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# HAZARD COMMUNICATION PROGRAM

## PURPOSE

Chemical exposure may cause or contribute to many serious health effects such as heart ailments, kidney and lung damage, sterility, cancer, burns, and rashes. Some chemicals can also present potential physical hazards such as fires, explosions and/or other serious accidents.

To ensure that employees know about the hazards of chemicals and how to protect themselves, the Occupational Safety and Health Administration (OSHA) issued the Hazard Communication Standard (29 CFR 1910.1200), also known as "The Right to Know" or "HazCom" standard.

More recently, growth in international trade of chemical products resulted in inconsistencies in chemical labeling and classification. In 2012, the Hazard Communication Standard was revised to address those inconsistencies through the adoption of a "Globally Harmonized System", or GHS, established by the United Nations. This finalized standard is referred to as "HazCom 2012", or "GHS", and includes the new GHS requirements.

The GHS system makes the communication of hazards consistent through pictograms and other means that overcome language barriers, and provides information to chemical handlers through one label, as opposed to the many labels and languages formerly used to label chemical products. The GHS also provides a uniform approach to evaluating and classifying hazards, and to communicating those hazards through Safety Data Sheets or SDSs, formerly referred to as Material Safety Data Sheets, or MSDSs.

OSHA developed a phased-in adoption schedule for the revised standard ranging from December 1, 2013 to June 1, 2016. While the Drake University program components have been revised to meet the new regulatory requirements, employees should expect to see both old and new chemical labels and data sheets as manufacturers work to meet the compliance deadlines.

## SCOPE

Drake University's Hazard Communication Program is designed to inform all employees who potentially could be exposed to hazardous chemicals on the job, and reduce injuries and illnesses related to chemical exposures. This program applies to all Drake University employees/facilities except where exemptions are detailed below. Employees are covered by this standard if they:

• Work in a non-laboratory setting where any known hazardous chemical is stored or used,
And
• May be exposed to any hazardous chemical under normal working conditions, or in a foreseeable emergency

Exemptions

Drake University laboratory employees are covered by a separate workplace-specific standard, Occupational Exposure to Hazardous Chemicals in Laboratories (29 CFR 1910.1450). The requirements of this standard and program components are covered in Drake University's Chemical Hygiene Plan.

Also exempt from the Hazard Communication Standard are chemical products typically found in households, if they are not used with more frequency than typically used in a household setting. Examples of these may include dish detergent occasionally used in a break room, or glass cleaner used to occasionally clean work surfaces.

## RESPONSIBILITIES

The responsibility for an effective Hazard Communication Program requires compliance through product manufacturers and the cooperation of multiple departments at Drake University. The following subsections outline the responsibilities of the respective parties.

**Chemical Manufacturers**
Chemical manufacturers and importers are required to determine the hazards of each chemical they produce or sell and communicate this hazard information to the user through labels and safety data sheets (SDS's). They are required to provide hazard communication documentation to any user upon request. OSHA's GHS adoption allows for phased-in compliance for manufacturers through June 1, 2016. During that transition period, manufacturers will be transitioning from MSDSs to SDSs and GHS labeling, so your department will likely see both types of hazard communication up to that deadline.

**Drake University**
As an employer, Drake University must:
• Provide a written Hazard Communication Program.
• Inform employees about the Hazard Communication Standard.
• Explain how it's being put into effect in their workplace.
• Provide information and training on hazardous chemicals in the workplace
These requirements are met by the assignments of responsibility detailed in the following subsections.

**Supervisors**
Supervisors are most familiar with the tasks performed and products used within their departments. Therefore, they are responsible for:
• providing employees with hazard communication training, or facilitating their receipt of training
• assuring that the training occurs at hiring, and then as needed
• assuring that the training is documented
• working with the EH&S during periodic departmental compliance reviews

• maintaining a list of hazardous chemicals used by their employees
• maintaining an SDS collection for every hazardous chemical on their departmental list.
EH&S Staff is available to serve as a resource for Supervisors.

**Employees**
Drake University Employees who work with hazardous chemicals are responsible for:
• Completing required training
• Reading SDSs and labels prior to using hazardous chemicals
• Following safety instructions contained in SDSs and labels
• Following Drake University chemical labeling procedures
• Informing their Supervisor when adequate labeling or MSDSs are missing

**Office of Environmental Health & Safety (EH&S)**
EH&S is responsible for:
• Development and revision of the Hazard Communication Program
• Compliance review of Drake University Departments
• Consultation as needed in matters of Hazard Communication Training, SDS interpretation, labeling, and non-routine tasks.

**Contractors**
All contractor coordination with respect to health and safety programs is conducted through Drake University Facility Services. Contractors bringing hazardous chemicals on site are responsible for providing SDSs with appropriate hazard information. Drake University employees working in the vicinity of the contractor's work site may review the contractor's SDSs. In turn, SDSs of Drake University's chemicals used at the work site may be reviewed by the contractor's employees.

## DEFINITONS

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

**Container:** any bag, barrel, bottle, box, can, cylinder, drum, storage tank, etc. that contains a hazardous chemical.

**Hazardous chemical:** any chemical which is a physical or health hazard.

**Health hazard:** any chemical for which there is significant evidence that acute or chronic health effects may occur in exposed individuals.

**MSDS:** written information concerning a hazardous chemical.

**Pesticide:** for the purposes of this procedure, pesticide refers to any pesticide, herbicide, insecticide, or fungicide.

**RQ:** reportable quantity. Established by federal, state, and local agencies, it is the quantity of chemical, that if release to the environment, must be reported to these agencies. Most RQs can be found on EPA lists (SARA, CERCLA) or in the chemical's MSDS.

**Work area:** room or defined space in a work place where hazardous chemicals are produced or used, and where employees are present.

See Appendix 4 for a glossary of SDS and MSDS terms.

## PROCEDURE

The following subsections explain the general components required under OSHA's Hazard Communication Standard.

**Written Program**
All Drake University employees must be made aware of the Drake University Written Hazard Communication Program and its contents through their immediate Supervisor. Drake University EH&S Office is responsible for the development and maintenance of the Written Program. An electronic version of this program is available online. Supervisors are responsible for ensuring that employees have access to an online and/or paper copy of the document**.**

**Labeling and Other Forms of Warning**
Under the Hazard Communication Standard, chemical manufacturers are required to provide labeling on every container of hazardous chemicals they manufacture.
GHS labels may vary in appearance, but they are required to include the 6 specific elements. A training example is provided in Figure 1.

