Working Safely with Hazardous Substances:

A Handbook for Employees

Environmental Health and Safety Office
Reed College
Portland, OR 97202

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Emergency Information

Fire, Ambulance/Rescue, Police	911
Community Safety	503/788-6666
Poison Control Center (OHSU)	800/222-1222
Reed Health Services (M-F 9 am - 5 pm)	503/777-7281
Reed Environmental Health and Safety	503/777-7788
Reed Physical Plant Maintenance	503/777-7283
Reed Public Affairs	503/777-7289

Where is my...

Nearest Fire Alarm
Pull Station: _____

Nearest Fire Extinguisher: _____

Nearest Automated
External Defibrillator: _____

Outside Assembly
Point Location: _____

Shelter-in-Place Location: _____

Nearest First Aid Kit: _____

Nearest Emergency Shower/Eyewash: _____

Nearest Spill Kit: _____

SDS Location: _____

Contents

I. Introduction

Do you work in an office? Teach in a classroom? Conduct research in a laboratory? Work in a dorm? Perhaps you keep our campus facilities running smoothly and looking beautiful? Every day we confront, defy, and dodge hazards both at home (check out **householdproducts@nih**) and at work. These might include:

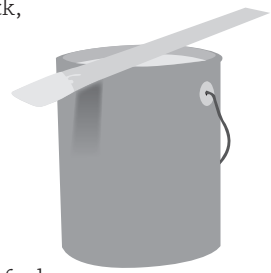
- Ergonomic hazards from improper lifting, poorly designed workstations, repetitive motion;
- Physical hazards from slippery surfaces, fast moving vehicles, physical assault, steep grades, uneven surfaces;
- Chemical hazards, such as flammables, corrosives, pesticides, incompatibles;
- Health hazards, such as dermatitis, allergens, respiratory disorders;
- Electrical hazards, such as ungrounded equipment, overloaded circuits, frayed or damaged cords;
- Biological hazards from bacteria and viruses, poison oak and ivy, animals, needle sticks;
- Noise hazards from machinery, tools, and construction;
- Radiation hazards from ionizing and non-ionizing radiation;
- Psychosocial from stress and violence;
- Thermal hazards, such as hot and cold environments, fires, and explosions;
- Natural hazards, such as earthquakes, wind storms, snow and ice, and floods.

One way we protect ourselves from harm is through knowledge and understanding. This booklet focuses on our "right-to-know" about one of these dangers, chemical hazards.

We use thousands of chemical products throughout our lives, yet most of us would have difficulty telling the difference between a safe product and a hazardous one without information and training. As an employee of Reed College, you not only have a right to know about the chemicals with which you work, but also have the right to understand how to work safely with chemicals — their health effects, how to handle them safely, and emergency procedures to follow in case of an accident. This handbook explains legislation about hazardous materials in the workplace. It shows you how to use a Safety Data Sheet (SDS) to learn more about the substances you use or are in your work area.

Reed College employs over 500 people in many different occupations. In every occupation, employees may work with or around potentially hazardous materials. Here are a few examples:

Office staff and **faculty**: rubber cement, cleaning products, disinfectants, copy machine and printer hazards such as resins, carbon black, ozone, and particulate production.



FACILITIES SERVICES STAFF:
Maintenance: thinners, solvents, flammable paints, paint containing lead, glues, solvents, corrosive chemicals, cutting fluid, welding fumes, degreasers.

Custodians: cleaning agents, bleach, floor finishes.

Grounds Keepers: fertilizers, growth retardants, pesticides, fuel.

Print Shop Staff: inks, solvents, copy machine chemicals, cleaners.

Visual Artists: paints, thinners, ceramic glazes, photographic chemicals.

Laboratory Workers: chemicals, bacteria, radioactive materials, drugs.

Residence Life Staff: students should have no hazardous materials in their rooms but they sometimes do. For example, sulfuric acid, propane gas, drugs, and white gas.

II. The "Right-To-Know" Law

Hazardous materials are an important part of our standard of living. We live around and work with many products each day. However, accidents also occur. Upon their release, they may cause harm to people, property, and the environment, and may disrupt critical activities in our lives. Reed College has almost 8,000 of these materials on campus. Examples include gasoline and sulfuric acid in our cars, toxic mushroom extracts and bacteria in laboratories, ionizing radiation in the nuclear reactor, and many, many other hazardous chemicals. Found in the Oregon Administrative Rules (OAR) Chapter 437 Division 2 Subdivision, Z, the Hazard Communication standard is called the "RIGHT TO KNOW LAW." It requires that we know and understand important up-to-date safety information about potentially hazardous substances to which we, as employees and others, could be exposed.

The manufacturers of these hazardous substances must provide users with SAFETY DATA SHEETS (SDSs) for each product. SDSs, which were called Material Safety Data Sheets (MSDSs) before 2013, tell about the health effects, safety hazards, and safe work procedures that we must use with the material. Employers must make this information available to the employee.

MSDS = SDS

Each work area that uses hazardous materials must maintain a list of these materials and have available the Safety Data Sheets that describe their hazards. Ask your supervisor where the list and the SDSs are located in your area. Contact the Environmental Health & Safety (EHS) Office at **ehs@reed.edu** for additional information.

The Right to Know law does not cover radiation hazards. The College employs a Radiation Safety Officer (RSO) for this purpose. For more information on this subject, contact the Director of the Reed Reactor Facility or the RSO.

In addition to the Hazard Communication law, Oregon also has a Hazardous Waste Operations and Emergency Response (HAZWOPER) standard found in OAR Chapter 437, division 2, subdivision H. This regulation covers all employees who may encounter a spill of a product, such as a gasoline leak in the parking lot, a spill of cleaning solvent, or other release.

Both of these programs, the Right-to-Know, and HAZWOPER, involve a series of basic steps that apply not only to hazardous materials but also to all other emergencies. After we recognize and identify all hazards on campus, we then can collect information about the hazards and train everyone in what to do.

The Right to Know program involves a series of steps:

1. Look for clues to help you recognize and identify hazardous substances.

   Think about our campus. What products come to mind when you think of a **location** such as the sports center? If you thought of chemicals such as liquid chlorine, Coleman fuel, propane, or laundry detergent, you'd be right. How about custodial closets? Cleaning products, polishes, and bleach should come to mind. What is underneath that sink? Perhaps ant traps, electronics cleaners, or disinfectants.

   Another clue is the **container size and shape.** For example, is it a glass carboy or is it tall and slender with good-looking shoulders and a valve on top [a gas cylinder]. Each of these gives clues about the type of hazard inside.

   Look for **markings, labels, and colors**. Red usually indicates flammable or combustible. What about blue? Are there **signal words** such as DANGER or POISONOUS (highly hazardous or toxic), WARNING (moderately hazardous), and CAUTION

(low toxicity)? Can you see any symbols, e.g., an explanation point, St. Andrew's cross, trefoil, a test tube? Want to know what these symbols mean? Read on!

