

Hazard Communication Program

**Environmental Health and Safety
Alabama A & M University**

Executive Summary

“Accidents happen”. You’ve heard that time and again. But, you know that is really a cop-out. Accidents do not need to happen. They often happen because: (1) the person was not aware of the hazardous nature of the work, they were doing or (2) they were aware of the hazardous but believed they could do the task “accident free”. The purpose of a Hazard Communication Program is to make workers aware of the hazards and inculcate all workers with the proper procedures to work safely.

One of the missions of the Occupational Safety and Health Administration (OSHA) is to insure that employees provide their workers with a safe work place. This is accomplished by promulgating rules and practices directed towards different types of work environments. Thus, research laboratories, which handle many very small quantities of hazardous chemicals, follow different set of rules than an industrial operation in which very large quantities of a few different hazardous chemicals are used.

To address most non-industrial, non-laboratory settings where hazardous chemicals are used, the Occupational Safety and Health Administration promulgated the Hazard Communication Standard, often known as the “Right –to-Know” act. Right-To-Know means that workers must be made aware of hazardous substances they may be working with and be provided with the information necessary to allow them the work safety with these substances.

Effecting a Hazard Communication Program should be relatively inexpensive and should not be too time consuming. It consists of 6 simple tasks.

- 1. Keep an inventory of the hazardous chemicals used in the work area.**
- 2. Maintain a file of Material Safety Data Sheets (MSDS) for each hazardous substance used. These sheets are included with each purchase of hazardous substance.**
- 3. Insure all containers are properly labels to identify the hazardous substances and practice that workers can employ to work safely with the chemicals.**
- 4. Evaluate work place tasks and determine the appropriate personnel protective equipment for each use.**
- 5. Initially train workers to recognize hazards specified on labels and how to use proper personnel protective equipment.**
- 6. Document the training and evaluation.**

The Environmental Health and Safety Hazard Communication Program contains all the information and forms needed to enact a Hazard Communication Plan and will provide you with guidance and training for your supervisors or to workers. Please call if you have questions or need assistance.

Approved by President’s Cabinet - September 9, 2005

Preface

Every year hundred of workers are killed in on-the-job accidents and thousands of workers are injured, some permanently. Many of these accidents are preventable.

The Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (HCS) often referred to as "HazCom" or the "Right-to-Know", is designed to prevent accidental worker injury and death from exposure to hazardous chemicals during the course of their work. The six major components of the HCS are: Chemical inventory, Material Safety Data Sheets, Labels, Hazardous evaluation, Training and evaluation and documentation. Supervisors are responsible for keeping a chemical inventory and file of Material Safety Data Sheets and for training workers on how to use labels and MSDS's to keep safe. The HCS contains a checklist (see page 51), which can be used to verify compliance.

"Checklist for Compliance". The following checklist will help to ensure you are in compliance with the rule.

- Obtain a copy of the rule.
- Read and understand the requirements.
- Assigned responsibility for tasks.
- Prepared an inventory of chemicals.
- Ensured containers are labeled
- Obtained MSDS for each chemical.
- Prepared written program.
- Make MSDS available to workers.
- Conduct training for workers.
- Established procedures to maintain current program.
- Established procedures to evaluate effectiveness.

This document is designed to help supervisors establish and maintain a HazCom or "Right-To-Know" program. It contains the information and forms to satisfy OSHA requirements.

- The body of the document contains the basic program responsibilities.
- Appendix A contains the forms that, when completed, document the program.
- Appendix B is a blank form you can use to record your chemical inventory.
- Appendix C is the OSHA Personnel Protective Equipment assessment checklist.
- Appendix D documents training of your workers.
- Appendix E describes the HMIA and NFPA diamond label system.
- Appendix F is a glossary of OSHA and HazMat terms.
- Appendix G is the full text of the OSHA Hazard Communication Standard (for the person in your work group who say's "Show me where it says that").
- Appendix H contains information supervisors and managers may need to answer questions raised by employees as they receive their training.
- Appendix I contain information dealing with Emergency Response.
- Appendix J short general training program that can be used to train persons on HazCom Standard, Labeling and MSDS's.
- Appendix K The safe handling of waste light bulbs.
- Appendix L Sharps and laboratory glass disposal.
- Appendix M Glove Chemical Resistance.

Hazard Communication Program

for Alabama A & M University

Potentially hazardous chemicals can be found everywhere. There are an estimated 575,000 existing chemical products and hundreds of new ones are introduced annually. Almost 32,000,000 workers are potentially exposed to one or more chemical hazards in the workplace. Depending upon magnitude, chemical exposure may cause or contribute to many serious health effects including cancer, heart disease, burns, rashes, kidney and lung damage. Additionally, some chemicals pose safety hazards and have the potential to cause fire, explosions, and other serious accidents. The fact that these chemicals are available at your local hardware store does not mean they are without hazard.

In 1983 the Occupational Safety and Health Administration (OSHA) set out to help control workers' on-the-job chemical exposure by publishing the Hazard Communication Standard (HCS), commonly called HazCom or "Right-To-Know". The Alabama Department of Environmental Management (ADEM) adopted the OSHA Standard which can be found in Title 29, Part 1910.1200 of the Code of Federal Regulations (29CFR 1910.1200) and is included in Appendix G of this document. The standard requires all employers to provide information and training on chemical hazards to any employees who have the potential of being exposed to a hazardous chemical "under normal conditions of use or in a foreseeable emergency".

The OSHA HCS covers all forms of chemicals – liquids, solids, gases, vapors, fumes and mists—whether they are contained or not. Chemicals determined to be hazardous must have a comprehensive **Material Safety Data Sheet (MSDS)** and **warning labels** on chemical containers. It is also required that the employer (e.g. AAMU) develop a written hazard communication program and provide information and training to employees about the hazardous chemicals in their workplace. The HCS establishes three major informational requirements: labels, MSDS's, and employee training.

- Labels provide a brief statement of the hazards associated with the chemical.
- MSDS's provide more comprehensive technical information on the hazardous chemical and serve as reference documents for employees, emergency responders, and health professionals.
- Training ensures that employees understand the information provided by labels and MSDS's, know where and how to obtain this information, and are aware of the proper protective measures and emergency procedures to follow.

At Alabama A & M University, a HazCom or Safety Plan is required for each workplace in which chemicals or chemical products are used. Given the broad use of chemicals, a HazCom Program should be in effect for non-laboratory workplaces such as:

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|--|---------------------------------------|
| * Art studios | * Vehicle maintenance and garages |
| * Custodial stockrooms | * Maintenance rooms and machine shops |
| * Electrical shops | * Paint spray booths |
| * Engineering stockrooms | * Printing operations |
| * Equipment repair areas | * Physical plant trade shops |
| * Facility supply rooms | * Welding areas |
| * Areas in which pesticides are used, either indoors or out of doors | |
| * Research areas that are not laboratories (e.g., field plots, animal care, prep rooms). | |

Certain chemicals are exempt from the standard. These include hazardous wastes (covered by another standard), food, wood, tobacco, and potentially hazardous substances such as drugs and cosmetics that are brought to the workplace for personal consumption. Outside of these exempt items, a safety plan of some sort is required for every work area in which chemicals or chemical products are used.

This Hazard Communication Plan does NOT cover laboratory and clinical workplaces. Part 1910.1450 (OSHA Laboratory Standard), and other OSHA rules and regulations, require that laboratories, medical clinical, and certain other specific facilities in which chemicals are used have a Chemical Hygiene Plan or other prescribed safety program. If you work in a research laboratory, see Alabama A & M University's Chemical Hygiene Plan and Hazardous Waste Manual. Call EH&S for copies of these documents.

When implemented, the HazCom Program consists of six major elements: a written program (e.g., this guide with appendices A-D forms filled in), hazardous evaluation, labeling, material safety data sheets, and training and contractor requirements. If these six elements are in place, it will help insure that persons who work with hazardous chemicals have been informed of and are aware of the:

- Chemical substances that are present in the products they handle.
- Health effects that overexposure to these chemicals are capable of causing.
- Precautions necessary to prevent overexposure.
- Physical hazards (e.g., fire, explosion) possible if the product is not handled properly.
- Way to handle the product in order to avoid hazard.

1. Hazard Communication Program Responsibilities

AAMU is committed to providing a safe and healthful environment for students, faculty, staff, and members of the general public. Each and every person at AAMU plays a part in that program. This Program is designed to inform supervisors and employees who use chemicals, chemical products and personal protective equipment. It will help you comply with the requirements of OSHA's Hazard Communication Standard and the Personal Protective Equipment Standard (29CFR 1910.132), as adopted by the Alabama Department of Environmental Management (ADEM).

While this HazCom Program satisfies the OSHA requirements, remember it may not be a complete safety program for your workplace, there are many other workplace risks. For example all employees should plan for emergencies, learn how to lift safely and learn to use fire extinguishers. Additionally, this Program does not discuss safety for users of radioactive materials, biological agents or other non-chemical hazards. Contact EH&S for separate guidance for these risks.

1.1 Supervisor/Manager Responsibilities

All employees who use chemicals—including student employees—need to be covered by a HazCom plan unless they work in a laboratory covered by a Chemical Hygiene Plan. The employee's immediate supervisor, either faculty or staff, is responsible for preparation and

Implementation of the Plan. If you are the only employee in your work unit, you still are responsible for completing a Plan. However, in the interest of safety and economy, one plan may suffice for many employees and workplaces it addresses the use of all chemicals. If you are a supervisor or manager of employees who may be exposed to hazardous chemicals as part of their duties, you must take certain steps to ensure their safety. Compliance with the OSHA Hazard Communication and Personal Protective Equipment Standards require you to:

- Complete the Hazard Communication Plan (Appendix A) or equivalent document.
- Inventory/list the chemicals and chemical products in your workplace (Appendix B).
- Keep Material Safety Data Sheets (MSDS's) for those listed chemicals (Section 3.2) and make the MSDS's available to your workers.
- Insure all chemical containers and chemical products are properly labeled (Section 3.3) and preserve existing labels where possible.
- Assess chemical hazards select and provide the appropriate personal protective Equipment for your employees (Section 4, Appendix C).
- Establish procedures to inform your employees of non-routine chemical hazards (Section 7).
- Train your employees to understand chemical hazards, chemical hazard labels and to properly select and use personal protective equipment (Section 8, Appendix H).
- Annually review your Plan with your staff.
- Post mandated "Right-to-Know" documents in all work sites.

You may delegate some of these tasks, but every supervisor and manager is responsible for these compliance duties for themselves and the employees who work for them.

1.2 Employee Responsibilities

Safety is everyone's responsibility. Each individual is responsible for the safe use of hazardous chemicals in their care. Many chemical accidents are completely avoidable. They often result from (1) a lack of knowledge or, (2) a disregard of the most basic safety precautions. This HazCom Program attempts to provide a mechanism to make employees aware of hazards in their workplace. All employees should:

- Accept the responsibility for knowing the safety requirements and putting them into practice in the workplace.
- Include safety considerations in planning and performing work.
- Learn in advance about the properties, hazards, and safety measures pertinent to the materials and equipment, which will be used.
- Know the established emergency procedures and the location and proper use of emergency equipment and supplies.
- Review this program with your supervisors/managers and suggest corrections to address deficiencies in the program document.
- Call EH&S with any questions you have about specific safety concerns.

1.3 Contractor Responsibility

When at AAMU, contractors are considered "employees" for the purpose of HazCom. The work that contractors perform must follow all applicable OSHA rules and regulations. Contractors must also keep exposure of AAMU faculty, staff and students within allowed levels. Some easily accomplished procedures include:

- Use break-resistant containers to transport, store, and use chemicals.
- Label all chemical containers with the chemical identity and hazard warning
- Have MSDS of all chemicals used at the work site.
- Properly dispose of all hazardous waste materials created at the work site.

