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REGION 6 LEPC Update



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This month, we will be looking at Material Safety Data Sheets, and how reading one accurately help help first responders, as well as emergency planners understand chemical hazards they may have stored or transported through their community. This is a comprehensive guide, with many varied sources.

We also have an entertaining article from Fred Cowie on being realistic when conducting local emergency preparedness.

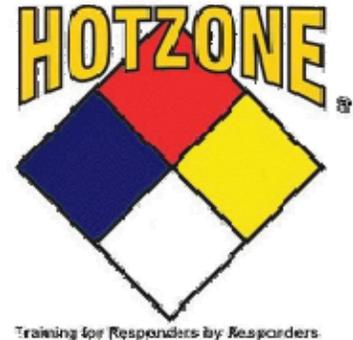
As always, if you received this Update from someone else, and would like to be added to the email list, just email us at one of the emails above.

Steve & Angie

10th Annual HOTZONE Conference

The goal of the HOTZONE conference is to train and equip local, state and federal responders for safe, coordinated and efficient response to releases of hazardous materials which threaten public health and the environment.

People who should attend include local fire, police, emergency management personnel, emergency medical services, health care providers, and state and federal response personnel who participate directly in the incident command system or in its immediate support at the scene of a hazmat response or terrorist event in Federal Region 6.



*THIS YEAR, HOTZONE 10 will be held:
October 22-25, 2009 -- Crowne Plaza Hotel - Reliant Park -- Houston, TX*

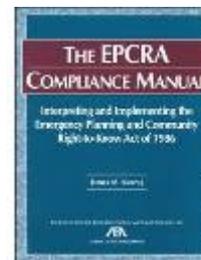
GO TO OUR WEBPAGE FOR MORE CONFERENCE INFORMATION and REGISTRATION, www.hotzone.org

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Understanding Material Safety Data Sheets

The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 establishes requirements for industry regarding emergency planning and "community right-to-know" reporting on hazardous chemicals.

Section 311(a) states: "The owner or operator of any facility which is required to prepare or have available a material safety data sheet for a hazardous chemical under the Occupational Safety and Health Act of 1970 and regulations promulgated under that Act (15 U.S.C. 651 et seq.) shall submit a material safety data sheet for each such chemical, or a list of such chemicals... to each of the following: the appropriate LEPC, State Emergency Response Commission (SERC), and fire department with jurisdiction over the facility."



MSDSs contain vital information LEPCs and SERCs utilize for planning purposes and fire departments utilize for response purposes.



This guidance can assist these groups in reviewing MSDSs for required and additional information provided.

The chemical manufacturer/ distributor reviews and evaluates the physical, chemical, and toxicological properties of its products based on data and information provided by various agencies, societies, scientific groups, and its own laboratory.

The Basics

By the way, never say MSDS Sheet... it's redundant... like Local LEPC...

What is a Material Safety Data Sheet (MSDS)?

- A MSDS is designed to provide both workers and emergency personnel with the proper procedures for handling or working with a particular substance. MSDSs include information such as physical data, toxicity, health effects, first aid, reactivity, storage, disposal, protective equipment, and spill/leak procedures. These are of particular use if a spill or other accident occurs. MSDSs vary in length depending on their format, content, and font size, from 1 to 10 pages, with most being 2 to 4 pages.

Who are MSDS's for?

- MSDS's are meant for:
 - Employees who may be occupationally exposed to a hazard while at work.
 - Employers who need to know the proper methods for storage etc.
 - Emergency responders such as fire fighters, hazardous material crews, emergency medical technicians, and emergency room personnel.

MSDS's are **not** meant for consumers. An MSDS reflects hazards of working with the material in an occupational fashion. For example, an MSDS for paint is not really pertinent to someone who uses paint once a year, but is extremely important to someone who does this in a confined space 40 hours a week.



The major hazard categories considered when preparing MSDS warning statements are:

- acute toxicity by all routes of exposure;
- chronic toxicity including carcinogenicity and teratogenicity;
- potential for irritation and sensitization;
- potential for the material to be swallowed; and,
- flammability and explosivity.

Information on the use and handling of products is then reviewed, simplified, and published as an MSDS. Many companies choose to produce their own MSDS format, thereby, causing confusion to those trying to interpret the information.

At a minimum, an MSDS should provide the following information:

- Name of the chemical, or chemical blend, and when appropriate, chemical formula, common synonyms, and chemical family.
- Name of manufacturer, manufacturers address, emergency and/or technical telephone number, name of preparer, and date of preparation.

- HAZARDOUS ingredients and regulatory exposure limits if determined by OSHA, ACGIH, or NIOSH.
- Physical data.
- Fire and explosion hazard data.
- Health data, including symptoms and first aid procedures.
- Reactivity data.
- Spill and/or leak procedures to prevent additional damage to the environment.
- Special information for breathing, eyes, and skin protection.
- Special precautions, including disposal information.
- The MSDS may contain regulatory compliance information for federal and state agencies.



The American National Standards Institute (ANSI) have provided standard headings for MSDSs:

- | | |
|---|-------------------------------------|
| 1. Chemical products and company identification | 9. Physical and chemical properties |
| 2. Composition/information on ingredients | 10. Stability and reactivity |
| 3. Hazards identification | 11. Toxicological information |
| 4. First-aid measures | 12. Ecological information |
| 5. Fire-fighting measures | 13. Disposal information |
| 6. Accidental release measures | 14. Transport information |
| 7. Handling and storage | 15. Regulatory information |
| 8. Exposure controls/personal protection | 16. Other information |

An understanding of the data on an MSDS is critical for proper response during an incident. This understanding can help prevent accidents and injuries.



MSDSs are prepared by many different manufacturing, supply, wholesale companies, and numerous consultants. Therefore, MSDSs will be of different quality. However, a properly prepared MSDS should have all sections fully completed.

If information is not applicable, or no information is available, the space on the MSDS must be marked so.

It is important to remember that an MSDS is not a complete source of health and safety information on its own.

This is because MSDSs are usually written for many different work sites and, therefore, cannot be specific in the advice they offer. They are an essential starting point for developing a complete health and safety program for a material.

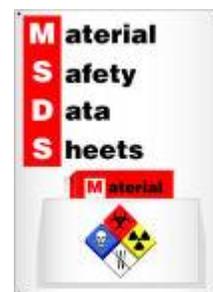
Important Questions To Answer When Reading An MSDS

Identification

- ___ Do you have the right MSDS for the material with which you are responding to?
- ___ Do you have an up-to-date MSDS?
- ___ Does the MSDS description of the material match the material you are responding to?

Potential Hazards

- ___ Can this material burn or explode?
- ___ Is this material unstable? If so, under what conditions?
- ___ Can this material react with other chemicals? If so, which ones?
- ___ Can this material harm your health? Do you know the symptoms which may warn you of exposure?
- ___ Have you discussed the health effects information with your doctor?
- ___ Can this material cause harm to the environment?



Preventive Measures

- ___ Does the response site need engineering controls?
- ___ Does this material require special handling precautions?
- ___ Do you need protective equipment?
- ___ Do you need to be careful when mixing this material with any other chemicals?
- ___ Does this material require special storage conditions?

Emergency Measures

- _____ Do you know what to do in case of a fire or explosion?
- _____ Do you know the first aid measures needed in case of an exposure?
- _____ Do you know what to do in case of a spill or leak?
- _____ Do you know where the emergency response equipment is and how to use it?



Explanation of Selected Sections on an MSDS

1. Chemical Products and Company Identification

IDENTITY: Name of material is provided here. Material name on MSDS should match exactly what is labeled on container (i.e. trade name, common name). If material has more than one name, each will be listed. Usually, trade name is adopted name given by manufacturer to distinguish it as his product and may be protected as a trademark. It is a good practice to list the Chemical Abstract Service (CAS) registry number. Formula may also be provided.

MANUFACTURER: Name, address, and telephone numbers (information and emergency) of the company that produced the material is provided here. Preparer's signature may be attached. Date prepared (or revised date) is provided.

DOT INFORMATION: Provides the generic class assigned by DOT, the United Nations (UN) identification number used on placards and labels, and the class that must be placed on the label of the container.

Importance of Information: Thousands of materials have similar names and compositions. First responders must be sure that the MSDS that they obtain from a facility matches with the material on-site. The supplier's telephone number can be vital during an incident in obtaining additional information on the material.

2. Hazardous Ingredients/Identify Information



HAZARDOUS COMPONENTS: Left column lists hazardous components of material. If material is a pure substance, then only one substance will be listed. If substance is a mixture, then all hazardous components must be listed, primary component by percentage first. Other components are then listed by decreasing percentage. Total percentage of mixture should equal 100%.

If mixture contains non-hazardous components, simply list these as "Non-Hazardous Components" and their total percentage. CAS numbers should be listed if available. If specific chemical composition is unknown, list general composition information. Identities of hazardous components must be listed.

A manufacturer may claim trade secret the name of an ingredient if it is hazardous. However, even if not identified by name, manufacturer must delineate hazards of trade secret ingredient. Information must also be supplied to safety personnel if they have supportable evidence for such a request.

PERCENTAGE: This column gives percentage, by weight, of each component listed. These percentages should equal to 100% or as close as possible. Many times, even in a pure substance, percentages may not equal exactly 100% since there may be impurities, such as water, in substance due to fluctuations in manufacturing process.

HAZARD DATA: This column provides known health hazard rating information concerning the material. Exposure limits developed by OSHA are called Permissible Exposure Limits (PELs). This is sometimes referred to as the OSHA Exposure Standard. American Conference of Governmental Industrial Hygienists' (ACGIH) Exposure Limits are called Threshold Limit Values (TLVs).

Bases for these exposure standards vary from material to material considering impairment of health, or freedom from irritation, dizziness, nuisance, or other stresses associated with use of a given material. Because of wide variations in individuals, a small percentage may experience discomfort or injury from some substances even when concentrations are below respective exposure standard. Other measures may be listed including IDLH, "Lethal Dose", "TWA", and "Short-term Exposure Limit."



Importance of Information: May be exposed to some hazardous chemicals without risk, if the threshold limits are not exceeded over the specified period of time. Protective clothing and breathing apparatus, sheltering-in-place, and evacuating all may be used to reduce the risk or consequences of exposure. Exposure to more than one hazardous substance at a time may be especially dangerous, because of "synergism", where the combined effects of two or more substances is more harmful than the effects of each substance added together.

3. Physical/Chemical Characteristics

This section outlines the physical properties of the material. This information may be used to determine conditions that may enhance exposure potential.

Boiling Point: (BP)	Temperature at which liquid changes to vapor state, generally at 1 atm. pressure. For mixtures, initial B.P. or boiling range may be given. Flammable materials with low B.P. generally present special fire hazards.
Vapor pressure (mm Hg)	Pressure of a saturated vapor above a liquid, in millimeters of mercury (mm of Hg) usually at 68F. The lower the boiling point, the higher the vapor pressure. As a rule of thumb, higher vapor pressure materials evaporate more quickly.
Vapor density (Air = 1)	Weight of gas or vapor compared to weight of equal volume of air. Density > 1 indicates it is heavier than air. Vapors heavier than air can flow along or hover above ground, where they may pose fire or explosion hazard. Concentrated vapors which are heavier than air can accumulate in low places, such as along the ground, in sewers, elevator shafts.
Solubility in Water	<p>The percentage of material that will dissolve in water. The following terms are generally used to express the solubility of a product by weight in water at ambient temperatures.</p> <ul style="list-style-type: none">• Negligible - less than 0.1 %• Slight - 0.1 - 1 %• Moderate - 1.0 - 10 %• Appreciable - >10 %• Complete - 100 % <p>Solubility information is useful in determining effective fire extinguishing methods and spill clean-up procedures.</p>
Appearance and Odor/odor threshold	What should the product look like and or smell like. Often a odor threshold is included indicating the smallest amount of the material that can be detected by the human nose. Odor threshold is usually subjective.
Specific Gravity (H₂O =1)	Weight of volume of liquid or solid compared to weight of equal volume of water. Materials with specific gravity of > 1 will sink in water; less than 1 will float. Most flammable liquids are lighter than water.
Melting Point	Temperature at which a solid begins to change to liquid state
Evaporation Rate (Butyl Acetate =1)	The rate at which a material evaporates when compared to a known material's evaporation rate. Differing rates are of concern in assessing the fire and health hazard of the material.
% Volatile by Volume	Percentage of a liquid or solid, by volume, that will change state at an ambient temperature.
Viscosity	Internal resistance to flow exhibited by a fluid. At 68F, water has a viscosity of 0.01002 poise or 1.002 centipoises (cps). Fluids with higher resistance to flow (e.g. molasses or fuel oil) have high viscosities.
Molecular Weight	Atomic weights in a molecule



Importance of Information: Handling or response to material is safer when it is known beforehand how material will behave at different temperatures or when exposed to other substances. If material has low BP, VP, fast evaporation rate, and a high percentage of volatility, it is very likely to be an inhalation hazard. The higher the temperature of a material, the more active it will be.

