

Propulsion Research Laboratory CHEMICAL HYGIENE PLAN

Laboratory Location (building and room): Industrial Sciences 101

Department or Campus Unit: Mechanical and Aerospace Engineering

Campus Unit Safety Coordinator: David Britt

Principal Investigator: Stephen A. Whitmore

Laboratory Safety Coordinator: _____
(if different from PI)

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Person who completed the plan: Stephen A. Whitmore

Title of person completing the plan: Professor

Annual review (including any necessary updating) of the plan is required. Once reviewed and updated it must be sent to the USU Chemical Hygiene Committee for approval, UMC 8315.

References in this document are made to the following text:
Prudent Practices for Handling Hazardous Chemicals in Laboratories,
National Research Council, National Academy Press, 2011.

This manual along with other chemical safety and health references are available online at
<http://rgs.usu.edu/ehs/>.

UTAH STATE UNIVERSITY CHEMICAL HYGIENE PLAN

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A. GENERAL PRINCIPLES FOR WORK WITH LABORATORY CHEMICAL

- 1. It is prudent to minimize all chemical exposures.** Because few laboratory chemicals are without hazards, precautions for handling all laboratory chemicals should be adopted. Skin contact with chemicals should be avoided as a cardinal rule.
- 2. Avoid underestimation of risk.** Even for substances of no known hazard, exposure should be minimized; for work with substances which present hazards, special precautions should be taken. One should assume that any mixture will be more toxic than its most toxic component and that all substances of unknown toxicity are toxic.
- 3. Provide adequate ventilation.** The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by use of local exhaust hoods and closed chemical containers.
- 4. Institute a chemical hygiene program.** The OSHA Laboratory Standard requires a chemical hygiene program be developed and implemented for all laboratories. A mandatory chemical hygiene program designed to minimize exposures is needed, it should be an ongoing, continuing effort, not merely a one-time or short-term activity. Its procedures should be followed in academic teaching laboratories as well as research laboratories.
- 5. Observe the PELs and TLVs.** The OSHA Permissible Exposure Limits (PEL's) and the American Conference of Governmental Industrial Hygienists Threshold Limit Values (TLV's) should not be exceeded. Engineering controls should be implemented if action levels are exceeded.
- 6. Understand Routes of Exposure to Toxic Chemicals.** Toxic chemicals may enter your body through several routes:
 - a.** By inhalation through the nose or mouth.
 - b.** By absorption through the skin, eyes, and mucous membranes.
 - c.** By ingestion, via unwashed hands.
 - d.** By injection via broken glass, needles, knives, or other sharp instruments.
- 7. Proper control methods reduce risk of chemical related injury or illness by eliminating these routes of entry.** Chemical hygiene control methods are divided into three categories:
 - a. Engineering Controls:**
Local exhaust ventilation, glove boxes, safety interlocks
 - b. Administrative Controls:**
Standard Operating Procedures (SOP's), Risk Assessment, substitution of a less toxic material for a more toxic material, process or protocol changes.
 - c. Personal Protection Equipment**
Safety glasses, goggles, face shields, respirators, and protective clothing (e.g. gloves, lab coats, aprons, and etc.)
- 8. Maintain readily available files of Safety Data Sheets.** Safety Data Sheets contain safety and health information on the hazardous properties and proper handling of chemicals. Chemical users should make an effort to be familiar with the SDS's for the chemicals with

which they work. OSHA requires that workers have immediate access to SDS's for each chemical in the work area. See section F to find out how to obtain SDS's.

B. CHEMICAL HYGIENE RESPONSIBILITIES

Responsibility for chemical hygiene rests with various individuals and organizations including the:

- 1. Laboratory Worker, who is responsible for:**
 - a. Knowing and following the chemical hygiene rules .
 - b. Planning and conducting each operation in accordance with the laboratory specific chemical hygiene procedures.
 - c. Developing good personal chemical hygiene habits.

- 2. Principal Investigator and Laboratory Supervisor who have primary responsibility for chemical hygiene in the laboratory, including responsibility to:**
 - a. Ensure that workers know and follow the chemical hygiene procedures that protective equipment is available and in working order, and that appropriate safety and health training has been provided.
 - b. Provide routine, formal chemical hygiene and housekeeping inspection; including inspections of emergency equipment.
 - c. Know the current legal requirements concerning regulated substances.
 - d. Determine the required levels of protective apparel and equipment.
 - e. Ensure that facilities are adequate and training is current for any material being used or ordered for the laboratory.

