UNIVERSITY of HOUSTON

Chemical Hygiene Plan

Guidelines for the Safety Handling of Hazardous Chemicals

Environmental Health and Risk Management Department

February 2006

CHEMICAL HYGIENE PLAN

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APPENDICES

1.0 INTRODUCTION

The purpose of this Chemical Hygiene Plan is to define work practices and procedures to help protect students, laboratory workers, researchers, and supervisors at the University of Houston from health hazards associated with the use of hazardous chemicals. The Chemical Hygiene Plan is consistent with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) standard entitled "Occupational Exposures to Hazardous Chemicals in Laboratories" (Code of Federal Regulations, 29 CFR 1910.1450) and the Texas Hazard Communication Act (Chapter 502 of the Texas Health and Safety Code).

OSHA has defined a hazardous chemical as "a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees." In addition, OSHA defines a laboratory as "a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis." Finally, laboratory workers are defined in the OSHA Lab Standard under the definition of "employee" as "an individual employed in a laboratory workplace that may be exposed to hazardous chemicals in the course of his or her assignments." An example of a laboratory worker would include researchers in laboratories and principal investigators; the students in the academic laboratory would not be considered laboratory workers according to OSHA, however they should be following the practices and procedures outlined in this Plan. If there is any confusion about whether a particular workplace is considered a laboratory that utilizes hazardous chemicals, or whether someone is considered a laboratory worker, the Biological and Chemical Safety Manager will, upon request, make this determination.

Laboratory workers, researchers, supervisors and students conducting laboratory procedures should be familiar with this Chemical Hygiene Plan and together share the responsibility for creating a safe and healthy work environment. In addition to the Plan, the laboratory workers shall be cognizant of and adhere to the procedures outlined in the General Laboratory Safety Manual, Biological Safety Manual and the Radiation Safety Manaual. These documents are available on the Environmental Health and Risk Management Department (EHRM) website at www.uh.edu/plantops/ . Further information is available by calling the Environmental Health and Risk Management Department at 713-743-5858.

2.0 RESPONSIBILITIES

The Environmental Health and Risk Management Department's main purpose is to support the University of Houston in its mission of higher education and research. The Department's efforts are directed at assisting the University in identifying safety hazards and controlling such hazards through protective equipment, hazard mitigation methods, development and presentation of safety training programs, purchase of insurance and other risk control and risk transfer techniques.

Specific to this Chemical Hygiene Plan, the responsibilities of the Environmental Health and Risk Management Department include the following:

- Provide technical assistance to laboratory supervisors and workers concerning appropriate storage, handling and disposal of hazardous chemicals;
- Provide general and specialized laboratory safety training upon request;
- Conduct exposure assessments and laboratory surveillance upon request;
- Make routine, as well as special, health and safety audits;
- Provide technical assistance concerning personal protective equipment and laboratory safety equipment;
- Facilitate access to manufacturer's Material Safety Data Sheets and other laboratory and chemical safety literature;
- Remain current on rules and regulations concerning chemicals used at UH.

Deans, Directors, and Heads of Academic and Administrative Units have the primary responsibility for the health and safety of their staff and students. Specific responsibilities regarding the implementation of the Chemical Hygiene Plan include:

- Collaborate with faculty and staff to adapt this model Chemical Hygiene Plan to include lab-specific guidelines and to develop strategies to implement the Plan; and,
- Make budget arrangements for health and safety improvements.

Faculty and staff in charge of supervising laboratories (referred to as laboratory supervisors throughout this document) have the following responsibilities for implementing the Chemical Hygiene Plan:

- Inform and train employees concerning chemical safety as required by this Plan and retain training records and all documentation;
- Implement and enforce rules and standards concerning health and safety for laboratories under supervisor's jurisdiction;
- Ensure compliance of laboratory workers with this Plan;
- Ensure the availability and enforce the use of: appropriate personal protective equipment, Material Safety Data Sheets (MSDSs), and relevant reference materials;
- Remain cognizant of chemicals stored and used in labs and their associated hazards;
- Dispose of chemicals no longer needed by filing an on-line waste pick up request with the Environmental Health and Risk Management Department;
- Conduct internal inspections of labs for health and safety concerns; and

- Request assistance from the Environmental Health and Risk Management Department as needed.

Laboratory Employee and Student responsibilities regarding implementation of the Chemical Hygiene Plan are as follows:

- Follow all health and safety policies and procedures;
- Report all hazardous conditions to the supervisor;
- Wear or use prescribed protective equipment;
- Report any job-related injuries or illnesses to the supervisor and seek treatment immediately;
- Refrain from the operation of any equipment or instrumentation without proper instruction and authorization;
- Remain aware of the hazards of the chemicals in the lab and how to handle hazardous chemicals safely; and,
- Request information and training when unsure how to handle a hazardous chemical or procedure.

3.0 STANDARD OPERATING PROCEDURES

*"Standard operating procedures relevant to safety and health considerations are to be followed when laboratory work involves the use of hazardous chemicals". 2*9 CFR 1910.1450(e)(3)(I)

The Plan represents a minimum set of guidelines for the handling of toxic chemicals on campus. Individual administrative units, laboratories or research groups are required to develop more detailed procedures as their situations warrant. Acceptable lab safety references such as those listed in Appendix 2 of this document may be adopted in whole or may be useful in developing additional procedures. In all situations, individual faculty or staff will be responsible for enforcing adequate safety and hygiene measures in laboratories they supervise. If necessary, additional assistance from Environmental Health and Risk Management is available.

Some rules or standard operating procedures, which apply to all laboratories at UH include the following:

3.1 General

Respect and understand the safety and health hazards associated with the chemicals and equipment in your laboratory, and practice the following general safety guidelines at ALL times:

- **No smoking.**
- **Unattended experiments**. Laboratory experiments should be placed in potentially low hazard condition before leaving them unattended.
- **Working alone.** When working with hazardous materials, it is advisable to have a second person present, or at a minimum, maintain surveillance via telephone contact.
- **Housekeeping.** Exits, aisles and safety equipment must be kept clear of any

obstructions, such as equipment, furniture, etc. Hazardous liquid chemicals should be stored below eye level. Work areas and floors should be kept clear of excessive storage.

- **Food, drink, cosmetics.** Eating, drinking and the application of cosmetics are not permitted in areas where hazardous chemicals are used and shall be done only in well-defined designated non-chemical areas. Do not store food in the same refrigerator with chemicals, biohazards or radioactive materials.
- **No horseplay.** Practical jokes or other behavior that might confuse, startle, or distract another worker is not permitted.
- **Equipment.** Use proper equipment that is in good condition. For example, never use chipped or cracked glassware. Shield pressurized or vacuum apparatus and safeguard against bumping or overheating.
- **Waste Minimization.** A laboratory waste minimization program is coordinated by EHRM. In general, this program includes:

    1. Bulking of similar wastes prior to shipment off-site.
    2. Use of the chemical redistribution (CHEM-SWAP) program.
    3. Research of new techniques that consider the hazards and quantities of waste produced.
    4. Elimination of thermometers and reagents that contain mercury. Use of other hazardous materials such as heavy metals and halogenated solvents should also be eliminated or reduced whenever possible.

Additional technical information on waste minimization is available from EHRM at 713-743-5858.

- **Disposal of chemicals.** To request a pick up of chemicals, go online at www.uh.edu/plantops/ and fill in the UH Hazardous Waste Disposal Form. Disposal of all laboratory waste shall follow the procedures outlined in the "Hazardous Waste Program Manual," a copy of which is available from the website. Appendix 1 contains a summary of chemical waste disposal procedures.
- **Chemical spills and accident response.** In the event of a chemical spill which is beyond the capability of the laboratory personnel, please call the main number at 713-743-5858. For large spills/leaks, incidents involving injury or after hour incidents call 911 and evacuate the area.
- **Mouth pipetting.** Mouth pipetting is not permitted.
- **Mercaptans (thiols, sulfhydryl reagents).** To avoid false reporting of natural gas leaks, Biological and Chemical Safety Manager should be contacted at 713-743-5858 when mercaptans will be used in a laboratory in such a manner that persons outside of the laboratory could smell the mercaptan and suspect a natural gas leak in the building. Mercaptans should be used in a chemical fume hood.
- **Perchloric acid.** If perchloric acid is heated above ambient temperature it will give off vapors that can condense and form explosive perchlorates. Hence, when heating perchloric acid above ambient temperature, a perchloric acid fume hood with a wash down system or a local scrubbing or trapping system must be used. A perchloric acid fume hood is a specialized type of hood that is currently not available at UH.

3.2 Personal Protection/Hygiene

Personal protection and personal hygiene are two very basic aspects of laboratory safety. Wearing appropriate personal protection and practicing good personal hygiene, as described below, will minimize exposures to hazardous chemicals during routine use and in the event of an accident.

- **Attire.** Wear a lab coat or apron, cover legs and feet (no sandals, open-toed shoes, or shorts), and confine loose clothing and long hair.
- **Gloves.** Gloves are essential when working with hazardous substances. The proper gloves will prevent skin absorption, infection or burns. All glove materials are not equally effective in protection from chemical hazards. ***In many cases, latex examination gloves do not provide adequate protection from hazardous chemicals.*** Consult a chemical resistance chart such as the one found in Appendix 2, consult a glove manufacturer or contact EHRM for assistance in appropriate selection.
- **Eye protection.** All personnel including students, staff and visitors in laboratories shall wear safety glasses, goggles, or face shields at all times where potential eye hazards exist. Goggles are recommended when chemical splashes are possible. The wearing of contact lenses in labs is an unsettled issue. *If contact lenses are to be worn, the eyes should be protected by goggles when in the lab.*
- **Face shields.** Full-face shields must be worn when conducting a procedure that may result in a violent reaction. Full-face shields with bottom caps to protect under the chin are preferred due to the tendency to raise the chin when a splash occurs.
- **Glass tubing.** When inserting glass tubing into stoppers, lubricate the tubing and protect hands from being cut in the event the tubing slips and breaks.
- **Personal hygiene.** Hands should be washed frequently throughout the day, before leaving the lab, after contact with any hazardous material, before eating, etc.

3.3 Hazardous Material Handling and Storage

Hazards associated with various chemicals and gases vary widely. Understanding the hazards associated with a compound and minimizing the quantity used and stored in the lab will decrease the chance of injury.

