

## CHAPTER 3 CHEMICALS IN LABORATORIES

### 3.1 INTRODUCTION

This chapter contains the requirements for chemical hygiene in those laboratories meeting the definition in paragraph 3.4.10. The OSHA standard which is the basis for this chapter allows exceptions to other OSHA standards which are difficult to comply with in a laboratory setting, such as the Hazard Communication Standard (see Section 8, Chapter 12). The requirements of this chapter are intended to provide equivalent safety. In particular, the requirement is established for each laboratory to have a Chemical Hygiene Plan (See 3.2 below).

### 3.2 CHEMICAL HYGIENE PLAN

3.2.1 Because the safety of employees is of direct and continuing interest and concern, PPPL has adopted a requirement for each "laboratory" (see definitions) to have a Chemical Hygiene Plan (CHP). Each CHP shall comply with Title 29, Code of Federal Regulations part 1910.1450, "Occupational exposure to hazardous chemicals in laboratories". In addition, the CHP will: establish a mechanism to provide employees with information and training, designate a Chemical Hygiene officer, establish designated areas and standard operating procedures to control chemical exposures in a laboratory environment, and procedures to comply with all other requirements set forth by this Chapter.

3.2.2 The Chemical Hygiene Plan is applicable to laboratory (see definitions) work operations where employees may be exposed to hazardous substances under normal conditions or during an emergency situation. Other users of chemicals at the Lab should use this Chapter as further reference for proper handling and storage of hazardous chemicals.

3.2.3 The CHP shall be readily available to employees or designated employee representatives. This document is created expressly for the welfare of employees and is therefore to be easily accessed by them. Supervisors must insure that interested employees are provided the opportunity to read this document and must provide sufficient training to assure that employees understand it.

### 3.3 SCOPE

This chapter shall apply to the use of hazardous chemicals in a "laboratory" only (see definitions).

### 3.4 DEFINITIONS

3.4.1 **Action Level** - The concentration of a specific airborne contaminant at which control measures are required. The Action Level is frequently, though not always, one-half of the Permissible Exposure Limit for a given chemical.

3.4.2 **Acute Health Effects** - An adverse effect on the human body with symptoms of high severity coming quickly to a crisis.

3.4.3 **Carcinogen** - A substance that is suspected or proven of causing cancer (Refer to Section 8, Chapter 2, "Carcinogens, Mutagens and Teratogens.")

3.4.4 **Chemical Hazards** - Hazards relating to the chemical properties of a substance. Examples are carcinogenicity, irritation and toxicity.

3.4.5 **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 implementation of the Chemical Hygiene Plan.

**3.4.6 Chemical Hygiene Plan** - a written program which sets forth procedures, equipment, personal protective equipment and work practices that are capable of protecting employees from the health hazards of the hazardous chemicals used in the chemical laboratory.

**3.4.7 Chronic Health Effects** - An adverse effect on the human body with symptoms that develop slowly over a long period of time or that frequently recurs.

**3.4.8 Designated Area** - an area which may be used for work with confirmed human carcinogens, teratogens, or highly toxic substances (see Chapter 2 of this Section).

**3.4.9 Hazardous Chemical** - a chemical which may cause acute or chronic health effects in humans. Such chemicals may include: carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins (poisonous to the liver), nephrotoxins (kidneys), neurotoxins (nervous system), agents which attack the hematopoietic systems (blood forming), and agents which damage the lungs, skin, eyes, or mucous membranes. Refer to Section 8, Chapter 12, "Hazard Communication" for more information.

**3.4.10 Laboratory** - for the purposes of this chapter, a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis and where all of the following conditions are met:

- A. Chemical manipulations are carried out on a "laboratory scale;"
- B. Multiple chemical procedures or chemicals are used;
- C. The procedures involved are not part of a production process; and
- D. "Protective laboratory practices and equipment" are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

**3.4.11 Laboratory Scale** - work with substances where the containers are designed to be easily and safely handled by one person.

**3.4.12 Permissible Exposure Limit (PEL)** - The maximum air contaminant concentration, as established by the Occupational Safety and Health Administration (OSHA), that a worker can be exposed to on a repeated basis without developing adverse effects.

