GLOSSARY OF CHEMICAL HAZARD TERMS

ACGIH - The American Conference of Governmental Industrial Hygienists consists of occupational safety and health professionals who recommend occupational exposure limits for many substances.

Action Level - An OSHA concentration calculated as an 8-your time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

Acute Health Effect - A severe effect which occurs rapidly after a brief intense exposure to a substance. ANSI - American National Standards Institute is a private group that develops consensus standards.

Acute toxicity -Acutely toxic substances cause adverse effects by any of the following exposure methods:

1. Oral or dermal administration of a single dose of a substance.
2. Multiple oral or dermal doses within a 24-hour period
3. An inhalation exposure of 4 hours.

Asphyxiant - A chemical (gas or vapor) that can cause death or unconsciousness by suffocation.

Aspiration hazard - A liquid or solid chemical that causes severe acute effects if it infiltrates into the trachea and lower respiratory tract. Possible effects include chemical pneumonia, pulmonary injury, or death

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

Boiling Point - The temperature of a liquid at which its vapor pressure is equal to the gas pressure over it. With added energy, all of the liquid could become vapor. Boiling occurs when the liquid's vapor pressure is just higher than the pressure over it.

Carcinogen - A substance that causes cancer in humans or, because it has produced cancer in animals, is considered capable of causing cancer in humans. Under the OSHA Laboratory Standard, a carcinogen is any chemical that has been found to be a carcinogen or potential carcinogen by the International Agency for Research on Cancer, is listed as a carcinogen or potential carcinogen in the Annual Report on Carcinogens published by the National Toxicology Program, or is regulated by OSHA as a carcinogen.

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

Ceiling Limit (CL or C) - An OSHA established concentration exposure limit which must never be exceeded, even for an instant. It is often written as TLV-C.

Chemical Reactivity - A chemical's ability to react with other materials. A chemical's ability to change in molecular arrangement or composition alone or with other chemicals. Reactivity implies, at least, a spontaneous action at the conditions, and is often rapid and energetic with dangerous and hazardous effects such as explosions, heat, etc.

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

Chronic Health Effect - An adverse effect with symptoms that develop or recur very slowly, or over long periods of time as a result of continued or periodic exposure to the offending agent.

Combustible - A material that will burn under most conditions.

Combustible Liquid - A liquids or liquid mixture having a flash point at or above 37.8 'V (100 "F), but below 93.3 °C. (200 °F). Combustible liquids shall be subdivided as follows:

Class II. Liquids having a closed cup flash point at or above 100°F (38°C) and below 140°F (60°C).

Class IIIA. Liquids having a closed cup flash point at or above 140°F (60°C) and below 200°F (93°C).

Class IIIB. Liquids having a closed cup flash point at or above 200°F (93°C). The category of combustible liquids does not include compressed gases or cryogenic fluids.

Compressed Gas - Any material which is a gas at normal temperature and pressure, and is contained under pressure as a dissolved gas or liquefied by compression or refrigeration. Other definitions include: (1) a gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 21 °C (70 °F); or (2) a gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 54.4°C (130 °F) regardless of the pressure at 21 °C (70 °F); or (3) a liquid having a vapor pressure exceeding 40 psi at 37.8 "C (100 °F) as determined by ASTM D-323-72.

Concentration - The amount of a substance present per unit of media. The amount of a substance (solute) in a mixture with substance(s) per amount of dominant substance (solvent) or sum of all substances (solution). These amounts can be mass, volume or molar amount. A single substance can be described by amount, mass or molar, in space. The former is density and the latter is the inverse of molar volume (e.g., water: 55.5 moles per liter).

Control Areas. Spaces within a building that are enclosed and bounded by exterior walls, fire walls, fire barriers and roofs, or a combination thereof, where quantities of hazardous materials not exceeding the maximum allowable quantities per control area are stored, dispensed, used or handled.

Controlled Substances - Drugs and certain other chemicals, both narcotic and non- narcotic, which come under the jurisdiction of federal Drug Enforcement Administration (DEA) and state laws regulating their manufacture, sale, distribution, use, and disposal.