4. Fire and Explosion Hazard Data

Flammable limits:

- LEL - Lower Explosive Limit or LFL - Lower Flammability Limit (Terms are synonymous.)
 - UEL - Upper Explosive Limit
 - UFL - Upper Flammability Limit (Terms are synonymous.)
- The minimum concentration (percent by volume) of flammable vapor in air that will allow ignition. A product's flammable range is between the LEL and the UEL. Concentrations below the lower explosive limit (LEL) are too lean to burn.
- The maximum concentration of flammable vapor (percent by volume) in air above which ignition cannot occur. (The mixture above the UEL becomes "too rich" to support combustion.)

Flashpoint	The lowest temperature at which a liquid gives off enough vapor to ignite when a source of ignition is present. Open or closed tests are used to determine the flash point.
Autoignition Temperature	The lowest temperature at which a flammable gas-air mixture will ignite spontaneously.
Extinguishing Media	The appropriate fire extinguishing agent(s) for the material. The selection of this media is based on the type of chemical, its properties and flammable characteristics. The most common media are water, carbon dioxide, dry chemical, and foams.
Fire-fighting Procedures	Appropriate equipment and methods to be used in limiting hazards encountered in fire situations.
Fire or Explosion Hazards	Unusual conditions which may cause or lead to fire or explosions. Hazards of the material not usually present during a fire. Could indicate a condition that might result in a BLEVE where the container may catastrophically fail and cause a massive explosion and fire ball.



Rating by NFPA, may be provided in this section. 704M Fire Diamond represents this rating. Number on left of the diamond (A) represents health rating; number on top (B) is flammability rating; and number on right represents reactivity rating. Special precautions, such as water reactive, are represented in bottom space (D) of diamond. Rating of 0 connotes essentially no hazard. Degree of hazard is increased as value increases until 4 is reached, which connotes severe hazard. Only 0 and whole numbers 1, 2, 3, and 4 are used in rating scheme.

NFPA Rating

Position A - Health Hazard (Blue)

- 0 = Ordinary Comb. Hazards
- 1 = Slightly Hazardous
- 2 = Hazardous
- 3 = Extreme Danger
- 4 = Deadly

Position C - Reactivity (Yellow)

- 0 = Stable and Not Reactive with Water
- 1 = Unstable if Heated
- 2 = Violent Chemical Change
- 3 = Shock and Heat
- 4 = May Detonate

Position B - Flammability (Red)

- 0 = Will Not Burn
- 1 = Will Ignite if Preheated
- 2 = Will Ignite if Moderately Heated
- 3 = Will Ignite at Most Temperatures
- 4 = Burns Readily at Ambient Conditions

Position D - Specific Hazard (White)

- OXY - Oxidizer
- COR - Corrosive
- ACID - Acid
- ALKALI - Alkali
- W- - Water Reactive (Use no Water)
- Specific Radiation Symbol - Radiation Hazard

Importance of Information: The flammability data, combined with the physical data, give emergency personnel a good indication of the seriousness of the hazardous material. A low flash point indicates a fire hazard. With most fires, the greatest danger to human life is not from the heat of the flame but from the toxic smoke that can quickly depress available breathing air.

5. Reactivity Data

Stability	"Unstable" indicates that a chemical may react violently, decompose spontaneously under normal temperatures, pressures, or mechanical shocks, or rapid decomposition may produce heat, cause fire or explosion. Conditions to avoid are listed in this section.
Incompatibility	Indicates chemicals or chemical families that may react violently or unpredictably in contact with the product. Incompatible chemicals should be separated during storage.
Hazardous Decomposition or Byproducts	Hazardous substances that may be created when the chemical decomposes or burns.
Hazardous Polymerization	Indicates if the product is prone to rapid polymerization causing potential for explosion. Conditions to avoid are listed in this section. A hazardous polymerization results in an uncontrolled release of energy.
Conditions to Avoid	Includes temperature extremes, jarring, inappropriate storage, etc. Reactives are also listed.



Importance of Information: Materials can be stored and handled more safely when it is known how the material may react to changes in temperature or contact with other materials. Information will assist in the selection of containers, shelving, and personal-protection clothing and equipment.

6. Health Hazard Data



This section indicates the medical signs and symptoms that may be encountered with overexposure to this product or its components.

Health hazard information may also distinguish the effects of acute (short term) and chronic (long-term) exposure.

Routes of Entry

Means by which the material may enter the body.

- Inhalation: through the respiratory tract.
- Ingestion: through the gastrointestinal tract. (i.e., by eating contaminated foods or by touching the mouth with contaminated fingers.)
- Absorption: transference through the skin.
- Injection: direct contact with the blood stream (i.e., through needle stick or glass cut.)

Health Hazards

Identification of target organs or systems that may be adversely affected by overexposure. Various hazards to the human body by different exposures to this material. Usually divided into routes of entry. The various exposure limits may be repeated in this section. Other information relating to exposure to the material or its components will be provided. Symptoms resulting from acute overexposure are listed if available, and epidemiological data is provided if pertinent. Additional information may be given on an attachment or additional page of the MSDS, such as for chronic toxicity, health and treatment information, and notes to physicians.

Carcinogenicity

Substances which are suspected or known to cause cancer in humans. Evidence of carcinogenicity may be provided by the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), or OSHA.

Signs and Symptoms of Exposure

Conditions that appear once the material contacts or enters the human body. Different routes of entry, site of exposure, duration of exposure, and first aid administered may vary the symptoms presented.

Medical conditions generally aggravated by exposure

A person who already is subject to some medical condition (e.g. arthritis, emphysema, heart disease, etc.), may find that condition worsened by exposure from specific materials. Persons who are sensitive to these conditions should reduce the possibility of exposure.

Emergency and First Aid Procedures

Recommended emergency and first aid procedures based on the toxicity of the product, degree of exposure and route of contact.

Importance of Information: Injury, and even death, from overexposure or improper exposure to certain materials can be prevented if emergency response personnel are aware of potential hazards ahead of time. Professional medical treatment should be obtained as soon as possible after an accident. However, actions taken in the first few minutes after an exposure can make the difference between a minor and major injury.

Chronic effects are particularly dangerous because discomfort may not be experienced after exposure, but severe health problems may develop later as a result of exposure. Some materials harm a particular organ of the body, or "target" an organ. Many chemicals have very little odor or quickly fatigue the sense of smell so that the odor is no longer detected but the toxic concentrations can still cause injury.

7. Precautions for Safe Handling and Use

This section provides general information for safe handling and use.

Local regulations must also be taken into consideration in dealing with spills and waste disposal.

Waste Disposal Method

Recommended methods for disposing of excess, used, or spilled material. However, regulatory requirements differ in various cities, counties, and states, and the specific governing regulations must be reviewed and complied with before actually disposing of any materials.

Spill or Release Data

Materials and methods to use in a small, moderate or large spill situation. This information can be used in pre-planning or in the event of an actual spill.

Precautions to be taken in Handling and Storage

This section may contain incompatibility information as well as special precautions for use or storage.

Other Precautions

Other hazards or precautions not elsewhere listed.

Environmental Hazards to Avoid

Alerts the user if the local environment (water supply, crops, population, etc.) may be endangered by release of the material.

EPA RCRA I.D. Code

Code given to a hazardous waste under RCRA statutes; provides for easier identification.

Reportable Quantity

Amount of waste that must be spilled to activate the reporting requirements under CERCLA.



"MAYBE IT'S SOME SORT OF LOCAL HUMOR, DEAR."

Importance of Information: Advises the emergency response personnel on how to remedy a spill while safeguarding their health and protecting the environment from further damage. Additionally, clean-up containment techniques will likely reflect compliance with Federal, State, and local laws. This will prevent the situation from getting worse through inadvertent violation of regulations.

8. Control Measures



This section includes general information about appropriate personal protective equipment for handling this material.

Many times, this section is written for large scale use of the material. Consider the amount and use of a material in choosing the right personal protective equipment.

Respiratory Protection

Indicates the type of respirator recommended. Some respirators supply air while others filter room air. Use of a respirator requires a medical exam, training and fit testing. Contact EHS prior to any respirator use.

Protective Gloves

Use compatible glove materials based upon the chemical used. Ask the glove supplier or manufacturer for more information.

Eye Protection

Safety glasses or Splash goggles must be ANSI approved for the intended use. Look for the ANSI imprint on the lens. Standard prescription glasses are not suitable safety glasses

Protective Clothing

Recommended clothing may not be appropriate for lab use.

Ventilation

Recommendations for general room ventilation and/or point source local exhaust ventilation.

Work/Hygienic Practices

Special recommendations for use.

Importance of Information: Specific steps and precautions to take to safeguard responder's health in an emergency response. The cautions in this section and other sections of the MSDS have the enforcement of the law. If the MSDS states that a responder should wear gloves or maintain a certain level of ventilation, it must be complied with. It is the responsibility of the person in command of the response activity to ensure that these measures are satisfied.

9. Special Precautions

In this section, you will find information about peculiar or unique problems with this material. Generally, the information provided here is valuable regarding health and safety issues as well as product quality. For example, the information here may suggest storage in a dark, cool area and prevent product freezing. All of these issues pertain to maintaining the quality of the product.

As you can see, the MSDS is a long and complex document that contains important chemical, safety and health information on chemicals in the workplace. Please become familiar with the MSDS's in your workplace. Read and understand the precautions and information contained on the MSDS.

Stored containers cannot be assumed to be safe. Additionally, comments may be included in this section regarding the material that does not particularly fit the content of other sections of the MSDS. For example, techniques about proper disposal of empty containers, or a particularly important hazard or safety practice, may be emphasized.

10. Transportation Requirements

The types of labels or markings for the container are described in this section. Classifications will be denoted. The DOT proper shipping name and other applicable regulations will be listed.

11. Other Regulatory Controls



This section will provide information on other laws and regulations that may apply to the storage, usage, manufacture, or release of this material. Information should be provided on sections of EPCRA, CERCLA, TSCA, RCRA, CWA, CAA, and applicable state and local laws that apply to this material.

12. Cross Reference Identification

As an illustrative example, the product FORMALDEHYDE is used here.

IDENTITY:	FORMALDEHYDE	REG. SYNONYM:	METHYLENE GLYCOL
CAS NUMBER:	50-00-0	DOT NUMBER:	2209
IMIS CODE:	1290	COAST GUARD ID:	FMS
STC CODE:	4940341	MOL. FORMULA:	C-H2-O
NFPA CODES:	2-4-0	HMIS CODES:	n / a
RCRA CODE:	U122	RTECS NUMBER:	LP8925000

Importance of Information: This information can be used to more easily identify a material, particularly during an emergency situation. If the data on the label has been torn off or smudged by contaminants, it is possible that only certain information may be available. These cross-references may provide the information necessary to positively identify the substance.

A Guide to Acronyms and Terms found on an MSDS is located at the end of this Update Newsletter.

Development of Material Safety Data Sheets

Presented at the 191st American Chemical Society National Meeting, 13-18 April 1986; New York, NY
Samuel Aaron Kaplan

Material safety data sheets contain written or printed material concerning a hazardous chemical as prescribed by law. They contain basic information needed to insure the safety and health of the user at all stages of its manufacture, storage, use, and disposal.

They developed out of the chemical data sheets that chemists have been using for the past one hundred or more years. But, they have a long and interesting history, extending back into time and climaxing into the present day format.



The history of the material safety data sheets (MSDS) can be presented in many ways. I have chosen to show its development in a logical, historical sequence. In order to do this, I have rearranged its format as it developed over time.



The earliest mention of some of the requirements covered in the MSDS goes back into the dawn of time when information was exchanged verbally on the materials used as medicines and for dyes. This required the random testing of the natural materials available to man at that time.

Through trial and error, man, that creative creature he is, gradually built up a large body of knowledge concerning the preparation of simple drugs and dyes, their storage parameters, application and hazards of use. This information forms the basis of a chemical data sheet.

The earliest written material has been found in the tombs of the Egyptians, either on the walls of their tombs or on papyrus records. These date back over 4,000 years and include the prescriptions of Imhotep, the first great Egyptian physician.



This data while basically a pharmaceutical description of the materials used in the treatment of the various diseases prevalent also included the sources, names, preparation, storage and application procedures, as well as warnings against improper use and application.

Within a few hundred years or so, the early Sumarians, in the land between the two great rivers, developed the cuneiform system of writing, which has been preserved for us on clay tablets.

They extended the knowledge of the Egyptians and added many more materials to this body of knowledge, especially in the area of dyes.



A thousand or so years later, the Greeks began to record not only their own observations, but also some of their early experimental work.

The recordings of Herophilus and others added to our growing knowledge of natural chemicals of daily use. During the great blossoming of medical inquiry, in the fourth and third centuries B.C. at Alexandria, real experimentation into new drugs, dyes, bleaches, and other organic and inorganic materials occurred.

