

Chemical Hygiene Plan

Department of Biological and Environmental
Sciences

University of Tennessee at Chattanooga



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Purpose of Chemical Hygiene Plan

(29 CFR 1910.1450 9(E))

The development and implementation of a written Chemical Hygiene Plan (CHP) is the foundation of compliance required by the Occupational Safety and Health Administration (OSHA) as stated in the publication Occupational Exposure to Hazardous Chemicals in Laboratories (Federal Register, January 31, 1990, pages 3327-3335, part of CFR 1910). These rules have also been adopted by the Tennessee Occupational Safety and Health Administration (TOSHA). Additionally, The University of Tennessee at Chattanooga shall be subject to any rules on this subject adopted by TOSHA at a subsequent time.

This rule and standard applies to all persons, including University employees, students, and visitors, authorized to be present in laboratories maintained by the Department of Biological and Environmental Sciences. All persons subject to the CHP shall be informed of the locations of the CHP, the availability of Material Safety Data Sheets (MSDS), and other pertinent reference materials relating to their health and safety while in the laboratory. Application of the CHP is in compliance with University of Tennessee Policies on Safety and Health, Subject H, Laboratory Safety.

The CHP shall be reviewed and evaluated for its effectiveness annually by the Departmental Chemical Hygiene Officer and the Chief Chemical Hygiene Officer for UT Chattanooga.

The University of Tennessee at Chattanooga is committed to providing a safe working environment and believes employees have a right to know about health hazards associated with their work. All employees have access to pertinent safety information through their supervisory staff. When safety concerns arise, employees are encouraged to contact their supervisor.

It is important that employees assume responsibility for laboratory safety. The people who work in a given laboratory are best able to detect potential hazards. So that employees can make knowledgeable decisions about the personal risks of employment, this Chemical Hygiene Plan includes policies, procedures, and responsibilities designed to encourage an awareness of potential hazards in the workplace and to train employees in the development of appropriate, safe working conditions. A training program has been designed for the benefit and protection of all laboratory employees.

Standard Operating Procedures

General precautions for handling all laboratory chemicals should include minimizing exposure because few laboratory chemicals are without hazard. Any mixture of hazardous chemicals is assumed to be more toxic than the most toxic component.

The following procedures are used when working with chemicals:

1. Accidents and spills: consult the MSDS file found in room 216 A, Holt Hall

Eye contact: promptly flush eyes with water for 15 minutes and seek medical attention. Medical attention should be obtained for body contact with hazardous chemicals. (See Appendix A)

Ingestion: Consult the MSDS (file found in room 216 A, Holt Hall) and/or Erlanger Poison Control Center (778-7000). Each chemical affects the body differently. Medical attention should be obtained for body contact with hazardous chemicals. (See Appendix A)

Skin contact : promptly flush the affected area with water and remove contaminated clothing. Use a safety shower if chemical contact is extensive. If symptoms persist after washing, seek medical attention. Medical attention should be obtained for body contact with hazardous chemicals. (See Appendix A)

Clean-up: promptly clean up spills, using appropriate protective apparel and equipment. Dispose of clean-up materials properly. If possible, clean-up should be performed by the staff technician. In any situation where there is question as to how to handle a spill safely, contact the Departmental Chemical Hygiene Officer (Becky Bell, Holt Hall room 212, phone 425-4066) immediately and consult the appropriate MSDS (file found in room 216 A, Holt Hall). In any situation where there are severe health hazards due to a chemical spill contact the Departmental Chemical Hygiene Officer (Becky Bell, Holt Hall room 212, phone 425-4066) who will in turn contact the UTC Chief Chemical Hygiene Officer (Jim Pulliam, 425-5209), when necessary.

Medical attention should be obtained for body contact with hazardous chemicals. (See Appendix A)

2. Avoid unnecessary exposure to hazardous chemicals

Ensure that appropriate eye protection is worn by all persons, including students and visitors, in areas where chemicals are stored or used.

Wear appropriate gloves when the potential for contact with toxic chemicals exists. Inspect the gloves before each use, wash before removal, and replace as needed.

Use properly fitted respiratory equipment when air contaminant concentrations are not sufficiently restricted by fume hoods. Inspect the respirator before each use.

Do not smell or taste chemicals.

Use only those chemicals for which an adequate ventilation system is available. Apparatus that can discharge toxic chemicals (vacuum pumps, distillation columns, etc.) should be vented into local exhaust devices.