Corrosive - A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the point of contact. A chemical shall be considered corrosive if, when tested on the intact skin of albino rabbits by the method described in DOT 49 CFR, Part 173.137, such a chemical destroys or changes irreversibly the structure of the tissue at the point of contact following an exposure period of 4 hours. A chemical can also be corrosive if it causes visible destruction of or irreversible alterations to metals at the site of contact by chemical action.

Cryogenic liquids - Materials with extremely low boiling points (i.e., less than -150 °F). Common examples of cryogenic liquids are liquid nitrogen, liquid helium, and liquid argon. One special property of both cryogenic liquids and dry ice (frozen carbon dioxide) is that they undergo substantial volume expansion when converted to the gas phase, which can potentially lead to an oxygen-deficient atmosphere in areas where ventilation is limited.

Cytotoxin - A substance toxic to cells in culture or to cells in an organism.

Dangerously Reactive Material -A material that can react readily and energetically alone (polymerize, fragment, rearrange) or with ordinarily non-reactive materials like air, water or combustibles.
Undesired results can include toxic release, fire, splattering or explosion.

Decomposition - A loss of molecular structure or composition (i.e., breakdown) by loss of simple molecules (water, carbon dioxide) or rearrangement to a simpler structure (loss of information). It is usually thermal, but could also be due to light, hydration or air oxidation.

Density - A measure of anything that is bound by a volume. Usually it is the mass per volume of a single substance at normal (standard) conditions of temperature and pressure. Energy density and power densities are useful measures as well. NFPA gives its highest hazard ratings to materials that generate greater than one kiloWatt per cubic centimeter (flames and halogen lights). Energy density has the same units as pressure (i.e., P = nRT/V or = QN). Specific gravity compares density to other common materials (e.g., water, air). Thus, vapor density, is the ratio of the molecular weight of a vaporized substance to that of

standard air, 28.8 g/mole. This ratio is an indicator as to how rapidly the pure vapor will settle out or rise if pushed into the air. If the density of a substance is compared with water (density = 1), then substances with densities < 1 will float on water if they don't dissolve; substances with densities > 1 will sink in water if they don't dissolve.

Dermal / Cutaneous - By or through the skin; pertaining to skin. Dermatitis - Skin rash; inflammation of the skin.

DOT - U.S. Department of Transportation. Regulates transportation of hazardous materials. Dyspnea - Shortness of breath, difficulty or labored breathing.

EPA Number - The number assigned to chemicals regulated by the EPA. Erythema - a reddening of the skin.

Evaporation Rate - Flow fast a material is converted to vapor (i.e., evaporates) compared to some other chemical at the same temperature and pressure. The known reference material is butyl acetate with a vaporization rate of 1. The higher the number, the more rapidly the liquid evaporates.

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

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

Eye Irritant - A chemical which irritates the eye.

Flammable - A chemical that catches on fire easily and bums readily.

Flammable Gas - A gas that, at an ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13% by volume or less; or, a gas that, at an ambient temperature and pressure forms a range of flammable mixtures with air wider than 12% by volume, regardless of the lower limit. These gases are likely to explode or burn readily if the vapor is exposed to an ignition source.

Flammable Liquid - Liquids with a flash point below 100 degrees Fahrenheit (38 degrees Celsius). Even a small energy spark like static electricity may ignite the vapors, which are usually given off readily under normal temperatures. Flammable liquids are further categorized into a group known as Class I liquids. The Class I category is subdivided as follows:

- **Class IA.** Liquids having a flash point below 73°F (23°C) and a boiling point below 100°F (38°C).
- **Class IB.** Liquids having a flash point below 73°F (23°C) and a boiling point at or above 100°F (38°C).
- **Class IC.** Liquids having a flash point at or above 73°F (23°C) and below 100°F (38°C). This category of flammable liquids does not include compressed gases or cryogenic fluids.

Flammable Solid - A solid, other than a blasting agent or explosive, that is capable of causing fire through friction, absorption or moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which has an ignition temperature below 212°F (100°C) or which burns so vigorously and persistently when ignited as to create a serious hazard. A chemical shall be considered a flammable solid as determined in accordance with the test method of CPSC 16 CFR; Part 1500.44, if it ignites and burns with a self-sustained flame at a rate greater than 0.1 inch (2.5 mm) per second along its major axis.

