



Delaware State University

University Area(s) Responsible: Office of Enterprise Risk Management

Policy Number & Name: 7-31: Hazardous Materials Handling and Storage

Approval Date: 1/30/2013

Revisions: _____

Reviewed: _____

Related Policies & Procedures: 7-16 Hazardous Waste Materials Disposal, 7-29 Personal Protective Equipment(PPE) & Hazard Assessment & Selection Program

I. Purpose

The purpose of this policy is to protect employees from risk of injury, illness or exposure to hazardous material and to minimize the handling of such materials by University personnel by providing guidance on the safe and proper storage and handling of Hazardous Materials.

This document does not cover all regulatory requirements concerning the handling and storage of hazardous materials. More information is available in the references listed below. Contact the DSU Office of Enterprise Risk Management at 302-857-6293 for help in accessing these references.

II. Scope

This policy applies to all Delaware State University (DSU) personnel including faculty, staff and student-employees whose duties may expose them to hazardous waste material.

III. Definitions:

Acute conditions – conditions that develop soon after exposure to hazardous materials and include burns, rashes, respiratory distress, convulsions, and possibly even death.

Chronic conditions - conditions that develop after long term exposure to hazardous materials and include cancers, nervous system disorders, and damage to other organ systems.

Harmful physical effects - fire, sudden release of pressure, explosion, and other violent reactions.

Harmful health effects - acute conditions and chronic conditions.

Hazardous material - is a material which is capable of producing harmful physical or health effects.

Classification of a Hazardous Material

- **Flammable liquid** - any liquid having a flash point below 100⁰F (37.8⁰C); i.e., at 100⁰F or less the Combustible liquid- any liquid having a flash point between 100 and 200⁰F (37.8-93.3⁰C). liquid produces enough vapors to ignite if exposed to an ignition source.
- **Flammable solid** - a substance that can cause a fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, will burn so vigorously that it creates a hazard.
- **Oxidizer** - a substance that readily yields oxygen or other electron acceptor to stimulate the combustion of organic matter (fuel).
- **Corrosive** - a liquid that corrodes steel (SAE 1020) at a rate greater than 6.35 mm (0.250 in.) at a test temperature of 130⁰F (55⁰C) or has a pH less than 2 or greater than 12.5.
- **Organic Peroxide** - an organic compound containing the chemical bond -O-O- (oxygen joined to oxygen).
- **Poison** - a substance so toxic that it presents a risk to life or health.
- **Explosive**- any chemical compound, mixture or device that reacts or decomposes with substantial instantaneous release of gas and heat.
- **Compressed Gas** - a substance in gas or liquid form contained in a vessel under pressure. This includes cylinders, lecture bottles, and aerosol cans. These substances may be flammable, non-flammable, or poisonous.
- **Cryogenics** - substances which are extremely cold such as liquid nitrogen, liquid helium and dry ice. These substances may also become asphyxiation hazards if spilled in non-ventilated areas.
- **Radioactive** - any material having a specific activity greater than 0.002 microcuries per gram (uCi/g).
- **Biomedical** - tissues, organs, and blood from humans and primates. Syringes, needles, sharps, and other objects containing materials above.

IV. Policy & Procedure

A. Storage

Hazardous materials must be stored based on their compatibility.

Materials of the same hazard together i.e. flammables with flammables and oxidizers with oxidizers should be stored together.

Incompatible materials must not be stored such that they may come in contact with each other.

Hazardous substances should be stored in an orderly manner with older products most accessible and the newer products least accessible.

Good housekeeping must be practiced in areas where hazardous products are stored.

All hazardous materials must be properly labeled including their exact contents, hazardous properties, date of receipt, and if appropriate, date of expiration.

Hazardous substances should be stored in original containers in which they were packaged at the manufacturing plant. (If this is not practical, these products should be transferred according to manufacturers' recommendations into containers that are constructed to withstand the effects of the product over the maximum storage time.)

Information regarding incompatible materials is summarized in **Appendix 1** of this policy.

B. Handling

University personnel working with hazardous materials must receive Hazard Communication Training, also known as "Right-To-Know Training". After performing a hazard assessment and determining hazards are present the supervisors must provide general hazard communication training; however, supervisors must train subordinates about specific hazards in their areas and provide appropriate personal protective equipment training.

Other training may be required as dictated by Federal and State regulations. Training sessions for Laboratory Safety, and Hazardous Waste Disposal are offered by DSU and the Office of ERM as well.

C. Protective Measures

Engineering controls must be used to reduce employee exposures to hazardous materials. The two most common engineering controls are the use of local exhaust and general ventilation.

