CHEMICAL HYGIENE PLAN

DREXEL UNIVERSITY AND DREXEL UNIVERSITY COLLEGE OF MEDICINE

2012

CONTACT INFORMATION

In the event of a life threatening emergency, dial 9- 911 for the emergency operator and contact Drexel security.

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(215) 895-2822 (General Information)

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DREXEL UNIVERSITY AND DREXEL UNIVERSITY COLLEGE OF MEDICINE - CHEMICAL HYGIENE PLAN (CHP)

FOREWORD/DISCLAIMER

The Occupational Safety and Health Administration (OSHA) promulgated a final rule on January 31, 1990 for occupational exposure to hazardous chemicals in laboratories (The Lab Standard – 29CFR1910.1450). The basis for this standard is that laboratories typically differ from industrial operations in their use and handling of hazardous chemicals and that a different approach from the Hazard Communication Standard of 1987 is warranted.

The final OSHA standard, commonly known as the "Chemical Hygiene Plan for Laboratories," applies to all laboratories that use hazardous chemicals in accordance with the definition of laboratory use and laboratory scale as provided in the OSHA standard.

The effective date of the OSHA standard is May 1, 1990 and all Chemical Hygiene Plans (CHP) are required to be in place by January 31, 1991 in accordance with 29 CFR Part 1910.1450 of the *Federal Register*.

In compliance therewith, Drexel University and Drexel University College of Medicine has developed a Chemical Hygiene Plan, as described herein, and made effective this date.

Drexel University and Drexel University College of Medicine reserves the right to change, amend, add or delete any part or the whole of this plan at any time. Although the information in this plan is compiled from sources believed to be reliable, its accuracy is not guaranteed, nor is any responsibility assumed or implied for any damage or loss resulting from inaccuracies or omissions.

Any questions pertaining to the contents of this plan should be discussed with persons indicated in the Plan.

A. FORMAL POLICY STATEMENT

Drexel University and Drexel University College of Medicine is committed to providing a safe working environment and believes employees have a right to know about health hazards associated with their work. This Chemical Hygiene Plan (CHP) introduces policies, procedures and responsibilities designed to develop in employees an awareness of potentially hazardous chemicals in the work place as well as the need to maintain appropriate and safe working areas and conditions. It is designed to assist employees in making knowledgeable decisions about any personal risks associated with employment at this institution. A copy of the CHP must be located in a visible area of each laboratory and be familiarized by all lab personnel. Copies are available thru the Department of Environmental Health and Safety or on their webpage http://www.drexel.edu/facilities/healthSafety/. This web page also has additional information on other important subjects, such as the Hazardous Waste Management Plan, Emergency Spill Response Plan, Lab Safety Manual, Blood born Pathogen Policy, and Chemical Fume Hood/Biological Safety Cabinet plans.

Every Drexel University and Drexel University College of Medicine student and employee is responsible for following the safety rules of Drexel University and Drexel University College of Medicine by reading and understanding the regulations and procedures contained within this document. All students and employees will have access to pertinent safety information through their supervisor who is the first individual to contact for information or problems. In this regard, the following procedure must be followed:

Teaching Laboratories

1. Discuss the problem with your Teaching Assistant.

2. If not satisfied, discuss the problem with the Faculty member in charge of the laboratory.

3. If still not satisfied and the problem is that of …

    a. A chemical or physical hazard (other than radiation or laser) discuss the problem with the University Chemical Hygiene Officer.
    b. A radiation or laser hazard discuss the problem with the Radiation Safety Officer.
    c. A biological hazard discuss the problem with the University Biosafety Officer.

4. If still unsatisfied, request a meeting with the appropriate Safety Officer, the Faculty Member/Laboratory Supervisor and your Department Head.

5. If still not satisfied, request for a meeting with the Dean of the College.

6. If still not satisfied, request for a meeting with the University Provost.

Research Laboratories

1. Discuss the problem with your immediate supervisor.

2. If you are not satisfied, then discuss the problem with the Principal Investigator

3. If still not satisfied and the problem is that of…

    a. A chemical or physical hazard (other than radiation or laser) discuss the problem with the University Chemical Hygiene Officer.
    b. A radiation or laser hazard discuss the problem with the Radiation Safety Officer.
    c. A biological hazard discuss the problem with the University Biosafety Officer.

6. If still unsatisfied, request a meeting with the appropriate Safety Officer, the Principal Investigator and your Department Chair.

7. If still not satisfied, request for a meeting with the Associate Vice President for Research Compliance

The Department of Environmental Health and Safety conducts an orientation program for new employees whether part time or temporary about the hazards of the work place and procedures to follow to avoid accidents. This orientation program is delivered online at http://www.drexelehstraining.com/. Additional site-specific training is available and may be necessary to fully educate employees and students on the hazards associated with different work practices, protocols and procedures. These training events may be presented by any of the appropriate University Safety Officers, the PI or the Department Head. Currently, the University's online safety training is located at http://www.drexelehstraining.com/, In any event, however, training activities must be properly documented and copies of all syllabi and sign-in sheets must be sent to the Department of Environmental Health and Safety.

For the purposes of this CHP, the term "supervisor" applies to that individual with the authority to assign, direct and review the work of one or more subordinates. This definition applies to laboratory, office or department heads and may, in some instances, apply to certain individuals who have supervisory functions under a laboratory, office or department head.

B. MSDS GLOSSARY

The following is a list of acronyms, terms, and definitions associated with the Material Safety Data Sheet of the Chemical Hygiene Plan.

Absorption -- The process by which a substance can be readily taken into a body. For example, some chemicals can be absorbed through unbroken skin.

Acid	--	A compound that reacts with a base to form a salt. Acids have the ability to turn litmus paper red and to neutralize bases. Acids are also defined as proton (or hydrogen ion (H^+)) donors and electron-pair acceptors. Strong or concentrated acids can be dangerous and *corrosive*. See also "*pH*" and "*Base*".
Acute	--	Severe, usually critical, often dangerous conditions in which relatively rapid changes occur as a result of exposure to high concentrations of material over a short period of time. Acute effects are easier to reverse than are the effects of chronic exposure. See "*chronic*."
Alkali	--	A compound which has the ability to neutralize an acid and form a salt. Alkalis turn litmus paper blue. See "*base*" "*alkaline*" and "*pH*."
Alkaline	--	Most commonly used as an adjective describing a compound or solution that is a base. See "*alkali*", "*base*", and "*pH*."
Aliphatic	--	Pertains to an open-chain carbon compound that is usually applied to petroleum products derived from paraffin base, has a straight or branched chain, and has a saturated or unsaturated molecular structure. Examples: hexane, naphtha, and mineral spirits.
Analgesia	--	Loss of sensitivity to pain.
Anaphylaxis	--	Hypersensitivity resulting from sensitization following prior contact with a chemical or protein.
Anesthesia	--	Loss of sensation or feeling.
Anhydrous	--	Does not contain water.
Anosmia	--	Loss of the sense of smell.
Anorexia	--	Loss of or decreased appetite.
Anuria	--	The absent production of urine. This may be a sign of renal failure, urinary retention/obstruction or dehydration. See "*Oliguria*".
Aqueous	--	A water-based solution.

Argyna	--	Local or generalized impregnation (gray-blue color) of the body tissues with silver.
Aromatic	--	Fragrant or of marked odor. Applied to a group of hydrocarbons and their derivatives characterized by the presence of one or more six-carbon benzene rings. Examples are: benzene, naphthalene, phenol, pyrene, toluene, and xylene. Some heretoarenes (non-benzene-ring based) compounds are also considered aromatic hydrocarbons. Examples include furan and pyridine.
Asphyxia	--	The inability of the body to take in sufficient oxygen usually due to difficulty breathing. Examples include oxygen displacement by an inert gas and choking.
Asphyxiation	--	A condition that resulting from asphyxia, suffocation.
Asthma	--	A disease characterized by recurring attacks of dyspnea, wheezing, and cough, due to spasmodic contraction of the bronchioles.
Ataxia	--	A loss of power of muscular coordination.
Auto-Ignition Temperature	--	the lowest temperature at which a flammable-gas or vapor-air mixture will ignite from its own heat source or a contacted heated surface without the presence of a spark or flame.
Barrier Cream	--	A cream for use on human skin to protect against injury from contact with specific types of harmful agents.
Base	--	Often refered to as an "*alkali*" or *alkaline* material, a base is a compound which reacts with an acid to form a salt. It turns litmus paper blue and neutralizes acids. Bases are also defined as hydroxide ion (OH^-) donors and electron-pair donors. Strong or concentrated bases can be dangerous, "*corrosive*", and "*caustic*". See "*pH*"
Biohazard	--	This is a combination of the words "biological" and "hazard" and is used to describe infectious agents presenting a risk or potential risk to the well-being of man or animals either directly through infection, or indirectly through disruption of the environment.
Biological Half-Life	--	The time required for a given species, organ, or tissue to eliminate half of a substance which it takes in

Boiling Point, Normal	--	The temperature at which a substance will boil. This is the point at which the vapor pressure of a liquid is equal to atmospheric pressure.
Bradycardia	--	A slow heartbeat in which the pulse rate falls below 60.
Breathing Zone	--	The area of the ambient environment in which a person breathes.
Bronchitis	--	Inflammation of the bronchial tubes in the lungs.
Buffer	--	Substance that reduces the change in hydrogen ion concentration in a solution, which otherwise would result from adding acids or bases.
Carcinogen	--	Any substance which, under certain quantified exposures, produces cancer in animals or humans. A chemical is considered to be a carcinogen if: (a) it has been evaluated by the International Agency for Research on Cancer (IARC) and found to be a carcinogen or potential carcinogen; or (b) it is listed as a carcinogen or potential carcinogen in the annual report on carcinogens published by the National Toxicology Program (NTP); or (c) it is regulated by OSHA as a carcinogen.
Carcinogenic	--	Cancer-producing.
Carcinoma	--	A malignant tumor or cancer; a new growth made up of epithelial cells, tending to infiltrate and give rise to metastasis.
Catalyst	--	A substance which, without changing its composition, causes a chemical reaction to occur.
Cataract	--	A loss of transparency of the crystalline lens of the eye or of its capsule.
Caustic	--	Something which strongly irritates, burns or destroys living tissue. Something that causes chemical burns. Frequently, but not always, refers to alkaline materials. See also "*Corrosive"*
Ceiling Limit	--	A concentration that is not to be exceeded.
Chemical	--	Any element, compound or mixture of elements and/or compounds.

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

Chemical Compound -- A substance composed of definite proportions by weight of two or more elements, and whose properties differ from those of its elements. Also see "mixture."

Chemical Family -- A group of individual elements or compounds with a common general name. Example: acetone, methyl ethyl ketone (MEK).

Chloracne -- An acne-like eruption from contact with chlorinated naphthalenes and polyphenyls acting on sweat glands.

Chronic -- Persistent, prolonged, and/or repeated effects, which are the result of repeated exposure to low concentrations of a chemical substance over a long period of time. See "*acute*."

Chronic Effect -- An adverse effect on a human or an animal with symptoms that develop slowly over an extended period of time or that recurs frequently.

Chronic Toxicity -- An adverse effect resulting from repeated doses or exposure to a substance over a relatively prolonged period of time. The term is usually used to denote effects in experimental animals.

Combustible Liquid -- Any liquid with a flashpoint at or above 100° F. Combustible liquids are divided into two classes as follows: **Class II** liquids include those with flashpoints at or above 100° F and below 140° F, except any liquid having components with flashpoints of 200° F or higher, the volume of which make up 99% or more of the total volume of the mixture.

Class IIIA liquids include those with flashpoints at or above 140° F. Class IIIA liquids are divided into two subclasses: Class III liquids include those with flashpoints at or above 140° F and below 200° F, except any mixture having components with flashpoints of 200° F, or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

Class IIIB liquids include those with flashpoints at or above 200° F.

Compressed Gas	--	A gas under pressure of at least 40 pounds per square inch (psi) and some liquids with very high vapor pressure, i.e., pressure that exceeds 40 psi. Examples are argon, helium, and nitrogen.
Concentration	--	The amount of a substance uniformly dispersed in a given amount of fluid or gas.
Conjunctivitis	--	Inflammation of the conjunctiva, the delicate membrane that lines the eyelids and covers the eyeballs.
Contact Dermatitis	--	Caused by contact with a primary irritant, a skin irritation at the area of skin contact.
Cornea	--	Transparent structure of the external layer of the eyeball.
Corrosive	--	Any material, liquid or solid, that causes visible destruction of, or irreversible alterations to other substances at the site of contact. See also "*Caustic*"
Cutaneous Hazards	--	Chemicals which irritate the skin.
Cyanosis	--	Blueness of the skin, generally caused by lack of oxygen.
Dermal	--	Pertaining to the skin.
Dermal Toxicity	--	Adverse effects resulting from exposure of the skin to a substance; ordinarily used to denote effects in experimental animals.
Dermatitis	--	Inflammation of the skin. There are two types of skin reaction: primary irritation dermatitis and sensitization dermatitis. Also see "*Eczema*", "*irritant"*, "*sensitize"r*, and "*contact dermatitis"*.
Dose	--	The term used to express the amount of energy or substance absorbed in a unit volume of an organ or individual. Dose rate is the dose delivered per unit of time.
Dysfunction	--	Any abnormality or impairment of an organ.
Dyspnea	--	Labored or difficult breathing; shortness of breath.

Eczema	--	A skin disease or disorder. Eczema usually manifests as a recurring skin rash which may have one or more of these symptons: dryness, redness, skin *edema*, itching, crusting, flaking, blistering, cracking, oozing, or bleading. One specific type of "*dermatitis*".
Edema	--	An abnormal accumulation of clear, watery fluid in the tissues; swelling.
Element	--	A substance composed entirely of one kind of atom. Elements are designated by chemical symbols.
Emphysema	--	A lung disease in which the presence of air in the connective tissues of the lungs causes swelling or inflammation.
Epistaxis	--	Nosebleed; hemorrhage from the nose.
Evaporation Rate	--	The inverse of the time it takes a given amount of material to completely vaporize (evaporate) when compared to an equal amount of reference material.
Flammable Aerosol	--	An aerosol that yields a flame projection longer than 18 inches of full valve opening or a flashback (a flame extending back to the valve) at any valve opening.
Flammable Gas	--	A gas that will burn or explode if combined with air over a wide concentration range. Examples are acetylene, hydrogen, and propane.
Flammable Liquid	--	A liquid that has a flashpoint below 100° F (38 C) and can be ignited by a spark without any pre-heating. Examples are acetone, toluene, and methanol. Class IA flammable liquids have flashpoints below 73^{o}F and boiling points below 100^{o}F. Class IB flammable liquids have flashpoints below 73^{o}F and boiling points greater than or equal to 100^{o}F. Class IC flammable liquids have flashpoints greater than or equal to 73^{o}F and below 100^{o}F.
Flammable Solid	--	A solid, other than a blasting agent or explosive, that is ignited easily and burns intensely without any other fuel being needed. Ignition can occur through friction, absorption of moisture, spontaneous chemical change, or retained from manufacturing or processing. Examples are aluminum and titanium powders.

Flammable (Explosive) Limits - LEL & UEL

-- Indicates the explosive or flammable range of a vapor or gas. Those concentrations of a vapor or gas in air below or above which flame does not occur on contact with a source of ignition. The-lower explosive limit (LEL) is the minimum concentration below which the vapor-air mixture is too lean to burn or explode. The upper explosive limit (UEL) is the maximum concentration above which the vapor-air mixture is too rich to burn or explode. LEL and UEL are given in terms of percentage by volume of gas or vapor in air.

Too Rich	Explosive/Flammable Range		Too Lean
100% Chemical	UEL	LEL	100% Air

Flash point -- The lowest temperature at which liquid produces enough vapors to form an ignitable mixture with the air.

Fume Fever -- An acute condition caused by a brief high exposure to the freshly generated fumes of metals, such as lead or magnesium, or their oxides.

Gastroenteritis -- Inflammation of the stomach and intestines.

Hazardous Material -- A material that is characterized by one or more of the following: (**1**) has a flashpoint below 140° F, closed cup, or is subject to spontaneous heating; (**2**) has a threshold limit value below 500 ppm for gases and vapors, below 500 mg/m3 for fumes, and below 25 mppcf for dusts; (**3**) single oral dose LD50 or below 50 mg/kg of body weight; (**4**) is subject to polymerization which results in the release of large amounts of energy; (**5**) is a strong oxidizing or reducing agent; (**6**) causes first degree burns to skin in short time exposure, or is systematically toxic on contact with the skin; and/or (**7**) in the course of normal operations may produce smoke, dusts, gases, fumes, vapors, or mists which have one or more of the above characteristics.

Health Hazard -- Anything (including certain chemicals) that, according to at least one scientific study, may be harmful to the health. Chemicals classified as health hazards include those that are carcinogens; toxic or highly toxic agents; reproductive toxins; irritants; corrosives; sensitizers; hepatotoxins; neurotoxins; nephrotoxins; agents that act on the hematopoietic system; or agents which damage the lungs, skin, eyes, or mucous membranes.

Hematologic Disturbances	--	Blood disturbance
Hematuria	--	The presence of blood in the urine.
Hepatotoxin	--	A chemical which produces liver damage.
Hydrocarbons	--	Composed solely of carbon and hydrogen. Hydrocarbons can be classified as "*aromatics"* (arenes), paraffins (alkanes or *"aliphatics"*), alkenes (olefins), and alkynes (acetylenes).
Hygroscopic	--	Readily absorbs moisture from the air.
Hypoxia	--	Insufficient oxygen especially as applied to body cells.
Immiscible	--	Liquids which will not mix with each other but will form two separate layers or will result in cloudiness or turbidity. Metals that cannot combine to form an alloy are also considered immiscible. See "*Miscible*"
Incompatible	--	Materials that cause dangerous reactions when in contact with one another.
Infectious Agent	--	Source that causes infections either by inhalation, ingestion, or direct contact with the host material.
Inflammation	--	A morbid series of reactions produced in the tissues by an irritant; it is marked by an afflux of blood with exudation of plasma and leukocytes.
Ingestion	--	The taking in of a substance through the mouth; eating it.
Inhalation	--	The act of breathing in. This is the most common route of entry for chemicals.
Inhibitor	--	An agent that arrests or slows chemical action.
Injection	--	The entry of chemicals into the body by means of broken skin from sores, cuts, burns, or scratches.
Insoluble	--	A substance that is incapable of being dissolved.
Irodocyditis	--	Inflammation of both the iris and ciliary body of the eye.

Irritant	--	A chemical that is not corrosive, but that causes a reversible inflammatory effect on living tissue by chemical action at the site of contact. Also see *dermatitis* and *sensitizer*.
Ketosis	--	The condition marked by excessive production of ketone bodies in the body. Ketosis often results from high fat metabolism. *Ketoacidosis* (A.K.A. diabetic ketoacidosis and common alcoholic ketoacidosis) is a severe form of ketosis causing blood pH to drop below 7.2 and is accompanied by dehydration, hyperglycemia, ketonuria and increased levels of glucogon.
Laboratory Scale	--	Work with the 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.
Laboratory Use	--	Handling or use of such chemicals in which all the following conditions are met: (1) Chemical manipulations are carried out on a "laboratory scale"; (2) Multiple chemical procedures or chemicals are used; (3) The procedures involved. are not part of the production process, nor in any way simulate a production process; and (4) "Protective laboratory practices and equipment" are available and in common use to minimize the potential for employee exposure to hazardous chemicals.
Latent Period	--	The period of time between exposure and the first manifestation of the damage.
Lead Intoxication	--	Lead absorption resulting from inhalation of lead dust or fumes, or from swallowing lead dust.
LEL	--	Lower explosive limit. See *flammable (explosive) limits*.
Lesion	--	Injury, damage, or abnormal change to body tissue or organs.
Lethal Concentration(LC)	--	A concentration of a substance that is sufficient to kill a test animal. See "*Toxic*."
Lethal Concentration 50	--	LC50. The Concentration of a substance necessary to kill 50% of the test animals - See "*Toxic*".
Lethal Dose (LD)	--	A dosage of a substance that is sufficient to kill a test animal. See "*Toxic*."
Lethal Dose 50	--	LD50 . The Dosage of a substance necessary to kill 50% of the test animals. See "*Toxic*".

Metastasis	--	Transfer of a disease producing agency from the site of disease to another part of the body; a secondary metastatic growth of a malignant tumor.
Metabolism	--	The chemical changes whereby the body functions.
Miscible	--	Two liquids are considered miscible when they can mix in all proportions, forming a clear homogenous solution. For example, water and ethanol are miscible, while water and octanol are immiscible. See "*Immiscible*", "*Soluble*" and "*Solubility in Water*."
Mixture	--	A combination of two or more substances, which may be separated by mechanical means.
Mutagen	--	A chemical that causes a defect in sperm or egg cells prior to conception.
Narcosis	--	Stupor or unconsciousness produced by some narcotic agent.
Nausea	--	Tendency to vomit, feeling of sickness of the stomach.
Necrosis	--	Local death of tissue.
Nephrotoxins	--	Chemicals that primarily affect the kidneys.
Nerve Agents	--	Chemicals that affect the central nervous system. Examples include Tabun (GA), Sarin (GB), Soman (GD), VX, Novichok Agents, and some insecticides.
Neurotoxins	--	Chemicals that primarily affect nerve cells.
Nystagmus	--	Spasmic, involuntary motion of the eyeballs, in either a horizontal, vertical, or circular pattern.
Olfactory	--	Pertaining to the sense of smell.
Oliguria	--	Scanty or low volume of urine. This may be a sign of renal failure, urinary retention/obstruction or dehydration. See "*Anuria*".
Opaque	--	Impervious to light.
Oral	--	Through the mouth.

Oral Toxicity -- Adverse effects resulting from taking a substance into the body via the mouth. Ordinarily used to denote the effects in experimental animals.

Organic Peroxides -- Organic compounds that are highly reactive; some are unstable and may act as an explosive or oxidizer. DO NOT handle any peroxide forming chemical if there are signs of crystal growth or precipitation. Contact the Department of Environmental Health and Safety (215-895-5907) IMMEDIATELY if this occurs. See "*Peroxide-formers*"

Oxidizer -- A material that releases oxygen atoms and/or accepts electrons during a chemical reaction. Oxidizers are materials, other than explosives and blasting agents, that contain oxygen and may start or assist combustion of other materials. Common oxidizers include peroxides, permanganates, concentrated nitric acid, bleach, halogen elements, hexavalent chromates, perchlorates, nitrous oxide, certain nitrates and nitrites, and ozone.

Oxidizing Agent -- Synonym for "*Oxidizer*".

Permissible Exposure Limit-- **(PEL)** An exposure limit established by OSHA regulatory authority. See "*Threshold Limit Value (TLV)*"

Peroxide-Formers -- Chemicals that can spontaneously produce potentially explosive peroxides, usually requiring exposure to air to do so. As such, these compounds must not be distilled or evaporated to dryness. Generally these materials are stable for only a limited amount of time before they have to be disposed of. See "*organic peroxides*" and Appendix II for a list of Peroxide forming chemicals. DO NOT handle any peroxide forming chemical if there are signs of crystal growth or precipitation. Contact Department of Environmental Health and Safety (215-895-5907) IMMEDIATELY if this occurs.

Personal Protective Equipment (PPE)
-- Devices worn by the worker to protect against hazards in the environment. Respirators, gloves, and ear protectors are examples.

pH -- A measure used to quantify the level of acidity or alkalinity. Strong acids have-a pH near 1, strong bases near 13, and a pH of 7 indicates neutrality. See "*Acid*" and "*Base*"

Pneumoconiosis -- Dusty lungs resulting from the continued inhalation of various kinds of dust and other particles.

Polymerization -- A chemical reaction in which many small molecules (monomers) combine covalently to form a long chain. Sometimes this process could occur too rapidly, potentially resulting in fire or explosion. This is known as *Hazardous Polymerization*.

Protective Laboratory Practices and Equipment
-- Those laboratory procedures, practices, and equipment accepted by the laboratory health and safety experts as effective, or that the employer can show to be effective, in minimizing the potential for employee exposure to hazardous chemicals

Pulmonary Agents -- Chemicals that may damage the lungs.

Pulmonary Edema -- The condition of having fluid in the lungs.

Pyrophoric -- A material that will ignite spontaneously and burn when exposed to air at temperatures below 130° F or if they have autoignition temperatures below room temperature. Some pyrophoric substances are also "*water reactive*." Most pyrophoric fires should be extinguished with a Class D Fire Extinguisher for burning metals.

Reactives -- Refers to chemicals that are inherently unstable and which, under specific conditions, either alone or with another substance, is susceptible to rapid decomposition, reacts in a violent manner, and/or releases heat, toxic gas, or may cause an explosion. Depending on the material, Reactive chemicals may react to exposure to air, heat, water, light, mechanical shock, or certain catalysts.

Reactivity -- The ability of a material to undergo a chemical reaction.

Reducing Agent -- A material which accepts oxygen atoms or gives up electrons in a reaction.

Reproductive Toxins -- Chemicals which have a negative effect on the reproductive capabilities, including chromosomal damage (mutations) and birth defects to the fetus (Teratogenesis).

Respirator -- A device designed to protect the wearer from the inhalation of contaminated air

Respiratory Disease -- Any disease that affects the lungs or the respiratory tract.

Respiratory Irritants -- Any chemical that produces a reversible inflammatory effect on the respiratory system.

Safety Can -- An OSHA-approved dosed container which has the following characteristics: (1) a capacity of not more than 5 gallons (19 liters); (Z) a spring-closing lid and spout cover; (3) flash-arresting screen; and (4) designed to safely relieve internal pressure if exposed to fire.

Saturation -- The maximum concentration of matter that can be dissolved in a solution at a given temperature.

Sensitization -- An allergic reaction that increases in severity with subsequent exposures. A person previously exposed to a certain material is more sensitive when further contact with this material is encountered.

Sensitizer -- Chemicals that my cause an allergic reaction after one or more exposure. Once an individual becomes sensitized, a small dose of the material may cause a big effect. See *dermatitis* and *irritant*.

Skin Notation -- A chemical that can penetrate unbroken skin.

Soluble -- Capable of being dissolved.

Solubility -- The ability of a material to dissolve in water or other solvent.

Solubility in Water -- The percentage of a material (by weight) that will dissolve in water at ambient temperature. Terms used to express solubility are:

negligible	less than 0.1%
slight	0.1 to 1.0%
moderate	1 to 10%
appreciable	more than 10%
complete	soluble in any proportion

See *miscible*.

Spasm -- An involuntary, convulsive, muscular contraction.

Specific Gravity -- A measurement used to quantify the weight of a substance by comparing the weight of a given volume of material to the

same volume of water. Material with a specific gravity greater than 1 is heavier than water and will sink if it does not dissolve. Material with a specific gravity of less than one will float on the water if it does not dissolve. See *solubility in water*.

Spontaneous Combustion-- Combustion resulting from a chemical reaction with the slow generation of heat from oxidation of organic compounds until the ignition temperature of the material (fuel) is reached. The condition is reached only where there is sufficient air from oxidation but not enough ventilation to carry away the heat as fast as it is generated.

Stability -- The tendency of a material to resist undesirable chemical changes during storage or transportation.

Stupor -- Partial or nearly complete unconsciousness.

Synergistic -- Pertaining to the action of two or more substances, organs or organisms to achieve an effect of which each is individually incapable.

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

Tachycardia -- Excessively rapid heartbeat.

Target Organ -- Primary organ in body attacked by a chemical.

Teratogens -- Chemicals that cause birth defects in a developing fetus.

Thermal Decomposition -- The breakdown of a material when heated.

Threshold Limit Value (TLV) The Threshold Limit Value (TLV) is a safe exposure level set by the American Conference of Governmental Industrial Hygienists (ACGIH). A *Permissible Exposure Limit* (PEL) is a similar level set by OSHA. Both refer to airborne concentrations of substances and represent an exposure level under which most people can work constantly for 8 hours a day, day after day, with no harmful effects. Three categories of TLVs are specified: (1) Time Weighted Average (TLV-TWA) - This is the time weighted average concentration for a normal 8-hour workday or 40-hour work week, to which all workers may normally be exposed day after day, without adverse effect; (2) Short Term Exposure Limit (TLV-STEL) - This is the maximum concentration to

which workers can be exposed for a period of up to 15 minutes continuously without suffering from (a) irritation, (b) chronic or irreversible tissue change, or c) narcosis of sufficient degree to impair self-rescue or reduce work efficiency. No more than four 15-minute exposure periods per day are permitted with at least 60 minutes between those periods; (3) Ceiling (TLVC) - The concentration that must not be exceeded even instantaneously.

NOTE: If any of the above TLVs is exceeded, a potential hazard from that substance is presumed to exist.

Tinnitus -- A ringing or singing sound in the ears.

Toxemia -- Poisoning by way of the bloodstream.