1.4 Environmental Health and Safety Responsibilities

Environmental Health and Safety has individuals who have expertise in many areas of health and safety. Some of the ways in which we can help you with your plan include:

- Survey your workplace for chemical hazards and inform you of required precautions.
- Provide a central source of MSDS's for materials you use.
- Suggest procedures, labels and training aids to help you and your employees learn more about chemicals and workplace safety.
- Provide information and advice on the safe use and disposal of chemicals (Section 6).
- Inspect campus safety showers, eye wash stations, and fume hoods and fire extinguishers to ensure proper operation.
- Coordinate campus chemical emergency response with the Huntsville Fire Department's Hazardous Incident Response Team.
- Conduct workplace training to address specific safety concerns of your workgroup.
- Provide safety videos or coordinate the use of videos from EH&S video library.

Contact Environment Health and Safety (372-4091) for more information.

2. Hazardous Communication Program Elements

To be classified as **hazardous**, a substance must have been proven capable of producing adverse effects on humans or the environment. Before using any chemical, even if it is something that you have worked with at home or in other work environments, it is important to understand what the exposure hazards may be and how to work with it safely. In order to assess the hazards of a particular chemical, both the physical and health hazards of the chemical must be considered. For example, gasoline is flammable, smoking/open flames nearby are dangerous situations. The vapor may be inhaled and may produce effects like headache, blurred vision, liver and kidney damage. Skin exposure can cause dryness, blisters and lesions. Generally, more accurate information is available about a chemical's physical hazards because the physical hazards can be measured, but effects on people are variable. An overview of basic toxicology and types of physical hazards is found in (Appendix H.1.)

2.1 Chemical Inventory

The foundation of a working HazCom Program is an up-to-date inventory of the chemicals used in the workplace. Appendix B contains forms, which can be used to keep your inventory. List the chemicals and chemical products that are present in your work areas. Include materials in use and in storage. The name on the inventory must be the same as the chemical name on the container label and the MSDS. Make copies of the blank pages if you need additional sheets.

The OSHA Hazard Communication Standard requires that your list be updated at least annually and kept for 30 years. As noted on the bottom of the inventory form, when the last year on your list is complete, send a copy to EH&S. We will file them for use in case of inspections by state or federal agency.

Keep your chemical inventory up-to-date by using the form at Appendix B, a card file or a computer base (available from EH&S). Remind your workers to watch for new chemicals in their work area and to make sure those chemicals are listed on the chemical inventory.

An inventory system for your chemical products can help you better manage your materials and improve safety. You'll make better purchasing decisions when you understand usage rates and you can reduce losses due to shelf-life expirations. Two important inventory elements are:

Buy only what you need. Once you have a good inventory, you will be better able to predict use. Stockpiling compounds because you got a good price may not be sound. Many chemicals degrade over time and lose their effectiveness. Storage of large quantities of certain substances may create a fire hazard or may produce hazardous environments. Materials that have reached a shelf life should be evaluated for effectiveness before deciding to use it. If material is no longer useful (e.g., left over from previous contract), it may have to be disposed of as hazardous waste, adding cost to the original cost with no value added.

When doubt, "throw it out". Dispose of materials you don't use. Many chemicals degrade over time and lose their effectiveness. Some chemicals can degrade their storage container and leak. Some containers may no longer have readable labels that describe the hazard. Call EH&S for help with proper disposal. We have persons trained in handling hazardous chemicals and hazardous wastes, and we have a contract with approved waste vendors.

By having a viable aggressive chemical inventory management program, your Hazard Communication Program will be easier. For example, you won't need to keep an MSDS or Personal Protective Equipment Assessment for materials that you don't have. You'll also have fewer hazardous chemicals in your workplace and more storage space.

2.2 Chemical Disposal

Read the MSDS for proper disposal of your compound. Remember, it is never permissible to dispose of hazardous chemicals by evaporation or by pouring into a storm sewer (any drain located outside a building will discharge into a lake via a storm sewer). Also don't pour chemicals down sink drains unless you get prior approval from the EH&S to do so.

Call EH&S for a disposal procedure, or for pickup of items that you cannot dispose of yourself. Depending on the properties of the chemical for disposal, EH&S will tell you to:

- dispose of the item in the normal trash
- pour it down the sink, followed by plenty of water
- pour it into a carboy (waste solvent collection jug) or
- fill out a "Chemical Waste Disposal List" and forward to EH&S to schedule a pick up.

2.3 Material Safety Data Sheets

The OSHA Hazard Communication Standard requires each work unit obtain Materials Safety Data Sheets (MSDS's from supplier and maintain them in such a way that they are readily assessable to personnel in any work areas at any time.

Suppliers are required by OSHA to supply an MSDS for all chemicals or chemical products purchased. While pesticides are exempt from the HazCom Standard, information standard to

MSDS is incorporated into the container label or label information that is usually in an Attached booklet. State purchasing rules require vendors to include an MSDS inside the package of all incoming chemicals, also send a copy of the MSDS to EH&S. Make sure that all packages of incoming chemicals are accompanied by an MSDS. If you do not receive an MSDS with your product contact the supplier and remind them of the requirement. Some chemicals vendors have MSDS's available on the Internet.

Have a system to catalogue MSDS's. One easy way is to keep a copy of each MSDS with your HazCom Plan. If an MSDS is not received with a shipment, it may have been sent to Purchasing and then forwarded to EH&S. Call EH&S if you are missing any MSDS. In the unlikely event that a supplier is uncooperative or if you have repeated problems obtaining MSDS, contact the EH&S and we will work with the Purchasing to enforce this rule.

There is no reason to think that MSDS's are confusing. True, they contain a lot of chemical, medical and legal information. But remember, they are written to be useful to a wide variety of individuals (e.g., workers, emergency responders, physicians, etc.), for any quantity of that chemical product. Therefore, there is some key information on an MSDS that every employee should review and understand for the chemicals they use. Managers should review MSDS's with their employees to check their ability to identify and comprehend key information. EH&S can answer questions or set up training sessions to review MSDS's for the chemical products in your workplace. Training videos are also available for loan.

MSDS is the centerpiece of the HazCom Standard and while OSHA does not prescribe a special format it does require that MSDS's have certain items of information such as:

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| * Health hazards | * what to do in an emergency |
| * Physical hazards | * How to clean up a spill |
| * Safety precautions for using the material | * Symptoms of exposure |
| * Personal Protective Equipment (PPE) | * How to dispose of the material |

Appendix H.2 discusses the types of information and its meaning.

2.4 Labels

MSDS's and container labels tell you about the hazards of the material you will work with and how to work safely with it. You must read the label before opening anything that contains a hazardous material.

Labels alert you to the health and physical hazards a material presents during use, handling and storage. Once you are aware of the potential hazards, you can take the necessary precautions. If a label tells you a material is corrosive, you need to avoid contact with you skin. And eyes, and don't breathe the vapors. If a label tells you a material is flammable, you must keep it away from heat, sparks, and flame. Good labels also include first aid instructions in case of an exposure or contact, fire and spill or leak procedures, and handling and storage requirements. If an accident or spill occurs, you can be prepared to deal with it quickly and efficiently. Therefore, completely evaluate the hazards of a material by reading the MSDS before use. The label then provides a summary of the MSDS.

Container labels are an essential information source and one key way in which workers are made aware of the chemical hazards in their work area. Do not remove or deface the

Manufacturer's original from any chemical container. The HazCom Standard requires all containers of hazardous chemicals be marked with:

- The chemical's identity
- Name and address of the chemical manufacturer or supplier
- The chemical's hazards

Pesticides are sold with extensive label information, which may include a booklet of safety information. Be sure to retain this information and distribute it to everyone who uses the pesticide. We recommend that you keep a copy of your pesticide labels with your MSDS's but don't remove the original label.

The OSHA Standard only requires what must be on the label. The manufacturers can use any type of label as long as the requirements are met. OSHA also requires an approximate hazard warning. The hazard warning must include "target organs" effects. For example, if the chemical when inhaled, causes lung damage, then that warning and the health hazard should be spelled out: "Do not inhale-May cause lung damage". All Carcinogenic or "cancer causing" information must be on the label. Because the label only provides a summary, workers still need to refer to the MSDS for complete information. However, because the first thing a worker sees when starting a job is the label, it is crucial that they provide sufficient warning. Key points to remember:

- Always read the containers label before the container is opened, moved, or handled. Labels provide an immediate warning of the hazards workers may be exposed to, and though the chemical identification, they provide a direct link to the MSDS.
- Report an unlabeled container immediately. You should not handle a container whose contents are unknown.
- Do not reuse empty containers for other chemical. Even a trace of a chemical residue in a supposedly empty container can pose serious health and safety risks if an incompatible chemical is added to the container. The combination could be deadly.
- Never remove a label unless you immediately replace it with another one (e.g., the original label has become soiled, torn, or unreadable and must be replaced with one containing the same (required) information.

Additionally, to help you track the shelf life and manage your chemical inventory, you should date the containers when they are received or opened, and note who is responsible for each container.

Appendix H.3 discusses the various kinds of labels, their interpretation and application.

2.5 Hazard Assessments and Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) is safety equipment that a person wears to protect her-or-himself from hazard. Examples include:

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| * aprons | * coveralls | * face mask | * face shields |
| * gloves | * goggles | * safety glasses | |

It is always safer to protect workers with engineering controls instead of relying on the worker wearing PPE. Permanently mounted shield and remote handling devices prevent chemical exposure without personnel reminders (e.g., signs) and decisions by the worker whether a hazard exists. Other alternatives to PPE are work practices and administrative controls, such as

procedures that specify less hazardous / safer chemicals or that limit amounts which can be used. Call EH&S for advice in choosing safety controls.

Assess chemical hazards to select the proper personal protective equipment for your employees. If you or your staff uses a hazardous chemical in a way that calls for the use of personal protective equipment (PPE) you need to:

- Select the type(s) of PPE that will protect your employees from chemical hazards.
- Explain to staff why, how and when PPE should be used.
- Select brands or types of PPE that fit properly.
- Require that each employee use the selected PPE when the hazard may be present.

The form found in Appendix C will perform your PPE hazardous assessment and to select the proper Personal Protective Equipment for your workplace. This assessment is sufficient for most chemical uses on campus in which the appropriate personal protective equipment is limited to the eyes, face, feet and hands. Radioactive and biological materials are excluded from the PPE Hazard Assessment because EH&S's Radiation and Biological Safety Programs perform these assessments through their authorization procedures. The assessment in Appendix C also covers PPE for some light (e.g., welding, torches, lasers) and temperature extremes.

Glove manufacturers publish chemical resistance charts for proper glove selection. For additional information on PPE consult Appendix M for the *Glove Chemical Resistance Guide* and glove chart.

Call Environmental Health and Safety if you need help in selecting proper personal protective equipment. Contact the EH & S to assess PPE needs for non-chemical physical hazards not found in Appendix C. EH & S can also help you select proper laser protective goggles, shielding for radiation sources, etc.

Respiratory protection, such as a mask or respirator, is also not included in the Appendix C assessment. If the material label or MSDS recommend a respiratory protection, contact the EH & S for advice. We will first try to improve a ventilation system, so that contaminants are captured before they reach your breathing zone. A glove box, fume hood or local ventilation is usually better than personal respiratory protection. If a respirator is needed, please contact EH & S for assistance.

OSHA requires a written certification of your PPE hazard Assessment. After you have completed the Hazard Assessment in Appendix C, sign and date the form. Additional PPE forms are available from EH & S. Once completed, describe in Appendix A any safety practice or PPE that are in addition to those described on your PPE Hazard Assessment and Certification form.

2.6 Emergency Response

Chemical emergencies require prompt, appropriate action. Appropriate emergency action is given in the Material Safety Data Sheet. There are also procedures for chemical emergencies that you need to know. See Chapter 6 of the "*Hazardous Waste Manual*" for a fuller discussion of emergency response. Appendix I of this plan discusses Emergency Response. This appendix can easily be copied and kept in each work area so personnel will know the appropriate response to the various issues

A key concept in responding to emergency situations is: **the situation dictates the response**. Thus, injuries require first removal of the injuring substances (e.g., emergency shower, removal from the area, etc.), fires should include calling (5555) or (911), spills require containment, evaluation, and clean up.

