

PPPL	PRINCETON PLASMA PHYSICS LABORATORY ES&H DIRECTIVES	
	ES&HD 5008 SECTION 8, CHAPTER 12 Hazard Communication	
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CHAPTER 12 HAZARD COMMUNICATION

12.1 INTRODUCTION

This directive establishes a formal procedure to ensure that accurate information concerning the hazards of chemicals used at Princeton Plasma Physics Laboratory (PPPL) is communicated to all personnel in a clear, concise manner. It is intended that concerns regarding chemical hazards be resolved at the lowest management level and to make information readily available. This directive includes the Occupational Safety and Health Administration's (OSHA) Hazard Communication Standard (HCS) alignment with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

12.2 POLICY

The PPPL Safety Division will ensure that the hazards of all chemicals purchased are evaluated and that this information is transmitted to workers within their work areas. This transmittal of information is to be accomplished by means of a Hazard Communication Program, which includes container labeling, Material Safety Data Sheets (MSDS)/ Safety Data Sheets ((SDS), and employee training.

12.3 SCOPE

This Hazard Communication Program covers all employees, students, collaborators, contractors, and subcontractors working at PPPL who are potentially exposed to hazardous chemicals.

12.4 DEFINITIONS (SEE GLOSSARY OF TERMS ON PAGE 18)

12.5 RESPONSIBILITIES

12.5.1 LINE ORGANIZATION

The Hazard Communication Program is a line responsibility extending throughout the line organization to all Laboratory workers.

12.5.2 SAFETY DIVISION/ INDUSTRIAL HYGIENIST (IH)

The Safety Division will be responsible for administering PPPL's Hazard Communication Program. IH will maintain or coordinate the:

- A. Hazard Communication Written Program (this chapter)
- B. List of hazardous chemicals
- C. SDS and legacy MSDS management records

- D. In-house labeling
- E. Personnel training materials and records will be maintained by Human Resources

12.5.3 MATERIAL SERVICES

The Receiving Department within Material Services is responsible to ensure that all delivered chemicals have correct and legible labeling for each container and that an SDS is on file for the chemical.

12.6 WRITTEN PROGRAM

The complete written Hazard Communication Program contains PPPL's policy and the procedures for hazard determination, container labeling, MSDS/ SDS management, worker training, and special topics, as well as the list of hazardous chemicals used at the facility. The official policy is contained within this Chapter. Contact the Safety Division if you would like to see the complete program including procedures and the list of hazardous chemicals.

12.7 HAZARD DETERMINATION

The OSHA Hazard Communication Standard requires chemical manufacturers and importers to evaluate chemicals they manufacture or import to determine if they are hazardous. Employers using chemicals may rely on the hazard determination performed by the chemical manufacturer or importer to identify the hazards of chemicals.

12.7.1 HAZARD DETERMINATION PROCESS

The PPPL is not a manufacturer or importer of chemicals but does receive chemicals from manufacturers and suppliers. These chemicals are used in fabrication, maintenance, cleaning and experimental processes related to the PPPL program. Items that are manufactured at PPPL for use outside the Lab are defined as articles and are therefore not covered under the Hazard Communication Standard because they:

- A. are formed to a specific shape or design during manufacture
- B. have end-use function(s) dependent in whole or in part upon its shape or design during end-use
- C. do not release, or otherwise result in, exposure to a hazardous chemical, under normal conditions of use.

Chemicals at PPPL shall not be combined unless the result is known. Where no chemical reaction occurs, the product is considered a mixture and is assumed to present the same hazards, as do the components from which it is comprised. PPPL relies on the information provided by the original chemical manufacturer and does not perform independent hazard determinations. If the hazards of a reaction product are unknown, they must be evaluated in accordance with industry standards.

12.8 MATERIAL SAFETY DATA SHEETS/ SAFETY DATA SHEETS

The Safety Division obtains SDS's for chemicals from the suppliers, reviews the hazards identified in the SDS's, utilizes this information for labeling and worker training, and makes those SDS's available to workers in their work areas. The SDS's are available through an online server readily accessible by all workers in their work areas. Paper copies of all MSDS and SDS's are also available from the Safety Division in case of system failure. For more information on reading and understanding SDS's, refer to Appendix A.

12.8.1 OBTAINING SUPPLIER'S SAFETY DATA SHEETS

A Safety Data Sheet must be obtained for each hazardous chemical purchased by PPPL. IH maintains a copy of the SDS and legacy MSDS for each hazardous chemical in the workplace.

12.8.2 LOCATIONS

MSDS/ SDS's are available through an online server accessible by all workers in their work areas through the PPPL Employee Services Home page at <http://www-local.pppl.gov/>. Paper copies are also available in the Safety Division Office.

12.8.3 ACTIONS

In order to ensure that there is proper hazard communication information present on site for every chemical, the following actions may be necessary:

- A. If a supplier cannot or will not supply an SDS, and information concerning the substance is minimal or unavailable, the use of the substance will be discontinued when practicable.
- B. If a supplier claims that a substance is not hazardous, he must provide a letter with a written signed statement to that effect. This statement will be kept in the online SDS server and in paper files.
- C. If delivery of a substance has been made without an SDS and no SDS is on file, the Safety Division will request an SDS from the supplier. If the supplier does not respond to the initial request, a series of three (3) request letters will be sent by the Safety Division. If an SDS is not received following the third request, the Head of the Safety Division will notify the OSHA area office of their unsuccessful efforts to obtain the SDS.
- D. All SDS's received at PPPL will be directed to IH who will compare them with the master chemical inventory and the master SDS file. If the SDS is an update or for a new material, they will update the master chemical inventory and master SDS file. IH will review SDS's to assure adequacy of existing training, labeling, handling procedures, and personal protective equipment and make the SDS's available to the appropriate employees via the electronic SDS system.
- E. If there is more than one supplier for a substance, all SDS's will be made available in the electronic SDS system.
- F. If a substance must be used without an SDS, the manufacturer will be notified that this is in violation of the OSHA Standard, and the manufacturer is jeopardizing PPPL's compliance.

with the standard. The Head of the Safety Division will prepare a written statement describing efforts to obtain the SDS and list any available hazard information on this substance. This statement will be placed in the electronic SDS system.