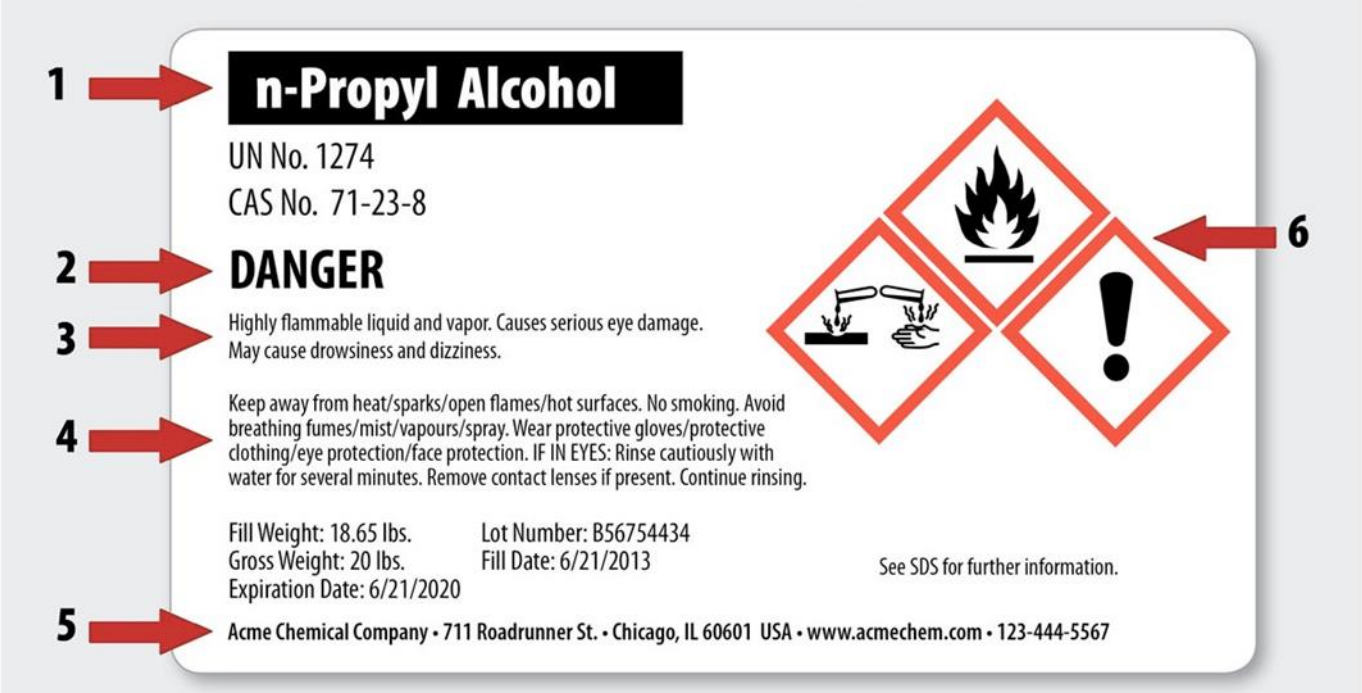



**Figure 1: Training Sample Label Courtesy of Weber Packing Solutions**

1 - Product Identifier: the product name provided here (n-Propyl Alcohol) should match the identifier on the product's Safety Data Sheet (SDS).

2 - Signal Word: A signal word is a single word on the label used to indicate the relative level of severity of a hazard and alert the reader to a potential hazard. The signal words used are "Danger" for the more severe hazards, while "Warning" is used for less severe hazards. Here, the manufacturer has used the word “DANGER” to indicate a more severe hazard.

3 - Hazard Statements: Hazard Statements are statements assigned to a hazard class that describes the nature of the products hazard, “may cause dizziness” for example.

4 - Precautionary Statements: Statements which describe recommended measures to minimize or prevent adverse effects resulting from exposure, “keep away from heat” for example.

5 - Supplier Identification: The name, address, and telephone number of the manufacturer or supplier, in case you need to contact them.

6 - Pictograms: Graphical symbol intended to convey specific hazard information visually, in the case of our sample label, the manufacturer has used 3 pictograms to denote hazards. Pictograms are explained in more detail in the following section.

**Pictograms**

Under GHS, graphical symbols called “pictograms” are used to convey specific hazards.
Product specific pictograms will be found on both GHS labels and within Safety Data Sheets (SDSs).
The nine established pictograms, and their conveyed hazards, are illustrated in Figure 2.


**Figure 2: GHS Pictograms**

**Secondary Labeling System**

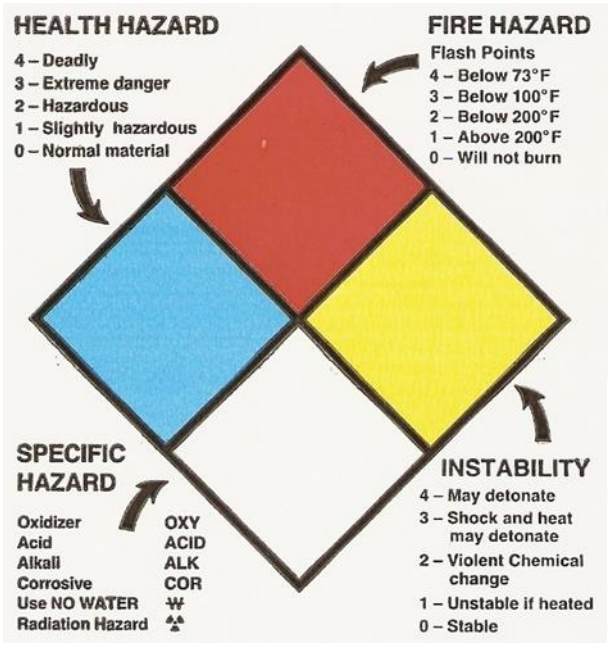
When transferring a chemical from one container to another, or replacing a damaged label, Drake University employees are required to label the new container properly to include:

- identity of the chemical
- appropriate hazard warnings (using the GHS format)

If you have questions, ask your supervisor or consult with EH&S Staff. Empty containers that may be reused for other purposes must have their original labels removed or obliterated and relabeled.