**3.4.13 Physical Hazards** - Hazards relating to the physical properties of a substance. Examples are flammability, reactivity, corrosivity and radioactivity.

**3.4.14 Protective Laboratory Practices and Equipment** - laboratory procedures, practices and equipment effective in minimizing the potential for employee exposure to hazardous chemicals.

### **3.5 EMPLOYEE EXPOSURES**

**3.5.1** Employee exposures will be reduced or eliminated through a combination of control measures, including the use of personal protective equipment where appropriate (See 3.6 "Hierarchy of Control Measures" below).

**3.5.2** PPPL will assure that laboratory uses of OSHA regulated substances will not exceed the permissible exposure limits specified in 29 CFR 1910 Subpart Z. This will be verified by sampling performed by the IH.

**3.5.3** The IH shall measure employee's exposures to any substance regulated by a standard which requires monitoring if there is reason to believe that exposure levels for that substance routinely exceed the action level (or in the absence of an action level, 1/2 the PEL).

**3.5.4** If the initial monitoring discloses employee exposures over the action level (or in the absence of an action level, 1/2 the PEL), PPPL will immediately comply with the exposure monitoring provisions of the relevant standard.

3.5.5 PPPL will, within 15 working days after the receipt of any monitoring results, notify the employee of these results in writing.

### 3.6 HIERARCHY OF CONTROL MEASURES

Control measures are any action taken to eliminate or reduce the employee's exposure to a chemical or physical hazard. There is a hierarchy of control measures which is based upon relative efficacy and worker comfort:

- A. Substitution to a less hazardous substance
- B. Engineering controls:
  - 1. Isolation or enclosure of an operation
  - 2. **Local exhaust ventilation**
- C. Administrative controls to limit employee's exposure:
  - 1. Minimizing duration of exposure through personnel rotation
  - 2. Use of signs, barriers and procedures
- D. Personal Protective Equipment.

### 3.7 GENERAL SAFETY PROCEDURES

3.7.1 Laboratory procedures which present hazards to the worker, facility, or environment must first be reviewed and approved by the IH. **Extreme or unusual hazards may require additional approvals as required by the Head of Environment, Safety and Health Division (ES&H).**

3.7.2 Wear appropriate personal protective equipment each time a hazardous laboratory operation is performed. For more information concerning personal protective equipment consult the IH, or read ES&H Directives 5008, Section 8, Chapter 6, "Personal Protective Equipment."

3.7.3 Do not eat, drink, apply cosmetics or smoke in laboratories.

3.7.4 Insure that any personal protective device or garment assigned is properly cleaned, maintained, and stored.

3.7.5 Maintain a high level of cleanliness and orderliness in all laboratory areas. Keep work spaces clear of all but essential items.

3.7.6 Orient all chemical and physical experimental apparatus away from co-workers.

3.7.7 Maintain a high level of awareness while working in laboratories.

3.7.8 Immediately clean up any manageable spills. For larger spills or accidents call Emergency Services at x3333.

3.7.9 NEVER mouth pipette chemicals. Use suction bulbs or automatic pipettes.

3.7.10 Do not wear contacts while working in laboratories.

3.7.11 Always wear enclosed leather shoes.

3.7.12 Never wear high heel shoes.

3.7.13 When handling an unknown sample, assume the worst hazards may apply. Therefore, use control measures to eliminate or reduce possible exposures.

3.7.14 **Comply with Section 8, Chapter 13, "ES&H Review of Procurements"** when obtaining any chemical.

### **3.8 CHEMICAL HYGIENE OFFICER**

3.8.1 A Chemical Hygiene Officer (**CHO**) shall be appointed for each area of PPPL covered by this **Chapter**.

3.8.2 The Chemical Hygiene Officer shall be responsible for implementing the provisions of the Chemical Hygiene Plan for the laboratory in which he or she works.

