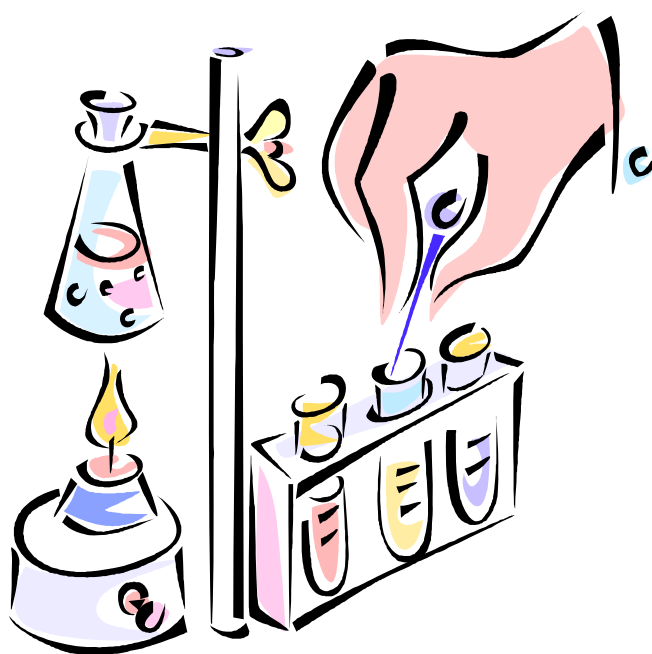


# Desert Research Institute



## Chemical Hygiene Plan



# Desert Research Institute Chemical Hygiene Plan

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# Desert Research Institute Chemical Hygiene Plan

## I. INTRODUCTION

On 31 January, 1990 the Occupational Safety and Health Administration (OSHA) promulgated a final rule for occupational exposure to hazardous chemicals in laboratories requiring employers engaged in the laboratory use of hazardous chemicals to develop a written Chemical Hygiene Plan (CHP). The CHP must describe the procedures, equipment, personal protective equipment and work practices employed to protect laboratory employees from the health hazards presented by the hazardous chemicals used in the laboratory. Per OSHA and NV/OSHA regulations, components of the CHP must include standard operating procedures for safety and health, criteria for the implementation of control measures, measures to ensure proper operation of engineering controls, provisions for training and information dissemination, permitting requirements, provisions for medical consultation, designation of responsible personnel, and identification of particularly hazardous substances.

## II. PURPOSE AND SCOPE

The DRI CHP was developed to meet the requirements of the OSHA Lab Standard (29 CFR 1910.1450) and to establish DRI policies and procedures that when implemented will minimize risks to personnel, facilities and the environment. The policies and procedures are based on currently accepted laboratory safety practices established at academic, government and industrial research laboratories. It is designed for alerting laboratory workers to potential workplace hazards, providing guidance to lab employees for avoidance of exposure to chemicals through their adherence to safe work practices and procedures and protecting all DRI personnel and property.

The Laboratory Standard applies to all DRI research divisions that use hazardous chemicals in laboratories where:

- Chemical operations are carried out on a laboratory scale as opposed to operations whose objective is to produce commercial quantities of materials.
- Operations are designed to be easily and safely operated by one person.
- Multiple chemicals or processes are used
- Procedures involved are not part of a product process nor simulate production process.
- Standard laboratory procedures and equipment are commonly used to minimize potential employee exposure.

The DRI Chemical Hygiene Plan provides general information on the following areas:

- Designation of responsibilities
- Employee information and training
- Control measures (administrative, engineering and PPE)

## Desert Research Institute Chemical Hygiene Plan

- Standard operating procedures for certain chemical classifications (e.g. carcinogens, cryogenics, corrosives, etc)
- Laboratory safety equipment operation
- Medical consultations and examinations
- Required recordkeeping (i.e., medical records, training records, etc.)

### III. RESPONSIBILITIES

#### A. Division Directors

The Division Directors have ultimate responsibility for environmental health and safety issues within her/his division and associated facilities. It is the director's responsibility to ensure that lab PIs/supervisors understand their responsibilities and are committed to the implementation of the CHP in DRI laboratories.

Each Division is responsible for

- Implementing the DRI CHP in Division laboratories, including development of Standard Operating Procedures (SOPs) specific to individual laboratory operations.
- Participating in health and safety assessments of Division laboratory facilities
- Reporting incidents (such as work related injuries and illnesses, fires, explosions or releases of chemicals to the environment) to EH&S in a timely manner<sup>1</sup>.
- Promoting good environmental health and safety practices (best management practices) within the Division.

#### B. Principal Investigators/Lab Supervisors

Principal Investigators (PIs) and/or Laboratory Supervisors are responsible for the health and safety of all personnel working in their laboratories. The DRI CHP is the guide for improving lab safety and PIs are responsible for implementing the plan in their lab(s); however, specific duties may be delegated. Responsibilities include:

- Approving planned laboratory activities and the hazardous chemicals involved
- Developing written SOPs specific to their lab operations that address the health and safety of lab operations, especially those that involve chemical uses
- Ensuring all lab personnel receive appropriate training as specified by the CHP
- Ensuring that appropriate engineering controls, lab specific safety equipment and personal protective equipment (PPE) are available and in working order, and that employees have been trained in the proper use of such equipment

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<sup>1</sup> Incidents requiring immediate response should be reported ASAP via the 4411 system. Those deemed minor and not requiring immediate response should be reported to EH&S the next business day. Divisions are responsible to investigating the cause of each incident and providing a report of that investigation to EH&S.

## **Desert Research Institute Chemical Hygiene Plan**

- Reporting any deficiencies in laboratory (facility) safety equipment (such as fire extinguishers, chemical hoods, safety showers and eyewashes, and emergency lighting) to Facilities via the work request system.
- Performing periodic lab safety assessments and initiating any corrective action
- Handling and disposing of hazardous waste in accordance with DRI policies and regulatory guidelines
- Reporting laboratory related injuries and illnesses to the Worker's Compensation Office, EH&S and responsible Division Director, ensuring necessary forms are completed and participating in incident investigations. Similarly, fires, explosion and chemical release incidents will be reported to EH&S and the responsible Division Director.
- Maintaining a current chemical inventory of hazardous chemicals in their lab
- Ensuring that MSDSs and other sources of chemical hazard information are available to lab personnel, and that workers know how to access this information

### **C. Laboratory Workers**

All laboratory workers (faculty and staff, graduate students, hourly workers and volunteers) are directly responsible for their own safety, as well as the safety of other laboratory workers and persons on DRI premises. Specific responsibilities include:

- Conducting laboratory activities in accordance with the DRI CHP and lab specific standard operating procedures.
- Participating in required training
- Utilizing engineering controls, safety equipment, and PPE in an appropriate manner
- Informing the laboratory PI/supervisor of any accidents or unsafe conditions

### **D. Environmental Health & Safety Department**

The EH&S Department has responsibility for the development and implementation of all institution policies, programs and procedures concerning occupational safety and environmental quality. A member of the DRI EH&S staff shall be delegated the responsibilities of Chemical Hygiene Officer (CHO). Responsibilities of the CHO include:

- Administering the DRI Chemical Hygiene Plan (CHP)
- Assisting Principal Investigators (PI) and Laboratory Supervisors in development and implementation of lab specific procedures and work practices
- Assisting Principal Investigators (PI) and Laboratory Supervisors in conducting laboratory hazard assessments