Toxic -- The toxicity chemicals can be measured using a variety of animal studies. OSHA uses three categories for this: (1) Oral LD50 - Lethal dose 50% test: the medium lethal dose that kills 50% of the test animals that received it. Oral LD50 is expressed as milligrams of chemical per kilogram of test animal body weight. A dose of one milligram per kilogram (mg/kg) is equal to 1 one millionth of the test animal's body weight. OSHA considers a chemical to be toxic if the Oral LD50 is between 60 mg/kg and 500 mg/kg; (2) Skin LD50 - A dose that kills 50% of the test animals that had the chemical applied directly to the bare skin for 24 hours. Skin LD50 is also expressed in mg/kg. OSHA considers a chemical to be toxic if the skin LD50 is between 200 mg/kg and 1000 mg/kg; (3) Inhalation LC50 - Lethal concentration 50%: the concentration of a chemical in the air or water needed to kill 50% of the test animals that breathed it. LC50 is expressed as parts per million (ppm) for bases and vapors. LC50 is also expressed as milligrams per liter (mg/l) for mists, fumes, and dust.

Toxicity -- The degree of injury or illness caused by a toxic material.

Unstable (Reactive) -- A chemical which in pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shock, pressure, or temperature.

UEL-Upper Explosive Limit See *flammable (explosive) limits*.

Urticaria -- Nettle-rash; hives; elevated itching, white patches.

Vapor Density -- A measure of how heavy a vapor is compared to air, which has a vapor density of one. Vapors more dense than air accumulate close to the floor and in low spaces.

Vapor Pressure -- A measure of how readily a material will evaporate and indicates how volatile a liquid is. The lower the vapor pressure, the slower it evaporates and the longer it takes to build up toxic or explosive concentrations.

Vertigo -- A feeling of revolving in space; dizziness, giddiness.

Viscosity -- Resistance to flow exhibited by a fluid.

Volatility -- The tendency or ability of a liquid to vaporize.

Volatile Organic Compound (VOC)
-- An organic compound that evaporates.

Volatile Percent -- The fraction by weight or volume of a chemical that evaporates in a mixture.

Water Reactive -- A material that reacts, often violently, with water. See also "*pyrophoric*"

C. MSDS Abbreviations and Symbols

ABIH	American Board of Industrial Hygiene
ACGIH	American Conference of Governmental Industrial Hygienists
ACS	American Chemical Society
AIHA	American Industrial Hygiene Association
AMA	American Medical Association
ANSI	American National Standards Institute
AQTX	Aquatic Toxicity
ASTM	American Society for Testing and Materials
atm	atmosphere
BLS	Bureau of Labor Statistics
ca	(circa) about
CAR	Carcinogenic effects
CAS	Chemical Abstract Service
cc	cubic centimeter
XXXX	Closed Cup
(C)	Ceiling concentration
CFM	Cubic Feet per Minute
CFR	Code of Federal Regulations
CNS	Central Nervous System
COC	Cleveland Open Cup
conc	concentration
decomp	decompose or decomposition
DHHS	U.S. Department of Health and Human Services
DOL	U.S. Department of Labor of which the Occupational Safety and Health Administration (OSHA) is a part
DOT	Department of Transportation
EPA	Environmental Protection Agency
FR	Federal Register
G.I. or GI	Gastrointestinal
g or gm	gram
IARC	International Agency for Research on Cancer
inhl	inhalation
insol	insoluble
IRDS	Primary irritation dose
IRR	Irritation effects (systemic)
kg	kilogram (one thousand grams)
L	Liter
LC50	Lethal concentration to 50% of those tested (AKA mean lethal concentration)
LDLo	Lowest possible lethal dose
LEL	Lower Explosive Limit
LFM	Linear Feet per Minute
m3	cubic meter
mg	milligram (1/1000, 10^{-3} of a gram)

gm/m3	milligrams of substance per cubic meter of air
ml	milliliter
mm Hg	millimeters of Mercury
MLD	Mild
mppcf	millions of particles per cubic foot of air
MSDS	Material Safety Data Sheet(s)
MLV	Molecular Weight
n-	normal
NBS	National Bureau of Standards
NCI	National Cancer
NEO	Neoplastic effects
NFPA	National Fire Protection Agency
NIOSH	National Institute of Occupational Safety and Health
NOx	Oxides of Nitrogen
NTIS	National Technical Information Services
ng	nanogram (one-billionth, 10^{-9} of a gram)
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit (OSHA)
pH	Negative logarithm of the hydrogen ion concentration
PMCC	Pensky-Martens Closed Cup
ppb	parts per billion
PPE	Personal Protective Equipment
ppm	parts per million part of air, parts per million
ppt	parts per trillion
PUL	Pulmonary
SCBAF	Self Contained Breathing Apparatus with Full Face piece
SCI	Specific Chemical Identity - means the chemical name, Chemical Abstracts Service (CAS) registry number, or any other information that reveals the precise chemical designator of the substance
SKN	Skin effects
soln	solution
SOx	Oxides of sulphur
STEL	Short Term Exposure Limit
STP	Standard Temperature and Pressure
SYS	Systemic effects
TCC	Tg Closed Cup
TCLo	Lowest published toxic dose
temp	temperature
TER	Teratogenic effects
TFX	Toxic effects
TLm	Median Tolerance Limit
TLV	Threshold Limit Value
TOC	Tag Open Cup
torr	mm HG pressure
TWA	Time Weighted Average
UEL	Upper Explosive Limit

μg	Microgram (one-millionth, 10^{-6} of a gram)
VOC	Volatile organic compounds
>	greater than
<	less than

D. RESPONSIBILITIES AND FUNCTIONS

1. University Chemical Hygiene Officer (CHO)

The University Chemical Hygiene Officer (CHO) is charged with the responsibility of implementing and monitoring the chemical hygiene plan. The Chemical Hygiene Officer at Drexel University is Martin W. Bell. The Drexel University CHO can be reached at (215) 895-5892.

The CHO's functions include, but are not limited to the following responsibilities:

- The development of chemical hygiene policies and procedures.
- Conduct safety inspections of all university spaces.
- Assist PI's in complying with federal and state regulatory agencies and developing a healthy workplace environment.
- Conduct implementation and monitoring procedures in accordance with approved policies and procedures.
- Certify the performance of protective equipment.
- Monitor procurement, use, and disposal of chemicals used in the lab
- See that appropriate audits are maintained.
- Help supervisors develop precautions and adequate facilities.
- Know the current legal requirements concerning regulated substances.
- Provide general training.

2. Principal investigator/Faculty Member/Laboratory Supervisor

The principal investigator/laboratory supervisor/faculty member has overall responsibility to:

- Ensure that employees and students know and follow the chemical hygiene rules that protective equipment is available and in working order, and that appropriate training has been provided.
- Provide regular, formal, chemical hygiene and housekeeping inspections including routine inspections of emergency equipment.
- Know the current legal requirements concerning regulated substances.
- Determine the required levels of protective apparel and equipment. Ensure that facilities and the training for use of any material being ordered are adequate.

3. Laboratory employee/Student

The laboratory employee is responsible for:

- Planning and conducting each operation in accordance with Drexel University's chemical hygiene procedures.
- Developing good personal chemical hygiene habits

E. STANDARD OPERATING PROCEDURES

Four fundamental principals define all work area and procedural precautions set forth in this Chemical Hygiene Plan:

- Plan Ahead!
- Minimize Exposure to Hazards
- Do Not Under Estimate Risks!
- Be Prepared for Accidents

Because few laboratory chemicals are without hazards, and based on the premise that many mixtures of hazardous chemicals are more toxic than the most toxic component, the following procedures must be observed when working with most chemicals:

1. Chemical Exposures

   a. Eye Contact: Promptly flush eyes with water for a prolonged period (15 minutes), obtain information from MSDS and report to Employee/Student Health or nearest emergency room for evaluation.

   b. Ingestion: Call Emergency Operator (9-911), Poison Control Center or Chemtrec. Do not induce vomiting or drink large quantities of water unless directed to do so by a medical professional.

   c. Skin Contact: Promptly flush the affected area with water for 15 minutes. Remove all contaminated clothing. Use a safety shower when contact is extensive.

   Note: In any of the above events, seek medical advice immediately. Phone or contact Drexel Public Safety 24-Hour Call Center (215) 895-2222 and the Department of Environmental Health and Safety at (215)-895-5919

2. Chemical Spills

   In the event of a chemical spill immediately implement the appropriate spill control procedures as outlined below. Additional information can be found on http://www.drexel.edu/facilities/healthSafety/ under the Emergency Spill Response Plan.

Chemical Spill Control Procedures

a. Immediately turn off all ignition sources (i.e. open flame, heating mantle, etc.).

b. If contaminated with hazardous material, immediately implement Personal Decontamination Procedures reference above in the Chemical Exposure Section or refer to Appendix I.

c. Assess the Risk

- Identify material, (i.e. acid, caustic or solvent).
- Determine if spill is a Major spill (equal to or greater than 500 ml/500 g, or any amount of an acutely hazardous material, or a Minor spill (<500 ml/500 g of non-acutely hazardous materials). Refer to Appendix II for list of acutely Hazardous Materials.
- If major spill, implement the major spill procedures as outlined in the section below. (Also, outlined in Appendix III).
- All minor spills (<500 ml/500g non-acutely hazardous materials) will be cleaned-up by Faculty Member/Laboratory Supervisor/Principle Investigator. If minor spill, implement the minor spill procedures as outlined below in Item e. (Minor Spill Clean-up Procedures, also, outlined in Appendix IV.)

d. Major Spills:

In the event of a major spill in a university area, all laboratory, educational, maintenance, outside contractor, administrative, and/or environmental services personnel will implement the following plan:

1. Notify persons in the immediate area that a spill has occurred.
2. Avoid breathing vapors, mists or dust of the spilled material.
3. Turn off all ignition sources (if possible).
4. Evacuate room and close the door
5. Immediately contact the Drexel Public Safety 24-hour Call Center

Campus	Public Safety Dispatcher	Emergency Operator
Center City	215-895-2222	215-762-7111
Queen Lane	215-895-2222	----------
University City	215-895-2222	----------
PA Biotech. Center	215-895-2222	----------

In order to assess the situation be prepared to provide the following information:

- Name and call back number
- The location of the spill (building and room number)
- Type of material spilled
- The amount of material that spilled

6. Remain on or near the telephone until you have received instructions from Public Safety or Department of Environmental Health and Safety.

e. Minor Spills:

In the event of a minor spill all laboratory personnel (Laboratory Supervisor/Laboratory Technician/Principle Investigator/Faculty Member) will implement the following steps when cleaning-up a minor chemical spill:

1. Review MSDS prior to clean-up.
2. Proper personnel protection equipment will be donned during clean up of all hazardous materials. Refer to MSDS for proper personnel protection equipment selection prior to cleaning up any spilled material(s). If the laboratory personnel does not have the proper personal protective equipment then contact the Department of Environmental Health and Safety for assistance
3. Contain spilled material(s) using absorbent pads and/or socks. **Paper towels must not be used for containment of spill nor will they be used for clean up.**
4. Neutralize spilled material(s) using the appropriate neutralizing agent.
5. Clean up neutralized material using dustpan and/or plastic scoop.
6. Place neutralized material in hazardous waste bags. Contact the Department of Environmental Health and Safety to dispose as hazardous waste.
7. Wash area where spill has occurred with water several times making sure no residue was left behind. Dispose of any disposable clean-up materials as hazardous waste.
8. All emergency equipment shall be decontaminated and stored.
9. All non-disposable personal protective equipment shall be decontaminated and stored.
10. All disposable personal protective equipment and clean up materials shall be disposed of as hazardous waste.
11. Always use extreme caution when cleaning up hazardous substances.

Report all minor spills involving the release of materials in quantities **greater than 100 milliliters** to the Department of Environmental Health and Safety at 215-895-5907.

3. Work Area Precautions

- Keep all work areas clean and free of clutter. Clean up the work area on completion of an operation or at the end of each work shift or class.

- Keep chemicals and equipment properly labeled and stored appropriately. Segregate chemicals as noted in Part 8 of this section. (For more information on Compatible Storage, refer to Appendix V).

- Do not store, handle or consume food or beverages in laboratory areas, refrigerators, or with glassware or utensils that are also used for laboratory operation.

- Seek information and advice about hazards, review MSDS (www.hazard.com) plan appropriate protective procedures, and plan positioning of equipment before beginning new operation.

- Leave lights on during work hours.

- Provide for containment of toxic substances in the event of failure of a utility service in an unattended operation.

- Beware of any unsafe conditions and see that they are corrected when detected.

- **Chemical Fume Hoods**

  - Use a chemical fume hood for operations that might result in release of chemical vapors or fine powders and dust. Respirators may be necessary for work with some substances. If a substance's OSHA permissible exposure limit (PEL) can be predicted to be exceeded than a respirator will be necessary for work with that substance. Refer to Appendix VI for the OSHA PELs. Laboratory personnel and/or students must fulfill all the requirements set forth by the University's Respirator Protection program prior to working with respirators.

  - As a rule of thumb, use a chemical fume hood or other local ventilation device when working with any appreciably volatile substance having a TLV of less than 500 ppm. Refer to Appendix VII for a list of some TLVs. This list is not the complete list of TLVs. Contact the Department of Environmental Health and Safety for the TLVs not list in Appendix VII.

- Confirm adequate chemical fume hood performance before use (i.e. kimwipe test). Keep chemical fume hood closed at all times except when adjustments within the chemical fume hood are being made. Do not store chemicals in chemical fume hoods for extended periods of time, and do not allow materials to block vents or airflow. Refer to the University's Chemical Fume Hood Plan (available at http://www.drexel.edu/facilities/healthSafety/) for more details concerning chemical fume hoods.

- Leave the chemical fume hood "on" when it is not in active use, if toxic substances are stored in it; or if it is uncertain whether adequate general laboratory ventilation will be maintained when it is "off."

Be aware of any unsafe conditions and see that they are corrected when detected. Contact the Department of Environmental Health and Safety for advice. The lab safety inspection form included in Appendix VIII of this manual will provide you with a list of items that must be inspected routinely.

4. Procedural Precautions

- Mouth suction for pipetting or starting a siphon is **strictly forbidden**.

- Do not smell or taste chemicals.

- Apparatus that can discharge toxic chemicals (vacuum pumps, distillation columns, etc.) must be vented into local exhaust devices or Chemical Fume Hoods.

- Handle and store laboratory glassware with care to avoid damage. Do not use damaged glassware.

- Use extra care with Dewar flasks and other evacuated glass apparatus; shield or wrap them to contain chemicals and fragments in the event that implosion might occur.

- Use equipment only for its designed purpose.

- **Highly Toxic and Reactive Material Precautions**

  - Review the Material Safety Data Sheets prior to working with any toxic or reactive chemicals. Refer to the Appendix II for a list of toxic chemicals.

  - Preparations for handling highly toxic and/or reactive substances must include sound and thorough planning of the experiment, understanding the intrinsic hazards of the substances and the risks of exposure inherent in the planned process, selecting additional precautions that may be necessary to

minimize or eliminate these risks, and reviewing all emergency procedures to ensure appropriate response to unexpected spills or accidents.

- Do not allow release of toxic substances in cold rooms or warm rooms, since these areas have contained re-circulated atmospheres.

- Do not use any chemicals that require ventilation in excess of your lab's capabilities. Most labs have between 6 and 12 air changes per hour. Chemicals requiring additional ventilation must be used only in hoods and glove boxes.

- Procedures involving highly toxic chemicals that can generate dust, vapors, or aerosols must be conducted in a hood, glove box, or other suitable containment device. Refer to Appendix II for hazardous chemical lists.

- When working with toxic liquids or solids, it is critical that gloves be worn to protect the hands and forearms. These gloves must be carefully selected to ensure that they are impervious to the chemicals being used and are of appropriate thickness to allow reasonable dexterity while also ensuring adequate barrier protection. Contact the Department of Environmental Health and Safety for assistance or glove selection.

- Always inspect all personal protective equipment prior to starting any experiment and never work alone.

- When using toxic substances that could generate vapors, aerosols, or dusts, additional levels of protection, including full-face shields and respirators, are appropriate, depending on the degree of the hazard represented.

- Equipment used for the handling of high toxic chemicals must be isolated from the general laboratory environment.

- After using toxic materials laboratory personnel shall wash his or her face, hands, neck and arms prior to leaving the laboratory.

- Laboratory personnel must be specifically trained on the use of certain highly toxic and/or reactive materials. The Department of Environmental Health and Safety provides additional training to anyone working with any of the Highly toxic or reactive materials listed in Appendix II or any on the OSHA regulated materials listed in Appendix VI (for example: Hydrofluoric Acid, Formaldehyde, Chlorine Gas, and Ammonia Gas).

- Perchloric Acid:
    - Perchloric acid is a very dangerous corrosive and oxidizing agent at high concentrations and elevated temperatures. Room temperature concentrations of 70% or less are not significant oxidizers, but are still highly corrosive.
    - Always review the Material Safety Data Sheet before using perchloric acid.
    - Always wear appropriate personal protective equipment when using perchloric acid.
    - Do not store perchloric acid with organic materials. Upon contact with perchloric acid, organic materials such as wood or cloth may ignite. Perchloric acid also must not be stored with bases, organic acids, or flammables.
    - Perchloric acid spills must not be allowed to dry as they become more unstable as the acid concentrated. Also, do not leave containers uncovered. Neutralize any spill with soda ash or similar and use an inorganic absorbent to clean up the material. Do not use rags or paper towels unless wetted. Seal any cleaning materials to be discarded in a plastic bag and contact the Department of Environmental Health and Safety for disposal.
    - Salts of perchloric acid are also oxidizers and may be explosive.
    - Any experiment involving the heating of perchloric acid MUST be done in a chemical fume hood specially designed as a perchloric acid hood. Do not use direct flame heating or oil baths. Perchloric Acid Hoods are made of stainless steel and have wash-down water spray systems.
    - The Department of Environmental Health and Safety requires any lab using perchloric acid to write the receive and open dates on the container's label.

- Hydrofluoric Acid (HF):
    - Hydrofluoric acid is an extremely dangerous material and all forms, including vapors and solutions, can cause severe, slow-healing burns to tissue. At concentrations of less than 50%, the burns may not be felt immediately and at 20% the effects may not be noticed for several hours. At higher concentrations, the burning sensations will become noticeable much more quickly, in a matter of minutes or less. HF burns pose unique dangers distinct from other acids, it readily penetrates skin, damaging underlying tissue. The fluoride ion can then cause destruction of soft tissues and decalcification of the bones. HF can cause severe burns to the eyes, which may lead to permanent damage and blindness. The Hydrofluoric Acid Standard Operating Procedure, which is

available from the Department of Environmental Health and Safety, and its MSDS must be posted prominently.
    - Review the MSDS before working with this material.
    - Do not work alone when using hydrofluoric acid.
    - For skin contact, a 2.5% calcium gluconate gel is recommended. For eye contact, a sterile solution of 1% calcium gluconate or dropper bottle of 0.5 % pontocaine hydrochloride is required to be made available. The Department of Environmental Health and Safety can supply any lab using HF the calcium gluconate gel.

- **Radioactive Material Precautions**

    - Prior to working with any radioactive material contact the Radiation Safety Department (215-255-7860) for the current regulations concerning radioactive materials.

    - Know the characteristics of the radioisotopes that are being used, including half-life, types and energies of emitted radiations, the potential for exposure, how to detect contamination, and the annual limit on intake.

    - Dispose of waste radionuclides and their solutions In accordance with the University's Hazardous Waste Management Plan. Contact the Radiation Safety Department or the Department of Environmental Health and Safety concerning proper disposal procedures.

    - Plan experiments so as to minimize exposure by reducing the time of exposure, using shielding against exposure, increasing your distance from the radiation, and paying attention to monitoring and decontamination.

    - Keep an accurate inventory of radioisotopes.

    - Place only materials with known or suspected radioactive contamination in appropriate radioactive waste containers.

- **Flammable Material Precautions**

    - Handle flammable substances only in areas free of ignition sources. Besides open flames, ignition sources include electrical equipment (especially motors), static electricity, and, for some materials (e.g., carbon disulfide), even hot surfaces.

    - Check the work area for flames or ignition sources prior to using a flammable substance.

- Never heat a flammable substance with an open flame. Preferred heat sources include steam baths, water baths, oil and wax baths, salt and sand baths, heating mantles, and hot air.

- Keep containers of flammable substances tightly closed at all times when not in use.

- Use only refrigeration equipment certified for storage of flammable materials.

- Pyrophoric Organometallic Materials:
    - Always read the relevant Material Safety Data Sheet before using these materials.
    - Pyrophorics users must be thoroughly trained in the proper lab techniques.
    - Never work alone when using these materials.
    - Set up work in a laboratory fume hood or glove box and ALWAYS wear the appropriate personal protective equipment. Portable shields might be acceptable. Glove boxes are recommended when an inert or dry atmosphere are required.
    - A face shield is required at any time there is a risk of explosion, large splash hazard or a highly exothermic reaction.
    - Lab coats or aprons, not made of easily ignited materials such as nylon or polyester, must be worn. Fire-resistant lab coats made from materials such as Nomex are required.
    - Minimize the quantity of pyrophoric reagents used or stored.
    - Pyrophoric chemicals must be stored under an atmosphere of inert gases or under kerosene, as appropriate.
    - Avoid working or storing these materials in areas near heat/flames sources, oxidizers, and water sources.
    - A container with any pyrophoric residue must never be left open to the air.
    - The use of smaller syringes is encouraged. If handling more than 20 ml of sample, one should use a cannula for transfer or use a 20 ml syringe repeatedly.
    - The Aldrich Sure/Seal Packaging system provides a convenient method for storing and dispensing air sensitive reagents. Replace the plastic cap after each use, particularly for long term storage. The Sure/Seal septum-inlet transfer adapter must be used when repeated dispensing is necessary.

- **Compressed Gas Cylinders**

    - Compressed gas is any gas or mixture of gases exerting in a container a pressure exceeding 40.6 psia at 68 degrees Fahrenheit. Also any

flammable liquid having an absolute vapor pressure exceeding 40.6 psia at 100 degrees Fahrenheit.

- All compressed gases are considered hazardous and contain a certain volume of gas even if the gauge reads empty or zero.

- Gases MUST be stored in separate hazard classes: Flammable, Asphyxiant, Oxidizing, Corrosive, Toxic, Cryogenic, High Pressure, and Pyrophoric. Some gases combine hazard classes, such as Hydrogen has both high pressure and flammable hazards.

- Gas cylinders of all sizes, whether empty or full, must be secured in an upright position at all times. The uses of straps, chains, or a suitable stand to prevent them from falling are all acceptable practices. Contact the Department of Environmental Safety and Health or Facilities Management for options.

- Cylinders not in use must be capped at all times to protect the valve stems.

- Do not expose cylinders to temperatures higher than about 50 degrees Celsius. This might result in excessive cylinder pressure. Some rupture devices on cylinders will release at about 65 degrees Celsius. Small cylinders, such as lecture bottles are not fitted with rupture devices and may explode if exposed to high temperatures.

- Old/Empty gas cylinders must be returned to the supplier in a timely fashion.

- Disposal of used lecture bottles can cost anywhere from $100 to $1000 each, depending on their contents. Use only if there is no other alternative.

5. Protective Clothing And Other Precautions

- Remove laboratory coats immediately upon significant contamination.

- When in the lab, appropriate footwear that completely covers the foot must be worn. Sandals, flip-flops, perforated shoes, any shoes made of canvas, or any other open-top or open-toed shoes are prohibited.

- When in the lab, pants and dresses must come down to the ankle. Shorts, short skirts and other clothing that leave sufficient skin exposed are prohibited in the lab. Shorts and short skirts may only be worn in the lab when wearing an ankle-length lab coat that covers all exposed skin.

- Do not wear contact lenses in the laboratory. Contact lenses can react with some chemicals, potentially damaging the eyes. They may also interfere with washing out any foreign material in the eyes.

- Disposable or special gloves, chemical aprons, goggles or eye shields must be used whenever appropriate.

- Disposable gloves must never be worn in hallways, elevators, or public areas of the University. If hazardous materials must be transported from one area to another, glove one hand to hold the product / apparatus or push cart and use a clean ungloved hand to open doors, press buttons, etc.

- Inspect all gloves before each use. Wash them before removal. Dispose of them appropriately.

- Reusable gloves should be washed and inspected before and after each use. Gloves that might be contaminated with chemicals must not be removed from the immediate area in which the chemicals are located.

- Eating, drinking, smoking, chewing gum or applying cosmetics in the laboratory is strictly forbidden. Lunches are not to be stored in standard laboratory refrigerators, but may be kept in the designated refrigerators.

- Wash areas of exposed skin thoroughly before leaving the laboratory.

- Confine long hair and loose clothing.

- Avoid practical jokes or other behavior that might confuse, startle or distract another worker.

- Refer to Section H of this plan for information concerning Personal Protective Equipment.

Note: Please contact the Department of Environmental Health and Safety for additional information on precautionary measures, i.e., housekeeping, gas cylinders, hazard warnings, etc.

6. Chemical Inventory

An inventory of all hazardous chemicals (refer to Appendix II for a list of hazardous substances or to individual MSDS) **and** non-hazardous chemicals must be prepared for each laboratory. Three copies of the chemical inventory will be maintained:

1. The first copy of this inventory will be maintained by the P.I./Faculty Member
2. The second copy will be maintained in the lab.

3. The third copy will be sent to the Department of Environmental Health and Safety via safeheal@drexel.edu. Copies of these inventories must be sent at least once a year.

A separate inventory list of carcinogens, mutagens and teratogens is to be forwarded to the Department of Environmental Health and Safety in accordance with Federal and State Regulations.

A hard copy of the chemical inventory must be posted on the outside of the lab entrance door. It is recommended that an additional copy be used as the first page of the MSDS binder.

For P.I.'s with multiple labs, each lab must have its own separate chemical inventory, specific for that room.

The inventory must contain the following:

- P.I. Name
- Building and Room ID
- Full Chemical Name
- Vender/Manufacturer
- Volume/Quantity

Hard copies of the inventories must be prepared annually. As new chemicals are obtained, chemical inventory sheets must be updated accordingly. Gas cylinders, cleaning supplies, and common household chemicals must also be inventoried. The inventories must be complete and up do date. It is from the inventories given to us that the Online MSDS Database is maintained.

The PI/Laboratory Supervisor/Faculty Member takes complete responsibility for compliance.

7. Material Safety Data Sheets (MSDS)

The Department of Environmental Health and Safety maintains and online database of material safety data sheets at http://hq.msdsonline.com/drex3646/Search/Default.aspx. It can be searched using either chemical name or location (i.e. building & room number). The list of MSDS on this website is compiled based upon the chemical inventories received by the Depatrtment of Envornmental Health and Safety from the laboratories. This complies with OSHA regulations. All lab personnel must know how to access and use the database.

It is recommended, but not required, that each lab keep hard copies of the MSDS for all of the chemicals within their lab. The hard copies should be kept in a labeled binder, sorted in alphabetical order. The MSDS must be kept in a visible location in the laboratory, near the entrance door to the laboratory.

Vendors and manufacturers are required by federal law to provide MSDS upon request, free of charge, within a reasonable time frame. Many venders post their MSDS on their webpages. Additional sources for obtaining MSDS include the internet at:

www.msds.com
www.msdssearch.com
www.ilpi.com/msds
www.hazard.com
www.msdsonline.com

The PI/Laboratory Supervisor/Faculty Member is responsible for reviewing the MSDS and recording which materials are carcinogenic, mutagenic or teratogenic. This information must be conveyed to all students and/or employees engaged in research in his/her laboratories, including locations used and stored within the lab. This information must be posted at the entrance to each lab in an effort to inform any individual who may need to enter that space. A copy of this information must be sent to the Department of Environmental Health and Safety.

8. Chemical Storage

All hazardous chemicals must be stored in clearly defined designated areas in accordance with this manual and OSHA Regulation 29 CFR 1910.1450 also known as the "Laboratory Standard". These storage guidelines must be followed when storing hazardous chemicals:

- The chemical inventory must be kept as small as possible. Any old, expired, or unused chemicals should be properly disposed.
- Do not store chemicals on top of high cabinets or shelves. Liquids, in particular corrosives or other hazardous liquids, should not be stored over 5 feet in height. The only exception is that non-hazardous liquids may be stored above 5 feet if there are space limitations. There is no height restriction for solids.
- Keep exits, passageways, areas under tables, and emergency equipment areas free of stored chemicals.
- Provide a definite storage place for each chemical and return the chemical to that location after each use.
- Do not store chemicals on bench tops and in fume hoods, except for those chemicals being used currently.
- Do not store chemicals on the floor.
- Store chemicals in a cool dry place avoiding direct sunlight.
- Ventilated storage cabinets shall be used to store extremely hazardous chemicals. The vents must be directed outside the building.