During the Roman period, there was an increase in the supply of pharmaceuticals available to the physician due to the large army required to maintain the Roman Empire. Much of this work was recorded by Galen in his works on medicine and the human body.

During the so called Dark Ages, the period between the fifth through about the fourteenth centuries, much of the work of the previous centuries was maintained in the monasteries of Europe, though not in its entirety.

The bulk of the knowledge of the Near East, Greece and Rome was preserved and expanded by the Islamic nations, especially during their great renaissance of the ninth, tenth, and eleventh centuries.

Much of this work was done and recorded in Alexandria and Baghdad. This material included, for the first time, some of the formulations of China, India and the Far East.



By the end of the fourteenth century, much of this knowledge had been transferred to the southern parts of Italy and France and led to the European Renaissance, which brought about a resurgence of inquiry into the very nature of the materials used today.



Up to this time every idea, formula, etc. had to be copied by hand, restricting the widespread use of "Chemical Data Sheets." With the advent of movable type toward the end of the fifteenth century, the emergence of the modern chemical data sheet grew near. It had to await the development of standard units of measurement which would be accepted by the growing scientific community. Though this did not occur for two hundred years or so, some material was printed concerning chemical hazards.

It is highly probable, though difficult to prove, that some of the more enlightened manufacturers of pharmaceuticals and dyes did pass on some of their precautions and methods of handling to their customers. This can be inferred from some of the letters written by the chemists of this time. Most of the information which would have been on these early chemical data sheets would have related to methods of handling, storage and possibility of some inherent danger.

It is safe to assume, from all the information I can gather, that by the middle of the nineteenth century, manufacturers were supplying their customers with some sort of data sheet, either along with their product or on demand.

Therefore, the parameters of the MSDS, Sections 1, 3, and 9, had been dealt with by this time.

The earliest example of an MSDS that I have ever seen is one by Valentine and Company of 1906. I came across this example while doing a research paper for NIOSH in 1980.



What makes this period difficult to reconstruct are two factors: A) Habit of chemists to dispose of older copies of chemical data sheets when a new one appears; and B) Where information does exist in manufacturers files of early data sheets they seem reluctant to part with it. As one of my sources told me, the legal department objected to its release, fearing a possible liability suit. Why, he wasn't sure.

By the middle of the nineteenth century, chemists had developed flash points and freezing points for various materials.

Over the next sixty or more years, with the increasing interest of the insurance industry, the infant fire fighting companies, which developed in the cities, and the newly founded National Fire Protection Association (NFPA), more and more chemists were involved in the development of the test of the parameters covered in Section 4.



By the early nineteen thirties, reactivity data, Section 6, had been added to the literature. Most of this work was prepared in the laboratories of the companies developing new chemicals, some in the laboratories of the Bureau of Standards and other government agencies, while some were consensus standards produced by NFPA, the American Standard Association and similar groups.



Stiles

Health hazard data, much of which was developed over the past five to six thousand years or more, was enhanced within the past one hundred and fifty years.

Started originally in Europe, and within a few years in the United States, work proceeded on the development of a body of literature covering the toxicity of chemicals to animals and man. Some of this early work was done at the United States Public Health Laboratory in downtown Washington, while other research was done at Johns Hopkins in Baltimore and other great medical institutions of that time.

Among those working in this field were Dr. Alice Hamilton, Charles Wardell Stiles, Drs. Henderson, Haggard, M.B. Jacobs, Tulipan, etc. Thus, the work that went into the development of the effects of overexposure, etc. became part of Section 5.

The threshold limit values were developed out of the early work of the industrial hygienists and toxicologists of the industrial states. Originally called Maximum Allowable Concentrations, they varied from state to state. They were compiled, in about 1947 by an insurance industrial hygienist, Mr. Warren Cook.

In 1938, the NCGIH's (National Conference of Governmental Industrial Hygienists) started to issue a consensus listing, "Maximum Allowable Concentrations" (MAC). In approximately 1958 - 1959, these were changed to "Threshold Limit Value" (TLV). With the adoption by OSHA of these values, they became "Time Weighted Averages" (TWA). The rest of the Section grew out of the work on health.



Signature Publications

The Section on emergency and first aid procedures is also as old as time. These requirements, listed under Section 7, developed over the years in response to problems arising in the production of a particular chemical. It was only fitting, in order to retain the good will of its customers, that this information was added to the chemical data sheets being supplied to them.



Through the years, elaborate procedures have been developed by chemical companies for emergencies.

At the same time, insurance companies, NFPA, the Chemical Manufacturers Association (CMA), [now the American Chemical Council], and the Department of Transportation have been developing standards, and in DOT's case, required procedures to be followed in the event of an emergency/accident.

One of the fastest emergency response sources of information is that maintained by CMA [ACC].

In essence, the last two sections, 8 and 2, are of fairly recent origin. The special protection requirements, listed in 8, have gradually developed in response to a particular hazard. Gloves, mitts, pads or what have you were used to protect the hands from heat and very sharp objects. They are the oldest form of body protection devices developed by man. Some sort of respiratory protection was in use over two thousand years ago for dusty atmospheres.

These methods, mostly an animal bladder and later a damp cloth covering the mouth and nose, were the only respiratory protective device used until World War I. The use of war gases led to the rapid development of the first gas masks, using charcoal and other materials as absorbants and inertants.

After the Great War, chemical companies, realizing the value of gas masks, adapted them for emergency use. Today, the throw-away masks are in essence a return to the old "wet rag" form of respiratory protection, though more highly developed for use in low hazard areas. Clothing is also an old form of body protection.





The two most recent forms of protective equipment are eye protective devices and the use of ventilation. Eye protection has developed as we know it mainly within the past fifty years or so. This came about when skilled labor began to be too expensive to replace. The lens manufacturers have developed many forms of eye protection, some specifically tailored to special industrial operations.

Natural ventilation has always existed and had been the only form of ventilation until the industrial revolution. Before electricity, during the late nineteenth century, some plants were mechanically ventilated by fans running off of jack shafts powered by water or steam.

The development of electric fans brought some relief into the work place. In the early part of this century, a centralized form of general ventilation began to be developed. At the same time, local exhaust ventilation as we know it started to make inroads on the industrial scene. By World War II, ventilation, general and local, was being used to an increasing extent by the chemical industry.

Section 2 of the MSDS was the last Section developed, and is the result of the Department of Labor's response to incidents occurring in the shipbuilding industry. The hazards discussed within this Section, i.e.: hazardous mixtures and ingredients - effect only a few industries, specifically the protective coating/paint industry.



Up to this point, we have discussed the history of the development of the various factors making up the MSDS. This has been done in order to show that nothing exists in a vacuum. What may appear to be a simple act, was based on thousands of years of development.

By the late nineteen fifties, thousands of chemical data sheets were in use by chemists throughout the world. These were supplied to the customer by the manufacturer.

They came in many forms, some were single sheets of pertinent information while others were elaborate bound volumes supplied gratis to the customer.

On November 25, 1983 OSHA published the Hazard Communication Standard as 29 CFR Part 1910, adding §1910.1200. This initial standard applied only to Standard Industrial Classification (SIC) Codes 20 through 39. The requirement that manufacturers and distributors provide MSDSs to their customers became effective on November 25, 1985. The standard does not require a particular format for the MSDS, but does specify what information must be included.

Effective September 23, 1987, the requirements of the standard were extended to include "... all employers with employees exposed to hazardous chemicals in their workplaces."

In 1986 the U.S. Environmental Protection Agency (EPA) published the "Emergency Planning and Community Right-To-Know Act of 1986," and in 1988 "Toxic Chemical Release Reporting: Community Right-To-Know."



The use and distribution of MSDSs is an important part of these regulations. The "Toxic Chemical Release Reporting" regulation requires that MSDSs for chemicals requiring reporting by these regulations contain specific language notifying users that these chemicals are subject to these regulations.

These and other EPA regulations have been promulgated under Title III C Emergency Planning and Community Right-To-Know Act of the Superfund Amendments and Reauthorization Act of 1986 (EPCRA).

Making Sense of Material Safety Data Sheets



OSHA's definition of a hazardous chemical is broad, and includes many materials that might otherwise be considered innocuous. Because of the potential for product liability suits, and the demands of customers for MSDSs for almost all materials they purchase, manufacturers usually prepare MSDSs for even relatively harmless materials.

The Act, for all intents and purposes, is in effect at this moment. The MSDS form was put together from existing formats published by various chemical companies, State regulations, and associations.

It was tailored to meet the needs of a specific area of industrial uses. With all its failings, it does include the main areas of concern of safety and health professionals while filling the needs of the working chemist, the end user, and above all, the industrial worker.

Ten Steps to Realistic Local Preparedness

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"The time has come, the Walrus said, to talk of many things."

And the one I have chosen to talk about for the past two decades is hometown preparedness, driven by local hazards, local needs, local capabilities.

This became a message more difficult to deliver emphasis moved dramatically and drastically—and momentarily necessarily—from 9-1-1 to 9/11.



But, "the time has come" to admit that we can actually, and maybe only, meet 9/11 goals in our more rural and non-metropolitan areas by building response pyramids from the bottom up.

To emphasize my point, I have, customarily, reverted to humor: "If Al Qaeda is not targeting Holsteins, you folks in upstate New York are safe!" "If Al Qaeda is not targeting roadside fruit stands, you folks in Wenatchee, WA, are safe!" And closer to home—my home: "If Al Qaeda is not targeting hamburger on the hoof, you folks in eastern Montana are safe."



We should shine a bright light on the inability of national priorities and international antiterrorism activities to make folks significantly safer from local hazards here in hometown America. Perhaps now is time to revive the saying it took us so long to develop: "All incidents are local!"

So, in an attempt to facilitate this re-education project, here are ten ideas which might lead to a more realistic culture of preparedness in your hometown, where you are most likely to encounter dangerous hazards and be at real risk. These ideas are not prioritized or sequenced, and all are essential to good response. None of these is new, but all are critical.

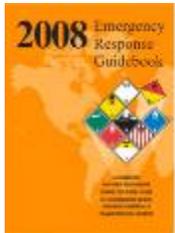
1. **Be the best you can be**, but realize you can't be all things to all people, or even some things to some people. Not every town can have a hazmat team. Or a bomb squad. Or a hostage rescue team. Or a full blown ER. But every town can have the best response that local circumstances allow. Every town can have a practical and practiced plan to address hazmat, explosives, school violence, biological and other low probability, high consequence incidents, even though response may take a while.

2. **Start with your ten most probable local hazards**, and build a secure base. It has been said that the very rich Baron von Rothschild once said: "The battle doesn't always go to the strong, nor the race to the swift—but that's the way to bet!"



We don't build great teams by preparing mainly for long shots or trick plays, but by preparing for the most common, the most probable, the most realistic hazards and risks.

3. **Honor your people**, whether paid or volunteer. Don't give them training they don't need or want, don't exercise them on bizarre scenarios, and don't give them trailers full of stuff they can't use tomorrow. They know, we know, when we're being played.



4. **Categorize, standardize, regularize**, in the face of overwhelming hazard numbers. There are just the first eight real hazard classes in the ERG; bio-problems revolve around proteins, viruses and bacteria; bad guys are often vandals, criminals, and terrorists.

We can't make firefighters into chemists, biologists and counter-terrorists, but we can teach some response related basics of chemistry, biology, and psychology.



- 5. Give them enough ICS to do their job well, but please don't initiate "death by projector" by teaching everyone all or even "way, way too much" of ICS or NIMS. Take a page from business.

A new hire at a burger joint needs to know how to flip burgers, fill out time sheets, who the supervisor is, how to be clean, how to smile, and how to follow orders.

They all don't have to go to Hamburger University as if they were buying a franchise!

- 6. Reverse engineer your responses, and then reverse them again. This is a bit hard, sometimes, to get across to all the players, so I will just give a few examples. Bomb squads have rules of engagement, so schools and other institutions need to be intimately familiar with how their particular bomb techs will operate. Also, the bomb teams will need a great deal of good data about the incident and device before they leave their home base. And in many towns, the bomb squad is a tertiary asset, coming from afar, so their interaction with local fire, law and EMS is already tenuous. I have heard things like "we'll just use the Air Force bomb team," when nothing is written, and they don't realize that if the base is on alert the squad ain't leaving the fenced area. Or, try this: Do your hazmat responders, fire fighters, ambulance crews, ERs and "local friendly hazard providers" really have a workable decontamination system? Could each player in the system really outline on paper the whole team's system regarding contamination and decontamination? Well, I haven't seen that happen yet! We have to know what our other team members need to know.



- 7. How many echelons above reality are you? In our business, reality is local responders: fire, law, EMS, public works, public health, co-op, railroad, school, etc. Local emergency management, local politicians, and so forth, closest view is one echelon above reality. State folks, minimum of two. Federal regional personnel, oh, at least three. Federal DC personnel, no less than four. Know your job at your particular echelon. It's simple, really. Your job is to give those below you all the support they need, and to protect them from unnecessary interference from you yourself, and from bureaucrats at your level and above.