- G. Supervisors are to ensure that there are no products used in their work areas for which SDS(s) are not available. If such a situation occurs, the supervisor is to notify the Safety Division immediately.
- H. Workers who wish to purchase a new chemical product must first submit a Chemical Requisition Review Sheet, in accordance with Section 8, Chapter 13 of this Manual, to Safety Division. If possible, an SDS should accompany each Review Sheet. Upon approval, the request can then be submitted to Procurement or procured by other means, as appropriate. If an SDS is not already available at PPPL, IH may request that the purchaser obtain one with the order.

12.8.4 PROVIDING SDS'S

The following applies to the availability and creation of SDS's at PPPL:

- A. SDS's are required for many of the materials that PPPL utilizes. PPPL does not write SDS's as explained in the Hazard Determination section of this manual.
- B. PPPL does not sell products on a commercial basis and, therefore, only provides manufacturer's SDS's to all workers that are on site.
- C. Additional copies of SDS's for any materials that Safety has in its file are available upon request.

12.9 LABELING OF HAZARDOUS CHEMICALS IN THE WORKPLACE

The purpose of labeling is to provide workers with rapid access to information concerning the potential hazards of chemicals used in their work areas. Each container in the workplace must be labeled, tagged, or marked with the product identifier and signal words (if needed), 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 personnel under the hazard communication program, will provide workers with the specific information regarding the physical and health hazards of the hazardous chemical. Hazardous chemicals in process equipment will be identified along with appropriate hazard warnings on a work area placard. These labels will be adequate to allow ready reference to the appropriate MSDS/SDS. The hazard warning must be stated in easily understandable English, which adequately conveys the hazards of the chemical within the container.

12.9.1 LABELING PROCEDURES FOR INCOMING CONTAINERS

Incoming containers of hazardous chemicals from manufacturers will be inspected by Materiel Control upon delivery for the following requirements:

- A. The container must be in good condition.

- B. The container must be properly labeled by the supplier and must include the product identifier and words, pictures, symbols, or combination thereof, which provide at least general information regarding the hazards of the chemicals..

If these conditions are not met, Material Control will notify the Safety Division, who will then notify the supplier. PPPL will not move the containers or contents from the receiving area until labeling problems have been reconciled. Materials in damaged containers may be removed by Emergency Services Unit or the Environmental Services Division to protect against leaks or spills. When receiving any new chemicals for the first time, the Safety Division will assure that an MSDS or SDS is on file prior to approving the use of the material.

12.9.2 LABELING PROCEDURES FOR PORTABLE CONTAINERS

Portable containers shall meet the following requirements:

- A. Workers shall use purchased, computer-generated or hand-written labels for any portable container used to store, transfer, or transport chemicals. These are available from the Safety Division or the PPPL Stockroom.
- B. Chemical containers are **not** to be reused without Safety approval unless those containers are specifically designed for such a purpose (such as flammable liquids safety cans.)
- C. Any worker using an empty container will completely remove or obliterate the original label on the container unless they plan to refill it with the same product.
- D. Prior to using a container for a new material, a worker will properly clean the container in accordance with all waste disposal and IH requirements, then re-label it using a purchased or computer-generated label. The Safety Division will review MSDS or SDS's and suppliers' labels and assign an adequate hazard warning for materials used at PPPL.
- E. Facility Managers and line managers are to ensure that all containers within their respective areas are properly labeled and report improper or lack of labels to the Safety Division.
- F. All portable containers shall be labeled with the required information as described in paragraph 12.9.2 above.

12.9.3 LABELING PROCEDURES FOR PROCESS EQUIPMENT

- A. Certain pieces of equipment used at PPPL contain hazardous chemicals such as hydraulic fluid and cutting oil. Each piece of equipment containing these materials will be identified on locally posted placards and on the hazardous chemical list that is kept by the Safety Division.
- B. Area labels will be posted where steel, aluminum, and/or other raw materials are stored or used unless the items are individually labeled. The area placard will state the material's name and any appropriate hazard warnings.

- C. Above-ground pipes that contain hazardous chemicals shall be marked in accordance with the American National Standard Institute system for identification of Piping Systems, ANSI/ASME A13.1 (most recent issue).

12.9.4 LABELING OF PRODUCTS

PPPL does not manufacture any products for sale that would be considered hazardous chemicals under the Hazard Communication Standard, and as such has no manufacturers' labeling requirement.

All contractor containers and chemical storage equipment must meet the labelling requirements listed in Section 12.9 LABELING PROCEDURES, to be allowed on site.

12.10 NON-ROUTINE TASKS

Workers must be informed of the hazards of non-routine tasks.

12.10.1 EXAMPLES

Examples could include: changing the oil in equipment, equipment maintenance or repair, coil repair and use of methylene chloride, acid backwash to drain filtration systems, and the maintenance of boiler systems. Some chemicals used in these non-routine tasks are used in daily operations, and no special training is required. Other tasks that are truly non-routine, utilizing unusual chemicals, require special training to ensure the use of proper personal-protective equipment and the proper handling of the chemicals.

12.10.2 AWARENESS

- A. It is the Supervisor's responsibility to review non-routine tasks to determine the potential for chemical exposure. Assistance can be provided by the Safety Division. The Supervisor must inform the workers of the hazards associated with the tasks, as well as the appropriate safety precautions and protective equipment that must be used.
- B. Workers occasionally perform minor maintenance duties such as painting. When the exposure to paint or other maintenance chemicals is similar to that of a consumer, workers do not require additional training.

12.11 CONTRACTORS

12.11.1 RESPONSIBILITY

PPPL brings many contractors on site. Contractors must be informed of PPPL's Hazard Communication Program. Potential hazards are to be identified; and the labeling systems, availability of MSDS and/ or SDS's, and the chemical inventory must be explained.