- 3. Campus Unit Safety Coordinator, as assigned by the department head or campus unit director who must:**
 - a. Serve as liaison between USU EH&S Office and his/her Campus Unit.
 - b. Know the current legal requirements concerning regulated substances.
 - c. See that laboratory personnel are informed and trained, as required by the standard.

- 4. The EH&S Office (ext. 7-2892) is a resource for improving chemical hygiene in the laboratories and for helping you comply with all safety and health regulations.** Some of the services provided by the EH&S Office to help you comply with the OSHA Lab Standard include:
 - a. Making a boilerplate Chemical Hygiene Plans available.
 - b. Review of laboratory specific Chemical Hygiene Plans.
 - c. Conduct general lab safety training and provide chemical hygiene information.
 - d. Annual inspections of lab hoods.
 - e. Environmental monitoring when high exposures to chemicals are suspected.
 - f. Periodic safety audits of lab facilities.
 - g. Consultation in developing Standard Operating Procedures.

5. **The Campus Chemical Hygiene Officer will be from the Environmental Health and Safety Office staff as assigned by the director and will:**
 - a. Work with administrators and other employees to develop and implement appropriate chemical hygiene policies and practices.
 - b. Provide information relating to procurement, use, and disposal of chemicals used in the lab.
 - c. See that appropriate audits are performed.
 - d. Help project directors identify appropriate equipment and adequate facilities.
 - e. Know the current legal requirements concerning regulated substances.
 - f. Seek ways to improve the chemical hygiene program.

6. **Department Head or other Campus Unit Director, who is responsible for overall chemical hygiene in that unit.**

7. **President of Utah State University, the Vice-president for Research and other administrators who have ultimate responsibility for chemical hygiene within the institution and must, with other administrators, provide continuing support for institutional chemical hygiene.**

C. THE LABORATORY FACILITY

1. **Design.** The laboratory facility should have:
 - a. An appropriate general ventilation system with air intakes and exhausts located so as to avoid intake of contaminated air.
 - b. Adequate, well-ventilated chemical storage rooms.
 - c. Properly functioning laboratory hoods and sinks.
 - d. Other safety equipment including eyewash fountains and drench showers.
 - e. Arrangements for waste disposal.

2. **Maintenance.** Chemical-hygiene-related equipment (hoods, incinerator, etc.) should be evaluated routinely.

3. **Usage.** The work conducted and to what extent the work is conducted must be appropriate for the physical facilities available and, especially, to the availability and quality of ventilation.

4. **Ventilation.**
 - a. **General laboratory ventilation.** This system should:
 - i. Provide a source of air for breathing and for input to local ventilation devices.
 - ii. It should not be relied on for protection from toxic substances released into the laboratory.

- iii. Ensure that laboratory air is continually replaced with acceptable levels of fresh air, thereby preventing increased concentrations of toxic substances during the working day.
 - iv. Direct air flow into the laboratory from non-laboratory areas and out to the exterior of the building.
- b. Hoods.** A laboratory hood with 2.5 linear feet of hood space per person should be provided for every 2 workers if they spend most of their time working with chemicals. Each hood should have a continuous monitoring device to allow convenient confirmation of adequate hood performance before use. If this is not possible, work with substances of unknown toxicity should be avoided or other types of local ventilation devices should be provided. Questions related to chemical hood adequacy, need, etc. should be directed to Environmental Health and Safety.
- c. Other local ventilation devices.** Ventilated storage cabinets, canopy hoods, snorkels, etc. should be provided as needed. Each canopy hood and snorkel should have a separate exhaust duct.
- d. Special ventilation areas.** Exhaust air from glove boxes and isolation rooms should be passed through scrubbers or other treatment devices before release into the regular exhaust system. Cold rooms and warm rooms should have provisions for rapid escape and for escape in the event of electrical failure.
- e. Modifications.** Any alteration of the ventilation system should be made only if thorough testing indicates that worker protection from airborne toxic substances will continue to be adequate.
- f. Performance.** Rate: 4-12 room air changes/hour is normally adequate general ventilation, for laboratories, if local exhaust systems such as hoods are used as the primary method of control.
- g. Quality.** General air flow should not be turbulent and should be relatively uniform throughout the laboratory, with no high velocity or static areas. Airflow into and within the hood should not be excessively turbulent. Ideally the hood face velocities should be 100 fpm (feet per minute) +/-25 fpm at the working sash height (generally 16").
- h. Evaluation.** Quality and quantity of ventilation should be evaluated on installation, regularly monitored, and reevaluated whenever a change in the local ventilation devices is made. EH&S Office personnel monitor hood flow rates regularly and are available for other ventilation monitoring and advice.