- Use chemical storage refrigerators and freezers only for chemical storage. Label these refrigerators with the following signage: "**No Food or Drink – Chemical Storage Only**"
- Safety containers must be used when transporting chemicals (i.e. carts, rubber totes, secondary containers etc), especially outside of the lab area.
- Observe all precautions regarding the storage of incompatible chemicals.
- Dry chemicals (solid materials) shall not be stored with liquid chemicals. If stored in the same cabinet, liquids are always stored under solid chemicals.
- Separate chemicals into the following hazard classes:

    1. Flammables
    2. Acids
        - Organic Acids
        - Inorganic Acids
    3. Bases
        - Organic Bases
        - Inorganic Bases
    4. Oxidizers
    5. Reactives
    6. Poisons (Toxic)
    7. Non-hazardous or non-regulated chemicals.

- The above hazard classes must be separated from each other. This can be accomplished by 1) placing them in different cabinets, 2) placing them on different shelves, or 3) separating them by placing the different hazard classes into separate secondary containment containers. The trays must be able to contain any spills or leaks and must be made of material compatible with the chemicals they contain.
- Other means of separating potentially incompatible chemicals are acceptable, such as the Flinn Scientific Guidelines. Contact the Department of Environmental Health and Safety to discuss options.
- Alphabetical storage of chemicals is not allowed. This may result in incompatibles appearing together on a shelf. Chemicals should first be segregated appropriately then stored alphabetically within each hazard class.
- Chemicals classified as Irritants may be stored separately or with Non-Hazardous Chemicals.
- Weak acids or bases, in their dry form, often can either be stored as Non-Hazardous or separated out as acids or bases, unless the label specifically classifies it as "Corrosive". Any chemical specifically labeled as "Corrosive" must be separated out as an acid or a base.
- Store all flammable liquids in a grounded, flammable storage cabinet with self-closing doors.
- The maximum quantity of flammable liquids in use at one time shall be 1.5 gal (5.68L). The maximum quantity of flammable liquids stored in the lab shall be 60 gal (227L).

- Do not store flammable liquids in a refrigerator unless it is an approved explosion-proof refrigerator.
- Organic Acids can be stored in the flammable storage cabinet; however, overspill containers must be used to contain any spills and to act as a means of separation.
- Acids must be stored separate from bases. Storage in the same cabinet is possible **ONLY IF OVERSPILL CONTAINERS ARE USED TO CONTAIN ANY SPILLS.**
- Separate inorganic and organic bases. These can be stored in the same cabinet. Shelves or overspill containers can be used as a means of separation.
- Separate inorganic and organic acids. These can be stored in the same cabinet. Shelves or overspill containers can be used as a means of separation. In particular, nitric acid and acetic acid must not be stored together.
- Store nitric acid, perchloric acid, and hydrofluoric acid separately from all other chemicals if possible (including from each other). Otherwise store them with other inorganic acids.
- Peroxide-forming chemicals may become unstable and potentially explosive when exposed to air. As such, all peroxide-forming chemicals must have a receive date and an open date written on their labels. Examples of commonly used peroxide-forming chemicals include: Tetrahydrofuran, Ethyl Ether, Dioxanes, Isopropyl Ether, Styrene, Vinyl Pyridine, and 2-Propanol. Most peroxide-forming chemicals must be disposed of after 12 months, although some uninhibited peroxide-formers may only be used up to 24 hours after opening (*See Appendix II*). Perchloric Acid is another potentially explosive chemical which should be disposed of after 12 months. While not as potentially hazardous as other peroxide-formers, older containers of 2-Propanol should be handled with care. To track how old the chemicals are, all labs are required to write the receive date and open date on the containers of peroxide-formers, unless there is an expiration date already present.
- DO NOT handle any peroxide forming chemical if there are signs of crystal growth or precipitation. Contact the Department of Environmental Health and Safety (215-895-5907) IMMEDIATELY if this occurs and leave the area.
- Oxidizers must be stored in a cabinet separate from all other chemicals. Some oxidizers may cause combustible materials to catch fire on contact. Avoid storing in wood cabinets/shelves and cardboard boxes.
- Reactive chemicals must be segregated and stored appropriately i.e. flammable cabinet, explosion proof refrigerator, dedicated container etc.
- Toxic chemicals, including carcinogens, must be properly labeled; small containers should be stored together in unbreakable chemical-resistant secondary containers. These containers must be labeled either “Caution: High Chronic Toxicity,” or “Cancer Suspect Agent.”
- As stated above, a separate inventory list of carcinogens, mutagens and teratogens is to be forwarded to the Department of Environmental Health and Safety in accordance with Federal and State Regulations.

- Cylinders of compressed gases, empty or full, must be labeled, strapped or chained at all times to a wall or bench top, and must be capped when not in use.
- Oxygen and other oxidizing gases must not be stored adjacent to flammable gases (except when in use).
- Do not store flammable gases near sources of heat or ignition.
- If unable to determine the best possible storage options consult the MSDS for the chemical. If further assistance is need contact the Department of Environmental Health and Safety:

  Martin Bell 215-895-5892
  Jeffrey Nemetz 215-895-5913

9. Labeling

Chemical Container Labels:

OSHA requirements for labeling under the Chemical Hygiene Plan will be the same as those defined in the hazard communication standard 1910.1200 and 1900.1450. Therefore, all containers in the workplace (including secondary containers (beakers, Erlenmeyer flasks, cap bottles, etc.) must contain the following information:

1. Identity of the substance (complete chemical name; abbreviations and/or symbols are not acceptable).
2. Appropriate hazard warnings (Irritant, Flammable, Corrosive, etc.; completed NFPA diamond is acceptable).

All labels must be prominently displayed and legibly written (printed) in English and other language as appropriate for employees. **It is the responsibility of the principal investigator to inspect all incoming shipments of containers of hazardous chemicals to ensure that they bear labels with the appropriate information**.

The names of buffers (PBS, TBS, HEPES, Tris, etc.) may be abbreviated, as long as a Key or Legend stating the full name is placed in a clearly visible location in the laboratory, preferably by the lab entrance. Abbreviations, formulae, or symbols of commonly used chemicals (ethanol (EtOH), hydrochloric acid (HCl), etc.) may also be written on secondary containers, provided they are included on a key or legend visibly posted in the lab.

Sample vials too small to write the full chemical name and hazard information on may be coded. Codes may be printed up on a key or legend and placed in a visible location at the work area for this purpose. Otherwise all code keys must be written clearly and legibly in the laboratory notebook. Signage is required at all work stations denoting both that the code key is located in the notebook and the location of the notebook itself. The laboratory notebook

must be kept in a visible area and returned there at the end of the experiment or the end of the day.

It is recommended that the date be placed on all chemical containers when they are received and opened. This is required for any peroxide-forming chemicals. For any solutions prepared by the laboratory personnel (i.e. buffers, media, and dilutions), it is also recommended to add the date it was made to the container's label.

If a container is improperly labeled, the PI/Laboratory Supervisor/Faculty Member or the PI's /Laboratory Supervisor's/Faculty Member's designee must contact the Department of Environmental Health and Safety (215-895-5919), who will notify the vendor for correction, and the receiving department for informational purposes.

Portable or secondary containers used for purposes of transferring hazardous material from a labeled container for immediate and complete use by an investigator or his /her technicians or research staff or student do not require labeling . However, if the transferred hazardous material is to be used by other research personnel/student, or is not immediately used, it is the responsibility of the investigator/lab supervisor/faculty member/student/lab technician for whom the chemical material was first intended, to properly label the portable container.

Laboratory Labels:
All laboratory entrance doors shall be labeled as follows:

1. NFPA diamond. Laboratory personnel shall fill in the diamond with the highest hazard number pertaining to their laboratory.
2. Biohazard label and appropriate Biosafety Level (if applicable).
3. UV Light label (if applicable).
4. Radiation Hazard Label (if applicable).
5. Emergency contact information. The information must include a name and number to contact in the event of an emergency. It must be clearly visible and placed on each outer laboratory door
6. Additional warning labels as applicable, i.e. "carcinogen in use", "water reactive materials", "inhalation hazard, respiratory protection required in this area", "high noise, hearing protection required in this area", etc.

Chemical Storage Labeling:
All cabinets, shelves and refrigerators containing chemical storage (including the cleaning supplies) must be labeled with the appropriate warning label (Flammable, Acids, Bases, Oxidizers, Reactives, Poisons (Toxic), Non-Hazardous, and/or NFPA Diamond). Refrigerators and freezers used for chemical storage must be labeled with appropriate hazard warnings and with the signage: "NO Food or Drink – Chemicals Storage Only." Lab microwaves

and ovens must also have "No Food or Drink" signs. Any refrigerator used of food or drink storage must be label as such (these must be kept out of the lab areas). Biohazard labels must be applied to all appropriate areas, such as Biological Safety Cabinets and refrigerators. Radiation hazard tape or labels must be applied to all applicable work and storage areas. UV Light warning labels must be placed on any device that can generate ultra-violet light, such as Biological Safety Cabinets.

Old and obsolete labels in the lab must be removed or defaced.

F. ENGINEERING CONTROLS

1. Chemical Fume Hoods, Biological Safety Cabinets and Ventilation

All chemical fume hoods and laminar flow hoods must be inspected annually and certified. Any hood not providing 80 to 120 linear feet per minute of airflow or manufactures recommended value must not be used. Inspections of chemical fume hoods are routinely conducted by the Department of Environmental Health and Safety at no cost to the investigator or department. If chemical fume hoods do not meet specifications, they will be taken out of service immediately and are not to be used until the hood has met the criteria for certification. Refer to the University's Chemical Fume Hood Policy for more information (Available at http://www.drexel.edu/facilities/healthSafety/).

The annual inspection and certification of laminar flow hoods and biosafety cabinets is scheduled through the Department of Environmental Health and Safety, the costs associated with these certifications are the investigator's/faculty member's responsibility. It is the responsibility of the principal investigator/faculty member/laboratory supervisor to certify, repair or replace such unit(s) in a timely fashion so as not to endanger the health and well-being of employees/students or place them at risk. Refer to the University's Biological Safety Cabinet Policy (Available at http://www.drexel.edu/facilities/healthSafety/) for more information.

Work involving chemicals with high vapor pressures or low threshold limit values (TLVS) must always be done within a fume hood. Refer to Appendix VII for TLVs or contact the Department of Environmental Health and Safety (215-895-5907) for chemicals not on the list.

Airflow through each laboratory should normally be not less than 20 cubic feet per minute, and exhausted to the exterior of the building. Quality and quantity of ventilation are monitored and records are maintained by University Facilities Management. If you need information on this, please contact Facilities Management at your campus.

2. Eyewash Fountains and Safety Showers

Eyewash and safety showers are essential in every laboratory. These stations must be within 25 feet and/or 10 seconds of unobstructed path of the laboratory operation. Eyewash stations and showers should be located within the laboratory, especially if corrosive or injurious chemicals, strong irritants, or toxins that can be absorbed through the skin are present, or if the lab is subject to BSL-2 (or higher) regulations. Regulatory standards insist that the eyewash station be hands-free or automatically operated. Drench hoses, sink faucets or showers are not acceptable eyewash substitutes. Facility limitations may affect these requirements. Locations of emergency eyewash stations and safety showers shall be identified with a highly visible sign.

Eyewash fountains must be inspected once a week by the PI/Faculty Member/Laboratory Supervisor. Records are maintained by the Principal Investigator/Faculty Member/Laboratory Supervisor are recommended to be kept near the eyewash station. Inspection forms are included in the Appendix IX of this manual. Weekly inspections are not necessary if the eyewash does not have access to a drain.

The Department of Environmental Health and Safety certifies eyewash stations during the biannual laboratory audits and requires an annual certification. All records will be maintained by the Department of Environmental Health and Safety.

Safety showers are inspected, tested, and flushed annually and records are maintained by the Department of Environmental Health and Safety. Inspection forms are included in the Appendix IX of this manual.

3. Fire Safety

Each laboratory should be equipped with the fire extinguisher appropriate for the work that goes on in the lab, or have one located nearby in the hallway. Classes of fire include:

A. For fires involving combustibles like wood or paper
B. For flammable or combustible liquids and gases
C. For fires where electricity may be present
D. For combustible materials like magnesium

Only trained employees should use fire extinguishers. If a fire occurs, remember **P.A.S.S.** when operating a fire extinguisher:

P – Pull the pin
A – Aim the hose at the base of the firs
S – Squeeze the trigger
S – Sweep

All laboratory personnel and/or students shall know the locations of the locations of all the fire extinguishers, fire blankets (if present) and the fire alarms. No smoking is allowed in any University building.

The Principle Investigator/Laboratory Supervisor/Faculty Member shall post laboratory evacuation procedures. During an evacuation, remember **R.A.C.E.:**

R – Remove everyone from the immediate area
A – Alert others by sounding alarm
C – Confine the fire by closing the door
E – Evacuate the building and report to a pre-arranged meeting place.

All laboratory personnel and students shall be familiar with these evacuation procedures. It is the responsibility of the Principle Investigator, Laboratory Supervisor, or Faculty Member to ensure that the students know these procedures, as well as to eliminate any potential fire hazard.

Fire extinguishers are inspected annually and recharged and/or replaced accordingly by the Facilities Department:

Center City Campus:	215-762-6500
Queen Lane Campus:	215-991-8484
University City Campus:	215-895-2808
PA Biotechnology Center	215-489-4904

Long-term storage of chemicals should be in a well ventilated, secure chemical storage area in accordance with current fire and building codes.

All cold rooms and warm rooms have provisions for rapid escape in the event of electrical failure. Escape instructions should be posted on the inside of the entrance door of each cold or warm room.

For more information, see the Fire Safety manual at
http://www.drexel.edu/facilities/healthSafety/.

G. PERSONAL EXPOSURE MONITORING

Upon request of the PI/Faculty Member/Laboratory Supervisor/Student/Laboratory personnel, the University CHO will review laboratory work practices and normal operations in an effort to determine if University employees are at risk of exposure to regulated substances in accordance with the OSHA permissible exposure limits and action levels as outlined in 29 CFR 1910.

Initial and annual surveillance monitoring (environmental and personal) will be conducted whenever exposures to hazardous agents are anticipated to exceed the action level, the

American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLV) or OSHA'S PEL. Additionally, monitoring will be conducted when:

- Past monitoring has indicated elevated exposures,
- When requested by an employee or student,
- When an employee or student experiences signs or symptoms of overexposure, or
- When laboratory operations change such that and area previously identified as not expected to have significant exposure would now be expected to have elevated concentrations of hazardous agents

All personal exposure monitoring activities (including sampling, analysis and record keeping) will be performed in accordance with OSHA requirements and/or NIOSH recommended practices.

H. PERSONAL PROTECTIVE EQUIPMENT (PPE)

The Department of Environmental Health and Safety requires that appropriate eye protection is worn at all times by by all persons in laboratories and areas where chemicals are used or stored.

Eye protection consists of safety glasses with side shields, goggles or face shield, or full-face respirator. Chin length face shields are to be worn to prevent splashes or sprays of blood, infectious materials, or hazardous chemicals when there is a potential for eye, nose, or mouth contamination. Eye protection is required whether or not one is actually performing experimental operations and must be worn by all lab personnel and visitors. Prescription eyeglasses and contact lenses are not appropriate protection. In fact, wearing contact lenses in the lab is prohibited as they can cause serious complications when exposed to certain chemicals.

Employees/students are required to wear appropriate gloves when an employee has the potential for direct contact with blood, hazardous chemicals, infectious agents, or other hazardous materials.

Select gloves appropriate for the task. Gloves protect differently for each chemical. Wearing the wrong type of glove can be more hazardous than wearing no gloves at all. If the chemical seeps through, the glove can hold it in prolonged contact with the wearer's hand. For more information concerning glove selection contact Department of Environmental Health and Safety. A link to a website to determine the appropriate glove for the chemical you are using can be found at http://www.drexel.edu/facilities/healthSafety/.

Lab coats and gloves must be worn only in the laboratory area and are to be removed upon exiting the laboratory. Lab coats are worn to protect street clothes from hazardous materials. For safety concerns, short pants, open-toed shoes, and loose clothing must not be worn in the lab and is prohibited. In addition, gloves and lab coats must only be worn in the lab and

taken off before leaving, especially when handling infectious material. Gloves are only worn in the laboratory and must be removed before leaving. If transporting hazardous materials from one are to another, glove one hand to hold the product/apparatus or push the cart and use a clean, ungloved hand to open doors, press buttons, etc. Hands must be washed with soap and water immediately after removing the gloves.

Chemical Fume Hoods, Glove Boxes, and Biological Safety Cabinets are not be used as alternatives to PPE. They are used only to augment PPE. Proper PPE must be worn when using these devises.

When the use of respirators, in research laboratories, is necessary to maintain exposure below the permissible exposure limit (PEL), the respirator will be provided by the PI at no cost to the employee. The Department of Environmental Health and Safety will provide students, at no cost, with respirators when the use is necessary to maintain exposure below the permissible exposure limit (PEL).

The proper respiratory equipment can be obtained from the Department of Environmental Health and Safety (215) 895-5907. The respirators shall be selected and used in accordance with the requirement of 29 CFR 1910.134 and ANSI Z88.2-1969. Training, an annual physical and pulmonary function test will be required for all individuals requiring the use of respirators in accordance with OSHA's standards on respiratory protection 29 CFR 1910.134.

Use appropriate respiratory equipment when air contaminant concentrations are not sufficiently restricted by engineering controls. The odor threshold for many chemicals is much lower than the permissible exposure limit, and in many circumstances is a great indicator of exposure. Refer to the Odor Threshold Chart, Appendix VII, and the OSHA PEL list, Appendix VI, to determine if a respirator is required.

The requirements set forth in the University's Respirator Protection Policy must be fulfilled prior to performing work with a respirator. Contact the Department of Environmental Health and Safety to enroll in the program.

Use any other protective apparel and equipment as appropriate. Know the locations of PPE and how to obtain additional materials when necessary. If appropriate PPE is not readily available do not initiate experiments involving hazardous chemicals.

The Principle Investigator shall provide proper personal protection equipment for all personal in the research laboratory and instruct them of the PPE's locations.

Faculty Members/Laboratory Supervisors shall require students to obtain the appropriate PPE prior to commencing any laboratory activities. If proper PPE is not available, no lab activity can proceed. For proper PPE selection contact the Department of Environmental Health and Safety.

I. WASTE REMOVAL/DISPOSAL

The Waste Disposal Program provided at the University for the collection, segregation, storing, transport, and incineration of contaminated materials is designed in accordance with the Pennsylvania Department of Environmental Protection (PADEP), the US Environmental Protection Agency (EPA) and the US Department of Transportation (USDOT) to minimize possible harm to people, other organisms and the environment. Refer to the university's hazardous waste management plan for waste removal/ disposal operations.

1. Drain Disposal

The Department of Environmental Health and Safety will permit drain disposal of elementary neutralized (ph adjustment of waste that are hazardous only because they exhibit the corrosivity characteristic) acidic and caustic aqueous solutions. The elementary neutralized aqueous solution must have a final ph value between 6 and 9. Disposal must not exceed a rate greater than 50 ml/min. while flushing. These compounds should be flushed with at least 10 volumes of excess water.

The Department of Environmental Health and Safety prohibits the drain disposal of the following:

- Flammable or explosive pollutants
- Poisonous (toxic) solids or liquids
- Hydrofluoric Acid
- Chromic Acid
- Sulfuric Acid
- Perchloric Acid
- Nitric Acid
- Pollutants that will cause corrosive structural damage to the Publicly Owned Treatment Works (POTW), but in no case discharges with pH lower than 5.0.
- Solid or viscous pollutants that may cause an obstruction of flow in the POTW
- Pollutants capable of releasing fumes or vapors
- Pollutants, including oxygen-demanding pollutants (high biological oxygen demand), which may cause interference with the POTW
- Wastewater with sufficient heat to inhibit biological activity in the POTW (must not exceed 104 F at the POTW)
- Petroleum, oil, non-biodegradable cutting oil or products of mineral oil origin in amounts that will cause interference or pass through
- No organic chemicals
- No heavy metal solutions

2. Incineration

Incineration, in an environmentally acceptable manner, is the most practical disposal method for combustible laboratory waste. Indiscriminate disposal by

pouring waste chemicals down the drain or adding them to mixed refuse for landfill burial is unacceptable.

3. Hoods and recycling

Hoods are not to be used as a means of disposal for volatile chemicals. Disposal by recycling or chemical decontamination must be used whenever possible.

4. Waste removal

Researchers rid their labs of unwanted materials by completing the online Chemical Pick-Up Request Form and submitting it at http://www.drexel.edu/facilities/healthSafety/ under the "Service Request Forms" section. Waste is removed from the laboratories to the long-term central waste storage area at regular intervals. Storage is allowed from the generation of the waste up to 90 days. The Department of Environmental Health and Safety stores its hazardous waste at its central storage area from which it is transported every 90 days for disposal.

Residual materials (less than 1 milliliter) may be rinsed from containers and disposed of down the drain. The remaining glassware should be cleaned, triple rinsed, labels defaced, and disposed of as municipal waste. All broken glassware should be disposed of in approved sharps containers.

Refer to the University's Hazardous Waste Management Plan, available at http://www.drexel.edu/facilities/healthSafety/, for more information on waste disposal.

J. ADMINISTRATIVE CONTROLS

The safe operation and compliance of each laboratory is the responsibility of the respective PI/Faculty Member/Laboratory Supervisor, while the overall responsibility for the enforcement of the chemical hygiene plan rests with the Department of Environmental Health and Safety. Policy and implementation procedures pertaining to the CHP require approval by the Department of Environmental Health and Safety.

The administrative controls enforced at the University include, but are not limited to:

1. Restricted access and proper signage on all entrances leading to areas containing agents that may be immediately dangerous to life or health.

2. Proper labeling on laboratory doors, cabinets and containers containing potentially hazardous materials.

3. The observation of Standard Universal Precautions when working with blood and bodily fluids of humans and animals, recombinant DNA or potentially pathogenic bacterial or viral agents.

4. The contents of the lab safety manual and the radiation safety manual and all applicable federal and state regulations established to protect human health and the environment.

5. If a chemical is produced for another user at Drexel University and Drexel University College of Medicine or at another facility, the researcher shall comply with the hazard communication standard 29 CFR 1910.1200 (www.osha.gov/comp-links.html), including the requirements for preparation of material safety data sheets and labeling.

6. Environmental monitoring is required in all laboratories using the chemicals listed in OSHA Standard 1910 Subpart Z - Toxic And Hazardous Substances that would generate anticipated exposures in excess of the action level or the TLV.

7. Chemical spill response must be performed in accordance with this manual. Laboratory personnel are responsible for cleaning up spills of materials that are not acutely hazardous or in quantities of less than 500 ml. Laboratory personnel are responsible for containing and reporting larger spills and/or spills of acutely hazardous materials such as phenol.

8. Procedures for containing and/or cleaning chemical spills have been developed in accordance with OSHA guidelines and are described in Section E, Part 2 of this Plan.

9. All chemical spills greater than 100 milliliters must be reported to the Department of Environmental Health and Safety immediately at (215) 895-5907.

10. To contain a chemical spill, remember to **"C.L.E.A.N."**
    a. **C**ontain the area.
    b. **L**eave the area.
    c. **E**mergency: eye wash, shower, medical care.
    d. **A**ccess MSDS.
    e. **N**otify the CHO.

11. Appropriate spill kits must be maintained in each lab or in centralized common areas accessible by all lab personnel. It is the responsibility of the PI/Faculty Member/Laboratory Supervisor to ensure that ample spill materials are available and that laboratory personnel are familiar with locations and use of these materials.

K. MEDICAL CONSULTATIONS AND EXAMINATIONS

The principal investigator or lab supervisor is authorized to obtain employment medical services from:

Worknet Occupational Health
Bobst Building, Rm. 133
245 N. 15th Street
Philadelphia, PA 19102

Drexel University Occupational Health Services
219 N. Broad Street, 8th Floor
Philadelphia, PA 19102

Occupational Health will have to receive written authorization from the Department of Environmental Health and Safety.

Services will include appropriate vaccinations, baseline medical monitoring and physicals as required under federal and state regulations for those individuals who have a potential for exposure. Additional medical services / consultations may be recommended by the Department of Environmental Health and Safety prior to the approval of protocols involving the use of extremely hazardous or pathogenic agents.

The principal investigator or lab supervisor is authorized to obtain medical consultation in work-related emergency cases. All employees needing medical attention will use:

University City Main	Worknet Occupational Medicine One Reed Street Philadelphia, PA 19147
Center City/ QL	Worknet Occupational Health Bobst Building, Rm 133 245 N. 15th Street Philadelphia, PA 19102

If you are faced with a medical emergency, you may secure initial emergency treatment from any emergency facility. However, any follow-up care to the emergency treatment must be with a designated health care provider.

All injury-related examinations and consultations are performed by or under the direct supervision of one of panel of licensed physician's without cost to the employee, without loss of pay, and at a reasonable time and place.

The employee is sent for medical evaluation:

1. Whenever signs and symptoms associated with a hazardous chemical develop.
2. When environmental monitoring reveals an exposure level routinely above the action level.
3. Whenever an event takes place in the work area such as a spill, leak, or explosion resulting in hazardous chemical exposure.

The employee's supervisor, Risk Management or Department of Environmental Health and Safety will provide the following information to the physician:

1. Identity of the hazardous chemical(s) to which the employee may have been exposed.
2. A description of the conditions under which the exposure occurred, including quantitative exposure data (if available).
3. A description of the signs and symptoms of exposure.
4. A copy of the MSDS for the chemicals involved.

The physician will provide a written opinion that will not reveal specific findings of diagnosis unrelated to the exposure but will include:

1. Any recommendation for further medical follow-up.
2. Results of the medical examination and any associated tests.
3. Any medical condition that may be revealed in the course of the examination that may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace.
4. A statement by the physician that the employee has been informed of the consultation and examination results and any medical condition that may require further examination or treatment.

All such medical records will be kept for at least as long as the employees affected are employed. OSHA requires some records to be kept for 30 years beyond the employee's time of employment. The laboratory standard requires that all records be maintained of all exposure evaluations, medical consultations, and reports and that those records be maintained in accordance to 29 CFR 1910.20. That section requires those records to be maintained for at least 30 years and describes the accessibility procedure for maintaining the records.

L. TRAINING

Training is a necessary and important part of the Chemical Hygiene Plan (CHP). All employees will be trained at the time of their initial assignment to a work area where hazardous chemicals are present. The PI or the PI's designee is responsible for training all employee(s) whose assignment(s) are to work in an area where hazardous chemicals are, or may be present. For this purpose, supervisors may be trained by the Chemical Hygiene Officer through "train-the-trainer" sessions. Such sessions shall be documented by written attendance records.

To aid the PI's in training their lab personnel, an online training program has been initiated. All P.I.'s and their laboratory personnel are required to complete Drexel's Online Research Personnel Lab Safety Training. This training is located at www.drexelehstraining.com.

All participants must first log in at the website to begin training. New users should select the "New Hire" button under the login box. After filling in the requested information, click "submit". Please remember to enter your full e-mail address complete with domain. The user will receive an e-mail shortly after that which will contain their password. Once receives, please go back to the login page and begin training. The user will be able to stop and save progress at their convenience, but must complete the program within 30 days. Failure to complete the required training within 30 days, will restart the training from the beginning.

The following is a list of the lesson plan for that session:

Objectives

Upon completion of the chemical hygiene training program, the employee will be able to:

A. Locate the hazardous chemicals in the workplace and identify them as carcinogenic, mutagenic, teratogenic, poisonous, flammable or caustic as strong acids or bases.
B. Recognize the chemical labeling (NFPA) and understand its meaning.
C. Locate the MSDS file in the lab, university and on the web (www.hazard.com/MSDS)
D. Locate the health hazard, physical hazard, environmental protection, and special protection sections of the MSDS and explain their usage.
E. Identify the name and contact number of the Emergency Operator, Security, the Chemical Hygiene Officer and the PI. Discuss the major components of the facility's standard labeling system for hazardous waste.
G. Identify appropriate protective clothing associated with their job and demonstrate its use.
H. Demonstrate emergency procedures in the event of a fire or hazardous chemical spill.
I. Describe the environmental monitoring protocol.

Training Program

A. Content of the OSHA laboratory standard and hazard communication standard
B. Location of CHP
C. Identification of hazardous chemicals
    1. Location of chemical inventory
    2. Location of MSDS
        a. MSDS book in lab
        b. Department of Environmental Health and Safety Office
        c. http://hq.msdsonline.com/drex3646/Search/Default.aspx

3. Labeling information
    a. Hazard warnings – NFPA diamond
    b. Carcinogen, teratogen, mutagen warnings
    c. Location in workplace
4. Procedures for handling hazardous chemicals
    a. Work practices
    b. Proper moving, storage, and use
    c. PEL for specific chemicals used by the employees
    d. Visual appearance of chemicals used by the employee
    e. Environmental monitoring required
    f. Signs and symptoms of exposure
    g. Location of target organ poster
    h. Protective equipment used to prevent overexposure
    i. Locations of eyewash and emergency shower, fire extinguishers, fire alarm pull stations, emergency exit and alternative exit
    j. Conditions to avoid
5. Environmental protection
    a. Emergency procedures
    b. Spill containment
    c. Medical consultation procedures
6. Documentation of training – sign in sheet with date, location, printed name, signature, social security number, department, title, contact number, name and title of trainer.