- 8. Train yourself and your employees to weaknesses, not to strengths. Think of a bumpy rock. Fill in the valleys, lower the hills, and what do you have? Something that is well-rounded and polished.

That's the goal. Not techy-nerd, not over-specialized. Well rounded people have access to specialists, for they have done their homework and have earned the respect of their mentors. Emergency management people are generalists, and we should be proud of it.

- 9. Use the technology that works best for you, but don't live in the past if your clients, customers, employees, and those in need of your help have made it out of the twentieth century and you're somewhere in the nineteenth. You don't have to twitter on a boysenberry, but a laptop and cell phone are commonplace. Beep, beep, beep: you have a text message!

- 10. Ride the current wave of money, to meet your permanent needs.

It once was civil defense, then hazmat, then natural hazards, then terrorism, but what your local cops and firefighters and EMS folks need most rarely if ever changes.

So, learn grant writing and grant management, learn to "be as smart as the funding sources are dumb," and those you serve will love you.





HAS YOUR LEPC:

- Established a permanent address for facilities, the SERC, and EPA to mail required forms and information;
- Notified the SERC of any changes to the LEPC structure, especially a change in the chair or address;
- Provided EPCRA training to local emergency responders, specifically local fire departments who often can provide information to facilities during fire inspections and police departments who respond to haz-mat incidents?
- Established a 24-hour manned emergency phone number (i.e., sheriff's office, 911, fire department) for facilities to make release notifications -- an answering machine is not sufficient;

The articles contained herein are provided for general purposes only.

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Please consult the applicable regulations when determining compliance.

Mention of trade names, products, or services does not convey, and should not be interpreted as conveying official EPA approval, endorsement, or recommendation.

Region 6 Emergency Notification Numbers

Arkansas Dept. of Emergency Management	800-322-4012
Louisiana State Police	877-925-6595
New Mexico State Police	505-827-9126
Oklahoma Dept. of Environmental Quality	800-522-0206
Texas Environmental Hotline	800-832-8224

National Response Center	800-424-8802
EPA Region 6	866-372-7745
CHEMTREC	800-424-9300

ABBREVIATIONS COMMONLY USED ON MSDSs

- ACGIH: American Conference of Governmental Industrial Hygienists
- ALARA: As low as reasonably achievable
- ALR: Allergenic effects
- ANSI: American National Standards Institute
- API: American Petroleum Institute
- AQTX: Aquatic toxicity
- ASTM: American Society for Testing and Materials
- atm: Atmosphere
- BAL: British Anti-Lewisite
- Be: Baume
- BEI: Biological exposure indexes
- BLD: Blood effects
- BP: Boiling point
- Btu: British thermal unit
- C: Continuous exposure
- C (deg): Celcius
- ca: circa (about)
- CAA: Clean Air Act
- CAR: Carcinogenic effects
- CAS: Chemical Abstract Service
- cc: Cubic centimeter
- CC: Closed cup
- (C): Ceiling concentration
- CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
- CFC: Chlorofluorocarbon
- CFR: Code of Federal Regulations
- CHEMTREC: Chemical Transportation Emergency Center
- cm³: Cubic centimeter
- CNS: Central nervous system
- CO: Carbon Monoxide
- CO₂: Carbon Dioxide
- COC: Cleveland open cup
- conc: Concentration
- \ COR: Corrosive effects
- cP: Centipose
- CPS: Centimeter per second
- CPSC: Consumer Product Safety Commission
- cstk: Centistoke
- CUM: Cumulative effects
- CVS: Cardiovascular effects
- CWA: Clean Water Act
- D: Day
- decomp: Decomposition
- DOT: Department of Transportation
- EC50: Effective concentration
- EP: Extreme pressure
- EPA: Environmental Protection Agency
- EPCRA: Emergency Planning and Community Right-to-Know Act
- F (de g): Fahrenheit
- F/cc: Fibers per cubic centimeter of air
- FP: Flash point
- FR: Federal Register
- FY: Fiscal year
- G- Gastrointestinal
- gm: Gram
- GRAS: Generally recognized as safe
- H: Hour
- HEPA: High-efficiency particulate air purifying respirator equipment
- HMIS: Hazardous materials identification system
- hr(s): Hour(s)
- HW: Hazardous waste under RCRA
- IARC: International Agency for Research on Cancer
- IDLH: Immediately dangerous to life and health
- IMDG: International maritime dangerous goods
- IMO: International Maritime Organization
- inhl: Inhalation
- insol: Insoluble
- IRDS: Primary irritation dose
- IRR: Irritant effects (systemic)
- J: Joule
- Kg: Kilogram
- L: Liter
- LC50: Lethal concentration to 50% of those tested
- LCLo: Lowest published lethal concentration by inhalation
- LD50: Lethal dose to 50% of those tested by ingestion
- LDLo: Lowest published lethal dose
- LEL: Lower explosive limit
- LFL: Lower flammable limit
- LFM: Linear feet per minute
- M: Minute
- m³: Cubic meter
- MESA: Mining Enforcement & Safety Administration
- mg: Milligram
- mg/kg: Milligrams per kilogram
- mJ: Millijoule
- MLD: Mild irritation effects
- ml: milliliter
- mm Hg: Millimeters of Mercury
- mppcf: Millions of particles per cubic foot of air (mg/m³)
- MSDS: Material safety data sheet
- MSHA: Mine Safety & Health Administration
- MSK: Muscular-skeletal effects
- MUT: Mutagen
- MW: Molecular weight
- n: normal
- NA: Not applicable; not available
- NC: National Cancer Institute
- ND: Not determined
- NEO: Neoplastic effects
- NFPA: National Fire Protection Association
- ng: Nanogram
- NIOSH: National Institute of Occupational Safety and Health
- NOC: Not otherwise classified
- NOEL: No effect level
- NOS: Not otherwise specified
- NOx: Oxides of Nitrogen
- NPCA: National Paint and Coatings Association
- NTIS: National Technical Information Service
- NTP: National Toxicology Program
- OEL: Occupational Exposure Limit
- ORM: Other regulated material
- OSHA: Occupational Safety and Health Administration
- PAH: Polycyclic aromatic hydrocarbons
- PCB: Polychlorinated biphenyl

- PEL: Permissible exposure limit
- pH: Negative logarithm of the hydrogen ion concentration
- PIN: Product identification number
- PMCC: Pinsky-Martens closed cup
- PNS: Peripheral nervous system effects
- POx: Oxides of phosphorus
- ppb: Parts per billion, by volume
- PPE: Personal protective equipment
- ppm: Parts per million, by volume
- ppt: Parts per trillion, by volume
- psia: Pounds per square inch
- PSY: Psychotropic, acting on the mind
- PUL: Pulmonary systems effect
- RBC: Red blood cell effects
- RCRA: Resource Conservation and Recovery Act
- REL: Recommended exposure limit
- RQ: Reportable quantity
- RTECS: Registry of Toxic Effects of Chemical Substances
- SARA: Superfund Amendments and Reauthorization Act
- SCBA: Self-contained breathing apparatus
- SCBAF: Self-contained breathing apparatus with full facepiece
- SCC SETAFLASH: closed cup
- SETA SETAFLASH: closed tester
- SKN: Skin effects
- soln: Solution
- Sox: Oxides of Sulfur
- STEL: Short-term exposure limit
- STEV: Short-term exposure value
- SUS: Saybolt universal seconds
- SYS: Systemic effects
- TCC: Tagged closed cup
- TCLo: Toxic concentration low
- TDL: Toxic dose level
- temp: Temperature
- TER: Teratogen
- TFX: Toxic effects
- TLm: Median tolerance limit
- TLV: Threshold limit value
- TOC: Tag open-cup
- Torr: mm Hg pressure
- TSCA: Toxic Substances Control Act
- TWA: Time weighted average
- TXDS: Qualifying toxic dose
- UEL: Upper explosive limit
- UFL: Upper flammable limit
- ug: Microgram
- UV: Ultraviolet
- VOC: Volatile organic compounds
- VP: Vapor pressure
- WBC: White blood cell effects
- W: Week
- ZFF: Zinc fume fever

GLOSSARY OF MSDS TERMS

- ABSOLUTE: substance that is relatively free of impurities.
- ABSOLUTE PRESSURE: The total pressure within a vessel, pipe, etc., not offset by external atmospheric pressure.
- ABSORPTION: To take in and make a part of an existing whole. The penetration of a solid substance by a liquid as by capillary, osmotic, solvent or chemical action.
- AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS: An organization of professionals in governmental agencies or educational institutions engaged in occupational safety and health programs. ACGIH develops and publishes recommended occupational exposure limits for chemical substances and physical agents.
- ACID: any chemical which undergoes dissociation in water with the formation of hydrogen ions. Acids have a sour taste and may cause severe burns. They turn litmus paper red and have Ph values of 0 to 6. Acids will neutralize bases or alkaline media. Acids will react with a base to form a salt.
- ACIDOSIS: condition of decreased alkalinity of the blood and tissues marked by sickly sweet breath, headache, nausea, vomiting, and visual disturbances; usually the result of excessive acid production.
- ACRID: irritating and bitter.
- ACTION LEVEL: exposure level at which OSHA regulations to protect employees takes effect. Exposure at or above the action level is termed occupational exposure. Exposure below this level can also be harmful.
- ACTIVE INGREDIENT: ingredient product that actually does what the product is designed to do. The remaining ingredients may be inert.
- ACUTE EFFECT: adverse effect on a human or animal body that takes place soon after exposure.
- ACUTE LETHALITY: death of animals immediately or within 14 days after a single dose of or exposure to a toxic substance.
- ACUTE TOXICITY: adverse effects resulting from a single dose of or exposure to a substance.
- ADENOCARCINOMA: A tumor with glandular (secreting) elements.
- ADENOSIS: Any disease of a gland.
- ADHESION: A union of two surfaces normally separate.
- ADSORB: collect gas or liquid molecules onto another material.
- AEROSOL: fine aerial suspension of liquid (mist, fog) or solid (dust, fume, smoke) particles small enough to be stable.
- AGENT: any substance, force, radiation, organism, or influence that affects the body. Effects may be beneficial or injurious.
- AIR-LINE RESPIRATOR: A respirator that is connected to a compressed breathable air source by a hose of small diameter. The air is delivered continuously or intermittently in a sufficient volume to meet the wearer's breathing requirements.
- AIR-PURIFYING RESPIRATOR: A respirator that uses chemicals to remove specific gases and vapors from the air or that uses a mechanical filter to remove particulate matter. An air-purifying respirator must only be used when there is sufficient oxygen to sustain life and the air contaminant level is below the concentration limits of the device.
- ALARA: Acronym for "as low as reasonably achievable."
- ALKALI: any chemical substance which forms soluble soaps with fatty acids. Alkalis are also referred to as bases. May cause severe burns to the skin. Alkalis turn litmus paper blue and have Ph values from 8 to 14.

- ALLERGIC REACTION: physiological response to a chemical or physical stimulus by a sensitive person.
- ALLERGIC RESPIRATORY REACTION: labored breathing, coughing, or gasping caused by inhaling a particular substance.
- ALLERGIC SKIN REACTION: reddening, swelling and/or itching of the skin following contact with a substance to which a person has become sensitized due to previous skin contact or natural body conditions.
- ALOPECIA: loss of hair.
- AMBIENT: usual or surrounding conditions.
- AMENORRHEA: Absence of menstruation.
- AMERICAN NATIONAL STANDARDS INSTITUTE: A privately funded organization that identifies industrial/public national consensus standards and coordinates their development.
- AMES TEST: short-term test commonly used for preliminary screening of chemicals to see if they cause mutations in a special type of bacterial cell.
- ANALGESIA: loss of sensitivity to pain.
- ANESTHETIC: chemical that causes a total or partial loss of sensation. Overexposure to anesthetics can cause impaired judgment, dizziness, drowsiness, headache, unconsciousness, and even death.
- ANHYDRIDE: compound derived from other compound by removing elements composing water (hydrogen and oxygen).
- ANHYDROUS: no water. No water molecules are present as hydrate or as water crystallization.
- ANOREXIA: loss of appetite.
- ANOSMIA: loss of the sense of smell.
- ANOXIA: lack of oxygen from inspired air.
- ANTIDOTE: remedy to relieve, prevent, or counteract the effects of a poison.
- ANURIA: absence or defective excretion of urine.
- APNEA: breathing temporarily stopped.
- APPEARANCE: physical state of a material.
- AQUATIC TOXICITY: adverse effects on marine life that result from their being exposed to a toxic substance.
- AQUEOUS: water-based solution or suspension. Frequently, a gaseous compound dissolved in water.
- ARGYRIA: local or generalized gray blue-colored impregnation of the tissue with silver.
- ARTICLE: manufactured item specifically shaped or formed with function dependent on shape or design. Does not release or result in exposure to a hazardous material in normal use. Excluded from hazard laws unless it gives off dust or fumes.
- ASBESTOSIS: chronic lung disease caused by inhaling airborne asbestos fibers.
- ASPHYXIA: lack of oxygen and interference with the oxygenation of the blood. Can lead to unconsciousness.
- ASPHYXIAN: vapor or gas which causes unconsciousness or death by suffocation. Most simple asphyxiants are harmful to the body only when they become so concentrated that they reduce oxygen in air (normally 21 %) to dangerous levels (16% or lower). Asphyxiation is a potential hazard of working in confined spaces.
- ASPIRATION HAZARD: danger of drawing material into the lungs leading to an inflammatory response.
- ASTHMA: characterized by recurrent attacks of dyspnea, wheezing, and perhaps coughing caused by spasmodic contraction of the bronchioles in the lungs.
- ASYMPTOMATIC: neither causing nor exhibiting symptoms.
- ATAXIA: loss of muscular coordination.
- ATMOSPHERE: pressure measurement. One atmosphere (atm) = 14.7 lbs/sq in.
- ATROPHY: wasting or diminution in the size of tissue, organs, or the entire body by lack of use.
- AUTOIGNITION TEMPERATURE: minimum temperature which a substance must be heated without application of flame or spark to cause substance to ignite. Should not be heated to > 80% of this temperature.

