

Hazard Type	Biohazards	Carcinogens	Chemical Storage	Compressed Gases
Definition & Examples	Organisms or their products that may cause harm to humans or animals. Example: disease-causing microorganisms. <i>Immuno-compromised individuals (who lack resistance to infection) may be at an increased risk of health effects from biohazards. These people should discuss their condition with their supervisor so that, if appropriate, additional precautions would be followed.</i>	Chemicals that cause malignant tumors, or other forms of cancer. Examples: some organic compounds (anthracene, aflatoxin), some solvents (chloroform, benzene), and some metals (hexavalent chromium).	Storage of material that is not in use, excluding the hazard classes of flammable gases, flammable liquids, oxidizers, poison inhalation hazards, and water reactives, which are considered separately.	Containers of compressed, liquified, or solidified gases which pose a risk of asphyxiation, and/or the risk of rapid freezing of tissue. Examples: Compressed oxygen, liquid nitrogen, and dry ice (solid carbon dioxide). <i>Flammable and highly toxic gases (poison inhalation hazards) are excluded from this category, and are considered separately.</i>
Risk Level Low	Microbiology lab using microorganisms that do not cause disease in healthy adults. Examples: <i>E. Coli</i> bacteria, yeast “Biosafety Level 1”	Occasional use of small amounts or dilute solutions. Example: Entomology lab using small quantities of dilute formaldehyde/water solutions to preserve specimens.	Storage of small quantities of chemicals. Storage where the amount on hand would not cause a fire or serious health hazard if it came into accidental contact with water. No storage of poison inhalation hazards. Example: chemical storage in a teaching lab.	Use where a) the release rate of the gas can be controlled and b) the area is well ventilated and air is not recirculated. Example: Gas cylinder with regulator used in a well ventilated laboratory where air is exhausted by fume hoods that vent to the roof.
Moderate	Organisms that can cause moderate to serious illness in healthy adults. Infections seldom occur via inhalation unless the organism is dispersed into the air as an aerosol. Infections readily occur from needle sticks or accidental contact with mucous membranes such as eyes and mouth. Ex: <i>Salmonella</i> bacteria, hepatitis B. “Biosafety Level 2”	Routine use of material in pure form, such as acrylamide powder or diaminobenzidine (DAB), or use of several liters per week of carcinogenic solvents, such as phenol/chloroform extraction procedures.	Storage of hundreds of chemical containers. Minimal amounts of air or water reactive material, unstable or incompatible chemicals, or compressed or liquefied gases. Example: chemical inventory of a large research group.	(1) Use of compressed gas with a low, well controlled flow rate in a area with poor ventilation or (2) the use of a container or gas supply system that could cause the sudden release of a large amount of gas.
High	Organisms that can cause serious illness or death in healthy adults. Exposure by inhalation is a risk from any sort of handling procedures or from spills or contaminated waste. Infections also readily occur from needle sticks or accidental contact with mucous membranes such as eyes and mouth. Example: the bacteria that cause TB. “Biosafety Levels 3 and 4”.	Routine use of larger quantities of carcinogenic material where the risk of exposure is high because the material can be absorbed through skin or inhaled. Example: veterinary embalming facility	Chemical stockrooms, large quantities of hazardous materials, including 55 gallon drums. Storage of significant amounts of air or water reactive material, unstable or incompatible chemicals, and/or compressed or liquefied gases.	Use of any compressed gases, including solidified or liquified gases, in small un-ventilated space. Example: Use of liquid nitrogen or dry ice in a cold room or environmental chamber. (Note: This applies to rooms/chambers with circulating fans. They do not supply fresh air.)

Hazard Type	Corrosives	Electrical Hazards	Explosive Materials	Flammable Gases
Definition & Examples	Any material that irritates or destructively attacks body tissues such as skin. Corrosive chemicals are typically acids such as hydrochloric acid and sulfuric acid, and bases such as sodium hydroxide and ammonium hydroxide.	A situation where a person could be injured through contact with an energized electrical conductor. The degree of hazard depends on the type of contact (wet vs. dry, small area vs. large area), the voltage of the conductor, and the shock protection designed into the system (such as ground fault interruption -GFI).	A chemical compound, usually containing nitrogen, that detonates as a result of shock or heat. Examples: trinitrotoluene (dynamite) and ammonium nitrate. Wetted explosives are Flammable Solids because they ignite easily at low temperatures. <i>For extensive information about the potential for a compound to detonate or react to form an explosive mixture, consult <u>Bretherick's Handbook of Reactive Chemical Hazards</u>.</i>	Gases that ignite easily and burn rapidly. Common flammable gases are hydrogen, carbon monoxide, and acetylene.