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- Performing laboratory inspections and audits of lab practices to ensure the CHP is implemented
- Reviewing CHP annually
- Determining if exposure monitoring is necessary
- Determining if medical surveillance is necessary

### E. Laboratory Safety Committee (LSC)

The Lab Safety Committee acts as an advisory body to EH&S on specific laboratory health and safety issues that come to the attention of EH&S or LSC members. In that regard the LSC is responsible for:

- Providing input to EH&S concerning deficiencies in DRI labs and/or the CHP
- Assisting in annual review of CHP
- Participating in laboratory safety inspections
- Reviewing and approving generic SOPs and laboratory safety guidelines
- Conducting investigations (with EH&S) of serious violations or operational problems
- Making recommendations to appropriate DRI personnel for the resolution of continued non-compliance or serious infractions
- Facilitating the dissemination of information to personnel in their division

## IV. STANDARD OPERATING PROCEDURES FOR LABORATORY CHEMICALS

### A. Chemical Procurement

The decision to procure a chemical is a commitment to handle and use the chemical properly from initial receipt to ultimate disposal. Chemicals to be purchased for the first time that are classified as an OSHA or NTP listed carcinogen; a known human reproductive toxin; a compound with high acute toxicity ( $LD_{50} \leq 50$  mg/Kg); the NDEP acutely hazardous material ordered in quantities greater than the [Reportable Quantity](#) (RQ); a water reactive, organic peroxide, explosive, oxidizer class IV or combustible dust ordered in quantities greater than or equal to one pound; or any quantity of a toxic gas, require prior approval from the Principal Investigator and EH&S prior to placing the order. (See [Appendix A](#) for a partial list of chemicals requiring prior approval and [Appendix B](#) for the Particularly Hazardous Substance Use Approval Form.)

All chemicals shall be received in a central location. Personnel who receive chemical shipments shall be knowledgeable of the proper procedures for receipt. Chemical containers shall not be accepted without accompanying labels, material safety data sheets and packaging in accordance with all appropriate regulations.

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Transport of chemicals from the central receiving area to the laboratory shall be consistent with the [DRI Procedures for Transporting/Moving Chemicals](#).

Upon delivery to the lab/work area, each chemical container should be bar coded and recorded into CHEMTRACKER™ (the chemical inventory database). In addition, all chemical containers should be dated when received and again when opened. Peroxide formers must also have a use or dispose by date based on the recommended storage period if such a date is not already provided on the manufacturer's label. See [Peroxide Forming Compounds Guideline](#) for details.

### B. Chemical Storage and Handling

Each laboratory employee with the training, education and resources provided by supervision, shall develop and implement work habits consistent with the CHP to minimize personal and coworker exposure to chemicals in the laboratory. Based on the realization that all chemicals inherently present hazards in certain conditions, exposure to all chemicals should be minimized. Employees working with radioactive and/or biological hazards must also follow safe work practices outlined in the [UNR Radiation Safety Manual](#) and the [DRI Exposure Control Plan](#) or other appropriate biosafety procedures.

Chemical Handling and Storage in the laboratory shall be consistent with the practices and procedures outlined in the [DRI Chemical Storage, Handling and Use BMP](#). Generic storage and handling procedures by chemical class are located in [Appendix E](#).

### C. Personal Work Practices

Laboratory supervision must verify that each employee knows and follows the rules and procedures established in this plan and the lab specific operating procedures. At a minimum, the following personal work practices apply to all DRI laboratories:

- All employees shall remain vigilant to unsafe practices and conditions in the laboratory and shall immediately report such practices and/or conditions to the laboratory supervisor. The supervisor must correct unsafe practices and or conditions promptly, or halt the operation until these can be corrected. Refrain from horseplay, practical jokes, or other behavior that might confuse, startle, or distract another employee or cause an accident.
- Procure, use, and store chemicals in accordance with Section VI.B of this plan.
- Employees should review the MSDS before working with any unfamiliar substance. Before beginning an unfamiliar procedure, the MSDSs for all substances to be used should be reviewed.
- Know the location of all laboratory safety equipment (such as eyewashes, safety showers, fire extinguishers, and fire blankets) and keep access to emergency exits, corridors, safety, or fire protection equipment clear.

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- Seek information and advice from knowledgeable persons, standards and codes about the hazards present in the laboratory and plan operations, equipment, and protective measures accordingly.
- All chemicals and equipment shall be properly labeled in accordance with DRI Hazard Communication Program and the Chemical Storage and Handling Procedure. This includes dating chemicals when they are received and again when they are opened. Secondary containers need to have full chemical name and hazard warnings. Storage must be by hazard groups and chemical compatibility and storage quantity must not exceed the limits allowed in the *International Fire Code*.
- Use chemical hoods when processes or experiments may result in the release of toxic or flammable vapors, fumes, dusts or mists. Use only those chemicals appropriate for the ventilation system.
- Avoid unnecessary exposure to all chemicals by any route. Eating, drinking, smoking, applying cosmetics or chewing gum in the laboratory is prohibited. Wash hands and arms thoroughly after working in the laboratory.
- Do not smell or taste any chemicals.
- Do not release hazardous chemicals in cold rooms, warm rooms, or other rooms with recirculating atmospheres.
- Mouth pipetting is never to be done. Transfer hazardous chemicals or biohazards with pipetting devices, such as pipette bulbs.
- Each employee shall keep the work area clean and uncluttered.
- Quantities of combustible materials (e.g., paper, cardboard) stored in laboratories should be kept to a minimum.
- A clearance of at least 18 inches (0.5 m) vertically and 12 inches (0.3 m) horizontally must be maintained between fire sprinkler heads and any material storage. No materials may be stored within 18" of the ceiling.
- Heavy objects should not be stored overhead or on shelves that are not adequately reinforced.
- Use engineering controls in accordance with Section 6.0 below.
- Use equipment only for its designed purpose. All laboratory safety equipment shall be inspected on a periodic basis and replaced or repaired as necessary. (A sample form for documenting equipment inspections is located [here](#).)
- Handle and store laboratory glassware with care to avoid damage. Do not use broken or otherwise damaged glassware. Broken glassware is to be disposed of in broken glassware containers for disposal.
- Position and clamp reaction apparatus to permit manipulation without moving the apparatus until the entire reaction is completed.

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- Use break-resistant bottle carriers when transporting chemicals in glass containers that are greater than 500 milliliters.
- Take extra care with Dewar flasks and other evacuated glass apparatus; such equipment should be PVC-coated or wrapped to contain chemicals and fragments should implosion occur. All evacuated glass apparatus shall be shielded to contain chemicals and glass fragments should implosion occur.
- Long hair and loose-fitting clothing shall be confined close to the body to avoid being caught in moving machine/equipment parts.
- Inspect your personal protective equipment prior to use and wear appropriate protective equipment as procedures dictate and when necessary to avoid exposure. This includes eye protection, lab coat, gloves, and appropriate foot protection (no sandals). Gloves should be made of a material known to be resistant to permeation by the chemical in use (see Section IV.D).
- Unless equipped with automatic door closures, laboratory doors leading to the corridor or other laboratories closed.
- Do not pour hazardous chemicals or biohazardous materials down sink or floor drains. Biohazardous wastes which are not otherwise hazardous and which have been inactivated by approved procedures may be sewerred (provided pH does not exceed permit discharge limits). No inactivated wastes containing mercury or other heavy metals are to be discharged.
- Outside visitors who wish to enter the laboratory are to receive authorization from an employee in that laboratory or the laboratory management and must use all required personal protective equipment.
- Avoid working alone in a laboratory if the procedures being conducted involve the use of hazardous chemicals and leaving potentially hazardous experiments or operations unattended. If this cannot be avoided, secure prior approval from the lab supervisor.
- To help prevent accidents from occurring to unattended operations, place an appropriate sign on the door and provide for containment of hazardous chemicals in the event of failure of a utility service (e.g., cooling water, glycol) to the unattended operation.