- BASE: Substances that (usually) liberate OH anions when dissolved in water. Bases react with acids to form salts and water. Bases have a pH greater than 7, turn litmus paper blue, and may be corrosive to human tissue. A strong base is called alkaline or caustic.
- BAUME: arbitrary scale of specific gravities; used to determine specific gravities and in graduation of hydrometers.
- BENIGN: Not recurrent or not tending to progress. Not cancerous.
- BEST AVAILABLE CONTROL TECHNOLOGY (BACT): The best control technology that is available for each contaminant. This determination will be made by the Commissioner on a case-by-case basis taking into account energy, environmental, health risk, costs and economic impacts of alternative control systems.
- BIOLOGICAL EXPOSURE INDEXES: values based on procedures to determine the amount of a material absorbed into the human body by measuring it or its metabolic products in tissue, fluid, or exhaled air.
- BIODEGRADABLE: organic material's capacity for decomposition as a result of attack by microorganisms.
- BIOLOGICAL MONITORING: periodic examination of body substances, such as blood or urine, to determine extent of hazardous material absorption as opposed to mere exposure.
- BIOPSY: Removal and examination of tissue from the living body.
- BOILING LIQUID EXPANDING VAPOR EXPLOSION (BLEVE): condition in which liquids are excessively heated, which may result in the violent rupture of a container, and the rapid vaporization of the material. The possibility increases with the volatility of the material.
- BODY BURDEN: total amount of a toxic material that person has ingested or inhaled from sources over time.
- BOILING POINT: temperature at which a liquid changes to vapor at a given pressure. Flammable materials with low boiling points present special fire hazards.
- BONDING: safety practice where two objects are interconnected with clamps and bare wire. This equalizes electrical potential between the objects and helps prevent static sparks that could ignite flammable materials.
- BRADYCARDIA: slow heartbeat with pulse rate below 60/minute.

- BRONCHITIS: swelling of the bronchial tubes in the lungs.
- BRITISH ANTI-LEWISITE: A name for the drug dimecaprol--a treatment for toxic inhalations.
- BRITISH THERMAL UNIT: quantity of heat required to raise the temperature of 1 pound of water 1 degree F at 39.2F, its temperature of maximum density.
- BUFFER: substance that reduces the change in hydrogen ion concentration (pH) that would be produced by adding acids or bases to a solution.
- BULK DENSITY: The mass (weight) per unit volume of a solid particulate material as it is normally packed, with voids between particulates containing air. Usually expressed as lb/ft³ or g/cm³.
- BUNA: trademark for synthetic rubber and rubberlike materials such as Buna-N (Nitrile).

- CALORIE: unit of heat. A calorie is the amount of heat required to raise 1 gram of water 1 degree C.
- CARBON DIOXIDE: heavy, colorless gas produced by combustion and decomposition of organic substances and as by-product of chemical processes. Can cause oxygen deficiency in large concentrations. Is useful as fire-extinguishing agent to block oxygen and smother fire.
- CARBON MONOXIDE: colorless, odorless, flammable, toxic gas produced by the incomplete combustion of carbon compounds and by-product of many chemical processes. An asphyxiant, it reduces the blood's ability to carry oxygen.
- CARCINOGEN: substance or agent capable of causing or producing cancer in mammals.
- CARCINOMA: malignant tumor or cancer; a new growth made up of epithelial cells tending to grow rapidly, infiltrate other cells, and give rise to metastasis (spreading).
- CATALYST: substance that modifies a reaction (makes it faster or slower) without being consumed.
- CATARACT: loss of transparency of the crystalline lens of the eye or its capsule.
- CEILING: maximum allowable exposure limit for airborne substance; not to be exceeded even momentarily.
- CENTIGRADE: a unit of temperature.
- CENTIMETER, cm: 1/100 meter. A cm = approximately 0.4 in.
- CENTIPOSE: cgs unit of the measure of viscosity equal to 1/100 poise. Viscosity of water is 1 centipose.
- CENTRAL NERVOUS SYSTEM: the brain and spinal cord.
- CHELATING AGENT: compound capable of forming multiple chemical bonds to a metal ion. Used to treat metal poisoning.
- CHEMICAL: any element, chemical compound, or mixture of elements and/or compounds.
- CHEMICAL ABSTRACTS SERVICE NUMBER: An assigned number used to identify a chemical. CAS stands for Chemical Abstracts Service, an organization that indexes information published in Chemical Abstracts by the American Chemical Society and that provides index guides by which information about particular substances may be located in the abstracts. Sequentially assigned CAS numbers identify specific chemicals, except when followed by an asterisk(*) which signifies a compound (often naturally occurring) of variable composition. The numbers have no chemical significance. The CAS number is a concise, unique means of material identification.
- CHEMICAL CARTRIDGE RESPIRATOR: respirator using chemical substances to purify inhaled air of certain contaminative gases or vapors. Effective for concentrations < 10 times the TLV of the contaminant if it has warning properties (odor or irritation) below the TLV.
- CHEMICAL FAMILY: group of single elements or compounds with a common general name.
- CHEMICAL FORMULA: gives the number and kinds of atoms that comprise a molecule of a material.
- CHEMICAL HYGIENE PLAN: Per 29 CFR 1910.1450, OSHA standard; "Occupational Exposures to Hazardous Chemicals in Laboratories." Effective 5/1/90. A written plan that includes specific work practices, standard operating procedures, equipment, engineering controls, and policies to ensure that employees are protected from hazardous exposure levels to all potentially hazardous chemicals in use in their work areas. The OSHA standard provides for training, employee access to information, medical consultations, examinations, hazard identification procedures, respirator use, and record keeping practices.
- CHEMICAL NAME: designation or name that clearly identifies chemical for hazard evaluation purposes.
- CHEMICAL PNEUMONITIS: inflammation of lungs by accumulation of fluids due to chemical irritation.
- CHEMICAL REACTIVITY: ability of a material to chemically change. Undesirable and dangerous effects such as heat, explosions, or the production of noxious substances can result.
- CHEMTREC: 24 -hour toll-free telephone number (800-424-9300), intended primarily for use by those who respond to chemical transportation emergencies. Established by the Chemical Manufacturer's Association.
- CHEMILUMINESCENCE: emission of light during a non-combustible chemical reaction.
- CHLORACNE: acne-like eruption caused by excessive contact with certain compounds.
- CHRONIC EFFECT: adverse effect on a human body with symptoms that develop slowly over a long period of time or that recur frequently.
- CHRONIC EXPOSURE: Long-term contact with a substance.
- CHRONIC TOXICITY: adverse effects resulting from repeated doses of or exposures to a material over a relatively prolonged period of time.
- CODE OF FEDERAL REGULATIONS: collection of the regulations established by law.
- COEFFICIENT OF WATER/OIL DISTRIBUTION: Also called the partition coefficient, it is the ratio of the solubility of a chemical in water to its solubility in oil. Used to indicate how easily human or other organisms can absorb or store a material. Sometimes abbreviated Ko/w; may also be expressed as its logarithm, log Ko/w.
- COMBUSTIBLE LIQUIDS: term used by NFPA and DOT to classify certain liquids that will burn, on the basis of flash points. NFPA and DOT generally define "combustible liquids" as having a flash point of 100F or higher. They do not ignite as easily as flammable liquids; however, they can be ignited under certain conditions, and must be handled with caution.
- COMMON NAME: designation other than chemical name, such as code, trade, brand, or generic name.

- COMPRESSED GAS: material contained under pressure (dissolved gas, liquefied by compression or refrigeration).
- CONCENTRATION: relative amount of a substance when combined or mixed with other substances.
- CONDITIONS TO AVOID: Conditions encountered during handling or storage that could cause a substance to become unstable.
- CONFINED SPACE: Any area that has limited openings for entry and exit that would make escape difficult in an emergency, has a lack of ventilation, contains known and potential hazards, and is not intended nor designated for continuous human occupancy.
- CONFIRMED HUMAN CARCINOGEN: Substances recognized to have carcinogenic or cocarcinogenic potential in humans.
- CONJUNCTIVITIS: inflammation of conjunctiva, the membrane that lines eyelid and covers the eyeball.
- CONTAINER: any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical. Under the HCS, pipes or piping systems, and engines, fuel tanks, or other operating systems in a vehicle are not considered to be containers.
- CORNEA: transparent structure of the external layer of the eye.
- CORROSION RATE: expressed in inches/ year; accompanied by temperature.
- CORROSIVE: liquid or solid that causes visible destruction or irreversible alterations in skin tissue at site of contact, or, in the case of leakage from its packaging, liquid that has severe corrosion rate on steel.
- CRITICAL PRESSURE/ TEMPERATURE: temperature above which a gas cannot be liquefied by pressure. Pressure required to liquefy a gas at its critical temperature.
- CRYOGENIC: Relating to extremely low temperature as for refrigerated gases.
- CURETTAGE: Cleansing of a diseased surface.
- CUTANEOUS: pertaining to the skin.
- CYANOSIS: purplish coloration of skin and mucous membrane caused by deficient oxygenation of the blood.

- DANGEROUSLY REACTIVE MATERIAL: can react by itself or with water/air producing hazard.
- DECOMPOSITION: breakdown of a material or substance into parts or elements or simpler compounds.
- DEFATTING: removal of natural oils from the skin by fat-dissolving solvents or other chemicals.
- DELIQUESCENT: water soluble salts (usually powdered) absorb moisture from air and to soften or dissolve as a result.
- DEMULCENT: material capable of soothing or protecting inflamed, irritated mucous membranes.
- DENSITY: ratio of weight to volume of a material, usually in grams per cubic centimeter.
- DEPRESSANT: A substance that reduces a bodily functional activity or an instinctive desire, such as appetite.
- DERMAL: used on or applied to the skin.
- DERMAL TOXICITY: effects from exposure to a substance.
 - NON-TOXIC: The probable lethal dose of undiluted product to 50% of the test animals determined from dermal toxicity studies (LD50) is greater than 2 grams per kilogram of body weight.
 - TOXIC: The probable lethal dose of undiluted product to 50% of the test animals determined from dermal toxicity studies (LD50) is greater than 200 milligrams and less than or equal to 2 grams per kilogram of body weight.
 - HIGHLY TOXIC: The probable lethal dose of undiluted product to 50% of the test animals determined from dermal toxicity studies (LD50) is less than or equal to 200 milligrams per kilogram of body weight.
- DERMATITIS: inflammation of the skin.
- DESIGNATED AREA: An area of (or device within) a lab to be used for work with "select carcinogens", reproductive toxins, and other materials which have a high degree of acute toxicity. An administrative control intended to minimize the potential for employee exposure to hazardous chemicals.
- DESIGNATED REPRESENTATIVE: any individual or organization to whom an employee gives written authorization to exercise such employee's rights under the HCS.
- DIAPHORESIS: perspiration, especially profuse.
- DIKE: A barrier constructed to control or confine hazardous substances and prevent them from entering sewers, ditches, streams, or other flowing waters.
- DILUTION VENTILATION: Air flow designed to dilute contaminants to acceptable levels.
- DISTRIBUTOR: a business, other than a chemical manufacturer or importer, which supplies hazardous chemicals to other distributors or to employers.
- DRY CHEMICAL: powdered fire extinguishing agent, usually composed of sodium bicarbonate, potassium bicarbonate, etc.
- DUST: solid particles suspended in air produced by some mechanical process, such as crushing, grinding, abrading, or blasting. Most are an inhalation, fire, and dust-explosion hazard.
- DYSPLASIA: An abnormality of development.
- DYSPNEA: difficult breathing.
- DYSURIA: difficult or painful urination.