Unusual circumstances can provide additional information. Use your senses where appropriate. Is there irritation of the skin and eyes? Is there fire and smoke? Can you hear a hissing sound? Is there a chemical odor, e.g., rotten fruit, sulphur, gunpowder, freshly cut grass, decaying fish, fingernail polish, or paint? Warning: if you are close enough to use your senses, you may already be part of the problem rather than part of the solution.

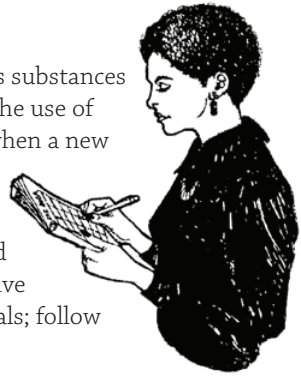
Each department or office dealing with hazardous substances will identify and provide a list of the materials in each work area.

2. Gathering chemical information.

   As SDSs are received from the manufacturer, departments must keep a copy of the SDS and send a copy to the Reed's Environmental Health & Safety (EHS) Office. The EHS office will help other departments accumulate and update SDSs for all hazardous materials present in the area. The EHS office reviews the departmental inventory of hazardous materials and the SDSs biennially.

3. Training.

   Supervisors must inform employees of the hazardous substances in the work area. New employees receive training in the use of hazardous substances. All employees need to know when a new hazard is introduced in the work area. EHS can assist with your training.



   Following this training, you should know how to: find health hazard data; determine what personal protective equipment to wear; properly dispose of waste materials; follow emergency procedures for fire, spills, and first aid.

   If you need to use a respirator during the course of your duties, you will get special respirator training. Contact the EHS Office for more information at **ehs@reed.edu.**

III. What is a Hazardous Substance?

A hazardous substance is any material that can harm our bodies, either at the time of exposure or later. These substances may be solids, liquids, gases, dusts, or fibers. The toxicity of a substance is the ability of the substance to cause damage to living tissue, illness, or even death. The degree of **toxicity** depends on several factors:

- Chemical makeup. Some chemicals are more toxic than others because of their chemical structure.
- Amount. All chemicals are toxic. It is a matter of how much to which you are exposed. For example, some chemicals that are extremely toxic may have beneficial therapeutic value when used in very small amounts in prescription drugs, e.g. strychnine. The amount to which an individual is exposed is called the **dose**.
- Type of contact. There are four primary **routes of exposure** for hazardous materials. These are **inhalation** (entry through the lungs), **absorption** (entry through the skin or eye), **ingestion** (entry through the mouth), and **injection** (entry through a skin puncture or cut). Each of these routes can cause different effects.
- Length of contact. For some substances, a short contact may cause no ill effect, while a long-term exposure may be harmful.
- Personal susceptibility. Some of us are more sensitive to hazardous materials than others. Some things that can cause any of us to be more sensitive are diet, smoking, allergies, and pregnancy.

IV. Health Effects of Hazardous Substances

Safety Data Sheets use some common terms to describe health effects of hazardous substances. For a more extensive list of technical terms, see "Glossary."

Acute effects show up after a single, brief exposure to a material. These symptoms include rashes or skin irritation, headache, nausea, or burns. Acute effects are often reversible when the exposure stops.

Chronic effects result from repeated or prolonged exposures to hazardous materials. They may take weeks, months, or even years to show up. The effects depend on the amount and frequency of exposure. Examples of chronic effects are liver and kidney disease, nerve and brain disorders, and reproductive damage. Often chronic effects cannot be reversed even if the exposure is stopped.

Some chemicals have both acute and chronic effects. One such chemical is a solvent called trichloroethylene (TCE). Its acute effects can include drowsiness, nausea, dizziness, and blistering of the skin while chronic effects may include liver damage and cancer.

A **latent effect** is a special type of chronic effect. For example, an individual exposed to asbestos, which was heavily used between 1950 – 1970 in building products, may not show symptoms for years after the original exposure. Some cancers have latency periods of 20 to 40 years.

Local effects occur when a toxic substance causes damage at the point of original contact. Some examples of local effects are:

Skin exposure: Symptoms include skin dryness, blistering, redness, rashes, and itching.

Eye exposure: The most common symptoms of eye exposure are burning, itching, and watering of the eyes.

Respiratory tract exposure: Symptoms may include headache, nose and throat irritation, dizziness, and disorientation.

Systemic effects can occur when a toxic substance passes through the point of original contact and affect the organs of the body, such as the liver, heart, nervous system, and muscles. Said another way, it causes harm to organs "system-wide" beyond the original point of contact.

Liver and kidneys: Chemicals can damage our liver and kidneys. The liver detoxifies or modifies many chemicals so they are no longer harmful. Our kidneys filter impurities from the blood for elimination from the body. These organs may be damaged while performing these functions.

Central nervous system: The central nervous system consists of the brain and spinal cord connected to thousands of nerves

throughout the body. When inhaled, chemicals such as carbon dioxide or solvents can impair brain function. We may become dizzy or drowsy, or even unconscious. Some chemicals impair nerve function by blocking nerve impulses. Some examples of chemicals that can cause nerve dysfunction are pesticides, mercury, and lead. Your symptoms may show up as a loss of reflexes, loss of feeling, tremors, or even paralysis. These effects may be temporary or permanent.

Carcinogens and reproductive effects: A carcinogen can cause cancer. The Occupational Safety and Health Administration (OSHA) regulates 26 human carcinogens. There are more than one thousand substances that we suspect to cause cancer. We must label known or suspected carcinogens in the workplace.

A ***mutagen*** affects the genetic material in human cells and causes changes or mutations. There are two kinds of hazards associated with mutagens:

Reproductive damage can affect both men and women by damaging or killing egg and sperm cells, which may prevent conception. If conception does occur, a miscarriage or a fetus with genetic defects may result.

Many mutagens have also been found to be ***carcinogens***.

A ***reproductive toxin*** affects the reproductive process. It may cause menstrual problems in women, which inhibit conception. In men, it may cause lowered sperm count or sperm motility. In either sex, it may cause decreased sex drive.

A ***teratogen*** affects the developing fetus. The fetus may be exposed to the substance through the mother's blood stream. Even though the mother may suffer no ill effects from exposure to the teratogen, the fetus may be more sensitive. It is especially important that pregnant women are aware of the hazardous materials to which they are exposed.

V. Safety Data Sheets (SDSs)

Manufacturers provide Safety Data Sheets (SDSs) for every hazardous material. SDSs provide important safety information about chemical products and their ingredients. As of June 1, 2015, OSHA requires that each SDS must include the uniform 16-section format outlined below.