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### D. Personal Protective Equipment (PPE)

To the extent possible, engineering and/or administrative controls shall be implemented to protect the laboratory worker and to reduce the need for personal protective equipment. Until such controls can be implemented (or in the case where the hazards can not be adequately eliminated by engineering and/or administrative controls) PPE will be required to be worn. Because PPE functions as a barrier between the laboratory worker and the chemical hazard, rather than by actually reducing or eliminating the hazard, its use should always be in addition to (and never as a substitute for) appropriate engineering and procedural controls.

It is the responsibility of the principal investigator/lab supervisor to ensure that appropriate PPE is provided to, and used by, all laboratory personnel at the project's/department's expense.

The principal investigator/lab supervisor shall document the need for PPE by conducting a [PPE Assessment](#). PPE assessments shall be completed for all laboratory areas and kept on file with the laboratory's safety information. PPE assessments should be reviewed annually or when new processes are planned, whichever occurs first. PPE selected should be adequate to ensure personnel are protected from chemical exposure to the eyes, skin, and respiratory tract. The subsections below discuss the minimum requirements.

- **Eye Protection.** Appropriate PPE for the eyes is required whenever there is a reasonable probability that the eyes could be exposed to flying particles (including dusts), molten liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation. Vented safety goggles are the preferred eye protection to be worn when chemicals are handled in the laboratory. These should be worn over prescription glasses. Historically the wearing of contact lenses has not been allowed in the laboratory since it was believed that contact lenses would exacerbate damage to the eye caused by chemical contact. This policy has been revisited and most experts now agree that contact lenses do not increase the risk of eye damage when handling chemicals. All protective equipment for the eyes must bear the stamp Z87, which indicates that it meets the performance guidelines established by the American National Standards Institute in ANSI Z87.1 "Practice for Occupational and Educational Eye and Face protection."
- **Face Protection.** A face shield is required whenever there is a potential for severe chemical exposure from splashes, fumes, or explosions. Because a face shield alone does not adequately protect the eyes, it must be worn over safety goggles. In general, any operation that requires a face shield should be conducted inside a hood with the sash lowered as an additional barrier.
- **Hand Protection.** Because the hands are typically the part of the body in closest contact with chemicals in the laboratory, they are particularly vulnerable to chemical exposures. For this reason it is essential that laboratory personnel select

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appropriate protective gloves and wear them whenever handling chemicals. Because different glove materials resist different chemicals, no one glove is suited for all chemical exposures. Glove selection guides are available from most manufacturers and should be consulted before choosing a glove. Below is a general guideline for glove selection.

Glove Material	Generally Recommended For	Not Recommended For
Nitrile	Many acids, caustics, alcohols, and hydrocarbons	Ketones, halogenated hydrocarbons, and strong acids
Neoprene	Organic acids, caustics, alcohols, ketones, and petroleum hydrocarbons	Aromatic and halogenated
Latex	Alcohols, caustics, ketones, and many acids	Hydrocarbon solvents (especially halogenated or aromatic)
Butyl Rubber	Acids, bases, ketones, esters, alcohols, aldehydes	Aliphatic, aromatic, and halogenated hydrocarbons
Polyvinyl	Most organic solvents, including aromatic, halogenated, and petroleum solvents	Inorganic acids, caustics, alcohols, and other aqueous or polar liquids
Viton	Halogenated and aromatic organic solvents	Ketones, ethers, amines, and aldehydes
4H/Silver Shield	Good resistance to many chemicals, including chlorinated solvents, hydrocarbons, and ketones	No specific guidance; consult North Safety Products ( <a href="http://www.northsafety.com">www.northsafety.com</a> )

- Body Protection.** By virtue of its large surface area, the skin is at considerable risk or exposure to chemicals in the laboratory. To lessen this risk, it is essential that laboratory personnel wear clothing that, to the extent possible, covers all skin surfaces. A fully buttoned lab coat should be worn when handling chemicals. Clothing and lab coats should be regarded, not as a means of preventing exposure, but as a means of lessening or delaying exposure. The effectiveness of clothing as a protective barrier for the skin depends upon its prompt removal in the event that it becomes contaminated.
- Foot Protection.** Safety shoes or other specialized foot protection are generally not required for most laboratory operations; however, if employees are required to move heavy objects, such as full gas cylinders, the PPE assessment should evaluate the potential for injury and determine whether safety shoes are required. Sandals and open-toed shoes are prohibited in the labs where chemical are in use. Footwear that completely covers the skin of the feet must be worn in these situations. Leather footwear protects the foot better than canvas or cloth from liquid splashes

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- **Respiratory Protection.** The implementation of appropriate engineering and procedural controls should always be the preferred strategy for ensuring that any airborne levels of chemicals within the laboratory are well below regulatory limits. However, in rare circumstances where such control measures are not sufficient, laboratory personnel may need to utilize respirators for a particular operation. In such instances, personnel must participate fully in DRI's [Respiratory Protection Program](#) that requires a medical exam, respirator fit-testing, and training prior to respirator use. The use of respirators voluntarily (when not required) also triggers certain portions of the respiratory protection program. Contact EH&S for more information.
- **Hearing Protection.** If noise levels exceed 80 dBA for an eight hour exposure, the employee's work area should be assessed to determine whether hearing protection (ear plugs or muffs) should be used. Area noise monitoring can be used for the initial assessment, followed by personal noise dosimetry if the conditions warrant. For work situations where noise monitoring is  $\geq 85$ dBA, a hearing conservation program, including baseline and annual medical surveillance, annual monitoring and mandatory hearing protection must be implemented. Hearing protection should be of the appropriate noise reduction rating to protect the affected employees. Employees may use hearing protection on a volunteer basis (for example for nuisance noise) without enrolling in the hearing conservation program.

### V. CRITERIA FOR IMPLEMENTATION OF CONTROL MEASURES

#### A. Air Sampling

- For hazardous chemicals with an OSHA PEL or ACGIH TLV and for which validated air sampling and analytical methods exist, employee exposures shall be determined if EH&S has reason to believe that exposures might exceed the OSHA Action Level (if one exists), or one-half the exposure limit if there is no OSHA Action Level.
- For NV/OSHA-regulated substances requiring air monitoring (e.g., benzene, formaldehyde, ethylene oxide, inorganic lead, inorganic arsenic, etc.), if results are above the action level (or one-half the PEL if no action level exists), periodic monitoring will be implemented as required in the exposure monitoring provisions of the relevant standards.
- EH&S will make the determination as to the number, type, and frequency of industrial hygiene air monitoring surveys needed.
- The EH&S Department, at the laboratory manager's or supervisor's request, will evaluate the need for industrial hygiene monitoring and will conduct (or arrange for) industrial hygiene air monitoring, will arrange for analysis by a competent IH analytical laboratory, and will receive and interpret monitoring results. Send a detailed email to EH&S to schedule these services.