12.11.2 CONTRACTOR HAZARDOUS CHEMICAL USE

If outside contractors use chemicals, they must provide a list of the chemicals and MSDS or SDS's on all chemicals to the Safety Division a minimum of twenty-four (24) hours before they begin their operations and shall be responsible for the removal of all unused portions of those chemicals and their waste products from the site.

12.12 TRAINING REQUIREMENTS

12.12.1 GENERAL

All workers who are or potentially may be exposed to hazardous chemicals, under normal operating conditions or in foreseeable emergencies, must be provided the required information and training. At PPPL, all workers shall receive the Basic Hazard Communication Training as part of the General Employee Training within one week of employment and at a frequency determined by Human Resources thereafter. More detailed Hazard Communication training is required of all workers who work with or around chemicals on a regular basis. Supervisors shall provide training on specific chemicals to workers before their initial work assignment and whenever any new hazards are introduced to their work area.

12.12.2 COURSE CONTENT

Basic Hazard Communication

This course must include at a minimum:

- A. the requirements of the Hazard Communication Standard and this policy
- B. the location and availability of the written hazard communication program, lists of chemicals, and associated material safety data sheets and Safety Data Sheets
- C. an explanation of the labeling system
- D. an explanation of Safety Data Sheets
- E. how to obtain and use appropriate hazard information
- F. how labels are keyed to SDS's

Hazard Communication Training

This course shall include at a minimum:

- A. methods and observations that may be used by the worker to detect the presence or release of hazardous chemicals in the work area, including any monitoring conducted by PPPL or any continuous monitoring devices that are being used in the workplace
- B. the physical and health hazards of chemicals in the work area
- C. the measures workers can take to protect themselves from these hazards, including engineering controls, administrative controls, personal protective equipment, and emergency procedures.
- D. the details of the hazard communication program including an explanation of the labels received on shipped containers, PPPL's labeling system, safety data sheets, and how employees can obtain and use the appropriate hazard information.

Supervisory Training

This course shall include a review of the MSDS or SDS's for chemicals that their workers will encounter as a result of their job function.

12.13 REFERENCES

OSHA Hazard Communication Standard, 29CFR 1910.1200

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SAF-T-FAX, Material Safety Data Sheet Glossary of Terms, Mogul Corporation, 1984

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Taber's Cyclopedic Medical Dictionary, F.A. Davis Company, Philadelphia, 12th Edition, 1973

Industrial Ventilation, American Conference of Governmental Industrial Hygienists, Edward Brothers, Inc., latest edition.

The Industrial Environment - Its Evaluation and Control, U.S. Department of Health, Education, and Welfare (NIOSH), Government Printing Office, 1973

Lange's Handbook of Chemistry, McGraw-Hill Book Company, New York, 1967

Texaco, Explanation of the Industrial Hygiene Toxicology, and Material Safety Data Sheet, 1985

Fundamentals of Industrial Hygiene, Julian Olishifski and Frank McElroy, National Safety Council, Chicago, IL, 1976

The MSDS Pocket Dictionary, Edited by Joseph O. Accrocco, Genium Publishing Corp., Schenectady, NY, 1988

APPENDIX A

MATERIAL SAFETY DATA SHEET (MSDS)

HOW TO USE A MATERIAL SAFETY DATA SHEET

The format and quality of material safety data sheets may vary greatly from one manufacturer to another, but all of the following material will be covered on every MSDS.

Section I - Material Identification

The first section identifies the material and the supplier. The material name on the MSDS must match the name on the container. If the material has more than one name, each will be listed. The chemical formula may also be given. The supplier's name, address, and an emergency telephone number are also listed in this section.

Section II - Ingredients and Hazards

Section 2 lists the individual hazardous chemicals in the product and their relative percentage of concentration. If exposure limits have been established, they will be shown for each chemical.

Section III - Physical Data

Physical data typically includes a material's boiling point, solubility in water, viscosity, specific gravity, melting point, evaporation rate, molecular weight, etc., as well as the appearance and odor of the material.

Section IV - Fire and Explosion Data

Section 4 of the MSDS will indicate what protective clothing or respiratory equipment should be used by fire fighters and what type of extinguishing materials are best for use when fighting a fire involving the material.

Section V - Reactivity Data

The information found in Section 5 will vary greatly from one MSDS to another because of the many different ways that materials may react with one another. The information presented should focus on the materials and circumstances that could be most hazardous when combined with the material covered by the MSDS.

Section VI - Health Hazard Information

Section 6 of the MSDS must describe all known routes of entry of the chemical into the body, including eye contact, skin contact, inhalation, and ingestion. Acute (immediate) and chronic (long-term) effects must be stated. If the material is carcinogenic, that fact must be stated. Medical and first-aid treatments for accidental exposure will be described.

Section VII - Spill, Leak, and Disposal Procedures

Safe work practices to be followed in the event of an accident with a particular material are described. Methods and procedures for proper handling of spills, leaks, and disposal of wastes are covered.

Section VIII - Special Protection Information

Methods for reducing exposure to a particular hazardous material are described. The methods may include ventilation requirements, breathing apparatus, as well as protective clothing such as gloves, aprons, and safety glasses.

Section IX - Special Precautions and Comments

Safe storage and handling of the material are described. The types of labels or markings for containers are described, and particular Department of Transportation (DOT) policies for handling the material are listed.

SAFETY DATA SHEET (SDS)

HOW TO USE A SAFETY DATA SHEET

The Hazard Communication Standard (HCS) (29 CFR 1910.1200(g)), was revised in 2012 and requires that the chemical manufacturer, distributor, or importer provide Safety Data Sheets (SDSs) (formerly MSDSs or Material Safety Data Sheets) for each hazardous chemical to downstream users to communicate information on these hazards. The information contained in the SDS is largely the same as the MSDS, except now the SDSs are required to be presented in a consistent user-friendly, 16-section format.