When engineering controls fail to adequately reduce hazards, other personal protective equipment is required. Examples of personal protective equipment include: safety glasses, hearing protection, gloves, respirators, etc. (See Enterprise Risk Management policy: 7-29 PPE & Hazard Assessment and Selection Program for more information.)

Personal protection devices must be provided and worn in accordance with the manufacturer's recommendations indicated on the label of the product or as stated in the Material Safety Data Sheet for the product.

Consult the MSDS for any chemical to which someone has been exposed, even if no immediate injury is apparent.

D. Spill Procedures

Each unit that may have to deal with hazardous chemical spills must have a Work Place Hazard Assessment per DSU Policy 7-29 Personal Protective Equipment(PPE) and Hazard Assessment and Selection Program and per OSHA's 29 CF9 1910.132.

The following general procedures may be used, but should be tailored to the individual needs of the handlers and the specific hazard associated with the hazardous material.

- If the spilled material is flammable, turn off ignition and heat sources.
- Attend to any person who may have been contaminated (see First Aid).
- Notify individuals in the area about the spill.
- Evacuate nonessential personnel.
- Avoid breathing vapors of spilled material. Establish an exhaust or ventilation, if it is safe to do so. Air handling units are not to be used because they re-circulate the hazardous vapors. Contact EH&S for information about the proper ventilation or exhaust required.
- If a spill is relatively large, or involves a highly toxic material, a carcinogen or flammable material, contact EH&S and University Police for assistance in cleaning up the spill and disposing of the hazardous waste resulting from the cleanup.

E. First Aid Procedures

Eye Contact: If a chemical has been splashed into the eyes, immediately wash the eye and inner surface of the eyelid with copious amounts of water for 15 minutes. Check for and remove any contact lenses at once. Seek medical attention immediately.

Ingestion: Consult MSDS, a chemical first aid manual or call the Poison Control Information Center at 1-800-282-3171. Follow directions and seek medical attention immediately.

Minor Skin Contact: Promptly flush the affected area with water and remove any contaminated clothing. If symptoms persist after washing, seek medical attention.

Major Skin Contact: If chemicals have been spilled over a large area of the body, quickly remove all contaminated clothing while using the shower. Repeat if pain returns. Wash off chemicals by using a mild detergent or soap and water, do not neutralize chemicals or apply salves. Seek medical attention immediately.

Fire: Help the individual to the floor and roll him around to smother the flames. If a safety shower is immediately available, douse the person with water; running to a remote shower will only fan the flame. Fire blankets are primarily used as a first aid measure for prevention of shock rather than against smoldering or burning clothing. A fire blanket may direct flames toward the face.

Remember that for some chemicals, such as hydrofluoric acid, effects resulting from exposure may not become apparent until hours or days later. Consult the MSDS for any chemical to which someone has been exposed, even if no immediate injury is apparent.

F. Disposal of Hazardous Materials

The disposal of most hazardous materials is strictly regulated by federal law. Do not dispose of any hazardous material in the sewer, on the ground or in the trash. See Enterprise Risk Management Policy 7-16 Hazardous Waste Materials Disposal for further instructions.

G. Receiving Toxic and Hazardous Materials

Hazardous Materials are not to be shipped to or from Central Receiving. All shipments of hazardous materials are to be delivered directly to the facility or department that placed the order. The facility or department placing the order is responsible for annotation on the purchase requisitions the nature and toxicity of the chemicals being ordered to ensure appropriate delivery. Campus delivery personnel are not permitted to transport hazardous materials on campus unless they have been certified to do so by Risk and Safety Management.

Upon receipt of the deliver all toxic and hazardous materials are to be stored in the appropriate manner as listed in section A of this policy.

Hazardous materials received in damaged containers shall be held in a secure manner by a responsible certified person. The Occupational Health and Safety Office shall be notified to assess possible hazards.

V. Responsibilities

Office of Enterprise Risk Management

Occupational Health and Safety Officer

Supervisors of Personnel and Student-employees with duties that expose them to hazardous waste materials.