2.7 Employee Training

Every employee who may work with a hazardous chemical needs information and training to ensure their safety. Supervisors are responsible for telling their employees about hazardous chemical in their work area at the time of their initial assignment. While there is not a requirement for refresher training, additional training is necessary whenever a new physical or health hazard is introduced into their work area or when the worker moves to another work area with different hazards. Information and training may be designed to cover specific hazard categories (e.g., flammability, carcinogen city) or specific chemicals. Chemical-specific information must always be available through labels and Material Safety Data Sheets.

HazCom training should cover the contents of this document. Specifically, discuss how to read / interpret Material Safety Data Sheets (MSDS's), the information found on labels and the proper use of Personal Protective Equipment (PPE). Training should start with a review of your HazCom Program as document in Appendix A. This review should include:

- the operation in your work area where hazardous chemicals are present.
- a list of the hazardous chemical used in your work area (Appendix B).
- an explanation of the labeling system used in your work unit (Appendix E).

Review Material Safety Data Sheets (MSDS's) with employees. During the review, use an MSDS for a product commonly used in your area and discuss:

- how to obtain Material Safety Data Sheets and where they are located in your job site.
- The principal physical and health hazards of chemical products in the work area and where to find this information on the MSDS.
- Measures employees can take to protect themselves from these hazards, including specific procedures, work practices and emergency procedures to protect employees from exposure to hazardous chemicals.
- Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area. Examples are the appearance of an odor or other physical warning signs of a hazardous chemical release, visual signs of spills, and continuous monitoring devices.

Discuss labels with your workers. Take a tour of the work place pointing out the work and storage locations and any special labeling requirements. Using NFPA and HMIS labels from common used substances discuss:

- The difference between NFPA and HMIS (i.e., NFPA pertains to acute hazard in a fire).
- The different colored sections and numbering system used and the meaning of the color and numbers (Appendix E).
- Any special precautions or personal protective equipment needed.

Train every employee who is required to use Personal Protective Equipment (PPE) to understand the purpose and limitations of such equipment. Review your PPE Assessment (Appendix C) and, when you conduct your employee training, be sure to include:

- Situations when Personal Protective Equipment is necessary

- The types of Personal Protection Equipment needed in specific situations.
- Medical surveillance and fit testing requirements for persons wearing respirators.
- How to properly fit, put on, adjust, wear and safely remove Personal Protective Equipment
- Limitations of Personal Protective Equipment.
- Proper care, maintenance, useful life and disposal of the Personal Protective Equipment.

Depending upon the scope of chemical usage in a particular work unit, requiring training could range from a simple group discussion of MSDS information to a formal presentation of chemical hazards. Also discuss appropriate work practices, engineering controls (such as exhaust ventilation systems) and personal protective equipment.

EH&S Office can help you obtain Material Safety Data Sheets and training materials. We can evaluate your work practices, engineering controls and protective equipment. We are available to assist you in your safety training and have training videos available for loan.

For initial training of workers, have the workers sign the training form in Appendix D. This is your record. For each training session, it is recommended that you keep a short note describing the subject discussed and a list of attendees. This record should be kept with your HazCom Program documents and provide a record of ongoing training.

3. Non-Routine Tasks

Employees must be made aware of non-routine tasks that may result in exposure to an unfamiliar hazardous chemical. Examples of non-routine tasks include an unplanned cleaning project using a solvent or strong cleaner, or cleaning a spill with which you are not familiar.

Read the label before you use any chemical or product for the first time. Review the MSDS. If you don't understand the product's hazards or safety precautions, call EH&S. Reacquaint yourself with chemical products you haven't used recently. Supervisors and staff should discuss the hazards of any activity that requires the use of new or unfamiliar chemical products.

One normally doesn't think of pipes as containing hazardous materials, but in research areas there are many kinds of pipes and even normal sanitary sewer drain pipes may contain hazardous materials. Pipes should be labeled as to what hazards they may contain and employees must be made aware of pipes containing hazardous chemicals and the effects that any residual hazardous materials or leaks in the pipe may present. Plumbers and maintenance shops should establish entry procedures to reduce the risk of unnecessary exposure in pipes and ductwork. Laboratories and departments should post emergency instructions nearby in case of a pipe leak.

In Appendix A, describe the additional procedures to inform staff of chemical hazards when performing non-routine tasks. If pipes containing hazardous chemical are present, describe the additional practices used to inform your staff of chemical hazards.



Appendix A. HazCom Documentation

Work Area(s) Covered by This Program

Record the administrative information for your workplace. Please notify the Environmental Health and Safety Office of new managers or supervisors or any changes in your mailing address so we can keep informed of updates and training seminars.

Manager/Supervisor	Date
Person responsible for Chemical List and MSDSs	Plan Review Dates (review at least annually)
	Room numbers and work areas covered by this Plan
Department and Building / Campus Mailing Address	

Labeling Practices for Your Work Area

Describe below the procedure for labeling hazardous chemicals in your work area and other locations, which your staff work. For example, if you always use the original container and never transfer compounds to secondary (e.g., smaller containers), simply check the block below.

<input type="checkbox"/> This work area uses the HMIS / NFPA container labeling system
Other/alternative practices for labeling chemical containers in this work area:

Safety Training Program for Staff

Describe the hazard communication and protection training program you intend to use for employees in your work unit by checking the training option boxes that apply.

<input type="checkbox"/>	A safety review is part of every new employee's initial orientation, and whenever new hazards are introduced into their work area.	
<input type="checkbox"/>	All employees review this Hazard Communication Program, including: ♦ PPE Hazard Assessment (Appendix C) ♦ Material Safety Data Sheets (MSDSs) for this work unit (Section 3) Supervisors and employees discuss any questions and unfamiliar terms.	
<input type="checkbox"/>	All employees read the <i>HazCom Training Outline</i> (Appendix G).	
<input type="checkbox"/>	All employees review the HMIS and NFPA labeling systems (Section 3.3.a) and understand how to use these labeling systems.	
<input type="checkbox"/>	What secondary containers are (Section 3.3.b), how to properly label them.	
<input type="checkbox"/>	Safety considerations when working with tradename compounds and how to interpret the labels on these containers.	
<input type="checkbox"/>	What to do in the event of a spill, chemical injury, or other emergency (Section 5).	
<input type="checkbox"/>	How to dispose of chemicals and hazardous waste in the work area (Section 6).	
<input type="checkbox"/>	All employees attend EH&S Fire Extinguisher training (call EH&S).	
<input type="checkbox"/>	All employees attend EH & S Chemical Safety training class.	
<input type="checkbox"/>	All employees view these safety videos	List safety videos:
<input type="checkbox"/>	All employees review safety training on web	List web site(s), safety exams taken:
<input type="checkbox"/>	All employees review these safety resources	List books, safety exams taken:
<input type="checkbox"/>	This workgroup discusses safety at regular group meetings	Frequency of group meetings in which safety is discussed:
Other safety training methods for this workgroup:		

Informing Staff and Contractors of Non-Routine Chemical Hazards

Describe the additional procedures to inform staff of chemical hazards when performing non-routine tasks. If pipes containing hazardous chemicals are present, describe the additional practices used to inform your staff of chemical hazards.

Procedures for informing staff of chemical hazards when performing nonroutine tasks:

Additional precautions for pipes containing hazardous chemicals (if applicable):

Personal Protective Equipment (PPE) Used by Your Staff

For each task, initially review Appendix C to determine appropriate PPE. Describe below any safety practices or PPE that are in addition to those described on your PPE Hazard Assessment and Certification form.

Other Personal Protective Equipment used :

NOTES

Appendix B. Chemical Inventory

[illegible]

Each year when the inventory is complete, send a copy to the EH&S Office for record keeping.



















Appendix C. PPE Hazardous Assessment and Certification
(Laboratory Hazardous Assessment Survey OSHA Standards 29 CFR 1910.132-138)

Person Completing the Assessment		Date of Assessment
Signature		
Hazards in the Workplace	Check If Present	Personal Protective Equipment (PPE) Required
HAZARDOUS LIQUID CHEMICALS		
Corrosive Liquids (Acids/Caustics)		
Small containers < 1 liter corrosive liquids	<input type="checkbox"/>	Safety goggles preferred, safety glasses accepted, proper gloves, coveralls or long sleeved shirt or lab coat, closed toe shoes. If work is done on an open bench and not in a chemical fume hood, it is advisable to use goggles instead of glasses.
Large containers > 1 liter corrosive liquids	<input type="checkbox"/>	Safety goggles, proper gloves, coveralls or long sleeved shirt or lab coat, rubber apron, closed toe shoes. If potential for a splash is high, it is advisable to use both face shield and goggles. Also if work is done on an open bench and not in a chemical fume hood, it is recommended that a face shield be used in addition to goggles.
Flammable Liquids		
Any flammable liquids	<input type="checkbox"/>	Safety goggles preferred, safety glasses accepted, proper gloves, coveralls or long sleeved shirt or lab coat, closed toe shoes.
Dispensing flammable liquids from 5 gal. drums	<input type="checkbox"/>	Safety goggles, proper gloves, coveralls or long sleeved shirt or lab coat, closed toe shoes. If potential for a splash is high, it is advisable to use a face shield in addition to goggles.
Liquid Reactives and Oxidizers		
Highly reactive liquid chemicals and strong oxidizers	<input type="checkbox"/>	Safety goggles preferred, safety glasses accepted, coveralls or long sleeved shirt or lab coat, proper gloves, closed toe shoes. Face shield or body shield must be used in addition to protective eyewear during the reaction based on the scale of the reaction.
Liquid Poisons and Toxic Chemicals		
Caution Call the EH&S Office for advice on selecting the proper PPE for toxic chemicals. Use a glove box, fume hood or local ventilation whenever possible.		
Liquids with high acute toxicity (poisons)	<input type="checkbox"/>	Safety goggles, proper gloves, coveralls or long sleeved shirt or lab coat, impermeable apron, closed toe shoes. If potential for a splash is high, use impermeable coveralls and a face shield in addition to goggles. If uncontained liquid must be used, call the EH&S Office for respiratory protection advice.
Liquids with high chronic toxicity (known and suspected carcinogens, reproductive toxins)	<input type="checkbox"/>	Safety goggles preferred, safety glasses accepted, proper gloves, coveralls or long sleeved shirt or lab coat, closed toe shoes. If uncontained liquid must be used, call the EH&S Office for respiratory protection advice.