Flash Point - The minimum temperature in degrees Fahrenheit at which a liquid will give off sufficient vapors to form an ignitable mixture with air near the surface or in the container, but will not sustain combustion. The flash point of a liquid shall be determined by appropriate test procedure and apparatus as specified in ASTM D 56, ASTM D 93 or ASTM D 3278.

GLOSSARY OF CHEMICAL HAZARD TERMS

Fume - A liquid mist or solid particle suspension that has condensed from the vapor state.

Gases under pressure - Gases which are: stored at a pressure of 29 psi (gauge) or more, liquefied, or liquefied and refrigerated. They are divided into the following four categories:

- Compressed gas: A gas which, when under pressure, is entirely gaseous at a temperature of -50°C (-58°F), including all gases with a critical temperature ≤ 50°C (-58°F).
- Liquefied gas: A gas which, when under pressure, is partially liquid at temperatures above -50°C (-58°F).
- Refrigerated liquefied gas: A gas which is made partially liquid because of its low temperature.
- Dissolved gas: A gas which, when under pressure, is dissolved in a liquid phase solvent.

Germ cell mutagen - A substance that causes mutations in the germ cells of humans which can be transmitted to their offspring. Germ cell mutagens are further classified into 3 hazard categories (1A, 1B, and 2) based on the weight of evidence for their germ cell mutagenicity, with category 1A having the most conclusive evidence.

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

Grams per Kilogram (g/Kg) - The dose of a substance given to test animals in toxicity studies.

Hazardous Chemical - OSHA's definition includes any substance or chemical which is a "health hazard" or "physical hazard," including: chemicals which are carcinogens, toxic agents, irritants, corrosives, sensitizers; agents which act on the hematopoietic system; agents which damage the lungs, skin, eyes, or mucous membranes; chemicals which are combustible, explosive, flammable, oxidizers, pyrophorics, unstable-reactive or water-reactive; and chemicals which in the course of normal handling, use, or storage may produce or release dusts, gases, fumes, vapors, mists or smoke which may have any of the previously mentioned characteristics..

Hazard Warning - Any words, pictures, symbols, or combination thereof appearing on a label that convey the hazards of the chemical(s) in the container.

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

Hematopoietic System - The body's blood system, including the production and circulation of blood and the blood itself.

Hepatotoxins - Chemicals that cause liver damage.

Highly Toxic Chemicals - A material which produces a lethal dose or lethal concentration that falls within any of the following categories:

1. A chemical that has a median lethal dose (LD50) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
2. A chemical that has 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.
3. 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.

Mixtures of these materials with ordinary materials, such as water, might not warrant classification as highly toxic. While this system is basically simple in application, any hazard evaluation that is required for the precise categorization of this type of material shall be performed by experienced, technically competent persons.

Incompatible - Materials that could cause dangerous reactions by direct contact

with one another

Ingestion - Taking a substance into the body through the mouth as food, drink, medicine, or unknowingly as on contaminated hands, make-up, cigarettes, etc. (e.g., swallowing).

Inhalation - The breathing in of an airborne substance that may be in the form of gas, fumes, mists, vapors, dusts or aerosols.

Irritants - Chemicals which cause reddening, swelling and pain when it contacts skin, eyes, nose or respiratory system, but are not likely to cause tissue destruction.

Label - Any written, printed, or graphic material displayed on or affixed to containers of hazardous chemicals.

Laboratory - A facility where relatively small quantities of hazardous materials are used on a non- production basis.

Laboratory Scale - Work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person.

Lethal Concentration 50 (LC_{50}) - The concentration of an air contaminant that will kill 50% of the test animals in a group during a single exposure.

Lethal Dose 50 (LD50 or LD50130) - the dose of a substance or chemical that will kill 50% of the test animals in a group within the first 30 days following exposure.

Melting Point - The temperature at which a solid substance melts or becomes liquid. **Meter** - A meter is about 40 inches.

mg/m^3 - A way of expressing the concentration of a substance in air. It means the mass of substance per cubic meter (m^3) of air.

Mixture - A heterogeneous association of substances where the various individual substances retain their identities and can usually be separated by mechanical means. Includes solutions or compounds but does not include alloys or amalgams.