Sections 1 through 8 contain general information about the chemical, identification, hazards, composition, safe handling practices, and emergency control measures (e.g., fire fighting). Sections 9 through 11 and 16 contain other technical and scientific information, such as physical and chemical properties, stability and reactivity information, toxicological information, exposure control information, and other information including the date of preparation or last revision.

Sections 12 through 15 contain additional regulatory information including: ecological, disposal and transportation requirements.

Section 1- Identification

This section identifies the chemical on the SDS as well as the recommended uses. It also provides the essential contact information of the supplier. The required information consists of:

- Product identifier used on the label and any other common names or synonyms by which the substance is known.
- Name, address, phone number of the manufacturer, importer, or other responsible party, and emergency phone number.
- Recommended use of the chemical (e.g., a brief description of what it actually does, such as flame retardant) and any restrictions on use (including recommendations given by the supplier).

Section 2- Hazard(s) Identification

This section identifies the hazards of the chemical presented on the SDS and the appropriate warning information associated with those hazards. The required information consists of:

- The hazard classification of the chemical (e.g., flammable liquid).
- Signal word.
- Hazard statement(s).
- Pictograms (the pictograms or hazard symbols may be presented as graphical reproductions of the symbols in black and white or be a description of the name of the symbol (e.g., skull and crossbones, flame).
- Precautionary statement(s).

- Description of any hazards not otherwise classified.
- For a mixture that contains an ingredient(s) with unknown toxicity, a statement describing how much (percentage) of the mixture consists of ingredient(s) with unknown acute toxicity. Please note that this is a total percentage of the mixture and not tied to the individual ingredient(s).

Section 3- Composition/ Information on Ingredients

Substances

- Chemical name.
- Common name and synonyms.
- Chemical Abstracts Service (CAS) number and other unique identifiers.
- Impurities and stabilizing additives, which are themselves classified and which contribute to the classification of the chemical.

Mixtures

- Same information required for substances.
- The chemical name and concentration (i.e., exact percentage) of all ingredients which are classified as health hazards and are:
 - Present above their cut-off/concentration limits or
 - Present a health risk below the cut-off/concentration limits.
- The concentration (exact percentages) of each ingredient must be specified except concentration ranges may be used in the following situations:
 - A trade secret claim is made,
 - There is batch-to-batch variation, or
 - The SDS is used for a group of substantially similar mixtures.

Chemicals where a trade secret is claimed

- A statement that the specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret is required.

Section 4- First-Aid Measures

This section describes the initial care that should be given by untrained responders to an individual who has been exposed to the chemical. The required information consists of:

- Necessary first-aid instructions by relevant routes of exposure (inhalation, skin and eye contact, and ingestion).

- Description of the most important symptoms or effects, and any symptoms that are acute or delayed.
- Recommendations for immediate medical care and special treatment needed, when necessary.

Section 5- Fire Fighting Measures

This section provides recommendations for fighting a fire caused by the chemical. The required information consists of:

- Recommendations of suitable extinguishing equipment, and information about extinguishing equipment that is not appropriate for a particular situation.
- Advice on specific hazards that develop from the chemical during the fire, such as any hazardous combustion products created when the chemical burns.
- Recommendations on special protective equipment or precautions for firefighters.

Section 6- Accidental Release Measures

This section provides recommendations on the appropriate response to spills, leaks, or releases, including containment and cleanup practices to prevent or minimize exposure to people, properties, or the environment. It may also include recommendations distinguishing between responses for large and small spills where the spill volume has a significant impact on the hazard. The required information may consist of recommendations for:

- Use of personal precautions (such as removal of ignition sources or providing sufficient ventilation) and protective equipment to prevent the contamination of skin, eyes, and clothing.
- Emergency procedures, including instructions for evacuations, consulting experts when needed, and appropriate protective clothing.
- Methods and materials used for containment (e.g., covering the drains and capping procedures).
- Cleanup procedures (e.g., appropriate techniques for neutralization, decontamination, cleaning or vacuuming; adsorbent materials; and/or equipment required for containment/clean up)

Section 7- Handling and Storage

This section provides guidance on the safe handling practices and conditions for safe storage of chemicals. The required information consists of:

- Precautions for safe handling, including recommendations for handling incompatible chemicals, minimizing the release of the chemical into the environment, and providing advice on general hygiene practices (e.g., eating, drinking, and smoking in work areas is prohibited).
- Recommendations on the conditions for safe storage, including any incompatibilities. Provide advice on specific storage requirements (e.g., ventilation requirements)

Section 8- Exposure Controls/ Personal Protection

This section indicates the exposure limits, engineering controls, and personal protective measures that can be used to minimize worker exposure. The required information consists of:

OSHA Permissible Exposure Limits (PELs), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet, where available.

- Appropriate engineering controls (e.g., use local exhaust ventilation, or use only in an enclosed system).
- Recommendations for personal protective measures to prevent illness or injury from exposure to chemicals, such as personal protective equipment (PPE) (e.g., appropriate types of eye, face, skin or respiratory protection needed based on hazards and potential exposure).
- Any special requirements for PPE, protective clothing or respirators (e.g., type of glove material, such as PVC or nitrile rubber gloves; and breakthrough time of the glove material).

Section 9- Physical and Chemical Properties

This section identifies physical and chemical properties associated with the substance or mixture. The minimum required information consists of:

- Appearance (physical state, color, etc.);
- Upper/lower flammability or explosive limits;
- Odor;
- Vapor pressure;
- Odor threshold;
- Vapor density;
- pH;
- Relative density;
- Melting point/freezing point;
- Solubility(ies);
- Initial boiling point and boiling range;
- Flash point;
- Evaporation rate;
- Flammability (solid, gas);

- Partition coefficient: n-octanol/water;
- Auto-ignition temperature;

Decomposition temperature; and

- Viscosity.