Never eat, drink, smoke, or apply cosmetics in areas where laboratory chemicals are present.

Storing, handling, or consuming food or beverages in a laboratory or chemical storage area is prohibited. The use of laboratory glassware, utensils, or refrigerators for foodstuff that will be consumed is also prohibited.

Do not use mouth suction for pipetting or to start a siphon.

Use protective and emergency apparel and equipment when appropriate.

If contact lenses are worn in the laboratory, inform the supervisor so that special precautions can be taken in the event of eye injury.

Remove laboratory coats immediately upon contamination and dispose of properly.

Wash areas of exposed skin before leaving the laboratory.

3. Follow standard laboratory safety protocols

All chemicals should be properly labeled and stored.

Keep all oxidizing agents stored at least 10' away from solvents. All chemicals should be stored in secure containers within enclosed cabinets, if possible.

Flammables and acids should be stored in authorized, appropriate storage cabinets.

Store flammable solvents and acids separately.

Keep all large quantity containers within appropriate storage cabinets. After removing the needed amount from a large container, return the container to the appropriate storage cabinet.

All chemicals should be monitored monthly to ensure effective status and continued safety measures. For example, picric acid crystals should be kept moist. Immediately request disposal of expired chemicals.

Keep the work area clean and uncluttered; clean up the work area on completion of an operation or at the end of each day.

Do not use damaged glassware. Handle and store laboratory glassware with care to avoid damage.

Dispose of broken or damaged glassware properly. Broken glassware may not be discarded in the regular trash.

Use a hood for operations that might result in the release of toxic chemical vapors or dust. Use a hood or other local ventilation device when working with any moderately volatile substance with a TLV of less than 50 ppm.

Keep materials stored in hood to a minimum; do not allow materials to block vents or air flow. Leave hood on if toxic substances are stored in it or if needed to augment laboratory ventilation.

Wear shoes at all times in the laboratory.

Confine long hair or loose clothing.

Horseplay, disorderly conduct, or use of abusive language in the laboratory is prohibited.

Seek information about hazards and plan appropriate protective procedures before beginning a new operation. Consult the MSDS or laboratory manual if in doubt about appropriate procedures for a specific chemical.

In the event of failure of a utility service leave lights on, place an appropriate sign on the door, and notify the Departmental Chemical Hygiene Officer.

If questionable hazardous conditions are found immediately notify supervisor in the Departmental Chemical Hygiene Officer (Becky Bell, Holt Hall 212, phone 425-4066) before attempting to remedy the problem.

Properly label all chemicals before disposal including a list of all chemicals in each container. Do not mix questionable agents.

A "Department Order Request Form" should be submitted to the Departmental Chemical Hygiene Officer (Becky Bell, Holt Hall room 212, phone 425-4066) when requesting a chemical order. The Departmental Chemical Hygiene Officer must be aware of all chemicals entering the department so proper handling, monitoring, record keeping, and training can be accomplished in a timely manner.

A current Material Safety Data Sheet (MSDS) manual is maintained in Holt Hall room 216A. Review the appropriate MSDS in regard to any question concerning how to handle, store, or dispose of a specific chemical.

Be aware of unsafe conditions and see that they are corrected.

No unauthorized persons, children or pets are allowed in laboratories.

Housekeeping

Floors are cleaned regularly by UTC Building Services. All employees of the housekeeping department are trained in the risks associated with working in the laboratory. Information concerning specific risks in individual laboratories will be relayed by the Departmental Chemical Hygiene Officer (Becky Bell, Holt Hall room 212, phone 425-4066) to Mr. Joe Milner, Superintendent of Building Services (400 Palmetto Street, phone 425-4521). Mr. Milner is responsible for conveying this information to the Custodial staff.

The housekeeping supervisor conducts a quarterly inspection to access if:

1. Trash is deposited in appropriate receptacles and properly removed from the laboratory. Broken glass must be placed in a separate labeled receptacle.
2. Chemical spills are promptly reported to the Departmental Chemical Hygiene Officer.
3. Proper storage is maintained to minimize clutter.
4. Housekeeping personnel are not to clean counter tops. It is the responsibility of the assigned technical personnel to clean all counter tops and upper surfaces in the laboratory area.
5. Housekeeping personnel are not to clean up any type of spill until approval and instructions are obtained from the assigned technical staff. If technical personnel are not available, contact the Departmental Chemical Hygiene Officer for instructions.