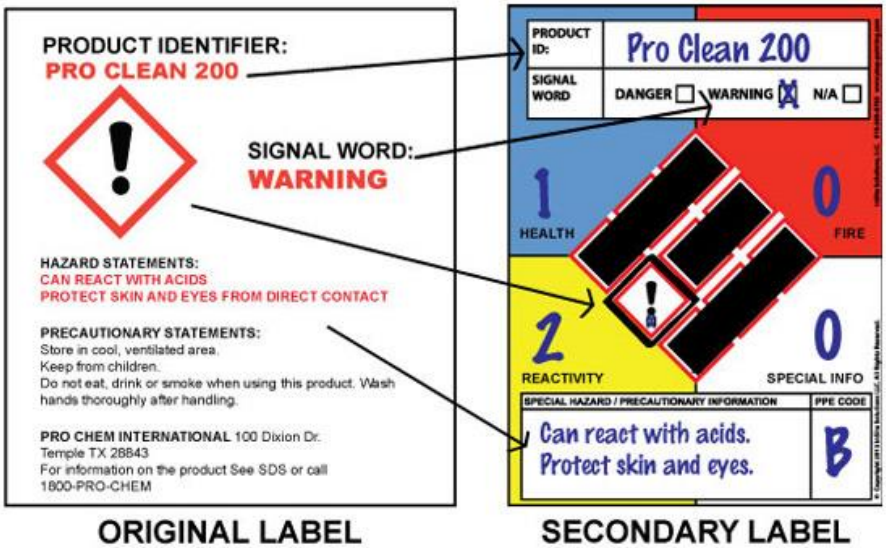
Prior to GHS adoption, Drake University promoted the NFPA (National Fire Protection Association) Hazard Warning Diamond labeling system. The NFPA Hazard Warning Diamond is based on the NFPA standard 704 rating system. This standard provides a readily recognized, easily understood system for identifying hazards and their severity using spatial, visual, and numerical methods to describe the relative hazards of a material. While this system is still used in the United States, it does not meet the GHS requirements. Therefore, the NFPA system can be used in addition to, but not in place of GHS labeling. Figure 3 provides a comparison between GHS hazard category and the NFPA 704 hazard ranking

systems. Although referring to the different systems can be confusing, keep in mind that the GHS hazard category systems are unlikely to be found on product labels. Both ranking systems may appear in SDSs, but the rankings are identified as either GHS or NFPA rankings.




**Classification of the substance or mixture**

According to Regulation (EC) No1272/2008
Flammable liquids (Category 2)
Acute toxicity, Inhalation (Category 4)
Acute toxicity, Dermal (Category 4)
Acute toxicity, Oral (Category 4)
Serious eye damage/eye irritation (Category 2)




ORIGINAL LABEL SECONDARY LABEL

| NFPA Hazard Ranking | GHS Hazard Categorization |
|---|---|
| 0-4 Hazard Range | 1-4 Hazard Range |

| | |
|---|---|
| 0 = Least Hazardous | 1 = Most Severe Hazard |
| 4= Most Hazardous | 4 = Least Severe Hazard |

**Figure 3: NFPA Hazard Rankings v. GHS Hazard Categories**

## List of Hazardous Chemicals

Under GHS, each department that uses hazardous chemical products is required to keep a written inventory, or "List of Hazardous Chemicals" at their location. This list must identify which chemicals are on-site, and should be kept current as new products are added to or removed from your inventory.

## Safety Data Sheets (SDS)

Safety Data Sheets (SDSs), previously called Material Safety Data Sheets (MSDSs), are standardized documents prepared by a product's manufacturer. SDSs provide in-depth information regarding the chemical's potential hazards and information on how one should protect themselves from these hazards. Federal law requires that they be produced by chemical manufacturers, distributors, importers or other responsible parties, and supplied to their chemical users.

SDSs are required to include the following sixteen sections of information:

- Product and company identification
- Hazards identification
- Information on ingredients
- First aid measures
- Firefighting measures
- Accidental release measures
- Handling and storage
- Exposure control/personal protection
- Physical and chemical properties
- Stability and reactivity
- Toxicological information
- Ecological information
- Disposal considerations
- Transport information
- Regulatory information
- Other information

SDSs can be requested from the manufacturer or distributor by phone, FAX or on the Internet. Many websites also have available collections of SDS/MSDSs. Contact EH&S if you have trouble obtaining an SDS/MSDSs for a product. SDS/MSDSs should be reviewed at minimum of semiannually to ensure that the most current and updated version is being utilized.

SDS's are usually considerably more informative than labels and they are a valuable source of hazard information. Hazards indicated on the label and the SDS for the same product will be consistent. Employees are responsible for reading the SDS before using a chemical substance.

**Hazardous, Non-Routine Tasks**

Supervisors planning to do non-routine tasks involving the use of hazardous chemicals (jobs that are not routine for an employee because of infrequency, location, or type, for example, the cleaning of tanks) must consult with EH&S prior to initiating work to discuss the hazards associated with the performance of these tasks. **Supervisors** must ensure that employees are informed of the hazards and required control measures, including safe work practices and proper personal protective equipment.

## TRAINING

Supervisors must provide or facilitate Hazard Communication training for their employees before they are assigned to work in areas where the possibility of exposure to hazardous chemicals exists, and whenever a new hazardous material is introduced into their workplace. EH&S Staff is available to assist supervisors with this task. Online training is available to all Drake University Employees. Under the Hazard Communication Standard, affected employees must receive training on the following:

- Location of the written Hazard Communication Program, list of hazardous materials and location of SDS and/or MSDSs.
- Description of the jobs where these hazards are present and special instruction for non-routine tasks.
- The physical and health hazards of chemicals they are exposed to in the workplace.
- Personal protection requirements for chemicals in the workplace.
- Ways to observe and detect the presence of hazardous chemicals in the workplace.
- Labeling requirements and explanation of the NFPA labeling system.