- **Chemical storage (general).** Chemicals must be stored by compatibility, not by alphabetical arrangement. For example, oxidizers should be separated from organics, air/water reactives must be kept dry and cyanides should be stored away from acids. Storage of all laboratory chemicals shall follow the recommendations outlined in Appendix 3 Chemical Segregation and Incompatibilities Guidelines.
- **Storage of volatile chemicals.** Volatile toxic substances shall be stored in storage cabinets adequate to the purpose, or in hoods when cabinets are unavailable. If volatile substances are stored in a hood, other uses of the hood shall be restricted to activities

compatible with the chemical and physical properties of the chemicals being stored or used. When volatiles must be stored in a cooled atmosphere, refrigerators or cold rooms designed for this purpose must be used.

- **Chemical handling.** Use secondary containment when transporting chemicals by placing the chemical being transported inside a protective container. For example, use polycoated bottles or bottle carriers for transporting chemicals that are in regular glass containers. Close caps securely and avoid storing chemical containers in hard to reach areas. Pour chemicals carefully, and never add water to concentrated acid or base. Metal containers and non-conductive containers (e.g., glass or plastic) holding more than five gallons must be grounded when transferring flammable liquids.
- **Cylinder storage.** Cylinders must be stored in well-ventilated areas with their protective caps screwed on and the cylinder secured (e.g., strapped or chained down) to reduce the chance of the cylinder being knocked over. For assistance in securing gas cylinders, call EHRM at 713-743-5858. Do not store cylinders near heat or high traffic areas. Do not store flammables and oxidizers together. Do not store empty and full cylinders together. Storage of large quantities of cylinders must be done in an approved gas cylinder storage area.
- **Cylinder handling.** Use appropriate handcarts to move cylinders. Cylinders must be secured to the cart during transport. Highly toxic gases should not be moved through the corridors, particularly during business hours. Always consider cylinders as full and handle them with corresponding care.
- **Labels.** Make sure all labels are legible. Label all secondary containers with the chemical name (as it appears on the original label or MSDS) and appropriate hazards. Health hazard warning information should include the target organs that may be affected and any of the following terms that are appropriate: carcinogen, toxic or highly toxic agent, reproductive toxin, irritant, corrosive, sensitizer, hepatotoxin, nephrotoxin, neurotoxin, agents which act on the hematopoietic system, or agents which damage the lungs, skin, eyes, and mucous membranes. Physical hazard warning information should include any of the following terms that are appropriate: combustible liquid, compressed gas, explosive, flammable, organic peroxide, oxidizer, pyrophoric, unstable (reactive), or water reactive. Date all peroxidizable (i.e. ethyl ether) and other chemicals that may become unstable over time; test and/or dispose of them when appropriate.
- **Containers.** Check the integrity of containers. Ensure that the container used is compatible with the chemical, for example hydrofluoric acid must not be stored in glass and some oxidizers should not be stored in plastic containers.

4.0 CONTROLLING CHEMICAL EXPOSURES

"*Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous."* 29 CFR 1910.1450(e)(ii)

There are three major routes of entry for a chemical to enter the body: inhalation, skin and eye contact, and ingestion. Three types of controls for prevention of these various routes of entry include: engineering controls, personal protective equipment and administrative controls. Each route of entry a chemical can take to enter the body can be controlled in a number of ways, as explained below.

4.1 Inhalation Hazards

Inhalation of chemicals is the most common route of entry a chemical can take to enter the body. To avoid significant inhalation exposures, engineering controls are the best option to eliminate or minimize hazards. For example, substituting a less volatile or a less toxic chemical, or substituting a liquid or solid chemical for a gaseous one are the best means of control. If substitution is not practical, ventilation should be used to lessen the chance of overexposure. The use of well-functioning local exhaust ventilation such as laboratory (fume) hoods, vented glove boxes and other local exhaust systems is often required to minimize exposure to hazardous chemicals. Dilution ventilation may be used to reduce exposure to non-hazardous nuisance odors. For extremely toxic chemicals such as those classified as poisonous gases by State or Federal Department of Transportation (e.g., arsine, phosgene) the use of closed systems, vented gas cabinets, fail-safe scrubbing, detection or other stricter controls may be required.

Administrative controls can be utilized to reduce the risk of overexposure to hazardous chemicals. Some examples of administrative controls include:

- minimization of exposure time for individual employees;
- restricted access to an area where a hazardous chemical is used;
- allowing a process that emanates nuisance odors to be done only after typical office hours, when most of the staff in the building have gone home; and,
- proper signage on lab doors to indicate special hazards within, a list of lab personnel who should be contacted in the event of an emergency, and appropriate telephone numbers. Call the for assistance.
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Finally, if engineering and administrative controls are not an option, the use of personal protective equipment may be required to reduce inhalation exposures. If respirators are worn by laboratory employees, requirements of the OSHA Respiratory Protection Standard (29 CFR 1910.134) must be met. This standard requires training on the proper use of respirators, medical surveillance to ensure the user is capable of wearing a respirator, and fit testing to ensure that the respirator fits properly. A lab worker or his/her supervisor should contact EHRM in the event that respiratory protection is needed to control exposures to hazardous chemicals.

4.2 Skin/Eye Contact Hazards

To reduce the risk of a chemical entering the body via skin and eye contact, engineering controls including substitution and appropriate ventilation, should be used as described above in "Inhalation Hazards." The more obvious means of preventing skin and eye contact is the wearing of personal protective equipment such as eye protection, face shields, gloves, appropriate shoes, lab aprons, lab coats, and other protective equipment appropriate to the hazard. Since the chemical resistivity of the different types of protective equipment varies significantly, the lab supervisor should consult Appendix 2 or other references to ascertain that the protective equipment material is resistant to the chemical being protected against.

Administrative controls to reduce skin/eye contact include: enforcement of policies pertaining to skin and eye protection, and discarding or repairing cracked or broken glassware.

4.3 Ingestion

Ingestion of chemicals is the least common route of entry into the body. A laboratory worker can easily ingest chemicals into the body via contaminated hands if they are not washed prior to eating or smoking. Also, introducing contaminated objects (writing tools) and/or hands in the mouth is another form of ingestion. Use engineering controls, such as isolating the hazardous substance so that minimal contact is required (e.g., use glove box), to help prevent exposures. Administrative controls such as restricting mouth pipetting, encouraging good personal hygiene, and designating a well-marked non-chemical area where eating, drinking and the application of cosmetics are permitted, is also beneficial in preventing chemical exposures via ingestion. Personal protective equipment, such as gloves, may also be used.

5.0 LABORATORY SURVEILLANCE

Laboratory safety surveys are conducted on a routine basis in all of the laboratories on campus. The focus of the surveys is to ensure compliance with a number of general safety, fire safety, chemical safety, and physical safety compliance issues. EHRM takes a proactive approach to compliance problems found in the laboratories and in most cases facilitates the corrective action process. The following outline the criteria in which the laboratory safety surveys are conducted.

General Housekeeping

It is the responsibility of each laboratory worker to ensure that the laboratory is maintained in a clean and orderly fashion. Excessive storage of equipment, supplies, and chemicals can pose various hazards to laboratory employees and other building occupants.

Current Emergency Information and Warning Signs Posted

All laboratories shall have posted near the telephone or door entrance, the telephone numbers of persons to call in the event of an emergency.

The NFPA 704 diamond shall also be posted outside each active laboratory for use by firefighters and safety personnel during emergency situations. Radioactivity work areas, laboratories and containers of radioactive materials must be posted with appropriate warning signs. [see Radiation safety manual] Areas where human blood or other potentially infectious materials are stored or used must bear the universal biohazard symbol. Researchers working with or storing biosafety level 2 or higher organisms shall utilize the universal biohazard warning. Appropriate locations for biohazard signs include laboratory entrance, incubator, refrigerator, and waste containers.

Emergency postings shall also be placed on the laboratory electrical panel and emergency gas shut off valve. These two emergency cut-offs are utilized in emergency situations and shall never be obstructed with equipment or storage.

No Food or Drink Rule Observed

Food and drink brought into areas of chemical or radiological use can easily become contaminated by these hazards. Airborne particulates can settle on exposed food, eating surfaces or utensils. Even though work surface contamination may not be readily apparent, it can adhere to hands and then be transferred to food items. Upon ingestion these harmful substances will be carried into the body, increasing the opportunity for toxic effects.

Appropriate Personal Protective Equipment Available

Chemical resistant gloves should be available and worn during procedures. To choose the best glove for a particular operation one must weigh the ability of the glove material to resist permeation and degradation by the chemicals in use against the dexterity needed to conduct the experimental protocol. There is no single glove material universally resistant to all classes of chemicals; glove selection must be individualized for each experimental protocol. Eye protection should be available and worn during procedures. The eyes are particularly sensitive to chemical or physical insult and should be protected at all times against chemical splashes or sprays, flying particles, UV radiation and other hazards. Protective clothing should be available and worn during procedures (lab coat, apron, etc.) Lab coats not only protect street clothing from being soiled, they also provide an additional layer of splash and burn protection and help protect family members by reducing take-home toxins.

Applicable Safety Binders/Manuals Available

Safety manuals available include: Chemical Hygiene Plan, Biological Safety Manual, and the Radiation Safety Manual. Every laboratory using hazardous chemicals, radioactive, or biological hazards must have a copy of the respective Laboratory Safety binder/manual in the lab or otherwise readily available. These manuals are readily available on the website. Thoroughly review all applicable safety manuals with laboratory staff. [OSHA 29CFR 1910.1450 (e) (2)]

Occupant's Safety Concerns Solicited

During routine surveys conducted by EHRM, the reprensentative will talk with the laboratory workers and ensure they have no specific safety concerns. If the employee raises concerns, the EHRM representative will make every effort to address the issue either personally, by way of a Safety Manager, or the Director.

Appropriate Training Records Maintained

Laboratory employees and investigators are to keep documentation of all required training for working in a laboratory. Training requirements will vary depending on the type of

research being conducted. Contact EHRM if there are any questions regarding training requirements. Appendix 4 contains an example training documentation form that can be used to cover laboratory specific training.

Egress Pathways Unobstructed

Laboratories shall be maintained in such a manner where there is at least 36 inches of clearance between obstructions to exit from the laboratory into the corridor. The corridors must have a minimum of 48 inches of clearance and shall be maintained free of obstructions to ensure clear egress to the nearest stairwell in the event of an emergency. Many times, emergency safety equipment i.e. safety showers and eyewashes are also located in the main corridors and this equipment shall be maintained free of any obstruction.