Chemical Inventory

Current chemical inventory for each laboratory should be maintained and a copy of the inventory provided to the Departmental Chemical Hygiene Officer on a quarterly basis. The Departmental Chemical Hygiene Officer will provide a complete departmental chemical inventory to the UTC Chief Chemical Hygiene Officer on an annual basis. The annual inventory will be submitted to the Department of Safety and Environmental Health no later than June 1st of each year.

A chemical inventory is performed annually, listing all the hazardous chemicals in the laboratory. Chemicals listed are those classified as hazardous by the Department of Transportation (DOT), the Environmental Protection Agency (EPA), or displaying a 2 or greater in any section of the National Fire Protection Association (NFPA) diamond. DOT and EPA classifications are in Appendices C and D.

Chemicals are listed alphabetically along with the average quantity. The NFPA hazard classification, if known, is listed as well as the manufacturer's name and address. A chemical inventory form is provided in Appendix E.

Inventories are computerized whenever possible to provide improved sorting capability. A complete chemical inventory is located in the office of the responsible Chemical Hygiene Officer, the UTC Chief Chemical Hygiene Officer, as well as the local fire department and the State Department of Labor (TOSHA).

When chemical inventories are kept current it serves the purpose of keeping tighter control over chemicals within laboratory areas, prevents excessive stock-piling of chemicals, thereby reducing the hazards involved, as well as saving money by purchasing only needed chemicals.

Material Safety Data Sheets

A departmental MSDS file is provided in Holt Hall room 216-A. The MSDSs are kept in alphabetical order. The Departmental Chemical Hygiene Officer (Becky Bell, 425-4066) is responsible for updating the MSDS file as new materials are purchased.

When a new chemical is introduced into the laboratory, immediately notify the Departmental Chemical Hygiene Officer (Becky Bell, 425-4066) so that proper training can be completed prior to the use of the chemical. In most cases this will only involve the review of the MSDS to determine the proper handling of the chemical. At this time the Departmental Chemical Hygiene Officer will determine if any special protective devices or procedures are required.

Chemical Storage

Chemicals can be stored in alphabetical order only if they are in compatible chemical categories. Special attention must be paid to ensure that oxidizing agents and other reactive chemicals are not stored close to interactive agents.

Chemical storage areas should be minimized. Storage on bench tops and hoods is not desirable. Ventilated cabinets and designated refrigerators are used for chemical storage only. No food is permitted in refrigerators where chemicals are stored.

Highly toxic chemicals, including carcinogens, are stored in ventilated storage areas in unbreakable chemical resistant secondary containers. The containers should be labeled: "Caution: High Chronic Toxicity or Cancer Suspect Agent". A separate inventory list of carcinogens and suspected carcinogens is maintained by the Chemical Hygiene Officer in order to comply with federal and state regulations.

Cylinders of compressed gases will be strapped or chained to a wall or bench top and are capped when not in use.

Labeling

The 29 CFR 1910. 1450 contains specific labeling requirements. Labeling must be done on all hazardous chemicals that are used in the workplace. Labels must not be removed or defaced.

Each hazardous chemical used in the laboratory that is not in its original container must be labeled. These labels must contain the following information:

1. Chemical name
2. Health hazard
3. Physical hazard

Engineering Controls

All biohazard hoods and fume hoods are inspected annually and certified by the Department of Safety and Environmental Health (425-5209). Any hood not passing inspection is taken out of service immediately and not used until the hood has passed inspection. It is the responsibility of the employer to purchase the parts and replace the unit in a timely fashion so that the risk to employees is minimized.

Eyewash fountains are inspected every three months by the responsible Departmental Chemical Hygiene Officer (Becky Bell, 425-4066) and records maintained by the Department of Safety and Environmental Health (425-5209).

Safety showers are inspected, tested, and flushed annually and records are maintained by the Department of Safety and Environmental Health (425-5209).

Fire extinguishers are inspected monthly by the Department of Safety and Environmental Health (425-5209).

A chemical storage facility is located in Holt Hall room 102. In this room there is a ventilated flammable storage cabinet and a refrigerator for storing flammables.

Ventilated storage cabinets with exhaust ducting are located in Holt Hall rooms 102 and 216-A.

All chemical hygiene-related equipment is monitored by the Departmental Chemical Hygiene Officer (Becky Bell, 425-4066).