D. CHEMICAL HYGIENE IN THE LABORATORY

Laboratory workers will know and follow the rules, procedures and recommendations in this Chemical Hygiene Plan.

1. Basic Chemical Hygiene Rules

The following will be used for essentially all laboratory work with chemicals:

- a. **Accidents and spills:**
 - i. **Eye Contact:** Promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention.
 - ii. **Ingestion:** Encourage the victim to drink large amounts of water. Refer to the Safety Data Sheet.
 - iii. **Skin Contact:** Promptly flush the affected area with water and remove any contaminated clothing. If symptoms persist after washing, seek medical attention.
 - iv. **Clean-up:** Promptly clean up spills, using appropriate protective apparel and equipment and proper disposal.
- b. **Avoidance of "routine" exposure:** Develop and encourage safe habits. Avoid unnecessary exposure to chemicals by any route.
 - i. Do not smell or taste chemicals.
 - ii. Vent any apparatus which may discharge toxic chemicals (vacuum pumps, distillation columns, and etc.) into local exhaust devices.
 - iii. Inspect gloves and other personal protective equipment before use.
 - iv. Do not allow release of toxic substances in cold rooms and warm rooms, since these contain re-circulated atmospheres.
- c. **Choice of chemicals:** Use only those chemicals for which the quality of the available ventilation system is appropriate.
- d. **Eating, smoking, etc.:** Do not eat, drink, smoke, chew gum, or apply cosmetics in areas where laboratory chemicals are present. Wash hands before conducting these activities. Do not allow storage, handling, preparation, or consumption of food and beverages in areas which are used for laboratory operations.
- e. **Equipment and glassware:** Handle and store laboratory glassware with care to avoid damage. Do not use damaged glassware. Use extra care with Dewar flasks and other evacuated glass apparatus; shield or wrap them to contain chemicals and fragments should implosion occur. Use equipment only for its designed purpose.

- f. **Exiting:** Thoroughly wash areas of exposed skin before leaving the laboratory.
- g. **Horseplay:** Avoid practical jokes or other behavior which might confuse, startle, or distract another worker.
- h. **Mouth suction:** Do not use mouth suction for pipetting or starting a siphon.
- i. **Personal apparel:** Confine long hair and loose clothing. Wear shoes at all times in the laboratory. Sandals, perforated or open-toed shoes should not be worn. Always wear long pants, not skirts or short pants. Wear a lab coat.
- j. **Personal housekeeping:** Keep the work area clean and uncluttered, with chemicals and equipment being properly labeled and stored. Clean up the work area on completion of an operation or at the end of each day.
- k. **Personal protection:** Assure that appropriate eye protection is worn by all persons, including visitors, where chemicals are stored or handled. Wear appropriate gloves when the potential for contact with toxic materials exists; inspect the gloves before each use, wash them before removal, and replace them periodically. Use appropriate respiratory equipment when air contaminant concentrations are not sufficiently restricted by engineering controls, inspecting the respirator before use. Use any other protective and emergency apparel and equipment as appropriate. Avoid use of contact lenses in the laboratory unless necessary; if they are used, inform supervisor so special precautions can be taken. Remove laboratory coats immediately on significant contamination.
- l. **Planning:** Seek information and advice about hazards, plan appropriate protective procedures, and plan positioning of equipment before beginning any new operation.
- m. **Unattended operations:** Leave lights on, place an appropriate sign on the door, and provide for containment of toxic substances in the event of failure of a utility service (such as cooling water) to an unattended operation.
- n. **Use of hood:** Use the hood for operations which might result in release of toxic chemical vapors or dust. In general, use the hood whenever feasible to limit exposure to laboratory workers. As a rule of thumb, use a hood or other local ventilation device when working with any appreciably volatile substance with a TLV of less than 50 ppm. Confirm adequate hood performance before use; keep hood closed at all times except when adjustments within the hood are being made; keep materials stored in hoods to a minimum and do not allow them to block vents or air flow. Leave the hood "on" when it is not in active use, if toxic substances are stored in it or if it is uncertain whether adequate general laboratory ventilation will be maintained when it is "off".
- o. **Vigilance:** Be alert to unsafe conditions and see that they are corrected when detected.