1. **Identification of the substance/mixture and supplier** includes product name; manufacturer name, address, phone numbers; emergency phone number; recommended use; restrictions on use.

2. **Hazard(s) identification** describes the dangers associated with the substance. It shows its classification based on hazards, such as the 16 types of physical hazards and 10 classes of health hazards. In addition, it includes a signal word, pictograms, and hazard and precautionary statements.

The hazard statements use a numbering system where 1 indicates the highest hazard and 4 the lowest hazard.

There are four types of precautionary statements:

- **Prevention** to minimize exposure;
- **Response** in case of a spill or exposure emergency response, and first-aid;
- **Storage**;
- **Disposal**.

For example, we might see that gasoline SDS has "no smoking, keep away from heat and sparks, do not breathe vapors [prevention]. If on skin, rinse with water. Get medical attention if you feel unwell [response]. Store in a well ventilated place. Keep cool [storage]. Dispose of contents in accordance with local [disposal]."

3. **Composition/information on ingredients** identifies the ingredients. This is the "recipe" information. It can include common names, synonyms, other unique identifiers, and trade secret claims.

4. **First Aid Measures** describe initial care to an exposed person by routes of exposure. Here you'll also find important symptoms and effects (acute and delayed).

5. **Firefighting measures** provide both suitable and unsuitable extinguishing media, equipment, chemical hazards from fire.

6. **Accidental release measures** recommends responses to spills, leaks, or releases. It lists needed protective equipment and proper methods for containment and cleanup.

7. **Handling and Storage** recommends precautions and conditions for safe handling and storage, and any incompatibilities.

8. **Exposure controls/personal protection** indicates exposure limits, appropriate engineering controls, and personal protection equipment (PPE).

9. **Physical and chemical properties** list characteristics such as odor, vapor pressure, evaporation rate, flash point, flammable ranges, density, solubility, and boiling point.

10. **Stability and reactivity** describes the possibility of hazardous reactions, conditions to avoid, incompatible materials, hazardous decomposition products.

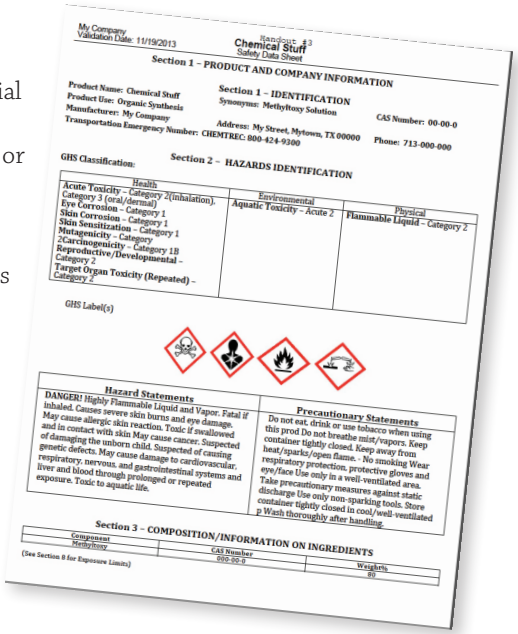
11. **Toxicological information** includes routes of exposure, related symptoms, acute and chronic effects, and numerical measures of toxicity.

12. **Ecological information** helps evaluate the potential for toxicity in aquatic and terrestrial organisms, the potential for accumulation, mobility in soil, or other harmful effects.

13. **Disposal considerations** describe appropriate containers and disposal methods.

14. **Transport information** lists UN number, hazard classes, packing group, and precautions.

15. **Regulatory information** identifies product specific safety and governmental regulations specific for the product in question.



My Company
Validation Date: 11/19/2013

Handout 13
Chemical Stuff
Safety Data Sheet

Section 1 – PRODUCT AND COMPANY INFORMATION

Product Name: Chemical Stuff
Product Use: Organic Synthesis
Manufacturer: My Company
Transportation Emergency Number: CHEMTREC: 800-424-9300

Section 1 – IDENTIFICATION
Synonyms: Methyltoxy Solution
CAS Number: 00-00-0
Address: My Street, Mytown, TX 00000
Phone: 713-000-000

Section 2 – HAZARDS IDENTIFICATION

GHS Classification:

Health	Environmental	Physical
Acute Toxicity – Category 2(inhalation). Category 3 (oral/dermal) **Eye Corrosion** – Category 1 **Skin Corrosion** – Category 1 **Skin Sensitization** – Category 1 **Mutagenicity** – Category 2Carcinogenicity – Category 1B **Reproductive/Developmental** – Category 2 **Target Organ Toxicity (Repeated)** – Category 2	**Aquatic Toxicity** – Acute 2	**Flammable Liquid** – Category 2

GHS Label(s)

Hazard Statements	Precautionary Statements
DANGER! Highly Flammable Liquid and Vapor. Fatal if inhaled. Causes severe skin burns and eye damage. May cause allergic skin reaction. Toxic if swallowed and in contact with skin May cause cancer. Suspected of damaging the unborn child. Suspected of causing genetic defects. May cause damage to cardiovascular, respiratory, nervous, and gastrointestinal systems and liver and blood through prolonged or repeated exposure. Toxic to aquatic life.	Do not eat, drink or use tobacco when using this prod Do not breathe mist/vapors. Keep container tightly closed. Keep away from heat/sparks/open flame. - No smoking Wear respiratory protection, protective gloves and eye/face Use only in a well-ventilated area. Take precautionary measures against static discharge Use only non-sparking tools. Store container tightly closed in cool/well-ventilated p Wash thoroughly after handling.

Section 3 – COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS Number	Weight%
Methyltoxy	000-00-0	80

(See Section 8 for Exposure Limits)

16. **Other information** indicates the date of the SDS preparation or revision and other changes provided by the supplier.

VI. Pictograms

Pictograms are graphic symbols used to communicate specific information about the hazards of a chemical. Below are the written name for each pictogram, the symbols, and the associated hazards. You'll find these on both SDSs and manufacturer labels.

Flame Over Circle

Oxidizers

Flame

Flammables
Self Reactives
Pyrophorics
Self-Heating
Emits Flammable Gas
Organic Peroxides

Exploding Bomb

Explosives
Self Reactives
Organic Peroxides

Skull and Crossbones

Acute toxicity (severe)

Corrosion

Corrosive to Metal
Skin Corrosion/Burns
Serious Eye Damage

Gas Cylinder

Gases Under Pressure
Liquefied Gas

Health

Carcinogen
Respiratory Sensitizer
Reproductive Toxicity
Target Organ Toxicity
Germ Cell Mutagen
Aspiration Toxicity

Environment

Environmental Toxicity

Exclamation Mark

Skin Irritant
Dermal Sensitizer
Acute Toxicity (harmful)
Narcotic Effects
Respiratory Irritation
Eye Irritation

VII. Common Types of Hazardous Materials

Three of the most common types of hazardous materials are organic solvents, corrosives, and compressed gases. Each has typical uses and possible health effects. Please note that adverse health effects can result from our improperly handling a chemical or because we did not use appropriate protective equipment.