Contaminated Waste Removal and Disposal

To assure that minimum harm to people and the environment will result from the disposal of waste laboratory chemicals a waste disposal program specifies how waste is to be collected, stored and transported. A copy of the waste disposal plan is on file in the Department of Safety and Environmental Health which is located at 400 Palmetto Street. All disposal is done in accordance with the Tennessee Department of Health and the Environment.

Administrative Controls

The Laboratory Manager is responsible for the safe operation of the laboratories. All activities and procedures require approval by the Departmental Chemical Hygiene Officer before implementation. Environmental monitoring is required in all laboratories that use any of the following chemicals three times per week.

29CFR 1910 Sub part Z

1910.1001 asbestos, tremolite, anthophyllite, and actinolite

1910.1002 coal tar pitch

1910.1003 4-Nitrobiphenyl

1910.1004 alpha-Naphtylamine

1910.1006 Methyl chloromethyl ether

1910.1007 3, 3'-dichlorobenzidine (and its salts)

1910.1008 bis-chloromethyl ether

1910.1009 beta-naphtylamine

1910.1010 benzidine

1910.1011 4-aminodiphenyl

1910.1012 ethyleneimine

1910.1013 beta-propiolactone

1910.1014 2-acetylaminofluorene

1910.1015 4-dimethylaminoazobenzene

1910.1016 N-nitrosodimethylamine

1910.1017 vinyl chloride

1910.1018 inorganic arsenic

1910.1025 lead

1910.1028 benzene

1910.1029 coke oven emissions

1910.1043 cotton dust

1910.1044 1, 2-dibromo-3-chloropropane

1910.1045 acrylonitrile

1910.1047 ethylene oxide

1910.1048 formaldehyde

1910.1101 asbestos

All spills are contained according to OSHA guidelines, and appropriate spill kits used. Spill kits are stored in Holt Hall room 216-A.

Assessment of significant risk of all operations is made by the Laboratory Manager or the person responsible for the Chemical Hygiene Plan. Chemical Hygiene and safety policies will be established for each task performed and engineering controls for personal protective equipment assigned.

Record Keeping

Records of environmental monitoring, medical consultations and examinations (including tests and written opinions) for each employee are required.

Accident investigations : records written and retained by the department of Safety and Environmental Health (400 Palmetto Street, 425-5209).

Chemical inventory : records written and retained by each Laboratory Manager and the Departmental Chemical Hygiene Officer (Becky Bell, Holt Hall room 212, 425-4066) and a copy is supplied to the department of Safety and Environmental Health 400 Palmetto Street, 425-5209)

Environmental monitoring : records written and maintained by the department Chemical Hygiene Officer (Becky Bell, Holt Hall room 212, 425-4066) and the department of Safety and Environmental Health (400 Palmetto Street, 425-5209).

Medical consultation : records maintained by the department of Safety and Environmental Health (400 Palmetto Street, 425-5209) and a copy placed in the employee's personnel file.

Training: records maintained by the Departmental Chemical Hygiene Officer (Becky Bell, Holt Hall room 212, 425-4066) and an annual report is provided to the UTC Chief Chemical Hygiene Officer.

When there is not a designated Departmental Chemical Hygiene Officer, full responsibility for all training and record keeping becomes the responsibility of the Laboratory Manager.

All records are kept, transferred, and made available in accordance with 29 CFR 1910.20.

Personal Protective Equipment

Eye protection meeting ANSI Standard Z. 87 required in all laboratories when hazardous chemicals are in use. Students may purchase this type of eye protection in the University Bookstore.

Employees and students are required to wear impervious gloves when there is a potential exposure to blood, hazardous chemicals, or infectious materials.

In areas where chemicals splashes are likely, an impervious apron appropriate for the task is required.

Training

Training is a necessary and important part of the Chemical Hygiene Plan. All employees are trained at the time of the employee's initial assignment to a work in an area where hazardous chemicals are present. Additional training is required if new assignments involve exposure to different risks. All training is documented in writing by attendance records.

Before training can begin, a lesson plan should be developed that outlines the expectations of the program. The lesson plan should include:

I. Objectives.

Upon completion of the Chemical Hygiene Training Program the employee will be able to:

- A. Locate the potentially hazardous chemicals in the workplace.
- B. Recognize the chemical labeling and its meaning.
- C. Locate the MSDS in the workplace.
- D. Locate the health hazard, physical hazard, environmental protection, and special protection sections of the MSDS and explain their use.
- E. Identify the person responsible for the Chemical Hygiene Plan by name and title.
- F. Discuss the major components of the facilities standard labeling system.
- G. Identify the appropriate protective clothing for the area and demonstrate its use.
- H. Demonstrate emergency procedures in the event of a hazardous chemical spill.
- I. Describe the environmental monitoring protocol.