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- EH&S will inform the PI/lab supervisor and the affected employees of the results verbally when obtained and in writing within 14 days of their receipt. The results of air sampling studies performed in the laboratory are maintained by the EH&S Department with copies sent to BCN Risk Management for long term storage.

### B. Designated Use Areas

Designated areas shall be established for work with select carcinogens, reproductive toxins, acutely toxic chemicals (also known as particularly hazardous substances, see [Appendix A](#)) and certain biological hazards. Designated areas are established to provide the highest level of assurance that highly toxic/potent compounds are handled properly and that all employees in the area are informed of the presence of the hazard and protected from it.

Depending on the procedure that needs to be conducted, a designated use area could consist of one of the following:

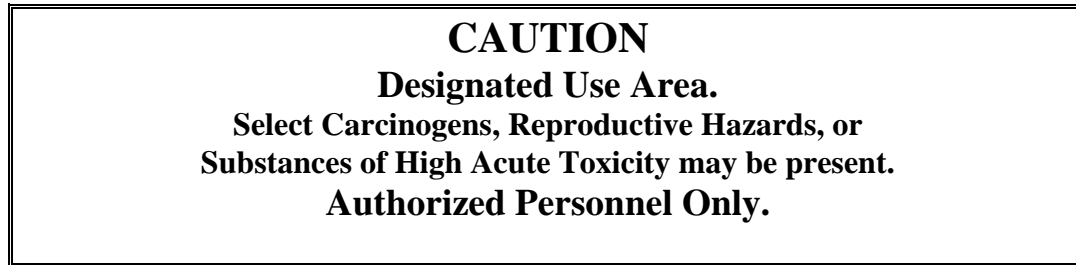
- Ventilated glove box or enclosure, with properly posted warning signs;
- An entire laboratory (separate room) with a sign on the door indicating the personal protective equipment required for entry and access limited to authorized personnel only;
- A laboratory hood, with appropriate warning signs;
- For biohazardous substances only: a biological safety cabinet, ducted out of the building (not back into the room), and labeled or marked with appropriate warning signs; or
- A section of a laboratory, with signs marking off the equipment or bench area to be isolated.

The PI/ laboratory supervisor and EH&S will approve all “designated areas” prior to their being established.

It may be acceptable practice for workers to handle other compounds within a designated area. However, if this does occur, all employees using the area must be aware that the listed highly potent/toxic compound is used in this area. Also, thorough decontamination practices must be instituted and practiced regularly after use of all compounds.

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Recommended signage<sup>2</sup> for designated areas is as follows:



### C. Housekeeping

Each laboratory worker is directly responsible for the cleanliness of his or her work space, and jointly responsible for common areas of the laboratory. Laboratory management shall insist on the maintenance of housekeeping standards.

The following procedures apply to the housekeeping standards of the laboratory:

- All spills on lab benches or floors shall be immediately cleaned and properly disposed of. Large spills of hazardous materials necessitate contacting outside help for remediation. These kinds of spills require immediate notification to EH&S via the emergency cell phone number, 775-742-6330.
- All floors, aisles, exits, fire extinguishing equipment, eyewashes, showers, electrical disconnects and other emergency equipment shall remain unobstructed.
- All labels shall face front.
- Chemical containers shall be clean, properly labeled and returned to storage upon completion of usage.
- All chemical wastes will be disposed of in accordance with the DRI's waste disposal procedures.

### D. Safety and Emergency Equipment

- **Emergency Information**

The emergency numbers and after hour contact information are posted under the NFPA sign on each laboratory door. The posting also identifies the location of the nearest fire extinguisher, eyewash and safety shower, first aid kit and AED and other lab specific emergency information.

Location signs for safety and emergency equipment have been posted.

- **Hoods, glove boxes, ventilated enclosures, etc.**

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<sup>2</sup> Contact EH&S for signs

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See Engineering Controls, Section VI.

- **Safety Showers**

Safety showers are required to be within 100 feet of areas where hazardous chemicals are used (no more than 10 seconds travel time). Safety showers provide an effective means of initial treatment in the event of chemical contamination of the skin or clothing. The shower area should be readily accessible, clear of obstructions, and clearly labeled. Every laboratory worker should know where the safety showers are located and how to use them. To ensure proper operation, safety showers are inspected on a monthly basis by Facilities. In the event of chemical contamination of an individual's body, immediately flush the body for 15 minutes under the shower, removing all clothing, and seek medical attention.

- **Eyewash Stations**

Eyewash stations are required in areas where hazardous chemicals are used. Eyewashes should be easily accessible, unobstructed, and clearly labeled. The use of hands should not be required to activate and maintain the water flow. Eyewashes are inspected monthly by Facilities to ensure proper operation and lab personnel should perform a weekly flushing to remove contamination build-up. In the event of chemical contamination of the eyes or face, immediately flush the eyes/flush for 15 minutes and seek medical attention.

- **Fire Extinguishers**

Fires are one of the most common types of laboratory accidents. Laboratory personnel should know the locations of all fire extinguishers in the laboratory, the type of fires for which they are appropriate, and how to operate them correctly. You must be trained to use a fire extinguisher. Training is scheduled at DRI annually, all laboratory personnel are encouraged to attend. Fire extinguishers in the laboratory should be the appropriate type for the expected fire emergency. Extinguishers are classified according to a particular fire type. Type A are used on combustible (wood, paper, rubber, plastic) fires, Type B are used on flammable liquid fires, Type C are used on energized electrical equipment fires, and Type D are used on combustible metal (lithium, sodium, magnesium, potassium) fires. Multipurpose (Type ABC) fire extinguishers are the type most commonly found at DRI. Fire extinguishers should be easily accessible, mounted properly on a wall, and unobstructed. Facilities inspect fire extinguishers monthly. Used fire extinguishers should be immediately serviced.

- **Chemical Storage Cabinets**

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*General Requirements for hazardous chemical storage cabinets include:*

- Cabinets taller than 5 feet must be earthquake braced.
- New purchases of storage cabinets require ordering cabinets which are FM approved and which are equipped with self-closing, self-latching doors.
- Flashback screens must be in place on all cabinets.
- If cabinets are not connected to exhaust, then caps will be in place over the bung openings.
- Labeling of storage cabinets will reflect the hazards of the contents.

*Specific Requirements for Flammable Liquid Storage Cabinets include:*

- Flammable liquids in quantities exceeding 10 gallons in a laboratory must be stored in an approved flammable liquid storage cabinet.
- Flammable storage cabinets shall be designed to meet National Fire Protection Agency (NFPA) guidelines.
- Approved cabinets shall be marked in conspicuous lettering “FLAMMABLE-KEEP FIRE AWAY.”
- Cabinets are not required to be vented (cabinets are generally vented only if the flammable liquids generate noxious vapors), but if venting is needed it shall be done according to NFPA and the Nevada State Fire Marshal’s guidelines.
- Only flammable and combustible material should be stored in flammable storage cabinets.