All employees trained by the supervisor must be documented as noted above. Copies of this documentation must be forwarded to the Department of Environmental Health and Safety.

M. HOUSEKEEPING

Environmental services responsibilities at the University are performed under the supervision of the Department of Facility Management and that individual is charged with the responsibility to supervise the performance of the following functions:

- Maintain the floors of laboratories, hallways and all areas of Drexel University and Drexel University College of Medicine in clean condition and free of obstruction.
- Removal of municipal which has been deposited in appropriate receptacles and properly removed from laboratory areas.
- Assist, when so directed, to clean spills of bodily fluids.
- Assist in obtaining proper storage to minimize clutter.
- Conduct training and instructional programs to ensure that all housekeeping employees are fully informed about the risks associated with laboratory research and all other activities at Drexel University and Drexel University College of Medicine.

Laboratory personnel/students shall keep all work areas, (i.e. bench tops, fume hoods, floor, emergency equipment, refrigerators, etc.), clean and free from clutter.

N. RECORDKEEPING

The Department of Environmental Health and Safety will establish and maintain an accurate record for each employee requiring environmental monitoring, medical consultations, and examinations, including tests or written opinion as required.

Accident Reports are written by the PI or lab supervisor. They are forwarded to the Department of Environmental Health and Safety. All workers' compensation claims and accidents that require hospitalization are filed accordingly.

Inventory records for high-risk substances must be maintained by the PI. A copy of the inventory must be sent to the Department of Environmental Health and Safety.

Environmental monitoring records are maintained by the Department of Environmental Health and Safety.

Medical consultation records are maintained by Employee Student Health. Drexel University and Drexel University College of Medicine Human Resources Department will maintain a digital database outlining the pre-employment services that have been provided to each employee.

Training attendance records are maintained by the Department of Environmental Health and Safety.

All records are kept, transferred, and made available for regulatory agencies and in accordance with 29 CFR 1910.20.

O. LABORATORY AUDITS

The Department of Environmental Health and Safety conducts semi-annual laboratory safety audits. These audits assess chemical, biological and physical hazards. Issues reviewed during the audits include but not limited to:

- Chemical Storage
- Chemical Waste
- Gas Cylinder Storage
- Hazard Communication
- Personal Protective Equipment
- Chemical Fume Hood usage
- Physical Hazards
- Biological Safety
- Fire Safety

The audit process is performed utilizing an online checklist system that generates reports automatically. These reports are sent electronically to each responsible party immediately upon completion of the audit. The report summarizes the unacceptable issues identified during the audit. Corrective actions and importance levels are included in the report to assist each responsible party in addressing the issue. The importance levels are listed from one (1) to five (5) with five (5) being the highest priority item. The corrective actions for priority five (5) items must be completed within thirty (30) days. All other importance levels must be completed within ninety (90) days.

The automated system will send an electronic follow up email for all unacceptable issues to each responsible party. All responsible parties with priority five (5) issues will receive a follow up message thirty (30) days from the initial audit date. All responsible parties with priory less than five (5) will receive a follow up message ninety (90) days from the initial audit date.

The automated system tracks repeat issues in each audit. The Department of Environmental Health and Safety will contact the responsible party if repeat issues are identified in the laboratory. A request for a meeting will be sent to discuss corrective actions and training. The Department of Environmental Health and Safety shall perform the following response action for repeat issues:

Number of Repeats per Issue	Response Action
1	Meeting request with laboratory PI
2	Meeting request with Department Chair or Head
3	Meeting request with Dean

The Department of Environmental Health and Safety will assist lab personnel in any way possible in maintaining laboraotry compliance.

P. DOCUMENTS OF REFERENCE

The following documents were used for reference purposes. Copies of these documents are available in the Department of Environmental Health and Safety.

1. Federal Register - Part II, Department of Labor, Occupational Safety and Health Administration 29 CFR Part 1910. "Occupational Exposures to Hazardous Chemicals in Laboratories"; Final Rule.
2. Furr, A. K.(2000).*CRC Handbook of Laboratory Safety*.5th ed.United States:CRC Press LLC.
3. National Research Council.(2000).Prudent *Practices in the Laboratory – Handling and Disposal of Chemicals*.3rd ed.United States:National Academy Press.
4. American Chemical Society.(1995).*Safety in Academic Chemistry Laboratories*.6th ed.United States:American Chemical Society.

APPENDICES

APPENDIX I

APPENDIX I

Personal Decontamination Procedures

If injured or contaminated with a hazardous substance these procedures will be implemented **immediately** prior to cleaning up or reporting spill.

- For spills contacting the of skin, follow these procedures:

1. Immediately flush with flowing water for no less than 15 minutes (i.e. sink or safety shower).
2. If there is no visible burn, wash with warm water and soap, removing any jewelry to facilitate clearing of any residual material.
3. Check the material safety data sheet to see if any delayed effects should be expected. If the MSDS is not available contact Department of Environmental Health and Safety immediately.
4. Seek medical attention for even minor chemical burns.
5. Do not use creams, lotions, or salves.

- For spills on clothing, follow these procedures:

1. Do not attempt to wipe the clothes.
2. Quickly remove all contaminated clothing, shoes, and jewelry while using the safety shower.
3. Seconds count, so do not waste time because of modesty
4. Take care not to spread the chemical on the skin or, especially, in the eyes.
5. Use caution when removing pullover shirts or sweaters to prevent contamination of the eyes; it may be better to cut the garments off.
6. Immediately flood the affected body area with warm water for no less than 15 minutes. Resume if pain returns.
7. Get medical attention as soon as possible. Discard contaminated clothes as hazardous waste or have them laundered separately from other clothing.

- For splashes into the eye, take these steps:

1. Using the eyewash immediately flush for at least 15 minutes.
2. Hold the eyelids away from the eyeball, and move the eye up and down and sideways to wash thoroughly behind the eyelids.
3. Get medical attention immediately. Follow first aid by prompt treatment by a member of a medical staff or an ophthalmologist who is acquainted with chemical injuries.

APPENDIX II

Appendix II - A

P-LIST	ACUTELY HAZARDOUS MATERIALS
Hazardous	TOXIC CHEMICALS
Waste No.	Substance
P023	Acetaldehyde, chloro
P002	Acetamide, N-(aminothioxomethyl)
P057	Acetamide, 2-fluoro
P058	Acetic acid, fluoro-, sodium salt
P002	1-Acetyl-2-thiourea
P003	Acrolein
P070	Aldicarb
P203	Aldicarb sulfone.
P004	Aldrin
P005	Allyl alcohol
P006	Aluminum phosphide (R,T)
P007	5-(Aminomethyl)-3-isoxazolol
P008	4-Aminopyridine
P009	Ammonium picrate (R)
P119	Ammonium vanadate
P099	Argentate(1-), bis(cyano-C)-, potassium
P010	Arsenic acid H3 As04
P012	Arsenic Oxide As2 O3
P011	Arsenic oxide As= OS
P011	Arsenic pentoxide
P012	Arsenic trioxide
P038	Arsine, diethyl
P036	Arsonous dichloride, phenyl
P054	Aziridine
P067	Aziridine, 2-methyl
P013	Barium cyanide
P024	Benzenamine, 4-chloro
P077	Benzenamine, 4-nitro
P028	Benzene, (chloromethyl)-
P042	1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-, (R)
P046	Benzeneethanamine, alpha,alpha-dimethyl
P014	Benzenethiol
P127	7-Benzofuranol, 2,3-dihydro-2,2-dimethyl-, methylcarbamate
P188	Benzoic acid, 2-hydroxy-, compd. with (3aS-cis)-1,2,3,3a,8,8a-hexahydro-1,3a,8-

	tdmethylpyrrolo[2,3
P001	2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-l-phenylbutyl)-, & salts, when present at concentrations
P028	Benzyl chloride
P015	Beryllium powder
P017	Bromoacetone
P018	Brocine
P045	2-Butanone, 3,3-dimethyl-l-(methylthio)-,
P021	Calcium cyanide
P021	Calcium cyanide Ca(CN):
P189	Carbamic acid, [(dibutylamino)- thio]methyl-, 2,3-dihydro-2,2-dimethyl- 7-benzofuranyl ester
P191	Carbamic acid, dimethyl-, 1-[(dimethyl-amino)carbonyl]- 5-methyl-lH-pyrazol-3-yl ester.
P192	Carbamic acid, dimethyl-, 3-methyl-l- (1-methylethyl)-1H- pyrazol-5-yl ester.
P190	Carbamic acid, methyl-, 3-methylphenyl ester.
P127	Carbofuran.
P022	Carbon disulfde
P095	Carbonic dichloride
P189	Carbosulfan.
P023	Chloroacetaldehyde
P024	p-Chloroaniline
P026	1-(o-Chlorophenyl)thiourea
P027	3-Chloropropionitrile
P029	Copper cyanide
P029	Copper cyanide Cu(CN)
P202	m-Cumenyl methylcarbamate.
P030	Cyanides (soluble cyanide salts), not otherwise specified
P031	Cyanogen
P033	Cyanogen chloride
P033	Cyanogen chloride (CN)CI
P034	2-Cyclohexyl-4,6-dinitrophenol
P016	Dichloromethyl ether
P036	Dichlorophenylarsine
P037	Dieldrin
P038	Diethylarsine
P041	Diethyl-p-nitrophenyl phosphate
P040	O,O-Diethyl O-pyrazinyl phosphorothioate
P043	Diisopropylfluorophosphate (DFP)
P004	1,4,5,8-Dimethanonaphthalene, 1,2,3.4,10,10-hexa- chloro-1,4,4a,5,8,8a; hexahydro-.

	(talpha,4alpha,4abeta,5alpha,8alpha,8abeta)
PO60	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexa-chloro-1,4,4a,5,8,8a-hexahydro-, (ialpha,4a]pha,4abeta,5beta,8beta.8abeta)
P037	2,7:3,6-Dimethanonaphth[2,3-b]oxirene, 3,4,5,6,9,9-hexachloro-la,2,2a,3,6,ea,7,7a-octahydro- (laalpha,2beta,2aalpha.3beta,6beta,6aalpha,7beta, 7aalpha)
P051	(laalpha,2beta,2abeta,3alpha,6alpha,6abeta,7beta, 7aalphay, & metabolites
P044	Dimethoate
P046	alpha, alpha-Dimethylphenethylamine
P191	Dimetilan.
P047	4,6-Dinitro-o-cresol, & salts
P048	2.4-Dinitrophenol
P020	Dinoseb
P085	Diphosphoramide, octamethyl
P711	Diphosphoric acid, tetraethyl ester
P039	Disulfoton
P049	Dithiobiuret
P785	1,3-Dithiolane-2carboxaldehyde, 2,4-dimethyl-, O- [(methylamino)-carbonyl]oxime.
P050	Endosulfan
PO88	Endothall
P051	Endrin
P051	Endrin, & metabolites
P042	Epinephrine
P031	Ethanedinitrile
P194	Ethanimidothioc acid, 2-(dimethylamino)-N-[[(methylamino) carbonyl]oxy]-2-oxo-, methyl ester.
P066	Ethanimidothioic acid,
P701	Ethyl cyanide
P054	Ethyleneimine
P097	Famphur
P056	Fluorine
P057	Fluoroacetamide
P058	Fluoroacetic acid, sodium salt
P798	Formetanate hydrochloride.
P197	Formparanate.
P065	Fulminic acid, mercury(2+) salt (R,T)
P059	Heptachlor
P062	Hexaethyltetraphosphate
P116	Hydrazinecarbothioamide

P068	Hydrazine, methyl
P063	Hydrocyanic acid
P063	Hydrogen cyanide
P096	Hydrogen phosphate
P060	Isodrin
P192	Isolan.
P202	3-Isopropylphenyl N-methylcarbamate.
P007	3(2H)-Isoxazolone, 5-(aminomethyl)
P196	Manganese, bis(dimethylcarbamodithioato-S,S')-,
P196	Manganese dimethyldithiocarbamate.
P092	Mercury, (acetato-0)phenyl
P065	Mercury fulminate (R,T)
P082	Methanamine, N-methyl-N-nitroso
P064	Methane, isocyanato
P016	Methane, oxybis[chloro
P712	Methane, tetranitro- (R)
P118	Methanethiol, trichloro
P798	Methanimidamide,
P197	N,N-dimethyl-N'-[2-methyl-4-[[(methylamino)carbonyl]oxy]phenyl]
P050	6,9-Methano-2.4,3-benzodioxathiepin, 6,7,8,9,10,10
P059	4,7-Methano-lH-indene, 1,4,5,6,7,8,8-heptachloro
P199	Melhiocarb.
P066	Methomyl
P068	Methyl hydrazine
P064	Methyl isocyanate
P069	2-Methyllactonitrile
P071	Methyl parathion
P790	Metolcarb.
P128	Mexacarbate.
P072	alpha-Naphthylthiourea
P073	Nickel carbonyl
P073	Nickel carbonyl Ni(CO)4, (T-4)
P074	Nickel cyanide
P074	Nickel cynide Ni(CN):
P075	Nicotine, & salts
P076	Nitric oxide
P077	p-Nitroaniline
P078	Nitrogen dioxide
P076	Nitrogen oxide NO
P078	Nitrogen oxide NO,
P081	Nitroglycerine (R)

P082	N-Nitrosodimethylamine
P084	N-Nitrosomethylvinylamine
P085	Octamethylpyrophosphoramide
P087	Osmium oxide 0$0,, (T-4)
P087	Osmium tetroxide
P088	7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
P794	Oxamyl.
P089	Parathion
P034	Phenol, 2-cyclohexyl-4,6-dinitro
P048	Phenol, 2,4-dinitro
P047	Phenol, 2-methyl-4,6-dinitro-, 8 salts
P020	Phenol, 2-(1-methylpropyl)-4,6-dinitro
P009	Phenol, 2,4,6-trinitro-, ammonium salt (R)
P128	Phenol, 4-(dimethylamino)-3,5-dimethyl-, methylcarbamate (ester).
P199	Phenol, (3,5-dimethyl-4-(methylthio)-, methylcarbamate
P202	Phenol, 3-(1-methylethyl)-, methyl carbonate.
P201	Phenol, 3-methyl-5-(1-methylethyl)-, methyl carbonate.
P092	Phenylmercury acetate
P093	Phenylthiourea
P094	Phorate
P095	Phosgene
P096	Phosphine
P041	Phosphoric acid, diethyl 4-nitrophenyl ester
P039	Phosphorodithioic acid, 0,0-diethyl
P094	Phosphorodithioic acid, 0,0-diethyl
P044	Phosphorodithioic acid, 0,0-dimethyl S-[2-(methylamino)-2-oxoethyl] ester
P043	Phosphorofluondic acid, bis(1-methylethyl) ester
P089	Phosphorothioic acid, 0,0-diethyl O-(4-nitrophenyl) ester
P040	Phosphorothioic acid, 0,0-diethyl O-pyrazinyl ester
P097	Phosphorothioic acid,O-[4-[(dimethylamino)sulfonyl]phenyl] 0,0.dimethyl ester
P071	Phosphorothioic acid, 0,0.-dimethyl 0.(4-nitrophenyl) ester
P204	Physostigmine.
P188	Physostigmine salicylate.
Pilo	Plumbane, tetraethyl
P098	Potassium cyanide
P098	Potassium cyanide K(CN)
P099	Potassium silver cyanide
P201	Promecarb
P070	Propanal, 2-methyl-2-(methylthio)-,O-[(methylamino)carbonyl]oxime
P203	Propanal, 2-methyl-2-(methyl-sulfonyl)-, O-[(methylamino)carbonyl]

	oxime.
P101	Propanenitrile
P027	Propanenitrile, 3-chloro
P069	Propanenitrile, 2-hydroxy-2-methyl
P081	1,2,3-Propanetdol, trinitrate (R)
P017	2-Propanone,1-bromo
P102	Propargyl alcohol
P003	2-Propenal
P005	2-Propen-l-of
P0671	2-Propylenimine
P102	2-Propyn-l-of
P008	4-Pyridinamine
P075	Pyridine, 3-(1-methyl-2-pyrrolidinyl)-, (S)-, 8 salts
P204	
P114	Selenious acid, dilhallium(1+) salt
P104	Silver cyanide
P104	Silver cyanide Ag(CN)
P105	Sodium azide
P106	Sodium cyanide
P106	Sodium cyanide Na(CN)
P108	Strychnidin-10-one, & salts
P018	Strychnidin-10-one, 2,3-dimethoxy
P108	Strychnine, & salts
P115	Sulfuric acid, dithallium(1+) salt
P109	Tetraethyldithiopyrophosphate
P110	Tetraethyl lead
P111	Tetraethyl pyrophosphate
P112	Tetranilromethane (R)
P062	Tetraphosphoric acid, hexaethyl ester
P113	Thallic oxide
P713	Thallium oxide Tlz O,
P114	Thallium(I) selenite
P115	Thallium(I) sulfate
P109	Thiodiphosphoric acid, tetraethyl ester
P045	Thiofanox
P049	Thioimidodicarbonic diamide [(H= N)C(S)1= NH
P014	Thiophenol
P116	Thiosemicarbazide
P026	Thiourea, (2-chlorophenyl)
P072	Thiourea, 1-naphthalenyl
P093	Thiourea, phenyl

P185	Tirpate.
P123	Toxaphene
P118	Trichloromethanethiol
P119	Vanadic acid, ammonium salt
P120	Vanadium oxide V_ OS
P120	Vanadium pentoxide
P084	Vinylamine, N-methyl-N-nitroso
P103	Selenourea
P001	Warfarin, & salts, when present at concentrations greater than 0.3
P205	Zinc, bis(dimethylcarbamodithioalo-S,S')-,
P121	Zinc cyanide
P121	Zinc cyanide Zn(CN)=
P122	Zinc phosphide Zn3 P2, when present at concentrations greater than 10% (R,T)
P205	Ziram
U007	Acrylamide
U135	Hydrogen sulfide
U135	Hydrogen sulfide H2S
U151	Mercury
U188	Phenol
See F027	2,4,5-T
U207	1,2,4,5-Tetrachlorobenzene
U208	1,1,1,2-Tetrachloroethane
U209	1,1,2,2-Tetrachloroethane
U210	Tetrachloroethylene
See F027	2,3,4,6-Tetrachlorophenol

Appendix II - B

U-LIST	HAZARDOUS MATERIALS
Hazardous	TOXIC CHEMICALS
Waste No.	Substance
U394	A2213.
U001	Acetaldehyde (I)
U034	Acetaldehyde, trichloro
U 187	Acetamide, N-(4-ethoxyphenyl)
U005	Acetamide, N-9H-fluoren-2-yl
U240	Acetic acid, (2,4-dichlorophenoxy)-, salts & esters
U112	Acetic acid ethyl ester (I)
U144	Acetic acid, lead(2+) salt
U214	Acetic acid, thallium(1+) salt
See F027	Acetic acid, (2,4,5-trichlorophenoxyr
U002	Acetone (I)
U003	Acetonitrile (I,T)
U004	Acetophenone
U005	2-Acetylaminofluorene
U006	Acetyl chloride (C,R,T)
U008	Acrylic acid (I)
U009	Acrylonitrile
U011	Amitrole
U012	Aniline (I,T)
U136	Arsinic acid, dimethyl
U014	Auramine
U015	Azaserine
U010	Azidno[2',3'=3,4]pyrrolo[1,2-a]indole-4,7-dione6-amino-8-[[(aminocarbo
U280	Barban.
U278	Bendiocarb.
U364	Bendiocarb phenol
U271	Benomyl.
U157	Benzfj]aceanlhrylene, 1,2-dihydro-3-methyl
U016	Benz[c]acridine
U017	Benzal chloride
U192	Benzamide, 3,5-dichloro-N-(i,t-dimethyl-2-propynyl)
U018	Benz[a]anthrocene
U094	Benz[a]anthracene, 7,12-dimethyl

U012	Benzenamine(I,T)
U014	Benzenamine, 4,4'-carbonimidoylbis[N,N-dimethyl
U049	Benzenamine, 4-chloro-2-methyl-, hydrochloride
U093	Benzenamine, N,N-dimethyl-4-(phenylazo)
U328	Benzenamine, 2-methyl
U353	Benzenamine, 4-methyl
U158	Benzenamine, 4,4'-methylenebis[2-chloro
U222	Benzenamine, 2-methyl-, hydrochloride
U181	Benzenamine, 2-methyl-5-nitro
U019	Benzene (I,T)
U038	Benzeneacetic acid, 4-chloro-alpha-(4-chlorophenyl)-alpha-hydroxy-, ethyl ester
U030	Benzene, 1-bromo-4-phenoxy
U035	Benzenebutanoic acid, 4-[bis(2-chloroethyl)amino]
U037	Benzene, chloro
U221	Benzenediamine, ar-methyl
U028	1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester
U069	1,2-Benzenedicarboxylic acid, dibutyl ester
U088	1,2Benzenedicarboxylic acid, diethyl ester
U102	1,2-Benzenedicarboxylic acid, dimethyl ester
U107	1,2-Benzenedicarboxylic acid, dioctyl ester
U070	Benzene, 1,2-dichloro
U071	Benzene, 1,3-dichloro
U072	Benzene, 1,4-dichloro
U060	Benzene, 1,1'-(2,2-dichloroethylidene)bis[4-chloro
U017	Benzene, (dichloromethyl)
U223	Benzene, 1,3-diisocyanatomethyl- (R,T)
U239	Benzene, dimethyl- (I,T)
U201	1,3-Benzenediol
U127	Benzene, hexachloro
U056	Benzene, hexahydro-(I)
U220	Benzene, methyl
U105	Benzene, 1-methyl-2,4-dinilro
U106	Benzene, 2-methyl-1,3-dinitro
U055	Benzene, (1-methylethyl)- (1)
U169	Benzene, nitro
U1B3	Benzene, pentachloro
U185	Benzene, pentachloronitro

U020	Benzenesulfonic acid chloride (C,R)
U020	Benzenesulfonyl chloride (C,R)
U207	Benzene, 1,2,4,5-tetrachloro
U061	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[4-chloro
U247	Benzene, 1,1'-(2,2,2-tdchloroethylidene)bis[4-methoxy
U023	Benzene, (trichloromethylr
U234	Benzene, 1,3,5-trinitro
U021	Benzidine
U202	1,2-Benzisothiazol-3(2H)-one, 1,1-dioxide, & salts
U278	1,3-Benzodioxol-4-ol, 2,2-dimethyl-, methyl carbamate.
U364	1,3-Benzodioxol-4-ol, 2,2-dimethyl-,
U203	1,3-Benzodioxole, 5-(2-propenyl)
U141	1,3-Benzodioxole, 5-(1-propenyl)
U367	7-Benzofuranol, 2,3-dihydro-2,2-dimethyl
U090	1,3-Benzodioxole, 5-propyl
U064	Benzo[rst]pentaphene
U248	2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-l-phenyl-butylr, & salts, wh
U022	Benzo[a]pyrene
U197	p-Benzoquinone
U023	Benzotrichloride (C,R,T)
U085	2,2'-Bioxirane
U021	[1,1'-Biphenyl]-4,4'-diamine
U073	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dichloro
U091	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethoxy
U095	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethyl-
U225	Bromoform
U030	4-BFomophenyl phenyl ether
U128	1,3-Butadiene, 1,1,2,3,4,4-hexachloro
U172	1-Butanamine, N-butyl-N-nilroso
U031	1-Butanol (I)
U159	2-Butanone (I,T)
U160	2-Butanone, peroxide (R,T)
U053	2-Butenal
U074	2-Butene, 1,4-dichloro- (I,T)
U143	2Butenoic acid, 2-methyl-, 7-[[2,3-dihydroxy2-(1-methoxyethylr3-methyl 2,3,5,7a-tetrahydro-lH-pyrrolizin-1-yl ester,
U031	n-Butyl alcohol (I)
U136	Cacodylic acid

U032	Calcium chromate
U372	Carbamic acid, 1H-benzimidazol-2-yl, methyl ester.
U271	Carbamic acid, [1[(butylamino)carbonyl]-1H-benzimidazol-2-yl]-, methyl ester.
U280	Carbamic acid, (3-chlorophenyl)-, 4-chloro-2-butynyl ester.
U238	Carbamic acid, ethyl ester
U178	Carbamic acid, methylnitroso-, ethyl ester
U373	Carbamic acid, phenyl-, 1-methylethyl ester
U409	Carbamic acid, [1,2-phenylenebis (iminocarbonothioyl)]bis-, dimethyl est
U097	Carbamic chloride, dimethyl
U389	Carbamothioic acid, bis(1-methylethyl)-, S-(2,3,3-trichloro-2-propenyl) ester
U387	Carbamothioic acid, dipropyl-, S-(phenylmethyl) ester
U114	Carbamodithioic acid, 1,2-ethanediylbis-,
U062	Carbamothioic acid, bis(1-methylethyl)-, S-(2,3-dichloro-2-propenyl) este
U279	Carbaryl
U372	Carbendazim
U367	Carbofuran phenol
U215	Carbonic acid, dithallium(1+) salt
U033	Carbonic difluoride
U156	Carbonochloridic acid, methyl ester (I,T)
U033	Carbon oxyfluodde (R,T)
U211	Carbon tetrachloride
U034	Chloral
U035	Chlorambucil
U036	Chlordane, alpha & gamma isomers
U026	Chlornaphazin
U037	Chlorobenzene
U038	Chlorobenzilate
U039	p-Chloro-m-cresol
U042	2-Chloroethyl vinyl ether
U044	Chloroform
U046	Chloromethyl methyl ether
U047	beta-Chloronaphthalene
U048	o-Chlorophenol
U049	4-Chloro-o-toluidine, hydrochloride
U032	Chromic acid H2 Cr04, calcium salt
U050	Chrysene
U051 ..	Creosote

U052	Cresol (Cresylic acid)
U053	Crotonaldehyde
U055	Cumene (I)
U246	Cyanogen bromide (CN)Br
U197	2,5-Cyclohexadiene-1,4dione
U056	Cyclohexane (I)
U129	Cyclohexane, 1,2,3,4,5,6-hexachloro-,
U057	Cyclohexanone (I)
U130	1,3-Cyclopentadiene,1,2,3,3,5,5-hexachloro-
U058	Cyclophosphamide
U240	2,4-D, salts & esters
U059	Daunomycin
U060	DDD
U061	DDT
U062	Diallate
U063	Dibenz[a,h]anthracene
U064	Dibenzo[a,i]pyrene
U066	1,2-Dibromo-3-chloropropane
U069	Dibutyl phthalate
U070	o-Dichlorobenzene
U071	m-Dichlorobenzene
U072	p-Dichlorobenzene
U073	3,3'-Dichlorobenzidine
U074	1,4-Dichloro-2-butene (I,T)
u075	Dichlorodifluoromethane
U078	1,1-Dichloroethylene
u079	1,2-Dichloroethylene
U025	Dichloroethyl ether
U027	Dichloroisopropyl ether
U024	Dichloromethoxy ethane
U081	2,4-Dichlorophenol
U082	2,6-Dichlorophenol
U084	1,3-Dichloropropene
U085	1,2:3,4-Diepoxybutane (I,T)
U108	1,4-Diethyleneoxide
U028	Diethylhexyl phthalate
U395	Diethylene glycol, dicarbamate.
U086	N,N'-Diethylhydrazine

U087	O,O-Diethyl S-methyl dithiophosphate
U088	Diethyl phthalate
U089	Diethylstilbesterol
U090	Dihydrosafrole
U091	3,3'-Dimethoxybenzidine
U092	Dimethylamine (I)
U093	p-Dimethylaminoazobenzene
U094	7,12-Dimethylbenz[a]anthracen
U095	3,3'-Dimethylbenzidine
U096	alpha,alpha-Dimethylbenzylhydroperoxide (R)
U097	Dimethylcarbamoyl chloride
U098	1,1-Dimethylhydrazine
U099	1,2-Dimethylhydrazine
U101	2,4-Dimethylphenol
U102	Dimethyl phthalate
U103	Dimethyl sulfate
U105	2,4-Dinitrotoluene
U106	2,6-Dinitrotoluene
U107	Di-n-octyl phthalate
U108	1,4-Dioxane
U109	1,2-Diphenylhydrazine
U110	Dipropylamine (I)
U111	Di-n-propylnitrosamine
U041	Epichlorohydrin
U001	Ethanal (1)
U404	Ethanamine, N,N-diethyl
U174	Ethanamine, N-ethyl-N-nitroso-
U155	1,2-Ethanediamine, N,N-dimethyl-N'-2-pyridinyl-N'-(2-thienylmethyl)
U067	Ethane, 1,2-dibromo-
U076	Ethane, 1,1-dichloro
U077	Ethane, 1,2-dichloro
U131	Ethane, hexachloro
U024	Ethane, 1,1'-[methylenebis(oxy)]bis[2-chloro
U117	Ethane, 1,1'-oxybis-(I)
U025	Ethane, 1,1'-oxybis[2-chloro
U184	Ethane, pentachloro
U208	Ethane, 1,1,1,2-tetrachloro
U209	Ethane, 1,1,2,2-tetrachloro