Risk Level Low	Routine use of dilute acid and base solutions, infrequent use of concentrated acids and bases. Example: undergraduate teaching laboratory	Use of only new, grounded, commercially available electrical devices. GFI circuits in wet areas.	Work that involves amounts that can not produce a harmful explosion or use of the material in form that is not explosive. Example: histology lab using picric acid solution as a stain.	Use of small individual low-pressure containers or piped supply systems. Example: aerosol can of spray paint with a flammable gas as a propellant.
Moderate	Routine use of a variety of strong acids and bases in concentrated form. Example: average chemistry laboratory	Use of old electrical devices which are not grounded. Work in dry areas that involves the construction or modification of equipment that operates at 24 volts or above.	Work that involves amounts that <i>can</i> produce a harmful explosion but use is limited to forms, such as aqueous solutions, that are not explosive. Example: Bouin's fixative	Routine use of large high-pressure flammable gas cylinders. Use and storage of up to five large, high pressure cylinders of flammable gases.
High	Labs with large quantities (more than 10 gallons) of concentrated mineral acids or bases in frequent use, and benchtop use of acid baths with acid concentrations of greater than 6 molar. Example: Kjeldahl extraction laboratory	Work that involves construction or modification of equipment that operates at 120 volts or above. Any area with electrical equipment under wet conditions, unless protected by GFI.	Use of explosive compounds, in quantities that <i>can</i> produce a harmful explosion, in procedures that could produce a form that <i>is</i> explosive. Examples: refluxing diethyl ether (potentially concentrating peroxides), drying of picric acid.	Daily use of several large high pressure cylinders of flammable gas. Use and storage of 6 or more cylinders in a laboratory. Use or storage of propane cylinders greater than 1.5 pounds.

Hazard Type	Flammable Liquids	Flammable Solids/Air Reactives/Pyrophorics	Lasers	Oxidizers
Definition & Examples	Liquids that ignite easily and burn rapidly, and have a flash point less than 100F (37.7C). Examples: 95% ethanol, ether, hexane, acetone, and ethyl acetate	(1) Solids that ignite easily at low temperatures such as metal hydrides, some organic solids, and wetted explosives. Examples: lithium hydride, nitronaphthalene, wetted dinitrophenol. (2) Any liquid or solid that ignites spontaneously in air. Examples: phosphorus, tributylaluminum (liquid); titanium dichloride, many fine metal powders (3) Materials that are spontaneously flammable in moist air because they react with water. Examples: sodium, lithium hydride, butyllithium.	Equipment that emits energy as a beam of electromagnetic radiation. Some laser beams are visible light that can be seen when they are present. Some lasers emit infra-red or ultraviolet radiation that is invisible. Medium and high intensity lasers can cause serious eye damage. High intensity lasers can also burn skin and can ignite combustible materials.	Compounds that readily provide oxygen to support combustion. Oxidizers can initiate a fire as well as cause other materials to burn much more intensely than normal. Examples: peroxides, chlorates, perchlorates, nitrates, and permanganates
Risk Level Low	Daily use of small quantities. Example: microbiology lab using alcohol for wiping bench tops.	Infrequent use of small quantities under conditions known to be controllable. Example: undergraduate teaching lab burning small pieces of magnesium ribbon to demonstrate oxidation.	Only class I or II lasers are in use. Beams from class I and II lasers are always visible. There is no risk of injury unless an individual looks directly into the beam for an extended period of time. Example: HeNe lasers pointers used in classrooms	Infrequent use of small quantities under conditions known to be controllable. Example: teaching lab using 10% hydrogen peroxide in an experiment
Moderate	Routine use of highly volatile solvents in moderate quantities, away from ignition sources or the storage of up to 50 gallons. Examples: solvent extractions, refluxing or solvent distillation.	Routine use of moderate quantities of flammable solids or air reactive/ pyrophoric materials.	Class III laser is in use. Momentary viewing of the direct beam, or a beam reflected from a mirror-like surface, may produce serious eye injury. Beams may not be visible.	Routine use and storage of moderate quantities of oxidizers. Example: chromic acid bath used to clean glassware.