- **Explosion-Proof, Laboratory-Safe and Commercial Refrigeration Equipment**

The use of household refrigerators or commercial cold boxes for the storage of flammable liquids presents a significant hazard to the laboratory work area. Refrigeration temperatures are commonly higher than the flash points of the flammable liquids stored inside. In addition, they contain readily available and exposed ignition sources such as thermostats, lights, and heater strips. Flammable liquids should only be stored in two types of laboratory refrigerators; explosion-proof and laboratory-safe models.

Explosion-proof refrigeration equipment is designed to protect against ignition of flammable vapors both inside and outside the refrigerated storage compartment and is only required in areas designated for storage or dispensing of flammable chemicals (i.e., flammable liquid dispensing room). Laboratory-safe equipment (also called explosion-safe) is designed to eliminate ignition of vapors on only the inside of the storage compartment, although other safety design features like self-closing doors, magnetic door gaskets, and compressors and circuits located at the top of the refrigeration unit have been incorporated.

All flammable liquids that need to be stored in a cool environment should be stored in these types of approved refrigerators. Containers should be tightly closed to minimize the amount of vapor released. Every laboratory refrigerator, controlled

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temperature room and freezer should be clearly marked to indicate whether or not it is safe for the storage of flammable liquids.

- **Portable Safety Shields**

Portable safety shields can provide limited protection against explosions, fires, and chemical splash hazards. When a hood sash cannot provide proper shielding, portable safety shields should be used. It should be noted that portable safety shields do not provide protection on the sides and back of equipment and therefore work best if used in conjunction with a laboratory (chemical) hood. Laboratory equipment/chemical apparatus should be shielded on all sides so that there is no line-of-sight exposure to laboratory personnel.

- **Chemical Spill Kits (for incidental spills only)**

The keys to effective spill response are location and appropriate content of spill control materials. General spill clean up information is located in the DRI [Emergency Procedures](#). Each laboratory unit is required to develop specific procedures for handling spills of the chemicals in inventory. Contact EH&S if assistance is required.

DRI has strategically located 5 gallon buckets of spill clean up materials around laboratory areas so they are easily accessible by multiple lab groups. These kits contain neutralizing material for acids or bases and absorbent material for solvents. Every laboratory that uses hazardous chemicals should consider purchasing smaller kits for the types of chemicals used in the lab so they have more access to spill control materials. In addition, spill pigs or pads may be appropriate for some labs to stock.

The following is a list of recommended items that should be used in a chemical spill clean-up. However, it is important that spill materials be tailored to meet the specific spill control needs of each laboratory.

Personal Protective Equipment--The minimum PPE required for spill cleanup is:

- Splash goggles (not just safety glasses)
- Lab coat with sleeves rolled down
- Nitrile or neoprene gloves in good condition (other gloves may be required for specific chemicals, check with EH&S if you are unsure).

Spill Cleanup Materials--The following is a minimum recommended list of supplies:

- Absorbent material
- Plastic trash bags (30 gallon, 3 mil thick)
- 3-5 gallon plastic bucket with lid
- 1 pair of plastic tongs for picking up broken glass

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- 1 plastic dust pan for scooping up solidified material
- Laboratories that use mercury or mercury thermometers, barometers, or manometers must have a mercury spill kit available.
- Labs using hydrofluoric acid must have an acid spill kit specifically designed for HF spills

Once a spill kit has been used it should be immediately restocked. Spill kits can be purchased through most vendors that sell chemicals or safety supplies.

- **First Aid Kits**

First aid kits should be easily accessible to all laboratory personnel. First aid kits should be regularly inspected and restocked as necessary. First aid kits can be purchased through any laboratory safety supply vendor. As a general guideline, first aid kits should contain the following:

Quantity	Item <sup>3</sup>
1	Absorbent compress (32 sq. in., no less than 4 inches)
16	Adhesive bandages (1" x 3")
1	Adhesive tape (5 yards total)
10	Antiseptic applications (moist wipes)
6	Burn treatment applications
2	Pair medical exam gloves
4	Sterile pads (3" x 3")
1	Triangular Bandage (40" x 40" x 56")
1	CPR mask
1	Eye dressing

## VI. ENGINEERING CONTROLS

### A. General Requirements

- Engineering controls installed in the laboratory are intended to minimize employee exposure to chemical and physical hazards in the workplace. These controls must be maintained in proper working order for this goal to be realized.
- No modification of engineering controls will occur unless testing indicates that worker protection will continue to be adequate.

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<sup>3</sup> Calcium gluconate gel must be available if hydrofluoric acid is used in lab.

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- Improper function of engineering controls must be reported to Facilities immediately via the work request system. The system shall be taken out of service until proper repairs have been executed.
- All employees shall follow proper work practices when using the engineering controls.

### **B. Local Exhaust Ventilation**

The following procedures shall apply to the use of local exhaust ventilation (e.g., elephant trunks, capture/slot ventilation devices, etc.)

- Openings for these devices shall be placed as close as possible to sources of the air contaminant.
- Clear the screen, if present, on the face of the device prior to usage.
- Fans shall operate when the devices are being used.
- After using one of these devices, operate the fan for an additional period of time sufficient to clear residual contaminants from the ductwork.
- The ventilation system shall be inspected. The duct velocity shall be maintained at 3500 feet per minute, minimum. A record of each inspection shall be maintained by the Facilities Department.
- Prior to the use of materials requiring localized ventilation, the adequacy of the ventilation system shall be established.

### **C. Laboratory (chemical) Hoods**

Chemical hoods are one of the most important items of safety equipment present within the laboratory. Chemical hoods serve to control the accumulation of toxic, flammable, and offensive vapors by preventing their escape into the laboratory atmosphere. In addition, chemical hoods provide physical isolation and containment of chemicals and their reactions and thus serve as a protective barrier (with the sash closed) between laboratory personnel and the chemical or chemical processes within the hood.

A chemical hood shall be used for any chemical procedures which have the potential of creating:

- Airborne chemical concentrations that might approach the permissible exposure limit (PEL) for an OSHA regulated substance. As a general rule, the hood should be used for all chemical procedures involving substances which are volatile and have a PEL of less than 50 ppm.

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- Flammable/combustible vapors approaching one tenth the lower explosion limit (LEL)<sup>4</sup>.
- Explosion or fire hazards.
- Odors that are annoying to personnel within the laboratory or adjacent lab/office units.

Hood use practices must follow those procedures outlined in [Safe Work Practices for Using the Laboratory Hood](#).

### D. Glove Boxes and Isolation Rooms

The exhaust air from a glove box or isolation room will pass through scrubbers or other treatment before release into the regular exhaust system.

## VII. EMPLOYEE INFORMATION AND TRAINING

The OSHA Laboratory Standard requires that individuals who will be working with chemicals in the laboratory be provided with sufficient education and training to enable them to conduct their work safely. Training must be provided prior individuals beginning work duties involving chemicals and whenever there is a significant change in the types or quantities of chemicals used. Division Executive Directors and, ultimately, the PI/laboratory supervisors are responsible for ensuring that all individuals working in their laboratories have been adequately trained.