The SDS may not contain every item on the above list because information may not be relevant or is not available. When this occurs, a notation to that effect must be made for that chemical property. Manufacturers may also add other relevant properties, such as the dust deflagration index (Kst) for combustible dust, used to evaluate a dust's explosive potential

Section 10- Stability and Reactivity

This section describes the reactivity hazards of the chemical and the chemical stability information. This section is broken into three parts: reactivity, chemical stability, and other. The required information consists of:

Reactivity

- Description of the specific test data for the chemical(s). This data can be for a class or family of the chemical if such data adequately represent the anticipated hazard of the chemical(s), where available.

Chemical stability

- Indication of whether the chemical is stable or unstable under normal ambient temperature and conditions while in storage and being handled.
- Description of any stabilizers that may be needed to maintain chemical stability.
- Indication of any safety issues that may arise should the product change in physical appearance.

Other

- Indication of the possibility of hazardous reactions, including a statement whether the chemical will react or polymerize, which could release excess pressure or heat, or create other hazardous conditions. Also, a description of the conditions under which hazardous reactions may occur.
- List of all conditions that should be avoided (e.g., static discharge, shock, vibrations, or environmental conditions that may lead to hazardous conditions).
- List of all classes of incompatible materials (e.g., classes of chemicals or specific substances) with which the chemical could react to produce a hazardous situation.
- List of any known or anticipated hazardous decomposition products that could be produced because of use, storage, or heating. (Hazardous combustion products should also be included in Section 5 (Fire-Fighting Measures) of the SDS.)

Section 11- Toxicological Information

This section identifies toxicological and health effects information or indicates that such data are not available. The required information consists of:

- Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact). The SDS should indicate if the information is unknown.
- Description of the delayed, immediate, or chronic effects from short- and long-term exposure.
- The numerical measures of toxicity (e.g., acute toxicity estimates such as the LD50 (median lethal dose)) - the estimated amount [of a substance] expected to kill 50% of test animals in a single dose.
- Description of the symptoms. This description includes the symptoms associated with exposure to the chemical including symptoms from the lowest to the most severe exposure.
- Indication of whether the chemical is listed in the National Toxicology Program (NTP) 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 found to be a potential carcinogen by OSHA

Section 12- Ecological Information

This section provides information to evaluate the environmental impact of the chemical(s) if it were released to the environment. The information may include:

- Data from toxicity tests performed on aquatic and/or terrestrial organisms, where available (e.g., acute or chronic aquatic toxicity data for fish, algae, crustaceans, and other plants; toxicity data on birds, bees, plants).
- Whether there is a potential for the chemical to persist and degrade in the environment either through biodegradation or other processes, such as oxidation or hydrolysis.
- Results of tests of bioaccumulation potential, making reference to the octanol-water partition coefficient (K_{ow}) and the bioconcentration factor (BCF), where available.
- The potential for a substance to move from the soil to the groundwater (indicate results from adsorption studies or leaching studies).
- Other adverse effects (e.g., environmental fate, ozone layer depletion potential, photochemical ozone creation potential, endocrine disrupting potential, and/or global warming potential).

Section 13- Disposal Considerations

This section provides guidance on proper disposal practices, recycling or reclamation of the chemical(s) or its container, and safe handling practices. To minimize exposure, this section should also refer the reader to Section 8 (Exposure Controls/Personal Protection) of the SDS. The information may include:

- Description of appropriate disposal containers to use.
- Recommendations of appropriate disposal methods to employ.
- Description of the physical and chemical properties that may affect disposal activities.

- Language discouraging sewage disposal.
- Any special precautions for landfills or incineration activities

Section 14- Transport Information

This section provides guidance on classification information for shipping and transporting of hazardous chemical(s) by road, air, rail, or sea. The information may include:

- UN number (i.e., four-figure identification number of the substance).
- UN proper shipping name.
- Transport hazard class(es).
- Packing group number, if applicable, based on the degree of hazard.
- Environmental hazards (e.g., identify if it is a marine pollutant according to the International Maritime Dangerous Goods Code (IMDG Code)).
- Guidance on transport in bulk (according to Annex II of MARPOL 73/78 and the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (International Bulk Chemical Code (IBC Code))).
- Any special precautions which an employee should be aware of or needs to comply with, in connection with transport or conveyance either within or outside their premises (indicate when information is not available).

Section 15- Regulatory Information

This section identifies the safety, health, and environmental regulations specific for the product that is not indicated anywhere else on the SDS. The information may include:

- Any national and/or regional regulatory information of the chemical or mixtures (including any OSHA, Department of Transportation, Environmental Protection Agency, or Consumer Product Safety Commission regulations)

Section 16- Other Information

This section indicates when the SDS was prepared or when the last known revision was made. The SDS may also state where the changes have been made to the previous version. You may wish to contact the supplier for an explanation of the changes. Other useful information also may be included here.

HCS Pictograms and Hazards

<p style="text-align: center;">Health Hazard</p>  <ul style="list-style-type: none"> • Carcinogen • Mutagenicity • Reproductive Toxicity • Respiratory Sensitizer • Target Organ Toxicity • Aspiration Toxicity 	<p style="text-align: center;">Flame</p>  <ul style="list-style-type: none"> • Flammables • Pyrophorics • Self-Heating • Emits Flammable Gas • Self-Reactives • Organic Peroxides 	<p style="text-align: center;">Exclamation Mark</p>  <ul style="list-style-type: none"> • Irritant (skin and eye) • Skin Sensitizer • Acute Toxicity (harmful) • Narcotic Effects • Respiratory Tract Irritant • Hazardous to Ozone Layer (Non-Mandatory)
<p style="text-align: center;">Gas Cylinder</p>  <ul style="list-style-type: none"> • Gases Under Pressure 	<p style="text-align: center;">Corrosion</p>  <ul style="list-style-type: none"> • Skin Corrosion/ Burns • Eye Damage • Corrosive to Metals 	<p style="text-align: center;">Exploding Bomb</p>  <ul style="list-style-type: none"> • Explosives • Self-Reactives • Organic Peroxides
<p style="text-align: center;">Flame Over Circle</p>  <ul style="list-style-type: none"> • Oxidizers 	<p style="text-align: center;">Environment (Non-Mandatory)</p>  <ul style="list-style-type: none"> • Aquatic Toxicity 	<p style="text-align: center;">Skull and Crossbones</p>  <ul style="list-style-type: none"> • Acute Toxicity (fatal or toxic)

