

# Appendix E: Particularly Hazardous Substances

Exposure to harmful chemicals can result in local toxic effects, systemic toxic effects, or both. Local effects involve injury at the site of first contact, for example skin, nose, and respiratory tract. Systemic effects, however, occur after the substance has been absorbed into the bloodstream and distributed throughout the body. Some terms are critical to understanding health effects and information from documents such as Materials Safety Data Sheets. For example, the term “acute exposure” refers to a local or systemic effect from a single exposure while the term “chronic exposure” refers to repeated or long-duration exposures.

<p><b>Irritant:</b> Non-corrosive chemical that causes reversible inflammatory effects (redness and swelling) on living tissue by chemical action at the site of contact.</p>		
Acrylamide Acetic anhydride	Formaldehyde Propylamine	Peracetic Acid Ozone
<p><b>Corrosive:</b> Chemical that causes destruction of living tissue by chemical action at the site of contact. These can be solids, liquids, or gases.</p>		
Sodium hydroxide Nitric acid	Perchloric acid Hydrochloric acid	Trifluoroacetic acid (TFA) Hydrofluoric acid
<p><b>Allergen:</b> A chemical that causes an adverse reaction by the immune system to a chemical resulting from a previous sensitization to that chemical or a structurally similar chemical. Once sensitization occurs, allergic reactions can result from exposure to extremely low doses of the chemical. Symptoms often include red, itchy, swollen skin or eyes, or difficulty breathing.</p>		
Formaldehyde	Latex	Toluene diisocyanate
<p><b>Asphyxiant:</b> A chemical that interferes with the transport of oxygen to the vital organs of the body leading to rapid collapse and death. Some asphyxiants simply displace oxygen in the air while others interact with hemoglobin in the blood to reduce the capacity of blood to carry oxygen.</p>		
Nitrogen	Carbon monoxide	Halon
<p><b>Neurotoxin:</b> A chemical that adversely affects the structure or function of the central and/or peripheral nervous system. Effects can be reversible or permanent. Confusion, slurred speech, and staggered gait are common symptoms of overexposure.</p>		
Acrylamide Hexane	Dimethyl mercury	Phenol
<p><b>Target Organ Toxin:</b> Chemical that causes adverse effects to organs other than the reproductive or neurological systems. These organs typically include the liver, kidneys, blood producing organs, and lungs.</p>		
Acrylonitrile Benzene	Carbon tetrachloride	Phenol
<p><b>Highly Flammable Substances</b> A gas, liquid, or solid that readily catches fire and burns in air. A highly flammable substance has a flash point of less than room temperature. (<i>The flashpoint is the lowest temperature at which a liquid has a sufficient vapor pressure to form an ignitable mixture with air near the surface of the liquid.</i>)</p>		
Acetone (-18°C) Benzene (-11.1°C)	Diethyl ether (-45°C) Tetrahydrofuran (-14°C)	Acetaldehyde (-37.8°C) Potassium hydride ( <i>ignites on contact with moist air</i> )

## OSHA’s Definition of “Hazardous Substance”

OSHA defines “hazardous substance” as “a chemical for which there is statistically significant evidence based on at least one study, conducted in accordance with established scientific principals, that acute or chronic health effects may occur in exposed employees”. Classifications of “health hazards” include carcinogens, sensitizers, hepatotoxins (liver), nephrotoxins (kidneys), neurotoxins (CNS), hematopoietic toxins (blood), reproductive toxins (mutagens, teratogens), and agents which damage the lungs, skin, eyes, or mucous membranes.

## Particularly Hazardous Substances

OSHA’s Laboratory Standard states that the employer must make “provisions for additional employee protection for work with “particularly hazardous substances”.

1. Establishment of a designated area;
2. Use of containment devices such as fume hoods or glove boxes;
3. Procedures for safe removal of contaminated waste; and
4. Decontamination procedures.