### A. General Chemical Hygiene Training

EH&S provides general information regarding the DRI Chemical Hygiene Program designed to cover many of the topics included in the OSHA Lab Standard. This is not intended to be the sole means of training laboratory workers, but must be supplemented by additional safety instruction from the PI/ laboratory supervisor on the potential hazards associated with an individual's specific duties. Additional training provided by EH&S, such as hazardous waste training or respiratory protection training, may also be required depending on the employee's specific job duties.

The general education required by the OSHA Lab Standard covered in the orientation training must include the following topics:

- The location and content of the OSHA Lab Standard.
- The location and availability of the DRI Chemical Hygiene Plan.
- Permissible exposure limits (PELs) for OSHA regulated substances.
- Signs and symptoms associated with chemical exposure.

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<sup>4</sup> The LEL is the minimum concentration (percent by volume) of the fuel (vapor) in air at which a flame is propagated when an ignition source is present.

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- Location and availability of known reference material on the hazards, safe handling, storage, and disposal of chemicals. This includes, but is not limited to, Material Safety Data Sheets (MSDSs).

### B. Lab Specific Training

In addition to the general information provided in the lab safety orientation, training on specific hazards present in the laboratory and how to eliminate or mitigate them is required. Each PI/laboratory supervisor is responsible for providing training on hazards specific to their laboratory. The lab specific training must be completed before personnel are exposed to the lab specific hazards, and whenever a new hazard is introduced into the laboratory.

Laboratory specific training should include the following information:

- Hazards of the chemicals used in the laboratory including the methods to detect the presence or release of these chemicals; the physical and health hazards of these chemicals; and the measures laboratory workers can take to protect themselves
- Location of laboratory SOPs and other lab specific safety information, such as MSDSs and other chemical hazard reference material
- Procedures requiring prior approval from the PI/laboratory supervisor
- Chemical storage and inventory practices
- Specific use of laboratory hoods and other engineering controls
- Availability, selection, and use of PPE (e.g., gloves, safety glasses, etc.)
- Emergency procedures, such as spill response and fires and any lab specific shut down procedures to follow during an emergency situation

### C. Training Documentation

PIs/laboratory supervisors are responsible for documenting the safety training provided to individuals working within their laboratories. A training documentation form has been developed for laboratory specific training ([see Appendix D](#)). For each individual, a record should be maintained not only of formal training sessions attended, but also for informal safety instruction provided. Training records shall be maintained in accordance with Section X.

## VIII. MEDICAL CONSULTATION AND EXAMINATIONS

### A. Medical Consultation

The opportunity for medical attention will be made available to employees at no cost to the employee and without loss of pay under the following circumstances:

- Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory,

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- Medical surveillance programs will be established where exposure monitoring reveals an exposure level above the action level for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements, and/or,
- Whenever an event takes place in the laboratory such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure the employee will be provided an opportunity for medical consultation for the purpose of determining the need for medical examination.

### B. Medical Surveillance

When toxicologically significant quantities<sup>5</sup> of carcinogens, reproductive toxins, or chemicals with high chronic toxicity are used on a regular basis (i.e., multiple times per week) implementation of a lab specific medical surveillance program should be considered. Consult with EH&S regarding the need to implement such a program.

### C. Reporting Occupational Injuries or Illnesses

All occupational injuries or illnesses should be reported to the DRI Workers Compensation Coordinator at (775) 673-7325, as soon as possible, but no longer than 24 hours after the injury/illness has occurred. The supervisor and EH&S should also be notified at the same time.

The coordinator will need a [C-1 Form](#) (Employer's Notice of Injury or Occupational Disease Incident Report) completed by the employee and supervisor within seven days of the incident. In addition, all laboratory incidents resulting in personal injury, illness, and/or property or equipment damage, should be reported to EH&S.

Additional responsibilities of the laboratory PI/supervisor include providing the following to the physician:

- Identity of any chemicals involved in exposure (include MSDS or other hazard information).
- A description on the conditions under which the exposure occurred.
- A description of the employee's symptoms.

The employer (usually the Worker's Compensation Office) must be provided a written medical opinion from the health care provider that includes:

- Any recommendation for medical follow-up.
- The results of the medical examination and any associated tests.

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<sup>5</sup> As a general guideline, a toxicologically significant quantity of a chronic toxin is an amount that exceeds one-half of the acute dose that is expected to be lethal to 50% of exposed test animals (LD50). The following equation is based on exposure to a 50 kilogram person (a conservative assumption): *Toxicologically Significant Quantity* (g)  $\geq$   $[LD50 \text{ (mg/kg)} \times 50 \text{ kg} \times 1/1000] / 2$

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- Any medical condition identified during the examination that may place the affected person at increased risk as a result of exposure to hazardous chemicals found in the workplace.
- A statement that the affected person has been informed by the physician of the results of the examination, and of any medical condition that may require further examination or treatment.

This report must not include specific findings of diagnoses unrelated to occupational exposure.

### D. Medical Facilities

Employees who are injured or exposed to chemicals, and require medical attention, should go to one of the following medical facilities that participate in the Worker's Compensation Program. For all life threatening injuries call **911**

Reno-Serious/Life Threatening Chemical Exposures	Las Vegas--Serious/Life <sup>6</sup> Threatening Injuries
<b>Renown Health Medical Center</b> Emergency Room 77 Pringle Way Reno, NV 775-982-4144 (call ahead to obtain instructions on which door to enter. Do Not use front door.) <b>Hours:</b> 24 hours, 7 days a week	Valley Health Systems Hospitals Closest to DRI-- <b>Desert Springs Hospital</b> Emergency Room 2075 E. Flamingo Road Las Vegas, NV 702-733-8800 <b>Hours:</b> 24 hours, 7 days a week
Reno-Minor/Not Life Threatening or after hours not involving serious chemical exposures	Las Vegas-Minor/Not Life Threatening
<b>Specialty Health Clinic</b> (preferred) 350 W. Sixth Street, Suite 2-D Reno, NV 775-322-2122 <b>Hours:</b> 8:00 a.m. to 7:00 p.m. M-F	<b>Harmon Medical Center</b> (preferred) 150 E Harmon Av, 2 <sup>nd</sup> floor #206 Las Vegas, NV 702-796-1116 <b>Hours:</b> 24 hours, 7 days a week <b>After Hours:</b> Go to 1 <sup>st</sup> floor clinic
<b>St. Mary's Hospital</b> 235 W. Sixth Street Reno, NV 775-770-3000 <b>Hours:</b> 24 hours, 7 days a week	<b>Any Concentra Medical Clinic</b>
<b>Northern Nevada Medical Center</b> 2375 E. Prater Way Sparks, NV 775-331-7000 <b>Hours:</b> 24 hours, 7 days a week	<b>Any Valley Health Systems Hospital</b>

<sup>6</sup> Exception for serious/life threatening chemical exposures, UMC Trauma Center, 1800 W. Charleston Blvd., is the preferred treatment center.

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## IX. SPECIAL PRECAUTIONS

When laboratory procedures change to require the use of additional classifications of chemicals (allergens, embryo toxins, teratogens, carcinogens, etc.), additional special precautions shall be implemented. No changes will be implemented without EH&S and supervisory review and approval.

### A. Working with Allergens and Embryo Toxins

Symptoms of chemical exposure to some materials may be similar to allergic reactions. Compounds such as diazomethane, chromium, nickel, dichromates, formaldehyde, isocyanates and certain phenols are considered allergens. Exposure to allergens can produce skin or lung hypersensitivity and is best avoided by wearing suitable gloves to prevent hand contact when working with these chemicals or other compounds of unknown allergenic activity.