Hazards in the Workplace	Check If Present	Personal Protective Equipment (PPE) Required
Other Hazardous Liquid Chemicals		
Other hazardous liquid chemicals not included in the above categories (describe):	<input type="checkbox"/>	Safety goggles/glasses based on a splash potential, proper gloves, coveralls or long sleeved shirt or lab coat, closed toe shoes.
HAZARDOUS SOLID CHEMICALS		
Toxic Solid Chemicals Caution! Call the EH&S Office for advice on selecting the proper PPE for toxic chemicals. Use a glove box, fume hood or local ventilation whenever possible.		
Solids of high acute toxicity (poisons)	<input type="checkbox"/>	Safety glasses, proper gloves, coveralls or long sleeved shirt or lab coat, closed toe shoes. If you must weigh or use uncontained material, call EH&S Office for respiratory protection advice. If potential for disseminating powder is high, use protective coveralls and a face shield in addition to appropriate respiratory protection.
Solids of high chronic toxicity (carcinogens and reproductive toxins)	<input type="checkbox"/>	Safety glasses, proper gloves, coveralls or long sleeved shirt or lab coat, closed toe shoes. If you must weigh or use uncontained material, call EH&S Office for respiratory protection advice.
Other Hazardous Solid Chemicals		
Caustic solids (lime, etc.)	<input type="checkbox"/>	Safety glasses, proper gloves, coveralls or long sleeved shirt or lab coat, closed toe shoes. If potential for getting a chemical into the face is high, use face shield in addition to glasses.
Flammable solids (alkali metals, red phosphorous, etc.)	<input type="checkbox"/>	Safety glasses, proper gloves, coveralls or long sleeved shirt or lab coat, closed toe shoes.
Highly reactive solids and strong oxidizers	<input type="checkbox"/>	Safety glasses, proper gloves, coveralls or long sleeved shirt or lab coat, closed toe shoes. Face shield or body shield during reaction based on the scale of the reaction in addition to protective eyewear.
Other hazardous solid chemicals not included in the above categories (describe):	<input type="checkbox"/>	Safety glasses, coveralls or long sleeved shirt or lab coat, proper gloves, closed toe shoes.
GASES		
Compressed gases	<input type="checkbox"/>	Safety goggles, proper gloves, coveralls or long sleeved shirt or lab coats, closed toe shoes.
Work with pressurized glass/plastic vessels (potential for creating flying fragments)	<input type="checkbox"/>	Face shield, safety goggles/glasses based on substances in the vessel, coveralls or long sleeved shirt or lab coat, proper gloves, closed toe shoes.

Hazards in the Workplace	Check If Present	Personal Protective Equipment (PPE) Required
LIGHT (visible / invisible) RADIATION		
Welding: Electric arc	<input type="checkbox"/>	Welding helmet or shield, leather gauntlet-type welding gloves, welder's tunic or coveralls, closed toe shoes.
Welding: Gas	<input type="checkbox"/>	Welding goggles or face shield, leather gauntlet-type welding gloves, welder's tunic or coveralls, closed toe shoes.
Cutting, torch brazing, torch soldering	<input type="checkbox"/>	Spectacles or welding face shield, leather gauntlet-type welding gloves, welder's tunic or coveralls, closed toe shoes.
Lasers	<input type="checkbox"/>	Protective goggles of the appropriate optical density
Class IIIb or IV Sources of UV light (hand held irradiators, UV screens, germicidal lamps)	<input type="checkbox"/>	Safety glasses, coveralls or long sleeved shirt or lab coat, proper gloves. Based on the duration of exposure and the source it may be advisable to use a face shield instead of glasses.
TEMPERATURE EXTREMES		
Heat (hot surfaces, hot solutions, etc.)	<input type="checkbox"/>	Face shield, thermal gloves, coveralls or long sleeved shirt or lab coat, closed toe shoes.
Cold Low temperature freezers	<input type="checkbox"/>	Thermal gloves, thermal coveralls or additional clothing as required, closed toe shoes.
Cryogenic gases (N ₂ , He, etc.)	<input type="checkbox"/>	Face shield, thermal gloves, coveralls or long sleeved shirt or lab coat, closed toe shoes.
Autoclave operation	<input type="checkbox"/>	Face shield, rubber apron, thermal gloves, lab coat, closed toe shoes.
OTHER HAZARDS NOT LISTED ABOVE		
Hazard (describe):	<input type="checkbox"/>	
Hazard (describe):	<input type="checkbox"/>	

Icons Commonly Used to Show Required Personal Protective Equipment (PPE)

 Safety Glasses		 Gloves		 Protective Apron	
 Face Shield		 Dust Respirator		 Vapor Respirator	
 Air Line Mask or Hood		 Full Suit		 Boots	

Notes

Appendix D. HazCom Training Documentation

Use this form to document your training

[illegible]

[illegible]

Appendix E. HMIS and NFPA Label Rating System

There are two major labeling systems in use. The Hazardous Materials Information System pertains to routine uses and the NFPA (diamond) pertains to hazards of the chemical in a fire situation. Both systems use numbers to rate the hazard level, 0 being a minimal hazard, 4 being an severe hazard.

Hazardous Materials Information System (HMIS)

I. Health Hazard Rating (blue)

- 0 Minimal Hazard - No significant risk to health.
- 1 Slight Hazard - Irritation or minor reversible injury possible.
- 2 Moderate Hazard - Temporary or minor injury may occur.
- 3 Serious Hazard - Major injury likely unless prompt action is taken and medical treatment is given.
- 4 Severe Hazard - Life-threatening, major or permanent damage may result from single or repeated exposures.

HEALTH	<input type="checkbox"/>	<input type="checkbox"/>
FLAMMABILITY	<input type="checkbox"/>	
PHYSICAL HAZARD	<input type="checkbox"/>	
PERSONAL PROTECTION		

II. Flammability Hazard Rating (red)

- 0 Minimal Hazard - Materials that are normally stable and will not burn unless heated.
- 1 Slight Hazard - Materials that must be preheated before ignition will occur. Flammable liquids in this category have flash points (the lowest temperature at which ignition can occur) at or above 200° F [93.4° C (NFPA Class IIIB)].
- 2 Moderate Hazard - Materials that must be moderately heated before ignition will occur, including flammable liquids with flash points at or above 100° F (37.8° C) and below 200° F [93.4° C (NFPA Class II and Class IIIA)].
- 3 Serious Hazard - Materials capable of ignition under almost all normal temperature conditions, including flammable liquids with flash points below 73° F (22.8° C) and boiling points above 100° F (37.8° C) as well as liquids with flash points between 73° F (22.8° C) and 100° F [37.8° C (NFPA Class IB and IC)].
- 4 Severe Hazard - Very flammable gases or very volatile flammable liquids that have flash points below 73° F (22.8° C) and boiling points below 100° F [37.8° C (NFPA Class 1A)].

III. Physical Hazard Rating (orange)

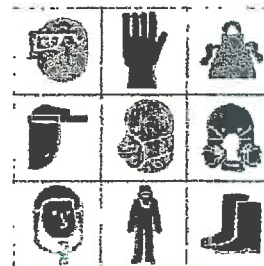
- 0 Minimal Hazard - Materials that are normally stable, even under fire conditions, and will not react with water.
- 1 Slight Hazard - Materials that are normally stable, but can become unstable at high temperatures and pressures. These materials may react with water, but they will not release energy violently.
- 2 Moderate Hazard - Materials that, in themselves, are normally unstable and that readily undergo violent chemical change, but will not detonate. These materials may also react violently with water.
- 3 Serious Hazard - Materials that are capable of detonation or explosive reaction but which require a strong initiating source or which must be heated under confinement before initiation; or materials that react explosively with water.
- 4 Severe Hazard - Materials that are readily capable of detonation or explosive decomposition at normal temperatures and pressures.

IV. Chronic Effects Information

Chronic health effects are not rated because of the complex issues involved and the lack of standardized classifications and tests. However, based on information provided by the manufacturer/supplier, chronic effects may be indicated by (1) use of an asterisk (*) or other designation after the Health hazard rating corresponding to other information that may be available; or (2) written warnings in the upper white section of the HMIS label.

V. Personal Protective Equipment

Information provided by the manufacturer/supplier is used to determine the proper personal protective equipment. This is represented by a letter coding system which refers to a series of protective equipment configurations. In some instances, icons may be used instead of the codes. Although use of icons is not endorsed by HMIS, the icons are more specific than having employees try to remember a bunch of codes or consult a chart, something that could lead to confusion and/or a fatal accident.



NFPA Hazard Rating- Fire Diamond

I. Health Hazard (Blue). Degree of hazard; level of short-term protection.

- 0 Ordinary Combustible Hazard in a Fire
- 1 Slightly Hazardous
- 2 Hazardous
- 3 Extreme Danger
- 4 Deadly



II. Flammability (Red). Susceptibility to burning.

- 0 Will Not Burn - Any material that will not burn in air when exposed to a temperature of 1500° F (815.5° C) for a period of 5 minutes.
- 1 Will Ignite if Preheated - Materials that will burn in air when exposed to a temperature of 1500° F (815.5° C) for a period of 5 minutes or less; liquids, solids, and semi-solids having a flash point above 200° F [93.4° C (i.e. Class IIIB combustible liquids)].
- 2 Will Ignite if Moderately Heated - Liquids having a flash point above 100° F (37.8° C), but not exceeding 200° F [93.4° C (i.e. Class II and Class IIIA combustible liquids)]; solid materials in a dust, fibrous, or shredded form that may burn rapidly or readily give off flammable vapors, but do not form explosive atmospheres with air.
- 3 Will Ignite at Ambient Conditions - Liquids having a flash point below 73° F (22.8° C) and having a boiling point at or above 100° F (37.8° C) and those liquids having a flash point at or above 73° F (22.8° C) and below 100° F [37.8° C (i.e. Class IB and Class IC flammable liquids)]; materials that can form explosive mixtures with air and materials that burn with extreme rapidity.
- 4 Burns Readily at Ambient Conditions - Flammable gases; flammable cryogenic materials; any liquid or gaseous material that is liquid while under pressure and has a flash point below 73° F (22.8° C) and a boiling point below 100° F [37.8° C (i.e. Class IA flammable liquid)]; materials that ignite spontaneously when exposed to air.

III. Reactivity, Instability (Yellow). Energy released if burned, decomposed, or mixed.

- 0 Stable Even Under Fire Conditions and Not Reactive with Water
- 1 Unstable if Heated
- 2 Violent Chemical Change
- 3 Shock and Heat May Detonate
- 4 May Detonate at Normal Temperatures and Pressures

IV. Special Hazard (White).

OX = Oxidizer

W = Use No Water, reacts!

- = No Special Hazard

Appendix F. Glossary of HazCom Terms

ACGIH - Abbreviation for the American Conference of Governmental Industrial Hygienists.

The ACGIH is a private organization of occupational safety and health professionals who recommend occupational exposure limits for many hazardous substances.

Acute Health Effect - An adverse effect which occurs rapidly, following a brief exposure to a substance.

ANSI - American National Standards Institute. A privately funded organization that develops consensus standards.

Autoignition Temperature - The lowest temperature at which a substance will burst into flames without a source of ignition like a spark or flame. The lower the ignition temperature, the more likely the substance is going to be a fire hazard.

Carcinogen - A substance that causes cancer in humans or because it has produced cancer in animals, is considered capable of causing cancer in humans.

CAS Number - Chemical Abstract Service. Registry of chemicals by assigning numerical identification.

Ceiling Limit (CL) - An OSHA established concentration exposure limit which must never be exceeded.

Chemical Reactivity - A chemical's ability to react with other materials. Dangerous and hazardous effects such as explosions, heat, etc.

CHEMTREC - Chemical Transportation Emergency Center. Established by the Chemical Manufacturers Association to provide emergency information on certain chemicals upon request. CHEMTREC has a 24-hour toll free telephone number (800-424-9300).

Chronic Health Effect - An adverse effect with symptoms that develop or recur very slowly, or over long periods of time.

Combustible - A material that will burn under most conditions.

Combustible Liquids - Liquids and liquid mixtures having flash points at or above 100 degrees Fahrenheit.

Compressed Gas - Any material which is a gas at normal temperature and pressure, and contained under pressure as a dissolved gas or liquefied by compression or refrigeration.

Concentration - The amount of a substance present per unit of media.

Corrosive - A chemical which can cause burns and destruction of unprotected skin and other tissue as well as metals.

Dangerously Reactive Material - A material that can react by itself (e.g., polymerize) or with air or water to produce a hazardous condition.

Decomposition - Breakdown of a chemical.

Density - The weight of a given volume of a substance. Gold is a very dense substance with a small amount weighing a lot. Plastic foams have low densities with a large volume weighing very little. The density of a substance is usually compared with water, which has a density of one. Substances with densities less than one will float on water if they don't dissolve; substances with densities greater than one will sink in water if they don't dissolve.

Dermal - By or through the skin; pertaining to skin.

Dermatitis - Skin rash; inflammation of the skin.

DOT - U.S. Department of Transportation. Regulates transportation of hazardous materials.