3.8.3 The Chemical Hygiene Officer shall **review his/her laboratory CHP annually and revise if necessary**.

### **3.9 INFORMATION AND TRAINING**

3.9.1 Information - Employees will be informed of the contents of **29CFR 1910.1450, "Occupational Exposures to Hazardous Chemicals in the Laboratory," and 29CFR 1910.1200, "Hazard Communication."** Employees shall be informed of the following during training:

- A. Location and availability of the Chemical Hygiene Plan.
- B. The PEL's for OSHA regulated substances or recommended exposure limits where no OSHA limits are available.
- C. Signs and symptoms associated with exposure.
- D. Location and availability of reference resources, including Material Safety Data Sheets.
- E. Recognition, measurement, control and evaluation techniques to be used for hazardous chemicals in the laboratory.
- F. Protective measures and equipment.
- G. Specifics of the Chemical Hygiene Plan.

3.9.2 Training shall be provided to all potentially exposed employees before the employee shall be allowed to handle or use hazardous substances.

3.9.3 The supervisor or CHO will be responsible for providing employees with **additional** training if there are any changes in the working conditions.

### **3.10 LABELING**

**Labels shall comply with** ES&H Directive 5008, Section 8, Chapter 12, "Hazard Communication" **with the following exceptions:**

3.10.1 Solutions mixed on-site must also be labeled with the time and date of mixture, the initials of the technician, and information concerning the concentrations.

3.10.2 Samples can be divided into two groupings: known and unknown.

- A. Known samples shall be labeled to reflect the known components, origin, date and time of collection, identity of the collector, and hazards.

- B. Unknown samples shall be labeled as completely as possible, to include (if known); origin, date and time of collection, identity of the collector, and possible hazards.

### 3.11 DESIGNATED AREAS

3.11.1 A designated area is a work area (usually a laboratory fume hood) determined by the Chemical Hygiene Officer and the **IH to be appropriate for use with highly hazardous materials such as confirmed human carcinogens and highly toxic agents**. Work with **these highly hazardous materials** may only be performed within these designated areas.

3.11.2 A designated area may be recognized by a prominently displayed sign, which states: "Designated Area for Work with **Highly Hazardous Chemicals**" The **chemical** must also be identified **on the sign**.

### 3.12 DECONTAMINATION

3.12.1 Employees should not attempt to clean up a spill if it involves more than a small quantity of material, if the material involved is highly dangerous, if the identity of the material is unknown, or if the employee does not feel adequately trained or equipped to handle the spill. In these circumstances, the employee should immediately call Emergency Services, at ext. 3333.

3.12.2 Decontamination procedures and equipment must be **included in the CHP and** approved by **the IH** before implementation.

3.12.3 Do not use sinks for decontamination procedures or disposal. Neither the equipment nor the sewage treatment plants are designed to handle these types of chemicals. If a question arises concerning disposal, contact the **Environmental Restoration / Waste Management (ER/WM) Division**.

### 3.13 PROTECTIVE EQUIPMENT

3.13.1 Protective equipment shall be maintained in good condition.

3.13.2 Each chemical laboratory shall have convenient to laboratory employees:

- A. A properly functioning fume hood, if the **IH** determines that one is required,
- B. Fire extinguishers **as determined by the Fire Protection Engineer**,
- C. An eye wash station, either plumbed or a static reservoir,
- D. A drench-type safety shower, drained, and fully accessible,
- E. Sufficient personal protective devices (gloves, goggles, glasses, aprons, face shields, etc.) to protect each individual under the most rigorous of work loads,
  1. Splash goggles shall be used in all laboratories when there is a possibility of chemical splashes,
  2. When working with corrosives, a face shield shall be used in addition to splash goggles.

### 3.14 CONTAINMENT DEVICES

3.14.1 Examples of containment devices used at PPPL are laboratory fume hoods and glove boxes.

3.14.2 The following rules for the use of these devices are to be followed by all personnel:

- A. All work performed in laboratory fume hoods must take place at least six inches inside the fume hood. No procedures should be performed on the sill.

- B. No items may be permanently or temporarily stored on the sills.
- C. Sashes may not be removed.
- D. Substances and equipment are not to be stored in fume hoods.
- E. No food or drink is allowed in or around the area of a fume hood.
- F. Equipment within the fume hood must be arranged so that the exhaust slots are not blocked.
- G. The fume hood user should extend only the hands and arms into the fume hood. The user should avoid leaning against the face of the hood.