Embryo toxins are substances which adversely effect the fetus carried within the exposed mother during her pregnancy. This category of chemicals includes organomercurials, lead compounds, and formamide. Exposure to these compounds during pregnancy can lead to spontaneous abortions, birth defects, and health problems for the mother and child which may not be evident until after delivery.

- Suitable gloves to prevent hand contact shall be worn when exposed to allergens or substances of unknown allergen activity.
- Women of child-bearing age will handle embryo toxins only in a hood with confirmed satisfactory performance and will use protective equipment to prevent skin contact as prescribed by the supervisor and EH&S.
- Embryo toxins will be stored in adequately ventilated areas in unbreakable secondary containers.
- The laboratory PI/supervisor and EH&S will be notified of spills and other exposure incidents.
- Medical consultation will be arranged when appropriate.

### B. Working with Chemicals of Moderate Chronic or High Acute Toxicity

Before beginning an experiment or other laboratory operation, all workers must review the hazards associated with the chemicals to be used. After this review, they may discover that the materials with which they will work have a moderate chronic or high acute toxicity. Chemicals with these degrees of toxicity include diisopropyl-fluorophosphate, hydrofluoric acid and hydrogen cyanide (see [Appendix A](#) for additional information).

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Using chemicals in these classifications requires the development of a lab specific SOP that addresses the hazards and their mitigation. In addition,

- Areas where these chemicals are stored and used are of restricted access and have special warning signs.
- A special hood with a minimum face velocity of 100 linear feet per minute or other containment device will be used for operations with volatile toxic substances or procedures which could generate toxic aerosols or vapors. Dust generating operations should be handled within a suitable containment device. Released vapors, aerosols or dusts will not discharge with the hood exhaust, but will be trapped.
- Gloves and long sleeves will be worn. In addition, sleeve covers will be used as appropriate. Hands and arms will be washed immediately after working with these chemicals.
- Two people will always be present during work with these chemicals.
- Breakable containers of these substances should be handled with extreme caution.
- Personnel responding to a spill must use the appropriate personal protective equipment.
- Contaminated clothing, shoes or objects must be disposed of as hazardous wastes by placing them into a suitable, labeled impervious container and contacting EH&S for immediate pick up and disposal.

### **C. Working with Chemicals of High Chronic Toxicity (Special Precautions)**

The substances considered to be of high, chronic toxicity include dimethylmercury, nickel carbonyl, benzo-pyrene, N-nitrosodiethylamine, as well as a number of potent human carcinogens.

Using chemicals in these classifications requires the development of a lab specific SOP that addresses the hazards and their mitigation. In addition

- All transfer and work with these substances shall be in a designated area: a restricted access hood, glove box or portion of the lab.
- Approval of the supervisor will be obtained before use.
- Vacuum pumps must have scrubbers or high efficiency particulate absolute (HEPA) filters.

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- Any contaminated equipment or glassware will be decontaminated in the hood before removing them from the designated area.
- For powders, a wet mop or vacuum with a HEPA filter will be used for cleanup.
- The designated area will be marked with warning and restricted access signs.
- Containers will be stored in a ventilated, limited access area in labeled, unbreakable, chemically resistant, secondary containers.

### **D. Animal Work using Chemicals of High Chronic Toxicity**

Work with experimental animals can present special exposure situations, because of the possibility of the formation of aerosols or dusts that contain toxins. These dusts and aerosols may become dispersed throughout the laboratory or animal quarters through animal food, urine, or feces. The following precautions are recommended for animal work involving compounds of high, chronic toxicity.

- For large scale studies, special facilities with restricted access will be provided.
- The substance will be administered by injection or gavage when possible rather than by diet. When diet is used, a caging system under negative pressure or under laminar air flow directed toward HEPA filters will be used.
- Procedures will be used to minimize contaminated aerosol from food, urine and feces. These include using a HEPA filtered vacuum equipment for cleaning; moistening contaminated bedding before removal from cage and mixing diets in closed containers in hood.
- Plastic or rubber gloves and fully buttoned lab coats will be worn in the animal room.

## **X. RECORDKEEPING**

### **A. Training Records**

Training records for each laboratory worker shall be maintained for the worker's entire tenure at DRI. EH&S maintains training records of general laboratory safety training and other training sessions conducted by EH&S. Copies of training certificates should be maintained within the lab unit. Laboratory-specific training records shall be maintained by individual laboratories and include documentation of content provided

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## B. Exposure Monitoring Records

Records of exposure monitoring results and exposure assessments performed or contracted by EH&S are maintained by EH&S. These records are available to personnel or their designated representatives upon request.

## C. Medical Surveillance, Injury and Illness Records

The Business Center North Worker's Compensation Office maintains records of reported accidents and illnesses, and associated medical consultations and examinations in accordance with NSHE policy. These records are confidential and must be maintained as such. Access to medical records is limited to those persons with legitimate needs.

## XI. CHEMICAL SPILLS, RELEASES AND ACCIDENTS

In the event of a chemical spill, release or other accident, EH&S will be notified immediately via the emergency cell phone, 775-742-6330. In the event of a hazardous chemical release, a Hazardous Materials Spill Report Form will also be completed and submitted to EH&S with 24 hours of the event.

## XII. ANNUAL CHEMICAL HYGIENE PLAN REVIEW

EH&S will conduct an annual review of the Chemical Hygiene Plan implementation. Results will be provided to the appropriate laboratory manager(s) who are responsible for taking necessary corrective action.

## XIII. DEFINITIONS

*ACGIH* - the American Conference of Governmental Industrial Hygienists, a nongovernmental agency that develops and publishes TLVs.

*Action level* - a concentration designated in 29 CFR part 1910 for a specific substance, calculated as an eight (8)-hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

*Administrative controls* - work practice procedures implemented to limit or eliminate employee exposure, such as shared duties, frequent breaks, etc.

*Assistant Secretary* - the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

*Carcinogen (see select carcinogen)*

*Chemical Hygiene Officer* - an employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and

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implementation of the provisions of the Chemical Hygiene Plan. This definition is not intended to place limitations on the position description or job classification that the designated individual shall hold within the employer's organizational structure.

*Chemical Hygiene Plan* - a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that (i) are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace and (ii) meets the requirements of Title 8 California Code of Regulations 5194 (e).

*Combustible liquid* - any liquid having a flashpoint at or above 100°F (37.8°C), but below 200°F (93.3°C), except any mixture having components with flashpoints of 200°F (93.3°C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

*Compressed gas* - A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70°F (21.1°C); or a gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130°F (54.4°C) regardless of the pressure at 70°F (21.1°C); or a liquid having a vapor pressure exceeding 40 psi at 100°F (37.8°C) as determined by ASTM D-323-72.

*Corrosive material* - under the U.S. Department of Transportation regulations, a liquid or solid that causes visible destruction or irreversible alterations in human skin tissue at the site of contact or -- in the case of leakage from its packaging -- a liquid that has a severe corrosion rate on steel. A solid or liquid waste that exhibits a "characteristic of corrosivity," as defined by the Resource, Conservation & Recovery Act (RCRA), may be regulated (by EPA) as a hazardous waste.