Organic Solvents

Organic solvents, found in almost all workplaces, are the most common industrial chemicals. At Reed, we find organic solvents in paints, paint thinners, lacquers, adhesives, floor polishes, and correction fluids. We use them in varnishes and glues, graffiti removers, and laboratories.

Because organic solvents can dissolve oils and greases, we should be aware that repeated skin exposure can cause dry skin. The solvent removes the protective oils from the skin, resulting in redness, itching, and pain. Breathing in the vapors of organic solvents may cause dizziness, headache, drowsiness, and nausea. The vapors can also irritate our respiratory tract and mucous membranes. Overexposure for a prolonged period can damage our liver, kidneys, nervous system, and other organs.

Most organic solvents are flammable. Some can explode or react with other materials to form other hazardous materials.

Corrosives

Corrosives, another common chemical in the workplace, include acids and bases or caustics. They may be either solid or liquid. For example, many soaps and cleaners are corrosive. We can also find corrosive materials in the laboratory.

These materials can cause severe harm to body tissue. They can cause skin irritation and eye damage. Exposure to vapors can affect the respiratory tract and mucous membranes. Ingestion can severely damage the throat and stomach and may even be fatal.

Most corrosive materials are not flammable. However, they can react with each other and with other materials to produce fire and explosion.

Compressed Gases

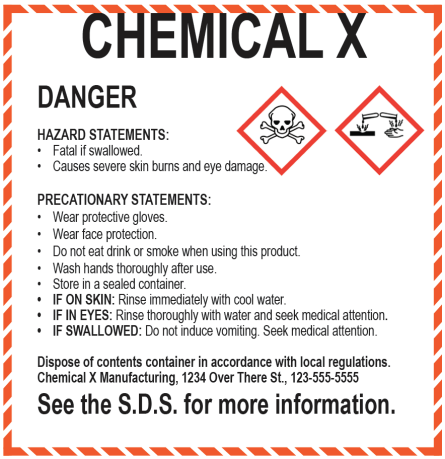
Reed College has compressed gases in a variety of workplaces, including laboratories, the sports center, health center, nuclear reactor, physical plant, commons, and art department. Many of these gases are flammable, corrosive, or toxic. There is also danger of a powerful propellant effect if the pressurized gas within the cylinder should suddenly escape. A cylinder with a damaged valve can suddenly release gas and can turn the cylinder into a missile with enough force to penetrate a concrete wall [check out **MythBuster: cylinder rocket**].

VIII. Container Labeling

Manufacturers label chemicals or potentially harmful substances with all kinds of hazard information. We can discover some very important things just by looking at the label of a container. **You must label your containers if you repackage anything that is potentially hazardous.** If you find a hazardous material that is not properly labeled, please bring it to the attention of your supervisor or the EHS Office at **ehs@reed.edu.**

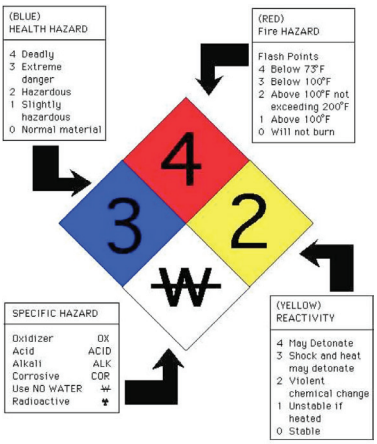
Primary Containers

New material from a manufacturer or vendor comes to you packaged in a **primary container**. The label on a primary container must be firmly secured to the container. Never remove or deface the label unless it is completely empty. It must have the following essential information:



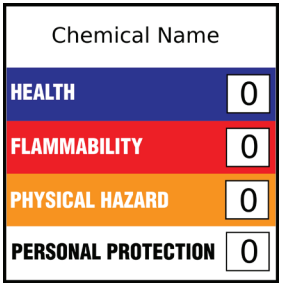
- Identity of the product
- Pictogram
- Signal word that indicates the severity of the hazard. The signal words used are "danger" and "warning." "Danger" is used for the more severe hazards, while "warning" is used for less severe hazards.
- Hazard statement
- Precautionary statement
- Manufacturer or supplier name and the address

Other Markings on Labels and SDSs



In addition to the OSHA pictograms, we may see some other symbols and markings on a label or the SDS. Some chemical suppliers add information from the National Fire Protection Association (NFPA). The NFPA uses a combination of colors and numbers to rate the hazard of a material. **The fire diamond has four colors – red for flammable, blue for health, yellow for reactivity, and white for special hazard.** Three of the diamonds also show a number that indicates the degree of hazard, where 0 is no hazard or very low risk and 4 is the highest hazard. **Please note that the numbers are the**

exact opposite of OSHA (see the previous section, on SDSs). Checking out **OSHA/NFPA Quick Card** will help to clarify this. These numbers are based on how a chemical may act in a fire. The white quadrant uses special symbols.



Manufacturers may also use the American Coatings Association (HMIS) system. The HMIS system has a color bar with four colors -- red for flammable, blue for health, orange for physical hazard, and white for personal protection protective equipment. Like the NFPA, the color bars use a numbering system of 0 for low hazard to 4 for highest hazards. These are also the exact opposite of OSHA numbering system (see the previous section, on SDSs).

Secondary Containers

A secondary container is any bottle, jar, or container of any type that is used to repackage a hazardous material. Except for manufacturer's name and address, the labeling requirements for a secondary container are the same as for the primary container. Be sure to include your own name and phone number in place of manufacturer name.

New Chemicals

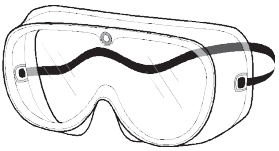
The rules concerning the labeling of new chemicals that are made in the laboratory are somewhat complicated. If you need more information on this subject, please review Reed College's Hazard Communication Program or contact the EHS Office at **ehs@reed.edu.**

IX. Chemical Handling, Storage, and Disposal

Guidelines for Chemical Handling:

Know what chemical you work with and how to handle it safely. Ask yourself these questions:

- Is it dangerous to inhale?
- Is skin contact dangerous?
- Is it flammable?
- Is it reactive?
- Should I use a fume hood, gloves, goggles, or other protective equipment to handle the material safely?



To find the answers to these questions:

- Read the label on the container.
- Read the SDS.