U218	Ethanethioamide
U226	Ethane, 1,1,1-trichloro
U227	Ethane, 1,1,2-trichloro-
U410	Ethanimidolhioic acid, N,N' [thiobis[(methylimino)carbonyloxy]]bis-, dimethyl ester
U394	Ethanimidothioic acid, 2-(dimelhylamino)-N-hydroxy-2-oxo-, methyl ester.
U359	Ethanol, 2-ethoxy
U173	Ethanol, 2,2'-(nilrosoimino)bis
U395	Ethanol, 2,2'-oxybis-, dicarbamate.
U004	Ethanone, 1-phenyl
U043	Ethene, chloro
U042	Ethane, (2-chloroethoxyr
U078	Ethene, 1,1-dichloro
U079	Ethene, 1,2-dichloro-, (E)
U210	Ethene, tetrachloro
U228	Ethane, trichloro
U112	Ethyl acetate (1)
U113	Ethyl acrylate (I)
U238	Ethyl carbamate (urethane)
U117	Ethyl ether (I)
U114	Ethylenebisdithiorarbamic acid, salts 8 esters
U067	Ethylene dibromide
U077	Ethylene dichloride
U359	Ethylene glycol monoethyl ether
U115	Ethylene oxide (I,T)
U116	Ethylenethiourea
U076	Ethylidene dichloride
U118	Ethyl methacrylate
U119	Ethyl methanesulfonate
U120	Fluoranthene
U122	Formaldehyde
U123	Formic acid (C,T)
U124	Furan (I)
U125	2-Furancarboxaldehyde (I)
U147	2,5-Furandione
U213	Furan, tetrahydro-(I)
U125	Furfural (I)
U124	Furfuran (I)

U206	Glucopyranose, 2-deoxy-2-(3-methyl-3-nitrosoureido)-, D
U206	D-Glucose, 2-deoxy-2-[[(methyinitrosoamino)
U126	Glycidylaldehyde
U163	Guanidine, N-methyl-N'-nitro-N-nilroso
U127	Hexachlorobenzene
U128	Hexachlorobutadiene
U130	Hexachlorocyclopentadiene
U131	Hexachloroethane
U132	Hexachlorophene
U243	Hexachloropropene
U133	Hydrazine (R,T)
U086	Hydrazine,1,2-diethyl-
U098	Hydrazine, 1,1-dimelhyl
U099	Hydrazine, 1,2-dimethyl
U109	Hydrazine, 1,2-diphenyl
U134	Hydrofluoric acid (C,T)
U134	Hydrogen fluoride (C,T)
U096	Hydroperoxide, 1-methyl-l-phenylethyl- (R)
U116	2-Imidazolidinethione
U137	Indeno[1,2,3-cd]pyrene
U190	1,3-Isobenzofurandione
U140	Isobutyl alcohol (I,T)
U141	Isosafrole
U142	Kepone
U143	Lasiocarpine
U144	Lead acetate
U146	Lead, bis(acetato-0)tetrahydroxytri
U145	Lead phosphate
U146	Lead subacetate
U129	Lindane
U163	MNNG
U147	Maleic anhydride
U148	Maleic hydrazide
U149	Malononitrde/
U150	Melphalan /
U152	Methacrylonitrile (I, T)
U092	Methanamine, N-methyl- (1)
U029	Methane, bromo

U045	Methane, chloro- (I, T)
U046	Methane, chloromethoxy-
U068	Methane, dibromo
U080	Methane, dichloro
U075	Methane, dichlorodifluoro
U138	Methane, iodo
U119	Methanesulfonic acid, ethyl ester
U211	Methane, telrachloro
U153	Methanethiol (I, T)
U225	Methane, tribromo
U044	Methane, trichloro
U121	Methane, trichlorofluoro-
U036	4,7-Methano-lH-indene, 1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7-ahexahydro
U154	Methanol (I)
U155	Methapyrilene
U142	1,3,4-Metheno-2H-cyclobuta[cd]pentalen-2-one, 1,ta,3,3a,4,5,5,5a,5b,6-decachlorooctahydro
U247	Methoxychlor
U154	Methyl alcohol (1)
U029	Methyl bromide
U186	1-Methylbutadiene (I)
U045	Methyl chloride (I,T)
U156	Methyl chlorocarbonate (I,T)
U226	Methyl chloroform
U157	3-Methylcholanthrene
U158	4,4'-Methylenebis(2-chloroaniline)
U068	Methylene bromide
U080	Methylene chloride
U159	Methyl ethyl ketone (MEK) (I,T)
U160	Methyl ethyl ketone peroxide (R,T)
U138	Methyl iodide
U161	Methyl isobutyl ketone (1)
U162	Methyl methacrylate (I,T)
U161	4-Methyl-2-pentanone (I)
U164	Methylthiouracil
U010	Mitomycin C
U059	5,12-Naphthacenedione, 8-acetyl-10-[(3-amino-2,3,6-tddeoxy)-alpha-L-lyxo-hexopyranosyl)oxy]
U167	1-Naphthalenamine

U168	2-Naphthalenamine
U026	Naphthalenamine, N,N'-bis(2-chloroethyl)
U165	Naphthalene
U047	Naphthalene, 2-chloro
U166	1,4-Naphthalenedione
U236	2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'
U279	1-Naphthalenol, methylcarbamate.
U166	1,4-Naphthoquinone
U167	alpha-Naphthylamine
U168	beta-Naphthylamine
U217	Nitric acid, thallium(1+) salt
U169	Nitrobenzene (I,T)
U170	p-Nitrophenol
U171	2-Nitropropane (I,T)
U172	N-Nitrosodi-n-butylamine
U173	N-Nitrosodiethanolamine
U174	N-Nitrosodiethylamine
U176	N-Nitroso-N-ethylurea
U177	N-Nilroso-N-methylurea
U178	N-Nitroso-N-methylurethane
U179	N-Nitrosopiperidine
U180	N-Nilrosopymolidine
U181	5-Nitro-o-toluidine
U193	1,2-Oxathiolane, 2,2-dioxide
U058	2H-1,3,2-Oxazaphosphorin-2-amine,N,N-bis(2-chloroethyl)tetrahydro-, 2-oxide
U115	Oxirane (I,T)
U126	Oxiranecarboxyaldehyde
U041	Oxirane, (chloromethyl)
U212	Paraldehyde
U183	Pentachlorobenzene
U184	Pentachloroethane
U185	Pentachloronitrobenzene (PCNB)
See F027	Pentachlorophenol
U161	Pentanol, 4-methyl
U186	1,3-Pentads ne (I)
U187	Phenace6
U048	Phenol, 2-chloro
U039	Phenol, 4-chloro-3-methyl

U081	Phenol, 2,4-dichloro
U082	Phenol, 2,6-dichloro
U089	Phenol, 4,4'-(1,2-diethyl-1,2-ethenediyl)bis-, (E)
U101	Phenol, 2,4-dimethyl
U052	Phenol, methyl
U132	Phenol, 2,2'-methylenebis[3,4,6-trichloro
U411	Phenol, 2-(1-methylethoxy)-, methylcarbamate.
U170	Phenol, 4-nitro-
See F027	Phenol, pentachloro
See F027	Phenol, 2,3,4,6-tetrachloro
See F027	Phenol, 2,4,5-trichloro
U150	L-Phenylalanine, 4-[bis(2-chloroethyl)amino]
U145	Phosphoric acid, lead(2+) salt (2:3)
U087	Phosphorodithioic acid, 0,0-diethyl S-methyl ester
U189	Phosphorus sulfide (R)
U190	Phthalic anhydride
U191	2-Picoline
U179	Piperidine, 1-nitroso
U192	Pronamide
U194	1-Propanamine (I,T)
U111	1-Propanamine, N-nitroso-N-propyl
U110	1-Propanamine, N-propyl- (I)
U066	Propane, 1,2-dibromo-3-chloro
U083	Propane, 1,2-dichloro
U149	Propanedinitrile
U171	Propane, 2-nitro- (I,T)
U027	Propane, 2,2'-oxybis[2-chloro
U193	1,3-Propane sultone
See F027	Propanoic acid, 2-(2,4,5-trichlorophenoxy)
U235	1-Propanol, 2,3-dibromo-, phosphate (3:1)
U140	1-Propanol, 2-methyl- (I,T)
U002	2-Propanone (I)
U007	2-Propenamide
u084	1-Propene, 1,3-dichloro
U243	1-Propene, 1,1,2,3,3,3-hexachloro
U009	2-Propenenitrile
U152	2-Propenenithle, 2-methyl- (I,T)

U008	2-Propenoic acid (I)
U113	2-Propenoic acid, ethyl ester (I)
U118	2-Propenoic acid, 2-methyl-, ethyl ester
U162	2-Propenoic acid, 2-methyl-, methyl ester (I,T)
U373	Propham.
U411	Propoxur.
U387	Prosulfocarb.
U194	n-Propylamine (I,T)
U083	Propylene dichloride
U148	3,6-Pyridazinedione, 1,2-dihydro-
U196	Pyridine
U191	Pyridine, 2-methyl
U237	2,4-(1H,3H)-Pyhmidinedione, 5-[bis(2chloroethyl)amino]-
U164	4(1H)-Pyrimidinone, 2,3-dihydro-6-methyl-2-thioxo-
U180	Pyrrolidine, 1-nitroso-
U200	Reserpine
U201	Resorcinol
U202	Saccharin, & salts
U203	Safrole
U204	Selenious acid
U204	Selenium dioxide
U205	Selenium sulfide
U205	Selenium sulfide $eS2 (R,T)
U015	L-Serine, diazoacetate (ester)
See F027	Silvex (2,4,5-TP)
U206	Streptozolocin
U103	Sulfuric acid, dimethyl ester
U213	Tetrahydrofuran (I)
U214	Thallium(I) acetate
U215	Thallium(I) carbonate
U216	Thallium(I) chloride
U216	Thallium chloride Tlcl
U217	Thallium(I) nitrate
U218	Thioacetamide
U410	Thiodicarb.
U153	Thiomethanol (I,T)
U244	Thioperoxydicarbonic diamide [(H: N)C(S)]z S2, tetramethyl

U409	Thiophanate-methyl.
U219	Thiourea
U244	Thiram
U220	Toluene
U221	Toluenediamine
U223	Toluene diisocyanate (R,T)
U328	o-Toluidine
U353	p-Toluidine
U222	o-Toluidine hydrochloride
U389	Triallate.
U011	1 H-1,2,4-Triazol-3-amine
U408	2,4,6-Tribromophenol.
U227	1,1,2-Trichloroethane
U228	Trichloroethylene
U121	Trichloromonofluoromethane
See F027	2,4,SThchlorophenol
See F027	2,4,6-Thchlorophenol
U404	Triethylamine.
U234	1,3,5-Thnitrobenzene (R,T)
U182	1,3,5-Trioxane, 2,4,6-trimethyl
U235	Tris(2,3-dibromopropyl) phosphate
U236	Trypan blue
U237	Uracil mustard
U176	Urea, N-ethyl-N-nitroso
U177	Urea, N-methyl-N-nitroso
U043	Vinyl chloride
U248	Warfarin, & salts, when present at concentrations of 0.3% or less
U239	Xylene (1)
U200	Yohimban-16-carboxylic acid, 11,17-dimethoxy-18-[(3,4,5-t6methoxybenzoyl)oxy]-, methyl ester,
U249	Zinc phosphide Zn, P=, when present at concentrations of 10 % or less

Appendix II - C

Highly hazardous chemicals, toxics, reactives; Highly flammable chemicals (NFPA #4); peroxidizable; and shock sensitive substances

Highly Hazardous Chemicals - Toxics and Reactives

Acetaldehyde
Acrolein (2-propenal
Acrylyl Chloride
Allyl Chloride
Allylamine
Alkylaluminums
Ammonia, Anhydrous
Ammonia, solutions > 44% by weight
Ammonium Perchlorate
Ammonium Permanganate
Arsine (Arsenic Hydride)
Bis (Chloromethyl) Ether
Boron Trichloride
Bromine
Chlorodiethylaluminum (Diethylaluminum Chloride)
1-Chloro-2,4-Dinitrobenzene
Chloromethyl Methyl Ether
Chloropicrin
Chloropicrin and Methyl Bromide Mixture
Chloropicrin and Methyl Chloride Mixture
Commune Hydroperoxide
Cyanogen
Cyanogen Chloride
Cyanuric Flouride
Diacetyl Peroxide (>70%)
Diazomethane
Dibenzoyl Peroxide
Diborane
Dibutyl Peroxide
Bromine Chloride
Bromine Pentaflouride
Bromine Triflouride
3-Bromopropyne (Propargyl Bromide)
Butyl Hydroperoxide (tert.) Butyl Perbenzoate (tert.)
Carbonyl Chloride
Carbonyl Flouride
Cellulose Nitrate (>12.6% nitrogen)
Ethylamine
Ethylene Flourohydrin
Ethylene Oxide
Ethyleneimine
Flourine
Formaldehyde (Formalin)
Furan
Hexaflouroacetone
Hydrochloric Acid (anhydrous)
Hydroflouric Acid (anhydrous)
Hydrogen Bromide
Hydrogen Chloride
Hydrogen Cyanide(anhydrous)
Hydrogen Flouride
Dichloro Acetylene
Dichlorosilane
Diethylzinc
Diisopropyl Peroxydicarbonate
Dilauroyl Peroxide
Dimethyldichlorosilane
Dimethylhydrazine, 1,1
Dimethylamine (anhydrous)
2,4-Dinitroaniline
Ethyl Methyl Ketone Peroxide
Methyl Ethyl Ketone
Peroxide (>60%)
Methyl Flouroacetate
Methyl Flourosulfate
Methyl Hydrazine
Methyl iodide
Methyl Isocyanate
Methyl Mercaptan
Methyl Vinyl Ketone
Methyltrichlorosilane
Nickel Carbonyl (Nickel Tetracarbonyl)
Nitric Acid (> 94.5% by weight)
Nitric Oxide

Chlorine
Chlorine Dioxide
Chlorine Pentaflouride
Chlorine Triflouride
Ethyl Nitrite
Hydrogen Sulfide
Hydroxylamine
Iron, Pentacarbonyl
Isopropylamine
Ketene
Methacrylaldehyde
Methacryloyl Chloride
Methacryloylxyethyl Isocyanate
Methyl Acrylonitrile
Methylamine (anhydrous)
Methyl Bromide
Methyl Chloride
Methyl Chloroformate
Perchloryl Flouride
Peroxyacetic Acid (>60% Acetic Acid)
Phosgene (Carbonyl Chloride)
Phosphine (Hydrogen Phosphide)
Phosphorus Oxychloride (Phosphoryl Chloride)
Phosphorus Trichloride
Phosphoryl Chloride
Propargyl Bromide
Propyl Nitrate
Sarin
Selenium Hexaflouride
Nitorgen Oxides (NO;NO(2);N2o4;N2o3)
Nitrogen Tetroxide (Nitrogen Peroxide)
Nitroaniline (para Nitroaniline)
Nitromethane
Nitogen Dioxide
Hydrogen Peroxide
Hydrogen Selenide
Nitrogen Trioxide
Oleum (65-80% by weight) (Fuming Sulfuric Acid)
Osmium Tetroxide
Oxygen Diflouride (Flourine Monoxide)
Ozone
Pentaborane
Peracetic Acid (>60% Acetic Acid) (Peroxyacetic Acid)
Perchloric Acid (>60% by wieght)
Perchloromethyl Mercaptan
Stibine (Antimony Hydride)
Sulfur Dioxide (liquid)
Sulfur Pentaflouride
Sulfur Tetraflouride
Sulfur Trioxide (Sulfuric Anhydride)
Tellurium Hexaflouride
Tetraflouroethylene
Tetraflourohydrazine
Tetramethyl Lead
Thionyl Chloride
Trichloro (chloromethyl) Silane
Trichloro (dichlorophenyl) Silane
Trichlorosilane
Triflourochloroethylene
Trimethyoxysilane

Highly Flammable Materials (NFPA #4)

Acetaldehyde
Acetylene
Butane
1-Butene
Calcium Carbide
Carbon Monoxide
Chlorine Monoxide
Cyanogen
Cyclobutane
Cylcopropane
Dueterium
Dibenzoyl Peroxide
Dibromane
1,1-Dichloroethene
Dichlorosilane
Dimethylamine
Dimethyl Sulfide
Ethane
Ethylamine
Ethyl Chloride
Ehtylene
Ethylene Oxide
Ethyl Ether
Propane
Propylene
Furan
Gas, Natural
Hydrocyanic Acid (96%)
Hydrogen
Hydrogen Sulfide
Isobutane
Isopentane
Isoprene
Isopropyl Chloride
Lithium Hydride
Methane
Methelamine
Methyl Chloride
Methyl Ether
Methyl Ethyl Ether
Methyl Formate
Methyl Mercaptan
Pentane
1-Pentane
Petroleum Ether
Phosphine
Picric Acid
Trinitrotoluene (TNT)
Vinyl Chloride
Propylene Oxide
Propyl Nitrate
Silane
Tetraflouroethylene
Trichlorosilane
Trimethylamine
Vinyl Ethyl Ether
Vinyl Flouride
Vinylidene Chloride
Vinylidene Flouride
Vinyl Methyl Ether

Peroxidizable

Acetal
Cumene
Cyclohexane
Cyclooctene
Decahydronaphthalene
Decalin
Diacetylene
Dicyclopentadiene
Diethyl Ether
Divinyl Acetylene
Ethyl Ether
Ethylene Glycol Dimethyl Ether (glyme)
Methyl Acetylene
Tetrahydrofuran
Tetrahydronaphthalene (tetralin)
Vinyl Acetate
Vinyl Ethers
Vinylidene Chloride

Shock Sensitive Materials

Acetylides
Aluminum Ophorite Explosive
Amatol
Ammonal
Ammonium Nitrate
Ammonium Perchlorate
Ammonium pPicrate
Ammonium salt lattice
Butyl Tetryl
Calcium Nitrate
Copper Acetylide
Dinitrophenyl Hydrazine
Dinitrotoluene
Dipicryl Sulfone
Dipicrylamine
Erythritol Tetranitrate
Fulminate of Silver
Fulminate of Gold
Fulminating Mercury
Fulminating Platinum
Gelatinized Nitrocellulose
Cyanuric Triazide
Cylcotrimethylenetrinitramine
Dinitroethyleneurea
Dinitroglycerine
Dinitrophenol
Dinitrophenolates
Hexanite
Hexanitrodiphenylamine
Hexanitrostilbene
Hexogen
Hydrazine Mixtures
Hydrazinium Nitrate
Hydrazoic Acid
Lead Azide
Lead Mannite
Lead Mononitroresorcinate
Lead Picrate
Lead Salts
Lead Styphnate
Magnesium Ophorite
Mannitol Hexanitrate
Mercury Oxalate
Mercury Tartrate
Nitrated Polyhydric Alcohol
Nitrogen Trichloride
Nitrogen Tri-Iodide
Nitroglycerin
Nitroglyceride
Nitroglycol
Nitroguanidine
Nitroparaffins
Nitronium Perchlorate
Nitrotoluene
Nitrourea
Guanyl Nitrosamino Guanyltetrazene
Guanyl Nitrosamino Guanylidene
Guanylidene
Heavy Metal Azides
Organic Amine Nitrates
Organic Nitramines
Organic Peroxides (t-Butyl Peroxide)
Picramic Acid
Picramide
Picric Acid
Picryl Chloride
Picryl Flouride
Polynitro Aliphatic Compounds
Potassium Nitroaminotetrazole
Silver Acetylide
Silver Azide
Silver Styphnate
Silver Tetrazene
Sodatol
Sodium Amatol
Sodium Dinitro-ortho-cresolate
Sodium/Potassium Nitrate explo. mix
Sodium Picramate
Syphnic Acid
Tetrazene
Tetranitrocarbazole
Tetrytol
Trinnitroanisole
Trinitrobenzene
Trimonite
Trinitronaphthalene
Trinitrophenetol
Tritonal

Nitrated Carbohydrate
Nitrated Glucoside
Urea Nitrate
TrinitroToluene (TNT)

Reporoductive Hazards, Teratogenic and Mutagenic Chemcials and Drugs

Acetohydroxamic acid
Actinomycin D
All-trans retinoic acid
Alprazolam
Amikacin sulfate
Aminoglutethimide
Aminoglycosides
Aminopterin
Androgenic Hormones
Angiotensin converting enzyme (ACE) inhibitors
Anisindione
Aspirin

Azathioprine
Barbiturates
Benomyl
Benzene
Benzphetamine hydrochloride
Benzodiazepines
Bischloroethyl nitrosourea (BCNU) (Carmustine)
Bromoxynil
Busulfan
Butabarbital sodium
1,4-Butanediol dimethylsulfonate (Busulfan)
Calcium Arsenate
Carbon disulfide
Carbon monoxide
Carboplatin
Chenodiol
Chlorcyclizine hydrochloride
Chlorambucil
Chlorobiphenyls
Chlordecone (Kepone)
Chlordiazepoxide
Chlordiazepoxide hydrochloride

1-(2-Chloroethyl)-3-cyclohexyl-l-nitrosourea (CCNU) Lomustine)
Cladribine
Clomiphene citrate
Clorazepate dipotassium
Cocaine
Colchicine

Cyhexatin
Cytarabine
Danazol
Daunorubicin hydrochloride
Demeclocycline hydrochloride (internal u
Diazepam
Dicumarol
Diethylstilbestrol (DES)
Dimethylmercury
Ditnitrogen pentoxide
Dinocap
Dinoseb
Diphenylhydantoin (Phenytoin)
Doxycycline (internal use)
Doxycycline calcium (internal use)
Doxycycline hyclate (internal use)
Doxycycline monohydrate (internal use)
Ergotamine tartrate
Ethidium Bromide
Ethyl alcohol in alcoholic beverages
Ethylene glycol monoethyl ether
Ethylene glycol monomethyl ether
Ethylene glycol monoethyl ether acetate
Ethylene glycol monomethyl ether acetat
Ethylene thiourea
Etoposide
Etretinate
Fluorouracil
Fluoxymesterone
Flurazepam hydrochloride
Flutamide
Halazepam
Halothane
Hexachlorobenzene
Ifosfamide

Isotretinoin
Lead
Lithium
Lithium carbonate
Lithium citrate

Conjugated estrogens
Coumarin Anticoagulants
Cyanazine
Cycloheximide
Cyclophosphamide (anhydrous)
Cyclophosphamide (hydrated)
Mercaptopurine
Mercury and mercury compounds
Methacycline hydrochloride
Methimazole
Methotrexate
Methotrexate sodium
Methylaminopterin
Methyl bromide as a structural fumigant
Methyl mercury
Methyltestosterone
Midazolam hydrochloride
Minocycline hydrochloride (internal use)
Misoprostol
Mitoxantrone hydrochloride
Nafarelin acetate
Neomycin sulfate (internal use)
Netilmicin sulfate
Nickel carbonyl
Nicotine
Nitrogen mustard (Mechlorethamine)
Nitrogen mustard hydrochloride (Mechlorethamine - hydrochloride)
Norethisterone (Norethindrone)
Norethisterone acetate (Norethindrone acetate)
Norethisterone (Norethindrone)/Ethinyl estradiol
Norethisterone (Norethindrone)/Mestranol
Norgestrel
Oxazepam
Oxytetracycline (internal use)
Oxytetracycline hydrochloride (internal use)
Paramethadione
Penicillamine
Pentobarbital sodium
Pentostatin
Phenacemide
Phenprocoumon
Pipobroman
Plicamycin
Lorazepam
Lovastatin
Medroxyprogesterone acetate
Megestrol acetate
Melphalan
Menotropins
Meprobamate
Polybrominated biphenyls
Polychlorinated biphenyls
Procarbazine hydrochloride
Propylthiouracil
Retinol/retinyl esters
When in daily dosages in excess of 10,000 IU 3,000 retinol equivalents. (NOTE: Retinol/retir esters are required and essential for maintena normal reproductive function. The recommend daily level during pregnancy is 8,000 IU.)
13-cis-retinoic acid
Ribavirin
Secobarbital sodium
Streptomycin sulfate
Tamoxifen citrate
Temazepam
Teniposide
Testosterone cypionate
Testosterone enanthate
2,3,7,8-Tetrachlorodibenzo-para-dioxin (TCDD
Tetracyclines (internal use)
Tetracycline (internal use)
Tetracycline hydrochloride (internal use)
Thalidomide
Thioguanine
Tobacco smoke (primary)
Tobramycin sulfate
Toluene
Triazolam
Trilostane
Trimethadione
Uracil mustard
Urethane
Urofollitropin
Valproate (Valproic acid)
Vinblastine sulfate
Vincristine sulfate
Warfarin

Reproductive Hazards - Infectious Agents

Cytomegavirus
Herpes Virus Hominis
Parvovirus B-19
Rubella Virus
Syphilis
Toxoplasmosis
Venezuelan Equine
Encephalitis Virus

Female reproductive toxicity

Aminopterin
Anabolic steroids
Aspirin
Carbon disulfide
Cocaine
Cyclophosphamide (anhydrous)
Cyclophosphamide (hydrated)
Ethylene oxide
Lead
Tobacco smoke (primary)
Uracil mustard

Male reproductive toxicity

Anabolic steroids
Benomyl
Carbon disulfide
Colchicine
Cyclophosphamide (anhydrous)
Cyclophosphamide (hydrated)
1,2-Dibromo-3-chloropropane (DBCP)
m-Dinitrobenzene
o-Dinitrobenzene
p-Dinitrobenzene
Dinoseb
Epichlorohydrin
Ethylene glycol monoethyl ether
Ethylene glycol monomethyl ether
Ethylene glycol monoethyl ether acetate
Ethylene glycol monomethyl ether acetate
Hexamethylphosphoramide
Lead
Nitrofurantoin
Tobacco smoke (primary)
Uracil mustard

Potential Teratogenic Agents Currently Under Investigation

Acetone
Acetonitrile
Acrylamide
Arsine
Bendectin
Bisphenol A
Bromoacetonitrile
Bromochloroacetic Acid
Butyl Benzyl Phthalate
d-Camphor
Carbon Disulfide
Chlordibromomethane
Chlorpromazine Hydrochloride
Codeine
Dibromoacetonitrile
Diethyl Phthalate
Diethylene Glycol
Diethylene Glycol Diethyl Ether
Diethylene Glycol Dimethyl Ether
Dimethyl Phthalate
Diphenyhydramine Hydrochloride
Dipropylene Glycol
Ethylene Chlorohydrin
Ethylene Glycol
Ethylene Glycol Diethyl Ether
Ethylene Glycol Monobutyl Ether
Ethylenediamine
Ethylene Oxide
Formamide
Gallium Arsenide
Gentian Violet (Hexamethyl-p-rosaniline Chloride)
Glyoxal Trimeric Dihydrate
Hexachloroacetone
Hexachloro-1,3-butadiene
Melatonin
Sodium Bromate
Tribromoacetic Acid

Peroxide Forming Compounds

Peroxide forming compounds represent a class of materials which can become more dangerous with prolonged storage because they tend to form explosive peroxides with age. Exposure to light and air enhance the formation of the peroxides. A partially empty container increases the amount of air available, and hence the rate at which peroxides will form in the container. These compounds tend to absorb and react with oxygen from the air to form unstable peroxides which may detonate with extreme violence when they become concentrated by evaporation or distillation, when combined with other compounds that give a detonable mixture, or when disturbed by unusual heat, shock, or friction.

Safe Storage Period for Peroxide Forming Compounds

The following table establishes storage period requirements for peroxide forming compounds. This table should be used in conjunction with the list of peroxide forming compounds below. This is not an all inclusive list. If uncertain please contact the Department of Environmental Health & Safety (215-895 – 5919).
It is required that all labs write on the product's label the receive date and the opening date on all peroxide formers to aid in determining its safe storage expiration.
DO NOT handle any peroxide forming chemical if there are signs of crystal growth or precipitation. Contact the Department of Environmental Health and Safety (215-895-5919) IMMEDIATELY if this occurs.

Description	Period
Unopened chemicals from manufacture	12 months
Opened containers of chemicals in part A	3 months
Opened containers of chemicals in part B and D	12 months
Opened containers of uninhibited chemicals in part C	24 hours
Opened containers of inhibited chemicals in part C	12 months*

* Do not store under inert atmosphere, oxygen required for inhibitor to function.