MSDS - see Safety Data Sheet.

Mutagen - Capable of changing (mutating) genetic material in such a way that future cell generations are affected.

Nanoparticle - A collection of tens to thousands of atoms approximately 1 to 100 nanometers in diameter, which may either be naturally occurring or engineered. Examples include: carbon buckyballs or fullerenes; carbon nanotubes; metal oxide nanoparticles (e.g., titanium dioxide); and quantum dots, among many others.

Neurotoxin - A chemical that produces its primary toxic effect on the nervous system.

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

Odor Threshold - The minimum concentration of a substance at which a majority of test subjects can detect and identify the substance's characteristic odor.

Organic peroxide - An organic compound that contains the bivalent -O-O- structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms have been replaced by an organic radical. Organic peroxides can pose an explosion hazard (detonation or deflagration) or they can be shock sensitive. They can also decompose into various unstable compounds over an extended period of time.

Class I. Those formulations that are capable of deflagration but not detonation.

Class II. Those formulations that burn very rapidly and that pose a moderate reactivity hazard.

Class III. Those formulations that burn rapidly and that pose a moderate reactivity hazard.

Class IV. Those formulations that burn in the same manner as ordinary combustibles and that pose a minimal reactivity hazard.

Class V. Those formulations that burn with less intensity than ordinary

combustibles or do not sustain combustion and that pose no reactivity hazard. Unclassified detonable. Organic peroxides that are capable of detonation. These peroxides pose an extremely high explosion hazard through rapid explosive decomposition

Class IV. Those formulations that burn in the same manner as ordinary combustibles and that pose a minimal reactivity hazard.

Class V. Those formulations that burn with less intensity than ordinary combustibles or do not sustain combustion and that pose no reactivity hazard.

Unclassified detonable. Organic peroxides that are capable of detonation. These peroxides pose an extremely high explosion hazard through rapid explosive decomposition.

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

Oxidizing Gas. A gas that can support and accelerate combustion of other materials

Oxidizer - A substance capable of oxidizing a reducing agent. Oxidizers are chemicals such as oxygen, chlorine, perchlorate and permanganates that support combustion but do not burn independently. Oxidizers can react violently with flammable and combustible materials. Oxidizers are subdivided as follows:

Class 4. An oxidizer that can undergo an explosive reaction due to contamination or exposure to thermal or physical shock. Additionally, the oxidizer will enhance the burning rate and can cause spontaneous ignition of combustibles.

Class 3. An oxidizer that will cause a severe increase in the burning rate of combustible materials with which it comes in contact or that will undergo vigorous self-sustained decomposition due to contamination or exposure to heat. Class 2. An oxidizer that will cause a moderate increase in the burning rate or that causes spontaneous ignition of combustible materials with which it comes in contact.

Class 1. An oxidizer whose primary hazard is that it slightly increases the burning rate but which does not cause spontaneous ignition when it comes in contact with combustible materials.

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

pH - A measure of how acidic or how basic a substance is on a scale of 0 - 14. pH 0 is very acidic; pH 7 is neutral; and pH 14 is very basic. Actually, an expression of the hydrogen ion, (i.e., (H20),H+), concentration in water, as the negative logarithm base 10 of its molarity. It is limited to being a measure in water, even though an analogous measure can be applied to any proton dissociating liquid (e.g., acetic acid). In equilibrium, the product of the concentrations of proton donor and proton receiver is characteristic of the molecule as an acid and a base. For water, the [(H20)„Hl[(H20)m0H1 = I0 regardless of the concentration of either. If [H] = 1 molar, then [011^{-}] = 10' molar. A very strong acid that is pure, may not be strongly dissociated because a neutral molecule may likely be a weak base for binding another proton. Similarly, liquid ammonia can easily form an ammonium ion with a donated proton but, ammonia is a very weak proton donor, thus a very low dissociation constant results. An acid stronger than hydronium ion, dissolved in water will produce a nearly equal amount of hydronium ions and proton ate any hydroxide ions as well. A practical limit of aqueous acid concentration would be 55.5 moles of a strong monoprotic acid added to a Titer of water (55.5 moles of 1120), forming a salt, $H_1$0+ A , that would likely have a volume greater than one liter. If its molarity is now, say, 25 mole per liter, and it is a liquid, the pH would be -1.40. Most concentrated, strong acids are up to 15 molar (above n = 3.7) and the pH can be