These chemicals include select carcinogens, reproductive toxins, and substances with a high degree of acute toxicity. But, according to “Prudent Practices in the Laboratory” (page 41), “in some circumstances, it may not be necessary to employ all of these special precautions, such as when the total amount of an acutely toxic substance to be handled is a small fraction of the harmful dose.” **Review the individual MSDS for toxicity information.**

<p><b>Select Carcinogens:</b> A chemical that is capable of causing cancer, or the uncontrolled growth of cells. Often there is no immediately apparent harmful effect upon exposure.</p> <p>Chemicals that are known to pose the greatest carcinogenic hazard are referred to as “select carcinogens” and must be handled as “particularly hazardous substances”. A select carcinogen is defined in the OSHA Laboratory Standard as a substance that meets one of the following criteria.</p> <ol style="list-style-type: none"> <li>1. It is regulated by OSHA as a carcinogen in 29 CFR 1910, Subpart Z, Toxic and Hazardous Substances.</li> <li>2. It is listed as “known to be a carcinogen” in the latest Annual Report on Carcinogens issued by the National Toxicology Program.</li> <li>3. International Agency for Research on Cancer (IARC), “Monographs” <ul style="list-style-type: none"> <li>o Group 1 – carcinogenic to humans</li> <li>o Group 2A – probably carcinogenic to humans</li> <li>o Group 2B – possibly carcinogenic to humans</li> <li>o Reasonably anticipated to be a carcinogen by the National Toxicology Program AND causes statistically significant tumor incidence in experimental animals.</li> </ul> </li> </ol>	<p>2-Acetylaminofluorene Acrylamide Acrylonitrile Aflatoxins 4-Aminobiphenyl Arsenic (<i>and certain arsenic compounds</i>) Asbestos Azathioprine Barium chromate Benzene Benzidine Bis(chloromethyl) ether Chloroethyl methyl ether 1,4-Butanediol dimethylsulfonate Chlorambucil Chromium (<i>and compounds</i>) Cyclophosphamide 1,2-Dibromo-3-chloropropane 3,3'-Dichlorobenzidine (<i>and its salts</i>) Diethylstilbestrol 4-Dimethylaminoazobenzene</p>	<p>Dimethyl sulfate Ethylene dibromide Ethylene oxide Ehtylenamine Formaldehyde Hexamethylphosphoramide Hydrazine Melphalan 4,4'-Methylene-bis[2-chloroaniline]Mustard gas N,N-Bis(2-chloroethyl)-2-naphthylamine Nampthylamine (α and β) Nickel carbonyl 4-Nitrobiphenyl N-Nitrosodimethylamine β-Propiolactone Thorium dioxide Treosulfan Vinyl chloride</p>
<p><b>Reproductive Toxins:</b> A chemical that affects reproductive capabilities, including chromosomal damage (mutations) and effects on fetuses (teratogenesis)</p>	<p>Arsenic (<i>and certain of its compounds</i>) Benzene Carbon disulfide Cadmium (<i>and certain compounds</i>) Toluene Xylene</p>	<p>Ethidium bromide Ethylene glycol monomethyl Ethyl ethers Ethylene oxide Ethylene dibromide Lead compounds Vinyl chloride</p>
<p><b>High Level Acute Toxins</b> Chemicals that can cause extremely harmful effects after a single exposure. “Prudent Practices in the Laboratory” indicates that substances with a toxicity rating of “highly toxic” or “extremely toxic”, based on an animal oral LD<sub>50</sub> of 50 mg per kg (or less), are considered to have a high level of acute toxicity. (See Table 3.2 on page 42 of Prudent Practices for details.)</p>	<p>Acrolein Arsine Chlorine Diazomethane Diborane (gas) Hydrogen cyanide Hydrogen fluoride Methyl fluorosulfonate</p>	<p>Nickel carbonyl Nitrogen dioxide Osmium tetroxide Ozone Phosgene Sodium azide Sodium cyanide (<i>and other cyanide salts</i>) Hydrofluoric acid</p>