II. Activity Plan.

- A. Audiovisuals that will be used
- B. An outline of topics to be discussed with approximate time limits.
- C. Topics to be covered
 - 1. Content of lab standard
 - 2. Location of CHP
 - 3. Identification of chemical hazards
 - a. Location of a chemical
 - b. Location of MSDS
 - c. Labeling information
 - 4. Procedures for handling hazardous chemicals
 - a. Work practices
 - b. Proper moving storing, and use
 - c. PEL for specific chemicals used by the employee
 - d. Visual appearance appearance of chemicals used
 - e. Environmental monitoring requirements
 - f. Signs and symptoms of exposure
 - g. Protective equipment used to prevent overexposure
 - h. Conditions to avoid
 - 5. Environmental protection
 - a. Emergency procedures
 - b. Spill containment
 - c. Medical consultation procedures

III. Summary

- A. Restate the objectives
- B. Restate the main points
- C. Answer questions

Chemicals Requiring Approval for Use

There are several potentially hazardous chemicals used in the Department of Biological and Environmental Sciences that require an evaluation of proposed protective procedures before any activity involving the handling of the chemical is commenced. If you plan to work with any of the chemicals in the listing below, you must complete the Permission for Chemical Use form and submit to the Departmental Chemical Hygiene Officer (Becky Bell, Holt 212, 425-4066). The Departmental Chemical Hygiene Officer then submits a recommendation for approval or rejection to the Department Chairman (Charles Nelson, 425-4341), who makes the final decision. Approval must be obtained in advance before purchase or usage of any chemical listed below. It is the responsibility of the Departmental Chemical Hygiene Officer to determine through inventory which chemicals are to be placed on the Acutely Hazardous Chemicals List.

This listing provides some examples of materials categorized as acutely hazardous. The person responsible for the Chemical Hygiene Plan should review the chemical inventory listing and designate the acutely hazardous materials actually present. The listing should be reviewed and updated as necessary.

Toxic Gas

carbon monoxide
arsine
fluorine
hydrogen cyanide
hydrogen selenite
phosphine

Acutely Toxic Compounds

dioxan
ricin
plutonium
cyanide compounds
pesticides

Shock Sensitive Compounds

picramide
picric acid
nitroglycerine (and other nitro- compounds)
benzoyl peroxide
acetyl peroxide

Highly Corrosive Compounds

benzenesulfonic acid
hydrofluoric acid
methanoic acid\ ethanoyl chloride
benzotrichloride

Extremely Flammable Compounds

carbonyl sulphide
arsine
di-n-propylamine

MEDICAL CONSULTATIONS AND EXAMINATIONS

All employees needing medical attention must use the University Worker's Compensation procedures defined by the University Personnel Office.

The employee is sent for medical evaluation under these circumstances:

1. There are signs and/or symptoms associated with exposure to a hazardous chemical.
2. Environmental monitoring reveals and exposure level above the action level.
3. A event, such as a spill, leak, or explosion, results in a hazardous chemical exposure.

The laboratory provides the following information to the examining physician:

1. Identity of the hazardous chemical (s) to which the employee has been exposed.
2. A description of the conditions under which the exposure occurred, including quantitative exposure data if available.
3. A description of the signs and/or symptoms of exposure.
4. A copy of the MSDS for the chemical(s) involved.

Non-University employees and students shall bear the expense for medical surveillance and treatment in the event of an accidental exposure to a hazardous chemical. These individuals mat contact the University Public Safety/ Risk Management Department (425-5209) to request information about filing appropriate claims for compensation pursuant to the guidelines set forth by the Tennessee Claims Commission.

CHEMICAL HYGIENE PLAN RESPONSIBILITIES

Safety responsibilities for a specific laboratory rest with the faculty or staff member designated by the Departmental Chemical Hygiene Officer and approved by the Department Head. The designated person must:

- Work with administrators and other employees to develop and implement appropriate chemical hygiene policies and practices.
- Monitor the procurement, use, and disposal of chemicals in the laboratory.
- See that appropriate audits are maintained.
- Help project directors develop precautions and adequate facilities.
- Know the current legal requirements concerning regulated substances.
- Seek ways to improve the chemical hygiene plan.
- Certify the performance of protective equipment.
- The immediate supervisor has the overall responsibility to:
 - Ensure that workers
 1. Understand and follow the chemical hygiene rules.
 2. Have working protective equipment available.
 3. Are provided with adequate training.
- Provide regular chemical hygiene and housekeeping inspections including routine inspections of emergency equipment.
- Know the current legal requirements concerning regulated chemicals.
- Determine the need for protective equipment.