- Ask your supervisor.
- Use the correct protective clothing and equipment for the material. Common personal protective equipment (PPE) includes:
  - Gloves that are impervious to the substance you are using.
  - Eye protection such as goggles and safety glasses.
  - Safety shoes or protective shoe coverings.
  - Various types of dust masks or other respirators.

Prevent Ingestion of Chemicals.

- Always wash your hands before leaving your work area and before eating, drinking, putting on lip balm, or smoking.
- Never store food or drinks in refrigerators used for chemical storage.
- Do not carry food, drinks, or cigarettes into an area where chemicals are present.
- Why? Food, drinks, or cigarettes can become contaminated by dust or vapors in the air. Your hands can become contaminated and then you can inadvertently contaminate your food, drink, or cigarettes.

Keep your work area clean and uncluttered. Good housekeeping leads to fewer accidents.

Be aware of and heed warning signs such as "CAUTION", "DANGER", "DO NOT ENTER", "EYE PROTECTION REQUIRED", "RADIOACTIVE MATERIALS."

If you do not understand, ASK!

Know what to do in an emergency. (See Chapter X).

Guidelines for Chemical Storage

Know what chemicals you have and their hazards. Clearly label each container.

Label all chemical storage areas. Mark storage areas with the appropriate classifications, such as corrosives or flammables.

Separate chemicals according to hazard class. Alphabetical storage is acceptable only within the same hazard classification. The pictograms will help you. Be sure to separate flammables from corrosives and toxics.

Some chemicals will react with each other even if they are in the same hazard class. For example, acids and bases, although both corrosive, can react and produce toxic gases. If you must store them close

together, use a secondary container such as a plastic container with a lid to keep them separate.

General Guidelines:

- Use only sturdy shelving.
- Ventilate storage areas.
- Store chemicals away from direct sunlight and heat.
- Date all chemicals when you receive them. Some chemicals become unstable over time. Dispose of unstable chemicals before they become dangerous.
- Never store flammables near any source of ignition.

Store solvents in a well-ventilated area. Drums should be stored in a cool place away from ignition sources and direct sunlight. Solvents stored inside buildings should be kept in fireproof storage cabinets. When transferring flammable solvents between containers, you must ground and bond the containers to prevent sparking.

Keep corrosives (acids and bases) stored separately. Make sure to keep them away from direct sunlight. Do not store corrosives in metal cabinets, as the chemicals may cause the cabinet to corrode.

Always secure compressed gas cylinders by a chain, strap, rack, or some other means to prevent falling. Keep the protective caps in place when the cylinder is moved or not in use. Store full and empty cylinders in separate places, clearly marked.

Store water reactive chemicals away from other chemicals. Inform the local fire department as to the location of these chemicals so they know how to handle them in case of an emergency.

Other chemicals may require special storage conditions. Call the EHS Office for help with any chemical storage questions.

Guidelines for Chemical Disposal

Unlabeled chemical waste causes severe problems for our disposal personnel. Therefore, you must properly label all chemical waste before sending to our waste disposal area, located in the Chemistry Building in room C211. The label description should include chemical name [no abbreviations] and your department and location. Direct any questions regarding the information required on the label to the EHS Office at **ehs@reed.edu.**

Never assume it is safe to pour chemical waste down the drain, even if it is diluted. Legal and ecological repercussions can result. Never put chemical wastes in trashcans or dumpsters. Unless you are sure that it is safe, treat all chemical waste as a hazardous material.

Discarded or broken glass that has been contaminated with chemicals must be packaged and disposed of separately to prevent accidental cuts and punctures.

Put all needles, whether used on humans or not, in red "biohazard" containers and send to the hazardous waste collection area for special disposal.

Contact the EHS Office at **ehs@reed.edu** or 503-777-7788 to get help with the cleanup of hazardous material spills.

Call the EHS Office for cleanup of any oils that may have leaked from old fluorescent light ballasts or other electrical equipment. Such oil may contain PCBs. For more information on PCB hazards, contact the EHS Office at **ehs@reed.edu.**

Properly dispose of animal remains from laboratories in biohazard containers. Follow the same procedures for hazardous wastes. Contact the EHS Office for more information.

X. Emergencies and First Aid

General Guidelines for Chemical Emergencies

Always be ready! An emergency happens without any warning so know how to react quickly:

- Know the location of emergency and first aid equipment including eye wash stations, safety showers, and first aid cabinets.
- Know who has first aid training in your area.
- Know emergency phone numbers (see inside cover). Have them posted by the telephone in your work area and put them in your cell phone.
- Be able to tell emergency responders the exact name of the chemical involved.

Fire:

- Never try to put out a fire unless you know what the substance is and what type of extinguisher to use.
- Remember that many materials produce toxic fumes when they burn.
- Immediately call 911 and ask for the Fire Department.
- Evacuate the area.
- Fire extinguisher training is encouraged for all employees. Contact the EHS Office to arrange a class.

Unconsciousness:

- Never enter an area to help an unconscious person, unless you are sure that hazardous fumes or lack of oxygen will not overcome you.
- If you can enter the area safely, evacuate the victim to fresh air immediately.
- Call for help. Get a person trained in first aid or call the Fire Dept. at 911.
- If the victim's eyes or skin is contaminated, flush with running water for 20-30 minutes. Remove contaminated clothing.
- Never give liquids to an unconscious person.

Vapors and Fumes:

- Use a fume hood when you work with hazardous materials and volatile liquids.
- Know the symptoms and effects of overexposure to the vapors or fumes of materials that you work with.
- Get to fresh air immediately if you feel a burning sensation in your eyes, nose, or throat, or if you feel dizzy, nauseous, or weak.
- Close the container of the material causing you discomfort.
- If none of these measures help, evacuate the area.

Eye Contact:

- Flush your eyes with water for at least 20-30 minutes. Hold your eye open and rotate your eyeballs to clear the material from all areas.
- Do not use ointments or salves. They may be dangerous.
- Always remove contact lenses if possible before flushing.
- Seek medical attention.

Skin Contact:

- Drench clothing and skin with plenty of water. Use any available water including safety showers, garden hose, or faucet.
- Remove contaminated clothing while flushing with water.
- Seek medical attention.

Spills:

- Get help in dealing with large spills. Call the EHS Office.
- Keep away from the spill unless you know what it is and how to handle it. If you don't know, call for help.
- Don't leave the material unattended.
- Never smoke around flammable solvent spills. Remove any source of ignition.

- Only if you are trained, please do the following:
  - Know the location of not only spill kits but also personal protective equipment such as respirators, goggles, gloves, and boots.
  - Know the proper cleanup method for small spills:
    1. Cover the spill with spill absorbent.
    2. Allow the spill to absorb.
    3. Sweep up the absorbed material.
    4. Place the material in a plastic bag, then place in in a second bag [i.e., double bagging], seal and label it with the contents of the spill.
    5. Take the spill residue to Chemistry room 211 or call the EHS Office.