Peroxide Forming Compound List:

A. Chemicals that form explosive levels of peroxides without concentration by evaporation or distillation. Some of these may form explosive concentrations of peroxide even if never opened.

Butadiene [a]
Chloroprene [a]
Divinylacetylene
Isopropryl ether
Tetrafiuoroethylene [a]
Vinylidene chloride

B. Chemicals that form explosive levels of peroxides on concentration by evaporation or distillation or otherwise treated to concentrate the peroxides.

Acetal
Acetaldehyde
Benzyl alcohol
2-Butane
Cumene
Cyclohexanol
2-Cyclohexen-1-ol
Cyclohexene
Decahdronaphtalene
Diacetylene
Dicyclopentadiene
Diethyl ether
Diethylene glycoldimethyl ether
Dioxanes
Ethylene glycol dimethyl ether (glyme)
4 Heptanol
2-Hexanol
Methylacetylene
> 80% Hydrogen Peroxide
Methyl-1-butanol
Methylcyclopentane
Methyl isobutyl ketone
4-Methyl-2-pentanol
2-Penten-1-ol
4-Penten-1-ol
Perchloric Acid [g]
1-Phenylethanol
2-Phenylethanol
2-Propanol
Tetrahydrofuran (THF)
Tetrahydronaphthalene
Vinyl ethers
Other Secondary Alcohols

C. Chemicals that may autopolymerize as a result of peroxide accumulation:

Acrylic acid [b]
Acrylonitrile [b]
Butadiene [c]
Chloroprene [c]
Chlorotrifluoroethylene
Methyl Methacrylate [b]
Styrene
Tetrafluoroethylene [c]
Vinyl acetate
Vinyl acetylene
Vinyl chloride
Vinyl pyridine
Vinyladiene chloride

D. Chemicals that may form peroxides but cannot clearly be placed in section A - C:

Acrolein
Allyl ether [d]
Allyl ethyl ether
Allyl phenyl ether
p-(n-Amyloxy)benzoyl chloride
n-Amyl ether
Benzyl n-butyl ether [d]
Benzyl ether [d]
Benzyl ethyl ether [d]
Benzyl methyl ether
Benzyl 1-naphthyl ether [d]

1,2-Bis(2-chloroethoxy) ethane
Bis(2-ethoxyethyl) ether
Bis[2-(methoxyethoxy)ethyl] ether
Bis(2-chloroethyl) ether
Bis(2-methoxyethyl) adipate
Bis(2-ethoxyethyl) phthalate
Bis(2-methoxyethyl) carbonate
Bis(2-methoxyethyl) ether
Bis(2-methoxyethyl) phthalate
Bis(2-methoxymethyl) adipate
Bis(2-n-butoxyethyl) phthalate
Bis(2-phenoxyethyl) ether
Bis(4-chlorobutyl) ether
Bis(chloromethyl) ether [c]
2-Bromomethyl ethyl ether
§-Bromophenetole
o-Bromophenetole
p-Bromophenetole
3-Bromopropyl phenyl ether
1,3 Butadiyne
Buten-3-yne
tert-Butyl ethyl ether
tert-Butyl methyl ether
n-Butyl phenyl ether
n-Butyl vinyl ether
Chloroacetadehydediethyl acetal [d]
2-Chlorobutadiene
1-(2-Chlororethoxy)-2-phenoxyethane
Chloromethylene
Chloromethyl methyl ether [e]
§-Chlorophenetole
o-Chlorophenetole
p-Chlorophenetole
Cyclooctane [d]
Cyclopropyl methyl ether
Diallyl ether [d]
p-Di-n-butoxybenzene
1, 2-Dibenzyloxyethane [d]
p-Dibenzyloxybenzene [d]
1, 2-Dichloroethyl ethyl ether
2, 4-Dichlorophenetole
Diethoxymethane [d]
2, 2-Diethoxypropane
Diethyl ethoxymethylene malonate
Diethyl fumarated
Diethyl acetal isoamyl benzyl ether [d]
Diethylketene [f]
m, o, p-Diethoxybenzene
1, 2-Diethoxyethane
Dimethoxymethane [d]
1, 1-Dimethoxymethane [d]
Dimethylketene [f]
3, 3-Dimethoxypropene
2, 4-Dinitrophenetole
1, 3-Dioxepne [d]
Di(1-propynyl) ether [f]
Di(2-propynyl) ether
Di-n-propoxymethane [d]
1,2-Epoxy-3-isopropoxypropane [d]
1, -Epoxy-3-phenoxypropane
Ethoxyacetophenone
1-(2-Ethoxyethoxyethyl)ethyl acetate
2-Ethoxyethyl acetate
(2-Ethoxyethyl)-o-benzoyl benzoate
1-Ethoxynaphthalene
o,p,-Ethoxyphenyl isocyanate
1-Ethyoxy-2-propyne
3 –Ethoxy-o-propionitrile
2-Ethylacrylaldehyde oxime
2-Ethylbutanol
Ethyl §-ethoxypropionate
2-Ethylhexanal
Ethyl Vinyl Ether
Furan p-Phenylphenetone
2, 5 Hexadiyn-1-ol
4, 5-Hexadien-2-yn-1-ol
n-Hexyl ether
o,p-Iodophenetole
Isoamyl benzyl ether [d]

Isoamyl ether [d]
Isobutyl vinyl ether
lsophorone [d]
3-Isopropoxypropiontrile d
Isopropy 1,2,4,5 trichlorophenoxyacetate
Limonene
1, 5-p-Methadiene
Methyl p-(n-amyloxy) benzoate
4-Methyl-2-pentanone
n-Methylphenetole
2-Methyltetrahydrofuran
3-Methoxy-1-butyl acetate
2-Methoxy ethanol
3-Methoxy ethyl acetate
2-Methoxyethyl vinyl ether
Methoxy-1,3,5,7-cyclooctateraene
B-methoxypropionitrile
m-Nitrophenetole 1-Octene
Oxybis (2 ethyl acetate)
Oxybis (2-ethyl benzoate)
B,B Oxdipropionitrile
1 -Pentene
Phenoxy acetyl chloride
a-Phenoxypropionitrile chloride
Phenyl o-propyl ether
p-Phenylphenetone
n-Propylisopropyl ether
Sodium 8, 11, 14 elcosate traenoate
Sodium ethoxyacetylide
Tetrahydropyran
Triethylene glycol diacetate
Trithylene glycol dipropionate
1,3,3-Trimethoxypropene [d]
l,l,2,3,-Tetrachloro-l,3-butadiene
4-Vinyl Cyclohexene
Vinylene carbonate
Vinylidene chloride [d]

a When stored as a liquid monomer.
b Although these chemicals form peroxides, no explosion involving these monomers have been reported.
c When stored in liquid form, these chemicals form explosive levels of peroxides without concentration. They may also be stored as a gas in gas cylinders. When stored as a gas, these chemicals may autopolymerize as a result of peroxide accumulation.
d These chemicals easily form peroxides and should probably be considered under part B.
e OSHA regulated carcinogen.
f Extremely reactive and unstable compounds.
g While not a peroxide-forming chemical, Perchloric Acid is potentially unstable and is treated as such.

Source:
Kelly, Richard J., Chemical Health & Safety, American Chemical Society, 1996, Sept, 28-36 Revised 12/97.

APPENDIX II - D
CONCENTRATIONS OF CHEMICALS IMMEDIATELY DANGEROUS TO LIFE OR HEALTH

Documentation for Immediately Dangerous to Life or Health Concentrations (IDLHs)

NIOSH CHEMICAL LISTING AND DOCUMENTATION OF REVISED IDLH VALUES (AS OF 3/1/95)

SUBSTANCE	ORIGINAL IDLH VALUE	REVISED IDLH VALUE
Acetaldehyde	10,000 ppm	2,000 ppm
Acetic acid	1,000 ppm	50 ppm
Acetic anhydride	1,000 ppm	200 ppm
Acetone	20,000 ppm	2,500 ppm [LEL]
Acetonitrile	4,000 ppm	500 ppm
Acetylene tetrabromide	10 ppm	8 ppm
Acrolein	5 ppm	2 ppm
Acrylamide	Unknown	60 mg/m3
Acrylonitrile	500 ppm	85 ppm
Aldrin	100 mg/m3	25 mg/m3
Allyl alcohol	150 ppm	20 ppm
Allyl chloride	300 ppm	250 ppm
Allyl glycidyl ether	270 ppm	50 ppm
2 Aminopyridine	5 ppm	5 ppm[Unch]
Ammonia	500 ppm	300 ppm
Ammonium sulfamate	5,000 mg/m3	1,500 mg/m3
n-Amyl acetate	4,000 ppm	1,000 ppm
sec-Amyl acetate	9,000 ppm	1,000 ppm
Aniline	100 ppm	100 ppm[Unch]
o-Anisidine	50 mg/m3	50 mg/m3[Unch]
p-Anisidine	50 mg/m3	50 mg/m3[Unch]
Antimony compounds (as Sb)	80 mg Sb/m3	50 mg Sb/m3
ANTU	100 mg/m3	100 mg/m3[Unch]
Arsenic (inorganic compounds, as As)	100 mg As/m3	5 mg As/m3
Arsine	6 ppm	3 ppm
Azinphosmethyl	20 mg/m3	10 mg/m3
Barium (soluble compounds, as Ba)	1,100 mg Ba/m3	50 mg Ba/m3

Benzene	3,000 ppm	500 ppm
Benzoyl peroxide	7,000 mg/m3	1,500 mg/m3
Benzyl chloride	10 ppm	10 ppm[Unch]
Beryllium compounds(as Be)	10 mg Be/m3	4 mg Be/m3
Boron oxide	N.E.	2000 mg/m3
Boron trifluoride	100 ppm	25 ppm
Bromine	10 ppm	3 ppm
Bromoform	Unknown	850 ppm
1,3-Butadiene	20,000 ppm [LEL]	2,000 ppm [LEL]
2-Butanone	3,000 ppm	3,000 ppm Unch]
2-Butoxyethanol	700 ppm	700 ppm [Unch]
n-Butyl acetate	10,000 ppm	1,700 ppm [LEL]
sec-Butyl acetate	10,000 ppm	1,700 ppm [LEL]
tert-Butyl acetate	10,000 ppm	1,500 ppm [LEL]
n-Butyl alcohol	8,000 ppm	1,400 ppm [LEL]
sec-Butyl alcohol	10,000 ppm	2,000 ppm
tert-Butyl alcohol	8,000 ppm	1,600 ppm
n-Butylamine	2,000 ppm	300 ppm
tert-Butyl chromate	30 mg/m3(asCrO3)	15 mgCr(VI)/m3
n-Butyl glycidyl ether	3,500 ppm	250 ppm
n-Butyl mercaptan	2,500 ppm	500 ppm
p-tert-Butyltoluene	1,000 ppm	100 ppm
Cadmium dust (as Cd)	50 mg Cd/m3	9 mg Cd/m3
Cadmium fume (as Cd)	9 mg Cd/m3	9 mgCd/m3[Unch]
Calcium arsenate (as As)	100 mg As/m3	5 mg As/m3
Calcium oxide	Unknown	25 mg/m3
Camphor (synthetic)	200 mg/m3	200 mg/m3[Unch]
Carbaryl	600 mg/m3	100 mg/m3
Carbon black	N.E.	1,750 mg/m3
Carbon dioxide	50,000 ppm	40,000 ppm
Carbon disulfide	500 ppm	500 ppm [Unch]
Carbon monoxide	1,500 ppm	1,200 ppm
Carbon tetrachloride	300 ppm	200 ppm
Chlordane	500 mg/m3	100 mg/m3
Chlorinated camphene	200 mg/m3	200 mg/m3[Unch]
Chlorinated diphenyl oxide	Unknown	5 mg/m3
Chlorine	30 ppm	10 ppm
Chlorine dioxide	10 ppm	5 ppm
Chlorine trifluoride	20 ppm	20 ppm [Unch]
Chloroacetaldehyde	100 ppm	45 ppm
alpha-Chloroacetophenone	100 mg/m3	15 mg/m3
Chlorobenzene	2,400 ppm	1,000 ppm
o-Chlorobenzylidene malononitrile	2 mg/m3	2 mg/m3 [Unch]
Chlorobromomethane	5,000 ppm	2,000 ppm
Chlorodiphenyl		

(42% chlorine)	10 mg/m3	5 mg/m3
Chlorodiphenyl (54% chlorine)	5 mg/m3	5 mg/m3 [Unch]
Chloroform	1,000 ppm	500 ppm
1-Chloro-1-nitropropane	2,000 ppm	100 ppm
Chloropicrin	4 ppm	2 ppm
beta-Chloroprene	400 ppm	300 ppm
Chromic acid and chromates	30 mg/m3(asCrO3)	15 mg r(VI)/m3
Chromium (II) compounds [as Cr(II)]	N.E.	250 mgcr(II)/m3
Chromium (III) compounds[as Cr(III)]	N.E.	25 mgcr(III)/m3
Chromium metal (as Cr)	N.E.	250 mg Cr/m3
Coal tar pitch volatiles	700 mg/m3	80 mg/m3
Cobalt metal, dust and fume (as Co)	20 mg Co/m3	20mg Co/m3[Unch]
Copper (dusts and mists, as Cu)	N.E.	100 mg Cu/m3
Copper fume (as Cu)	N.E.	100 mg Cu/m3
Cotton dust (raw)	N.E.	100 mg/m3
Crag (r) herbicide	5,000 mg/m3	500 mg/m3
Cresol (o, m, p isomers)	250 ppm	250 ppm [Unch]
Crotonaldehyde	400 ppm	50 ppm
Cumene	8,000 ppm	900 ppm [LEL]
Cyanides (as CN)	50 mg/m3(as CN)	25 mg/m3 (asCN)
Cyclohexane	10,000 ppm	1,300 ppm [LEL]
Cyclohexanol	3,500 ppm	400 ppm
Cyclohexanone	5,000 ppm	700 ppm
Cyclohexene	10,000 ppm	2,000 ppm
Cyclopentadiene	2,000 ppm	750 ppm
2,4-D	500 mg/m3	100 mg/m3
DDT	N.E.	500 mg/m3
Decaborane	100 mg/m3	15 mg/m3
Demeton	20 mg/m3	10 mg/m3
Diacetone alcohol	2,100 ppm	1,800 ppm [LEL]
Diazomethane	2 ppm	2 ppm [Unch]
Diborane	40 ppm	15 ppm
Dibutyl phosphate	125 ppm	30 ppm
Dibutyl phthalate	9,300 mg/m3	4,000 mg/m3
o-Dichlorobenzene	1,000 ppm	200 ppm
p-Dichlorobenzene	1,000 ppm	150 ppm
Dichlorodifluoromethane	50,000 ppm	15,000 ppm
1,3-Dichloro 5, 5-dimethylhydantoin	Unknown	5 mg/m3
1,1-Dichloroethane	4,000 ppm	3,000 ppm
1,2-Dichloroethylene	4,000 ppm	1,000 ppm
Dichloroethyl ether	250 ppm	100 ppm
Dichloromonofluoromethane	50,000 ppm	5,000 ppm
1,1-Dichloro 1-nitroethane	150 ppm	25 ppm

Dichlorotetrafluoroethane	50,000 ppm	15,000 ppm
Dichlorvos	200 mg/m3	100 mg/m3
Dieldrin	450 mg/m3	50 mg/m3
Diethylamine	2,000 ppm	200 ppm
2-Diethylaminoethanol	500 ppm	100 ppm
Difluorodibromomethane	2,500 ppm	2,000 ppm
Diglycidyl ether	25 ppm	10 ppm
Diisobutyl ketone	2,000 ppm	500 ppm
Diisopropylamine	1,000 ppm	200 ppm
Dimethyl acetamide	400 ppm	300 ppm
Dimethylamine	2,000 ppm	500 ppm
N,N-Dimethylaniline	100 ppm	100 ppm [Unch]
Dimethyl 1,2-dibromo 2,2-dichlorethyl phosphate	1,800 mg/m3	200 mg/m3
Dimethylformamide	3,500 ppm	500 ppm
1,1-Dimethylhydrazine	50 ppm	15 ppm
Dimethylphthalate	9,300 mg/m3	2,000 mg/m3
Dimethyl sulfate	10 ppm	7 ppm
Dinitrobenzene (o, m, p isomers)	200 mg/m3	50 mg/m3
Dinitroocresol	5 mg/m3	5 mg/m3 [Unch]
Dinitrotoluene	200 mg/m3	50 mg/m3
Di sec-octyl phthalate	Unknown	5,000 mg/m3
Dioxane	2,000 ppm	500 ppm
Diphenyl	300 mg/m3	100 mg/m3
Dipropylene glycol methyl ether	Unknown	600 ppm
Endrin	2,000 mg/m3	2 mg/m3
Epichlorohydrin	250 ppm	75 ppm
EPN	50 mg/m3	5 mg/m3
Ethanolamine	1,000 ppm	30 ppm
2-Ethoxyethanol	6,000 ppm	500 ppm
2-Ethoxyethyl acetate	2,500 ppm	500 ppm
Ethyl acetate	10,000 ppm	2,000 ppm [LEL]
Ethyl acrylate	2,000 ppm	300 ppm
Ethyl alcohol	15,000 ppm	3,300 ppm [LEL]
Ethylamine	4,000 ppm	600 ppm
Ethyl benzene	2,000 ppm	800 ppm [LEL]
Ethyl bromide	3,500 ppm	2,000 ppm
Ethyl butyl ketone	3,000 ppm	1,000 ppm
Ethyl chloride	20,000 ppm	3,800 ppm [LEL]
Ethylene chlorohydrin	10 ppm	7 ppm
Ethylenediamine	2,000 ppm	1,000 ppm
Ethylene dibromide	400 ppm	100 ppm
Ethylene dichloride	1,000 ppm	50 ppm
Ethylene glycol dinitrate	500 mg/m3	75 mg/m3

Ethyleneimine	100 ppm	100 ppm [Unch]
Ethylene oxide	800 ppm	800 ppm [Unch]
Ethyl ether	19,000 ppm[LEL]	1,900 ppm [LEL]
Ethyl formate	8,000 ppm	1,500 ppm
Ethyl mercaptan	2,500 ppm	500 ppm
N-Ethylmorpholine	2,000 ppm	100 ppm
Ethyl silicate	1,000 ppm	700 ppm
Ferbam	N.E.	800 mg/m3
Ferrovanadium dust	N.E.	500 mg/m3
Fluorides (as F)	500 mg F/m3	250 mg F/m3
Fluorine	25 ppm	25 ppm [Unch]
Fluorotrichloromethane	10,000 ppm	2,000 ppm
Formaldehyde	30 ppm	20 ppm
Formic acid	30 ppm	30 ppm [Unch]
Furfural	250 ppm	100 ppm
Furfuryl alcohol	250 ppm	75 ppm
Glycidol	500 ppm	150 ppm
Graphite (natural)	N.E.	1,250 mg/m3
Hafnium compounds (as Hf)	Unknown	50 mg Hf/m3
Heptachlor	700 mg/m3	35 mg/m3
n-Heptane	5,000 ppm	750 ppm
Hexachloroethane	300 ppm	300 ppm [Unch]
Hexachloronaphthalene	2 mg/m3	2 mg/m3 [Unch]
n-Hexane	5,000 ppm	1,100 ppm [LEL]
2-Hexanone	5,000 ppm	1,600 ppm
Hexone	3,000 ppm	500 ppm
sec Hexyl acetate	4,000 ppm	500 ppm
Hydrazine	80 ppm	50 ppm
Hydrogen bromide	50 ppm	30 ppm
Hydrogen chloride	100 ppm	50 ppm
Hydrogen cyanide	50 ppm	50 ppm [Unch]
Hydrogen fluoride (as F)	30 ppm	30 ppm [Unch]
Hydrogen peroxide	75 ppm	75 ppm [Unch]
Hydrogen selenide (as Se)	2 ppm	1 ppm
Hydrogen sulfide	300 ppm	100 ppm
Hydroquinone	Unknown	50 mg/m3
Iodine	10 ppm	2 ppm
Iron oxide dust and fume (as Fe)	N.E.	2,500 mg Fe/m3
Isoamyl acetate	3,000 ppm	1,000 ppm
Isoamyl alcohol (primary and secondary)	10,000 ppm	500 ppm
Isobutyl acetate	7,500 ppm	1,300 ppm [LEL]

Isobutyl alcohol	8,000 ppm	1,600 ppm
Isophorone	800 ppm	200 ppm
Isopropyl acetate	16,000 ppm	1,800 ppm
Isopropyl alcohol	12,000 ppm	2,000 ppm [LEL]
Isopropylamine	4,000 ppm	750 ppm
Isopropyl ether	10,000 ppm	1,400 ppm [LEL]
Isopropyl glycidyl ether	1,000 ppm	400 ppm
Ketene	Unknown	5 ppm
Lead compounds (as Pb)	700 mg Pb/m3	100 mg Pb/m3
Lindane	1,000 mg/m3	50 mg/m3
Lithium hydride	55 mg/m3	0.5 mg/m3
L.P.G.	19,000 ppm[LEL]	2,000 ppm [LEL]
Magnesium oxide fume	N.E.	750 mg/m3
Malathion	5,000 mg/m3	250 mg/m3
Maleic anhydride	Unknown	10 mg/m3
Manganese compounds (as Mn)	N.E.	500 mg Mn/m3
Mercury compounds [except (organo) alkyls as Hg]	28 mg Hg/m3	10 mg Hg/m3
Mercury (organo) alkyl compounds(as Hg)	10 mg Hg/m3	2 mg Hg/m3
Mesityl oxide	5,000 ppm	1,400 ppm [LEL]
Methoxychlor	N.E.	5,000 mg/m3
Methyl acetate	10,000 ppm	3,100 ppm [LEL]
Methyl acetylene	15,000 ppm[LEL]	1,700 ppm [LEL]
Methyl acetylenepropadiene Mixture	15,000 ppm	3,400 ppm [LEL]
Methyl acrylate	1,000 ppm	250 ppm
Methylal	15,000 ppm[LEL]	2,200 ppm [LEL]
Methyl alcohol	25,000 ppm	6,000 ppm
Methylamine	100 ppm	100 ppm [Unch]
Methyl (namyl) ketone	4,000 ppm	800 ppm
Methyl bromide	2,000 ppm	250 ppm
Methyl Cellosolve (r)	2,000 ppm	200 ppm
Methyl Cellosolve (r) acetate	4,000 ppm	200 ppm
Methyl chloride	10,000 ppm	2,000 ppm
Methyl chloroform	1,000 ppm	700 ppm
Methylcyclohexane	10,000 ppm	1,200 ppm [LEL]
Methylcyclohexanol	10,000 ppm	500 ppm
o-Methylcyclohexanone	2,500 ppm	600 ppm
Methylene bisphenyl isocyanate	100 mg/m3	75 mg/m3
Methylene chloride	5,000 ppm	2,300 ppm

Methyl formate	5,000 ppm	4,500 ppm
5-Methyl 3-heptanone	3,000 ppm	100 ppm
Methyl hydrazine	50 ppm	20 ppm
Methyl iodide	800 ppm	100 ppm
Methyl isobutyl carbinol	2,000 ppm	400 ppm
Methyl isocyanate	20 ppm	3 ppm
Methyl mercaptan	400 ppm	150 ppm
Methyl methacrylate	4,000 ppm	1,000 ppm
Methyl styrene	5,000 ppm	700 ppm
Mica	N.E.	1,500 mg/m3
Molybdenum (insoluble compounds, as Mo)	N.E.	5,000 mg Mo/m3
Molybdenum (soluble compounds, as Mo)	N.E.	1,000 mg Mo/m3
Monomethyl aniline	100 ppm	100 ppm [Unch]
Morpholine	8,000 ppm	1,400 ppm [LEL]
Naphtha (coal tar)	10,000 ppm[LEL]	1,000 ppm [LEL]
Naphthalene	500 ppm	250 ppm
Nickel carbonyl (as Ni)	7 ppm	2 ppm
Nickel metal and other compounds (as Ni)	N.E.	10 mg Ni/m3
Nicotine	35 mg/m3	5 mg/m3
Nitric acid	100 ppm	25 ppm
Nitric oxide	100 ppm	100 ppm [Unch]
p-Nitroaniline	300 mg/m3	300 mg/m3[Unch]
Nitrobenzene	200 ppm	200 ppm [Unch]
p-Nitrochlorobenzene	1,000 mg/m3	100 mg/m3
Nitroethane	1,000 ppm	1,000 ppm[Unch]
Nitrogen dioxide	50 ppm	20 ppm
Nitrogen trifluoride	2,000 ppm	1,000 ppm
Nitroglycerine	500 mg/m3	75 mg/m3
Nitromethane	1,000 ppm	750 ppm
1-Nitropropane	2,300 ppm	1,000 ppm
2-Nitropropane	2,300 ppm	100 ppm
Nitrotoluene (o, m, p isomers)	200 ppm	200 ppm [Unch]
Octachloronaphthalene	Unknown	Unknown [Unch]
Octane	5,000 ppm	1,000 ppm [LEL]
Oil mist (mineral)	N.E.	2,500 mg/m3
Osmium tetroxide (as Os)	1 mg Os/m3	1 mgOs/m3[Unch]
Oxalic acid	500 mg/m3	500 mg/m3[Unch]
Oxygen difluoride	0.5 ppm	0.5 ppm [Unch]
Ozone	10 ppm	5 ppm
Paraquat	1.5 mg/m3	1 mg/m3

Parathion	20 mg/m3	10 mg/m3
Pentaborane	3 ppm	1 ppm
Pentachloronaphthalen	Unknown	Unknown [Unch]
Pentachlorophenol	150 mg/m3	2.5 mg/m3
n-Pentane	15,000 ppm[LEL]	1,500 ppm [LEL]
2-Pentanone	5,000 ppm	1,500 ppm
Perchloromethyl mercaptan	10 ppm	10 ppm [Unch]
Perchloryl fluoride	385 ppm	100 ppm
Petroleum distillates (naphtha)	10,000 ppm	1,100 ppm [LEL]
Phenol	250 ppm	250 ppm [Unch]
p-Phenylene diamine	Unknown	25 mg/m3
Phenyl ether (vapor)	N.E.	100 ppm
Phenyl etherbiphenyl mixture (vapor)	N.E.	10 ppm
Phenyl glycidyl ether	Unknown	100 ppm
Phenylhydrazine	295 ppm	15 ppm
Phosdrin	4 ppm	4 ppm [Unch]
Phosgene	2 ppm	2 ppm [Unch]
Phosphine	200 ppm	50 ppm
Phosphoric acid	10,000 mg/m3	1,000 mg/m3
Phosphorus (yellow)	N.E.	5 mg/m3
Phosphorus pentachloride	200 mg/m3	70 mg/m3
Phosphorus pentasulfide	750 mg/m3	250 mg/m3
Phosphorus trichloride	50 ppm	25 ppm
Phthalic anhydride	10,000 mg/m3	60 mg/m3
Picric acid	100 mg/m3	75 mg/m3
Pindone	200 mg/m3	100 mg/m3
Platinum (soluble salts, as Pt)	N.E.	4 mg Pt/m3
Portland cement	N.E.	5,000 mg/m3
Propane	20,000 ppm[LEL]	2,100 ppm [LEL]
n-Propyl acetate	8,000 ppm	1,700 ppm
n-Propyl alcohol	4,000 ppm	800 ppm
Propylene dichloride	2,000 ppm	400 ppm
Propylene imine	500 ppm	100 ppm
Propylene oxide	2,000 ppm	400 ppm
n-Propyl nitrate	2,000 ppm	500 ppm
Pyrethrum	5,000 mg/m	35,000 g/m3[Unch]
Pyridine	3,600 ppm	1,000 ppm
Quinone	300 mg/m3	100 mg/m3
Rhodium (metal fume and insoluble compounds, as Rh)	N.E.	100 mg Rh/m3
Rhodium (soluble compounds, as Rh)	N.E.	2 mg Rh/m3
Ronnel	5,000 mg/m3	300 mg/m3
Rotenone	Unknown	2,500 mg/m3