Fire Extinguisher Available and Inspected

Fire extinguishers shall be located inside all laboratories or, in some instances, a minimum of 75 feet from the laboratory. Extinguishes are inspected on a quarterly basis and maintained by the Fire Marshall's Office, which is part of the University of Houston Department of Public Safety. Laboratory workers should routinely inspect for broken seals, damage, and low gauge pressure (depending on type of extinguisher). If problems are identified, repairs are requested by contacting Department of Public Safety at 713-743-3333.

Heat Sources Separated from Combustibles

One of the easiest methods of fire risk reduction is to remove ignition sources from a flammable system (fuel + oxygen + ignition source). Ignition sources include electrical outlets, lighting fixtures, switches, exposed machinery components, as well as open flame. Flammable solvents should be used inside a chemical fume hood so vapors will be prevented from reaching flammable proportions. In the special case of a flammable solvent being heated (as in a distillation) it is important that all ignition sources (electrical outlets, Variac controllers, outlet strips) be located outside of the hood.

Appropriate Clearance to Ceiling

It is required that there is an 18 inch clearance to the ceiling to comply with NFPA codes for sprinkler systems. Minimizing the "stacking" of combustible material will also decrease the fuel package arrangement of the laboratory and help contain the fire to one laboratory unit in the event of a fire.

Electrical Circuit Loading and Cords

Insufficient or overloading of electrical outlets should be avoided. A sufficient number of outlets will eliminate the need for extension cords. Overloading electrical circuits and extension cords can result in a fire.

A cord should not be pulled or dragged over nails, hooks, or other sharp objects that may cause cuts in the insulation. In addition, cords should never be placed on radiators, steam pipes, walls, and windows. Particular attention should be placed on connections behind furniture, since files and bookcases may be pushed tightly against electric outlets, severely bending the cord at the plug.

When the outer jacket of a cord is damaged, the cord may no longer be water-resistant. The insulation can absorb moisture, which may then result in a short circuit or excessive current leakage to ground. If wires are exposed, they may cause a shock to a worker who contacts them. These cords should be replaced. Electric cords should be examined on a routine basis for fraying and exposed wiring.

Household extension cords and multi-use plugs are prohibited. Check that cords on equipment are in good condition with no fraying. Equipment supplied with a grounded plug requires attachment to a ground source. Removal of the grounding prong interferes with this electrical safety feature and can result in shock or electrocution.

Minimize Trip Hazards

Laboratories shall be maintained free of trip hazards. This includes items such as power cords on the floor, excessive equipment in the laboratory, and/or damaged flooring.

Compressed Gas Cylinders Secured

Compressed gas cylinders are under great pressures, often exceeding 2000 pounds per square inch or 136 atmospheres. To prevent the accidental and uncontrolled release of energy it is important to protect cylinders from toppling over and rupturing the valve stem. All compressed gas cylinders, including lecture bottles, “empty” cylinders, and cylinders in transit, must be secured in racks, clamping devices, stands, or other protective structure.

Guards for Mechanical Hazards in Place

Some common pieces of lab equipment present physical hazards due to rotating parts, nip points or other mechanical action. Particularly prevalent in the lab are vacuum pumps that have had their belt guards removed. To prevent injury due to entrapment of hair, clothing or other items it is necessary that these areas remain guarded. Any piece of equipment with a detached, disengaged or inoperable guard must be prominently tagged and removed from service.

Proper Segregation of Chemicals

Storage of chemicals as a general group alphabetically is not recommended as it may place incompatible materials together on a shelf. Instead, separate chemicals into organic and inorganic families and then into related and compatible groups. Suggested chemical

storage schemes and compatibility lists can be found in a number of lab safety resources available from the National Institute of Occupational Safety and Health (NIOSH) website and this Chemical Hygiene Plan . A quick and very general rule of thumb is to separate acids from bases, flammables from oxidizers, and reactives from air or water. Chemicals should never be stored on the floor.

Chemicals Properly Labeled

Manufacturers are required to label every chemical container with hazard information that includes chemical name, physical and health hazard information, and name of manufacturer. These labels relay valuable information that can assist in hazard evaluation and control, and cannot be removed or defaced from the original container unless the contents have been altered or removed. Secondary containers that will remain in use for a period of time (storage vials, squirt bottles) should bear an abbreviated label that includes chemical name and hazard warning such as flammable, caustic, sensitizer, carcinogen, absorbed through the skin etc.

Flammables Properly Stored

A number of common solvents have flash points close to or below the temperature at which most refrigerators operate (around 39°F or 4°C). Flammable solvents evaporate rapidly, even at lowered temperatures, so they can quickly reach equilibrium inside the small, well-sealed space of a refrigerator. When this "off-gassing" reaches the lower explosive limit (LEL) sources of ignition inside a conventional refrigerator such as the thermostat, interior light, defroster, compressor, or fan can set off an explosion. Flammable liquids that must be stored at reduced temperature require a specially designed refrigerator, termed a "flammable material storage refrigerator," where ignition sources are isolated from the inside space.

Controlled Substances Secured

Controlled substances must be secured in accordance with the Texas Legislature Chapter 481 *Texas Controlled Substances Act* which include the following criteria:

Establishing adequate security to prevent unauthorized access to controlled substances and dangerous drugs, including a preliminary security inspection (contact EHRM for assistance).

Not allowing any individual access to controlled substances and dangerous drugs storage areas except those authorized for efficient operations during the course of business activities.

Storing controlled substances and dangerous drugs listed in schedules I, II, III, IV, and V in securely-locked substantially-constructed cabinets or security cabinets or safes.

Absence of Old or Potentially Explosive Chemicals

Out-dated, expired, unknown chemicals should be promptly disposed of by the appropriate means. Many materials, as they age, become unstable, possibly forming explosive by-products or undergoing rapid and violent decompositions. Other materials

simply lose purity as contaminants are introduced or residues form. Chemicals that may no longer be used, that are of questionable purity, or that are past their expiration dates should be removed from the lab by submitting an on-line request form.

Hazardous Liquid Chemicals Stored Below Eye Level

Every chemical should have assigned to it a definite storage place and should be returned to that place after each use. Do not store materials on top of high cabinets where they will be hard to reach and see.

Adequate Air flow in Chemical Fume Hood

Hazardous chemicals that are flammable, volatile, or gases should be manipulated inside a properly functioning chemical fume hood. Optimum height is the sash height at which air flow is maximized without creating turbulence, generally between 60 and 150 linear feet per minute (lfpm). A yellow sticker placed on the hood face indicates the most recently recommended sash height. Hoods can malfunction at any time without warning. It is important to confirm hood operation before each work session. Check the air flow gauge if so equipped. In the absence of a gauge one can tape an inch wide strip of tissue to the lower corner of the sash. Air flow can be visually assessed by noting that the tissue is pulled gently into the hood. Laboratories fume hoods that have been upgraded will have a digital display of the hood flow rate. Variable air volume valves have been calibrated to maintain 100 lfpm. If the flow rate is not within the acceptable range, the correction is to be made by Plant Operations by contacting 713-743-4948.

Ventilation Negative to Hallway

The primary objective in controlling occupational exposures is to prevent contamination of the work atmosphere. This shall be achieved first by use of a chemical fume hood, or other enclosure. The second way in which this achieved is by making sure the ventilation is such that the air pressure in the laboratory is negative with respect to the hallway, thus assuring airflow into the laboratory.

Safety Shower/Eyewash Station Available

Emergency shower and eyewash equipment shall be maintained in accordance with the American National Standards Institute (ANSI) code Z358.1 – 1998. If there are any questions or concerns with this equipment please contact Plant Operations at 713-743-4948.

Previous Deficiencies Adequately Resolved

EHRM reprensentatives will review past laboratory inspections and compare to the current inspection. If discrepancies remain that were identified on previous surveys, they will be communicated to the principal investigator. If not resolved, corrective actions will be followed as outlined in section 6.0.

Biological Agents / rDNA

Biohazards are a concern in laboratories in which microorganisms or material contaminated with them is handled. These hazards are usually present in clinical and infectious disease research laboratories, but may also be present in any laboratory in which bodily fluids or tissues of human or animal origin are handled. Identify what bioagents are being used, whether the agents are infectious, and whether the research includes the use of recombinant DNA (rDNA). Identify any animals being used in the research. If the research includes the use of rDNA, approval is required by the Institutional Biosafety Committee (IBC). Contact the Biosafety Manager for assistance.

Biological Safety Cabinet Certified Within Past Year

Biosafety cabinets should be certified when installed or moved, and annually thereafter. The biosafety cabinet's (BSC) ability to filter out microscopic particles relies on the seals being intact and the HEPA filter free of micro tears or breaks that can easily occur during moving, installation or careless handling. To ensure continued proper operation, each BSC should be tested and certified at least annually. [CDC/NIH Primary Containment for Biohazards: Selection, Installation and Use of Biological Safety Cabinets p. 29; NRC Biosafety in the Laboratory p. 26].

Chemical Waste

Ensure that all chemical waste containers are kept closed and marked "Hazardous Waste" or equivalent.

Label all hazardous waste containers with the word "waste" and list the individual waste chemical constituents on the label. Accumulation start dates should be marked on the container.

Biological Waste

All biological waste must be labeled as such. Ensure that waste bags are contained within a separate solid rigid container (secondary containment), such as a trashcan or cardboard box. Metal frames are insufficient and do not constitute secondary containment. EHRM can be contacted for assistance. Contaminated sharps include needles, scalpels, broken capillary tubes, exposed dental wires, and broken glass if contaminated with human blood or other potentially infectious material. These items must be collected in a sharps box or other puncture resistant container that is color coded or labeled with the universal biohazard symbol.

Needles, razors and other sharps should be contained within rigid plastic sharps containers after use. Coffee cans or other metal containers are not allowed due to the incineration process during disposal. If sharps are to be reused, they should be stored between uses in Styrofoam blocks to reduce the possibility of needlesticks.

6.0 RESPONSE TO NON-COMPLIANCE

Discrepancies discovered during routine inspection will be addressed in the following manner.

Step One - Verbal Notification:

If, during a routine evaluation or inspection, a problem involving chemical safety procedures is observed, a verbal recommendation will be provided. If upon receipt of a verbal recommendation, the laboratory staff or the staff takes immediate steps to correct the problem, then no further response regarding the discrepancy will be requested.

Step Two - Written Notification

Following the survey a written summary of the findings along with recommendations to address any remaining concerns, if applicable, will be sent to the PI responsible for the laboratory. The PI will then be requested to respond in writing within 30 days and describe his/her plan to address any unresolved safety concerns.