Evaporation Rate - How fast a liquid evaporates compared to some other chemical. The known reference material is butyl acetate with a vaporization rate of 1. The higher the number, the more rapidly the liquid evaporates.

Explosives - Chemicals which may release energy uncontrollably (i.e., explode) or detonate releasing large quantities of hot gases.

Explosive Limits - The amounts of vapor in air which forms explosive mixtures. Explosive limits are expressed as Lower Explosive Limit (LEL) and Upper Explosive Limit (UEL). These give the range of vapor concentrations in air which will explode if heat is added. Explosive limits are expressed as per cent of vapor in air.

Eye Irritants - Chemicals which irritate the eyes.

Flammable - Catches on fire easily and burns rapidly.

Flammable Gases - Gases which are likely to explode or burn readily if the vapor is exposed to an ignition source.

Flammable Liquids - Liquids with a flash point below 100 degrees Fahrenheit (38 degrees Celsius). Even a small energy spark like static electricity may ignite the vapors, which are usually given off readily under normal temperatures.

Flammable Solids - Solids which ignite very easily and burn intensely. Their dusts are a special problem since they may explode if mixed with air and an ignition source.

Flash Point - The lowest temperature at which a liquid gives off enough vapor to catch on fire if heat is applied. Flash point provides an indication of how flammable a substance is.

Gram - A unit of weight in the metric system. An ounce is about 28 grams, and a pound is approximately 450 grams. A teaspoon of sugar weighs about 8 grams.

Health Hazard - A harmful effect on health if an overexposure occurs. There are acute and chronic health hazards.

Highly Toxic Chemicals - Chemicals which are poisonous in extremely small doses.

Inflammable - Same as flammable.

Ingestion - Swallowing.

Irritants - Chemicals which cause reddening, swelling and pain, but are not likely to cause tissue destruction.

Melting Point - The temperature at which a solid substance melts or becomes liquid.

Meter - A meter is about 40 inches.

mg/m³ - A way of expressing the concentration of a substance in air. It means the mass of substance per cubic meter (m³) of air.

Mutagenic - Capable of changing cells in such a way that future cell generations are affected.

Occupational Exposure Limits - Maximum allowable concentration of hazardous substances in workroom air to protect workers over a working lifetime.

OSHA - The Occupational Safety and Health Administration, United States Department of Labor. OSHA develops and enforces standards for occupational safety and health.

Oxidizer - An oxidizer is a substance that yields oxygen readily to cause or enhance the combustion of other materials. It may cause the ignition of combustible materials without the aid of an external source of ignition.

Permissible exposure limit (PEL) - Established by OSHA expressed as a time-weighted average (TWA) limit, a short-term exposure limit (STEL), or a ceiling exposure limit.

pH - A measure of how acidic or how basic a substance is on a scale of 0 - 14. pH 1 is very acidic; pH 7 is neutral; and pH 14 is very basic.

Polymerization - A chemical reaction, usually carried out with a catalyst, in which individual molecules combine to form a large chemical molecule.

ppm - Parts per million. A unit of measurement of concentration of a gas or vapor in air.

Reactivity - The ability of a substance to undergo a chemical change with the release of energy. Highly reactive substances may explode.

Respirator - A device which is designed to protect the wearer from inhaling harmful contaminants.

Routes of Entry - Ways in which a chemical can come into contact with the body. Included are the skin, the eyes, the mouth, the nose and the lungs.

Sensitizers - Chemicals which cause certain exposed people to develop an allergic reaction.

Short term exposure limit (STEL) - A term used by the ACGIH to express the maximum concentration most workers can tolerate for a 15-minute exposure period (with a maximum of four periods a day with at least 60 minutes between exposure periods and provided that the TLV-TWA is not exceeded) without adverse effects.

Solvent - A substance, usually a liquid in which other substances are dissolved. The most common solvent is water.

Specific Gravity - A chemical's density compared to water, which has a relative value of 1. If the chemical's specific gravity is greater than 1, the chemical is heavier than water and will sink in water.

Toxic- Poisonous. Causes adverse health effects when the body is exposed.

Target Organ Effect - Chemically caused health effects from exposure to a substance on specific organs i.e., lungs, kidneys, nervous system, blood or blood-forming organs, eyes, skin, etc.

Threshold limit value (TLV) - Term used by the ACGIH to express the maximum airborne concentration of a material to which most workers can be exposed during a normal daily and weekly work schedule without adverse effects.

Time weighted average (TWA) - A technique for averaging individual variant measurements over an 8-hour workday.

Vapor- The gas given off by a solid or liquid substance at ordinary temperatures.

Vapor Density - Whether a substance is heavier or lighter than air (which has a vapor density of 1). A vapor with a density lighter than 1 is lighter than air and will rise in air.

Vapor Pressure - Useful in learning how quickly a substance becomes airborne within the workplace and how quickly a worker could be exposed to it.

Viscosity - A measure of how slowly a substance pours or flows. Very viscous substances, like honey, pour very slowly. Slightly viscous substances, like water, pour and splash easily.

Volatility - A measure of how quickly a substance forms vapor at ordinary temperatures.

Work Area - A room or defined space in a workplace where hazardous chemicals are used, produced or stored, and where employees are present.

Additional Terms / Definitions

Appendix G. 29 CFR 1910.1200 Hazard Communication

(a) "Purpose."

(1) The purpose of this section is to ensure that the hazards of all chemicals produced or imported are evaluated, and that information concerning their hazards is transmitted to employers and employees. This transmittal of information is to be accomplished by means of comprehensive hazard communication programs, which are to include container labeling and other forms of warning, material safety data sheets and employee training.

(2) This occupational safety and health standard is intended to address comprehensively the issue of evaluating the potential hazards of chemicals, and communicating information concerning hazards and appropriate protective measures to employees, and to preempt any legal requirements of a state, or political subdivision of a state, pertaining to this subject. Evaluating the potential hazards of chemicals, and communicating information concerning hazards and appropriate protective measures to employees, may include, for example, but is not limited to, provisions for: developing and maintaining a written hazard communication program for the workplace, including lists of hazardous chemicals present; labeling of containers of chemicals in the workplace, as well as of containers of chemicals being shipped to other workplaces; preparation and distribution of material safety data sheets to employees and downstream employers; and development and implementation of employee training programs regarding hazards of chemicals and protective measures. Under section 18 of the Act, no state or political subdivision of a state may adopt or enforce, through any court or agency, any requirement relating to the issue addressed by this Federal standard, except pursuant to a Federally-approved state plan.

(b) "Scope and application."

(1) This section requires chemical manufacturers or importers to assess the hazards of chemicals which they produce or import, and all employers to provide information to their employees about the hazardous chemicals to which they are exposed, by means of a hazard communication program, labels and other forms of warning, material safety data sheets, and information and training. In addition, this section requires distributors to transmit the required information to employers. (Employers who do not produce or import chemicals need only focus on those parts of this rule that deal with establishing a workplace program and communicating information to their workers. Appendix E of this section is a general guide for such employers to help them determine their compliance obligations under the rule.)

(2) This section applies to any chemical which is known to be present in the workplace in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency.

(3) This section applies to laboratories only as follows:

(i) Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced;

(ii) Employers shall maintain any material safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible during each workshift to laboratory employees when they are in their work areas;

(iii) Employers shall ensure that laboratory employees are provided information and training in accordance with paragraph (h) of this section, except for the location and availability of the written hazard communication program under paragraph (h)(2)(iii) of this section; and,

(iv) Laboratory employers that ship hazardous chemicals are considered to be either a chemical manufacturer or a distributor under this rule, and thus must ensure that any containers of hazardous chemicals leaving the laboratory are labeled in accordance with paragraph (f)(1) of this section, and that a material safety data sheet is provided to distributors and other employers in accordance with paragraphs (g)(6) and (g)(7) of this section.

(4) In work operations where employees only handle chemicals in sealed containers which are not opened under normal conditions of use (such as are found in marine cargo handling, warehousing, or retail sales), this section applies to these operations only as follows:

(i) Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced;

(ii) Employers shall maintain copies of any material safety data sheets that are received with incoming shipments of the sealed containers of hazardous chemicals, shall obtain a material safety data sheet as

soon as possible for sealed containers of hazardous chemicals received without a material safety data sheet if an employee requests the material safety data sheet, and shall ensure that the material safety data sheets are readily accessible during each work shift to employees when they are in their work area(s); and,

(iii) Employers shall ensure that employees are provided with information and training in accordance with paragraph (h) of this section (except for the location and availability of the written hazard communication program under paragraph (h)(2)(iii) of this section), to the extent necessary to protect them in the event of a spill or leak of a hazardous chemical from a sealed container.

(5) This section does not require labeling of the following chemicals:

(i) Any pesticide as such term is defined in the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136 et seq.), when subject to the labeling requirements of that Act and labeling regulations issued under that Act by the Environmental Protection Agency;

(ii) Any chemical substance or mixture as such terms are defined in the Toxic Substances Control Act (15 U.S.C. 2601 et seq.), when subject to the labeling requirements of that Act and labeling regulations issued under that Act by the Environmental Protection Agency;

(iii) Any food, food additive, color additive, drug, cosmetic, or medical or veterinary device or product, including materials intended for use as ingredients in such products (e.g. flavors and fragrances), as such terms are defined in the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 et seq.) or the Virus-Serum-Toxin Act of 1913 (21 U.S.C. 151 et seq.), and regulations issued under those Acts, when they are subject to the labeling requirements under those Acts by either the Food and Drug Administration or the Department of Agriculture;

(iv) Any distilled spirits (beverage alcohols), wine, or malt beverage intended for nonindustrial use, as such terms are defined in the Federal Alcohol Administration Act (27 U.S.C. 201 et seq.) and regulations issued under that Act, when subject to the labeling requirements of that Act and labeling regulations issued under that Act by the Bureau of Alcohol, Tobacco, and Firearms;

(v) Any consumer product or hazardous substance as those terms are defined in the Consumer Product Safety Act (15 U.S.C. 2051 et seq.) and Federal Hazardous Substances Act (15 U.S.C. 1261 et seq.) respectively, when subject to a consumer product safety standard or labeling requirement of those Acts, or regulations issued under those Acts by the Consumer Product Safety Commission; and,

(vi) Agricultural or vegetable seed treated with pesticides and labeled in accordance with the Federal Seed Act (7 U.S.C. 1551 et seq.) and the labeling regulations issued under that Act by the Department of Agriculture.

(6) This section does not apply to:

(i) Any hazardous waste as such term is defined by the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6901 et seq.), when subject to regulations issued under that Act by the Environmental Protection Agency;

(ii) Any hazardous substance as such term is defined by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 U.S.C. 9601 et seq.) when the hazardous substance is the focus of remedial or removal action being conducted under CERCLA in accordance with the Environmental Protection Agency regulations.

(iii) Tobacco or tobacco products;

(iv) Wood or wood products, including lumber which will not be processed, where the chemical manufacturer or importer can establish that the only hazard they pose to employees is the potential for flammability or combustibility (wood or wood products which have been treated with a hazardous chemical covered by this standard, and wood which may be subsequently sawed or cut, generating dust, are not exempted);

(v) Articles (as that term is defined in paragraph (c) of this section);

(vi) Food or alcoholic beverages which are sold, used, or prepared in a retail establishment (such as a grocery store, restaurant, or drinking place), and foods intended for personal consumption by employees while in the workplace;

(vii) Any drug, as that term is defined in the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 et seq.), when it is in solid, final form for direct administration to the patient (e.g., tablets or pills); drugs which are packaged by the chemical manufacturer for sale to consumers in a retail establishment (e.g.,

over-the-counter drugs); and drugs intended for personal consumption by employees while in the workplace (e.g., first aid supplies);

(viii) Cosmetics which are packaged for sale to consumers in a retail establishment, and cosmetics intended for personal consumption by employees while in the workplace;

(ix) Any consumer product or hazardous substance, as those terms are defined in the Consumer Product Safety Act (15 U.S.C. 2051 et seq.) and Federal Hazardous Substances Act (15 U.S.C. 1261 et seq.) respectively, where the employer can show that it is used in the workplace for the purpose intended by the chemical manufacturer or importer of the product, and the use results in a duration and frequency of exposure which is not greater than the range of exposures that could reasonably be experienced by consumers when used for the purpose intended;

(x) Nuisance particulates where the chemical manufacturer or importer can establish that they do not pose any physical or health hazard covered under this section;

(xi) Ionizing and nonionizing radiation; and,

(xii) Biological hazards.