Selenium compounds (as Se)	Unknown	1 mg Se/m3
Selenium hexafluoride	5 ppm	2 ppm
Silica, amorphous	N.E.	3,000 mg/m3
Silica, crystalline (respirable dust)	N.E.	
cristobalite/tridymite:		25 mg/m3
quartz/tripoli:		50 mg/m3
Silver (metal dust and soluble compounds, as Ag)	N.E.	10 mg Ag/m3
Soapstone	N.E.	3,000 mg/m3
Sodium fluoroacetate	5 mg/m3	2.5 mg/m3
Sodium hydroxide	250 mg/m3	10 mg/m3
Stibine	40 ppm	5 ppm
Stoddard solvent	29,500 mg/m3	20,000 mg/m3
Strychnine	3 mg/m3	3 mg/m3[Unch]
Styrene	5,000 ppm	700 ppm
Sulfur dioxide	100 ppm	100 ppm [Unch]
Sulfuric acid	80 mg/m3	15 mg/m3
Sulfur monochloride	10 ppm	5 ppm
Sulfur pentafluoride	1 ppm	1 ppm [Unch]
Sulfuryl fluoride	1,000 ppm	200 ppm
2,4,5-T	Unknown	250 mg/m3
Talc	N.E.	1,000 mg/m3
Tantalum (metal and oxide dust, as Ta)	N.E.	2,500 mg Ta/m3
TEDP	35 mg/m3	10 mg/m3
Tellurium compounds (as Te)	N.E.	25 mg Te/m3
Tellurium hexafluoride	1 ppm	1 ppm [Unch]
TEPP	10 mg/m3	5 mg/m3
Terphenyl (o, m, p isomers)	Unknown	500 mg/m3
1,1,1,2-Tetrachloro 2, 2-difluoroethane	15,000 ppm	2,000 ppm
1,1,2,2-Tetrachloro 1, 2-difluoroethane	15,000 ppm	2,000 ppm
1,1,2,2-Tetrachloroethane	150 ppm	100 ppm
Tetrachloroethylene	500 ppm	150 ppm
Tetrachloronaphthalene	Unknown	Unknown [Unch]
Tetraethyl lead (as Pb)	40 mg Pb/m3	40 mg Pb/m3[Unch]
Tetrahydrofuran	20,000 ppm [LEL]	2,000 ppm [LEL]
Tetramethyl lead (as Pb)	40 mg Pb/m3	40 mg Pb/m3[Unch]
Tetramethyl succinonitrile	5 ppm	5 ppm [Unch]
Tetranitromethane	5 ppm	4 ppm
Tetryl	N.E.	750 mg/m3
Thallium (soluble compounds, as Tl)	20 mg Tl/m3	15 mg Tl/m3
Thiram	1,500 mg/m3	100 mg/m3

Tin (inorganic compounds, as Sn)	400 mg Sn/m3	100 mg Sn/m3
Tin (organic compounds, as Sn)	Unknown	25 mg Sn/m3
Titanium dioxide	N.E.	5,000 mg/m3
Toluene	2,000 ppm	500 ppm
Toluene 2,4-diisocyanate	10 ppm	2.5 ppm
o-Toluidine	100 ppm	50 ppm
Tributyl phosphate	125 ppm	30 ppm
1,1,2-Trichloroethane	500 ppm	100 ppm
Trichloroethylene	1,000 ppm	1,000 ppm [Unch]
Trichloronaphthalene	Unknown	Unknown [Unch]
1,2,3-Trichloropropane	1,000 ppm	100 ppm
1,1,2-Trichloro 1,2, 2-trifluoroethane	4,500 ppm	2,000 ppm
Triethylamine	1,000 ppm	200 ppm
Trifluorobromomethane	50,000 ppm	40,000 ppm
2,4,6-Trinitrotoluene	1,000 mg/m3	500 mg/m3
Triorthocresyl phosphate	40 mg/m3	40 mg/m3 [Unch]
Triphenyl phosphate	N.E.	1,000 mg/m3
Turpentine	1,500 ppm	800 mg
Uranium (insoluble compounds, as U)	30 mg U/m3	10 mg U/m3
Uranium (soluble compounds, as U)	20 mg U/m3	10 mg U/m3
Vanadium dust	70 mg/m3 (as V2O5)	35 mg V/m3
Vanadium fume	70 mg/m3 (as V2O5)	35 mg V/m3
Vinyl toluene	5,000 ppm	400 ppm
Warfarin	350 mg/m3	100 mg/m3
Xylene (o, m, p isomers)	1,000 ppm	900 ppm
Xylidine	150 ppm	50 ppm
Yttrium compounds (as Y)	N.E.	500 mg Y/m3
Zinc chloride fume	4,800 mg/m3	50 mg/m3
Zinc oxide	2,500 mg/m3	500 mg/m3
Zirconium compounds (as Zr)	500 mg Zr/m3	50 mg Zr/m3

APPENDIX III

Appendix III

Hazardous Material Spill Procedures for Major Spills

The following procedure applies to:

- Laboratory personnel
- Education personnel
- Maintenance personnel
- Outside Contractor Personnel
- Environmental Services personnel
- Administrative personnel

In the event of a major spill in a university area, all personnel will implement the following plan:

1. Notify persons in the immediate area that a spill has occurred.
2. Avoid breathing vapors, mists or dust of the spilled material.
3. Turn off all ignition sources.
4. 4, Evacuate room and close the door. Contact Public Safety 24-hour Call Center

In order to assess the situation be prepared to provide the following information:

- Name and call back number
- The location of the spill (building and room number)
- Type of material spilled
- The amount of material that spilled

5. Remain on or near the telephone until you have received instructions from Public Safety or the Department of Environmental Health and Safety.

APPENDIX IV

APPENDIX IV

Hazardous Material Spill Procedures for Minor Spills

In the event of a minor spill the following emergency procedures shall be implemented:

1. If injured or contaminated with hazardous substances immediately proceed with personal decontamination procedures.
2. Laboratory personnel will be responsible for the containment and clean up of all **minor** spills.
3. Proper personal protection equipment shall be donned during the cleanup of all **minor** spills. If the laboratory occupants do not have the proper personal protective equipment then contact the Department of Environmental Health and Safety for assistance at 215-895-5892 or 215-778-4278 or 215-895-5919 or Public Safety at 215-895-2822 to contact a representative from the Department of Environmental Health and Safety.
4. All non-disposable personal protective equipment shall be decontaminated and stored.
5. All disposable personal protective equipment and clean up materials shall be disposed of as hazardous waste.
6. If the material spilled is not covered under the **minor** spill definition (< 500 gm or 500 ml of non-acutely hazardous material) then laboratory personnel shall implement the **major spill procedures.**

APPENDIX V

Appendix V

Related and Compatible Storage Groups

Inorganic Family

Nitric acid, other inorganic acids

Metals, hydrides

Sulfur, phosphorus, arsenic, phosphorus pentoxide

Halides, sulfates, sulfites, thiosulfates, phosphates, halogens

Amides, nitrates (except ammonium nitrate), nitrites, azides

Hydroxides, oxides, silicates, carbonates, carbon

Sulfides, selenides, phosphides, carbides, nitrides

Chlorates, perchlorates, perchloric acid, chlorites, hypochlorities, peroxides, hydrogen perioxide

Arsenates, cyanides, cyanates

Borates, chromates, manganates, Permanganates

Organic Family

Acids, anhydrides, peracids

Alcohols, glycols, amines, amides, imines, imides

Hydrocarbons, esters, aldehydes

Ethers, ketones, ketenes, halogenated hydrocarbons, ethylene oxide

Peroxides, hydroperoxides, azides

Phenols, cresols

Sulfides, polysulfides, sulfoxides, Nitrites

NOTE: Store flammables in a storage cabinet for flammable liquids or in safety cans. Separate chemicals first into liquids and solids, then into their organic and inorganic families and finally into related and compatible groups, as shown. Separation of

chemical groups can be by different shelves within the same cabinet. Appropriate secondary containers may also be used to separate compatibility group.

Do NOT store liquids with solids. Liquids are always stored beneath solid chemicals.

Do **NOT** store chemicals alphabetically as a general group. This may result in incompatibles appearing together on a shelf. Rather, store alphabetically within compatible groups.

This listing is only a suggested method of arranging chemical materials for storage and is not intended to be complete.

APPENDIX VI

APPENDIX VI-A - Regulations (Standards - 29 CFR)

TABLE Z-1 Limits for Air Contaminants. - 1910.1000TABLEZ-1

- **Standard Number:** 1910.1000TABLEZ-1
- **Standard Title:** TABLE Z-1 Limits for Air Contaminants.
- **SubPart Number:** Z
- **SubPart Title:** Toxic and Hazardous Substances

TABLE Z-1 LIMITS FOR AIR CONTAMINANTS

NOTE: Because of the length of the table, explanatory Footnotes applicable to all substances are given below as well as at the end of the table. Footnotes specific only to a limited number of substances are also shown within the table.

Footnote(1) The PELs are 8-hour TWAs unless otherwise noted; a (C) designation denotes a ceiling limit. They are to be determined from breathing-zone air samples.

Footnote(a) Parts of vapor or gas per million parts of contaminated air by volume at 25 degrees C and 760 torr.

Footnote(b) Milligrams of substance per cubic meter of air. When entry is in this column only, the value is exact; when listed with a ppm entry, it is approximate.

Footnote(c) The CAS number is for information only. Enforcement is based on the substance name. For an entry covering more than one metal compound measured as the metal, the CAS number for the metal is given - not CAS numbers for the individual compounds.

Footnote(d) The final benzene standard in 1910.1028 applies to all occupational exposures to benzene except in some circumstances the distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures; for the excepted subsegments, the benzene limits in Table Z-2 apply. See 1910.1028 for specific circumstances.

Footnote(e) This 8-hour TWA applies to respirable dust as measured by a vertical elutriator cotton dust sampler or equivalent instrument. The time-weighted average applies to the cotton waste

processing operations of waste recycling (sorting, blending, cleaning and willowing) and garnetting. See also 1910.1043 for cotton dust limits applicable to other sectors.

Footnote(f) All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the Particulates Not Otherwise Regulated (PNOR) limit which is the same as the inert or nuisance dust limit of Table Z-3.

Footnote(2) See Table Z-2.

Footnote(3) See Table Z-3

Footnote(4) Varies with compound.

TABLE Z-1. - LIMITS FOR AIR CONTAMINANTS

Substance	CAS No. (c)	ppm (a)(1)	mg/m(3) (b)(1)	Skin designation
Acetaldehyde	75-07-0	200	360	
Acetic acid	64-19-7	10	25	
Acetic anhydride	108-24-7	5	20	
Acetone	67-64-1	1000	2400	
Acetonitrile	75-05-8	40	70	
2-Acetylaminofluorene; see 1910.1014	53-96-3			
Acetylene dichloride; see 1,2-Dichloroethylene				
Acetylene tetrabromide	79-27-6	1	14	
Acrolein	107-02-8	0.1	0.25	
Acrylamide	79-06-1	.....	0.3	X
Acrylonitrile; see 1910.1045	107-13-1			
Aldrin	309-00-2	.....	0.25	X
Allyl alcohol	107-18-6	2	5	X
Allyl chloride	107-05-1	1	3	
Allyl glycidyl ether (AGE)	106-92-3	(C)10	(C)45	
Allyl propyl disulfide	2179-59-1	2	12	
alpha-Alumina	1344-28-1			
Total dust		.....	15	
Respirable fraction…		.....	5	
Aluminum Metal (as Al)	7429-90-5			
Total dust		.....	15	
Respirable fraction…		.....	5	
4-Aminodiphenyl; see 1910.1011	92-67-1			
2-Aminoethanol; see Ethanolamine				
2-Aminopyridine	504-29-0	0.5	2	

Ammonia	7664-41-7	50	35	
Ammonium sulfamate	7773-06-0			
Total dust		.....	15	
Respirable fraction…		.....	5	
n-Amyl acetate	628-63-7	100	525	
sec-Amyl acetate	626-38-0	125	650	
Aniline and homologs	62-53-3	5	19	X
Anisidine (o-,p-isomers)	29191-52-4	.....	0.5	X
Antimony and compounds (as Sb)	7440-36-0	.....	0.5	
ANTU (alpha Naphthylthiourea)	86-88-4	.....	0.3	
Arsenic, inorganic compounds (as As); see 1910.1018	7440-38-2			
Arsenic, organic compounds (as As)	7440-38-2	.....	0.5	
Arsine	7784-42-1	0.05	0.2	
Asbestos; see 1910.1001	(4)			
Azinphos-methyl	86-50-0	.....	0.2	X
Barium, soluble compounds (as Ba)	7440-39-3	.....	0.5	
Barium sulfate	7727-43-7			
Total dust		.....	15	
Respirable fraction…		.....	5	
Benomyl	17804-35-2			
Total dust		.....	15	
Respirable fraction…		.....	5	
Benzene; See 1910.1028. See Table Z-2 for the limits applicable in the operations or sectors excluded in 1910.1028(d)	71-43-2			
Benzidine; See 1910.1010	92-87-5			
p-Benzoquinone; see Quinone.				
Benzo(a)pyrene; see Coal tar pitch volatiles				
Benzoyl peroxide	94-36-0	.....	5	
Benzyl chloride	100-44-7	1	5	
Beryllium and beryllium compounds (as Be)	7440-41-7		(2)	
Biphenyl; see Diphenyl.				
Bismuth telluride, Undoped	1304-82-1			
Total dust		.....	15	
Respirable fraction…		.....	5	
Boron oxide	1303-86-2			
Total dust		.....	15	

Boron trifluoride.....	7637-07-2	(C)1	(C)3	
Bromine.....	7726-95-6	0.1	0.7	
Bromoform.....	75-25-2	0.5	5	X
Butadiene (1,3-Butadiene); See 29 CFR 1910.1051; 29 CFR 1910.19(1).....,	106-99-0	1 ppm/5 ppm STEL		
Butanethiol; see Butyl mercaptan.				
2-Butanone (Methyl ethyl ketone)	78-93-3	200	590	
2-Butoxyethanol.....	111-76-2	50	240	X
n-Butyl-acetate.....	123-86-4	150	710	
sec-Butyl acetate.....	105-46-4	200	950	
tert-Butyl-acetate.....	540-88-5	200	950	
n-Butyl alcohol.....	71-36-3	100	300	
sec-Butyl alcohol.....	78-92-2	150	450	
tert-Butyl alcohol.....	75-65-0	100	300	
Butylamine.....	109-73-9	(C)5	(C)15	X
tert-Butyl chromate (as CrO(3)).....	1189-85-1	.....	(C)0.1	X
n-Butyl glycidyl ether (BGE).....	2426-08-6	50	270	
Butyl mercaptan.....	109-79-5	10	35	
p-tert-Butyltoluene....	98-51-1	10	60	
Cadmium (as Cd); see 1910.1027.....	7440-43-9			
Calcium Carbonate.....	1317-65-3			
Total dust.....		.....	15	
Respirable fraction…		.....	5	
Calcium hydroxide.....	1305-62-0			
Total dust.....		.....	15	
Respirable fraction…		.....	5	
Calcium oxide.....	1305-78-8	.....	5	
Calcium silicate.....	1344-95-2			
Total dust.....		.....	15	
Respirable fraction…		.....	5	
Calcium sulfate.....	7778-18-9			
Total dust.....		.....	15	
Respirable fraction…		.....	5	
Camphor, synthetic.....	76-22-2	.....	2	
Carbaryl (Sevin).....	63-25-2	.....	5	
Carbon black.....	1333-86-4	.....	3.5	
Carbon dioxide.....	124-38-9	5000	9000	
Carbon disulfide.....	75-15-0		(2)	
Carbon monoxide.....	630-08-0	50	55	
Carbon tetrachloride...	56-23-5		(2)	
Cellulose.....	9004-34-6			
Total dust.....,|		.....	15	
Respirable fraction..,|		.....	5	
Chlordane.....	57-74-9	.....	0.5	X
Chlorinated camphene...	8001-35-2	.....	0.5	X
Chlorinated diphenyl oxide.....,|	55720-99-5	.....	0.5	
Chlorine.....	7782-50-5	(C)1	(C)3	
Chlorine dioxide.....	10049-04-4	0.1	0.3	

Chlorine trifluoride...	7790-91-2	(C)0.1	(C)0.4	
Chloroacetaldehyde.....	107-20-0	(C)1	(C)3	
a-Chloroacetophenone (Phenacyl chloride)..,	532-27-4	0.05	0.3	
Chlorobenzene.....	108-90-7	75	350	
o-Chlorobenzylidene malononitrile.....,	2698-41-1	0.05	0.4	
Chlorobromomethane.....	74-97-5	200	1050	
2-Chloro-1,3-butadiene; See beta-Chloroprene.,				
Chlorodiphenyl (42% Chlorine)(PCB)…	53469-21-9	.....	1	X
Chlorodiphenyl (54% Chlorine)(PCB)…	11097-69-1	.....	0.5	X
1-Chloro-2, 3-epoxypropane; See Epichlorohydrin.				
2-Chloroethanol; See Ethylene chlorohydrin				
Chloroethylene; See Vinyl chloride.				
Chloroform (Trichloromethane)....	67-66-3	(C)50	(C)240	
bis(Chloromethyl) ether; see 1910.1008..	542-88-1			
Chloromethyl methyl ether; see 1910.1006..	107-30-2			
1-Chloro-1-nitropropane	600-25-9	20	100	
Chloropicrin.....	76-06-2	0.1	0.7	
beta-Chloroprene.....	126-99-8	25	90	X
2-Chloro-6 (trichloromethyl) pyridine.....	1929-82-4			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Chromic acid and chromates (as CrO(3))	(4)		(2)	
Chromium (II) compounds (as Cr).....	7440-47-3	.....	0.5	
Chromium (III) compounds (as Cr).....	7440-47-3	.....	0.5	
Chromium metal and insol. salts (as Cr)..	7440-47-3	.....	1	
Chrysene; see Coal tar pitch volatiles.....				
Clopidol.....	2971-90-6			
Total dust.....		.....	15	
Respirable fraction…		.....	5	
Coal dust (less than 5% SiO(2)), respirable fraction…			(3)	
Coal dust (greater than or equal to 5% SiO(2)), respirable fraction.....			(3)	
Coal tar pitch				

volatiles (benzene soluble fraction), anthracene, BaP, phenanthrene, acridine, chrysene, pyrene	65966-93-2	.....	0.2	
Cobalt metal, dust, and fume (as Co)	7440-48-4	.....	0.1	
Coke oven emissions; see 1910.1029				
Copper	7440-50-8			
Fume (as Cu)		.....	0.1	
Dusts and mists (as Cu)		.....	1	
Cotton dust (e), see 1910.1043		.....	1	
Crag herbicide (Sesone)	136-78-7			
Total dust		.....	15	
Respirable fraction…		.....	5	
Cresol, all isomers	1319-77-3	5	22	X
Crotonaldehyde	123-73-9	2	6	
	4170-30-3			
Cumene	98-82-8	50	245	X
Cyanides (as CN)	(4)	.....	5	X
Cyclohexane	110-82-7	300	1050	
Cyclohexanol	108-93-0	50	200	
Cyclohexanone	108-94-1	50	200	
Cyclohexene	110-83-8	300	1015	
Cyclopentadiene	542-92-7	75	200	
2,4-D (Dichlorophenoxyacetic acid)	94-75-7	.....	10	
Decaborane	17702-41-9	0.05	0.3	X
Demeton (Systox)	8065-48-3	.....	0.1	X
Diacetone alcohol (4-Hydroxy-4-methyl-2-pentanone)	123-42-2	50	240	
1,2-Diaminoethane; see Ethylenediamine…				
Diazomethane	334-88-3	0.2	0.4	
Diborane	19287-45-7	0.1	0.1	
1,2-Dibromo-3-chloropropane (DBCP); see 1910.1044	96-12-8			
1,2-Dibromoethane; see Ethylene dibromide				
Dibutyl phosphate	107-66-4	1	5	
Dibutyl phthalate	84-74-2	.....	5	
o-Dichlorobenzene	95-50-1	(C)50	(C)300	
p-Dichlorobenzene	106-46-7	75	450	
3,3'-Dichlorobenzidine; see 1910.1007	91-94-1			
Dichlorodifluoromethane	75-71-8	1000	4950	
1,3-Dichloro-5,5-dimethyl hydantoin.	118-52-5	.....	0.2	
Dichlorodiphenyltrichloroethane (DDT)	50-29-3	.....	1	X

1,1-Dichloroethane.....	75-34-3	100	400	
1,2-Dichloroethane; see Ethylene dichloride…				
1,2-Dichloroethylene...	540-59-0	200	790	
Dichloroethyl ether....	111-44-4	(C)15	(C)90	X
Dichloromethane; see Methylene chloride....				
Dichloromonofluoro-methane.....	75-43-4	1000	4200	
1,1-Dichloro-1-nitroethane.....	594-72-9	(C)10	(C)60	
1,2-Dichloropropane; see Propylene dichloride..				
Dichlorotetrafluoro-ethane.....	76-14-2	1000	7000	
Dichlorvos (DDVP).....	62-73-7	.....	1	X
Dicyclopentadienyl iron	102-54-5			
Total dust.....		.....	15	
Respirable fraction…		.....	5	
Dieldrin.....	60-57-1	.....	0.25	X
Diethylamine.....	109-89-7	25	75	
2-Diethylaminoethanol..	100-37-8	10	50	X
Diethyl ether; see Ethyl ether.....				
Difluorodibromomethane.	75-61-6	100	860	
Diglycidyl ether (DGE).	2238-07-5	(C)0.5	(C)2.8	
Dihydroxybenzene; see Hydroquinone.....				
Diisobutyl ketone.....	108-83-8	50	290	
Diisopropylamine.....	108-18-9	5	20	X
4-Dimethylaminoazo-benzene; see 1910.1015.....	60-11-7			
Dimethoxymethane; see Methylal.....				
Dimethyl acetamide.....	127-19-5	10	35	X
Dimethylamine.....	124-40-3	10	18	
Dimethylaminobenzene; see Xylidine.....				
Dimethylaniline (N,N-Dimethylaniline)	121-69-7	5	25	X
Dimethylbenzene; see Xylene.....				
Dimethyl-1,2-dibromo-2,2-dichloroethyl phosphate.....	300-76-5	.....	3	
Dimethylformamide.....	68-12-2	10	30	X
2,6-Dimethyl-4-heptanone; see Diisobutyl ketone.....				
1,1-Dimethylhydrazine..	57-14-7	0.5	1	X
Dimethylphthalate.....	131-11-3	.....	5	
Dimethyl sulfate.....	77-78-1	1	5	X
Dinitrobenzene (all isomers).....			1	X

(ortho).....	528-29-0			
(meta).....	99-65-0			
(para).....	100-25-4			
Dinitro-o-cresol.....	534-52-1	.....	0.2	X
Dinitrotoluene.....	25321-14-6	.....	1.5	X
Dioxane				
(Diethylene dioxide)..	123-91-1	100	360	X
Diphenyl (Biphenyl)....	92-52-4	0.2	1	
Diphenylmethane				
diisocyanate; see				
Methylene bisphenyl				
isocyanate.....				
Dipropylene glycol				
methyl ether.....	34590-94-8	100	600	X
Di-sec octyl phthalate				
(Di-(2-ethylhexyl)				
phthalate).....	117-81-7	.....	5	
Emery.....	12415-34-8			
Total dust.....		.....	15	
Respirable fraction…		.....	5	
Endrin.....	72-20-8	.....	0.1	X
Epichlorohydrin.....	106-89-8	5	19	X
EPN.....	2104-64-5	.....	0.5	X
1,2-Epoxypropane; see				
Propylene oxide.....				
2,3-Epoxy-1-propanol;				
see Glycidol.....				
Ethanethiol; see				
Ethyl mercaptan.....				
Ethanolamine.....	141-43-5	3	6	
2-Ethoxyethanol				
(Cellosolve).....	110-80-5	200	740	X
2-Ethoxyethyl acetate				
(Cellosolve acetate)..	111-15-9	100	540	X
Ethyl acetate.....	141-78-6	400	1400	
Ethyl acrylate.....	140-88-5	25	100	X
Ethyl alcohol (Ethanol)	64-17-5	1000	1900	
Ethylamine.....	75-04-7	10	18	
Ethyl amyl ketone				
(5-Methyl-3-				
heptanone).....	541-85-5	25	130	
Ethyl benzene.....	100-41-4	100	435	
Ethyl bromide.....	74-96-4	200	890	
Ethyl butyl ketone				
(3-Heptanone).....	106-35-4	50	230	
Ethyl chloride.....	75-00-3	1000	2600	
Ethyl ether.....	60-29-7	400	1200	
Ethyl formate.....	109-94-4	100	300	
Ethyl mercaptan.....	75-08-1	(C)10	(C)25	
Ethyl silicate.....	78-10-4	100	850	
Ethylene chlorohydrin..	107-07-3	5	16	X
Ethylenediamine.....	107-15-3	10	25	
Ethylene dibromide.....	106-93-4		(2)	
Ethylene dichloride				
(1,2-Dichloroethane)..	107-06-2		(2)	
Ethylene glycol				

dinitrate.....	628-96-6	(C)0.2	(C)1	X
Ethylene glycol methyl acetate; see Methyl cellosolve acetate....				
Ethyleneimine; see 1910.1012.....	151-56-4			
Ethylene oxide; see 1910.1047.....	75-21-8			
Ethylidene chloride; see 1,1-Dichlorethane				
N-Ethylmorpholine.....	100-74-3	20	94	X
Ferbam.....	14484-64-1			
Total dust.....		.....	15	
Ferrovanadium dust.....	12604-58-9	.....	1	
Fluorides (as F).....	(4)	.....	2.5	
Fluorine.....	7782-41-4	0.1	0.2	
Fluorotrichloromethane (Trichloro-fluoromethane).....	75-69-4	1000	5600	
Formaldehyde; see 1910.1048.....	50-00-0			
Formic acid.....	64-18-6	5	9	
Furfural.....	98-01-1	5	20	X
Furfuryl alcohol.....	98-00-0	50	200	
Grain dust (oat, wheat barley).....	.....	.....	10	
Glycerin (mist).....	56-81-5			
Total dust.....		.....	15	
Respirable fraction…		.....	5	
Glycidol.....	556-52-5	50	150	
Glycol monoethyl ether; see 2-Ethoxyethanol…				
Graphite, natural respirable dust.....	7782-42-5		(3)	
Graphite, synthetic....				
Total dust.....		.....	15	
Respirable Fraction...		.....	5	
Guthion; see Azinphos methyl…				
Gypsum.....	13397-24-5			
Total dust.....		.....	15	
Respirable fraction…		.....	5	
Hafnium.....	7440-58-6	.....	0.5	
Heptachlor.....	76-44-8	.....	0.5	X
Heptane (n-Heptane)....	142-82-5	500	2000	
Hexachloroethane.....	67-72-1	1	10	X
Hexachloronaphthalene..	1335-87-1	.....	0.2	X
n-Hexane.....	110-54-3	500	1800	
2-Hexanone (Methyl n-butyl ketone).....	591-78-6	100	410	
Hexone (Methyl isobutyl ketone).....	108-10-1	100	410	
sec-Hexyl acetate.....	108-84-9	50	300	
Hydrazine.....	302-01-2	1	1.3	X
Hydrogen bromide.....	10035-10-6	3	10	
Hydrogen chloride.....	7647-01-0	(C)5	(C)7	

Hydrogen cyanide	74-90-8	10	11	X
Hydrogen fluoride (as F)	7664-39-3		(2)	
Hydrogen peroxide	7722-84-1	1	1.4	
Hydrogen selenide (as Se)	7783-07-5	0.05	0.2	
Hydrogen sulfide	7783-06-4		(2)	
Hydroquinone	123-31-9		2	
Iodine	7553-56-2	(C)0.1	(C)1	
Iron oxide fume	1309-37-1		10	
Isomyl acetate	123-92-2	100	525	
Isomyl alcohol (primary and secondary)	123-51-3	100	360	
Isobutyl acetate	110-19-0	150	700	
Isobutyl alcohol	78-83-1	100	300	
Isophorone	78-59-1	25	140	
Isopropyl acetate	108-21-4	250	950	
Isopropyl alcohol	67-63-0	400	980	
Isopropylamine	75-31-0	5	12	
Isopropyl ether	108-20-3	500	2100	
Isopropyl glycidyl ether (IGE)	4016-14-2	50	240	
Kaolin	1332-58-7			
Total dust			15	
Respirable fraction			5	
Ketene	463-51-4	0.5	0.9	
Lead inorganic (as Pb); see 1910.1025	7439-92-1			
Limestone	1317-65-3			
Total dust			15	
Respirable fraction			5	
Lindane	58-89-9		0.5	X
Lithium hydride	7580-67-8		0.025	
L.P.G. (Liquified petroleum gas)	68476-85-7	1000	1800	
Magnesite	546-93-0			
Total dust			15	
Respirable fraction			5	
Magnesium oxide fume	1309-48-4			
Total Particulate			15	
Malathion	121-75-5			
Total dust			15	X
Maleic anhydride	108-31-6	0.25	1	
Manganese compounds (as Mn)	7439-96-5		(C)5	
Manganese fume (as Mn)	7439-96-5		(C)5	
Marble	1317-65-3			
Total dust			15	
Respirable fraction			5	
Mercury (aryl and inorganic)(as Hg)	7439-97-6		(2)	
Mercury (organo) alkyl compounds (as Hg)	7439-97-6		(2)	
Mercury (vapor) (as Hg)	7439-97-6		(2)	
Mesityl oxide	141-79-7	25	100	