Step Three - Documentation

A list of discrepancies will be maintained by the Environmental Health and Risk Management Department Staff and a follow-up will be conducted within 60 days of the inspection to determine if corrective actions were taken.

Step Four - Follow-up

If the follow-up reveals that the same discrepancy exists, notification of this situation may be sent to both the PI and the Department Chair. The Director EHRM of , depending on the nature of the concern, may present the issue to the appropriate Dean and other senior administration officials. Any operation causing a high or unacceptable risk to employees or personnel exposure to any chemical hazard will be suspended immediately by EHRM without regard to the above procedure.

7.0 LABORATORY (FUME) HOODS AND OTHER ENGINEERING CONTROLS

"A requirement that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment." 29 CFR 1910.1450 (e)(3)(iii)

Laboratory personnel should be certain that their hood has a sticker on it and that the date on the sticker is less than a year old. Because the status of a hood can change within one year, continuous air flow indicators are recommended for all fume hoods. New laboratory (fume) hoods should be equipped with air flow monitoring devices which will alert the user if there is a problem with air flow. For older hoods without air flow monitoring devices, a simple visible test to ensure flow into hoods and other ventilating devices is to tape a Kimwipe to the hood and note its movement when the exhaust fan is on.

Protective equipment other than laboratory hoods should be checked periodically by the laboratory supervisor to ensure that the equipment is functioning properly. Any questions or requests for assistance in evaluation of hoods and other protective equipment may be directed to Environmental Health & Risk Management at 713-743-5858.

8.0 PRIOR APPROVAL FOR THE AQUISITION AND USE OF HAZARDOUS CHEMICALS

"The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the employer or the employer's designee before implementation." 29 CFR 1910.1450(e)(3)(v)

The principal investigator/laboratory supervisor is responsible for obtaining approval for the acquisition and use of toxic chemical agents. Certain materials including toxic chemical agents, radioactive materials, recombinant DNA and certain biological agents require prior approval from the respective safety committee at various levels. Questions concerning the need for approvals should be directed to EHRM .

9.0 MEDICAL CONSULTATION

"Provisions for medical consultation and medical examinations in accordance with paragraph (g) of this section." 29 CFR 1910.1450(e)(3)(vi)

An opportunity to receive medical consultation shall be provided under the following circumstances: if an employee develops any symptoms thought to arise from chemical overexposure; after an event such as a major spill, leak or explosion which may have resulted in an overexposure; or, if an overexposure is identified as the result of an evaluation by the Chemical Hygiene Officer or designee. These suspected or actual exposures requiring medical evaluation can and should be treated as a regular Worker's Compensation claim. A "Supervisor's First Report of Injury" form should be filled out and signed by the supervisor. Following notification of overexposure, arrangements for an appropriate medical examination must be completed before the exposed individual may return to work. Any medical examination required by this Chemical Hygiene Plan shall be provided without cost to the employee, without loss of pay and at a reasonable time and place. Records of any medical examination will be maintained by EHRM.

10.0 CHEMICAL HYGIENE OFFICER AND CHEMICAL HYGIENE COMMITTEE

"Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene Officer and, if appropriate, establishment of a Chemical Hygiene Committee." 29 CFR 1910.1450(e)(3)(vii)

Currently the University of Houston's Chemical Safety Committee is not active. EHRM will serve as the University's Chemical Hygiene Committee. The Biological and Chemical Safety Manager also serves as the Chemical Hygiene Officer for University of Houston.

Academic units are encouraged to have their own Chemical Safety Officers to help implement this Plan in their units.

11.0 SPECIAL PROVISIONS FOR SELECT CARCINOGENS, REPRODUCTIVE TOXINS AND ACUTELY TOXIC CHEMICALS

"Provisions for additional employee protection for work with particularly hazardous substances. These include "select carcinogens," reproductive toxins and substances which have a high degree of acute toxicity. Specific consideration shall be given to the following provisions which shall be included where appropriate:

(A) Establishment of a designated area;
(B) Use of containment devices such as fume hoods or glove boxes;
(C) Procedures for safe removal of contaminated waste; and
(D) Decontamination procedures." 29 CFR 1910.1450(e)(3)(viii)

Carcinogens, reproductive toxins, and acutely toxic chemicals may require approval from the Biological and Chemical Safety Manager. A listing of these chemicals is found in Appendix 3. In addition to the general safety guidelines mentioned in the first section and throughout the Plan, special precautions are needed when handling these types of chemicals. A minimum set of guidelines that should be followed is listed below. The lab supervisor should ensure that these and other precautions designed to minimize risk of exposure to these substances are taken.

- Quantities of these chemicals used and stored in the laboratory should be minimized, as should their concentrations in solutions or mixtures.

- Work with genotoxins, reproductive toxins and acutely toxic chemicals should be performed within a functioning laboratory (fume) hood, ventilated glove box, sealed system, or other system designed to minimize exposure. (The exhaust air from the ventilation systems may require scrubbing before being released into the atmosphere.) In all cases, work with these types of chemicals shall be done in such a manner that the OSHA permissible exposure limits or similar standards are not exceeded.

- Compressed gas cylinders that contain acutely toxic chemicals such as arsine and nitrogen dioxide should (and may be required to) be kept in ventilated gas cabinets.

- The ventilation efficiency of the designated hood, glove box or gas cabinet, and the operational effectiveness of mechanical and electrical equipment used to contain or manipulate these special substances should be evaluated periodically by laboratory personnel at intervals determined by the laboratory supervisor. The interval of evaluating systems may vary from weekly to biannually depending upon the frequency of usage, quantities employed and level of hazard.

- Each laboratory utilizing these substances must designate an area for this purpose and must sign or mark this area with an appropriate hazard warning. The designated area may be an entire laboratory, an area of the laboratory or a device such as a fume hood or glove box. The designated area should be marked with a DANGER, specific agent, AUTHORIZED PERSONNEL ONLY or comparable warning sign.

- All laboratory workers who work in a laboratory that has an area designated for use with genotoxins, reproductive toxins and acutely toxic chemicals must be trained about the deleterious effects of these substances as well as signs and symptoms regarding

exposure to these substances, whether or not they actually work with the substance themselves. Training to ensure the safe handling and storage of these substances is required for those who use these materials. This training is the responsibility of the laboratory supervisor and must be done prior to the use of any of these materials.

- Laboratory workers working with these chemicals must have access to appropriate protective equipment and clothing (available at no expense to the workers) and must be trained on how to properly utilize the safety equipment.

- Detection equipment may be required in laboratories where chemicals (especially poisonous gases) with a high degree of acute toxicity are utilized.

- All wastes contaminated with these substances should be collected and disposed of in a timely manner and appropriately as outlined in the EHRM waste disposal guide (mentioned previously). For special disposal information, call EHRM at 713-743-5858. If possible and as soon as practical, waste products shall be destroyed by a suitable, generally acceptable chemical procedure to lessen or eliminate their toxicity.

- The designated working area shall be thoroughly and appropriately decontaminated and cleaned at regular intervals determined by the laboratory supervisor. The interval may be as short as one day or as long as six months depending upon the frequency of usage and level of hazard.

- Special precautions to avoid release and exposure to highly toxic chemicals, genotoxins and reproductive toxins must be utilized. For instance, volatile substances should be kept cool and contained; gases should have properly functioning valves, check valves, regulators, containment which can withstand pressure buildup, and appropriate piping; and dispersive solids should be kept in closed containers, used in places with minimum air currents, and appropriate contact materials should be used to avoid static charging.

- Emergency response planning for releases or spills shall be prepared by the lab supervisor and included in the training of the laboratory workers and others who may be affected in the building. EHRM can be contacted for assistance.

Appendix 1

Chemical Waste Disposal Procedures

BEFORE REQUESTING A HAZARDOUS WASTE PICK UP

1. Determine if you can reuse of recycle this waste in your laboratory. If so, there is no need to dispose of the material through the UH Hazardous Waste Program pickup procedures.

2. If you have unopened or uncontaminated containers in a usable form, you should attempt to find another user. This will avoid the cost of disposal, the environmental impact of disposal, and needless cost to another user incurred through the purchase of new chemicals. EHRM operates a chemical exchange program called CHEM-SWAP expressly to aid in the exchange of useable chemicals. For more information contact EHRM.

3. Separate solids and liquids. All liquids must be free of solid material and or sludge to facilitate consolidation, recycling and proper disposal. If solids cannot be separated from liquids, the identification and quantity of the solid component must be listed on the UH Hazardous Waste Pickup Request Form. Every effort should be made to separate solids and liquids.

4. Consolidate similar wastes. Effort should be made by the waste generator to consolidate same-type waste into as few containers as possible.

5. Properly package the waste. Make sure containers are compatible with the material inside and if not, perform a transfer to a new container. Containers must be leak free, have a tight cap, and be clean on the outside. Stoppers and corks will not do. Containers must be no more than 90% full.

6. Label all hazardous waste containers with the hazardous waste labels. Information on the containers must agree with the information on the UH Hazardous Waste Pickup Request Form. Do not use abbreviations for chemical names.

7. Prepare the waste containers for pick-up and transport. Waste is transported with other waste shipments and so must be protected from the potential hazards of that process. All containers must be visible within the packing, and accessible to EHRM personnel for labeling purposes. Accordingly, do not completely cover waste containers and do not tape boxes shut. Packed boxes must be of a size and weight which one person can carry (50 pounds or less). Five-gallon cans and strong plastic containers need not be boxed. Please note that plastic milk jugs are not acceptable for the transport of hazardous substances.

8. Anticipate a slight lag time between your request to EHRM for a waste pick-up and the actual time and date an EHRM staff member actually arrives to remove the materials. Staff vacancies, sickness, changing priorities, and incidents can all adversely impact the waste program pick-up schedule.

FILLING OUT THE UH HAZARDOUS WASTE PCKUP REQUEST FORM

The on-line waste pickup request form can be found on the EHRM website at www.uh.edu/plantops/ehrm Complete each of the sections of the waste form with the information requested. Note any special information requirements, explained below where necessary:

1. Waste Labeled and Properly Package

   Check the correct box.

2. Requestor

   The person who is submitting the actual waste form.

3. Extension (EXT)

   This is the extension or telephone number you can be reached at, if we should have questions.

4. Building

   Type the building name. Example: Fleming Building.

5. Room number

   The room number where the waste is stored.

6. Principal Investigator

   The person whose research or lab produced the waste.

7. Department

   Indicate the department where the principal investigator works in. Example: Chemistry department.

8. Waste Category

   Check the appropriate waste type box.