Training must be easy to understand and communicated orally, either in person or through audio or audiovisual means.

Additional employee training concerning workplace hazards when:

- Chemicals with new hazards are introduced into the workplace.
- Equipment changes are made which could cause new or increased employee exposure.
- Procedures and work practices are introduced or changed which could cause new or increased employee exposure.

- Employees are transferred from one work area to another where different hazards may be present.

**Documentation**

Supervisors must keep adequate documentation to show that Hazard Communication information and training has been provided. Meeting minutes, training evaluations, certification sheets, memoranda, training sign-in sheets all constitute training documentation. Those employees who take the Drake University Online HazCom Training will receive and email confirmation of completion. That completion is also recorded electronically through WeComply.

## EVALUATION

Appendix 1 can be used to perform an annual written gap analysis or program evaluation.

# APPENDIX 1

## Hazard Communication
## Program Compliance Audit Checklist

| | | Yes | No |
|---|---|---|---|
| 1. | Does a list of all the hazardous chemicals for the university and individual departments exist? | | |
| 2. | Are SDS/MSDS's available for each hazardous chemical used? | | |
| 3. | Is a system is in place to ensure that all incoming hazardous chemicals are labeled & SDS/MSDS's obtained ? | | |
| 4. | Do SDS/MSDS's contain all required information? | | |
| 5. | Are SDS/MSDS's available where necessary throughout the Campus? | | |
| 6. | Does a written hazard communication program exist? | | |
| 7. | Does a method to communicate to employees and others exist? | | |
| 8. | Are employees informed of protective measures for hazardous chemicals used in the work place? | | |
| 9. | Are employees aware of forms of warning, such as the in-plant labeling system? | | |
| 10. | Is there a periodic review of SDS/MSDSs to verify the most current version is on site and in use? | | |

| | |
|---|---|
| **Conducted by:** | |
| **Date:** | |

| | Actions Required | Responsibilities | Due Date | Completion Date |
|---|---|---|---|---|
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# APPENDIX 2

## Hazard Communication Examination

| | | |
|---|---|---|
| 1. Anyone who may become exposed to a hazardous chemical must receive training on the hazards when first assigned to the job and any time new chemicals are introduced into the work area? | **T** | **F** |
| 2. Secondary Containers with GHS Labels have numbers: (Check all that apply)<br>a. From 1-4<br>b. From 0-4<br>c. 4 is least Hazardous<br>d. 4 is most Hazardous<br>e. none of the above | | |
| Fill in the blanks.<br>3. GHS labels may vary in appearance, but they are required to include the _____specific elements. There are_____ different pictograms used to communicate hazards. | | |
| 3. If you transfer a chemical from a bulk container to a smaller container, you are required to label the container only if it contains more than one liter of a liquid or more than one kilogram of a solid? | **T** | **F** |
| 4. The greatest amount of information about a chemical can be found :<br>a. by asking an experienced co worker<br>b. reading the MSDS<br>c. reading the label<br>d. listening to the radio | | |
| 6. The most important reason for knowing about the hazards of chemicals is:<br>a. to improve product quality<br>b. to comply with governmental regulations<br>c. to minimize environmental pollution<br>d. to protect our safety and health<br>e. all of the above | | |
| 7. SDS/MSDS contain information about a chemicals: (Check all that apply)<br>a. physical properties and health hazards<br>b. reactivity and fire hazards<br>c. spill control procedures and necessary PPE<br>d. trade secrets<br>e. all of the above | | |
| 8. What types of hazards may exist around chemicals? (Check all that apply)<br>a. chemicals may be toxic<br>b. chemicals may be corrosive<br>c. chemicals may be flammable<br>d. chemicals may cause cancer or birth defects<br>e. all of the above | | |
| 9. Access to SDS/MSDSs are restricted to management and safety personnel? | **T** | **F** |
| 10. A list of all the hazardous materials and a written program for the university has to be developed? | **T** | **F** |

**Name** _____ **Date** _____

**Instructor** _____ **Score** _____

## ANSWER SHEET
## Hazard Communication Examination

1. True
2. A and C
3. 6 – 9
4. False – You are required to label all secondary containers unless the chemicals will be used right away (during the shift).
5. B
6. D
7. E – Trade secrets may be listed on a MSDS with further instruction to contact manufacturer for specific chemical information.
8. E
9. False – MSDS information needs to be accessible to all employees. It's important for all employees to know the location where the sheets are stored.
10. True

# APPENDIX 3

***Chemical Inventories are kept with the individual departments***

# APPENDIX 4

## GLOSSARY OF COMMON SDS/MSDS TERMS

### --A—

**Acute Effect** - An adverse health effect with a rapid onset. A simple example of an acute effect is an acid burn, which causes almost immediate skin irritation.

**Acute Toxicity** - The adverse health effects resulting from a single or short term over exposure to a substance.

**ACGIH** - American Conference of Governmental Industrial Hygienists

**Alcohols** - Family of hydrocarbon compounds containing one hydroxyl (-OH) group. In general, alcohols are irritating to mucous membranes and usually produce some narcotic effect.

**Aldehydes** - Family of relatively reactive hydrocarbon compounds bonded with oxygen. These compounds are potential eye, skin and respiratory system irritants. They have a reactive nature which means they can be used to produce a number of other chemicals.

**Aliphatic** - A large group of organic chemicals composed primarily of carbon and hydrogen. Common in petroleum products and they are major ingredients of products like gasoline, paint thinner and natural gas.

**Aliphatic Amines** - Family of hydrocarbon compounds which are derivatives of ammonia (NH3). These tend to have the characteristic ammonia smell and are strongly alkaline (caustic) compounds which may be highly irritating to the eyes, skin and respiratory systems.

**Ambient Conditions** - Normal or typical surrounding temperature and pressure conditions.

**ANSI** - American National Standards Institute

**Anoxia** - A deficiency of oxygen in the blood. Overexposure to certain chemical can cause anoxia. Carbon monoxide, for a simple example, bonds with blood hemoglobin and prevents it from taking oxygen to the cells.

**Aromatic Hydrocarbons** - Group of organic chemicals composed of carbon and hydrogen. Each chemical in the group has one-sixth member carbon ring which is known as an aromatic nucleus or benzene ring. Benzene, toluene and xylene are three of the many types of aromatic hydrocarbons.