- EDEMA: accumulation of clear, watery fluid in body tissue.
- EFFECTIVE CONCENTRATION: concentration of a material in water, a single dose which is expected to cause a biological effect on 50% of a group of test animals.
- ELECTROLYTE: non-metallic substance that conducts electric current in solution by moving ions rather than electrons.
- EMBOLISM: obstruction of a blood vessel by a transported clot, a mass of bacteria, etc.
- EMBRYO: early stage of development before birth.
- EMBRYOTOXIN: harmful to a developing embryo at a concentration that has no adverse effect on the pregnant female.
- EMETIC: agent that induces vomiting.
- EMPHYSEMA: irreversibly diseased lung condition in which the alveolar walls have lost their resiliency, resulting in an excessive reduction in the lungs' capacity.

- EMPLOYEE: worker who may be exposed to chemicals under normal operating conditions or in foreseeable emergencies.
- EMPLOYER: a person engaged in a business where chemicals are either used, distributed, or are produced for use or distribution, including a contractor or subcontractor.
- ENDOTHERMIC: A chemical reaction that absorbs heat.
- ENGINEERING CONTROLS: systems that reduce potential hazards by isolating the worker from the hazard or by removing the hazard from work environment. Methods include ventilation, isolation, and enclosure.
- EPIDEMIOLOGY: science that deals with the study of disease in a general population.
- EPIPHORA: excessive flow of tears.
- EPISTAXIS: nosebleed.
- ERGONOMICS: study of human characteristics for the appropriate design of living and work environments.
- ERYTHEMA: abnormally red skin from capillary congestion.
- ETIOLOGY: all of the factors that contribute to the cause of a disease or an abnormal condition.
- EVAPORATION RATE: rate at which a particular material will vaporize when compared to the rate of vaporization of a known material. Evaporation rate can be useful in evaluating the health and fire hazards of a material.
- EXPLOSIVE: material that produces a sudden, almost instantaneous release of pressure, gas, and heat when subjected to abrupt shock, pressure, or temperature.
- EXPOSURE OR EXPOSED: State of being open and vulnerable to a hazardous chemical by inhalation, ingestion, skin contact, absorption, or any other course; includes potential (accidental or possible) exposure.
- EXPOSURE LIMITS: concentration in air of a chemical that is thought to be acceptable.
- EXTINGUISHING MEDIA: extinguisher or extinguishing method for use on specific material.
- EYE IRRITATION: Ratings corresponding to the following definitions are derived from data obtained from test methods described in the 16 CFR 1500.42 graded pursuant to the Draize Scale for scoring ocular lesions and temporal reversibility criteria as set forth in NAS Publication 1138.
 - PRACTICALLY NON-IRRITATING: The undiluted product, when instilled into the eyes of rabbits produces no noticeable irritation, or slight transient conjunctiva irritation.
 - SLIGHTLY IRRITATING: The undiluted product, when instilled into the eyes of rabbits, produces slight to moderate conjunctiva irritation, slight corneal involvement, and/or slight iritis.
 - MODERATELY IRRITATING: The undiluted product, when instilled into the eyes of rabbits, produces moderate corneal involvement with or without severe iritis. The effects clear within 21 days.
 - SEVERELY IRRITATING (OR CORROSIVE): The undiluted product, when instilled into the eyes of rabbits, produces severe corneal involvement with or without severe iritis. The effects persist for 21 days or more.
- FASCICULATION: muscular twitching.
- FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT (FIFRA): requires that certain useful poisons, such as chemical pesticides, sold to the public contain labels that carry health hazard warnings to protect users. It is administered by EPA.
- FEDERAL REGISTER: daily publication that lists and discusses the regulations of agencies.
- FIBER: basic form of matter, usually crystalline, with a high ratio of length to diameter.
- FIBROSIS: formation of fibrous tissue, as in reparative or reactive process to particulates, in excess of normally present in lung-tissue walls. This reduces the oxygen and carbon dioxide exchange efficiency.
- FINES: finely crushed or powdered material or fibers; smaller than the average in a mix of various sizes.
- FIRE DIAMOND: symbol designed by the NFPA to give a quick number ratings for the particular material's degree of flammability, reactivity, and health hazard.
- FIRE POINT: lowest temperature at which liquid will produce sufficient vapor to flash near its surface and continue to burn.
- FLAMMABLE: defined by DOT and NFPA as a liquid with a flash point below 100F. Flammable liquids are:
 - Class Liquids and may be subdivided as follows:
 - Class IA - those having flash points below 73F and having a boiling point below 100F.
 - Class IB - those having flash points below 73F and having boiling point at or above 100F.
 - Class IC - those having flash points at or above 73F and below 100F.
- FLAMMABLE AEROSOL: product packaged in an aerosol container and can release a flammable material.
- FLAMMABLE GAS: gas that at ambient temperature and pressure forms a flammable mixture with air at a concentration of 13% by volume or less; or a gas that at ambient temperature and pressure forms a range of flammable mixtures with air greater than 12% by volume, regardless of the lower limit.
- FLAMMABLE LIMITS: minimum and maximum concentrations of flammable gas or vapor between which ignition occurs.
- FLAMMABLE LIQUID: gives off vapors that can be ignited at room temperature; liquid with flash point <100F.
- FLAMMABLE SOLID: will ignite readily and continue to burn or is liable to cause fires under ordinary conditions or during transportation through friction or retained heat from manufacturing or processing and that burns so vigorously and persistently as to create a serious transportation hazard.
- FLASH BACK: occurs when a trail of flammable material is ignited by a spark or ignition source. The flame then travels along the trail of the material back to its source.
- FLASH POINT: temperature at which a liquid will give off enough flammable vapor to ignite. There are several flash point test methods, and flash points may vary for the same material depending on the method used, so the test method is indicated when the flash point is given.
- FOAM: fire-fighting material consisting of bubbles of air, water, and concentrating agents. Put out a fire by blanketing it, excluding air and blocking escape of vapor.
- FOG: visible suspension of droplets in a gas.

- FORESEEABLE EMERGENCY: potential occurrence such as equipment failure, rupture of containers, or failure of control equipment which could result in an uncontrolled release of a hazardous chemical.
- FORMULA: The scientific expression of the chemical composition of a material (e.g., water H₂O, sulfuric acid H₂SO₄, sulfur dioxide is SO₂).
- FREEZING POINT: material changes its physical state from liquid to solid. Important because frozen material may burst its container or the hazards could change.
- FROSTBITE: damage to tissue from exposure to extreme cold or contact with cold liquids or solids.
- FUGITIVE EMISSION: gas, liquid, solid, vapor, fume, mist, fog, or dust that escapes from process equipment or a product.
- FULL PROTECTIVE CLOTHING: fully protective gear that keeps gases, vapor, liquid, and solids from any contact with skin and prevents them from being inhaled or ingested.
- FUME: airborne suspension consisting of minute solid particles arising from the heating of a solid. This heating is often accompanied by a chemical reaction where the particles react with oxygen to form an oxide.

- GANGRENE: death of tissue combined with putrefaction.
- GAS: formless fluid that occupies the space of its enclosure. Can settle to the bottom or top of an enclosure when mixed with other materials. Can be changed to its liquid or solid state only by increased pressure and decreased temperature.
- GASTRIC LAVAGE: washing out of the stomach using a tube and fluids.
- GASTRITIS: irritation of lining of stomach which may be evident as stomach pains, vomiting, or diarrhea, etc.
- GASTROENTERITIS: inflammation of stomach and intestine.
- GASTROINTESTINAL TRACT: stomach and intestine as a functional unit.
- GAVAGE: feeding by means of a stomach tube.
- GENERAL VENTILATION: removal of contaminated air and its replacement with clean air from general workplace area as opposed to local ventilation, which is specific air changing in immediate air of a contamination source.
- GENERIC NAME: designation or identification to identify a chemical by other than its chemical name.
- GENETIC: Pertaining to or carried by genes. Hereditary.
- GINGIVITIS: inflammation of the gums.
- GRAM: metric unit of mass weight. One U.S. ounce is about 28 grams and one pound is 454 grams.
- GRAM/KILOGRAM: expression of dose used in oral and dermal toxicology testing to indicate the grams of substance dosed per kilogram of animal body weight.
- GROUNDING: safety practice to conduct electrical charge to ground, preventing igniting sparks of a material.

- HAZARDOUS CHEMICAL: Any chemical whose presence or use is a physical hazard or a health hazard.
- HAZARDOUS DECOMPOSITION: breaking down or separation of a substance into its constituent parts, elements, or into simpler compounds accompanied by the release of heat, gas, or hazardous materials.
- HAZARDOUS INGREDIENTS: hazardous substances that make up a mixture.
- HAZARDOUS MATERIAL: any substance or mixture having properties capable of producing adverse effects on the health or safety of a human being.
- HAZARDOUS MATERIALS IDENTIFICATION SYSTEM (HMIS): provide information on health hazards, reactivity, and flammability that are encountered in the workplace. A number is assigned to a material indicating the degree of hazard, from 0 for the least up to 4 for the most severe. Letters are used to designate personal protective equipment.
- HAZARDOUS WASTE NUMBER: number assigned by the EPA, per RCRA law, to identify and track hazardous wastes.
- HEALTH HAZARD: chemical from which acute or chronic health effects may occur in exposed individuals.
- HEMATOPOIETIC SYSTEM: The blood-forming mechanism of the human body.
- HEMATURIA: presence of blood in the urine.
- HEMOLYSIS: separation of the hemoglobin from red blood corpuscles.
- HEPATIC: pertaining to the liver.
- HEPATOTOXIN: A substance that causes injury to the liver.
- HIGHLY TOXIC:
 - A chemical in any of the following categories:
 - A chemical with a median lethal dose (LD₅₀) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats between 200 and 300 grams each.
 - A chemical with a median lethal dose (LD₅₀) 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 2 and 3 kilograms each.
 - A chemical that has a median lethal concentration (LC₅₀) 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 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.
- HYDROCARBON: organic compound composed only of carbon and hydrogen. Petroleum, natural gas, and coal are the main sources of hydrocarbons for industry.
- HYDROPHILIC: materials having large molecules that absorb and retain water, causing them to swell and frequently to gel.
- HYGROSCOPIC: readily adsorbs moisture.
- HYPEREMIA: congestion of blood in a body part.
- HYPERGOLIC: self-igniting upon contact of its components without a spark or external aid.
- HYPOCALCEMIA: calcium deficiency of the blood.

- HYPOXIA: insufficient oxygen, applied to cells.
- IGNITION TEMPERATURE: Lowest temperature at which a combustible material will catch fire in air and will continue to burn independently of the source of heat when heated.
- IMMEDIATE USE: chemical will be under the control and used only by person who transfers it from a labeled container and only within shift.
- IMMEDIATELY DANGEROUS TO LIFE AND HEALTH (IDLH): maximum concentration from which one could escape within minutes without any escape-impairing symptoms or any irreversible health effects.
- IMPERVIOUS: material that does not allow another substance to pass through or penetrate it.
- IMPORTER: first business with employees within the Customs Territory of U.S. which receives hazardous chemicals produced in other countries for the purpose of supplying them to distributors or employers within U.S.
- INCOMPATIBLE: materials which could cause dangerous reactions from direct contact with one another.
- INERT INGREDIENTS: anything other than the active ingredient in a product; not having active properties.
- INFLAMMABLE: capable of being easily set on fire and continuing to burn, especially violently.
- INFLAMMATION: series of reactions produced in tissue by an irritant, injury, or infection. Characterized by swelling and redness by an influx of blood and fluids.
- INGESTION: taking of substance through the mouth.
- INHALATION: breathing in of a substance in the form of a gas, vapor, fume, mist, or dust.
- INHALATION TOXICITY: Ratings corresponding to the following definitions are derived from the test methods and categories of toxicity described in 16 CFR 1500.3.
 - NON-TOXIC: The probable lethal concentration of the undiluted product to 50% of the test animals (LC50) is greater than 200 milligrams per liter by volume when inhaled continuously for one hour or less.
 - TOXIC: The probable lethal concentration of the undiluted product to 50% of the test animals (LC50) is greater than 2 milligrams and less than or equal to 200 milligrams per liter by volume when inhaled continuously for one hour or less.
 - HIGHLY TOXIC: The probable lethal concentration of the undiluted product to 50% of the test animals (LC50) is less than or equal to 2 milligrams per liter by volume when inhaled continuously for one hour or less.
- INHIBITOR: chemical added to another substance to prevent an unwanted chemical change from occurring.
- INORGANIC MATERIALS: derived from other than vegetable or animal sources; generally do not contain carbon atoms.
- INSOLUBLE: incapable of being dissolved in a liquid.
- INTERSTITIAL FIBROSIS: scarring of the lungs.
- IRIDAL: pertaining to the iris of the eye.
- IRIDOCYCLITIS: inflammation of both the iris and the ciliary body of the eye.
- IRRITANT: substance which, by contact in sufficient concentration for a sufficient period of time, will cause an inflammatory response or reaction of the eye, skin, or respiratory system.
- ISOMERS: compounds that have same molecular weight and atomic composition but differ in molecular structure.
- JAUNDICE: yellowish discoloration of tissue, whites of eyes, and bodily fluids with bile pigment caused by any of several pathological conditions that interrupt the liver's normal production and discharge of bile.
- KETOSIS: Condition marked by excessive production or accumulation of ketone bodies in the body caused by disturbed carbohydrate metabolism.
- KILOGRAM: Metric unit of weight; about 2.2 pounds.
- LABEL: any written, printed, or graphic sign or symbol displayed on or affixed to containers of hazardous chemicals. Should contain identity of the material, appropriate hazard warnings, and name and address of the chemical manufacturer, importer, or other responsible party.
- LABORATORY SCALE (ACTIVITY): The work involves containers of substances used for reactions and transfers that are designed for easy and safe handling by one person. Workplaces that produce commercial quantities of materials are excluded from the definition of "Laboratory."
- LACRIMATION: secretion and discharge of tears.
- LACRIMATOR: material that produces tears.
- LANDFILL: disposal of trash and waste products at controlled location that is sealed and buried under earth.
- LATENCY PERIOD: time that elapses between exposure and the first manifestations of disease or illness.
- LAVAGE: washing of an organ, such as the stomach, using tube and fluids.
- LESION: change, injury, damage to tissue or organ.
- LETHAL CONCENTRATION: concentration being tested which will kill a test animal.
- LETHAL CONCENTRATION 50, median lethal concentration. The concentration of a material in air that on the basis of laboratory tests (respiratory route) is expected to kill 50% of a group of test animals when administered as a single exposure in a specific time period, usually 1 hour LC50 is expressed as parts of material per million parts of air, by volume (ppm) for gases and vapors, as micrograms of material per liter of air (ug/l), or milligrams of material per cubic meter of air (mg/m3) for dusts and mists, as well as for gases and vapors.
- LETHAL CONCENTRATION LOW. The lowest concentration of a substance in air reported to have caused death in humans or animals. The reported concentrations may be entered for periods of exposure that are less than 24 hr (acute) or greater than 24 hr (subacute and chronic).
- LETHAL DOSE: amount of substance being tested which kills a test animal.