9. Identification/Description of Waste Chemicals

   State whether the waste is a mixture and list all waste components using their common chemical or IUPAC names.

   Estimate and indicate the volume (liquids) or weight (solids) each represents in the container.

   Please use metric units. *Example:* grams, kilograms, liters, milliliters.

   Do not use chemical name abbreviations or formulas. However, you can include abbreviations on the form if they provide additional information.

   The identification and quantity of any solids present in liquid waste must also be listed if such solids/sludge cannot be separated.

   Example 1: Do not type "aqueous lead waste", instead type "1000 ppm lead nitrate in dilute nitric acid".

Example 2: If several chemicals have been poured in one container list the volume or weight of each component as follows: Acetone-1L, Hexane- 500 ml, Methanol- 250 ml.

Example 3: If a trade name such as "Datagraphix First Developer, Auto 2" is all the information available, refer to the products Material Safety Data Sheet (MSDS) for hazardous constituent information as well as any special disposal instructions. If you are unsure how to properly name the waste, email an electronic copy of the MSDS to the EHRM Waste Coordinator after submitting the UH Hazardous Waste Pickup Request Form. An MSDS can be obtained from the manufacturer listed on the bottle or can of the substance.

Example 4: Do not type common names such as "Zilkers Solution" on the waste form. List all components by their specific, non-abbreviated, chemical name.

Example 5: Do not list "AgNO3"; rather, type the complete chemical name, silver nitrate.

10. Solid Liquid Gas

Check the appropriate letter to indicate the present physical state of the waste. Choose "S" for solid, "L" for liquid, and “G" for Gas or “LSV” for Liquid Scintillation Vials if the waste pertains to radiation.

11. Number, Size, & Type of Container(s)

Identify the number, size and type of containers.

Example 6: If you had 20 containers of waste Hexane in 4 liter bottles, your entry would be: 20 x 4 liter bottles.

Example 7: If you had 5 gallons of Methylene chloride and 10 gallons of a mixture of Trichloroethane and Acetone, both in 5-gallon metal cans, your entry would be separate for each chemical or mixture. For the Methylene chloride you would enter: 1 x 5 gal. For the mixture of Trichloroethane and Acetone you would enter in the next box down: 2 x 5 gal cans.

Example 8: If you had 3 separate containers of Sodium hydroxide, each of a different size or type, they should be listed on separate lines of the form. For example the first box might read, 1 x 4 L bottle. The second box would read, 1 x 100 g can, and the third would read, 1 x 500 ml bottle.

Example 9: If you have broken thermometers collected in a 4 liter bottle or any other unusual item or container, list the number, size and type of container and make a special note of the unusual item or container in the box below under Waste Notes and/or Handling Instructions.

12. Volume or Weight per Container

Indicate the total volume or weight of each container. Differing sizes of containers should be listed on separate lines of the form.

Example 10: If you had 5 bottles of liquid Potassium chloride in the same size containers, each containing 400 milliliters, the entry would be: 400 ml. in ea.

Example 11: If you had 2 bottles of solid Barium chloride, one containing 100 grams and the other containing 500 grams, they would be listed in separate boxes. The first box would read, 100 g. The second box would read, 500 g.

Example 12: If you had two containers of Calcium hydroxide, one liquid and one solid, they would be listed in separate boxes also.

Example 13: If you have a container with liquid and solids in it, every effort should be made to separate the two. If this cannot be done, list the amount of solid and volume of liquid in the same box for that particular container.

13. Waste Notes and/or Special Handling Instructions

Note any location access restrictions or any special hazards associated with the wastes.

Appendix 2

Chemical Resistance Chart

CHEMICAL RESISTANCE CHART

Resistance to Chemicals of Common Glove Materials
(E=Excellent, G=Good, F=Fair, P=Poor)

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CHEMICAL	NATURAL RUBBER	NEOPRENE	NITRILE	VINYL
Acetaldehyde	G	G	E	G
Acetic acid	E	E	E	E
Acetone	G	G	G	F
Acrylonitrile	P	G	-	F
Ammonium hydroxide	G	E	E	E
Aniline	F	G	E	G
Benzaldehyde	F	F	E	G
*Benzene	P	F	G	F
*Benzyl chloride	F	P	G	P
Bromine	G	G	-	G
Butane	P	E	-	P
Butyraldehyde	P	G	-	G
Calcium hypochlorite	P	F	G	F
Carbon disulfide	P	P	G	F
*Carbon tetrachloride	P	F	G	F
Chlorine	G	G	-	G
Chloroacetone	F	E	-	P
*Chloroform	P	F	G	P
Chromic acid	P	F	F	E
Cyclohexane	F	E	-	P
Dibenzyl ether	F	G	-	P
Dibutyl phthalate	F	G	-	P
Diethanolamine	F	E	-	E

Diethyl ether	F	G	E	P
**Dimethyl sulfoxide	-	-	-	-
Ethyl acetate	F	G	G	F
*Ethylene dichloride	P	F	G	P
Ethylene glycol	G	G	E	E
*Ethylene trichloride	P	P	-	P
Fluorine	G	G	-	G
Formaldehyde	G	E	E	E
Formic acid	G	E	E	E
Glycerol	G	G	E	E
Hexane	P	E	-	P
Hydrobromic acid (40%)	G	E	-	E
Hydrochloric acid (conc)	G	G	G	E
Hydrofluoric acid (30%)	G	G	G	E
Hydrogen peroxide	G	G	G	E
Iodine	G	G	-	G
Methylamine	G	G	E	E
Methyl cellosolve	F	E	-	P
*Methyl chloride	P	E	-	P
Methyl ethyl ketone	F	G	G	P
*Methylene chloride	F	F	G	F
Monoethanolamine	F	E	-	E
Morpholine	F	E	-	E
*Naphthalene	G	G	E	G
Nitric acid (conc)	P	P	P	G
Perchloric acid	F	G	F	E
Phenol	G	E	-	E
Phosphoric acid	G	E	-	E
Potassium hydroxide	G	G	G	E
*Propylene dichloride	P	F	-	P
Sodium hydroxide	G	G	G	E

Sodium hypochlorite	G	P	F	G
Sulfuric acid (conc)	G	G	F	G
*Toluene	P	F	G	F
*Trichloroethylene	P	E	G	F
Tricresyl phosphate	P	E	-	F
Triethanolamine	F	E	E	E
Trinitrotoluene	P	E	-	P

* Aromatic and halogenated hydrocarbons will attack all types of natural and synthetic glove materials. Should swelling occur, the user should change to fresh gloves and allow the swollen gloves to dry and return to normal.

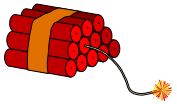
** No data on the resistance of dimethyl sulfoxide of natural rubber, neoprene, nitrile rubber, or vinyl materials are available; the manufacturer of the substance recommends the use of butyl rubber gloves.

This appendix taken from “Prudent Practices for Handling Hazardous Chemicals in the Laboratory”

Appendix 3

Chemical Segregation and Incompatibilities Guidelines

Chemical Segregation & Incompatibilities Guidelines

Class of Chemical	*1.1.1 Examples*	Recommended Storage Method	Incompatible Materials	Possible Reaction If Mixed
Corrosive Acids 	Mineral Acids – Chromic Acid Hydrogen Chloride Hydrochloric Acid Nitric Acid Perchloric Acid Phosphoric Acid Sulfuric Acid	Separate cabinet or storage area away from potential water sources, i.e. under sink	Flammable Liquids Flammable Solids Bases Oxidizers Poisons	Heat   Gas Generation  Violent Reaction
Corrosive Bases/ Caustics 	Ammonium Hydroxide Sodium Hydroxide Sodium Bicarbonate	Separate cabinet or storage area away from potential water sources, i.e. under sink	Flammable Liquids Flammable Solids Acids Oxidizers Poisons	 Heat  Gas Generation  Violent Reaction
	Ammonium Nitrate Nitro Urea Picric Acid Trinitroaniline Trinitrobenzene Trinitrobenzoic Acid Trinitrotoluene Urea Nitrate	Secure location away from other chemicals	Flammable Liquids Oxidizers Poisons Acids Bases	Explosion Hazard 

Flammable Liquids 	Acetone Benzene Diethyl Ether Methanol Ethanol Toluene Glacial Acetic Acid	Grounded flammable storage cabinet of flammable storage refrigerator	Acids Bases Oxidizers Poisons	 Fire Hazard  Heat  Violent Reaction
Flammable Solids 	Phosphorus Magnesium	Separate dry cool area	Acids Bases Oxidizers Poisons	Fire Hazard  Heat  Violent Reaction
Oxidizers 	Sodium Hypochlorite Benzoyl Peroxide Potassium Permanganate Potassium Chlorate Potassium Dichromate Peroxides Perchlorates Chlorates Nitrates	Spill tray that is separate from flammable and combustible materials	Reducing Agents Flammables Combustibles Corrosives	Fire Hazard  Toxic Gas Generation 
Poisons 	Cyanides Cadmium Mercury Osmium Acrylamide DMSO	Vented, cool, dry area in unbreakable chemically resistant secondary containers	Flammable Liquids Acids Bases Oxidizers Corrosives	Generation of Toxic & Flammable Gas   Violent Reaction
Water Reactive Chemicals 	Sodium Metal Potassium Metal Lithium Metal Lithium Aluminum Hydride	Dry, cool location away from potential spray from fire sprinklers and other water sources, i.e. under sink	Aqueous Solutions Oxidizers	Heat   Violent Reaction

Flammable Compressed Gases 	Methane Acetylene Propane Hydrogen	Cool, dry area away from oxidizing gases while securely attached to wall or bench	Oxidizing & Toxic Compressed Gases Oxidizing Solids	Fire Hazard   Explosion Hazard
Oxidizing Compressed Gases 	Oxygen Chlorine Bromine	Cool, dry area away from flammable gases while securely attached to wall or bench	Flammable Gases	Fire Hazard   Explosion Hazard
Poisonous Compressed Gases 	Carbon Monoxide Hydrogen Sulfide	Cool, dry area away from flammable gases or liquids while securely attached to wall or bench	Flammable Gases Oxidizing Gases	Release of Toxic Gas   Violent Reaction