The laboratory employee is responsible for:

- Planning and conducting each laboratory operation in accordance with the institutional chemical hygiene procedures.
- Developing good personal chemical hygiene habits.

UNIVERSITY CHEMICAL HYGIENE OFFICER RESPONSIBILITIES

The University Chemical Hygiene Officer for UTC coordinates the Campus Chemical Hygiene Program within University guidelines has the responsibility to:

- Develop a written hygiene plan to be submitted to the University Safety Office for approval.
- Perform periodic reviews, at least annually, of department plans and prepare revisions to keep the campus plan current relative to changes in regulations and University safety policy.
- Coordinate the necessary activities required to ensure that an adequate emergency reaction response capability exists within each department.
- Coordinate a program to ensure that all hazardous materials information resources required by regulations are available to department employees and that the contents of these materials are current.
- Oversee training of departmental employees to ensure compliance with safety regulations. Laboratory employees should have adequate job orientation so that they can protect themselves against the potential adverse effects of exposure to hazardous chemicals.
- Coordinate necessary medical consultations to satisfy the requirements of the “medical consultation and medical examination” section of the standard.
- Coordinate the arrangements of all required employee monitoring to satisfy the requirements of the “employee exposure determination” of the standard.
- Coordinate the implementation of the approval procedure for those substances that are designated as requiring prior approval before use.
- Coordinate all other activities that are shown to be necessary to ensure compliance with all aspects of the standard.

In order to assure compliance with the University of Tennessee Safety Policies, the University Chemical Hygiene Officer, working in consort with the UT Chattanooga Safety Officer, has the authority to initiate action to close down a laboratory if safety requirements of the UTC Chemical Hygiene Plan are not met.

ADDITIONAL SAFETY REQUIREMENTS OTHER THAN FOR HAZARDOUS CHEMICALS

- Dispose of glass and sharp objects in designated disposal containers.
- Non-contaminated waste is to be disposed of in regular trash.
- Never obstruct exits, fire extinguishers, fire hoses, gas valves, etc.
- Doors into laboratory areas are to remain closed at all times when not in use. Never prop doors open.
- Make sure that all equipment is properly grounded and that the wiring of all equipment is in good condition. If cracks in insulation or exposure of the wiring is noticed, immediately unplug the equipment and notify your supervisor and the Departmental Chemical Hygiene Officer.
- In the case of exhaust failure, immediately notify your supervisor and the Departmental Chemical Hygiene Officer. If personnel are in danger of contamination by toxic or infectious agents, immediately remove all personnel from the area, closing off the area until the problem has been properly resolved.
- Chemical storage cabinets are to be placed at least six (6) feet away from laboratory exits.

Radiation Safety

The purpose of this section of the Chemical Hygiene Plan is to present regulations and recommended procedures for work with radiation sources at the University of Tennessee at Chattanooga in order to protect the individual, prevent the spread of contamination and to assist in fulfilling the responsibilities of the University to its students, its staff, and its neighbors.

Radiation is an invaluable tool in teaching and research and, when properly used, can provide great benefits to mankind with little or no attendant risk. However, improper use can bring risk of radiation exposure resulting in chronic illness, injury, or even death. The known hazards in the order of their importance, are the deposition of radioactive materials in the body, external exposure to neutrons, to gamma and x-rays, and to beta radiation.

Use of radiation sources implies acceptance by the user of some increased exposure above the natural background radiation to which man has always been exposed. Common sense dictates that such increase in personnel exposures and contamination levels should be kept to the minimum consistent with reasonable effort and expense. Minimums considerably lower than the so-called "Maximum Permissible Levels" can be maintained provided the user has adequate knowledge, adequate equipment, and the skill and disposition to use them. Proper disposition means a balanced perspective towards radiation entailing a healthy respect, free of both the blind fear of the novice and the familiar contempt one sometimes encounters in the "old hand."

This section is designed to help University staff in performing teaching and research with radiation sources in a safe, legal and efficient manner without imposing unnecessary restrictions on anyone's work. Some of the rules come from Federal and State Regulations which, having the force of law, permit no modifications unless specifically permitted by law.