XI. Services and Publications Available Through EHS

We all want a healthy life and a safe place to work. The Environmental Health and Safety (EHS) office provides the following services to assist you here at Reed College:

- **Advice and information** that addresses your concerns, such as the safe handling of chemicals, indoor air quality, ergonomics at computer work stations, and the interpretation of environmental, occupational health, and safety regulations and standards.
- **Evaluation and control of hazards** through inspections, monitoring, and assessing hazardous materials and conditions. We make recommendations for controlling or eliminating hazards; and suggest practices to minimize harmful exposure. We also coordinate hazardous waste disposal and assist with recycling for the campus.
- **Partnering with other departments** to advise and support the health and safety efforts of other employees. For example, we work with Human Resources staff to investigate the causes of injuries and illnesses, and develop accident prevention programs. The risk management program seeks to minimize the risks and losses on campus.
- **Education and training** offers programs and educational materials on a number of health and safety topics including chemical hazards, lab safety (biological, chemical, laser, and radiological), fire safety, asbestos, noise, emergency preparedness, and the "right to know."

  For instance, we have produced another publication called the "Hazard Communication Program." This written program complies with the Oregon Occupational Health and Safety Code, OAR Chapter 437, Division 2 Subdivision Z *Hazard Communication*. As an employee, you have a right to review this program. If you don't find a copy posted in your work area, ask your supervisor to see one or contact the Environmental Health & Safety Office at **ehs@reed.edu** or 503-777-7788.

Briefly, the Hazard Communication Program covers the following areas:

- **Responsibilities** of the administration, supervisors, employees, and safety officer as they pertain to hazardous materials training and communication.
- **Container labeling** describes what labels and warnings are required on primary and secondary containers that hold hazardous materials.
- **Safety Data Sheets** states Reed's policy on the availability of SDSs in the workplace.
- **Employee information and training** reviews the steps to take to train new employees and update the training for other employees.
- **Lists of hazardous chemicals** requires that each work area will make available to its employees a list of the hazardous materials present in the area.
- **Hazardous non-routine tasks** describe the training required before an employee does a hazardous task that is beyond her/his routine duties.
- **Chemicals in unlabeled pipes** describe procedures taken if an employee works in an area in which hazardous chemicals are transferred through unlabeled pipe systems.
- **Reed College contractors** specifies the information exchange that must occur between Reed College and any contractors working on campus when hazardous materials are involved.
- **Chemical hazard determination** describes when a chemical prepared on campus must be evaluated for hazard determination.
- **Questions regarding program —** Direct any questions regarding the Hazard Communication Program to the EHS Office at **ehs@reed.edu** or call 503-777-7788.

XII. GLOSSARY

Listed here are the most common terms you will see when reading Safety Data Sheets or other reference materials concerned with chemical toxicity.

ACGIH - American Conference of Governmental Industrial Hygienists, a professional society that recommends exposure limits (TLV's) for toxic substances.

Acid - A substance that dissolves in water or certain other solvents, and releases hydrogen ions. For example, hydrogen chloride in solution is an acid, also referred to as hydrochloric acid or muriatic acid. (See pH.)

Acute - Acute exposures and acute effects involve short-term high concentrations and immediate results of some kind (illness, irritation, or death). The effect of a chemical is considered acute when it appears with little time lag, such as within minutes or hours.

Alkaline - Also called Basic or Caustic. Having the ability to neutralize an acid and form a salt. Such a substance is also called an alkali.

ANSI - American National Standards Institute, a private organization that recommends work practices and engineering designs pertaining to safety and health.

Asphyxiant (simple) - A vapor or gas that has little or no toxic effects but can cause loss of consciousness or death by displacing air in the lungs and depriving an organism of oxygen. Examples are carbon dioxide and nitrogen.

Asthma - A disease that causes constriction of the bronchial tubes in the lungs as a result of irritation, allergy, or other stimulus.

Basic - See Alkaline.

Boiling Point -The temperature at which a liquid boils and changes rapidly to a vapor state at a given pressure. Often expressed in degrees Fahrenheit at sea level pressure.

Carcinogen - A chemical capable of causing cancer. Such a material is often called carcinogenic.

C.A.S. - The Chemical Abstracts Service Registry Number is a numerical designation that uniquely identifies a specific chemical compound.

Caustic - Something that strongly irritates, corrodes, or destroys living tissue. (See Alkaline.)

Ceiling limit - The maximum concentration of a material in air that should not be exceeded, even instantaneously. (See PEL and TLV.)

Cell - The structured unit of which tissues are made. There are many types (e.g., nerve cells, muscle cells, and blood cells), with each type performing a special function.

Chemical Family - A group of single elements or compounds with a common general name, such as "Ketones."

Chronic Effect - An adverse effect with symptoms that develop slowly over time and persist or recur.

Circulatory System - The heart and blood vessels.

Combustible - Able to burn. Commonly defined to mean solids that ignite and burn slowly and liquids with a flash point above 100 degrees Fahrenheit (37.8 degrees Centigrade).

Concentration - The relative amount of one substance mixed into another substance.

Corrosive - A liquid or solid that causes visible destruction in human skin tissue at the site of contact.

Cubic centimeter (cc) - A metric unit of volume. One cc is equivalent to about 20 drops of water. One cc is also referred to as a milliliter (ml).

Cubic meter - A metric unit of volume. One cubic meter equals 35.5 cubic feet or 1.3 cubic yards. One cubic meter also equals 1000 liters or one million cubic centimeters.

Decomposition - Breakdown of a chemical by heat, chemical reaction, etc. into simpler parts, compounds, or elements.

Density - Measures the "heaviness" of a substance in weight or mass per volume. Water has a density of 1 gram per milliter. Liquids with density less than one will float on water; those with densities greater than one will sink.

Dermal - Pertaining to the skin.

Dose - The amount of chemical to which an organism is exposed. Often expressed in milligrams per kilogram (mg/kg) or part per million (ppm).

Duration - Length of time exposed to a substance.

Edema - Swelling of body tissues due to water or fluid accumulation.

Evaporation - The process by which a liquid is changed into a vapor state and mixed into the surrounding air.

Evaporation rate - The ratio of the time required to evaporate a measured volume of a liquid chemical to the time required to evaporate the same volume of a reference liquid (usually ethyl ether). In general, the higher the ratio, the lower the boiling point.

Excursion Limit - The average maximum concentration allowed over a short period of time (5 to 30 minutes depending upon the chemical). (See PEL.)

Exposure Limit- Found in section 8 of the SDS; air-borne concentrations of a product to which nearly all workers may be exposed day after day for a lifetime of work without harmful effects. (See PEL and TLV)

Flammable - Ignites easily and burns rapidly. The National Fire Protection Agency and the U.S. Dept. of Transportation define a flammable liquid as having a flash point of less than 100 degrees Fahrenheit (37.8 degrees Centigrade).