thus -1.18. A 50% sodium hydroxide solution is about 17 molar an its pH is 15.23. The measurement of pH is an artifact. A pH meter is really measuring the electropotential of a proton concentration dependent redox equilibrium against a standard potential (i.e., calomel) and the indicator scale is a voltage meter calibrated to read - Log_{io} of proton concentration. Hydrofluoric acid or concentrated sodium hydroxide solutions will treat the porous glass probe like it's candy and consume it. Colorimetric indicators, dyes that show different visible light transmissions dependent on protonation of the molecule, change their color at a certain proton concentration in solution given their acid-base characteristics. Distinct color changes of dyes can range from at pH 1 to 13. A clever combination of four dyes that are water soluble, universal indicator, results in a prism color spectrum from red at pH of 4 to blue at pH of 10 with purple at about 11. This will only indicate truly in aqueous systems; solvent mixtures can protonate or deprotonate the dyes at conditions other than what water, acidic or basic, will do. The colors can be off-spectrum, interesting in themselves, but not really saying anything.

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

pK - An acid or base equilibrium constant, pKa or pKb, as the negative logarithm (- $Log_{ic)}$) of proton or hydroxide molar concentrations, times the conjugate ion concentration, [A^-] or LBW], divided by the un-dissociated species concentration. Water concentration, certainly a participant in the equation, is not included (i.e., dilute solutions will be 55.5 molar water). For acids stronger than hydronium, protonated water, pKa = 0, the pKa has limited meaning for aqueous systems; hydronium ion is the acid. To obtain a pK value, it is necessary to know the reaction that the pK is being referred to. Experimentally determined pK values depend on temperature, ionic strength, and the microenvironment of the ionizable group. Generally, only the pKa's are listed for both acids and bases. That is because pKb is 14 - pKa, just as pOH = 14 - pH. The pKa of an amine, that obviously doesn't donate a proton in normal cases, is the pKa of its conjugate, BH^+; thus pKa = - Log_{10}{[B][H^+]/[BH^+]} and pKb = - Log_{10} {[BH^+][OH^-]/[B]}, pKa pKb = - Log10{[H^+][OH^-]} = pKw = 14.

Polymerization - A chemical reaction, usually carried out with a catalyst, in which two or more small molecules combine to form larger molecule that contain repeating structural units of the original molecules. A hazardous polymerization occurs when the reaction results in an uncontrolled release of energy.

ppm - Parts per million. An expression of concentration of a gas or vapor in air or a solute in a solvent, but can also express precision. It can be dimensionless (e.g., micromoles per mole, milligram per kilogram), or it can be mixed units (e.g., milligram per liter [i.e., liter equated to kilogram by water density] or even milliliter per kilogram) if necessary. In these situations, it is important to know what it means in terms of the units.

Pyrophoric - A chemical that will ignite spontaneously in air at a temperature of 54.4 'V (130 °F) or below.

Reactivity -The ability of a substance to undergo a chemical change alone or with other substances, without energy input and usually with a release of energy and/or volatiles. Highly reactive substances may burn, explode or produce corrosive or toxic emissions. See also Dangerously Reactive.

Reproductive Toxin - A chemical that affects the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

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

Respiratory Hazard - A particular concentration of an airborne contaminant that, when it enters

the body by way of the respiratory system results in some bodily function impairment.

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

Safety Data Sheet (SDS) - Written or printed material concerning a hazardous chemical that includes information on the chemical's identity; physical and chemical characteristics; physical and health hazards; primary routes of entry; exposure limits; whether the chemical is a carcinogen; precautions for safe handling and use; control measures; emergency and first aid procedures; the date of preparation of the SDS or the last change to it; and the name, address, and telephone number of the manufacturer, importer, or employer distributing the SDS.

Select Agent Toxins - Certain toxins of biological origin identified by the United States Department of Health and Human Services (HHS), Centers for Disease Control and Prevention (CDC), the United States Department of Agriculture (USDA), and the Animal and Plant Health Inspection Service (APHIS) as posing a potential threat to public health or welfare. Selected biological organisms (bacteria, viruses, fungi) are also regulated as Select Agents.