**Asphyxiants** - Vapors or gasses that may cause unconsciousness or death by suffocation (lack of oxygen). Most simple asphyxiants are only harmful to the body when they become so concentrated that the amount of oxygen in the air is reduced to dangerous levels (18% or lower). Asphyxiation is one of the potential hazards of working in confined spaces.

### --B—

**Boiling Point** - The temperature at which a liquid changes to a vapor state at a given pressure. Boiling point is usually expressed in degrees F at a pressure of 760 mm Hg (one atmosphere). Each liquid has a different boiling point at a given pressure.

## --C—

**Carcinogen** - A chemical, substance or agent capable of causing or producing cancer.

**Ceiling "C"** - A type of chemical exposure standard established by OSHA and ACGIH which indicates the maximum allowable exposure level for a given chemical. Most chemicals do not have ceiling limits.

**Chemical Family** - A group[ of chemicals that are structurally related. The chemicals of a given family often have similar component parts and chemical characteristics.

**CHEMTREC -** Chemical Transportation Emergency Center is a national center established by the Chemical Manufacturers Association (CMA). CHEMTREC relays pertinent emergency information concerning specific chemicals. CHEMTREC has a 24-hour toll free telephone number (800-424-9300) for use by those who respond to chemical transportation emergencies.

**Chloracne -** An acne-like skin problem caused by overexposure to certain chlorinated compounds.

**Chlorinated Compounds -** Chemical compounds which have one or more chlorine atoms. See halogenated compounds.

**Cholinesterase -** An enzyme associated with the nervous system.

**Chronic Effect -** An adverse health effect with symptoms that develop slowly over a long period of time or which recur frequently. A simple example of a chronic effect is cirrhosis of the liver cause by long-term alcohol abuse.

**Chronic Toxicity -** The adverse heath effects resulting from long-term **overexposure** to a substance.

**CNS -** Central nervous system

**CO -** Carbon monoxide is a colorless, odorless and tasteless toxic gas produced by the incomplete combustion of carbon.

**$CO_2$ -** Carbon dioxide is a heavy, colorless and odorless gas produced by combustion and decomposition of organic substances. $CO_2$ will not burn and is relatively non-toxic, so it is often used as a fire extinguishing agent.

**Corneal -** Pertaining to the cornea of the eye

**Corrosive -** Liquid or solid substances that cause destruction or alterations of skin at the sire of contact. Acids, alkalies, and oxidizers are examples of corrosive substances.

**Cutaneous -** Pertaining to the skin

## --D –

**Decomposition -** Breakdown or a material or substance by heat, chemical reaction, electrolysis, decay or other processes.

**Dermal -** Relating to the skin.

**Dermal Toxicity -** Adverse health effects resulting from overexposure of the skin to a substance.

**Dermatitis -** An inflammation of the skin. Dermatitis has many causes including disease, allergies and chemical exposure. Many industrial chemicals can cause dermatitis when they are used without appropriate gloves.

**DOL -** U.S. Department of Labor

**DOT -** U.S. Department of Transportation

## --E--

**Edema -** The excessive accumulation of fluid in tissue spaces.

**Endocrine -** Pertaining to the glands which secrete hormones.

**Endocrine Glands -** The glands which produce hormones including the pituitary, thyroid, parathyroid, pancreas, adrenal, ovary, and testis.

**EPA -** U.S. Environmental Protection Agency

**Epidemiology -** The science which deals with the study of diseases and health effects in specific populations in an effort to provide information about the causes.

**Esters -** A large family of organic chemicals widely used in industry and commerce. Certain esters are found naturally in fruits (e.g., bananas) and account for the smell and taste of the fruit. Other esters are used in soap, perfume and general purpose solvents. Ethyl acetate and butyl acetate are examples of two esters often used in solvents and paints.

**Ethers -** A large family of organic chemicals with many important industrial uses. Ethyl ether, commonly known as ether, has been used as a general anesthetic. Certain ethers (e.g., glycol ethers) have commercial uses in solvents, paints, lacquers, cleaning and spotting agents.

**Evaporation Rate -** A term used to express the relative rate of evaporation for a chemical when compared to the known evaporation rate of a **standard** liquid. The standard liquid is usually

**normal butyl acetate** (NBUAC or n-BuAc). Evaporation rates of chemicals derived using n-BuAc are classified as fast, medium and slow using the following guidelines:

**FAST Evaporating -** Rates greater than 3.0
**MEDIUM Evaporating -** Rates between 0.8 and 3.0
**SLOW Evaporating -** Rates less than 0.8

## --F--

**F, °F -** Fahrenheit when used in the context of temperature.

**Fire Classifications -**

**Class A:** Fires involving ordinary combustible materials such as paper, wood and cloth. Also includes some fires involving rubber and plastic.
**Class B:** Fires involving flammable or combustible liquids, flammable gases, greases and similar materials. Also includes some fires involving rubber and plastics.
**Class C:** Fires involving energized electrical equipment.
**Class D:** Fires involving combustible metals such as magnesium or titanium.

**Flammable -** Non-specific term meaning easily ignited.

**Flammable and Combustible Liquid Classifications -**

**CLASS 1A FLAMMABLE LIQUIDS -** Have flash points below 73°F (22.8°C) and boiling points below 100°F (37.8°C).
**CLASS1B FLAMMABLE LIQUIDS -** Have flash points below 73°F (22.8°C) and boiling points at or above 100°F (37.8°C).
**CLASS 1C FLAMMABLE LIQUIDS -** Have flash points between 73°F (22.8°C) and 100°F (37.8°C).
**CLASS 11 COMBUSTIBLE LIQUIDS -** Have flash points between 100°F (37.8°C) and 140°F (60°C)
**CLASS 111A COMBUSTIBLE LIQUIDS -** Have flash points between 140°F (60°C) and 200°F (93.3°C).
**CLASS 111B COMBUSTIBLE LIQUIDS -** Have flash points at or above 200°F (93.3°C).

**Flammable Gases -** Compressed gases which will ignite in air at concentrations of 13% or less by volume. Also those gases which have a flammability range in air of 12% or more regardless of lower flammable limit (lfl).