GLOSSARY OF TERMS

ACGIH - American Conference of Governmental Industrial Hygienists.

acid - A compound that reacts with bases neutralizing them and forming a salt. Acids have a pH of less than 7.0. They are corrosive to human tissue and are to be handled with care.

action level - An exposure level set by OSHA which is generally equal to one-half the value of the Permissible Exposure Limit (PEL).

acute effects - The adverse effects that normally are evident immediately or shortly after the exposure to a hazardous material.

acute exposure - A sudden or one-time exposure to a large dose of a hazardous material.

administrative controls - Any measure taken by management to reduce worker's Time-Weighted-Average exposures without involving engineering changes. These "administrative" measures may include such methods as worker rotation, housekeeping, training, or limiting the time spent performing a job function.

alkali - see "base"

asphyxiant - A vapor or gas that can cause injury by reducing the amount of oxygen available for breathing.

autoignition temperature - The minimum temperature at which a substance will ignite in air when there is no other ignition source. For liquids, it is defined as the lowest temperature at which a drop of solvent will ignite spontaneously.

base, basic - A compound which reacts with an acid to form a salt and has a pH greater than 7.0. It attacks biological tissue by chemical action. Some examples are sodium hydroxide (NaOH) and potassium hydroxide (KOH). (3,7)

°C - Degrees Celsius (See "Celsius").

carcinogen, carcinogenic - Any substance or agent capable of causing cancer. 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 REPORT ON CARCINOGENS (RoC) published by the National Toxicology Program (NTP) (latest edition); or (c) It is regulated by OSHA as a carcinogen.

CAS number - Chemical Abstract Service registry number.

caustic - See "base".

Celsius - (Degrees Celsius, Centigrade) A temperature scale in which water freezes at 0°C and boils at 100°C. A Celsius degree is 1/100th the difference between the temperature of melting ice and boiling water at 1.0 atmospheric pressure.

Centigrade - See "Celsius".

central nervous system - The part of the nervous system comprising the brain and the spinal cord.

Chemical - Any single molecule or mixture of molecules. For the purposes of this chapter, a chemical includes:

1. All solids, liquids, and gases not excepted below;
2. All stock materials such as wood, metal and plastic that will be cut or formed into other shapes; and
3. Solder, welding rods, grinding wheels and any other materials that will be used up or worn down as part of their use.

Exceptions include:

1. Articles – items sold in their finished shape where their use is a function of that shape. (NOTE: This does not include liquids or powders; such items are considered chemicals);
2. Wood products that are not treated, and will not be cut;
3. Tobacco, food and beverages, drugs, cosmetics;
4. Hazardous waste (refer to Section 7 of ESHG 5008); and
5. Items having radiological or biological hazards (refer to Section 10 of ESHG 5008 for rules pertaining to radiological hazards, contact Industrial Hygiene for information on biological hazards).

chronic effects - Adverse effects that develop slowly over a long period of time or upon repeated prolonged exposure to a hazardous material.

chronic exposure - An exposure to low-level sub-lethal concentrations of a substance over a prolonged period of time. A repeated and long-term exposure.

combustible, combustible liquid - A liquid with a flash point 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, or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

compressed gas - (a) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi or 70 °F (21.1 °C); or (b) 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 (3) A liquid having a vapor pressure exceeding 40 psi at 100 °F (37.8 °C) as determined by ASTM D-323-72.

corrosive - A chemical which causes visible destruction of, or irreversible alterations in, living tissues by chemical action at the site of contact.

danger- a signal word indicating that a chemical poses a potential severe hazard.

decomposition products - Any of the new substances created by the breakdown (decomposition) of an original material into smaller components. This breakdown may be thermal, chemical, electrochemical, electromagnetic, etc.

engineering controls - Engineering measures taken to reduce worker's Time-Weighted-Average exposures involving equipment change, process change, ventilation, containment, isolation, etc.

explosive - A chemical that causes a sudden, almost instantaneous release of energy, pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

explosive limits - The range of concentrations over which a flammable vapor mixed with proper proportions of air will flash or explode if an ignition source is present. The range extends between two points designated lower explosive limit (LEL) and the upper explosive limit (UEL) and are expressed in percent by volume of vapor in air.

exposure - When a worker is subjected to a hazardous chemical in a course of employment through any route of entry (inhalation, ingestion, skin contact or absorption, etc.) and includes potential (e.g., accidental or possible) exposure.

°F - Degrees Fahrenheit. (See "Fahrenheit")

Fahrenheit - (Degrees Fahrenheit) A temperature scale in which water freezes at 32 °F and boils at 212 °F . A Fahrenheit degree is 1/180th the difference between the temperature of melting ice and boiling water at 1.0 atmospheres (atmospheric pressure at sea level, 14.7 psi).

flammable - Easily set on fire: any aerosol, gas, liquid, or solid which meets the specific physical criteria to be classified as "flammable." (6)

- (a) flammable aerosol - 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.
- (b) flammable gas (i) - 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 (ii) 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.
- (c) flammable liquid - 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 makes up 99 percent or more of the total volume of the mixture.
- (d) flammable solid - A solid, other than a blasting agent or explosive as defined in 29 CFR 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.

flammable limits - See "explosive limits."

flash point - The lowest temperature in degrees Fahrenheit (°F) at which a liquid will give off enough flammable vapor to ignite. Since flash points vary according to how they are obtained, the method used must be listed. The methods used most extensively include: Tag Closed Cup (TCC); Pensky-Martens Closed Cup (PMCC); and Setaflash (SETA).

fume - An aerosol of very fine solid particles produced by re-condensation from the vapor phase. An example of this is weld fume which is formed as vaporized metal re-condenses in the air into very fine solid repairable particles.

gas - A state of matter in which the material has very low density and viscosity, can expand and contract greatly in response to changes in temperature and pressure; a gas easily diffuses into other gases, readily and uniformly distributing itself throughout any container.

hazard warning - Any words, pictures, symbols, or combination thereof appearing on a label or other appropriate form of warning which convey the hazards of the chemical(s) in the container(s).

hazardous chemical - Any chemical capable of causing injury or disease due to flammable, toxic, corrosive, radioactive, explosive, or reactive properties. Any chemical that meets the criteria of a **physical hazard** or a **health hazard** (see below).

health hazard - 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 workers. The term "health hazard" includes chemicals which are carcinogens, toxic or high 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.

