

DRI BEST MANAGEMENT PRACTICE
CHEMICAL STORAGE, HANDLING and USE
(supplements information found in the DRI [Chemical Hygiene Plan](#))

I. CHEMICAL STORAGE

Received chemicals shall be moved from the central receiving areas as soon as possible. Large glass containers shall be placed in over packs (if they are not in their original shipping boxes/containers) during transportation on campus. Once in the laboratory/work area, chemicals shall be immediately unpacked and placed in approved storage cabinets/locations and packing boxes shall be removed from the work area for recycling or disposal.

Storage areas shall be well illuminated. Storage of hazardous materials should be below eye level. Large bottles should be stored on lower shelves close to ground level.

Chemicals shall be segregated by hazard classification and compatibility in a well-identified area, with good general room ventilation and, as necessary to control vapors, additional local exhaust ventilation. Segregation is defined by Chapter 27, Section 2703.9.8 of the International Fire Code as follows:

- Separating of incompatible materials in storage by a distance of not less than 20 feet.
- Isolating incompatible materials in storage by a noncombustible partition extending not less than 18 inches above and to the sides of the stored material.
- Storing liquid and solid materials in hazardous materials storage cabinets.¹
- Storing compressed gases in gas cabinets or exhausted enclosures¹ in accordance with IFC 2703.8.5 and 2703.8.6.

In general, segregate the following hazard classes²:

- Pyrophorics from flammable liquids.
- Flammable liquids from corrosives (except for acetic acid).
- Organic acids from inorganic acids, especially nitric from formic and acetic acids, anhydrides, etc.
- Acids from caustics (bases).
- Acids from cyanides.
- Oxidizers from flammable or combustible material.
- Perchloric acid is to be stored separately (contained with glass wool in a glass container).

Chemicals should be bar coded and entered onto CHEMTRACKER™ log sheets (or directly into the database if possible) upon receipt. In addition, write the date of receipt on chemical containers with an indelible marker. This makes chemical tracking and the job of identifying old chemicals much easier

¹ Materials, which are incompatible, shall not be stored within the same cabinets or exhausted enclosure.

² Refer to the [Partial List of Chemical Incompatibilities](#) for more details.

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and is particularly important for chemicals that can form explosive peroxides, such as the isopropyl and diethyl ethers.

Chemicals in the workplace shall not be exposed to direct sunlight or heat or left open except to add or remove materials. Liquid chemicals and wastes must be stored in secondary containment designed to protect against spills, leaks, or breakage. Acid-resistant trays shall be placed under bottles of mineral acids.

The quantity of chemicals stored in the laboratory should be kept to the minimum needed for the project. Storage of chemicals at the lab bench or other work areas shall be limited to those amounts necessary for one operation or shift. The container sizes shall be the minimum convenient.

Open shelving holding chemicals shall be fitted with earthquake barriers. These should extend a minimum of 2 inches (or 1/5 of the height of the largest bottle stored) above each shelf. Wall and other hazardous materials storage cabinet doors must be kept closed when not actually in use.

Highly toxic³ or carcinogenic materials (see [Particularly Hazardous Substance List](#) for examples) should be ordered in the smallest quantity practical. Storage of highly toxic or odorous chemicals, including chloroform, benzene, alkylating agents, etc., in a vented cabinet (not a laboratory hood) is highly recommended. In addition, highly toxic chemicals that have been opened should be placed in a zip lock bag or other appropriate secondary container.

Store all flammable liquids⁴, except for quantities not to exceed one day's supply that are currently being used at a workstation, in a Factory Mutual (FM) approved flammable liquid storage cabinet. Cabinets taller than five feet should be seismically braced. Doors should be self-closing, self-latching, and closed when not in use. Flammable liquids that need refrigeration should be stored in a laboratory-safe (i.e.: approved for flammable liquid storage) refrigerator.

Cabinets or rooms used for chemical storage should be marked by appropriate signs that clearly indicate the nature of their contents.

- Flammable and combustible liquid storage cabinets must be labeled "FLAMMABLE--KEEP FIRE AWAY" in conspicuous red lettering.
- Cabinets used to store other hazardous materials must be labeled "HAZARDOUS--KEEP FIRE AWAY" in conspicuous red lettering.
- In addition, NFPA-704 fire diamonds shall be affixed to doors of rooms where storage and/or use of hazardous materials exceeds the quantities listed in the International Fire Code, section 105.

³ Note: The use of toxic gases may require a permit and special storage and use equipment. Contact the Environmental, Health and Safety Department for details.

⁴ Note: The allowable storage of flammables outside of a flammable cabinet is limited to 10 gallons total per fire control area. Areas where multiple uses of flammable liquids occur must be vigilant in returning 4-liter bottles to the storage cabinets after dispensing the amount needed.

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[Compressed Gas Storage](#) requirements include the following:

- All gas cylinders greater than or equal to 26 inches in height must be tightly secured by double chaining or noncombustible strapping to a rigid structure so that they cannot fall or be knocked over. All cylinders must be secured or chained separately. Small cylinders, such as lecture bottles, which are not amenable to chaining, must be stored upright using ring stands or other secure fixtures.
- Cylinders, other than lecture bottles, that are not connected or in use must be fitted with a valve protection cap.
- The appropriate regulator must be used for each type of cylinder and the gas it contains. Main cylinder valve should always be opened before opening the downstream regulator or needle valve.
- Cylinders containing acetylene must never be used with regulators, fittings, or piping that contain copper or brass that may come into direct contact with the gas.
- Cylinders of oxygen, except when on a welding cart, must be stored at least 20 feet away from any flammable gas.
- Cylinders containing toxic gases (e.g., ammonia, hydrogen chloride) may require a special permit and storage/use equipment. Contact the Environmental, Health and Safety Department prior to purchasing any of these materials.
- Gas cylinder labels must face out or there must be signs immediately adjacent to the cylinder(s) indicating the kind of gas(es) in use/storage.
- Empty cylinders and empty cylinder storage areas should be clearly marked with appropriate labels or signs.
- Use gases in the smallest cylinders practicable.

The Reno and Clark County Fire Departments, the Office of the State Fire Marshall and the Nevada Department of Environmental Protection (DEP) require periodic inspection of hazardous materials storage areas. At a minimum include: area/room number, date of inspection, observations, inspector's name, corrective actions required/taken and supervisor/manger verification of completion of corrective actions. Satellite waste storage area must be inspected weekly per NDEP. A copy of the recommended log is found at [Inspection of Hazardous Waste Containers and Tanks](#).

In addition to the periodic inspections above, the PI/supervisor/team leader (or his/her designate) shall examine at least annually stored chemicals for deterioration and container integrity. The inspection should also determine whether any corrosion, deterioration, or damage has occurred to the storage facility as a result of leaking chemicals. Records of the annual inspection shall be maintained for review by EH&S during the annual laboratory inspection and review of records.

Maintenance of a current chemical inventory and the department's/area's MSDSs is the responsibility of the PI/supervisor/team leader. It is highly suggested that the chemical inventory be updated when

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chemicals are received or depleted as that will make the annual chemical inventory reconciliation, which must be done each January, an easier task.

Additional storage guidelines by chemical class are located in [Appendix E](#) of the DRI [Chemical Hygiene Plan](#).

II. CHEMICAL HANDLING

General precautions which shall be followed for the handling and use of all chemicals are:

- Avoid unnecessary exposure to chemicals by any route. Skin contact with chemicals should be avoided as a cardinal rule.
- All employees shall wash hands and arms thoroughly prior to leaving the work area.
- Mouth suction for pipetting or starting a siphon is prohibited.
- Eating, drinking, smoking, gum chewing, or application of cosmetics in areas where chemicals are present shall be avoided. PPE shall be removed and hands shall be thoroughly washed prior to performing these activities.
- Storage, handling and consumption of food or beverages shall not occur in storage areas, refrigerators, glassware or utensils also used for chemical operations. Refrigerators, microwaves, etc. used for chemical operations should be labeled “Not for food or beverage use” or with similar wording. Conversely appliances which are for food or beverage use should be labeled: “Food/beverage use only. No chemicals, biologicals or radioactive materials” or with similar wording.
- Avoid underestimation of risk. Even for substances of no known significant hazard, exposure should be minimized. For work with substances that present hazards, special precautions should be taken. One should assume that any mixture will be at least as toxic as its most toxic component and that all substances of unknown toxicity are toxic.
- Employees shall be familiar with the symptoms of exposure for the chemicals with which they work and the precautions necessary to prevent exposure. Much of this information can be found on the chemical’s MSDS and should also be provided as part of the annual hazard communication and/or chemical hygiene training and education.
- In all cases of chemical exposure, the Permissible Exposure Limits (PELs) of OSHA shall not be exceeded and the Threshold Limit Values (TLVs) of the American Conference of Governmental Industrial Hygienists (ACGIH) or the DRI Occupational Exposure Limits (OELs), if applicable, should not be exceeded.
- Engineering controls and safety equipment shall be utilized as outlined in work area specific procedures and will be inspected as part of the routine safety inspection. Work area specific inspection checklists should be tailored to include these inspection items.

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- Specific precautions based on the toxicological characteristics of individual chemicals shall be implemented as required by their use. Some examples of where these specific precautions are necessary would be when work involves using allergens, embryo toxins, and chemicals with high acute, moderate chronic and high chronic toxicity (See Section IX of the [DRI Chemical Hygiene Plan](#)). All work conducted with these kinds of materials must undergo a hazard analysis, which includes EH&S approval, prior to the commencement of use.
- Transportation of chemicals through corridors must comply with local fire department requirements. At a minimum, these are as follows:
 - Hazardous materials in a solid or granular form may be transported through corridors if they have tight covers and normal care is exercised.
 - Hazardous materials in liquid form should be transported through corridors only in their original unopened shipping containers, in safety bottle carriers, or in approved safety carts. Exception: safety coated glass bottles may be transported without a safety bottle carrier.
 - Carts and trucks used to transport hazardous materials shall
 - * be designed to provide a stable base for the commodities being transported,
 - * have a means of restraining containers to prevent accidental dislodgment,
 - * be provided with a device which will enable the operator to safely control the movement by providing stops or speed reduction devices,
 - * be constructed of materials compatible with those being transported,
 - * be of substantial construction, and
 - * for the transport of liquids, have adequate secondary containment to contain the content of the largest container to be transported.
 - Hazardous materials in gaseous or liquefied gas form should be transported in corridors only on a special safety cart that is designed to prevent toppling (except for lecture-size bottles, which should be carefully hand-carried one at a time). Cylinder caps must be kept in place at all times during transportation.
 - At no time should any container of hazardous chemicals be left in corridors.
 - At no time should transport of chemicals take place through carpeted corridors or through office space.

Additional information about transporting chemicals can be found in the [DRI Procedure for Moving/Transporting Chemicals](#).

III. LABELING REQUIREMENTS

All containers of hazardous materials shall be labeled.

- The label shall be informative and durable, and at a minimum, will identify contents and hazards, including target organ effects. Dating incoming containers is highly recommended for inventory control and shelf life determination. It is also recommended that any transferred materials or

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preparations be labeled with the date and the responsible person's name in addition to the required minimum label elements.

- Portable containers shall be labeled by the individual using the container.
- Exemptions for labeling requirements shall be made for chemical transfers from a labeled container into a container which is intended only for the immediate use (i.e.: never left unattended) by the employee who performed the transfer.
- For more information, see Section 8 of the DRI [Hazard Communication Program](#).

During hazardous materials inventory inspections, the inspector will verify that labeling is in compliance with hazard communication requirements.

Hazardous waste satellite containers must be labeled according the Nevada DEP requirements. (See also Section 4.3 of the DRI [Hazardous Waste Generation Satellite Accumulation SOP](#).)

Operations and reactions that are left to run unattended should be labeled to indicate the contents (see also Section IV). Names and telephone numbers of employees should be displayed on personal laboratory hoods and benches or when communal equipment is used.

IV. PRIOR APPROVAL OF HAZARDOUS OPERATIONS, including Laboratory Activities using chemicals that require approval for purchase and use (see DRI [Chemical Hygiene Plan](#), Section IV.A.

All hazardous operations, including work with hazardous chemicals, are to be performed during a time when at least two personnel are present at the work area. At no time shall an employee while working alone, perform work which is considered hazardous. The PI/ supervisor/team leader shall make the hazardous operation determination.

With the exception of operating commercial clinical analyzers⁵, which routinely run unattended, the following procedures for unattended operations (experiments or operations in progress) will be employed:

- The supervisor/team leader will review work procedures to verify the safe completion of the operation.
- An appropriate sign will be posted at all entrances to the laboratory/work area. Include name and phone numbers (home or pager) of the responsible party and the supervisor/team leader.
- Precautions shall be made for the interruption of utility service during the unattended operation (loss of water pressure, electricity, etc.).
- The person responsible for the operation will return to the laboratory/work area at the conclusion of the operation to assist in the dismantling of the apparatus.

⁵ Unattended commercial analyzers utilizing hazardous materials should be similarly labeled in case any problems, such as leakage, develop.