health hazard.
Polymerization: Chemical reaction in which small molecules combine to form larger ones.
ppb: Parts per billion.
ppm: Parts per million.
psi: Pounds per square inch.
RCRA: Resource Conservation and Recovery Act.
Reaction: Chemical transformation or change; the interaction of two or more substances to form new substances.
Reactivity: Description of a substance's tendency to undergo chemical reaction with the release of energy.
Reducing Agent: Chemical or substance that combines with oxygen or loses electrons in a reduction reaction, which always occurs simultaneously with an oxidation reaction. See "Oxidation".
Sensitizer: Chemical that causes a substantial number of humans or animals to develop an allergic reaction in normal tissue after repeated exposure.
Solubility in Water: Percentage of material, by weight, that will dissolve in water at ambient temperature. Terms used to express solubility: negligible—0.1%; slight—0.1 to 1.0%; moderate—1.0 to 10%; appreciable—10%; complete—soluble in all proportions.
Specific Gravity: Density of a material as defined by weight of the material compared to the weight of an equal volume of water.
Stability: Ability of a material to remain unchanged.
STEL: Short-Term Exposure Limit.
Synonym: Other name by which a material is known.
TLV/TWA: Time Weighted Average; concentration to which nearly all persons may be exposed, in a normal eight-hour workday and 40-hour work week, without adverse effects.
Toxicity: Sum of adverse effects resulting from exposure to a material.
Unstable: Tending toward decomposition or other unwanted chemical change during normal handling or storage.
Vapor Density: Expression of density of a vapor or gas as defined by weight of the material compared to the weight of an equal volume of air.
Vapor Pressure: Pressure exerted by a saturated vapor above its own liquid in a closed container.