(c) "Definitions."

"*Article*" means a manufactured item other than a fluid or particle: (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities, e.g., minute or trace amounts of a hazardous chemical (as determined under paragraph (d) of this section), and does not pose a physical hazard or health risk to employees.

"*Assistant Secretary*" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

"*Chemical*" means any element, chemical compound or mixture of elements and/or compounds.

"*Chemical manufacturer*" means an employer with a workplace where chemical(s) are produced for use or distribution.

"*Chemical name*" means the scientific designation of a chemical in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry (IUPAC) or the Chemical Abstracts Service (CAS) rules of nomenclature, or a name which will clearly identify the chemical for the purpose of conducting a hazard evaluation.

"*Combustible liquid*" means any liquid having a flashpoint at or above 100° F (37.8° C), but below 200° F (93.3° C), except any mixture having components with flashpoints of 200° F (93.3° C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

"*Commercial account*" means an arrangement whereby a retail distributor sells hazardous chemicals to an employer, generally in large quantities over time and/or at costs that are below the regular retail price.

"*Common name*" means any designation or identification such as code name, code number, trade name, brand name or generic name used to identify a chemical other than by its chemical name.

"*Compressed gas*" means:

(i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70° F (21.1° C); or

(ii) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130° F (54.4° C) regardless of the pressure at 70° F (21.1° C); or

(iii) A liquid having a vapor pressure exceeding 40 psi at 100° F (37.8° C) as determined by ASTM D-323-72.

"*Container*" means any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical. For purposes of this section, pipes or piping systems, and engines, fuel tanks, or other operating systems in a vehicle, are not considered to be containers.

"*Designated representative*" means any individual or organization to whom an employee gives written authorization to exercise such employee's rights under this section. A recognized or certified collective bargaining agent shall be treated automatically as a designated representative without regard to written employee authorization.

"*Director*" means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

"Distributor" means a business, other than a chemical manufacturer or importer, which supplies hazardous chemicals to other distributors or to employers.

"Employee" means a worker who may be exposed to hazardous chemicals under normal operating conditions or in foreseeable emergencies. Workers such as office workers or bank tellers who encounter hazardous chemicals only in non-routine, isolated instances are not covered.

"Employer" means a person engaged in a business where chemicals are either used, distributed, or are produced for use or distribution, including a contractor or subcontractor.

"Explosive" means a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

"Exposure or exposed" means that an employee is subjected in the course of employment to a chemical that is a physical or health hazard, and includes potential (e.g. accidental or possible) exposure.

"Subjected" in terms of health hazards includes any route of entry (e.g. inhalation, ingestion, skin contact or absorption.)

"Flammable" means a chemical that falls into one of the following categories:

(i) "Aerosol, flammable" means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame projection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening;

(ii) "Gas, flammable" means: (A) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of thirteen (13) percent by volume or less; or

(B) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than twelve (12) percent by volume, regardless of the lower limit;

(iii) "Liquid, flammable" means any liquid having a flashpoint below 100° F (37.8° C), except any mixture having components with flashpoints of 100° F (37.8° C) or higher, the total of which make up 99 percent or more of the total volume of the mixture.

(iv) "Solid, flammable" means a solid, other than a blasting agent or explosive as defined in 1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

"Flashpoint" means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:

(i) Tagliabue Closed Tester (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24-1979 (ASTM D 56-79)) for liquids with a viscosity of less than 45 Saybolt Universal Seconds (SUS) at 100° F (37.8° C), that do not contain suspended solids and do not have a tendency to form a surface film under test; or

(ii) Pensky-Martens Closed Tester (see American National Standard Method of Test for Flash Point by Pensky-Martens Closed Tester, Z11.7-1979 (ASTM D 93-79)) for liquids with a viscosity equal to or greater than 45 SUS at 100° F (37.8° C), or that contain suspended solids, or that have a tendency to form a surface film under test; or

(iii) Setaflash Closed Tester (see American National Standard Method of Test for Flash Point by Setaflash Closed Tester (ASTM D 3278-78)).

Organic peroxides, which undergo autoccelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified above.

"Foreseeable emergency" means any potential occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment which could result in an uncontrolled release of a hazardous chemical into the workplace.

"Hazardous chemical" means any chemical which is a physical hazard or a health hazard.

"Hazard warning" means any words, pictures, symbols, or combination thereof appearing on a label or other appropriate form of warning which convey the specific physical and health hazard(s), including target organ effects, of the chemical(s) in the container(s). (See the definitions for "physical hazard" and "health hazard" to determine the hazards which must be covered.)

"Health hazard" means a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health

effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes. Appendix A provides further definitions and explanations of the scope of health hazards covered by this section, and Appendix B describes the criteria to be used to determine whether or not a chemical is to be considered hazardous for purposes of this standard.

"*Identity*" means any chemical or common name which is indicated on the material safety data sheet (MSDS) for the chemical. The identity used shall permit cross-references to be made among the required list of hazardous chemicals, the label and the MSDS.

"*Immediate use*" means that the hazardous chemical will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred.

"*Importer*" means the first business with employees within the Customs Territory of the United States which receives hazardous chemicals produced in other countries for the purpose of supplying them to distributors or employers within the United States.

"*Label*" means any written, printed, or graphic material displayed on or affixed to containers of hazardous chemicals.

"*Material safety data sheet (MSDS)*" means written or printed material concerning a hazardous chemical which is prepared in accordance with paragraph (g) of this section.

"*Mixture*" means any combination of two or more chemicals if the combination is not, in whole or in part, the result of a chemical reaction.

"*Organic peroxide*" means an organic compound that contains the bivalent -O-O-structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.

"*Oxidizer*" means a chemical other than a blasting agent or explosive as defined in 1910.109(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

"*Physical hazard*" means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

"*Produce*" means to manufacture, process, formulate, blend, extract, generate, emit, or repackage.

"*Pyrophoric*" means a chemical that will ignite spontaneously in air at a temperature of 130° F (54.4° C) or below.

"*Responsible party*" means someone who can provide additional information on the hazardous chemical and appropriate emergency procedures, if necessary.

"*Specific chemical identity*" means the chemical name, Chemical Abstracts Service (CAS) Registry Number, or any other information that reveals the precise chemical designation of the substance.

"*Trade secret*" means any confidential formula, pattern, process, device, information or compilation of information that is used in an employer's business, and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it. Appendix D sets out the criteria to be used in evaluating trade secrets.

"*Unstable (reactive)*" means a chemical which in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

"*Use*" means to package, handle, react, emit, extract, generate as a byproduct, or transfer.

"*Water-reactive*" means a chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

"*Work area*" means a room or defined space in a workplace where hazardous chemicals are produced or used, and where employees are present.

"*Workplace*" means an establishment, job site, or project, at one geographical location containing one or more work areas.

(d) "Hazard determination."

(1) Chemical manufacturers and importers shall evaluate chemicals produced in their workplaces or imported by them to determine if they are hazardous. Employers are not required to evaluate chemicals unless they choose not to rely on the evaluation performed by the chemical manufacturer or importer for the chemical to satisfy this requirement.

(2) Chemical manufacturers, importers or employers evaluating chemicals shall identify and consider the available scientific evidence concerning such hazards. For health hazards, evidence which is statistically significant and which is based on at least one positive study conducted in accordance with established scientific principles is considered to be sufficient to establish a hazardous effect if the results of the study meet the definitions of health hazards in this section. Appendix A shall be consulted for the scope of health hazards covered, and Appendix B shall be consulted for the criteria to be followed with respect to the completeness of the evaluation, and the data to be reported.

(3) The chemical manufacturer, importer or employer evaluating chemicals shall treat the following sources as establishing that the chemicals listed in them are hazardous:

(i) 29 CFR part 1910, subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA); or,

(ii) "Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment," American Conference of Governmental Industrial Hygienists (ACGIH) (latest edition). The chemical manufacturer, importer, or employer is still responsible for evaluating the hazards associated with the chemicals in these source lists in accordance with the requirements of this standard.

(4) Chemical manufacturers, importers and employers evaluating chemicals shall treat the following sources as establishing that a chemical is a carcinogen or potential carcinogen for hazard communication purposes:

(i) National Toxicology Program (NTP), "Annual Report on Carcinogens" (latest edition);

(ii) International Agency for Research on Cancer (IARC) "Monographs" (latest editions); or

(iii) 29 CFR part 1910, subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration.

Note: The "Registry of Toxic Effects of Chemical Substances" published by the National Institute for Occupational Safety and Health indicates whether a chemical has been found by NTP or IARC to be a potential carcinogen.

(5) The chemical manufacturer, importer or employer shall determine the hazards of mixtures of chemicals as follows:

(i) If a mixture has been tested as a whole to determine its hazards, the results of such testing shall be used to determine whether the mixture is hazardous;

(ii) If a mixture has not been tested as a whole to determine whether the mixture is a health hazard, the mixture shall be assumed to present the same health hazards as do the components which comprise one percent (by weight or volume) or greater of the mixture, except that the mixture shall be assumed to present a carcinogenic hazard if it contains a component in concentrations of 0.1 percent or greater which is considered to be a carcinogen under paragraph (d)(4) of this section;

(iii) If a mixture has not been tested as a whole to determine whether the mixture is a physical hazard, the chemical manufacturer, importer, or employer may use whatever scientifically valid data is available to evaluate the physical hazard potential of the mixture; and,

(iv) If the chemical manufacturer, importer, or employer has evidence to indicate that a component present in the mixture in concentrations of less than one percent (or in the case of carcinogens, less than 0.1 percent) could be released in concentrations which would exceed an established OSHA permissible exposure limit or ACGIH Threshold Limit Value, or could present a health risk to employees in those concentrations, the mixture shall be assumed to present the same hazard.

(6) Chemical manufacturers, importers, or employers evaluating chemicals shall describe in writing the procedures they use to determine the hazards of the chemical they evaluate. The written procedures are to be made available, upon request, to employees, their designated representatives, the Assistant Secretary and the Director. The written description may be incorporated into the written hazard communication program required under paragraph (e) of this section.

(e) "Written hazard communication program."

(1) Employers shall develop, implement, and maintain at each workplace, a written hazard communication program which at least describes how the criteria specified in paragraphs (f), (g), and (h) of this section for labels and other forms of warning, material safety data sheets, and employee information and training will be met, and which also includes the following:

(i) A list of the hazardous chemicals known to be present using an identity that is referenced on the appropriate material safety data sheet (the list may be compiled for the workplace as a whole or for individual work areas); and,

(ii) The methods the employer will use to inform employees of the hazards of non-routine tasks (for example, the cleaning of reactor vessels), and the hazards associated with chemicals contained in unlabeled pipes in their work areas.

(2) "Multi-employer workplaces." Employers who produce, use, or store hazardous chemicals at a workplace in such a way that the employees of other employer(s) may be exposed (for example, employees of a construction contractor working on-site) shall additionally ensure that the hazard communication programs developed and implemented under this paragraph (e) include the following:

(i) The methods the employer will use to provide the other employer(s) on-site access to material safety data sheets for each hazardous chemical the other employer(s)' employees may be exposed to while working;

(ii) The methods the employer will use to inform the other employer(s) of any precautionary measures that need to be taken to protect employees during the workplace's normal operating conditions and in foreseeable emergencies; and,

(iii) The methods the employer will use to inform the other employer(s) of the labeling system used in the workplace.