*Designated area* - an area which may be used for work with "select carcinogens," reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory or a device such as a laboratory hood.

*Emergency* - any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the workplace.

*Employee* - an individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments.

*Engineering controls* - Those methods developed to control the exposure at the source by containment, enclosure, isolation, local exhaust ventilation, chemical substitution or any combination of one or more of these.

*Explosive* - a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

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*Flammable* - a chemical that falls into one of the following categories:

*Aerosol, flammable* - an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame protection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening.

*Gas, flammable* - A gas that, at ambient temperature and pressure, forms a flammable mixtures with air at a concentration of 13 percent by volume or less; or a gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12 percent by volume, regardless of the lower limit.

*Liquid, flammable* - any liquid having a flashpoint below 100 °F (37.8 °C), except any mixture having components with flashpoints of 100 °F (37.8 °C) or higher, the total of which make up 99 percent or more of the total volume of the mixture.

*Solid, flammable* - a solid, other than a blasting agent or explosive as defined in Title 29 CFR 1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

*Flashpoint* - the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:

Tagliabue Closed Tester (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24-1979 (ASTM D 56-79)) - for liquids with a viscosity of less than 45 Saybolt Universal Seconds (SUS) at 100 °F (37.8 °C), or that contain suspended solids, or that have a tendency to form a surface film under test; or

Pensky-Martens Closed Tester (see American National Standard Method of Test for Flash Point by Pensky-Martens Closed Tester, Z11.7-1979 (ASTM D 93-79)) - for liquids with a viscosity equal to or greater than 45 SUS at 100 °F (37.8 °C), or that contain suspended solids, or that have a tendency to form a surface film under test; or

Setaflash Closed Tester (see American National Standard Method of Test for Flash Point by Setaflash Closed Tester (ASTM D 3278-78)) - Organic peroxides, which undergo auto accelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified above.

*Hazardous chemical* - a chemical with an acute or chronic health hazard, including (but not limited to) carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, liver toxins, kidney toxins, neurotoxins, agents that act on blood-forming organs, and agents that damage the lungs, skin, eyes, or mucous membranes. Or

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any chemical that meets the definition of “hazardous chemical” under the CAL/OSHA “Hazard Communication Standard” (California Code of Regulation Title 8, General Industry Safety Orders, Section 5194).

*Laboratory* - a facility where the “laboratory use of hazardous chemicals” occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

*Laboratory scale* - work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person. “Laboratory scale” excludes those workplaces whose function is to produce commercial quantities of materials.

*Laboratory-type hood* - a device located in a laboratory, enclosure on five sides with a moveable sash or fixed partial enclosed on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms. Walk-in hoods with adjustable sashes meet the above definition provided that the sashes are adjusted during use so that the airflow and the exhaust of air contaminants are not compromised and employees do not work inside the enclosure during the release of airborne hazardous chemicals.

*Laboratory use of hazardous chemicals* - handling or use of such chemicals in which all of the following conditions are met:

chemical manipulations are carried out on a “laboratory scale,”

multiple chemical procedures or chemicals are used,

the procedures involved are not part of a production process, nor in any way simulate a production process, and

“protective laboratory practices and equipment” are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

*Medical consultation* - a consultation which takes place between an employee and a licensed physician for the purpose of determining what medical examinations or procedures, if any, are appropriate in cases where a significant exposure to a hazardous chemical may have taken place.

*New chemical* - any chemical not on the current Beckman chemistry inventory.

*Occupational Exposure Limit (OEL)* - an eight-hour, time-weighted average exposure concentration developed by Beckman for Beckman-specific compounds, including active ingredients and intermediates.

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*Organic peroxide* - an organic compound that contains the bivalent -O-O- structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.

*Oxidizer* - a chemical other than a blasting agent or explosive as defined in Title 29 CFR 1910.109(a) that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

*Permissible exposure limit (PEL)* - an exposure limit established by OSHA regulatory authority. May be a time-weighted average (TWA) limit or a maximum concentration exposure limit.

*Physical hazard* - 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.

*Protective laboratory practices and equipment* - those laboratory procedures, practices and equipment accepted by laboratory health and safety experts as effective, or that the employer can show to be effective, in minimizing the potential for employee exposure to hazardous chemicals.

*Recordable discharge* - As defined by City of Palo Alto's Hazardous Materials Storage Ordinance 15.04, a recordable discharge of hazardous material is any threatened release or unauthorized discharge which escapes secondary containment, or any release which is contained, but presents a threat to health or property, or becomes reportable under state, federal or local regulations.

*Reproductive toxins* - chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

*Select carcinogen* - any substance which meets one of the following criteria:

It is regulated by OSHA as a carcinogen; or

it is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or

it is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (latest editions); or

it is listed in either Group 2 A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

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after inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m<sup>3</sup>;

after repeated skin application of less than 300 (mg/kg of body weight) per week; or

after oral dosages of less than 50 mg/kg of body weight per day.

*Threshold limit value (TLV)* - a term used by ACGIH to express the airborne concentration of a material to which nearly all persons can be exposed day after day without adverse effects. ACGIH expresses TLVs in three ways:

TLV-TWA: the allowable Time-Weighted Average concentration for a normal 8-hour workday or 40-hour work week.

TLV-STEL: the Short-Term Exposure Limit, or maximum concentration for a continuous 15-minute exposure period (maximum of four such periods per day, with at least 60 minutes between exposure periods and provided that the daily TLV-TWA is not exceeded).

TLV-C: the Ceiling exposure limit, the concentration that should not be exceeded even instantaneously.

*Time-weighted average (TWA)* - the airborne concentration of a material to which a person is exposed, averaged over the total exposure time -- generally the total workday (8 to 12 hours). Also see Threshold Limit Value.

*Unstable (reactive)* - a chemical which in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

*Volatile* - a solid or liquid material which has the tendency to pass into the vapor state at a room temperature.

*Water-reactive* - a chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

# Desert Research Institute Chemical Hygiene Plan

## XIV. REFERENCES

[DRI Chemical Storage, Handling and Use Best Management Practice](#)

[DRI Exposure Control Plan](#)

[DRI Hazard Communication Program](#)

[DRI Hazardous Waste Satellite Accumulation SOP](#)

[DRI Hazardous Waste Generation Safe Handling Practices](#)

[DRI Personal Protective Equipment Assessment Form](#)

[DRI Procedure for Moving/Transporting Chemicals](#)

[DRI Respiratory Protection Program](#)

[DRI Safe Work Practices for Using the Laboratory Hood](#)

[International Fire Code](#), Chapters 27 through 44

National Fire Protection Association Standard # 45, [Standard on Fire Protection for Laboratories Using Chemicals](#)

[UNR Radiation Safety Manual](#)

Title 29 [Code of Federal Regulations 1910.1450](#)

## XV. Appendices

[Appendix A](#) - Partial List of Particularly Hazardous Substances

[Appendix B](#) - Particularly Hazardous Substance Use Approval Form

[Appendix C](#) - Laboratory Inspection Checklist

[Appendix D](#) - Lab Specific Training Documentation Form

[Appendix E](#) - Generic Storage and Handling Guidelines, by chemical class

[Appendix F](#) - Physical Hazards in the Laboratory