Appendix 1

Short list of incompatible materials

Do Not Contact

<p>ALKALI METALS such as calcium, potassium, and sodium</p> <p>with: water, carbon dioxide, carbon tetrachloride, and other chlorinated hydrocarbons.</p>	<p>ACETIC ACID</p> <p>with: chromic acid, nitric acid, hydroxyl containing compounds, ethylene glycol, perchloric acid, peroxides, and permanganates.</p>
<p>ACETONE</p> <p>with: concentrated sulfuric acid and nitric acid mixtures.</p>	<p>ACETYLENE</p> <p>with: copper (tubing), fluorine, bromine, chlorine, iodine, silver, mercury, or their compounds.</p>
<p>AMMONIA, ANHYDROUS</p> <p>with: mercury, halogens, calcium hypochlorite, or hydrogen fluoride.</p>	<p>AMMONIUM NITRATE</p> <p>with: acids, metal powders, flammable liquids, chlorates, nitrates, sulfur, and finely divided organics or other combustibles.</p>
<p>ANILINE</p> <p>with: nitric acid, hydrogen peroxide, or other strong oxidizing substances.</p>	<p>BROMINE</p> <p>with: ammonia, acetylene, butadiene, butane, hydrogen, sodium carbide, turpentine, or finely divided metals.</p>
<p>CHLORATES</p> <p>with: ammonium salts, acids, metal powders, sulfur, carbon, finely divided organics or other combustibles.</p>	<p>CHROMIC ACID</p> <p>with: acetic acid, naphthalene, camphor, alcohol, glycerine, turpentine, and other flammable liquids.</p>
<p>CHLORINE</p> <p>with: ammonia, acetylene, butadiene, benzene and other petroleum fractions, hydrogen, sodium carbides, turpentine, and finely divided metals.</p>	<p>CYANIDES</p> <p>with: acids.</p>

<p style="text-align: center;">HYDROGEN PEROXIDE</p> <p>with: copper, chromium, iron, most metals or their respective salts, flammable liquids and other combustible materials, aniline, and nitromethane.</p>	<p style="text-align: center;">HYDROGEN SULFIDE</p> <p>with: nitric acid, oxidizing gases.</p>
<p style="text-align: center;">HYDROCARBONS</p> <p>generally, with: fluorine, chlorine, bromine, chromic acid, or sodium peroxide.</p>	<p style="text-align: center;">IODINE</p> <p>with: acetylene or ammonia.</p>
<p style="text-align: center;">MERCURY</p> <p>with: acetylene, fluminic acid, or hydrogen.</p>	<p style="text-align: center;">NITRIC ACID</p> <p>with: acetic, chromic, or hydrocyanic acids, aniline, carbon, hydrogen sulfide, flammable liquids or gases, or other substances which are readily nitrated.</p>
<p style="text-align: center;">OXYGEN</p> <p>with: oils greases, hydrogen, flammable liquids, solids, or gases.</p>	<p style="text-align: center;">OXALIC ACID</p> <p>with: silver or mercury</p>
<p style="text-align: center;">PERCHLORIC ACID</p> <p>with: acetic anhydride, bismuth and its alloys, alcohol, paper, wood, and other organic materials.</p>	<p style="text-align: center;">PHOSPHOROUS PENTOXIDE</p> <p>with: water.</p>
<p style="text-align: center;">POTASSIUM PERMANGANATE</p> <p>with: glycerine, ethylene glycol, benzaldehyde, or sulfuric acid.</p>	<p style="text-align: center;">SODIUM PEROXIDE</p> <p>with: any oxidizable substances, for instance: methanol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerine, ethylene glycol, ethyl acetate, furfural, etc.</p>
<p>SULFURIC ACID</p> <p>with: chlorates, perchlorates, permanganates, and water</p>	

NOTE: This list is not a complete list of incompatible materials. It contains some of the more common incompatible materials. Always research the materials you work with in order to be safe.

Appendix 2: Rules for Storing Chemicals Safely

Segregate all incompatible chemicals for proper storage of chemicals for hazard class codes. In other words, store like chemicals together and away from other groups of chemicals that might cause reactions if mixed. Do not simply store chemicals in alphabetical order.

Flammable materials should be stored in an approved, dedicated, flammable materials storage cabinet or room if the volume exceeds ten (10) gallons.

Chemicals shall be stored separately from non-compatible hazard classes. The following is a recommended storage scheme to minimize incompatibility of chemicals:

Inorganic:

- metals, hydrides.
- halides, sulfates, sulfites, thiosulfates, phosphates, halogens.
- amides, nitrates, nitrites, azides, nitric acid.
- hydroxides, oxides, silicates, carbonates, carbon.
- sulfides, selenide, phosphides, carbides, nitrides.
- chlorates, perchlorates, perchloric acid, chlorites, hypochlorites, peroxides, hydrogen peroxide.
- arsenates, cyanides, cyanates.
- borates, chromates, manganates, permanganates.