(3) The employer may rely on an existing hazard communication program to comply with these requirements, provided that it meets the criteria established in this paragraph (e).

(4) The employer shall make the written hazard communication program available, upon request, to employees, their designated representatives, the Assistant Secretary and the Director, in accordance with the requirements of 29 CFR 1910.1020 (e).

(5) Where employees must travel between workplaces during a workshift, i.e., their work is carried out at more than one geographical location, the written hazard communication program may be kept at the primary workplace facility.

(f) "Labels and other forms of warning."

(1) The chemical manufacturer, importer, or distributor shall ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged or marked with the following information:

(i) Identity of the hazardous chemical(s);

(ii) Appropriate hazard warnings; and

(iii) Name and address of the chemical manufacturer, importer, or other responsible party.

(2) (i) For solid metal (such as a steel beam or a metal casting), solid wood, or plastic items that are not exempted as articles due to their downstream use, or shipments of whole grain, the required label may be transmitted to the customer at the time of the initial shipment, and need not be included with subsequent shipments to the same employer unless the information on the label changes;

(ii) The label may be transmitted with the initial shipment itself, or with the material safety data sheet that is to be provided prior to or at the time of the first shipment; and,

(iii) This exception to requiring labels on every container of hazardous chemicals is only for the solid material itself, and does not apply to hazardous chemicals used in conjunction with, or known to be present with, the material and to which employees handling the items in transit may be exposed (for example, cutting fluids or pesticides in grains).

(3) Chemical manufacturers, importers, or distributors shall ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged, or marked in accordance with this section in a manner which does not conflict with the requirements of the Hazardous Materials Transportation Act (49 U.S.C. 1801 et seq.) and regulations issued under that Act by the Department of Transportation.

(4) If the hazardous chemical is regulated by OSHA in a substance-specific health standard, the chemical manufacturer, importer, distributor or employer shall ensure that the labels or other forms of warning used are in accordance with the requirements of that standard.

(5) Except as provided in paragraphs (f)(6) and (f)(7) of this section, the employer shall ensure that each container of hazardous chemicals in the workplace is labeled, tagged or marked with the following information:

(i) Identity of the hazardous chemical(s) contained therein; and,

(ii) Appropriate hazard warnings, or alternatively, words, pictures, symbols, or combination thereof, which provide at least general information regarding the hazards of the chemicals, and which, in conjunction with the other information immediately available to employees under the hazard communication program, will provide employees with the specific information regarding the physical and health hazards of the hazardous chemical.

(6) The employer may use signs, placards, process sheets, batch tickets, operating procedures, or other such written materials in lieu of affixing labels to individual stationary process containers, as long as the alternative method identifies the containers to which it is applicable and conveys the information required by paragraph (f)(5) of this section to be on a label. The written materials shall be readily accessible to the employees in their work area throughout each work shift.

(7) The employer is not required to label portable containers into which hazardous chemicals are transferred from labeled containers, and which are intended only for the immediate use of the employee who performs the transfer. For purposes of this section, drugs which are dispensed by a pharmacy to a health care provider for direct administration to a patient are exempted from labeling.

(8) The employer shall not remove or deface existing labels on incoming containers of hazardous chemicals, unless the container is immediately marked with the required information.

(9) The employer shall ensure that labels or other forms of warning are legible, in English, and prominently displayed on the container, or readily available in the work area throughout each work shift. Employers having employees who speak other languages may add the information in their language to the material presented, as long as the information is presented in English as well.

(10) The chemical manufacturer, importer, distributor or employer need not affix new labels to comply with this section if existing labels already convey the required information.

(11) Chemical manufacturers, importers, distributors, or employers who become newly aware of any significant information regarding the hazards of a chemical shall revise the labels for the chemical within three months of becoming aware of the new information. Labels on containers of hazardous chemicals shipped after that time shall contain the new information. If the chemical is not currently produced or imported, the chemical manufacturer, importers, distributor, or employer shall add the information to the label before the chemical is shipped or introduced into the workplace again.

(g) "Material safety data sheets."

(1) Chemical manufacturers and importers shall obtain or develop a material safety data sheet for each hazardous chemical they produce or import. Employers shall have a material safety data sheet in the workplace for each hazardous chemical which they use.

(2) Each material safety data sheet shall be in English (although the employer may maintain copies in other languages as well), and shall contain at least the following information:

(i) The identity used on the label, and, except as provided for in paragraph (i) of this section on trade secrets:

(A) If the hazardous chemical is a single substance, its chemical and common name(s);

(B) If the hazardous chemical is a mixture which has been tested as a whole to determine its hazards, the chemical and common name(s) of the ingredients which contribute to these known hazards, and the common name(s) of the mixture itself; or,

(C) If the hazardous chemical is a mixture which has not been tested as a whole:

(1) The chemical and common name(s) of all ingredients which have been determined to be health hazards, and which comprise 1% or greater of the composition, except that chemicals identified as carcinogens under paragraph (d) of this section shall be listed if the concentrations are 0.1% or greater; and,

(2) The chemical and common name(s) of all ingredients which have been determined to be health hazards, and which comprise less than 1% (0.1% for carcinogens) of the mixture, if there is evidence that the ingredient(s) could be released from the mixture in concentrations which would exceed an established OSHA permissible exposure limit or ACGIH Threshold Limit Value, or could present a health risk to employees; and,

(3) The chemical and common name(s) of all ingredients which have been determined to present a physical hazard when present in the mixture;

(ii) Physical and chemical characteristics of the hazardous chemical (such as vapor pressure, flash point);

(iii) The physical hazards of the hazardous chemical, including the potential for fire, explosion, and reactivity;

(iv) The health hazards of the hazardous chemical, including signs and symptoms of exposure, and any medical conditions which are generally recognized as being aggravated by exposure to the chemical;

(v) The primary route(s) of entry;

(vi) The OSHA permissible exposure limit, ACGIH Threshold Limit Value, and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the material safety data sheet, where available;

(vii) Whether the hazardous chemical is listed in the National Toxicology Program (NTP) Annual Report on Carcinogens (latest edition) or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest editions), or by OSHA;

(viii) Any generally applicable precautions for safe handling and use which are known to the chemical manufacturer, importer or employer preparing the material safety data sheet, including appropriate hygienic practices, protective measures during repair and maintenance of contaminated equipment, and procedures for clean-up of spills and leaks;

(ix) Any generally applicable control measures which are known to the chemical manufacturer, importer or employer preparing the material safety data sheet, such as appropriate engineering controls, work practices, or personal protective equipment;

(x) Emergency and first aid procedures;

(xi) The date of preparation of the material safety data sheet or the last change to it; and,

(xii) The name, address and telephone number of the chemical manufacturer, importer, employer or other responsible party preparing or distributing the material safety data sheet, who can provide additional information on the hazardous chemical and appropriate emergency procedures, if necessary.

(3) If no relevant information is found for any given category on the material safety data sheet, the chemical manufacturer, importer or employer preparing the material safety data sheet shall mark it to indicate that no applicable information was found.

(4) Where complex mixtures have similar hazards and contents (i.e. the chemical ingredients are essentially the same, but the specific composition varies from mixture to mixture), the chemical manufacturer, importer or employer may prepare one material safety data sheet to apply to all of these similar mixtures.

(5) The chemical manufacturer, importer or employer preparing the material safety data sheet shall ensure that the information recorded accurately reflects the scientific evidence used in making the hazard determination. If the chemical manufacturer, importer or employer preparing the material safety data sheet becomes newly aware of any significant information regarding the hazards of a chemical, or ways to protect against the hazards, this new information shall be added to the material safety data sheet within three months. If the chemical is not currently being produced or imported the chemical manufacturer or importer shall add the information to the material safety data sheet before the chemical is introduced into the workplace again.

(6) (i) Chemical manufacturers or importers shall ensure that distributors and employers are provided an appropriate material safety data sheet with their initial shipment, and with the first shipment after a material safety data sheet is updated;

(ii) The chemical manufacturer or importer shall either provide material safety data sheets with the shipped containers or send them to the distributor or employer prior to or at the time of the shipment;

(iii) If the material safety data sheet is not provided with a shipment that has been labeled as a hazardous chemical, the distributor or employer shall obtain one from the chemical manufacturer or importer as soon as possible; and,

(iv) The chemical manufacturer or importer shall also provide distributors or employers with a material safety data sheet upon request.

(7) (i) Distributors shall ensure that material safety data sheets, and updated information, are provided to other distributors and employers with their initial shipment and with the first shipment after a material safety data sheet is updated;

(ii) The distributor shall either provide material safety data sheets with the shipped containers, or send them to the other distributor or employer prior to or at the time of the shipment;

(iii) Retail distributors selling hazardous chemicals to employers having a commercial account shall provide a material safety data sheet to such employers upon request, and shall post a sign or otherwise inform them that a material safety data sheet is available;

(iv) Wholesale distributors selling hazardous chemicals to employers over-the-counter may also provide material safety data sheets upon the request of the employer at the time of the over-the-counter purchase, and shall post a sign or otherwise inform such employers that a material safety data sheet is available;

(v) If an employer without a commercial account purchases a hazardous chemical from a retail distributor not required to have material safety data sheets on file (i.e., the retail distributor does not have commercial accounts and does not use the materials), the retail distributor shall provide the employer, upon request, with the name, address, and telephone number of the chemical manufacturer, importer, or distributor from which a material safety data sheet can be obtained;

(vi) Wholesale distributors shall also provide material safety data sheets to employers or other distributors upon request; and,

(vii) Chemical manufacturers, importers, and distributors need not provide material safety data sheets to retail distributors that have informed them that the retail distributor does not sell the product to commercial accounts or open the sealed container to use it in their own workplaces.

(8) The employer shall maintain in the workplace copies of the required material safety data sheets for each hazardous chemical, and shall ensure that they are readily accessible during each work shift to employees when they are in their work area(s). (Electronic access, microfiche, and other alternatives to maintaining paper copies of the material safety data sheets are permitted as long as no barriers to immediate employee access in each workplace are created by such options.)

(9) Where employees must travel between workplaces during a workshift, i.e., their work is carried out at more than one geographical location, the material safety data sheets may be kept at the primary workplace facility. In this situation, the employer shall ensure that employees can immediately obtain the required information in an emergency.

(10) Material safety data sheets may be kept in any form, including operating procedures, and may be designed to cover groups of hazardous chemicals in a work area where it may be more appropriate to address the hazards of a process rather than individual hazardous chemicals. However, the employer shall ensure that in all cases the required information is provided for each hazardous chemical, and is readily accessible during each work shift to employees when they are in their work area(s).

(11) Material safety data sheets shall also be made readily available, upon request, to designated representatives and to the Assistant Secretary, in accordance with the requirements of 29 CFR 1910.1020(e). The Director shall also be given access to material safety data sheets in the same manner.

(h) "Employee information and training."

(1) Employers shall provide employees with effective information and training on hazardous chemicals in their work area at the time of their initial assignment, and whenever a new physical or health hazard the employees have not previously been trained about is introduced into their work area. Information and training may be designed to cover categories of hazards (e.g., flammability, carcinogenicity) or specific chemicals. Chemical-specific information must always be available through labels and material safety data sheets.

(2) "Information." Employees shall be informed of:

{i} The requirements of this section;

(ii) Any operations in their work area where hazardous chemicals are present; and,
(iii) The location and availability of the written hazard communication program, including the required list(s) of hazardous chemicals, and material safety data sheets required by this section.

(3) "Training." Employee training shall include at least:

(i) Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

(ii) The physical and health hazards of the chemicals in the work area;

(iii) The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used; and,

(iv) The details of the hazard communication program developed by the employer, including an explanation of the labeling system and the material safety data sheet, and how employees can obtain and use the appropriate hazard information.

(i) "Trade secrets."