- LETHAL DOSE 50. The single dose of a substance that causes the death of 50% of an animal population from exposure to the substance by any route other than inhalation. LD50 is usually expressed as milligrams or grams of material per kilogram of animal weight (mg/kg or g/kg). The animal species and means of administering the dose (oral, intravenous, etc.) should also be stated.
 - LETHAL DOSE LOW. The lowest dose of a substance introduced by any route, other than inhalation, reported to have caused death in humans or animals.
 - LEUKEMIA: progressive, malignant disease of the blood-forming organs.
 - LIPID GRANULOMA: mass of chronically inflamed tissue that is usually infective.
 - LIPID PNEUMONIA: chronic condition caused by the aspiration of oily substances into the lungs.
 - LOCAL EFFECTS: toxic or irritating effects which occur at the site of contact with a chemical or substance.
 - LOCAL VENTILATION: drawing off and replacement of contaminated air from its source.
 - LOWER EXPLOSIVE (FLAMMABLE) LIMIT: lowest concentration (lowest percentage of the substance in air) that will produce a flash of fire when an ignition source (heat, arc, or flame) is present.
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- MALAISE: general discomfort, distress, or uneasiness.
 - MAXIMUM ACCEPTABLE AMBIENT CONCENTRATION (MAAC): The maximum allowable twenty-four hour average concentration, in ambient air, of a toxic air contaminant.
 - MELTING POINT: temperature a solid changes to a liquid state. For mixtures, a melting range may be given.
 - METABOLISM: chemical and physical processes whereby the body functions.
 - METASTASIS: transmission of a disease from one part of the body to another.
 - METHEMOGLOBINEMIA: presence of methemoglobin in the bloodstream caused by the reaction of materials with the hemoglobin in blood reducing their oxygen-carrying capacity.
 - MILLILITER: 1/1000 of a liter. A metric unit of capacity, for all practical purposes equal to 1 cubic centimeter. One cubic inch is about 16 ml.
 - MISCIBLE: extent to which liquids/gases can be mixed/blended.
 - MIST: suspended liquid droplets in air generated by condensation from gaseous to liquid state or by mechanically breaking up liquid by splashing or atomizing.
 - MIXTURE: heterogeneous association that cannot be represented by a chemical formula and does not undergo chemical change as a result of interaction with mixed materials.
 - mm Hg: A measure of pressure in millimeters of a mercury column above a reservoir, or difference of level in a U-tube.
 - MOLE: quantity of a substance that has a weight in a unit numerically equal to the molecular weight.
 - MOLECULAR WEIGHT: mass in grams per mole.
 - MUCOUS MEMBRANE: the mucous-secreting lining that lines the hollow organs of the body.
 - MUTAGEN: substance or agent capable of altering the genetic material in a living cell.
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- N-: normal. Used as a prefix in chemical names signifying a straight-chain structure.
 - NARCOSIS: stupor or unconsciousness produced by narcotics or other materials.
 - NAUSEA: tendency to vomit; feeling of sickness.
 - NECROSIS: localized death of tissue.
 - \ NEOPLASM: new or abnormal tissue growth that is uncontrollable and progressive.
 - NEPHROTOXIC: poisonous to the kidney.
 - NEURITIS: inflammation of the nerves.
 - NEUTRALIZE: to render chemically harmless; to return the pH to the neutral level of 7.
 - NON-FLAMMABLE: incapable of being easily ignited or burning with extreme rapidity when lighted. Also, a DOT hazard class for any compressed gas other than a flammable one.
 - NOx: A general formula for oxides of nitrogen (NO, NO₂). They react with moisture in the respiratory tract to produce acids that corrode and irritate tissue, causing congestion and pulmonary edema. Symptoms of acute exposure can develop over 6 to 24 hours. Chronic exposure to low levels can cause irritation, cough, headache, and tooth corrosion. Exposure to 5 to 50 ppm of NO₂ can cause slowly evolving pulmonary edema. Commonly produced by combustion processes, including motor vehicle engines.
 - NUISANCE PARTICULATES: dusts that do not produce significant organic disease or toxic effect from "reasonable" concentrations and exposures.
 - NYSTAGMUS: spastic, involuntary motion of the eyeballs.
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- OCCUPATIONAL EXPOSURE LIMIT (OEL): The most restrictive eight-hour time weighted average concentration specified for workroom air selected from either the 1986-1987 Threshold Limit Values and Biological Exposure Indices as adopted by the American Conference of Governmental Industrial Hygienists; the Recommended Standards for Occupational Exposure set forth in the July 1985 summary of National Institute for Occupational Safety and Health Recommendations for Occupational Health Standards; or the 1986 Workplace Environmental Exposure Levels set forth by the American Industrial Hygiene Association.
 - ODOR: description of the smell of the substance.
 - ODOR THRESHOLD: lowest concentration of a substance's vapor, in air, that can be smelled.
 - OLFACTORY: relating to the sense of smell.
 - OLIGURIA: scanty or low volume of urine.
 - OPAQUE: Impervious to light rays.
 - OPEN TRANSFER: Any transfer that at any time involves contact of a moving fluid with the atmosphere, air, or oxygen. Open transfer of flammable liquids, especially Class IA liquids, is dangerous due to the release of flammable vapors into the work area. Since there is a risk of fire or explosion if an ignition source is present, do these transfers only in a hood.

- ORAL: used in or taken into the body through the mouth.
- ORAL TOXICITY: adverse effects resulting from taking a substance into the body via the mouth. Ratings corresponding to the following definitions are derived from data obtained from the test methods and categories of toxicity as described in 16 CFR 1500.3.
 - NON TOXIC: The probable lethal dose of undiluted product to 50% of the test animals determined from ingestion studies (LD50) is greater than 5 grams per kilogram of body weight.
 - TOXIC: The probable lethal dose of undiluted product to 50% of the test animals determined from ingestion studies (LD50) is greater than 50 milligrams and less than or equal to 5 grams per kilogram of body weight.
 - HIGHLY TOXIC: The probable lethal dose of undiluted product to 50% of the test animals determined from ingestion studies (LD50) is less than or equal to 50 milligrams per kilogram of body weight.
- ORGANIC MATERIALS: compounds composed of carbon, hydrogen, and other elements with chain or ring structures.
- OVEREXPOSURE: exposure to a hazardous material beyond the allowable exposure levels.
- OXIDATION: reaction which a substance combines with oxygen provided by an oxidizer or oxidizing agent. An oxidation reaction is always accompanied by an offsetting reduction reaction in which (1) oxygen is removed from a compound; or (2) atoms, molecules, or ions gain electrons.
- OXIDE POX: dermatitis caused by contact with oxides under poor personal hygienic conditions.
- OXIDIZER: substance that yields oxygen readily to stimulate combustion of organic matter.
- OXIDIZING AGENT: chemical or substance that brings about an oxidation reaction.

- PALPITATION: irregular, rapid heart beat.
- PARATHESIA: sensation of pricking, tinkling, or creeping on the skin that has no objective cause.
- PARTICULATE: small, separate pieces of an airborne material. Generally, anything not a fiber and has an aspect ratio of 3 to 1.
- PARTS PER MILLION: unit for measuring concentration of a gas or vapor in air. Parts of the gas or vapor in a million parts of air. Also used to indicate the concentration of a particular substance in a liquid or solid.
- PERMISSIBLE EXPOSURE LIMIT: legally enforced exposure limit for a substance established by OSHA. The PEL indicates the permissible concentration of air contaminants to which nearly all workers may be repeatedly exposed 8 hours a day, 40 hours a week, over a working lifetime (40 years), without adverse health effects.
- PERCENT VOLATILE: percent of liquid or solid that evaporates at ambient temperature and pressure at 70F.
- PERSONAL HYGIENE: precautionary measures taken to maintain good health when exposed to harmful materials.
- PERSONAL PROTECTIVE EQUIPMENT: devices or clothing worn to help isolate a worker from direct exposure to hazardous materials.
- PETROLEUM DISTILLATE: complex mixture of hydrocarbons, liquid at normal ambient conditions, separated from crude oil and other refinery process streams by distillation.
- pH: scale of 0 to 14 representing acidity or alkalinity of aqueous solution. Pure water has pH of 7. Substance in aqueous solution will ionize to various extents giving different concentrations of H⁺ and OH⁻ ions.
- PHLEGM: thick mucous from the respiratory passage.
- PHOTOPHOBIA: intolerance to light.
- PHYSICAL HAZARD: Means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water reactive.
- PHYSICAL STATE: condition of a material (solid, liquid, or gas) at room temperature.
- PNEUMOCONIOSIS: respiratory tract and lung condition caused by inhalation and retention of irritant mineral or metallic particles. An X-ray can detect changes, which include fibrosis.
- POISON: any substance that is injurious to health and may lead to death when relatively small amounts are taken either internally or externally.
- POISON, CLASS A: DOT term for an extremely dangerous poison such as a poisonous gas or liquid of such a nature that a very small amount of the gas or vapor of the liquid mixed with air is dangerous to life.
- POISON, CLASS B: DOT term for liquid, solid, paste, or semisolid substances other than class A poisons or irritating materials known or presumed by animal tests to be so toxic to man to be a health hazard during transportation.
- POISON CONTROL CENTER: provides medical information on a 24-hour basis for accidents involving ingestion of potentially poisonous materials.
- POLYCHLORINATED BIPHENYL: pathogenic and teratogenic compound used as a heat-transfer medium. It accumulates in tissue.
- POLYMERIZATION: reaction in which one or more small molecules combine to form larger molecules.
- POUR POINT: temperature at which a liquid ceases or begins to flow or at which it congeals.
- POX: A general term for the several oxides of phosphorus.
- PRECORDIAL: in front of the heart, stomach.
- PRIMARY SKIN IRRITANT: a non-corrosive substance which produces severe skin irritation.
- PRODUCE: to manufacture, process, formulate, or repackage.
- PRODUCT IDENTIFICATION NUMBER: four digit number, prefaced by UN or NA, used in Canada under the Transportation of Dangerous Goods Regulation to identify a material in the event of an accident.
- PROSTRATION: physical exhaustion, incapacitation.
- PROTEINURIA: presence of protein in the urine.
- PSYCHOTROPIC: acting on the mind.
- PULMONARY EDEMA: fluid in the lungs.
- PYOLYSIS: chemical decomposition or breaking apart of molecules produced by heating.
- PYROPHORIC: materials that ignite spontaneously in air below 130F. Occasionally friction will ignite them.