- p. **Waste disposal:** Assure that each laboratory operation includes plans and training for waste disposal. Deposit chemical waste in appropriately labeled chemically compatible receptacles and follow USU Hazardous Waste Guidelines. The following chemicals will not be discharged to the sewer: concentrated acids or bases, toxic, flammable substances, reactive materials, malodorous, lachrymatory, explosive, or any substances which might interfere with the biological activity of waste water treatment plants, create fire or explosion hazards, cause structural damage, or obstruct flow. Consult the EH&S Office if you have disposal questions on a particular chemical waste.
- q. **Working alone:** Avoid working alone in a building. Do not work alone in a laboratory if the procedures being conducted are hazardous.
- r. **Chemicals with unknown hazards:** Chemicals whose hazardous properties have not been evaluated (no SDS available) will be considered highly toxic and handled as such. (See sections 3.4 and 3.5 of this CHP)

2. Additional Rules specific to this laboratory

- a. **Aim:** To assure that hazards specific to the lab are addressed.

Examples of additional rules:

- i. Requirement that visitors check-in at office and wear eye protection.
- ii. Requirement that cabinet doors to chemical storage be kept closed.

3. Chemicals posing significantly high hazards

3.1 Work with Allergens

Allergens or sensitizers. A chemical allergy is an adverse reaction by the immune system to a chemical. Such allergic reactions result from previous sensitization to that chemical or a structurally similar chemical. Once sensitization occurs, allergic reactions result from exposure to extremely low doses of the chemical. Individuals differ widely in their tendency to become sensitized to allergens. Examples of chemical substances that cause that cause allergic reactions in some individuals include: diazomethane, dicyclohexylcarbodiimide, formaldehyde and phenol derivatives, various isocyanates, benzylic and allylic halides, acid anhydrides, and metals such as nickel, beryllium, platinum, cobalt, tin, and chromium.

- a. Wear suitable gloves to prevent hand contact with allergens of substances of unknown allergenic activity. Thoroughly wash hands immediately after working with these materials.
- b. Utilize chemical hoods or other local exhaust ventilation to limit exposure.
- c. Review each use of these materials with the research supervisor and review ongoing uses annually or whenever a procedural change is made.
- d. Store these substances, properly labeled, in an adequately ventilated area in an unbreakable secondary container.
- e. Notify supervisors of all incidents of exposure or spills; consult a qualified physician when appropriate.

3.2 Work with Chemicals of High Acute Toxicity

Acute toxicity is the ability of a chemical to cause a harmful effect after a single exposure. Acutely toxic agents cause local toxic effects, systemic toxic effects, or both. This class of toxicants includes corrosive chemicals, irritants, and allergens. Examples include: diisopropylfluorophosphate, hydrofluoric acid, and hydrogen cyanide.

- a. **Aim:** To minimize exposure to these toxic substances by any route using all reasonable precautions.
- b. **Applicability:** These precautions are appropriate for substances with moderate chronic or high acute toxicity used in significant quantities.
- c. **Location:** Use and store these substances only in areas of restricted access with special warning signs.
 - i. Always use an approved hood or other containment device for procedures which may result in the generation of aerosols or vapors containing the substance.
 - ii. Trap released vapors to prevent their discharge with the hood exhaust.
- e. **Personal protection:** Always avoid skin contact by use of gloves and long sleeves (and other protective apparel as appropriate). Always wash hands and arms immediately after working with these materials.
- f. **Records:** Maintain records of the amounts of these materials on hand, amounts used, and the names of the workers involved.
- g. **Prevention of spills and accidents:** Be prepared for accidents and spills. Assure that at least 2 people are present at all times if a compound in use is highly toxic or of unknown toxicity.
 - i. Store breakable containers of these substances in chemically resistant trays. Also, work and mount apparatus above such trays or cover work and storage surfaces with removable, absorbent, plastic backed paper.
 - ii. If a major spill occurs outside the hood, evacuate the area and call 9-1-1.
- h. **Waste:** Following use thoroughly decontaminate clothing or shoes. If possible, chemically decontaminate by chemical conversion. Store waste or other contaminated objects in closed, suitably labeled, impervious containers. Dispose of in accordance with USU Hazardous Waste guidelines.