In general, it is the responsibility of the individual radiation user to understand and conduct his operations in an acceptable manner to minimize hazards to himself and others. It is the responsibility of the laboratory supervisor to insure that all personnel, particularly new personnel, in his area are properly instructed with respect to the nature of the radiation hazards and the necessary radiation safety procedures in his laboratory and that they possess the necessary skills and disposition to cope with radiation safety problems safely. The Radiation Safety staff is responsible for assisting all users and supervisors by providing consultation and certain services in matters of radiation safety.

The Radiation Safety Committee is responsible for establishing policies for the Radiation Safety Program, for reviewing the work of the Radiation Safety staff, and advising both them and the radiation users on particular problems.

Radiation Laboratory Procedures

1. The use of radioisotopes is restricted to approved areas.
2. Before using any radioisotope in the laboratory, you must be familiar with limitations placed on this institution regarding isotope use.
3. To prevent accidental entry of radioactive materials into the body, high standards of cleanliness and good housekeeping must be maintained in all laboratories where radioactive material is present.
4. Always use gloves. Remove gloves before leaving the work area. Wear protective clothing (lab coats, masks, shoe covers) as needed.
5. Wash hands and arms thoroughly before handling any object which goes to the mouth, nose, or eyes (e.g., cigarettes, cosmetics, foods). Keep fingernails short and clean.
6. Smoking and eating in radioisotope laboratories is prohibited. No food or drink may be stored in laboratory refrigerators.
7. One or more trial runs with non-radioactive materials are recommended for new procedures and new personnel to test effectiveness of procedures and equipment.
8. Use double containers for storage of working solutions of radioisotopes. For example, if the radioisotope solution is in a liquid scintillation vial, place the vial in a small beaker.
9. Never pipette by mouth. Use rubber bulbs, syringes, or mechanical devices.
10. Clean up minor spills immediately. For major spills follow emergency procedures.
11. Whenever possible, operations with radioactive materials should be conducted in a hood, dry box, or some other type of closed system. Operations with materials susceptible to atmospheric distribution, such as boiling, evaporating, distilling or ashing, must be done in a hood with an air flow of approximately 100 linear feet per minute. Work with activities of more than a few hours half-life should be done over a tray. Work with finely divided powder must be done in a hood or closed system.

12. Table and bench tops should be of a non-porous, chemical resistant material. Working surfaces shall be covered with absorbent paper regardless of the type of surface.
13. When work is completed each person will clean up his own work area and arrange for disposal or proper storage of all radioactive materials and equipment.
14. Vacuum pumps used in systems containing radioisotopes must not be permitted to exhaust into room air or out windows. Use a double trap mechanism on any vacuum system.
15. Exhaust stacks must not be vented near openable windows or building air intake vents.
16. Laboratories shall provide special radioactive waste containers. These shall bear the words "Caution, Radioactive Waste," and a warning to janitors against handling.
17. Housekeeping should not touch benches and instruments, etc., but are permitted to clean floors and windows only. Laboratory personnel are responsible for the rest of the housekeeping.
18. Repairs such as plumbing, etc., should not be undertaken unless Radiation Safety has been notified.
19. When use and storage of radioactive materials is to be terminated at a facility, notify the Radiation Safety which must make a terminal survey before an area can be released for other uses.

Radioactive Waste Management

Researchers must ensure, prior to the procurement of any radioactive materials, that a method of disposal of the materials either presently exists or can be worked out to the satisfaction of the Radiation Safety Committee.

1. Each Radioisotope Laboratory Supervisor must maintain accurate records of the types, quantities, and forms of radioisotopes which are placed in the radioactive waste which is released from his/her radioisotope laboratory. Records kept by the Laboratory Supervisor may be based on either calculations or on measurements.
2. Radioactive waste containers should be stored as close to the work area as possible to minimize the probability of spillage during the transfer of the waste to the containers.
3. Waste containers shall not be stored in hallways, stairwells or other uncontrolled areas.
4. Radioactive waste containers should be covered at all times when not in use.
5. Each radioactive waste container shall be labeled with a "Caution Radioactive Materials" label or sticker.
6. When handling or transferring radioactive waste, the individual should wear a laboratory coat and disposable gloves.
7. Radioactive wastes containing carcinogens, biohazards, or very hazardous chemicals must be inactivated, if possible, and packaged in such a way that they present minimal hazards to people who handle the wastes.