(1) The chemical manufacturer, importer, or employer may withhold the specific chemical identity, including the chemical name and other specific identification of a hazardous chemical, from the material safety data sheet, provided that:

(i) The claim that the information withheld is a trade secret can be supported;

(ii) Information contained in the material safety data sheet concerning the properties and effects of the hazardous chemical is disclosed;

(iii) The material safety data sheet indicates that the specific chemical identity is being withheld as a trade secret; and,

(iv) The specific chemical identity is made available to health professionals, employees, and designated representatives in accordance with the applicable provisions of this paragraph.

(2) Where a treating physician or nurse determines that a medical emergency exists and the specific chemical identity of a hazardous chemical is necessary for emergency or first-aid treatment, the chemical manufacturer, importer, or employer shall immediately disclose the specific chemical identity of a trade secret chemical to that treating physician or nurse, regardless of the existence of a written statement of need or a confidentiality agreement. The chemical manufacturer, importer, or employer may require a written statement of need and confidentiality agreement, in accordance with the provisions of paragraphs (i)(3) and (4) of this section, as soon as circumstances permit.

(3) In non-emergency situations, a chemical manufacturer, importer, or employer shall, upon request, disclose a specific chemical identity, otherwise permitted to be withheld under paragraph (i)(1) of this section, to a health professional (i.e. physician, industrial hygienist, toxicologist, epidemiologist, or occupational health nurse) providing medical or other occupational health services to exposed employee(s), and to employees or designated representatives, if:

(i) The request is in writing;

(ii) The request describes with reasonable detail one or more of the following occupational health needs for the information:

(A) To assess the hazards of the chemicals to which employees will be exposed;

(B) To conduct or assess sampling of the workplace atmosphere to determine employee exposure levels;

(C) To conduct pre-assignment or periodic medical surveillance of exposed employees;

(D) To provide medical treatment to exposed employees;

(E) To select or assess appropriate personal protective equipment for exposed employees;

(F) To design or assess engineering controls or other protective measures for exposed employees; and,

(G) To conduct studies to determine the health effects of exposure.

(iii) The request explains in detail why the disclosure of the specific chemical identity is essential and that, in lieu thereof, the disclosure of the following information to the health professional, employee, or designated representative, would not satisfy the purposes described in paragraph (i)(3)(ii) of this section:

(A) The properties and effects of the chemical;

(B) Measures for controlling workers' exposure to the chemical;

(C) Methods of monitoring and analyzing worker exposure to the chemical; and,

(D) Methods of diagnosing and treating harmful exposures to the chemical;

(iv) The request includes a description of the procedures to be used to maintain the confidentiality of the disclosed information; and,

(v) The health professional, and the employer or contractor of the services of the health professional (i.e. downstream employer, labor organization, or individual employee), employee, or designated representative, agree in a written confidentiality agreement that the health professional, employee, or designated representative, will not use the trade secret information for any purpose other than the health need(s) asserted and agree not to release the information under any circumstances other than to OSHA, as provided in paragraph (i)(6) of this section, except as authorized by the terms of the agreement or by the chemical manufacturer, importer, or employer.

(4) The confidentiality agreement authorized by paragraph (i)(3)(iv) of this section:

(i) May restrict the use of the information to the health purposes indicated in the written statement of need;

(ii) May provide for appropriate legal remedies in the event of a breach of the agreement, including stipulation of a reasonable pre-estimate of likely damages; and,

(iii) May not include requirements for the posting of a penalty bond.

(5) Nothing in this standard is meant to preclude the parties from pursuing non-contractual remedies to the extent permitted by law.

(6) If the health professional, employee, or designated representative receiving the trade secret information decides that there is a need to disclose it to OSHA, the chemical manufacturer, importer, or employer who provided the information shall be informed by the health professional, employee, or designated representative prior to, or at the same time as, such disclosure.

(7) If the chemical manufacturer, importer, or employer denies a written request for disclosure of a specific chemical identity, the denial must:

(i) Be provided to the health professional, employee, or designated representative, within thirty days of the request;

(ii) Be in writing;

(iii) Include evidence to support the claim that the specific chemical identity is a trade secret;

(iv) State the specific reasons why the request is being denied; and,

(v) Explain in detail how alternative information may satisfy the specific medical or occupational health need without revealing the specific chemical identity.

(8) The health professional, employee, or designated representative whose request for information is denied under paragraph (i)(3) of this section may refer the request and the written denial of the request to OSHA for consideration.

(9) When a health professional, employee, or designated representative refers the denial to OSHA under paragraph (i)(8) of this section, OSHA shall consider the evidence to determine if:

(i) The chemical manufacturer, importer, or employer has supported the claim that the specific chemical identity is a trade secret;

(ii) The health professional, employee, or designated representative has supported the claim that there is a medical or occupational health need for the information; and,

(iii) The health professional, employee or designated representative has demonstrated adequate means to protect the confidentiality.

(10) (i) If OSHA determines that the specific chemical identity requested under paragraph (i)(3) of this section is not a "bona fide" trade secret, or that it is a trade secret, but the requesting health professional, employee, or designated representative has a legitimate medical or occupational health need for the information, has executed a written confidentiality agreement, and has shown adequate means to protect the confidentiality of the information, the chemical manufacturer, importer, or employer will be subject to citation by OSHA.

(ii) If a chemical manufacturer, importer, or employer demonstrates to OSHA that the execution of a confidentiality agreement would not provide sufficient protection against the potential harm from the unauthorized disclosure of a trade secret specific chemical identity, the Assistant Secretary may issue such orders or impose such additional limitations or conditions upon the disclosure of the requested

chemical information as may be appropriate to assure that the occupational health services are provided without an undue risk of harm to the chemical manufacturer, importer, or employer.

(11) If a citation for a failure to release specific chemical identity information is contested by the chemical manufacturer, importer, or employer, the matter will be adjudicated before the Occupational Safety and Health Review Commission in accordance with the Act's enforcement scheme and the applicable Commission rules of procedure. In accordance with the Commission rules, when a chemical manufacturer, importer, or employer continues to withhold the information during the contest, the Administrative Law Judge may review the citation and supporting documentation "in camera" or issue appropriate orders to protect the confidentiality of such matters.

(12) Notwithstanding the existence of a trade secret claim, a chemical manufacturer, importer, or employer shall, upon request, disclose to the Assistant Secretary any information which this section requires the chemical manufacturer, importer, or employer to make available. Where there is a trade secret claim, such claim shall be made no later than at the time the information is provided to the Assistant Secretary so that suitable determinations of trade secret status can be made and the necessary protections can be implemented.

(13) Nothing in this paragraph shall be construed as requiring the disclosure under any circumstances of process or percentage of mixture information which is a trade secret.

(j) "Effective dates."

Chemical manufacturers, importers, distributors, and employers shall be in compliance with all provisions of this section by March 11, 1994.

Note: The effective date of the clarification that the exemption of wood and wood products from the Hazard Communication standard in paragraph (b)(6)(iv) only applies to wood and wood products including lumber which will not be processed, where the manufacturer or importer can establish that the only hazard they pose to employees is the potential for flammability or combustibility, and that the exemption does not apply to wood or wood products which have been treated with a hazardous chemical covered by this standard, and wood which may be subsequently sawed or cut generating dust has been stayed from March 11, 1994 to August 11, 1994.

[59 FR 17479, April 13, 1994; 59 FR 65947, Dec. 22, 1994; 61 FR 5507, Feb. 13, 1996]

1910.1200 Appendix A - Toxic and Hazardous Substances (Mandatory)

Although safety hazards related to the physical characteristics of a chemical can be objectively defined in terms of testing requirements (e.g. flammability), health hazard definitions are less precise and more subjective. Health hazards may cause measurable changes in the body - such as decreased pulmonary function. These changes are generally indicated by the occurrence of signs and symptoms in the exposed employees - such as shortness of breath, a non-measurable, subjective feeling. Employees exposed to such hazards must be apprised of both the change in body function and the signs and symptoms that may occur to signal that change.

The determination of occupational health hazards is complicated by the fact that many of the effects or signs and symptoms occur commonly in non-occupationally exposed populations, so that effects of exposure are difficult to separate from normally occurring illnesses. Occasionally, a substance causes an effect that is rarely seen in the population at large, such as angiosarcomas caused by vinyl chloride exposure, thus making it easier to ascertain that the occupational exposure was the primary causative factor. More often, however, the effects are common, such as lung cancer. The situation is further complicated by the fact that most chemicals have not been adequately tested to determine their health hazard potential, and data do not exist to substantiate these effects.

There have been many attempts to categorize effects and to define them in various ways. Generally, the terms "acute" and "chronic" are used to delineate between effects on the basis of severity or duration. "Acute" effects usually occur rapidly as a result of short-term exposures, and are of short duration. "Chronic" effects generally occur as a result of long-term exposure, and are of long duration.

The acute effects referred to most frequently are those defined by the American National Standards Institute (ANSI) standard for Precautionary Labeling of Hazardous Industrial Chemicals (Z129.1-1988) - irritation, corrosivity, sensitization and lethal dose. Although these are important health effects, they do

not adequately cover the considerable range of acute effects which may occur as a result of occupational exposure, such as, for example, narcosis.

Similarly, the term chronic effect is often used to cover only carcinogenicity, teratogenicity, and mutagenicity. These effects are obviously a concern in the workplace, but again, do not adequately cover the area of chronic effects, excluding, for example, blood dyscrasias (such as anemia), chronic bronchitis and liver atrophy.

The goal of defining precisely, in measurable terms, every possible health effect that may occur in the workplace as a result of chemical exposures cannot realistically be accomplished. This does not negate the need for employees to be informed of such effects and protected from them. Appendix B, which is also mandatory, outlines the principles and procedures of hazard assessment.

For purposes of this section, any chemicals which meet any of the following definitions, as determined by the criteria set forth in Appendix B are health hazards. However, this is not intended to be an exclusive categorization scheme. If there are available scientific data that involve other animal species or test methods, they must also be evaluated to determine the applicability of the HCS.

1. "Carcinogen:" A chemical is considered to be a carcinogen if:

(a) It has been evaluated by the International Agency for Research on Cancer (IARC), and found to be a carcinogen or potential carcinogen; or

(b) It is listed as a carcinogen or potential carcinogen in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or,

(c) It is regulated by OSHA as a carcinogen.

2. "Corrosive:" A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact. For example, a chemical is considered to be corrosive if, when tested on the intact skin of albino rabbits by the method described by the U.S. Department of Transportation in appendix A to 49 CFR part 173, it destroys or changes irreversibly the structure of the tissue at the site of contact following an exposure period of four hours. This term shall not refer to action on inanimate surfaces.

3. "Highly toxic:" A chemical falling within any of the following categories:

(a) A chemical that has a median lethal dose (LD_{50}) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.

(b) A chemical that has a median lethal dose (LD_{50}) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.

(c) A chemical that has a median lethal concentration (LC_{50}) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

4. "Irritant:" A chemical, which is not corrosive, but which causes a reversible inflammatory effect on living tissue by chemical action at the site of contact. A chemical is a skin irritant if, when tested on the intact skin of albino rabbits by the methods of 16 CFR 1500.41 for four hours exposure or by other appropriate techniques, it results in an empirical score of five or more. A chemical is an eye irritant if so determined under the procedure listed in 16 CFR 1500.42 or other appropriate techniques.

5. "Sensitizer:" A chemical that causes a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemical.

6. "Toxic." A chemical falling within any of the following categories:

(a) A chemical that has a median lethal dose ($LD(50)$) of more than 50 milligrams per kilogram but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.

(b) A chemical that has a median lethal dose ($LD(50)$) of more than 200 milligrams per kilogram but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.

(c) A chemical that has a median lethal concentration ($LC(50)$) in air of more than 200 parts per million but not more than 2,000 parts per million by volume of gas or vapor, or more than two milligrams per liter but not more than 20 milligrams per liter of mist, fume, or dust, when administered by continuous