3.3 Work with Reproductive Toxins

Reproductive Toxins are defined by the OSHA Laboratory Standard as substances that cause chromosomal damage (mutagens) and substances with lethal or teratogenic (malformation) effects on fetuses. These substances have adverse effects on various aspects of reproduction including: fertility, gestation, lactation, and general reproductive performance. Reproductive toxins can affect both men and women.

Embryotoxins or teratogens are chemicals that are harmful to a developing fetus at a concentration that may have no effect on the mother (examples: organomercurials, lead compounds, formamide). Embryotoxins have the greatest impact during the first trimester of pregnancy. Because a woman often does not know that she is pregnant during this period of high susceptibility, women of childbearing potential are advised to be especially cautious when working with chemicals, especially those rapidly absorbed through the skin. If you are a woman of childbearing age, handle these substances only in a hood whose satisfactory performance has been confirmed, using appropriate protective apparel (especially gloves) to prevent skin contact.

- a. Review each use of these materials with the research supervisor and review ongoing uses annually or whenever a procedural change is made.
- b. Store these substances, properly labeled, in an adequately ventilated area in an unbreakable secondary container.
- c. Notify supervisors of all incidents of exposure or spills; consult a qualified physician when appropriate.

3.4 Work with Chemicals of High Chronic Toxicity (Carcinogens)

A carcinogen is a substance capable of causing cancer. Carcinogens are chronically toxic substances; that is, they cause damage after repeated or long-duration exposure and their effects may become evident only after a long latency period. Carcinogens are particularly insidious toxins because they may have no immediate apparent harmful effects.

Compounds that are known to pose the greatest carcinogenic hazard are referred to as select carcinogens. A select carcinogen is defined in the OSHA Laboratory Standard as a substance that meets one of the following criteria:

1. It is regulated by OSHA as a carcinogen.
2. It is listed as known to be a carcinogen in the latest Annual Report on Carcinogens issued by the National Toxicology Program (NTP).
3. It is listed under Group I (carcinogenic to humans) by the International Agency for Research for Cancer (IARC).
4. It is listed under IARC Group 2A (probably carcinogenic to humans) or 2B (possibly carcinogenic to humans), or under the category "reasonably anticipated to be a carcinogen" by the NTP.

Examples: dimethyl mercury and nickel carbonyl, benzo-a-pyrene, N-nitrosodiethylamine, formaldehyde, and other human carcinogens or substances with high carcinogenic potency in animals.

- a. **Access:** Conduct all transfers and work with these substances in a "designated and controlled area".
 - i. Controlled areas include: a restricted access **chemical** hood, glove box, or portion of a lab designated for use of highly toxic substances.
 - ii. These restricted areas will be posted with warning signs, to ensure that people with access to the lab are aware of the substances being used and necessary precautions.
 - iii. These substances will be stored separately with access restricted.
- b. **Signs and labels:** Assure that the designated and controlled area is conspicuously marked with warning and restricted access signs and that all containers of these substances are appropriately labeled with identity and warning labels.
- c. **Approvals:** Prepare a plan for use and disposal of these materials and obtain the approval of the laboratory supervisor.
- d. **Non-contamination/Decontamination:**
 - i. Protect vacuum pumps against contamination by scrubbers or HEPA filters and vent them into the hood.
 - ii. Decontaminate vacuum pumps or other contaminated equipment, including glassware, in the hood before removing them from the controlled area.
 - iii. Decontaminate the controlled area before normal work is resumed there.

- e. **Exiting:** On leaving a controlled area remove any protective apparel (placing it in an appropriate, labeled container) and thoroughly wash hands, forearms, face, and neck.
- f. **Housekeeping:** Use a wet mop or a vacuum cleaner equipped with a HEPA filter instead of dry sweeping if the toxic substance was a dry powder.
- g. **Medical surveillance:** If using toxicologically significant quantities of such a substance on a regular basis (e.g., 3 times per week), consult a qualified physician concerning desirability of regular medical surveillance.
- h. **Records:** Keep accurate records of the amounts of these substances stored and used, the dates of use, and names of users.
- i. **Spills:** Assure that contingency plans, equipment, and materials to minimize exposures of people and property in case of accident are available.
- j. **Storage:** Store containers of these chemicals only in a ventilated, limited access area in appropriately labeled, unbreakable, chemically resistant, secondary containers.
- k. **Glove boxes:** For a negative pressure glove box, ventilation rate must be at least 2 volume changes/hour and pressure at least 0.5 inches of water. For a positive pressure glove box, thoroughly check for leaks before each use. In either case, trap the exit gases or filter them through a HEPA filter and then release them into the hood.
- l. **Waste:** Use chemical decontamination whenever possible; ensure that containers of contaminated waste (including washings from contaminated flasks) are transferred from the controlled area in a secondary container under the supervision of authorized personnel. Dispose of waste in accordance with USU Hazardous Waste guidelines.