Self-heating chemical - A solid or liquid chemical that is not a pyrophoric liquid or solid, which, by reaction with air and without outside supply of energy, is liable to self-heat. These chemicals differ from pyrophoric substances in that they will ignite only when in large amounts (kilograms) and after long periods of time (hours or days).

Self-reactive (also referred to as “unstable”) - (Per 29 CFR 1910.1200 App B.8) Thermally unstable liquid or solid chemicals which are liable to undergo a strongly exothermic decomposition even without participation of oxygen (air). This definition excludes chemicals classified as explosives, organic peroxides, oxidizing liquids, or oxidizing solids.

Sensitizer - A chemical that may cause no reaction in a person during initial exposure, but afterward, further, repeated exposures will cause an allergic reaction in normal tissue in a substantial proportion of exposed people or animals exposed to the chemical.

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

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

Specific Gravity - A ratio of the density of a substance with the density of water, which has a relative value of 1 when metric units are used. The gram was defined as being the mass of one cubic centimeter of water (note: initially the meter was one ten millionth the distance from the Equator to the North pole along the Greenwich meridian). Finer measurements showed water has a maximum density at 3.98 °C, so the milliliter was defined as being the volume of one gram of water at maximum density (i.e., 0.999972 ml = 1.000000 cm' @ 3.98 °C [Merck Index]). If the chemical's specific gravity is greater than 1, the chemical is heavier than water and will sink in water.

Specific target organ toxicity (STOT):- (Per 29 CFR 1910.1200 App A.8 and App A.9) A specific target organ toxicant is a substance that has non-lethal toxic effects on specific organs or biological systems. This term includes all significant health effects that impair organ function and are not specifically covered by another hazard classification (e.g., acute toxicity, carcinogenicity, etc.). These toxicants are divided into two types by the number of exposures necessary for toxic effects to occur:

- Single exposure (STOT-SE)
- Repeated exposure (STOT-RE)

Both STOT-SE and STOT-RE are divided into two categories (1 and 2) by the weight

of evidence for toxic effects in humans, with Category 1 having the most conclusive evidence

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

Teratogen - An agent or substance that may cause physical defects in the developing embryo or fetus when a pregnant female is exposed to the substance.

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

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

Threshold Limit Value (TLV) - Term used by the ACGIH to express the maximum airborne concentration of a material to which most workers can be exposed during a normal daily and weekly work schedule (i.e., day-after-day) without adverse health effects.

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

Toxic - A chemical falling within any of the following categories:

1. A chemical that has a median lethal dose (LD50) of more than 50 milligrams per kilogram, but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
2. A chemical that has a median lethal dose (LD50) of more than 200 milligrams per kilogram but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.
3. A chemical that has a median lethal concentration (LC50) in air of more than 200 parts per million but not more than 2,000 parts per million by volume of gas or vapor, or more than 2 milligrams per liter but not more than 20 milligrams per liter of mist, fume or dust, when administered by continuous inhalation for 1 hour

Unstable (reactive) - A material, other than an explosive, which in the pure state or as commercially produced, will vigorously polymerize, decompose, condense or become self-reactive and undergo other violent chemical changes, including explosion, when exposed to heat, friction or shock, or in the absence of an inhibitor, or in the presence of contaminants, or in contact with incompatible materials. Unstable (reactive) materials are subdivided as follows:

Class 4. Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures. This class includes materials that are sensitive to mechanical or localized thermal shock at normal temperatures and pressures.

Class 3. Materials that in themselves are capable of detonation or of explosive decomposition or explosive reaction but which require a strong initiating source or which must be heated under confinement before initiation. This class includes materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures.

Class 2. Materials that in themselves are normally unstable and readily undergo violent chemical change but do not detonate. This class includes materials that can undergo chemical change with rapid release of energy at normal temperatures and pressures, and that can undergo violent chemical change at elevated temperatures and pressures.

Class 1. Materials that in themselves are normally stable but which can become unstable at elevated temperatures and pressure.