Partial Incompatibility Listing

Compound/Class	Avoid Storage Near or Contact With:
Acids	
Acetic Acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene, glycogen, perchloric acid, peroxides, permanganate
Hydrofluoric Acid	Ammonia (aqueous or anhydrous)
Nitric Acid (conc.)	Acetic acid, aniline, chromic acid, acetone, alcohol, or other flammable liquids, hydrocyanic acid, hydrogen sulfide, or other flammable gases, nitratable substances: copper, brass or any heavy metals (or will generate nitrogen dioxide/nitrous fumes) or organic products such as wood and paper
Sulfuric Acid	Light metals (lithium, sodium, potassium), chlorates, perchlorates, permanganates
Bases	
Ammonia	Mercury, chlorine, bromine, iodine, hydrofluoric acid, calcium hypochlorite
Calcium oxide	Water
Alkaline metals	Sodium, potassium, magnesium, calcium, aluminum, carbon dioxide, carbon tetrachloride or other chlorinated hydrocarbons, halogens, water
Bromine	Ammonia, acetylene, butadiene, methane, propane, butane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals
Carbon, activated	Calcium hypochlorite, oxidizing agents
Chlorine	Ammonia, acetylene, butadiene, methane, propane, butane, or other petroleum gases, hydrogen, sodium carbide, turpentine, benzene, finely divided metals
Copper	Acetylene, hydrogen peroxide, nitric acid
Fluorine	Isolate from everything
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, ammonia, fulminic acid (produced in nitric acid ethanol mixtures)
Oxygen	Oils, grease, hydrogen, other flammable gases, liquids, or solids
Phosphorous (white)	Air, oxygen, caustic alkalis as reducing agents (or will generate phosphine)
Potassium	Carbon tetrachloride, carbon dioxide, water
Silver	Acetylene, oxalic acid, tartaric acid, fulminic acid (produced in nitric acid-ethanol mixtures), and ammonium compounds
Organics	
Acetone	Concentrated nitric acid and sulfuric acid mixtures
Acetylene	Fluorine, chlorine, bromine, copper, silver, mercury

Aniline	Nitric acid, hydrogen peroxide
Flammable Liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Hydrocarbons (propane, butane, etc.)	Fluoride, chlorine, bromine, chromic acid, sodium peroxide
Nitroparaffins	Inorganic bases, amines
Oxalic Acid	Silver, mercury

Oxidizers

Chlorates	Ammonia salts, acids, metal powders, sulfur, finely divided organics, or combustible materials
Chromic Acid (trioxide)	Acetic acid, naphthalene, camphor, glycerol, turpentine, alcohol or flammable liquids
Ammonium Nitrate	Acids, metal powders, flammable liquids, chlorates, nitrates, sulfur, finely divided organic or combustible materials
Chlorine Dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Cumene Hydroperoxide	Organic or inorganic acids
Hydrogen Peroxide	Copper, chromium, iron, most other metals or salts, alcohols, acetone, or other flammable liquids, aniline, nitromethane, or other organic or combustible materials
Hypochlorites	Acids (will generate chlorine or hypochlorous acid
Nitrates	Sulfuric acid (will generate nitrogen dioxide)
Perchloric Acid	Acetic acid, bismuth and its alloys, alcohol, paper, wood, grease, oils
Peroxides (Organics)	Organic or inorganic acids; also avoid friction and store cold
Potassium Chlorate	Acids, especially sulfuric acid
Potassium Permanganate	Glycerol, ethylene glycol, benzaldehyde, sulfuric acid
Sodium Peroxide	Any oxidizable substance such as methanol, ethanol, glycerol, ethylene glycol, glacial acetic acid, acetic anhydride, benzaldehyde, furfural, methyl acetate, ethyl acetate, carbon disulfide
Alkaline metals	Sodium, potassium, magnesium, calcium, aluminum, carbon dioxide, carbon tetrachloride or other chlorinated hydrocarbons, halogens, water
Calcium oxide	Water
Cyanides	Acids (will generate hydrogen cyanide)
Phosphorous (white)	Air, oxygen, caustic alkalis as reducing agents (will generate phosphine)
Potassium	Carbon tetrachloride, carbon dioxide, water
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium Peroxide	Any oxidizable substance such as methanol, ethanol, glycerol, ethylene glycol, glacial acetic acid, acetic anhydride, benzaldehyde, furfural, methyl acetate, ethyl acetate, carbon disulfide
Sulfides	Acids (will generate hydrogen sulfide)

Reducing Agents

Hydrazine	Hydrogen peroxide, nitric acid, other oxidants
Nitrites	Acids (will generate nitrous fumes)
Sodium Nitrite	Ammonium nitrate and other ammonium salts

Toxics/Poisons

Arsenicals	Reducing agents (will generate arsine)
Azides	Acids (will generate hydrogen azide)
Cyanides	Acids (will generate hydrogen cyanide)
Hydrocyanic Acid	Nitric Acid, alkalis
Hydrogen Sulfide	Fuming nitric acid, oxidizing gases
Selenides	Reducing agents (will generate hydrogen selenide)
Sulfides	Acids (will generate hydrogen sulfide)
Tellurides	Reducing agents (will generate hydrogen telluride)

Date created 03/05

APPENDIX 4

Laboratory Specific Training Form

UH CHEMICAL OR HAZARD-SPECIFIC TRAINING RECORD

NAME: _____

EMPLOYMENT START DATE: _____

DEPARTMENT: _____

PRINCIPAL INVESTIGATOR: _____

BUILDING / ROOM: _____

SAFETY ITEM	INSTRUCTOR	DATE COMPLETED
List Lab-specific Safety Training by Department*		

DATE OF COMPLETION: _____

SIGNATURE: _____

** All laboratory-specific training must be documented and maintained by the Principle Investigator.*

APPENDIX 5

List of Select Carcinogens, Reproductive Toxins and Acutely Toxic Chemicals

Table A. Carcinogens

Agent is classified as "carcinogenic to humans", or "probably carcinogenic to humans by the International Agency for Research on Cancer (IARC)", or is a "Known Carcinogen" by the National Toxicology Program (NTP).

Acetaldehyde	75-07-0
Acetylaminofluorene, 2	53-96-3
Acrylamide	79-06-1
Acrylonitrile	107-13-1
Adriamycin	23214-92-8
Aldrin	309-00-2
Amino-2-methylanthraquinone,1	82-28-0
Aminoanthraquinone, 2	117-79-3
Aminoazotoluene	975-63-6
Aminobiphenyl, 4	92-67-1
Amitrole	618-25-1
Ammoniumdichromate (VI)	7789-09-5
Analgesic mixtures (Contain phenacetin)	62-44-2
Anisidine	90-04-0
Anisidine Hydrochloride	134-29-2
Antimony oxide (Antimony trioxide)	1309-64-4
Arsenic acid	7440-38-2
Arsenic pentoxide	1303-28-2
Arsenic trioxide	1327-53-3
Arsenic/Certain Arsenic Compounds	7440-42-1
Arsenious acid	
Asbestos	1332-21-4
Auramine	492-80-8
Azacitidine	320-67-2
Azathioprine	446-86-6
Barium chromate(VI)	10294-40-3
Benz[a]anthracene	56-55-3
Benzene	71-43-2
Benzidine	92-87-5
Benzo[a]pyrene	50-32-8
Benzo[b]fluoranthene	205-99-2
Benzo[j]fluoranthene	205-82-3
Benzo[k]fluoranthene	207-08-9
Benzotrichloride	96-07-7
Beryllium and Certain Beryllium Compounds	7440-41-7
Bis(2-chloroethyl)-2-naphthylamine, N, N	494-03-1
Bischloroethyl Nitrourea(BCNU)	154-93-8
Bis-chloromethyl Ether(BCME)	542-88-1
Bromodichloromethane	75-27-4

Butadiene,1,3	106-99-0
Butanediol Dimethane sulphonate(Myleran),1,4	55-98-1
Butanone	5407-91-0
Butanone, 4-(N-Nitrosomethylamino)-1-(3-pyridyl)-1-(NNK)	
Butylamine, N-Nitrosodi-n-	
Butylated hydroaxyanixole	25013-16-5
C.I. Basic red 9	
Cadmium and Certain Cadmium Compounds	7440-43-9
Cadmium fume	
Cadmium sulfate	10124-36-4
Cadmium sulfide	1306-23-6
Calcium chromate (VI)	13765-19-0
Carbon tetrachloride	56-23-5
Chlorambucil	305-3-3
Chlordecone	143-50-0
Chlorendic acid	115-28-6
Chlorinated paraffins (C12 43% Chlorine)	
Chlorinated paraffins (C12 60% Chlorine)	108171-26-2
Chloro-2-methyl propene,3 ,3	563-47-3
Chloroethyl nitrosourea, bis-	
chloroethyl)-3-cyclohexyl-1-nitrosourea(CCNU),1 2-	13010-47-4
Chloroform	67-66-3
Chloromethyl ether, bis	
Chloromethyl methyl ether	107-30-2
Chlorophenols	95-57-8
Chloroprene, inhibited	126-99-8
Chloropropane	540-54-5
Chloropropane, 1,2-Dibromo-3-(DBCP)	96-12-8
Chlorozotocin	54749-90-5
Chromic acid, disodium salt	
Chromic acid, lead (2+) salt (1:1)	
Chromium (VI) compounds	7440-47-3
Chromium phosphate	7789-04-0
Chromium triacetate	
Ciclosporin	
Cisplatin	15663-27-1
Cobalt alloy, Co, Cr	7440-48-4
Conestoral	
Conjugated estrogens	
Cresidine	120-71-8
Cupferron	135-20-6
Cycasin	14901-08-7
Cyclophosphamide	50-18-0

Cyclosprin A	
Dacarbazine	4342-03-4
DDT	50-29-3
Di(2,3-epoxypropyl) ether (DGE)	
Di(2-ethylhexyl)phthalate	117-61-7
Diaminoanisole and its salts,2,4	615-05-4
Diaminoanisole sulfate,2,4	39156-41-7
Diaminodiphenyl ether (4,4'. Oxydianiline)	101-80-4
Diaminotoluene,2,4	95-80-7
Dibenz[a,h] acridine	226-36-8
Dibenz[a,h]anthracene	53-70-3
Dibenz[a,j] acridine	224-42-0
Dibenzo[a,e]pyrene	192-65-4
Dibenzo[a,h]pyrene	189-64-0
Dibenzo[a,j]pyrene	191-30-0
Dibenzo[a,l]pyrene	189-55-9
Dibenzo[cg]carbazole, 7-H	194-59-2
Dibromo-3-chloropropane(DBCP),1,2	96-12-8
Dibromoethane,1,2	
Dichlorobenzene, p	106-46-7
Dichlorobenzidine dihydrochloride, 3,3'	
Dichlorobenzidine,3,3	91-94-1
Dichloroethane,1,2	
Dichloromethane (Methylene Chloride)	75-09-2
Dichloropropene,1,3	542-75-6
Dichlorvos (DDVP)	62-73-7
Dichromic acid, diammonium salt	
Dieldrin	60-57-1
Dienestrol	84-17-3
Diepoxybutane	
Diepoxybutane	1464-53-5
Diethyl Sulfate	64-67-5
Diethylstilbestrol(DES)	56-53-1
Diglycidyl resorcinol ether	
Dimethoxybenzidine, 3,3-(ortho-Dianisidine)	119-90-4
Dimethyl carbamoyl chloride	79-44-7
Dimethyl sulfate	77-78-1
Dimethylaminoazobenzene, 4	60-11-7
Dimethylbenzidine, 3,3'-(o-Tolidine)	119-93-7
Dimethylhydrazine,1,1	57-14-7
Dioxane,1,4	123-91-1
Dichlorobenzene,p-	106-46-7
Epichlorohydrin	106-89-8
Erionite	12510-42-8
Estra-1,2,5(10),7-tetraene-17-one,3-(sulfooxy)-;sodium salt	