3.5 Animal Work with Chemicals of High Chronic Toxicity (Carcinogens)

- a. **Access:** For large scale studies, special facilities with restricted access are preferable.
- b. **Administration of the toxic substance:** When possible, administer the substance by injection or gavage instead of in the diet. If administration is in the diet, use a caging system under negative pressure or under laminar air flow directed toward HEPA filters.
- c. **Aerosol suppression:** Devise procedures which minimize formation and dispersal of contaminated aerosols, including those from food, urine, and feces (e.g., use HEPA filtered vacuum equipment for cleaning, moisten contaminated bedding before removal from the cage, mix diets in closed containers in a hood).
- d. **Personal protection:** When working in the animal room, wear plastic or rubber gloves, fully buttoned laboratory coat or jumpsuit and, if needed because of incomplete suppression of aerosols, other apparel and equipment (shoe and head coverings, respirator).
- e. **Waste disposal:** Dispose of contaminated animal tissues and excreta by incineration if the available incinerator can convert the contaminant to non-toxic products; otherwise, package the waste appropriately and dispose of waste according to USU Hazardous Waste Guidelines.

3.6 Work with Materials that pose a significant Physical Hazard

OSHA defines a physical hazards as a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive), or water-reactive.

Other physical hazards include:

Cryogenics

Electric hazards

High pressure reactions

Magnetic fields

Radio frequency, microwave, ultra violet, and infrared radiation

Vacuum work

Cutting, sawing, or grinding

Lab specific SOPs for Physical Hazards should be developed and inserted here.

4. Standard Operating Procedures (SOPs) specific to this laboratory

- a. **Aim:** to assure that hazardous operations specific to the lab are conducted in a prudently safe manner.
- b. **Content:** Chemical Hygiene SOPs may be incorporated into general lab procedural protocols or may be written up separately. These SOPs contain 1) the major hazards associated with a task and/or chemicals and 2) controls to avoid exposure. Examples of SOPs can be found in Prudent Practices, chapters 1B, 1C and 1D. A guide to preparing Chemical Hygiene SOPs is available from the Campus EH&S Office.

Examples of procedures or tasks that support implementation of SOPs.

- 1) Use of perchloric acid.
- 2) End of day clean-up procedures.
- 3) Mixing of acrylamide gels-will be conducted in a "controlled area", with local exhaust (i.e. a lab hood) and measures taken to limit exposure including preventing skin contact.
- 4) Use of Ethidium Bromide - similar to number 3 above.

- c. **Insert any SOPs specific to the lab after this page.**

5. Chemical Procurement, Distribution, and Storage

- a. **Procurement:** Before a substance is received, information on proper handling, storage, and disposal will be known to those who will be involved. No container will be accepted without an adequate identifying label.
- b. **Stockrooms/storerooms:**
 - i. Incompatible substances will be segregated in a well-identified area with local exhaust ventilation.
 - ii. Chemicals which are highly toxic or other chemicals whose containers have been opened will be in unbreakable secondary containers.
 - iii. Stored chemicals will be examined periodically (at least annually) for replacement, deterioration, and container integrity.
 - iv. Chemicals with sensitive shelf lives, such as peroxide formers, will be dated and used or disposed of properly within suggested shelf life period.
 - v. Stockrooms/storerooms will not be used as preparation or repackaging areas, will be open during normal working hours, and will be controlled by one person.
- c. **Distribution:** When chemicals are hand carried, the container will be placed in suitable secondary containment (e.g. an outside container or bucket). Freight-only elevators will be used if possible.
- d. **Laboratory storage:**
 - i. Amounts permitted will be as small as practical. Storage on bench tops and in hoods is inadvisable.
 - ii. Exposure to heat or direct sunlight will be avoided.
 - iii. Periodic inventories will be conducted, with unneeded items being discarded, returned to the storeroom/stockroom, or made available to other users.
 - iv. Care will be taken to protect the integrity of chemicals, (prevent contamination etc.) so that the chemicals can be of use to others.
 - v. Proper storage will ensure that incompatible chemicals are stored separately.
 - vi. Chemicals referred to in 3.1, 3.2, 3.3, 3.4, 3.5, and 3.6 will be stored in areas of restricted access.