An instability may be a slow, easy and low energy yielding reaction of decomposition or

change that may build up products to sufficient levels to seriously react. Some examples include:

- Nitroesters, such as nitroglycerine and even nitrocellulose will slowly decompose by moisture hydrolysis of the ester to nitric acid, which furthers hydrolysis of esters leading to combustion or explosion involving nitric acid produced.
- Silver diamine ion from silvering solutions will slowly disproportionate to ammonia, silver amide,imide and nitride, as well as air oxidize to trisilver tetranitride, all of which silver compounds are very mechanically sensitive and powerful explosives.
- Air oxygen slowly and non-energetically adducts with certain alkenes (polymer monomers) which slowly adduct more alkene to an extent that it later becomes a vigorous, heat producing reaction runaway.
- Pyruvic acid and formic acid both will auto-decompose producing carbon dioxide and carbon monoxide respectively, which builds internal pressure that is not limited by pressure, thus bursting the container if tightly sealed.

Vapor - The gaseous state of substances which are normally in the liquid or solid state (i.e., condensed phase) at normal / ambient room temperature and pressure. Vapors evaporate into the air from liquids such as solvents. The gaseous versus condensed state amounts (i.e., equilibrium vapor pressure) are determined by the transition temperature (i.e., boiling or sublimation point), temperature of material and the energy of transition to gas phase. The ratio of molar transition energy to absolute temperature of transition is approximately constant for most non-ionic substances.

Vapor Density - Whether a substance is heavier or lighter than air (which has a vapor density of I). A vapor with a density lighter than 1 is lighter than air and will rise in air. Specifically, it is the density of the vapor of a substance at normal atmospheric pressure, but at a temperature that is above its boiling point, compared to air at that temperature. Using ideal gas behavior (i.e., PV = nRT), this allows the molecular weight of the substance as a ratio to normal air (i.e., 28.8 g/mole), to be the density of the vapor. The true density of an escaping vapor must be based on its vapor pressure in air, at the prevailing temperature. Just as air's density is a composite, the vapor density of a volatile liquid will be a composite calculated using molecular weight and mole fraction in air (i.e., vapor pressure). $D_v = [P_vM_w + (1-P_v) \times 28.8] / 28.8$. For example, ether vapor: $D_v = [440/760 \times 74 + (1 - 440/760) \times]/ 28.8 = 1.91$ -times that of air.

Vapor Pressure - The pressure that a solid or liquid exerts when it is in equilibrium with its vapor at a given temperature. It relates to how quickly a substance becomes airborne within the workplace and how quickly a worker could be exposed to it. The pressure of the gas phase of a liquid or solid, whether the only component of an atmosphere or as a partial pressure in a mixture (e.g., in air at normal pressure, in equilibrium with the condensed phase); it is the same. If a material evaporates in a closed space with enough vapor to achieve vapor pressure and there is some condensed phase of the material remaining, there exists a dynamic equilibrium. If the air is being replaced in the space or the pool is in open air, the material will continue to evaporate (and steal heat from its surroundings) until it is gone (i.e., evaporated). The evaporation rate of a condensed substance depends on the vapor pressure at pool temperature (i.e., this may be depressed from the ambient due to evaporation energy requirement) minus any vapor concentration already in air (e.g., a puddle of water on a humid day), the air speed over the pool, the length of pool to be traversed (i.e., air saturates with vapor) and the total area of the pool. Diffusivity and fluid viscosity are factors in this as well. The vapor concentration exponentially decreases with height above pool in a simple model of plume formation. It may be hard to predict the particular scaling of this profile in any situation.

GLOSSARY OF CHEMICAL HAZARD TERMS

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

Volatility - A measure of how quickly a substance forms vapor at ordinary temperatures. Equivalently, a measure of equilibrium vapor pressure of a liquid or solid but also denotes how quickly a substance forms vapor. See evaporation rate under vapor pressure

Water-reactive - A material that explodes; violently reacts; produces flammable, toxic or other hazardous gases; or evolves enough heat to cause self-ignition or ignition of nearby combustibles upon exposure to water or moisture. Water-reactive materials are subdivided as follows:

Class 3. Materials that react explosively with water without requiring heat or confinement.

Class 2. Materials that may form potentially explosive mixtures with water.

Class 1. Materials that may react with water with some release of energy, but not violently, include bromine, chlorine and fluorine..

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