Radiation Emergency Procedures

In all emergencies, the UTC Chief Chemical Hygiene Officer (Jim Pulliam, 425-5209) should be contacted as soon as possible.

Extreme hazards: high radiation levels or the possibility of airborne contamination from dry or volatile radioactive materials.

1. Evacuate the laboratory immediately. Close and lock the door.
2. Summon the University Safety Officer and the Radiation Safety Officer immediately.
3. Remove shoes if contamination is suspected. Do not touch anything unnecessarily.

Other hazards: for example, spills or suspected spills of radioactive materials where the material is not airborne. Keep calm. Assume that you are contaminated until a survey proves otherwise.

1. Confine contamination.
 - a. Localize the spill. Right a tipped container then drop absorbent material on the spill. Damp down a dry spill.
 - b. Do not track contamination around the laboratory. Call for help if possible.
 - c. Close the door to prevent the spread of airborne contamination.
 - d. Check shoes before leaving the area after a spill has been cleaned up.
2. Protect personnel.
 - a. Remove contaminated clothing and wash contaminated parts of the body with detergent.
 - b. Warn other workers.
3. Decontaminate.
 - a. If thorough washing does not remove contamination from the body, consult the UTC Chief Chemical Hygiene Officer (Jim Pulliam, 425-5209).
 - b. Do not spread radioisotopes to clean areas.

Emergency Procedures Electrical Power Outage

1. Cease work as rapidly as possible. If the hood was in use, close the hood door.
2. Evacuate the area immediately. Close and lock the laboratory door. A notice not to enter the room must be placed on the door to prevent entry.
3. Remove contaminated clothing and wash contaminated areas of the body with detergent.
4. Call the UTC Chief Chemical Hygiene Officer (Jim Pulliam, 425-5209)

GLOSSARY

The following terms are used as part of the Chemical Hygiene Plan:

Acute: An adverse effect with symptoms of high severity coming quickly to a crisis.

Carcinogen: A substance capable of causing cancer.

Chemical: A wide variety of fluids that have a high potential for body entry by agents various means. Some are more toxic than others and require special measures of control for safety and environmental reasons.

Chronic: An adverse effect with symptoms that develop slowly over a long period of time or that frequently recur.

Combustible: Able to catch on fire and burn.

DOT: Department of Transportation

EPA: Environmental Protection Agency

Flammable Capable of being easily ignited and burning with extreme rapidity.

Infectious: Sources that cause infections either by inhalation, ingestion, or direct agents contact with the host material.

LC50: The concentration of a substance in air that causes death in 50% of the animals exposed by inhalation. A measure of acute toxicity.

LD50: The dose that causes death in 50% of the animals exposed to a substance through ingestion. A measure of acute toxicity.

MSDS: Material Safety Data Sheet

Mutagen Capable of changing cells in such a way that future cells are affected.
Mutagenic substances are usually considered to be suspected carcinogens.

OSHA: Occupational Safety and Health Administration, the regulatory branch of the Department of Labor concerned with employee safety and health.

PEL: Permissible Exposure Limit. The legally allowed concentration in the workplace that is considered a safe level of exposure for an 8-hour shift, 40 hours per week.

pH: A measure of how acidic or caustic a substance is on a scale of 1 to 14. A pH of 1 indicates that a substance is strongly acidic; a pH of 14 indicated that a substance is strongly basic.

Physical Workplace sources recognized for their potential effects on the body. agents Heat exposure or excessive noise levels are examples of this risk group.

Sensitizers: Agents that can cause an allergic reaction at some point in time following repeated exposures.

Sterility: Changes made in male or female reproductive systems that result in an inability to reproduce.

Teratogens: A substance that causes a deformity in newborns if a significant exposure exists during pregnancy.

TLV: Threshold Limit Value. The amount of exposure allowable for an employee in an 8-hour day.

REFERENCES

THE FOLLOWING SOURCES WERE USED TO PREPARE THIS PLAN:

1. U.S. Department of Labor, final rule part II. Federal Register 29 CFR Part 1910. Occupational Exposure to Hazardous Chemicals in Laboratories, Wednesday, January 31, 1990.
2. National Research Council. Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Academy Press, 1981.
3. National Research Council. Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Academy Press, 1983.
4. A Model Chemical Hygiene Plan for Laboratories, Terry Jo Gile, MT(ASCP), MA Ed. Clinical Laboratory Management Association, Inc. 1990.