6. Environmental Monitoring

- a. Regular instrumental monitoring of airborne concentrations is not usually justified or practical in laboratories but may be appropriate when testing or redesigning hoods or other ventilation devices or when a highly toxic substance is stored or used regularly (e.g. 3 times/week).

7. Housekeeping and Maintenance

- a. **Cleaning:** Floors will be cleaned regularly.
- b. **Maintenance:**
 - i. Eye wash fountains should be inspected by users at intervals of not less than 3 months.
 - ii. All labs will have ready emergency access to an eye wash station and drench shower, and the location will be communicated to all workers.
 - iii. Respirators for routine use will be inspected periodically. All respirator users will be enrolled in the USU Respirator Program, will be trained, and fit tested.
 - iv. Other safety equipment will be inspected regularly (e.g., every 3-6 months) and prior to use.
 - v. Procedures to prevent restarting of out-of-service equipment will be established.
- c. **Passageways:** Stairways and hallways will not be used as storage areas. Access to exits, emergency equipment, and utility controls will never be blocked.
- d. **Aisles and Walkways:** Aisles and walkways will be kept clear and free of obstruction. Boxes, bottles of chemical, waste containers, lab equipment, and other materials should not be stored on the floor in aisles or walkways.

8. Laboratory Audits

- a. **Frequency:** Formal housekeeping and chemical hygiene audits of the laboratory will be held at least quarterly.
- b. **Documentation:** Dated copies of the completed quarterly audits will be filed at the end of this plan. A copy of the Safety Audit will be sent to the EH&S Office.
- c. Informal inspections should be continual.

9. Medical Program

- a. **Compliance with regulations:** Regular medical surveillance will be established to the extent required by regulations.
- b. **Routine surveillance:** Anyone whose work involves regular and frequent handling of toxicologically significant quantities of a chemical will consult a qualified physician to determine on an individual basis whether a regular schedule of medical surveillance is desirable.

- c. First aid:**
- i.** Personnel trained in first aid will be available during working hours.
 - ii.** In case of a medical emergency call 911.
Tell the dispatcher:
 - Location of the patient (building & room number)
 - Name and condition of the patient (alert, conscious, breathing)
 - iv.** USU employees with non-life threatening injuries should be evaluated at IHC WorkMed, 412 North 200 East, 435-713-2700.
 - v.** Supervisors must be notified of any work related injury or illness. Supervisors are required to fill out appropriate worker's compensation forms available on the HR website.
 - vi.** All laboratory injuries or illnesses must be reported to the Chemical Hygiene Officer.

10. Protective Apparel and Equipment

These will include for each laboratory:

- a.** Protective apparel compatible with the required degree of protection for substances being handled.
- b.** An easily accessible drench-type safety shower.
- c.** An eyewash fountain.
- d.** A fire extinguisher.
- e.** Respiratory Protection - Any worker issued a respirator must be trained in its appropriate use and under go medical determination of fitness. This is a simple process, through which EH&S can guide you. For additional information, contact EH&S at 797-2892.
- f.** Fire alarm and telephone for emergency use will be available nearby.
- g.** Other items designated by the laboratory Safety Coordinator.

11. Records

- a.** Accident records will be written and retained.
- b.** Chemical Hygiene Plan records will document that the facilities and precautions are compatible with current knowledge and regulations.
- c.** Inventory and usage records for high-risk substances will be kept.

- d. Medical records will be retained by the institution in accordance with the requirements of state and federal regulations.

12. Signs and Labels

Prominent signs and labels of the following types will be posted:

- a. Emergency telephone numbers including: emergency personnel/facilities, supervisors, laboratory personnel, and other pertinent contact persons.
- b. Chemical container labels showing contents of containers (including waste receptacles) and associated hazards. All containers must have a legible label.
- c. Location signs for safety showers, eyewash stations, other safety and first aid equipment, exits and areas where food and beverage consumption and storage are permitted. Food and beverages will not be allowed in areas where chemicals are stored or handled
- d. Warnings at areas or equipment where special or unusual hazards exist. This includes controlled areas for use of chemicals described in 3.1, 3.2, 3.3, 3.4, 3.5, and 3.6.