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.

IDLH - Immediately dangerous to life or health.

ignition source - Any source (spark, flame, heat) with sufficient energy to ignite a flammable or combustible mixture.

ignition temperature - See "autoignition."

incompatibility (chemical) - Unsuitable for mixing, contact, or association due to undesirable reaction and effects.

industrial hygiene - The science that deals with the recognition, evaluation, and control of potential health hazards in the industrial environment.

inflammable - See "flammable."

ingestion - The process of taking substances into the body by mouth, such as food, drink, medicine, etc.

inhalation - The breathing in of vapors, gases, mists, aerosols, fumes, and/or dusts.

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.

LEL - Lower explosive limit. See also "explosive limits."

LFL - Lower flammable limit.

liquid - A state of matter in which the substance is a formless fluid that flows in accordance with the law of gravity.

Material Safety Data Sheet (MSDS) - Written or printed material concerning a hazardous chemical as required by OSHA, also see Safety Data Sheet definition below.

mist - Suspended liquid droplets generated by condensation from the gaseous to the liquid state or by breaking up a liquid into a dispersed state, such as by splashing, foaming, or atomizing. Generally mists are formed when a finely divided liquid is suspended in air.

mixture - Any combination of two or more chemicals if the combination is not, in whole or in part, the result of a chemical reaction. A combination of two or more substances which may be separated by mechanical means. The components may not be uniformly dispersed.

mutagen - A chemical or physical effect which can alter genetic material in an organism and results in physical or functional changes in all subsequent generations.

nuisance particulates - General innocuous dust, not recognized as the direct cause of a serious pathological condition. Dust or other fine solids that are nuisances to the respiratory tract.

odor threshold - (human odor threshold) The minimum concentration of a substance in air which is necessary for detection by the human olfactory system.

OSHA - Usually refers to the Occupational Safety and Health Administration but sometimes is used for the Occupational Safety and Health Act.

oxidizer - A chemical other than a blasting agent or explosive as defined in 29 CFR 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.

Permissible Exposure Limit (PEL) - Permissible Exposure Limit as required by OSHA regulation 29 CFR-1910.1000(e) Tables Z-1, Z-2, and Z-3. These are the Federally Regulated "legal" limits set at a level which is determined to be safe for employee worker exposed for eight hours per day, 40 hours per week, for a "working lifetime."

personal protective equipment (PPE) - Any clothing or gear worn or used by an individual to protect against some external physical (chemical, noise, heat, electricity, dust, mist, fume, etc.) hazard. Examples of PPE are gloves, boots, respirators, hearing protection, coveralls, glasses, space suit, etc.

pH - A system used to express the degree of acidity or alkalinity of a solution. A pH of 7.0 is neutral.

physical hazard - 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.

pictograms- a symbol and other graphic elements, such as a border, background patter, or color, that is intended to convey specific information about the hazards of a chemical.

pyrophoric - Any chemical substance that ignites spontaneously in dry or moist air at or below 130 °F.

reactive material - A chemical substance or mixture that may vigorously polymerize, decompose, condense, or become self-reactive under conditions of shock, pressure, or temperature.

reproductive toxin - Chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

Safety Data Sheet (SDS)- Formerly referred as Material Safety Data Sheets, are an essential component of the Globally Harmonized System for hazard Communication and are intended to provide comprehensive information about a substance or mixture for use in workplace chemical management.

self-contained breathing apparatus (SCBA) - Protective equipment that supplies fresh air to the user from some tank storage system, not filtered air as with a respirator.

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. If the first exposure does not cause a reaction, but subsequent exposures do, an individual has become sensitized.

smoke - An air suspension (aerosol) of particles, usually but not necessarily solid, often originating in a solid nucleus, formed from combustion or sublimation.

teratogen - An agent or factor that causes the production of physical defects in the developing embryo.

TLV - The Threshold Limit Value as recommended by the American Conference of Governmental Industrial Hygienists. Usually expressed as a time-weighted average (TWA), it is the concentration of a chemical in air (as vapor, mist, etc.) to which most workers can be exposed for a normal eight-hour work day, 40 hours a week, without experiencing adverse effects. Refer to entry on (SKIN) for additional information on certain chemicals.

TLV-C or TLV-CEILING - Threshold Limit Value-Ceiling. The workplace concentration of chemical in air that should not be exceeded even instantaneously.

TLV-STEL - Threshold Limit Value - Short Term Exposure Limit. The workplace concentration of a chemical in air (as vapor, mist, etc.) to which workers can be exposed continuously for a 15 minute period of time without suffering from: 1) irritation, 2) chronic or irreversible tissue damage, or 3) narcosis, provided the TLV-TWA is not exceeded. Exposures at the STEL should not be repeated more than four times per day, and there should be a minimum of 60 minutes between STEL exposures.

toxic - A substance that can produce injury or illness to man through ingestion, inhalation, or absorption; a poison.

A chemical falling within any of the following categories: (a) Chemical that has a median lethal dose (LD₅₀) 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) Chemical that has a median

lethal dose (LD₅₀) 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) Chemical that has a median lethal concentration (LC₅₀) 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 inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

UEL - Upper Explosive Limit. See also "explosive limits."