**Flammable Solids -** Solids which ignite readily and burn vigorously as a result of friction, moisture absorption or spontaneous chemical changes.

**Flammable Range -** The numerical difference between the upper and lower flammable limits.

**Flash Point -** The initial temperature at which a liquid will produce enough flammable vapor to ignite in the presence of an ignition source. Flash point can be used to categorize the potential fire hazards of flammable and combustible liquids as follows:

**Severe Fire Hazards** include liquids with flash points below 100°F (37.8°C).
**Moderate Fire Hazards** include liquids with flash points between 100°F (37.8°C) and 200°F (93.3°C)
**Slight Fire Hazards** include liquids with flash points above 200°F (93.3°C).

**Formula -** The shorthand notation used by chemists to identify specific chemicals. A simple example is carbon dioxide which has the chemical formula $CO_2$.

## --G--

**g -** Gram is a metric unit of weight. One ounce equals 28.35 grams.

**General Exhaust Ventilation -** A ventilation system for removing air and contaminants from and entire work area.

**Glycol Ethers -** Group of five related ethers that are colorless liquids with a slight odor. Glycol ethers are occasionally used in solvents, paints, lacquers and cleaning compounds. The synonym **cellosolve** is frequently used for glycol ethers (e.g., methyl cellosolve or cellosolve acetate).

## --H--

**Halogens -** The group of atoms known as halogens includes chlorine, bromine, fluorine and iodine.

**Halogenated Compounds -** Chemicals that contain one or more halogen atoms (e.g., carbon tetrachloride contains four chlorine atoms).

**Hazardous Chemicals -** All chemicals listed by OSHA in 29 CFR 1910, Subpart Z, Toxic and Hazardous Substances (i.e., Chemicals with OSHA Standards). All chemicals which gave published ACGIH Threshold Limit Values (TLVs) are also considered hazardous chemicals under the OSHA Hazard Communication Standard. Additionally, any chemical which is considered a carcinogen or potential carcinogen by OSHA, NTP (National Toxicology Program) or IARC (International Agency for Research on Cancer).

**Hepatic -** Pertaining to the liver

**Hydrocarbons -** Class or organic compounds that are composed exclusively of carbon and hydrogen atoms. This class of compounds includes several hundred thousand chemicals.

## --I--

**IARC -** International Agency for Research on Cancer.

**Ignitable -** Capable of being set afire.

**Incompatible -** Materials which could cause dangerous reactions from direct contact with one another are defined as incompatible.

**Industrial Hygiene -** The study and control of occupational factors that may cause sickness, impaired health or significant discomfort of employees.

**Inebriation -** State if intoxication or disorientation characterized by symptoms including loss of balance, lack of coordination or drunken behavior. Inebriation can be caused by excessive exposure to alcohol and certain other organic chemicals. A state of inebriation caused by chemical exposure is often a symptom of overexposure.

**Inert -** Chemical substances which do not react or are physiologically inactive.

**Inflammation -** The reaction of tissues to injury or irritation characterized by symptoms (i.e., inflammatory responses) like pain, tenderness, redness, swelling, heat and edema. The symptoms may be confined to the site of injury or irritation (i.e., localized inflammatory responses) or in some cases to the entire body (i.e., systemic inflammatory responses.

**Ingestion -** The process of eating, drinking or inadvertent consumption which involves taking a substance into the body through the mouth.

**Inhalation -** The process of drawing air into the lungs (i.e., breathing).

**Inhalation Hazards -** The respiratory hazards which may result from overexposure to the gases, vapors, fumes, mists and dusts of many chemicals which enter or affect the body through the respiratory system.

**Irritants -** Chemical substances which may cause inflammatory responses or reactions of the eyes, skin or respiratory system.

## --K--

**kg -** Kilogram is a metric unit of weight equivalent to 2.205 U.S. pounds.

**Ketones -** A family of organic compounds which are similar in their chemical and toxicological characteristics. Ketones are flammable, colorless liquids with pungent odors similar to acetone. Ketones are widely used in general purpose solvents.

## --L--

**L, l -** Liter is a metric unit of capacity (volume) equivalent to 1.057 U.S. quarts.

**Lacrimators -** Chemical substances which irritate the eyes and cause tears to form (e.g., tear gas).

**$LC_{50}$ -** Lethal Concentration 50 is the minimum concentration of a chemical that will kill 50% of a group of test animals. $LC_{50}$ values may be expressed in units of parts per million or milligrams per cubic meter.

**$LD_{50}$ -** Lethal Dose 50 is the minimum amount (dose) of a chemical which will kill 50% of the experimental test animals when administered a single time. $LD_{50}$ values are expressed with units of milligrams of chemical per kilogram of animal body weight. $LD_{50}$ data typically indicates the type of animal and method of dose administration (e.g., Rat-Oral $LD_{50}$ = 5- mg/kg).

**LEL, lel or LFL, lfl -** The lower explosive limit or lower flammable limit of a vapor or gas is the minimum percent concentration of the substance in air that will explode or produce a flash of fire when an ignition source is present. At concentration below the LEL or LFL the substance is too lean to burn.

**Local Exhaust Ventilation -** A ventilation system designed to capture and exhaust contaminants from the air at the point where the contaminants are produced.

## --M--

**M, m -** Meter is a metric unit of length equivalent to 39.37 inches.

**$M^2$, $m^2$ -** Square meter is a metric unit of area equivalent to 10.76 square feet.

**$M^3$, $m^3$ -** Cubic meter is a metric unit of volume equivalent to 35.315 cubic feet or 1000 liters.

**Melting Point -** The temperature at which a solid chemical changes to a liquid.

**mg/kg -** Milligrams per kilogram is a metric unit often used to express toxicological dose.

**mg/$M^3$, mg/cu.M. mg/$m^3$, mg/cu.m -** Milligrams per cubic meter is a metric unit for expressing concentrations of dusts, gases or mists in air.

**Miscible -** Capable of being mixed or dissolved.

**ml -** Milliliter is a metric unit of volume equivalent to one cubic centimeter.

**mm -** Millimeter is a metric unit of length equivalent to 1/1000 of a meter. It is occasionally used as a shorthand for mm Hg.