Flammable range - (flammability limits, explosive limits): minimum and maximum concentration of flammable gas or vapor between which ignition can occur. Concentrations below the lower explosive limit (LEL) are "too lean to burn," while concentrations above the upper explosive limit (UEL) are "too rich to burn." All concentrations between the LEL and UEL are in the flammable range and require special precautions.

Flash point - The lowest temperature at which a liquid gives off enough vapors to ignite and produce a flame when an ignition source is present.

Gram (g) - A metric unit of weight. One U.S. ounce equals 28.4 grams. One U.S. pound equals 454 grams.

Hazard - The probability that a person will be harmed due to working with a toxic substance under given conditions of use. OSHA use two categories, physical and health. The criteria for classifying a chemical as health hazard include the following:

- Acute toxicity.
- Skin corrosion or irritation.
- Serious eye damage or eye irritation.
- Respiratory or skin sensitization.
- Germ cell mutagenicity.
- Carcinogenicity.
- Reproductive toxicity.
- Specific target organ toxicity - single or repeated exposure.
- Aspiration hazard.

The physical hazard criteria includes the following:

- **Explosives.**
- **Flammable** (gases, aerosols, liquids, or solids).
- **Oxidizer** (gases, liquids, or solids).
- **Gases** under pressure..
- **Self-reactive** substances and mixtures.
- **Pyrophoric** liquids or solids.
- **Self-heating** substances and mixtures.
- **Substances** and mixtures which, in contact with water, emit flammable gases.
- **Organic** peroxides.
- **Corrosive** to metals.

SDSs may also have environmental hazards listed in section 12. There are two: hazardous to the aquatic environment (acute and chronic) and hazardous to the ozone layer.

IDLH - Immediately Dangerous to Life or Health. A term used to describe certain very hazardous environments, usually with high concentrations of toxic chemicals, insufficient oxygen, or both.

Ignition temperature - The lowest temperature at which a substance will catch on fire and burn.

Incompatibles - Materials that could cause hazardous reactions from direct contact with each other.

Inflammable - Same as flammable.

Ingestion - A route of exposure; taking in a substance through the mouth.

Inhalation - A route of exposure; breathing in air or other substance.

Irritant - A substance that can cause an inflammatory response or reaction of the eye, skin, or respiratory system.

Kilogram (kg) - A metric unit of mass. Equals 1000 grams. Also equals 2.2 U.S. pounds.

Latency - The time lag between exposure and the first manifestation of health damage.

Latent Effect - An effect that occurs a considerable time after exposure to a toxic substance.

LEL/LFL - Lower explosive limit or lower flammable limit; see flammable range.

Lethal Concentration - A concentration of a chemical in air that will kill a test animal inhaling it.

Lethal Dose-50% (LD_{50}) - The dose of a chemical that will kill 50% of the test animals receiving it. The chemical may be given by mouth (oral), applied to the skin (dermal), or injected (parenteral). A given chemical will generally show different LD50 values depending on the route of administration.

Liter - A metric unit of volume. One U.S. quart is about 0.94 liter. One liter equals 1000 cubic centimeters (1000 cc)

Local Effect - An effect, which a toxic substance causes at the original point of contact, e.g., eye damage.

Local Exhaust Ventilation - A system for capturing and exhausting contaminants from the air at the point of origin, as in welding, grinding, sanding, or laboratory experiments.

Melting Point - The temperature at which a solid substance changes into the liquid state.

Milligram (mg) - A metric unit of mass. One gram equals 1000 mg. One U.S. ounce equals 28,400 mg.

Milligrams per cubic meter - mg/m^3. A measure of concentration, often used to express PELs and TLVs.

mm Hg - Millimeters (mm) of the metal mercury (Hg). A measurement for pressure. At sea level, the earth's atmosphere exerts 760 mm Hg of pressure.

Molecular Weight (MW) - combined weight of all the atoms that make up a molecule, e.g., air has a MW= 29. Gases or vapors with MW greater than 29 will sink, flow across the floor and pool in low places; those greater than 29 tend to rise.

MSHA - Mine Safety and Health Administration, an agency in the U. S. Dept. of Labor which regulates safety and health in the mining industry. Also tests and certifies respirators. (See NIOSH.)

Mutagen - A chemical or physical agent that affects the genetic material in cells in such a way that it may cause an undesirable mutation to occur in some later generation. Such an agent is called mutagenic. Many mutagens are also carcinogens.

Nervous System- The nerves, brain, and associated mechanisms in the body which control its processes.

NFPA - National Fire Protection Association. NFPA has developed a scale for rating the severity of fire, reactivity, and health hazards. References to these ratings frequently appear on SDSs.

NIOSH - National Institute for Occupational Safety and Health. NIOSH is a federal agency that conducts research on occupational safety and health questions and recommends new standards to federal OSHA. NIOSH, along with MSHA, tests and certifies respirators.

Oral - Pertaining to the mouth.

OSHA - Occupational Safety and Health Administration, an agency in the U.S. Dept. of Labor, which regulates safety and health conditions in most of the nation's private sector workplaces.

Oxidizer - Materials that release oxygen or act like oxygen; materials that attract electrons.

Oxygen Deficiency - An atmosphere having less than the normal amount

(21%) of oxygen. When oxygen concentration in air falls dangerously low to 19.5% or less, many people become dizzy, experience a buzzing in the ears, have a rapid heartbeat, become confused, or lose consciousness.

PEL - Permissible Exposure Limit. For federal purposes, PELs refer to three different types of exposure limits to a hazardous substance: a ceiling limit, a short-term (15 minute) limit, and an eight-hour time weighted average (TWA) limit. These limits are enforceable by law.

pH - A unit for expressing how acidic or how alkaline a solution or chemical is, on a scale of 1 to 14. A pH of 1 indicates a strongly acidic solution; pH 7 indicates a neutral solution; and pH 14 indicates a strongly alkaline solution.

Polymerization - A chemical reaction in which small molecules combine to form much larger molecules. A hazardous polymerization is a reaction that occurs at a fast rate, releasing large amounts of energy.

ppb - Parts per billion. A measure of concentration. 1000 times less than a ppm. For example, one second in nearly 32 years, or one pinch of salt in 10 tons of potato chips.

PPE - personnel protective equipment. PPE information is located in Section 8 of the SDS.

ppm - Parts per million. A measure of concentration. (Usually parts of a substance per million parts of air.) PELs and TLV s are often expressed in ppm. For example, 1 inch in 16 miles = 1 ppm.

psi - Pounds per square inch. A unit of pressure. At sea level, the earth's atmosphere exerts 14.7 psi.

Reaction - A chemical transformation or change.