UFL - Upper Flammable Limit.

unstable - (reactive) 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.

vapor - Matter brought to a gaseous state. That fraction of a liquid which will change to the vapor state even though conditions are such that the material should remain a liquid. Example: water boils at 212 °F, however; liquid water will become vapor (evaporate) from an open vessel at room temperature.

ventilation - General Ventilation - when the concentration of a contaminant in the exhaust air stream is not significantly higher than in the general room air.

- (a) natural general ventilation - when air movement through buildings and enclosures is controlled by wind and thermal convection.
- (b) mechanical general ventilation - when air movement through buildings and enclosures is controlled mechanically with fans designed to adequately distribute air, but not to ventilate any specific operation.

Local Exhaust Ventilation - when the concentration of contaminant in the exhaust air stream is significantly higher than that in the general room air. A local exhaust system is one in which the contaminant being controlled is captured at or near the place where it is created or dispersed. A local exhaust system usually includes the use of hoods or enclosures, ductwork leading to an exhaust fan, an air cleaning device for air pollution abatement and finally, discharged to the outside air.

warning- A signal word that advises the chemical poses less severe hazards.

water-reactive - A chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

Appendix B

HAZARD COMMUNICATION TRAINING OUTLINE**I. PURPOSE**

- A. Provide formal training on hazard communication.
- B. Promote safe handling of potentially hazardous materials at work and home.
- C. To comply with the OSHA Hazard Communication Standard.

II. EXPLANATION OF RULE

- A. Hazard Evaluation
- B. Chemical Listing/Inventory
- C. Labeling
 - 1. Name of material (must match MSDS or SDS)
 - 2. Appropriate hazard warnings
- D. Material Safety Data Sheet/ Safety Data Sheets (MSDS/SDS)
 - 1. Prime tool for hazard communication - name should match label.
 - 2. Available to all workers in their areas during their workshift (online MSDS/SDS system)
- E. Training
 - 1. All personnel must participate in HazCom training.
 - 2. All new hires and contractors will be trained prior to being assigned any tasks exposing them to any hazardous materials.
- F. Written Program
 - 1. PPPL's Policy is contained in the Environment, Safety and Health Manual, Section 8, Chapter 12.
 - 2. The complete Written Program is available to all workers upon request from the Safety Division. .

III. CHEMICAL HAZARDS

- A. Health Hazards

1. Toxic: a substance that can produce injury or illness through ingestion, inhalation, or absorption.
2. Carcinogens: any substance or agent capable of causing cancer, or that has produced cancer in laboratory animals.
3. Reproductive toxin: chemicals which affect the reproductive capabilities. Those affecting the worker directly causing chromosomal damage (mutations) and those affecting fetuses (teratogenesis).
4. Irritants: chemicals, which are not corrosive, but which cause a reversible inflammatory effect by chemical action at the site of contact.
5. Corrosives: chemicals that cause destruction of, or irreversible alterations by chemical action (acid, bases).
6. Sensitizers: chemicals that cause a substantial proportion of exposed people to develop an allergic reaction in normal tissue after repeated exposure to the chemical. If the first exposure does not cause a reaction, but subsequent exposures do, an individual has become sensitized.
7. Target organ: a chemical has a toxic effect on one particular organ or organ system. An example is drinking alcohol affects the liver.

B. Physical Hazards

1. Combustible: a substance with a flashpoint at or above 100°F (37.8 °C), but below 200 °F (93.3 °C).
2. Compressed gas: a gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70 °F (21.1 °C); or 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 a liquid having a vapor pressure exceeding 40 psi at 100 °F (37.8 °C) as determined by ASTM D-323-72.
3. Explosive: a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.
4. Flammable: easily set on fire: any aerosol, gas, liquid or solid which meets the specific physical criteria to be classified as "flammable."
5. Organic peroxide: an organic compound that contains the bivalent -O-O- structure derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.
6. Oxidizer: 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.

7. Pyrophoric: any liquid that ignites spontaneously in dry or moist air at or below 130 °F.
8. Unstable: 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.
9. Water reactive: a chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

C. Glossary of Terms

Contained in Appendix A of the Hazard Communication Policy (Section 8, Chapter 12 of the ES&H Manual).

IV. CHEMICAL SAFETY PRINCIPLES

A. Routes of Entry into the human body

1. Inhalation or breathing is the most significant route for gases, vapors, dust, mists or fumes.
2. Absorption of chemicals is generally through the skin.
3. Ingestion or swallowing chemicals is usually due to contamination of food or cigarettes.
4. Injection or entry of chemicals can happen due to cuts or open sores.

B. Exposure Limits

1. Permissible Exposure Limits (PEL's) and Threshold Limit Values (TLV's)
2. Time weighted average (TWA)
3. Short Term Exposure Limits (STEL)
4. Additive effects

C. Methods of Detection

1. Use of the five senses (smell, sight, hearing, taste, feel (skin irritation)).
2. Symptoms of overexposure
 - a. Observable by others:
 - Skin discoloration
 - Lack of coordination
 - Changes in demeanor

- Excessive sweating or salivation
- Pupil response
- Breathing difficulties
- Coordination changes
- Coughing

b. Non-Observable by others:

- Headaches
- Dizziness
- Blurred vision
- Cramps
- Irritation of eyes, skin or respirator tract

3. Air monitoring and evaluation by the Safety Division Industrial Hygienist

D. Recognition, Evaluation and Control

V. SDS

Section 1- Identification

Section 2- Hazard(s) Identification

Section 3- Composition/ Information on Ingredients

Section 4- First- aid Measures

Section 5- Fire-fighting Measures

Section 6- Accidental Release Measures

Section 7- Handling and Storage

Section 8- Exposure Controls/ Personal Protection

Section 9- Physical and Chemical Properties

Section 10- Stability and Reactivity

Section 11- Toxicological Information

Section 12- Ecological Information

Section 13- Disposal Considerations

Section 14- Transport Information

Section 15- Regulatory Information

Section 16- Other Information

VI. MATERIALS USED AT PPPL

Chemical Hazard Information by groups (e.g. Acids and Bases; Alcohols; Aromatic Hydrocarbons; etc.)