**mm Hg -** Millimeters of mercury is a metric unit of pressure.

**mppcf -** Millions of particles per cubic foot is a rarely used unit for expressing concentrations of dust particles suspended in air.

**Mutagen -** A substance or agent capable or altering the genetic material in a living cell.

**Mutagenic -** Capable of causing or inducing a cellular mutation.

**Mucous Membranes -** Mucous secreting linings or respiratory, gastrointestinal and urinogenital passageways.

## --N--

**NaOH -** Sodium hydroxide or caustic soda which is a strong base.

**Narcosis** - Unconsciousness or stupor produced by overexposure to certain chemicals.

**NFPA -** National Fire Protection Association.

**Nephric -** Pertaining to the kidney.

**Nephro- -** Pertaining to the kidney.

**Nephron -** The basic structural and functional unit of the kidney.

**Neuron -** A nerve cell, the structural and functional unit of the nervous system.

**Neuropathy -** Any dysfunction of the nervous system.

**NIOSH -** National Institute for Occupational Safety and Health

**NTP -** National Toxicology Program

## --O--

**Olfactory -** Pertaining to the sense of smell.

**Oral -** Pertaining to the mouth or region of the mouth.

**Oral Toxicity -** Adverse effects resulting from taking a substance into the body via the mouth.

**Organic -** A chemical term indicating almost all compounds that contain one or more carbon atoms. Certain materials which contain carbon are not considered organic compounds. Some of these include certain oxides of carbon (e.g., carbon monoxide), graphite and carbide. Organic compounds comprise the cast majority of chemicals handled by newspaper employees.

**OSHA -** Occupational Safety and Heath Administration.

**Oxidation -** A type of chemical reaction with the potential to produce significant amounts of energy (e.g., the explosion of gunpowder). Controlled oxidation reactions are widely used in industry for chemical processing, adhesive materials, and cleaning. Uncontrolled oxidation caused by a strong oxidizing agent can be very dangerous. Care should always be taken in handling and storage of any strong oxidizers. Oxidation reactions occur simultaneously with reduction reactions.

**Oxidation-Reduction -** A major type of chemical reaction which involves the simultaneous oxidation and reduction of two or more substances. This type of reaction can result in significant

amounts of heat and energy. Oxidation-Reduction reactions are sometimes called **REDOX** reactions.

**Oxidizing Agents -** Chemicals which are readily reduced in the presence of reducing agents. Oxidizing agents either yield oxygen or gain electrons during an oxidation-reduction reaction.

## --P--

**PAH -** Polynuclear aromatic hydrocarbons are a group of chemicals that have two or more aromatic nuclei (e.g., six-member carbon rings). Naphthalene, Benz (a) pyrene, chyrsene and anthracene are four examples of PAH compounds.

**PEL -** Permissible exposure limit is the legal exposure limit established by OSHA for regulated chemicals. PEL are published by OSHA in **29 CFR 1910.1000.** When exposures are maintained at or below the PELs, OSHA believes that nearly all workers may be repeatedly exposed day after day with no adverse effects. PELs are based on the best available information from industrial experience, experimental human and experimental animal studies.

**Peripheral Neuropathy -** Dysfunction of the peripheral nerves (i.e., sensory, motor, reflex, and vasomotor nerves).

**Percent (%) Volatile -** The percentage of a liquid or solid (by volume) that will vaporize or evaporate at a given temperature (typically 70°F). Certain chemicals like butane, gasoline, and mineral spirits are 100% volatile. Other chemicals, such as paint, are only partially volatile (i.e., the paint thinner will evaporate but the pigment will not).

**Petroleum Distillates -** Various organic chemicals which result from refining (distillation) of crude oil (petroleum). All refined petroleum oils, fuels and many common solvents (e.g., Stoddard Solvent and mineral spirits) are petroleum distillates.

**pH -** A measure of chemical acidity or alkalinity. The pH scale goes from 1 (extremely acidic) to 14 (extremely caustic). Solutions like distilled water which are essentially neutral have a pH near 7. Chemicals which are not water soluble do not have a pH.

**Poison, Class A -** Term used for extremely poisonous gases or liquids. These chemicals are so toxic that even small amounts mixed with air are potentially dangerous to life.

**Poison, Class B -** Term used for liquid, solid, paste or semi-solid substances which are potentially very toxic if they come in contact with the body.

**Polymerization -** A reaction in which small chemical molecules combine to form larger molecules (polymers). **Hazardous polymerization** is an uncontrolled reaction where polymer formation occurs rapidly and releases large amounts of energy.

**PPB, ppb -** Parts per billion is a unit for expressing concentrations of gases and vapors in air. PPB indicates the number of molecules of gas or vapor contained in a billion molecules of air. PPB may also be used to express the concentration of a substance in a liquid or solid.

**PPM, ppm -** Parts per million is a unit used for expressing concentrations of gases and vapors in air. PPM indicates the number of molecules of gas or vapors contained in a million molecules of air. PPM may also be used to express the concentration of a substance in a liquid or solid.

**psi, psia, psig -** Pounds per square inch is a unit of pressure. For certain technical situations, pressure may be expressed in units of **psig** (pounds per square inch gauge) or **psia** (pounds per square inch absolute).

**Pulmonary -** Pertaining to the lungs.

## --R—

**Reaction -** A chemical transformation or change involving the interaction of two or more chemicals to form one or more new substances (e.g., a reaction between hydrogen and oxygen produces water).

**Reactivity -** A measure of the tendency for a substance to undergo an uncontrolled chemical reaction with the release of energy. Undesirable effects including pressure buildup, temperature increase and the formation of noxious, toxic or corrosive by-products may occur in conjunctions with an uncontrolled chemical reaction.

**Reducing Agents -** Chemicals which are readily oxidized in the presence of oxidizing agents. Reducing agents either combine with oxygen or lose electrons during an oxidation-reduction reaction.

**Reduction -** A type of chemical reaction which occurs simultaneously with oxidation.

**Renal -** Pertaining to the kidneys.

**Respiratory System -** The breathing system including the lungs, trachea (windpipe), larynx, mouth, nose and the associated portions of the nervous and circulatory systems.