3.14.3 Glove boxes must be used by placing hands and arms into sealed gloves. No other means of manipulation within the glove box is permitted.

- A. Storage of equipment and substances within the glove box must be kept to an absolute minimum.
- B. Items stored within the glove box must be arranged so that the exhaust ports are not blocked.
- C. No alteration to the glove box design is permitted without prior approval from the IH.

3.14.4 Laboratory fume hoods are to operate with an average face velocity of 100 fpm  $\pm$  20 fpm, unless approval is obtained from the IH for different flow rates.

3.14.5 Fume hoods must be checked on a frequency determined by the IH based upon hazard potential to insure that performance standards are being met. Each acceptable device will be labeled, displaying the date of the test and the initials of the person performing the test.

### 3.15 PROCEDURES FOR WORKING WITH CARCINOGENS

All use of carcinogens shall comply with ES&H Manual Section 8, Chapter 2, "Carcinogens, Mutagens and Teratogens."

### 3.16 WASTE REMOVAL PROCEDURES

3.16.1 Hazardous waste materials will be disposed of in accordance with policies and procedures as published by the ER/WM Division.

### 3.17 CHEMICAL STORAGE

3.17.1 Chemicals must be stored in accordance with ES&H Directive 5008, Section 8, Chapters 1 "Chemicals, Chapter 2, "Carcinogens, Mutagens and Teratogens," and Section 5, "Fire Protection," Paragraph 3.13, "Fire Prevention Practices" as appropriate.

3.17.2 All chemicals should be dated and initialed upon arrival.

3.17.3 All chemicals should be dated and initialed when opened.

### 3.18 MEDICAL CONSULTATION AND MEDICAL EXAMINATION

3.18.1 PPPL shall provide any employee who works with hazardous chemicals an opportunity to receive medical attention, including follow-up exams which the examining physician determines to be necessary, under the following circumstances:

- A. Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory, the employee shall be provided an opportunity to receive an appropriate medical examination from the **Occupational Medicine Office (OMO)**.
- B. Where exposure monitoring reveals an exposure level above the action level (or in the absence of an action level, a PEL) for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance shall be established for the affected employee. The physician or a referred specialist will maintain medical monitoring.
- C. Whenever an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee shall be provided an opportunity for a medical consultation with the corporate physician or emergency room physician. Such consultation shall be for the purpose of determining the need for a medical examination.

3.18.2 All medical examinations (except emergencies) and consultations shall be performed by the **OMO**. Emergencies shall be **handled by Emergency Services and Princeton Medical Center, as appropriate**. These services shall be provided to the employee without cost and without loss of pay.

3.18.3 **Emergency Services, the affected employee, or his/her supervisor** will provide the following information to the physician:

- A. The identity of the hazardous chemical(s) to which the employee may have been exposed.
- B. A description of the conditions under which the exposure occurred including quantitative exposure data, if available.
- C. A description of the signs and symptoms of exposure that the employee is experiencing, if any.

3.18.4 **A written report from the examining physician shall be obtained and maintained by the OMO and shall include:**

- A. Any recommendation for further medical follow up.
- B. The results of the medical examination and any associated tests.
- C. Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace.
- D. A statement that the employee has been informed by the physician of the results of the medical consultation or examination and any medical condition that may require further examination or treatment.

### **3.19 RECORD-KEEPING**

3.19.1 The **OMO** will maintain employee medical records, to include results, diagnosis and treatment recommendations for any employee who receives a medical evaluation or examination for conditions or symptoms relating to occupational exposure to chemicals.

3.19.2 The **IH** will maintain all measurements taken to monitor employee exposure to hazardous chemical or physical agents. The records shall include;

- A. The date of measurement;
- B. The operation being monitored;

- C. The methods of sampling and analysis;
- D. The number, duration, time, and results of samples taken;
- E. The types of protective devices worn;
- F. The names, social security numbers, job descriptions, and exposure estimates of employees who were monitored or who were represented by the exposure monitoring.

### 3.20 REFERENCES

American Conference of Governmental Industrial Hygienists, Threshold Limit Values for Chemical Substances and Physical Agents, Cincinnati, OH, (latest edition).

OSHA, