

Appendix D

Information on Chemical Exposures from Health Hazards

Information on exposure limits can be found here: [OSHA 1910](#) and [NIOSH/CDC Pocket Guide](#). Some more information on specific types of chemical exposure is detailed below.

Health Hazards

Extreme caution should be taken to prevent exposure to chemicals like carcinogens, toxic chemicals or highly toxic chemicals, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes. Immediate treatment should be sought upon possible exposure to these chemicals.

Corrosive chemicals

- Eye exposures
 - symptoms include pain, blood shot eyes, tearing, and blurring of vision.
- Skin exposures
 - symptoms may include reddening, pain, inflammation, bleeding, irritation, blistering, and burns.
- Inhalation exposure
 - symptoms include a burning sensation, coughing, wheezing, laryngitis, shortness of breath, nausea, and vomiting.
- Acid and Akali Burns
 - The burned areas must be washed with large volumes of water, for a period of five times longer than is necessary to stop the burning sensation. The area must then be covered with sterile dressing and then aluminum foil or plastic wrap to prevent exposure to air.
 - No ointments, creams, baking soda or other substances should be applied. Severe burns should be examined by a physician.

Irritants

- Symptoms of exposure can include reddening or discomfort of the skin and irritation to respiratory systems.

Sensitizers

- Sensitizer exposure can lead to all of the symptoms associated with allergic reactions or can increase an individual's existing allergies.
- Inhalation of sensitizers can lead to an allergic response
 - It is recommended that sensitizers always be used in a fume hood or with proper ventilation.

Target organs (hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes)

- Symptoms of exposure to these materials vary. Staff working with these materials should review the SDS for the specific material being used and should take special note of the associated symptoms of exposure.

Nanomaterials

- Risk of exposure is lowest when nanomaterials are bound in a solid matrix with little potential to create airborne dust or when in a non-volatile liquid suspension.
- Risk of exposure increases when nanomaterials are used as fine powders, are suspended in volatile solvents or gases, or in procedures in which aerosols may be produced.

- The parent compound of the nanomaterial should also be taken into consideration when evaluating the potential hazards associated with exposure (e.g., a highly toxic compound such as cadmium should be anticipated to be toxic and possibly more toxic when used as a nanomaterial).
- However, some materials that are non-toxic in their bulk phase may display significant toxicity as nanomaterials, always take the necessary precautions to avoid exposure.
- Nanoparticles can cross an alveolar wall into bloodstream. It also can spread to other organs, tissues and brain. Potential nanomaterial exposure routes include inhalation, dermal contact, and ingestion.
- To prevent the exposure, always maintain good work practices like clean work areas, hand washing, and shower use /change of clothes).
- Use engineering controls like source enclosure, local exhaust ventilation, and HEPA filters. During any experiment, wear NIOSH-approved personal protective equipment and respirator.
- Cleanup any spill immediately and properly dispose of any Nanomaterials.
- Metal powders have similar exposure risk to nanomaterials.

Allergens

- Such as diazomethane, isocyanates, and bichromates, require wearing suitable gloves to prevent hand contact with allergens or substances of unknown allergenic activity.
 - Laboratory hoods or glove boxes are a preferred enclosure for allergen work.

Embryo toxins

- Such as organomercurials, lead compounds, and formamide require women of childbearing age to only work with these substances in a hood whose satisfactory performance has been confirmed. Appropriate protective clothing is required to prevent skin contact.
- Procedures for safe handling, use, and storage of allergens and embryo toxins shall be reviewed annually and prior to the introduction of any new material.
- Allergens and embryo toxins shall be properly labeled and stored in unbreakable secondary containers in adequately ventilated areas.
- Spills and incidents of exposure to these materials require immediate notification of supervisor and consultation of a qualified physician when appropriate.
- Chemicals of moderate chronic or high acute toxicity (Appendix A - Acutely Toxic Chemicals) may not exceed TLV50 ppm, e.g. hydrogen cyanide and hydrofluoric acid.

Moderate chronic and high acute toxicity

- Additional precautions are appropriate when working with chemicals of moderate chronic and high acute toxicity (see Appendix A - Acutely Toxic Chemicals).
- Minimize exposure to these toxic substances by any route using all reasonable precautions and appropriate protective equipment, including washing of hands and arms thoroughly after removal of protective equipment.
- Use and store these substances only in areas of restricted access. The storage area containers require special warning signs to alert users of the hazards and safe handling procedures.
- Use in fume hoods that have been previously evaluated to confirm adequate performance. Trap released vapors to prevent their discharge into the fume hood exhaust.
- Maintain records of the amounts of these materials on hand, amounts used, and names of personnel working with the materials.
- Incidents and spills are prevented by preparing the work area prior to chemical handling.
- Assure that at least two people are present at all times when working with highly toxic materials.
- Cover the work area with containment devices such as plastic sheeting and absorbent materials. Prepare a waste disposal receptacle for the waste chemicals and containment material.

- If a major spill occurs outside of the hood, evacuate the area. Assure that cleanup personnel wear suitable protective equipment.

Chemicals with High Chronic Toxicity

- Such as
 - Organic mercury compounds and carcinogens; see Appendix A - Acutely Toxic Chemicals.
 - Carcinogens are those listed in the definition of a carcinogen in Ch 3.
- Restrict all transfers and work with these substances to a "controlled area" such as a restricted access hood, glove box, or a portion of the laboratory designated for use of highly toxic substances.
- All personnel in the laboratory must be made aware of the substances being used and necessary precautions.
- Prior to introduction of highly toxic materials in the laboratory, prepare a plan for the use, disposal and decontamination of equipment.
- The controlled area must be decontaminated after using highly toxic materials.
- Personnel shall remove protective equipment and place it in an appropriate labeled container.
 - Personnel will thoroughly wash hands, forearms, face, and neck after removing protective equipment.
- Laboratory personnel are responsible for cleaning the area when highly toxic materials are used.
- The area must be decontaminated prior to allowing Janitorial personnel to resume normal cleaning procedures.
- *Medical surveillance is required if using significant quantities of a highly toxic material on a regular basis (three times per week). Consult a qualified physician concerning desirability of regular medical monitoring. Only if the SOP (Standard Operating Procedure) for the use of the chemical ensures no exposure to personnel at or above the PEL and/or TLV can the material be used without medical monitoring.*
- Maintain records of the amounts of these materials on hand, amounts used, and names of personnel working with the materials.
- Incidents and spills are prevented by preparing the work area prior to chemical handling.
- Assure that at least two people are present at all times when working with highly toxic materials.
- Cover the work area with containment devices such as plastic sheeting and absorbent. Prepare a waste disposal receptacle for the waste chemicals and containment material.
- If a major spill occurs outside of the hood, evacuate the area. Assure that cleanup personnel wear suitable protective equipment.

Explosive Chemical Management

- An explosive chemical is a gas, solid or liquid chemical which is in itself capable by chemical reaction of producing gas at a temperature and pressure at a speed able to cause damage to the surroundings. This includes chemicals purchased from supplied by vendors or products and by-products generated from experiments or reactions. Examples of explosive chemicals are:
 - organic peroxides
 - oxidizers including? salts containing nitrates
 - chlorates
 - high concentration of perchloric acids
- Ensure proper control measures and protective barriers are in place when using or working with explosive chemicals or reactions.
 - Labs working with explosive chemicals or reactions should have a blast shield.
 - Follow proper procedures listed below.

Lasers

- No person may use a laser of any type prior to training in laser safety. Contact the Radiation Safety Officer at 940-565-3282 to obtain this training.
- The type and intensity of radiation from lasers varies widely with the instrument design. Prior to working with an instrument, the specifications for operation and protection must be consulted.
- Always wear goggles that offer protection against the specific wavelength of laser in use. If more than one wavelength is being used, additional goggles specific for each wavelength are required. No available spectacles protect against all laser wavelengths.
- Never look directly at the beam or pump source.
- Never view the beam pattern directly; use an image converter or other safe, indirect means. To decrease reflecting hazards, do not aim by looking along the beam.
- Do not allow any objects that cause reflections to be present in or along the beam. Even buttons on clothing and polished screw heads can be dangerous.
- Keep a high general illumination level in areas where lasers are in operation. Low light levels cause dilation of the pupils, thereby increasing the hazard.
- Display warning signs in laser areas.

The following procedures must be followed to minimize the risk of exposure of particularly hazardous substances and risk of explosion.

1. Responsibility
 - a. The PI involved in using particularly hazardous substances and/or explosive chemicals must perform a Risk Assessment prior to submitting a research proposal to the Risk Management Services for approval. Detailed Standard Operating Procedures must be attached with the proposal.
2. Purchasing
 - a. All chemicals must be purchased through EIS approval system.
3. Chemical Register
 - a. A register of all used/stored chemicals on site shall be generated by the manager of the lab or PI. This list should be submitted to Risk Management Services for review.
4. Chemical User
 - a. A list of chemical users includes name, employment status, contact email address, phone number and training status must be submitted with Standard Operating procedures (SOP) to Risk Management Services .
5. New chemical hazard identification and risk assessment
 - a. For all new chemicals, a hazard and risk assessment must be performed immediately.
6. Training
 - a. Staff and workers must receive related training before handling the chemicals and doing any hands-on experiments.
7. Labeling
 - a. The label must be specific and firmly secured on the container with appropriate hazards. See Ch 3.1.1 Labeling.
8. Personal Protective Equipment
 - a. Appropriate Personal Protective Equipment must be worn during the experiment.
9. Handling and storage of chemicals
 - a. Proper procedures found in the SDS sheets must be used.
10. Waste disposal

- a. Chemical waste must not be mixed with other chemical waste unless the waste is the same type. Users must take "Hazardous Wastes" training prior to handling explosive waste,
11. Updates and records
- a. All SDS's must be updated regularly. Risk Managements Services ensures that new chemicals are entered into the Database inventory.
12. Signage
- a. Warning signage must be posted on the wall or entrance to warn building occupants of any hazards.
13. Emergency phone number
- a. Emergency contact numbers of responsible lab persons, the PI(s), and the UNT Police department must be posted on the outside lab door.
14. Overnight experiments
- a. Describe how to stop the process(es) or turn off the equipment if an emergency happens; also attach a map showing all equipment locations in the lab.
15. Incident report
- a. Principal Investigator or Lab Manager must report any incident to the Risk Management Services within 7 working days. Injuries involving employees require a separate report to Risk Management Services Insurance and Claims, (940) 565-2109.