Estrogens	
Ethyl acrylate	140-88-5
Ethyl Methanesulfonate	62-50-0
Ethylene dibromide(EDB)	106-93-4
Ethylene dichloride(EDC)	107-06-2
Ethylene oxide	75-21-8
Ethylene Thiourea	96-45-7
Ethyleneimine, inhibited	151-56-4
Formaldehyde (gas)	50-00-0
Fowlers solution	10124-50-2
Glycidol	556-52-5
Gyromitrin	
Hexachlorobenzene	118-74-1
Hexachlorobenzene, gamma	
Hexachlorobutadiene	87-68-3
Hexachlorocyclohexanes	
Hexachloroethane	67-72-1
Hexamethylphosphoramide	680-31-9
Hydrazine	302-01-2
Hydrazine Sulfate	10034-93-2
Hydrazobenzene	122-66-7
Indeno[1,2,3-cd]pyrene	193-39-5
Inorganic acid mists containing sulfuric acid	7664-93-9
IQ(2-Amino-3methylimidazo(4,5-f)quinoline)	
Kepone (Chlordecone)	143-50-0
Lead (II) phosphate	7446-27-7
Lead acetate (II), trihydrate	6080-56-4
Lead chromate (VI) oxide	18454-12-1
Lindane, alpha	58-89-9
Lindane, beta	
Melphalan	148-82-3
Mestranol	72-33-3
Methoxsalen	298-81-7
Methoxypsoralen, 5	484-20-8
Methyl Bromide	74-83-9
Methyl Chloride	74-87-3
Methyl Hydrazine	302-15-8
Methyl Iodide	74-88-4
Methyl Methanesulfonate	66-27-3
Methylaziridine	75-55-8
Methylaziridine, 2-(ploye neimine)	
Methylchrysene, 5	3697-24-3
Methylene bis (N-N-dimethylbenzenamine),4,4	
Methylene bis(2-chloroaniline) (MOCA), 4, 4	101-14-4
Methylene bis(n,n-dimethyl)benzenamine, 4, 4	101-61-1

Methylenedianiline, 4,4	101-77-9
Methylpropene, 1-Chloro-2-	513-37-1
Methylpropene, 3-Chloro-2-	563-47-3
Methyl-N'-nitro-N-nitroso-guanidine, N	70-25-7
Metronidazole	443-48-1
Michler's Ketone	90-94-8
Mirex	2385-85-5
Mitomycin C	50-07-7
Mirex	2385-85-5
Molybdate orange	
MOPP and other combined chemotherapy including alkylating	
Mustard gas	505-60-2
Naphthylamine, 2	91-59-8
Naphthylamine, alpha	134-32-7
Naphthylamine, beta	91-89-6
Nickel (II) acetate	373-02-4
Nickel (II)carbonate	12607-70-4
Nickel (II) hydroxide	12054-48-7
Nickel (II) oxide	
Nickel (III) hydroxide	
Nickel carbonyl	13463-39-3
Nickel sulfide	
Nickel metallic	7440-02-0
Nitrilotriacetic acid	139-13-9
Nitrobiphenyl, 4	92-93-3
Nitrofen	1836-75-5
Nitrogen mustard	51-75-5
Nitro-n-ethylurea, N	759-73-9
Nitro-n-methylurea, N	684-93-5
Nitro-o-anisidine, 5	99-59-2
Nitropropane, 2	79-46-9
Nitrosodiethanolamine, N	1116-54-7
Nitrosodiethylamine, N	55-18-5
Nitrosodiethylamine, N	55-18-5
Nitrosodimethylamine, N	62-75-9
Nitrosodi-n-butylamine, N	924-16-3
Nitrosodiphenylamine, P	156-10-5
Nitrosomethylvinylamine, N	4549-40-0
Nitrosomorpholine, N	59-89-2
Nitrosonornicotine, N	16543-55-8
Nitrosopiperidine, N	100-75-4
Nitrosopyrrolidine, N	930-55-2
Nitrososarcosine, N	13256-22-9
Norethisterone, N	68-22-4
Ochratoxin A	303-47-9
Oestrogen	
Oxymetholone	434-07-1
Pentachlorbiphenyl	
Phenacetin	62-44-2

Phenoxybenzamine hydrochloride	59-96-1
Phenazopyridine	94-76-0
Phenazopyridine hydrochloride	136-40-3
Phenlyenediamine, 4-chloro-o-	
Phenyl-beta-naphthylamine - N	135-88-6
Phenytoin	63-93-3
Phosphate, Tris-(2,3-dibromopropyl)	
Phtalate, Di-(2-ethylhexyl)	
Polybrominated Biphenyls(PBBs)	36355-01-8
Polychlorinated Biphenyls(PCBs)	1336-36-3
Potassium chromate VI	7789-00-6
Potassium dichromate VI	7778-50-9
Procarbazine	671-16-9
Procarbazine Hydrochloride	366-70-1
Progesterone	57-83-0
Propane sultone,1,3	1120-71-4
Propiolactone, beta	57-57-8
Propylamine, N, Nitrosodi-n	107-10-8
Propylene oxide	75-56-9
Propylthiouracil	51-52-5
Saccharin,	81-07-2
Safrole	94-59-7
Silica, Crystalline	14808-60-7
Silicic acid, beryllium salt	7699-41-4
Sodium dichromate (VI)	10588-01-9
Staphylococcal enterotoxins	
Streptozotocin	18883-66-4
Strontium chromate	7789-06-2
Styrene –7,8-oxide	
Sulfallate	95-06-7
Sulfur trioxide	7446-11-9
Tetrachlorodibenzo-para-dioxin	
Tetrachlorodibenzo-p-dioxin(TCDD), 2,3,7,8	1746-01-6
Tetrachloroethane	79-34-5
Tetrachloroethane,1,1,2,2	79-34-5
Tetrachloroethylene	127-18-4
Tetranitromethane	509-14-8
Thioacetamide	62-55-5
Thiotepa	52-24-4
Thiourea	62-56-6
Thorium Dioxide	1314-20-1
Toluene diisocyanate	26471-62-5
Toluidine Hydrochloride, o-	636-21-5
Toluidine, o-	95-53-4
Toluidine, p-	106-49-0
Toluidine, p Chloro-o-	
Toxaphene	8001-35-2
Trenimone	010
Treosulphan	299-75-2

Trichloroethylene	79-01-6
Trichlorophenol,2,4,6	88-06-2
Trichloropropane, 1,2,3-	
Triethylenemelamine	51-18-3
Tris(1-aziridinyl)phosphine Sulphide	52-24-4
Tris(2,3-dibromopropyl) phosphate	126-72-7
Tris(aziridinyl)-para-benzoquinone (Triziquone)	68-76-8
Uracil Mustard	66-75-1
Urethane	51-79-6
Vinyl bromide	593-60-2
Vinyl chloride	75-01-4
Vinyl Cylohexene Dioxide	106-87-6
Vinyl Fluoride	75-02-5
Vinylidene Fluoride Monomer	75-38-7
Zinc Chromate	13530-65-9

Table B . Reproductive Toxins

Agents known to cause either male and female reproductive toxicity by the State of California.

Acetihydroxamic Acid	546-88-3
Actinomycin D	50-76-0
All-trans retinoic Acid	302-79-4
Alprazolam	28981-97-7
Amikacin Sulfate	39831-55-5
Aminoglutethimide	125-84-8
Amonoglycosides	
Aminopterin	54-62-6
Amiodarone hydrochloride	19774-82-4
Amoxapine	14028-44-5
Angiotensin converting enzyme inhibitors	1407-47-2
Anisindione	117-37-3
Arsenic	7440-42-1
Atenolol	29122-68-7
Azathioprine	446-86-6
Barbituates	
Beclomethasone dipropionate	5534-09-8
Benomyl	17804-35-2
Benzene	71-43-2
Benzphetamine hydrochloride	5411-22-3
Benzodiazepines	
Bischloroethyl nitrosurea (BCNU)	154-93-8
Bromoxynil	1689-84-5
Butabarbital sodium	143-81-7
Butanediol dimethylsulfonate, 1,4’	55-98-1
Cadmium	7440-43-9
Carbon Disulfide	75-15-0
Carbon Monoxide	630-08-0
Carboplatin	41575-94-4
Chenodiol	474-25-9
Chinomethionat	2439-01-2
Chlorambucil	305-03-3
Chlorcyclizine hydrochloride	1620-21-9
Chlordecone	143-50-0
Chlodiazepoxide	58-25-3
Chlodiazepoxide hydrochloride	438-41-5
CCNU	13010-47-4
Cladribine	4291-63-8
Clarithromycin	81103-11-9
Clobetasol propionate	25122-46-7
Clomiphene citrate	50-41-9
Clorazepate dipotassium	57109-90-7
Cocaine	50-36-2
Codeine phosphate	52-28-8