Organic:

- acids, anhydrides, peracids
- alcohols, glycols, amines, amides, imines, imides.
- hydrocarbons, esters, aldehydes.
- ethers, ketones, ketenes, halogenated hydrocarbons, ethylene oxide.
- epoxy compounds, isocyanates.
- peroxides, hydroperoxides, azides.
- sulfides, polysulfides, sulfoxides, nitriles.
- phenols, cresols.

Liquids should be stored in unbreakable or double-contained packaging, or the storage cabinet should have the capacity to hold the contents if the container breaks.

Avoid floor chemical storage (even temporary).

Chemicals should be stored no higher than eye level and never on the top shelf of a storage unit.

Shelf assemblies should be firmly secured to the walls. Avoid island shelves.

Each shelf should have an anti-roll lip.

Store acids in a dedicated acid cabinet. Nitric acid may be stored there also, if it is kept isolated from the others.

Store severe poisons in a dedicated poison cabinet.

All chemicals should be labeled and dated.

Look for unusual conditions in chemical storage areas, such as:

- improper storage of chemicals
- leaking or deteriorating containers
- spilled chemicals
- temperature extremes (too hot or cold in storage area)
- lack of or low lighting levels
- blocked exits or aisles
- doors blocked open, lack of security
- trash accumulation
- smoking or open lights or matches
- fire equipment blocked, broken or missing
- lack of information or warning signs ("No Smoking", "Flammable Liquids", "Acids", "Corrosives", "Poisons", "Chemical Storage")

Any of these conditions should be corrected immediately. Inspections of chemical storage areas on a routine basis will help to correct deficiencies and prevent accidents.

Appendix 3: Suggested Chemical Storage Pattern

Inorganic	Organic
Sulfur, Phosphorus, Arsenic, Phosphorus Pentoxide	Alcohols, Glycols, etc. (store flammables in dedicated cabinets)
Halides, Sulfates, Sulfites, Thiosulfates Phosphates, etc.	Hydrocarbons, Esters, etc. (store flammables in dedicated cabinet)
Amides, Nitrates (not ammonium nitrate), Nitrites, etc.	Ethers, Ketones, etc. (store flammables in dedicated cabinet)
Metals, Hydrides (store away from water)	Epoxy compounds, Isocyanates
Hydroxides, Oxides, Silicates, etc.	Sulfides, Polysulfides, etc.
Arsenates, Cyanides (store above acids)	Phenol, Cresols
Sulfides, Selenides, Phosphides, Carbides, Nitrides	Peroxides, Azides, etc.
Manganates, Chromates, Permanganates, Borates	Acids, Anhydrides, Peracids, etc.
Chlorates, Chlorites, Perchlorates, Peroxides, Perchloric acid	Miscellaneous
Acids. except nitric. (store acids in dedicated cabinets)	Miscellaneous (Nitric Acid)

Appendix 5: Suggested Storage Time Limits for Common Peroxidizable Compounds

MOST DANGEROUS: Discard after **3 months**.

Peroxide formation hazard during storage.

isopropyl ether
divinyl acetylene
vinylidene chloride
potassium metal
sodium amide

DANGEROUS: Discard after **one year**.

Peroxide formation hazard during storage and on concentration (i.e. distillation) of compound.

diethyl ether	dicyclopentadiene
tetrahydrofuran	diacetylene
dioxane	methyl acetylene
acetal	cumene
methyl isobutyl ketone	tetrahydronaphthalene
ethylene glycol dimethyl ether	cyclohexene
vinyl ethers	methylcyclopentane

Safety Hints

1. Do not purchase these compounds in quantities greater than can be used in the specified storage time period.
2. Ethers should be stored in the dark and under nitrogen if possible.
3. Always check for the presence of peroxides before distilling any peroxide former.
4. Consult safety references before working with peroxidizable compounds.

References

1. Hazard Communication Standard (OSHA) 29 CFR 1910.1200, Chapter 442 F.S., Rule 38I-20.003 F.A.C.
2. Hazardous Waste Management (EPA) 40 CFR Parts 260-299, Rule 62-730 F.A.C.
3. Occupational Exposure to Hazardous Chemicals in Laboratories (OSHA) 29 CFR 1910.1450, Rule 38I- 20.003 F.A.C.
4. "Safety in Academic Chemistry Laboratories"; American Chemical Society, Washington D.C.,1991.
5. Prudent Practices for Handling Hazardous Chemicals in Laboratories; National Academy of Sciences, Washington D.C., 1981.
6. "Flammable and Combustible Liquids Code"; NFPA Standard 30, National Fire Protection Association, Quincy, MA, 1992 li