13. Spills and Accidents

- a. Spill response plan will be established and communicated to all personnel. It will include procedures for: ventilation failure, evacuation, medical care, reporting, prevention, containment, cleanup, and drills.
- b. There will be an alarm system to alert people in all parts of the facility including isolation areas such as cold rooms.
- c. All accidents or near accidents will be carefully analyzed with the results distributed to all who might benefit. All chemical spills must be reported to the supervisor.
- d. For questions on spill clean-up procedures consult the SDS or call EH&S at 797-2892.
- e. In the event of a chemical spill emergency, dial 911.

14. Information and Training Program

- a. **Aim:** To assure that all individuals at risk are adequately informed about the work in the laboratory, its risks, and what to do if an accident occurs. Laboratory Safety Training seminars are available through EH&S.

- b. **Emergency and Personal Protection Training:** Every laboratory worker will know the location and proper use of available protective apparel, emergency equipment and procedures.

Such training as well as first aid instruction will be available to and encouraged for everyone who might need it. First aid courses are offered through the local Red Cross Chapter.

- c. **Handling:** Receiving and stockroom/storeroom personnel will know about hazards, handling equipment, protective apparel, and relevant regulations.
- d. **Frequency of Training:** The training and education program will be a regular, continuing activity - not simply an annual presentation. All laboratory personnel are required to attend the Laboratory Safety Initial training course offered by EH&S. Periodic Lab Safety Refresher training can be scheduled for laboratories and/or departments. A variety of training materials are available from the EH&S office.
- e. **Literature/Consultation:** Literature and consultation concerning chemical hygiene is readily available to laboratory personnel, through EH&S 797-2892. Laboratory personnel are encouraged to use these information resources.

15. Waste Disposal Program

- a. **Aim:** To assure that the potential minimal harm to people and the environment resulting from the disposal of chemical waste is minimized.
- b. **Content:** Chemical waste and radioactive waste disposal requests can be made online at <http://rgs.usu.edu/ehs/htm/hazardous-waste-pickup>.
- c. **Discarding Chemical Stocks:** Designate chemicals that are no longer need as waste. Every possible effort should be made by laboratory personnel to identify exactly or generally chemicals contained in any unlabeled containers. In the event waste chemicals may be potentially explosive (e.g. picric acid, ethers etc.) they must not be opened or moved by laboratory personnel.

All departing employees, including faculty, students, and staff must ensure that all chemicals in his/her work area are properly distributed. All chemicals must be discarded, returned to storage, or given to a fellow researcher.

- d. **Frequency of Disposal:** Waste must be stored in a secure place within the laboratory and removed at a regular interval.
- e. **Method of Disposal:** All discarded chemicals are shipped off-site and handled at approved disposal facilities. USU personnel should not attempt to minimize chemical waste through practices such as elementary neutralization, chemical

reactions, dilution, or evaporation, unless these practices are part of the experiment. Disposal by pouring waste chemicals down the drain is unacceptable.

E. Chemical Inventory

Insert Lab Specific Chemical Inventory Here or Attach as an Appendix to this document.

F. Safety Data Sheets

Safety Data Sheets contain information on the hazardous properties and proper handling of chemicals. OSHA requires chemical handlers be familiar with the chemicals with which they work. OSHA also requires that workers have ready access to an SDS for each chemical in the work area. You will receive a SDS with or shortly after the arrival of an ordered chemical product. Request a copy of the SDS for each product you purchase. SDSs should be maintained in a notebook or file that is easily accessible to employees in the lab. Most chemical manufacturers and distributors have SDSs available on their websites.

G. Physical Hazards

Numerous physical hazards may be present in the laboratory. Physical hazards are responsible for the majority of workplace injuries. Many of the above recommendations are directed primarily toward prevention of toxic exposure and related health effects rather than prevention of physical injury. However, failure to take precautions against physical injury will often have the secondary effect of causing toxic exposures. Please note that the most current version of the USU Chemical Hygiene Plan (2013) has been modified to specifically address physical hazards in section 3.6. Below are some of the major categories of physical hazards which also have implications for chemical hygiene:

1. Compressed gases
2. Electrically powered laboratory equipment
3. Fires or explosions
4. Procedures involving temperature extremes (both low and high)
5. Pressurized and vacuum operations (including use of compressed gas cylinders)
6. Slippery surfaces or tripping hazards
7. Use of power tools (cutting, sanding, grinding)
8. Sharps

The Fire Marshal's Office offers advice on fire and electrical safety, and sponsors a hands on extinguisher training session. The USU Lab Safety Audit Form includes sections on basic control methods for both physical and health hazards in laboratories.

H. Lab Safety Training Certificates