**RCRA -** Resource Conservation and Recovery Act

## --S—

**Salts -** Inorganic chemicals typically composed of two charged ions (groups of atoms). One ion has a positive charge and the other a negative charge. These ions tend to separate when dissolved in a liquid such as water. A simple example is sodium chloride (table salt) which is composed of positive sodium ions and negative chloride ions.

**Sensitization -** The process by which an individual is rendered sensitive to an allergen or chemical.

**Sensitization Response -** The uncontrolled, allergic like responses that occur when a sensitized individual is exposed to the sensitizing agent (i.e., sensitizer).

**Sensitizer -** A substance or event which induces sensitization or elicits a sensitization response (allergic reaction). The first exposure to a sensitizer typically causes little or no reaction. However, subsequent exposures may cause marked adverse responses which are not necessarily limited to the contact site.

**Solubility in Water** - A term expressing the percentage of a material (by weight) that will dissolve in water at room temperature. Categories used to express varying degrees of solubility include:

| | |
|---|---|
| **Negligible** | Less than 0.1% soluble |
| **Slight** | 0.1 to 1.0% soluble |
| **Moderate** | 1 to 10 % soluble |
| **Appreciable** | Greater than 10% soluble |
| **Complete** | 100% soluble |

**Solvent -** A liquid which will dissolve or dispense other substances.

**Specific Gravity -** The relative weight of a substance as compared to the weight of an equal volume of water. For a simple example, assume that a certain volume of a chemical weighs 8 pounds and an equal volume of water weighs 10 pounds. The chemical has a specific gravity of 0.8 (i.e., 8 divided by 10 equals 0.8). Insoluble materials with specific gravities less than 1.0 tend to float in a layer above water. Insoluble materials with specific gravities greater than 1.0 tend to sink and form a layer underwater.

**Stability -** An expression of the tendency for a material to remain unchanged. A material is usually considered stable if it remains in the same form under typical conditions of use and storage.

**STEL -** Short term exposure limit is a term used by the ACGIH when referring to the airborne concentration of a substance to which workers can be exposed to continuously for a short period of time without suffering adverse health effects. A STEL is defined as a 15-minute time-weighted average exposure which should not be exceeded at any time during the work day even if the eight-hour time-weighted average is within the TLV. STEL exposure should not be longer than 15 minutes for a maximum of four such periods per day with at least 60 minutes between exposure periods. The STEL is designed to supplement the TLV-TWA where there are possible acute effects from a substance whose effects are mainly chronic.

**Surfactants -** Materials used to change the surface chemistry of liquids. A simple example illustrating the action of surfactants is the effects of detergents on water. Water and oil do not ordinarily interact with one another. However, when detergents are added to water the surface chemistry is changed and water is able to dissolve oil.

**Synonym -** An accepted name or expression which may be used as an alternative name for something. In chemistry, synonyms are additional names by which certain chemical compounds are known. For example, methyl alcohol is also known by the synonyms methanol and wood alcohol.

**System Toxicity -** Adverse effects to the liver or kidneys resulting from overexposure to a chemical substance. May also refer to effects of a substance which is absorbed by an organ of the body independent of the site of entry.

## --T--

**Teratogen -** A substance capable of causing damage to a developing embryo or fetus.

**Teratogenic -** Capable of causing or producing damage to a developing embryo or fetus.

**TLV -** A Threshold Limit Value is a recommended exposure standard established by ACGIH. The legal exposure standards applicable to newspapers are established by OSHA. However, TLVs are intended to be used as **guidelines** for good practices. When exposures are maintained at or below the TLVs, ACGIH believes that nearly all workers may be repeatedly exposed day after day with no adverse effects. TLVs are based on the best available information from industrial experience, experimental human studies, and experimental animal studies. ACGIH establishes three types of TLVs including: TLV-Ceiling, TLV-STEL and TLV-TWA.

**Tolerance -** An increased ability to withstand irritating materials. Tolerance to many irritants develops over a period of time with repeat exposures.

**Toxic -** Poisonous or pertaining to poisons.

**Toxicity -** The adverse effects resulting from overexposure to a toxic material.

**Toxicology -** The study of the harmful effects of toxic chemicals on living organisms.

**Trade Name -** The registered trademark name or commercial trade name for a material (e.g., VARSOL*).

**TWA -** Time-weighted average is an 8-hour exposure limit (TLV) established by ACGIH. TWA values correspond to OSHA Permissible Exposure Limits (PEL). TWA values are the most common type of TLV. When exposure are maintained at or below the TWA values, ACGIH believes that nearly all workers maybe repeatedly exposed day after day with no adverse effects. TWAs are based on the best available information from industrial experience, experimental human studies and experimental animal studies.

## --U--

**UEL, uel, or UFL, ufl -** Upper explosive limit or upper flammable limit of a vapor or gas is the maximum percent concentration of the substance in air that will explode or produce a flash of fire when an ignition source is present. At concentrations above the UEL or UFL, insufficient oxygen exists to support combustion.

**µg -** Microgram is a metric unit of weight equivalent to 1/1,000,000 of a gram.

**Unstable -** Tending toward uncontrolled, violent decomposition or other unwanted chemical change during normal handling or storage.

## --V--

**Vapor Density -** The relative weight of a given volume of vapor or gas when compared to the weight of an equal volume of air which is assigned a value of 1.0 (i.e., air = 1). Materials

heavier than air have vapor densities greater than 1.0. All vapors and gases will mix with air, but the lighter materials will tend to rise and dissipate. Heavier vapors and gases tend to sink and are likely to concentrate in low places or confined spaces.

**Vapor Pressure -** The pressure exerted by a saturated vapor above its own liquid in a closed container at a given temperature. The units of vapor pressure are usually mm Hg. Vapor pressure increases with increasing temperature.

**Vascular** - Pertaining to the blood vessels.

**Vehicle -** The liquid portion of paint or ink which is the carrier of the pigment. Oil is a common vehicle for paint and inks. Water is used as a vehicle for latex paint and water-based inks.

**Ventilation -** A system or equipment for circulating fresh air in and foul air out of an area.

**Vesicants -** Chemical substances which cause blistering.

**Volatile -** Chemicals which are readily vaporized or changed to a gas are known as volatile. These chemicals also tend to readily evaporate at comparatively low temperatures.