Reactivity - A substance's ability to undergo a chemical reaction or change that may result in dangerous side effects, such as an explosion, burning, and corrosive or toxic emissions.

Reducer - Materials that burn, chemically react with, and give up electrons. (see Oxidizer)

Reduction - A reaction in which oxygen is lost from a substance, or a chemical change in which an atom gains one or more electrons. A reduction reaction always occurs simultaneously with an oxidation reaction; that is, one substance gains oxygen (is oxidized) while another substance loses oxygen (is reduced).

Reproductive Toxin - A chemical that can interfere with the reproductive system.

Respirator - A device worn to protect against inhalation of hazardous substances.

Respiratory System - The breathing system. Includes lungs, air passages, larynx, mouth, nose and the associated nerves and blood vessels.

Route of Exposure - The means by which a hazardous substance enters the body. Common routes are skin contact, eye contact, inhalation, injection, and ingestion.

SDS - Safety Data Sheet. A form listing the properties and hazards of a substance. The manufacturer must supply a SDS form upon request.

Sensitizer - A substance that on first exposure causes little or no reaction in a person, but which on repeated exposure may cause an intense response, not necessarily limited to the site of initial contact.

Signal word - OSHA uses two signal words, Danger and Warning, to describe the relative hazards of a chemical on both the label and SDS. Pesticides regulated by the EPA use a third signal word – Caution.

Solubility - The degree to which a chemical can dissolve in a solvent, such as water.

Solution - A mixture in which the components are uniformly dispersed. All solutions are composed of a solvent (water or other fluid) and the dissolved substance (called the solute).

Solvent - A substance (most commonly water but often an organic compound) that dissolves another substance. (See Solution.)

Specific Gravity - The ratio of the mass of a volume of material to the mass of an equal volume of water, at a given temperature.

STEL - Short-term Exposure Limit. The maximum average concentration allowed for a continuous 15-minute exposure period. (See TLV.)

Susceptibility - Increased risk of harm from toxic substances due to personal traits such as diet, smoking, drinking, allergy, and pregnancy.

Systemic Effect - Spread throughout the body, affecting all body systems and organs, not localized in one spot or area.

Teratogen - A chemical or physical agent that affects a developing embryo or fetus and can cause birth defects in offspring. Such an agent is called teratogenic.

Thermal - Involving heat.

TLV - Threshold Limit Value. An exposure limit recommended by the ACGIH. There are three types of ACGIH TLVs:

- **TLV-TWA:** The allowable Time Weighted Average concentration for a normal eight-hour workday.
- **TLV-STEL:** The short-term Exposure Limit or maximum average concentration for a continuous 15-minute exposure period.
- **TLV-C:** The Ceiling Limit, or maximum concentration that should not be exceeded even instantaneously.

Toxic - The ability of a substance to cause disease, injury, or death.

Toxicology - The study of poisons. The basic assumption of toxicology is that there is a relationship between the dose (amount), the concentration at the affected site, and the resulting effects (response).

Trade Name - The trademark name or commercial name used by the manufacturer or supplier for a material.

TWA - Time Weighted Average. The average concentration of a chemical in air over the total exposure time, usually 8 hours. (See PEL and TLV .)

UEL/UFL - Upper explosive limit or upper flammable limit; see flammable range.

Vapor Pressure - The pressure exerted by a saturated vapor above its own liquid in a closed container at given conditions of temperature and pressure. The lower the boiling point of a substance, the higher its vapor pressure.

Name [print]: _____ Reed ID: _____

HazCom/Right-to-Know Quiz

1. A SDS provides:
   a. Detailed information about chemical hazards.
   b. Marketing information to salepersons and customers.
   c. A list of persons and telephone numbers to contact during an emergency.
   d. An informational pamphlet on the safety hazards specific to each work area.

2. How might you ingest a chemical?
   a. Contaminated broken glass piercing the skin.
   b. Not washing hands prior to eating or putting on lip balm.
   c. Breathing in vapors or dust.
   d. Solvents penetrating unprotected hands.

3. The following symbol represents which type of hazard:
   a. Flammable
   b. Oxidizer
   c. Corrosive
   d. Acute toxicity

4. Before working with a chemical for the first time, you should:
   a. Put on nitrile gloves and a dust mask.
   b. Consult the SDS for the proper protective gear to wear.
   c. Talk with your supervisor about the hazards of the product, how to use it, appropriate PPE.
   d. Both b and c are correct.

5. What key words indicate that a material is hazardous?
   a. Warning
   b. Danger
   c. Causes severe burns
   d. Highly flammable
   e. All of the above

6. Which is not true of the NFPA fire diamond?
   a. The numbers on NFPA diamonds are exactly the same as found on a SDS.
   b. The blue quadrant indicates a health hazard.
   c. Special hazards such as oxidizers, acids, and use no water, appear in the white quadrant.
   d. The highest hazards are 4 and the lowest are 1. The exact opposite of SDS where category 1 represents the highest hazard.

7. Should you spill a chemical, under what section of an SDS would you look for information regarding spill response?
   a. Section 5, fire fighting measures
   b. Section 6, accidental release measures
   c. Section 7, handling and storage
   d. Section 8, exposure controls and PPE

8. Which of the following is a signal word?
   a. Attention
   b. Notice
   c. Warning
   d. Alert, Alert, Will Robinson.

Continued

9. A label for a hazardous chemical includes which of the following?
    a. Signal word
    b. Hazard statements
    c. Precautionary statements
    d. All the of above

10. When making up a new solution from a stock bottle (for example, pouring bleach into a spray bottle and diluting it), what elements of information are required on the label of the spray bottle?
    a. Product identity, hazard information in the form of words, pictograms or symbols, and your name and phone number.
    b. Secondary containers need no label because we use them every day.
    c. Only a pictogram because it can be understood by people who speak different languages.
    d. None is needed when everyone has been verbally informed of its contents

11. The pictogram for a carcinogen is
    a. Skull and crossbones
    b. Cylinder
    c. Health
    d. Exclamation point

12. The Hazard Communication standard covers the following hazards that may be found in office and classroom environments:
    a. Copier/printer toners
    b. Cleaning supplies, dry-erase board cleaners
    c. Loose rugs and daisy-chained electrical cords
    d. Both a and b

XIII. Employee Training Checklist

_____ 1. I am aware of the location of Safety Data Sheets for the hazardous materials used in my work area. I understand how to use them.

_____ 2. I know whom to contact in case of an emergency.

_____ 3. I am aware of the location of the personal protective equipment and spill control materials I may need in my work area.

_____ 4. My supervisor has informed me of the hazards associated with the materials I will commonly use on the job.

Employee/Student Signature Date

Supervisor Signature Date

Environmental Health and Safety Office
Reed College
Portland, OR 97202