- REACTION: chemical transformation or change; interaction of two or more substances to form substance.
- REACTIVE MATERIAL: chemical substance or mixture that will vigorously polymerize, decompose, condense, or become self-reactive due to shock, pressure, or temperature. Includes explosive materials, organic peroxides, pressure-generating materials, and water-reactive materials.
- REACTIVITY: tendency of a substance to undergo chemical reaction with the release of energy.
- REAGENT: substance used in a chemical reaction to produce another substance or to detect its composition.
- RECOMMENDED EXPOSURE LIMIT: the highest allowable airborne concentration that is not expected to injure a worker. Expressed as a ceiling limit or as a time-weighted average, usually for 10-hour work shifts.
- REDUCING AGENT: substance that (1) combines with oxygen or (2) loses electrons to the reaction during a reduction reaction.
- REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES: published by NIOSH. Presents basic toxicity data on thousands of materials. Objective is to identify "all-known toxic substances" and to reference original studies.
- RENAL: pertaining to the kidney.
- REPORTABLE QUANTITY: amount of material that when spilled must be reported to the Federal, State, and local authorities under CERCLA, EPCRA, and the CWA.
- REPRODUCTIVE HEALTH HAZARD: any agent that has a harmful effect on the adult male or female reproductive system or the developing fetus or child.
- RESPIRATORY PROTECTION: Devices that will protect the wearer's respiratory system from overexposure by inhalation to airborne contaminants. Respiratory protection is used when a worker must work in an area where he/she might be exposed to concentration in excess of the allowable exposure limit.
- RESPIRATORY SYSTEM: breathing system, including lungs and air passages, as well as associated system of nerves and circulatory supply.
- RESPONSIBLE PARTY: someone who can provide information on the hazardous chemical and appropriate emergency procedures, if necessary.
- ROUTES OF ENTRY: means by which material may gain access to the body (inhalation, ingestion, skin contact).
- SAINT ANDREW'S CROSS (X): used in packaging for transport; means harmful - stow away from foodstuffs.
- SARCOMA: A tumor that is often malignant.
- SCLERAE: tough, white, fibrous covering of the eyeball.
- SENSITIZATION: state of immune-response reaction in which further exposure elicits an immune or allergic response. A person previously exposed to a certain material is more sensitive when he experiences further contact with it.
- SENSITIZER: substance which, on first exposure, causes little or no reaction in man or test animals but which, on repeated exposure, may cause a marked response not necessarily limited to the contact site.
- SIDEROSIS: pneumoconiosis caused by the inhalation of iron particles. Also, tissue pigmentation caused by contact with iron.
- SIGN: abnormality indicating poisoning or disease which is observable by another person.
- SIGNAL WORDS: distinctive words on a MSDS which serves to alert the reader to the existence and relative degree of a hazard. Signal words are limited to:
 - Danger: materials that are: highly toxic; corrosive to living tissue; extremely flammable; or are suspected human carcinogens.
 - Warning: materials that are: moderately toxic; have severe skin irritation potential; cause allergic skin reactions; or are flammable.
 - Caution: materials that: have a low order of toxicity; produce only slight to moderate skin irritation; or are combustible.
- SILICOSIS: condition of massive fibrosis of the lungs causing shortness of breath because of prolonged inhalation of silica dusts.
- SKIN: notation indicating possible significant contribution to overall exposure to material via absorption or contact.
- SKIN IRRITATION: Ratings corresponding to the following definitions are derived from data obtained from the test methods as described in the CFR 16 1500.41 and or NAS publication 1138 and categories of toxicity as described in 16 CFR 1500.3.
 - PRACTICALLY NON-IRRITATING: The undiluted product causes no noticeable irritation or causes slight inflammation (edema and erythema skin reaction values of 0 to 1) of intact or abraded skin of rabbits during the study period. Primary irritation index of 0 - 1.9.
 - MODERATELY IRRITATING: The undiluted product causes well-defined inflammation (edema and erythema skin reaction values of 2) during the study period. Primary irritation index of 2 - 4.9.
 - PRIMARY SKIN IRRITANT: The undiluted product cause moderate to severe inflammation (edema and erythema skin reaction values of 3 or 4) of the intact or abraded skin of rabbits during the study period. Primary irritation index of 5 or more.
 - CORROSIVE: The undiluted product causes visible destruction or irreversible alterations of the tissue structure at the site of contact on intact or abraded skin of rabbits during the study period.
- SLURRY: pourable mixture of solid and liquid.
- SMOKE: dry particles and droplets generated by incomplete combustion of an organic material combined with and suspended in the gases from combustion.
- SOLUBILITY IN WATER: percentage of a material (by weight) that will dissolve in water at ambient temperature.
- SOLUTION: uniformly dispersed mixture. Composed of a solvent and a dissolve substance, called the solute.
- SOLVENT: substance, usually liquid, in which other substances are dissolved. Water is the most common solvent.
- SOOT: fine particles, usually black, formed by combustion consisting chiefly of carbon. Gives smoke color.
- SPASM: involuntary, convulsive muscular contraction.
- SPECIFIC CHEMICAL IDENTITY: name, CAS number, or other information that reveals the precise chemical designation of the

- substance.
- **SPECIFIC GRAVITY:** weight of material compared to equal volume of water; expression of density of material.
- **STABILITY:** ability of a material to remain unchanged. A material is stable if it remains in the same form under expected and reasonable conditions of storage or use.
- **STOMATITIS:** inflammation of the membrane of the mouth.
- **STUPOR:** partial or nearly complete unconsciousness.
- **SUBCUTANEOUS:** beneath the skin.
- **SUBLIME:** change from the solid to the vapor phase without passing through the liquid phase.
- **SUBSTANCES OF HIGH TOXICITY:** Those chemicals having an acute toxicity of either
 - (1) Median Lethal Dose, single oral dose, rat, less than or equal to 50 mg/kg, or
 - (2) Median Lethal Concentration, four-hour inhalation exposure, rat, less than or equal to 100 ppm, or
 - (3) Median Lethal Dose, dermal exposure, rabbits, less than or equal to 100 mg/kg.
- **SUBSTANCES OF MODERATE TOXICITY:** Those substances that have been shown to produce moderate toxicity following exposure or have been demonstrated to produce carcinogenic, mutagenic, or teratogenic action in a single animal species with little or no human evidence of carcinogenic, mutagenic, or teratogenic action, or those chemicals having an acute toxicity of either
 - (1) Median Lethal Dose, single oral dose, rat, greater than 50 mg/kg but less than 500 mg/kg, or
 - (2) Median Lethal Concentration, four-hour inhalation exposure, rat, greater than 100 ppm but less than 1,000 ppm, or
 - (3) Median Lethal Dose, dermal exposure, rabbits, greater than 100 mg/kg but less than 500 mg/kg.
- **SUBSTANCES OF LOW TOXICITY:** Those substances that have been shown to produce low toxicity or irritation, or those chemicals having an acute toxicity of either
 - (1) Median Lethal Dose, single oral dose, rat, greater than 500 mg/kg but less than 5 g/kg, or
 - (2) Median Lethal Concentration, four-hour inhalation exposure, rat, greater than 1,000 ppm but less than 10,000 ppm, or
 - (3) Median Lethal Dose, dermal exposure, rabbits, greater than 500 mg/kg but less than 3,000 mg/kg.
- **SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT.** Signed into law October 17, 1986. Title II of SARA is known as the Emergency Planning and Community Right-to-Know Act of 1986. A revision and extension of CERCLA, SARA is intended to encourage and support local and state emergency planning efforts. It provides citizens and local governments with information about potential chemical hazards in their communities. SARA calls for facilities that store hazardous materials to provide officials and citizens with data on the types (flammables, corrosives, etc.); amounts on hand (daily, yearly); and their specific locations. Facilities are to prepare and submit inventory lists, MSDSs, and tier 1 and 2 inventory forms. The disaster in Bhopal, India in 1987 added impetus to the passage of this law.
- **SUSPECT HUMAN CARCINOGEN:** A substance suspected of inducing cancer based on human evidence or demonstration by appropriate methods, or carcinogenesis in two or more animal species or strains.
- **SYNERGY:** interaction of materials to give a combined result different from either material alone.
- **SYNONYM:** name or names by which a material is known.
- **SYSTEMIC EFFECTS:** acute or chronic adverse health effects which occur in parts of the body removed from the site of exposure to the material.

- **TACHYCARDIA:** Excessively rapid heartbeat, with a pulse rate above 100.
- **TACHYPNEA:** Increased rate of respiration.
- **TARGET ORGAN TOXIN:** Toxic substance that attacks a specific organ of the body.
- **TERATOGEN:** Substance or agent to which exposure of a pregnant female can result in malformation in the fetus.
- **THRESHOLD LIMIT VALUE:** Airborne concentration of a material to which nearly all persons can be exposed day after day, without adverse effects. TLV's are expressed in 3 ways:
 - TLV-C: Ceiling limit, concentration that should not be exceeded even instantaneously.
 - TLV-STEL: Short term exposure limit, maximum concentration for a continuous 15-minute exposure period.
 - TLV-TWA: Time-weighted average, concentration for a normal 8-hour work day or 40-hour work week.
- **THRESHOLD PLANNING QUANTITY (TPQ):** Per 40 CFR 302. The amount of material at a facility that requires emergency planning and notification per CERCLA.
- **TINNITUS:** Ringing sound in the ears.
- **TOXICITY:** Sum of adverse effects resulting from exposure to a material, generally by the mouth, skin, or respiratory tract.
- **TOXICOLOGY:** Study of the nature, effects, and detection of poisons in living organisms. Also, substances that are otherwise harmless but prove toxic under particular conditions.
- **TOXIC SUBSTANCE:** Chemical or material that (1) has evidence of an acute or chronic health hazard, and (2) is listed in the RTECS manual, provided that the substance causes harm at any dose level; causes cancer or reproductive effects in animals at any dose level; has a median lethal dose level of less than 500 mg per kg of body weight when administered orally to rats; has a median lethal dose level of less than 1000 mg per kg of body weight when administered by continuous contact to the bare skin of albino rabbits; or has a median lethal concentration in air of less than 2000 ppm by volume of gas or vapor, or less than 20 mg per liter of mist, fume, or dust when administered to albino rats.
- **TOXIC SUBSTANCES CONTROL ACT (TSCA):** Public Law PL 94-469. Found in 40 CFR 700-799. EPA has jurisdiction. Effective January 1, 1977. Controls the exposure to and use of raw industrial chemicals not subject to other laws. Chemicals are to be evaluated prior to use and can be controlled based on risk. The act provides for a listing of all chemicals that are to be evaluated prior to manufacture or use in the US.
- **TRADE NAME:** Trademark name or commercial trade name for a material given by the manufacturer.
- **TRADE SECRET:** Any confidential formula pattern, process, device, information, or compilation of information used in an employer's business and gives the employer an opportunity to obtain an advantage over competitors.

- TIME-WEIGHTED AVERAGE: the airborne concentration of a material to which a person is exposed, averaged over the total exposure time, generally the total workday (8 to 12 hours).
- UPPER EXPLOSIVE (FLAMMABLE) LIMIT (UEL): Highest concentration (highest percentage of the substance in air) that will produce a flash of fire when an ignition source (heat, electric arc, or flame) is present.
- UNSTABLE: Tending toward decomposition or other unwanted chemical change during normal handling or storage.
- USE: To package, handle, react, or transfer.
- UTRICARIA: Nettle rash; hives; elevated, itching white patches.
- VAPOR: Gaseous state of a material suspended in air that would be a liquid or solid under ordinary conditions.
- VAPOR DENSITY: Weight of vapor or gas compared to an equal volume of air; expression of the density of the vapor or gas.
- VAPOR PRESSURE: Pressure exerted by a saturated vapor above its liquid in a closed container. Important facts to remember:
 - Vapor pressure of a substance at 100° F will always be higher than the vapor pressure of the substance at 60° F.
 - Vapor pressures reported on MSDS/s in mmHg are usually very low pressures; 760 mmHg is equivalent to 14.7 psi.
 - The lower the boiling point of a substance, the higher its vapor pressure.
- VENTILATION: Circulating fresh air to replace contaminated air.
- VERTIGO: Feeling of revolving in space; dizziness, giddiness.
- VISCOSITY: Tendency of a fluid to resist internal flow without regard to its density.
- VOLATILE ORGANIC COMPOUNDS (VOC): Used in coatings and paint because they evaporate very rapidly.
- VOLATILITY: Measure of how quickly a substance forms a vapor at ordinary temperatures.
- WATER REACTIVE: Material that reacts with water to release a gas that is either flammable or presents a health hazard.
- WORK AREA: A room or defined space in a workplace where hazardous chemicals are produced or used, and where employees are present.
- WORKPLACE: An establishment at one geographical location containing one or more work areas.
- ZINC FUME FEVER: Caused by inhalation of zinc oxide fume characterized by flu-like symptoms, a metallic taste in the mouth, coughing, weakness, fatigue, muscular pain, and nausea, followed by fever and chills.
- Z LIST: OSHA's Toxic and Hazardous Substances Tables Z-1, Z-2, and Z-3 of air contaminants, found in 29 CFR 1910.1000. These tables record PEL's, TWA's, and ceiling concentrations for the materials listed. Any material found on these tables is considered to be hazardous.