Methanethiol; see Methyl mercaptan.				
Methoxychlor	72-43-5			
Total dust		.....	15	
2-Methoxyethanol; (Methyl cellosolve)…	109-86-4	25	80	X
2-Methoxyethyl acetate (Methyl cellosolve acetate)	110-49-6	25	120	X
Methyl acetate	79-20-9	200	610	
Methyl acetylene (Propyne)	74-99-7	1000	1650	
Methyl acetylene propadiene mixture (MAPP)		1000	1800	
Methyl acrylate	96-33-3	10	35	X
Methylal (Dimethoxy-methane)	109-87-5	1000	3100	
Methyl alcohol	67-56-1	200	260	
Methylamine	74-89-5	10	12	
Methyl amyl alcohol; see Methyl Isobutyl carbinol				
Methyl n-amyl ketone	110-43-0	100	465	
Methyl bromide	74-83-9	(C)20	(C)80	X
Methyl butyl ketone; see 2-Hexanone				
Methyl cellosolve; see 2-Methoxyethanol				
Methyl cellosolve acetate; see 2-Methoxyethyl acetate				
Methyl chloride	74-87-3		(2)	
Methyl chloroform (1,1,1-Trichloro-ethane)	71-55-6	350	1900	
Methylcyclohexane	108-87-2	500	2000	
Methylcyclohexanol	25639-42-3	100	470	
o-Methylcyclohexanone	583-60-8	100	460	X
Methylene chloride	75-09-2		(2)	
Methyl ethyl ketone (MEK); see 2-Butanone				
Methyl formate	107-31-3	100	250	
Methyl hydrazine (Monomethyl hydrazine)	60-34-4	(C)0.2	(C)0.35	X
Methyl iodide	74-88-4	5	28	X
Methyl isoamyl ketone	110-12-3	100	475	
Methyl isobutyl carbinol	108-11-2	25	100	X
Methyl isobutyl ketone; see Hexone				
Methyl isocyanate	624-83-9	0.02	0.05	X
Methyl mercaptan	74-93-1	(C)10	(C)20	
Methyl methacrylate	80-62-6	100	410	

Methyl propyl ketone; see 2-Pentanone				
alpha-Methyl styrene	98-83-9	(C)100	(C)480	
Methylene bisphenyl isocyanate (MDI)	101-68-8	(C)0.02	(C)0.2	
Mica; see Silicates				
Molybdenum (as Mo)	7439-98-7			
Soluble compounds		.....	5	
Insoluble Compounds Total dust		.....	15	
Monomethyl aniline	100-61-8	2	9	X
Monomethyl hydrazine; see Methyl hydrazine.				
Morpholine	110-91-8	20	70	X
Naphtha (Coal tar)	8030-30-6	100	400	
Naphthalene	91-20-3	10	50	
alpha-Naphthylamine; see 1910.1004	134-32-7			
beta-Naphthylamine; see 1910.1009	91-59-8			
Nickel carbonyl (as Ni)	13463-39-3	0.001	0.007	
Nickel, metal and insoluble compounds (as Ni)	7440-02-0	.....	1	
Nickel, soluble compounds (as Ni)	7440-02-0	.....	1	
Nicotine	54-11-5	.....	0.5	X
Nitric acid	7697-37-2	2	5	
Nitric oxide	10102-43-9	25	30	
p-Nitroaniline	100-01-6	1	6	X
Nitrobenzene	98-95-3	1	5	X
p-Nitrochlorobenzene	100-00-5	.....	1	X
4-Nitrodiphenyl; see 1910.1003	92-93-3			
Nitroethane	79-24-3	100	310	
Nitrogen dioxide	10102-44-0	(C)5	(C)9	
Nitrogen trifluoride	7783-54-2	10	29	
Nitroglycerin	55-63-0	(C)0.2	(C)2	X
Nitromethane	75-52-5	100	250	
1-Nitropropane	108-03-2	25	90	
2-Nitropropane	79-46-9	25	90	
N-Nitrosodimethylamine; see 1910.1016				
Nitrotoluene (all isomers)		5	30	X
o-isomer	88-72-2			
m-isomer	99-08-1			
p-isomer	99-99-0			
Nitrotrichloromethane; see Chloropicrin				
Octachloronaphthalene	2234-13-1	.....	0.1	X
Octane	111-65-9	500	2350	
Oil mist, mineral	8012-95-1	.....	5	
Osmium tetroxide (as Os)	20816-12-0	.....	0.002	
Oxalic acid	144-62-7	.....	1	

Oxygen difluoride.....	7783-41-7	0.05	0.1	
Ozone.....	10028-15-6	0.1	0.2	
Paraquat, respirable dust.....	4685-14-7 1910-42-5 2074-50-2	.....	0.5	X
Parathion.....	56-38-2	.....	0.1	X
Particulates not otherwise regulated (PNOR)(f).....				
Total dust.....		.....	15	
Respirable fraction…		.....	5	
PCB; see Chlorodiphenyl (42% and 54% chlorine).....				
Pentaborane.....	19624-22-7	0.005	0.01	
Pentachloronaphthalene.	1321-64-8	.....	0.5	X
Pentachlorophenol.....	87-86-5	.....	0.5	X
Pentaerythritol.....	115-77-5			
Total dust.....		.....	15	
Respirable fraction...		.....	5	
Pentane.....	109-66-0	1000	2950	
2-Pentanone (Methyl propyl ketone).....	107-87-9	200	700	
Perchloroethylene (Tetrachloroethylene)	127-18-4		(2)	
Perchloromethyl mercaptan.....	594-42-3	0.1	0.8	
Perchloryl fluoride....	7616-94-6	3	13.5	
Petroleum distillates (Naphtha)(Rubber Solvent).....		500	2000	
Phenol.....	108-95-2	5	19	X
p-Phenylene diamine....	106-50-3	.....	0.1	X
Phenyl ether, vapor....	101-84-8	1	7	
Phenyl ether-biphenyl mixture, vapor.....		1	7	
Phenylethylene; see Styrene.....				
Phenyl glycidyl ether (PGE).....	122-60-1	10	60	
Phenylhydrazine.....	100-63-0	5	22	X
Phosdrin (Mevinphos)...	7786-34-7	.....	0.1	X
Phosgene (Carbonyl chloride).....	75-44-5	0.1	0.4	
Phosphine.....	7803-51-2	0.3	0.4	
Phosphoric acid.....	7664-38-2	.....	1	
Phosphorus (yellow)....	7723-14-0	.....	0.1	
Phosphorus pentachloride.....	10026-13-8	.....	1	
Phosphorus pentasulfide	1314-80-3	.....	1	
Phosphorus trichloride.	7719-12-2	0.5	3	
Phthalic anhydride.....	85-44-9	2	12	
Picloram.....	1918-02-1			
Total dust.....		.....	15	
Respirable fraction…		.....	5	

Picric acid	88-89-1	.....	0.1	X
Pindone (2-Pivalyl-1, 3-indandione)	83-26-1	.....	0.1	
Plaster of paris	26499-65-0			
Total dust		.....	15	
Respirable fraction		.....	5	
Platinum (as Pt)	7440-06-4			
Metal		.....	.....	
Soluble Salts		.....	0.002	
Portland cement	65997-15-1			
Total dust		.....	15	
Respirable fraction		.....	5	
Propane	74-98-6	1000	1800	
beta-Propriolactone; see 1910.1013	57-57-8			
n-Propyl acetate	109-60-4	200	840	
n-Propyl alcohol	71-23-8	200	500	
n-Propyl nitrate	627-13-4	25	110	
Propylene dichloride	78-87-5	75	350	
Propylene imine	75-55-8	2	5	X
Propylene oxide	75-56-9	100	240	
Propyne; see Methyl acetylene				
Pyrethrum	8003-34-7	.....	5	
Pyridine	110-86-1	5	15	
Quinone	106-51-4	0.1	0.4	
RDX: see Cyclonite				
Rhodium (as Rh), metal fume and insoluble compounds	7440-16-6	.....	0.1	
Rhodium (as Rh), soluble compounds	7440-16-6	.....	0.001	
Ronnel	299-84-3	.....	15	
Rotenone	83-79-4	.....	5	
Rouge				
Total dust		.....	15	
Respirable fraction		.....	5	
Selenium compounds (as Se)	7782-49-2	.....	0.2	
Selenium hexafluoride (as Se)	7783-79-1	0.05	0.4	
Silica, amorphous, precipitated and gel.	112926-00-8		(3)	
Silica, amorphous, diatomaceous earth, containing less than 1% crystalline silica	61790-53-2		(3)	
Silica, crystalline cristobalite, respirable dust	14464-46-1		(3)	
Silica, crystalline quartz, respirable dust	14808-60-7		(3)	
Silica, crystalline tripoli (as quartz), respirable dust	1317-95-9		(3)	

Silica, crystalline tridymite, respirable dust	15468-32-3		(3)	
Silica, fused, respirable dust	60676-86-0		(3)	
Silicates (less than 1% crystalline silica)				
Mica (respirable dust)	12001-26-2		(3)	
Soapstone, total dust	.....		(3)	
Soapstone, respirable dust	.....		(3)	
Talc (containing asbestos): use asbestos limit: see 29 CFR 1910.1001			(3)	
Talc (containing no asbestos), respirable dust	14807-96-6		(3)	
Tremolite, asbestiform; see 1910.1001				
Silicon	7440-21-3			
Total dust		.....	15	
Respirable fraction…		.....	5	
Silicon carbide	409-21-2			
Total dust		.....	15	
Respirable fraction		.....	5	
Silver, metal and soluble compounds (as Ag)	7440-22-4	.....	0.01	
Soapstone; see Silicates				
Sodium fluoroacetate	62-74-8	.....	0.05	X
Sodium hydroxide	1310-73-2	.....	2	
Starch	9005-25-8			
Total dust		.....	15	
Respirable fraction…		.....	5	
Stibine	7803-52-3	0.1	0.5	
Stoddard solvent	8052-41-3	500	2900	
Strychnine	57-24-9	.....	0.15	
Styrene	100-42-5		(2)	
Sucrose	57-50-1			
Total dust		.....	15	
Respirable fraction		.....	5	
Sulfur dioxide	7446-09-5	5	13	
Sulfur hexafluoride	2551-62-4	1000	6000	
Sulfuric acid	7664-93-9	.....	1	
Sulfur monochloride	10025-67-9	1	6	
Sulfur pentafluoride	5714-22-7	0.025	0.25	
Sulfuryl fluoride	2699-79-8	5	20	
Systox; see Demeton				
2,4,5-T (2,4,5-tri-chlorophenoxyacetic acid)	93-76-5	.....	10	
Talc; see Silicates				

Tantalum, metal and oxide dust	7440-25-7	.....	5	
TEDP (Sulfotep)	3689-24-5	.....	0.2	X
Tellurium and compounds (as Te)	13494-80-9	.....	0.1	
Tellurium hexafluoride (as Te)	7783-80-4	0.02	0.2	
Temephos	3383-96-8			
Total dust		.....	15	
Respirable fraction		.....	5	
TEPP (Tetraethyl pyrophosphaate)	107-49-3	.....	0.05	X
Terphenylis	26140-60-3	(C)1	(C)9	
1,1,1,2-Tetrachloro-2, 2-difluoroethane	76-11-9	500	4170	
1,1,2,2-Tetrachloro-1, 2-difluoroethane	76-12-0	500	4170	
1,1,2,2-Tetrachloro-ethane	79-34-5	5	35	X
Tetrachoroethylene; see Perchloroethylene				
Tetrachloromethane; see Carbon tetrachloride.				
Tetrachloronaphthalene	1335-88-2	.....	2	X
Tetraethyl lead (as Pb)	78-00-2	.....	0.075	X
Tetrahydrofuran	109-99-9	200	590	
Tetramethyl lead, (as Pb)	75-74-1	.....	0.075	X
Tetramethyl succinonitrile	3333-52-6	0.5	3	X
Tetranitromethane	509-14-8	1	8	
Tetryl (2,4,6-Trinitro-phenylmethyl-nitramine)	479-45-8	.....	1.5	X
Thallium, soluble compounds (as Tl)	7440-28-0	.....	0.1	X
4,4'-Thiobis(6-tert, Butyl-m-cresol)	96-69-5			
Total dust		.....	15	
Respirable fraction		.....	5	
Thiram	137-26-8	.....	5	
Tin, inorganic compounds (except oxides) (as Sn)	7440-31-5	.....	2	
Tin, organic compounds (as Sn)	7440-31-5	.....	0.1	
Titanium dioxide	13463-67-7			
Total dust		.....	15	
Toluene	108-88-3		(2)	
Toluene-2, 4-diisocyanate (TDI)	584-84-9	(C)0.02	(C)0.14	
o-Toluidine	95-53-4	5	22	X
Toxaphene; see Chlorinated camphene.				
Tremolite; see Silicates				

Tributyl phosphate.....	126-73-8	.....	5	
1,1,1-Trichloroethane; see Methyl chloroform				
1,1,2-Trichloroethane..	79-00-5	10	45	X
Trichloroethylene.....	79-01-6		(2)	
Trichloromethane; see Chloroform				
Trichloronaphthalene...	1321-65-9	.....	5	X
1,2,3-Trichloropropane.	96-18-4	50	300	
1,1,2-Trichloro-1,2, 2-trifluoroethane....	76-13-1	1000	7600	
Triethylamine.....	121-44-8	25	100	
Trifluorobromomethane..	75-63-8	1000	6100	
2,4,6-Trinitrophenol; see Picric acid.....				
2,4,6-Trinitrophenyl-methyl nitramine; see Tetryl.....				
2,4,6-Trinitrotoluene (TNT).....	118-96-7	.....	1.5	X
Triorthocresyl phosphate.....	78-30-8	.....	0.1	
Triphenyl phosphate....	115-86-6	.....	3	
Turpentine.....	8006-64-2	100	560	
Uranium (as U).....	7440-61-1			
Soluble compounds....		.....	0.05	
Insoluble compounds..		.....	0.25	
Vanadium.....	1314-62-1			
Respirable dust (as V(2)O(5)).....		.....	(C)0.5	
Fume (as V(2)O(5))...		.....	(C)0.1	
Vegetable oil mist.....				
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Vinyl benzene; see Styrene.....				
Vinyl chloride; see 1910.1017.....	75-01-4			
Vinyl cyanide; see Acrylonitrile				
Vinyl toluene.....	25013-15-4	100	480	
Warfarin.....	81-81-2	.....	0.1	
Xylenes (o-, m-, p-isomers)..	1330-20-7	100	435	
Xylidine.....	1300-73-8	5	25	X
Yttrium.....	7440-65-5	.....	1	
Zinc chloride fume.....	7646-85-7	.....	1	
Zinc oxide fume.....	1314-13-2	.....	5	
Zinc oxide.....	1314-13-2			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Zinc stearate.....	557-05-1			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Zirconium compounds (as Zr).....	7440-67-7	.....	5	

Footnote(1) The PELs are 8-hour TWAs unless otherwise noted; a (C) designation denotes a ceiling limit. They are to be determined from breathing-zone air samples.
Footnote(a) Parts of vapor or gas per million parts of contaminated air by volume at 25 degrees C and 760 torr.
Footnote(b) Milligrams of substance per cubic meter of air. When entry is in this column only, the value is exact; when listed with a ppm entry, it is approximate.
Footnote(c) The CAS number is for information only. Enforcement is based on the substance name. For an entry covering more than one metal compound measured as the metal, the CAS number for the metal is given - not CAS numbers for the individual compounds.
Footnote(d) The final benzene standard in 1910.1028 applies to all occupational exposures to benzene except in some circumstances the distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures; for the excepted subsegments, the benzene limits in Table Z-2 apply. See 1910.1028 for specific circumstances.
Footnote(e) This 8-hour TWA applies to respirable dust as measured by a vertical elutriator cotton dust sampler or equivalent instrument. The time-weighted average applies to the cotton waste processing operations of waste recycling (sorting, blending, cleaning and willowing) and garnetting. See also 1910.1043 for cotton dust limits applicable to other sectors.
Footnote(f) All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the Particulates Not Otherwise Regulated (PNOR) limit which is the same as the inert or nuisance dust limit of Table Z-3.
Footnote(2) See Table Z-2.
Footnote(3) See Table Z-3
Footnote(4) Varies with compound.

[54 FR 36767, Sept. 5, 1989; 54 FR 41244, Oct. 6, 1989; 55 FR 3724, Feb. 5, 1990; 55 FR 12819, Apr 6, 1990; 55 FR 19259, May 9, 1990; 55 FR 46950, Nov. 8, 1990; 57 FR 29204, July 1, 1992; 57 FR 42388, Sept. 14, 1992; 58 FR 35340, June 30, 1993; 61 FR 56746, Nov. 4, 1996; 62 FR 42018, August 4, 1997]

OSHA Regulations (Standards - 29 CFR) - Table of Contents

Appendix VI-B
Regulations (Standards - 29 CFR)

TABLE Z-2 - 1910.1000TABLEZ-2

- **Standard Number:** 1910.1000TABLEZ-2
- **Standard Title:** TABLE Z-2
- **SubPart Number:** Z
- **SubPart Title:** Toxic and Hazardous Substances

TABLE Z-2

Substance	8-hour time weighted average	Acceptable ceiling concentration	Acceptable maximum peak above the acceptable ceiling concentration for an 8-hr shift	
			Concentration	Maximum duration
Benzene(a) (Z37.40-1969)	10 ppm	25 ppm	50 ppm	10 minutes.
Beryllium and beryllium compounds (Z37.29-1970)	2 ug/m(3)	5 ug/m(3)	25 ug/m(3)	30 minutes.
Cadmium fume(b) (Z37.5-1970)	0.1 mg/m(3)	0.3 mg/m(3)	.....	
Cadmium dust(b) (Z37.5-1970)	0.2 mg/m(3)	0.6 mg/m(3)		
Carbon disulfide (Z37.3-1968)	20 ppm	30 ppm	100 ppm	30 minutes.
Carbon tetrachloride (Z37.17-1967)	10 ppm	25 ppm	200 ppm	5 min. in any 4 hrs.
Chromic acid and chromates (Z37-7-1971)	.....	1 mg/10 m(3)		
Ethylene dibromide (Z37.31-1970)	20 ppm	30 ppm	50 ppm	5 minutes.
Ethylene dichloride (Z37.21-1969)	50 ppm	100 ppm	200 ppm	5 min. in any 3 hrs.
Fluoride as dust (Z37.28-1969)	2.5 mg/m(3)	.....	.....	
Formaldehyde: see 1910.1048	.....	.....	.....	

Hydrogen fluoride (Z37.28-1969)	3 ppm	.....	.....	
Hydrogen sulfide (Z37.2-1966)	.....	20 ppm	50 ppm	10 mins. once only if no other meas. exp. occurs.
Mercury (Z37.8-1971)	.....	1 mg/10m(3)	.....	
Methylene chloride (Z37.18-1969)	.....	.....	.....	
Methylene Chloride: see 1910.1052				
Organo (alkyl) mercury (Z37.30-1969)	0.01mg/m(3)	0.04 mg/m(3)	.....	
Styrene (Z37.15-1969)	100 ppm	200 ppm	600 ppm	5 mins. in any 3 hrs.
Tetrachloroethylene (Z37.22-1967)	100 ppm	200 ppm	300 ppm	5 mins. in any 3 hrs.
Toluene (Z37.12-1967)	200 ppm	300 ppm	500 ppm	10 minutes
Trichloroethylene (Z37.19-1967)	100 ppm	200 ppm	300 ppm	5 mins. in any 2 hrs.

Footnote(a) This standard applies to the industry segments exempt from the 1 ppm 8-hour TWA and 5 ppm STEL of the benzene standard at 1910.1028.

Footnote(b) This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.

[62 FR 42018, August 4, 1997]

APPENDIX VII

APPENDIX VII

ODOR AS AN AID TO CHEMICAL SAFETY*

CHEMICAL	TLV (PPM)	AOT (PPM)
ACETONE	750	13
AMMONIA	25	5.2
ARSINE	0.05	0.5
CARBON MONOXIDE	50	100,000
CHLORINE	1	0.31
CHLOROFORM	10	85
P-DICHLOROBENZENE	75	0.18
ETHYL ALCOHOL	1000	84
ETHYL ETHER	400	8.9
HYDROGEN SULFIDE	10	0.008
METHYL ALCOHOL	200	100
METHYLENE CHLORIDE	100	250
NAPHTHALENE	10	0.084
OZONE	0.1	0.045
PHENOL	5	0.04
TOLUENE	100	2.9
VINYL CHLORIDE	5	3000
M-XYLENE	100	1.1

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APPENDIX VIII

Laboratory Safety Compliance Checklist

Chemical Safety:

- Chemical inventory is posted
- MSDS are present and bound and staff is aware of the location
- All chemical containers are properly capped and labeled
- Chemicals are stored according to compatibility and hazard class
- All chemicals are stored properly in the designated storage area
- Liquid chemicals are not stored in excess of five feet in height
- Approved explosion-proof refrigerator is used if/when refrigerating flammable chemicals
- Flammable chemicals are stored in an approved flammable storage cabinet with self-closing doors (you can also use the cabinets under a fume hood if they have self closing doors that latch closed)
- Chemicals are being disposed according to University policy
- Satellite accumulation area for chemical waste is clearly defined in the laboratory
- Chemical waste containers are properly capped and labeled
- Annual chemical fume hood certification is current
- Chemical fume hoods are being used properly
- Secondary leak-proof containers are always used when transporting liquid chemicals

Hazard Communication:

- Hazard communication labels are present where needed (i.e. flammable, corrosive, toxic, biohazard)
- Principle Investigator's contact information is posted on the entrance door
- Laboratory Safety plans are present and visible (i.e. Chemical Hygiene Plan, Lab Compliance Packet, site-specific SOPs)

Personal Protection:

- Lab coats and proper eye protection are being worn
- Appropriate gloves are available and worn when handling hazardous chemicals or biological samples
- Eyewash station is present within 25 feet or 10 seconds of unobstructed path
- Eyewash station weekly inspection checklist is present and current
- Annual eyewash station certification is current
- Safety shower is present within 25 feet or 10 seconds of unobstructed path
- Annual safety shower certification is current
- Chemical spill materials are available
- Face protection is used when potential for body fluids or hazardous chemicals being splashed or splattered
- Utility gloves are worn when handling items at extreme temperatures (liquid nitrogen, -80 freezers, autoclaved items)
- No eating, drinking… policy is being followed
- Fire extinguisher is present in the lab

General Housekeeping:

- Bench tops and clean and uncluttered
- Isles are maintained clear and unobstructed
- Compressed gas tanks are always secured in the upright position

Biological Safety:

- Biohazard labels are present where potentially infectious materials are being used or stored (i.e. entrance door, BSC, incubators, etc.)
- A hand washing sink is readily available
- Policies for the safe handling of sharps, such as needles, scalpels, pipettes, and broken glassware are developed and implemented
- All sharps are properly disposed in a puncture-proof biohazard sharps container
- Appropriate disinfectant (i.e. 10 bleach, 70% ethanol, etc.) is used for surface decontamination at the end of each procedure or immediately following a spill
- All biohazard waste is properly disposed in the infectious waste containers
- All potentially infectious specimens are placed in a labeled secondary leak-proof container when transported
- Annual biological safety cabinet certification is current and being used properly
- Personnel are familiar with procedures to follow in the event of an exposure when handling potentially infectious materials
- Universal precautions are being observed
- Gloves are worn to protect hands from exposure to hazardous materials
- Laboratory coats and gloves are removed and left in the laboratory before leaving for non-laboratory areas
- All procedures are performed to minimize the creation of splashes and/or aerosols
- Eye and face protection (i.e. goggles, mask, face shield or other shield) is used for procedures creating potential splashes or sprays of infectious materials
- No eating, drinking, smoking, handling contact lenses, applying cosmetics, and storing food or drinks for human consumption in the laboratory
- All personnel handling human blood, body fluids, or tissues have completed:
    1. Hepatitis B vaccination or signed waiver declining vaccination
    2. Site-specific exposure control plan
    3. Bloodborne pathogens training
- The laboratory director ensures that lab support personnel receive appropriate training on the potential hazards associated with the work involved and the necessary precautions to prevent exposures
- If your lab is ever shipping biological materials to other institutions (i.e. through UPS or FedEx), all personnel have completed appropriate IATA shipping training (every 2 years)

Training:

- All personnel have completed the appropriate online safety training modules on the Department of Environmental Health and Safety website at http://www.drexel.edu/facilities/healthSafety/ by clicking on the "Safety Training" or by going directly to the training site at http://www.drexelehstraining.com/.

*** If you have any questions, contact the Department of Environmental Health and Safety at 215-895-5919**

LABORATORY AUDITS

Lab Audits are performed by the Department of Environmental Health and Safety twice a year to assist lab personnel in maintaining laboratory compliance. Principle investigators (P.I.'s) and department heads are notified before the lab audits are scheduled to start via e-mail. The principle investigators and/or their lab personnel are given the option to schedule the audit with the auditor in order to be present to discuss any unacceptable issues that may arise. Otherwise the lab audits will proceed at the auditor's discretion.

Lab Audit Summary Reports are sent to the principle investigator, or other responsible party, usually within 48 hours of the audit. Depending on the severity of the unacceptable issue, the lab personnel have between 30 to 90 days to address any unacceptable issue raised in the summary report. Lab personnel should inform the Department of Environmental Health and Safety when and how any unacceptable issues are addressed. Follow-up letters and/or inspection will be performed by the Department of Environmental Health and Safety to inquire on the status of any unacceptable issues.

The Department of Environmental Health and Safety must be notified of any new laboratories, vacating or moving labs, or changes in principle investigators before any changes are made.

Vacant, shared, or departmental laboratories are the responsibility of the Department Head. Where possible, shared labs will have audit summary reports sent to the individual P.I.'s covering their respective work areas and common areas. Otherwise, any Lab Audit Summary Reports generated for these rooms will be sent to the department head, unless the Department of Environmental Health and Safety is otherwise notified. Any lab audit report for a laboratory where the P.I. is unknown will be sent to the department head.

At any time, the Department of Environmental Health and Safety may enter into a laboratory for an impromptu survey or inspection. If sensitive experiments are in progress and cannot be disturbed, place a notice on all lab entrance doors. The principle investigator and any present lab personnel will be notified of any unacceptable issues observed.

APPENDIX IX

EYEWASH WEEKLY
INSPECTION CHECK LIST

Directions for Inspection:

1. Flush eyewash for 5 to 10 seconds. The eyewash does not need to be run at full strength.
2. If water does not flow from heads or any other problem occurs (i.e. unit does not shut off; broken handle; etc.) then contact the University Department of Safety and Health.
3. Print and post this inspection checklist next to your eyewash for appropriate documentation.

JANUARY	OK or Not OK	Tester Initials	JULY	OK or Not OK	Tester Initials
Week 1			Week 1		
Week 2			Week 2		
Week 3			Week 3		
Week 4			Week 4		
FEBRUARY	**OK or Not OK**	**Tester Initials**	**AUGUST**	**OK or Not OK**	**Tester Initials**
Week 1			Week 1		
Week 2			Week 2		
Week 3			Week 3		
Week 4			Week 4		
MARCH	**OK or Not OK**	**Tester Initials**	**SEPTEMBER**	**OK or Not OK**	**Tester Initials**
Week 1			Week 1		
Week 2			Week 2		
Week 3			Week 3		
Week 4			Week 4		
APRIL	**OK or Not OK**	**Tester Initials**	**OCTOBER**	**OK or Not OK**	**Tester Initials**
Week 1			Week 1		
Week 2			Week 2		
Week 3			Week 3		
Week 4			Week 4		
MAY	**OK or Not OK**	**Tester Initials**	**NOVEMBER**	**OK or Not OK**	**Tester Initials**
Week 1			Week 1		
Week 2			Week 2		
Week 3			Week 3		
Week 4			Week 4		
JUNE	**OK or Not OK**	**Tester Initials**	**DECEMBER**	**OK or Not OK**	**Tester Initials**
Week 1			Week 1		
Week 2			Week 2		
Week 3			Week 3		
Week 4			Week 4		

APPENDIX X

Appendix X

Drexel University
Department of Environmental Health and Safety

Phone (215) 895-5907
Fax (215) 895-5926

Chemical Pick-Up Request / Chain of Custody

Dept. _____
Location _____ Page _____ of _____

Floor _____ Room # _____
Phone _____

Chemical / Product Name	Hazard Classification	Container Type	Number Of Containers	Total Quantity

Released By

Print _____
Sign _____
Fax _____ Date _____

Transport to Temporary Storage By

Print _____
Sign _____
Fax _____ Date _____

Received at Temporary Storage By

Print _____
Sign _____
Fax _____ Date _____

Released from Temporary Storage By

Print _____
Sign _____
Fax _____ Date _____

It is recommended by the Department of Environmental Health and Safety to use our online Chemical Pick-Up Request on our web page, http://www.drexel.edu/facilities/healthSafety/. This form is located under the heading "Service Request & Forms." Fill out the required information and submit the request.

Fax the Department of Environmental Health and Safety a copy of the above form ONLY if the web page is unavailable.