High	(1) Routine use of large quantities (2) any work with flammable liquids near an open flame or at elevated temperatures.	Routine use of large quantities of flammable solids or air reactive/ pyrophoric materials.	Class IV laser is in use. Viewing of the direct beam and viewing of any type of reflection is likely to cause serious eye injury. Beams can cause skin burns. Beams can cause materials to burn and/or release hazardous materials to the air.	Routine use and storage of large quantities of strong oxidizers Examples: hot perchloric acid digestion, fertilizer storage areas.

Hazard Type	Poisonous Gases (Poison Inhalation Hazards)	Poisonous Liquids and Solids	Ionizing Radiation	Water Reactive
Definition & Examples	Highly toxic materials that are easily inhaled (gases, or liquids that have a high vapor pressure). Examples: chlorine, ethyl chloroformate, and phosgene.	Any substance which, in small quantities, can cause serious illness or death. Examples: arsenic, lead, and pesticides that block nerve transmission. <i>For extensive information about poisons, consult <u>Prudent Practices in the Laboratory</u> published by the National Research Council.</i>	Energy emitted from radioactive materials (alpha, beta, gamma radiation) or emitted by radiation producing equipment (X-rays) that can cause chemical changes in living cells that may result in immediate injury or an increased risk of cancer.	Materials that react, sometimes violently, on contact with water, releasing heat. Flammable or toxic gases may also be released. Examples: sodium metal, sodium amide, and lithium aluminum hydride.
Risk Level Low	None — Because of the toxicity, all use or storage of this material results in a moderate or high hazard level.	Use and storage of materials for which the lethal dose is more than an ounce (LD50 more than 500mg per kilogram) and that are not readily absorbed through the skin Examples: methyl ethyl ketone, acetaldehyde, benzoic acid, methanol, hexane	Locations where an individual could not receive a harmful exposure to ionizing radiation under any circumstances. Example: 1) laboratory where the total amount of radioactive material is less than the annual limit of intake for a radiation worker or 2) an X-ray diffraction unit that is entirely enclosed by shielding	Infrequent use of small quantities under conditions known to be controllable. Storage where the amount on hand would not cause a fire or serious health hazard if it came into accidental contact with water. Example: Demonstration of hydrogen production using sodium in a teaching laboratory.
Moderate	Any use or storage of liquid poison inhalation hazards. Examples: silicon tetrachloride , trimethyl gallium	Use and storage of materials for which the lethal dose is between an ounce and a teaspoon (LD50 between 50 to 500 mg per kilogram) OR less toxic compounds which can be absorbed through the skin Examples: pyridine (skin absorbed), phenol (skin absorbed), butylamine, coomassie blue, guanidine hydrochloride, zinc chloride	Locations where an individual will not receive a harmful exposure if basic precautions are followed. Example: use of several millicuries of radioactive material that emit gamma or high energy beta radiation that requires shielding.	Routine use of small quantities under conditions known to be controllable. The amount on hand could cause a fire or serious health hazard if it came into accidental contact with water. Example: an organic synthesis laboratory drying organic solvents using sodium metal
High	Any use or storage of a gaseous poison inhalation hazard. Examples: an ethylene oxide gas sterilizer, chlorine, phosphorus pentafluoride, vinyl chloride	Use and storage of materials for which the lethal dose is less than a teaspoon (LD50 less than 50mg per kilogram). Examples: sodium cyanide, osmium tetroxide, sodium azide, heptafluorobutyric acid	Locations where an individual could receive a harmful exposure to radiation unless appropriate precautions are followed. Example: use of sealed sources that contain curie amounts of radioactive material.	Use of large quantities or use in new or original procedures that do not have a history of predictable results.