Cojugated estrogens	----------
Cyanazine	21725-46-2
Cycloheximide	66-81-9
Cyclophosphamide (anhydrous)	50-18-0
Cyclophosphamide (hydrated)	6055-19-2
Cyhexatin	13121-70-5
Cytarabine	147-94-4
Danazol	17230-88-5
Daunorubicin hydrochloride	23541-50-6
DDT, o,p-	789-02-6
DDT, p,p-	50-29-3
Demeclocycline Hydrochloride	64-73-3
Diazepam	439-14-5
Dicumarol	66-76-2
Diethylstillbestrol (DES)	56-53-1
Dihydroergotamine mesylate	6190-39-2
Dinocap	39300-45-3
Dinoseb	88-85-7
Diphenylhydantoin (Phenytion)	57-41-0
Doxycycline (internal)	564-25-0
Doxycycline calcium (internal)	94088-85-4
Doxycycline hyclate (internal)	24390-14-5
Doxycycline monohyrdate (internal)	17086-28-1
Endrin	72-20-8
Ergotamine tartrate	379-79-3
Estropripate	7280-37-7
Ethionamide	536-33-4
Ethylene dibromide	106-93-4
Ethylene glycol monoethyl ether	110-80-5
Ethylene glycol monomethyl ether	109-86-4
Ethylene glycol monoethyl ether acetate	111-15-9
Ethylene glycol monomethyl ether acetate	110-49-6
Ethylene thiourea	96-45-7
Etoposide	33419-42-0
Etretinate	54350-48-0
Fluazifop butyl	69806-50-4
Flunisolide	3385-03-3
Fluoruracil	51-12-8
Fluoxymesterone	76-43-7
Flurazepam hydrochloride	1172-18-5
Flutamide	13311-84-7
Fluticasone propionate	80474-14-2
Fluvalinate	69409-94-5
Goserelin acetate	65807-02-5
Halazepam	23092-17-3
Halothane	151-67-7
Hexachlorobenzene	118-74-1
Histrelin acetate	

Hydroxyurea	127-07-0
Ifosfamide	3778-73-2
Iodine 131	10043-66-0
Isotretinoin	4759-48-2
Lead	7439-92-1
Leuprolide acetate	74381-53-6
Lithium carbonate	554-13-2
Lithium citrate	919-16-4
Lorazepan	846-49-1
Lovastatin	75330-75-5
Medroxyprogesterone acetate	71-58-9
Megestrol acetate	595-33-5
Melphalan	148-82-3
Menotropins	9002-68-0
Meprobamate	57-53-4
Mercaptopurine	6112-76-1
Mercury compounds	7439-97-6
Methacycline hydrochloride	3963-95-9
Metham sodium	137-42-8
Methim azole	60-56-0
Methotrexate	59-05-2
Methotrexate sodium	15475-56-6
Methyl bromide as structural fumigant	74-83-9
Methyl Mercury	593-74-8
Methyltestosterone	58-18-4
Midazolam hydrochloride	59467-96-8
Minocycline hydrochloride	13614-98-7
Misoprostol	59122-46-2
Mitoxantrone hydrochloride	70476-82-3
Nafarelin acetate	86220-42-0
Neomycin sulfate	1405-10-3
Netilmicin sulfate	56391-57-2
Nickel carbonyl	13463-39-3
Nicotine	54-11-5
Nitrogen Mustard	51-75-2
Nitrogen Mustard hydrochloride	55-86-7
Norethisterone	68-22-4
Norethisterone acetate	51-98-9
Norethisterone/Ethinyl estradiol	68-22-4/57-63-6
Norethisterone Mestranol	68-22-4/72-33-3
Noroestrel	6533-00-2
Oxadiazon	19666-30-9
Oxazepam	604-75-1
Oxymetholone	434-07-0
Oxytetracycline	79-57-2
Oxytetracycline hydrochloride	2058-46-0
Paclitaxel	33069-62-4
Paramethadione	115-67-3
Penicillamine	52-67-5

Pentobarbital sodium	57-33-0
Pentostatin	53910-25-1
Phenacemide	63-98-9
Phenprocoumon	435-97-2
Pipobroman	54-91-1
Plicamycin	18378-89-7
Polybrominated Biphenyls	36355-01-8
Polychlorinated Biphenyls	1336-36-3
Procarbazine hydrochloride	366-70-1
Propylthiouracil	51-52-5
Quazepam	36735-22-5
Resmethrin	10453-86-8
Retinol/retinyl esters	
Ribavirin	36791-04-5
Secobarbitol sodium	309-43-3
Tamoxifen citrate	54965-24-1
Temazepan	846-50-4
Teniposide	29767-20-2
Testostereone cypionate	58-20-8
Testosterone enantahate	315-37-7
TCDD	1746-01-6
Thalidomide	50-35-1
Thiguanine	154-42-7
Tobramycin Sulfate	49842-07-1
Triazolam	28911-01-5
Trilostane	13647-35-3
Trimethadione	127-48-0
Trimetrexate glucuronate	82952-64-5
Uracil Mustard	66-75-1
Urethane	51-79-6
Urofollitropin	26995-91-5
Valproate (Valproic acid)	99-66-1
Vinblastine sulfate	143-67-9
Vinclozin	50471-44-8
Vincristine sulfate	2068-78-2
Warfarin	81-81-2

Table C . Select Agents

Agent is classified as a "Select Agent" by the EPA (40CFR part 72 – appendix A)

Aflatoxins	1402-68-2
Aflatoxin B1	
Aldrin	309-00-2
Botulisum Toxin	
Clostridium perfringens epsilon toxin	
Conotoxins	
Diacetoxyscirpenol	
Ricin	
Saxitoxin	
Shigatoxin	
Tetrodotoxin	4368-28-9
T-2 Toxin	

Table D. Pesticides

Agents classified as a "pesticide" by the EPA under the Federal Insecticide, Rodenticide Act, (FIFRA) - Title 7, United States Code, Chapter 125, Section 2

Azinphos methyl	86-50-0
Demeton	8065-48-3
Disulfoton	298-04-4
Fensulfoton	115-90-2
Mevinphos	7786-34-7
Nemaphos	297-97-2
Parathion	56-38-2
Parathion methyl	298-00-2
Phorate	298-02-2
TEPP	107-79-3
DDT	50-29-3
DDE	72-55-9
DDD(Rothane)	72-54-8
Aldrin	309-00-2
Endrin	72-20-8
Endosulfan	115-29-7
Isobenzan(telodrin)	297-78-9
Chlordane	57-74-9
Heptachlor	76-44-8
Hexachlorocyclohexane	319-84-6
Lindane	58-89-9
Chlordecone(Kepone)	143-50-0
Kelevan	050
Mirex(Dechlorane)	2385-85-5
Dicofiol(Kelthane)	115-32-2
Methoxychlor(Marlate)	72-43-5
Toxaphene	8001-35-2

Table E. - Explosives

Agent is classified as an explosive - DOT (Title 49CFR, Part 100-199).

Ammonium perchlorate	7790-98-9
Ammonium picrate	131-74-8
1-Bromo-2-nitrobenzene	577-19-5
1-Bromo-3-nitrobenzene	585-79-5
1-Bromo-4-nitrobenzene	586-78-7
Cyclotrimethylenetrinitramine (RDX)	121-84-4
1,1-Dinitroethane(dry)	600-40-8
1,2-Dinitroethane	7570-26-5
Dinitroethyleneurea	035
Dinitroglycerine	623-87-0
Dinitroglycol	628-96-6
Dinitromethane	625-76-3
Dinitrophenol (less than 15% water ,by mass)	25550-58-7
2,4-Dinitropheny	036
Dinitropropylene glycol	6423-43-4
Dinitrostilbene	6275-02-1
Ethanol amine dinitrate	None
Ethyl4,4-dinitropentanoate	037
Galactsan trinitrate	None
Glycerol monoglugonate trinitrate	038
Glycerol monolactate trinitrate	039
Hexamethylol benzene hexanitrate	105554-30-1
Hexanitro dihydroxazobenzene	None
Hexanitroazoxy benzene	None
Hexanitrodiphenyl ether	040
Hexanitrodiphenylamine	35860-31-2
Hexanitrodiphenylurea	None
Hexanitroethane	918-37-6
Hexanitrooxanilide	29135-62-4
Hexanitrostilbene	20062-22-0
Inulin trinitrate	None
Mannitan tetranitrate	None
Methyl nitrate	598-58-3
Methyl picric acid(Heavy salts of metal)	None
Methylamine ditramine	None
Methylene glygol dinitrate	38483-28-2
Mercury oxalate	041
N-Nitroaniline	645-55-6
5-Nitro 1H-benzotriazole	2338-12-7
Nitrocellulose	9004-70-0
Nitroethyl nitrate	4528-34-1
Nitrogen trichloride	10025-85-1
Nitroglycerine	55-63-0
Nitroguanidine	556-88-7
Nitrohydantoin	2825-15-2

Nitromannite	15825-70-4
N-Nitrourea	556-89-8
Octogen	2691-41-0
Pentaerythritol tetranitrate	78-11-5
Pentanitroaniline	21985-87-5
Pentolite	8066-33-9
Picramic acid	96-91-3
Tetranitroaniline Styphic acid	042
Nitroglycide	043
Nitroglycol	044
Nitroguanidine	556-88-7
Nitrourea	556-89-8
Pentaerythritetetranitrate (PETN)	78-11-5
Picramic acid	96-91-3
Sodium amitol	045
Tetranitroaniline	53014-37-2
Tetranitrocarbazole	046
Tetranitrochrysazin	047
Tetrytol	048
Tetryl	479-45-8
Trinitroacetic acid	None
Triacetonitrile	630-72-8
Trinitroaniline	26952-42-1
Trinitrobenzene	99-35-4
Trinitrocresol	049
Trinitroresorcinol	82-71-3
Urea nitrate	124-47-0

Table F. - Antineoplastic Agents

(Cytotoxic drugs) - Agents used for treating cancer

Agathioprine	014
Amsacrine	54301-15-4
Askparaginase	9015-68-3
Azacytidine	016
Carmustine	017
Chlorambucil	305-03-3
Chlornaphazine	018
Cyclophosphamide (anhydrous)	50-18-0
Cytarabine	147-94-4
Dacarbazine	4342-03-4
Dactinomycin	50-76-0
Daunorubicin hydrochloride	23451-50-6
Doxorubicin hydrochloride	25316-40-9
Etoposide	23935-92-4
Flurouracil	51-21-8
Ifosfamide	7782-42-5
Lomustine	13909-09-6
Mechlorethamine hydrochloride	55-86-7
Melphalan	148-82-3
Mercaptopurine	28128-19-0
Methotrexate	59-05-2
Mithramycin	18378-89-7
Mitomycin C	50-07-7
Mitoxantrone hydrochloride	019
Procarbazine	671-16-9
Streptozocin	1883-66-4
Teniposide	020
Treosulphan	299-75-2
Thiotepa	021
Uracil mustard	66-75-1
Vinblastine sulfate	143-67-9
Vincristine sulfate	2068-78-2
Vindesine	023

APPENDIX 6

Reference Materials

REFERENCE MATERIALS

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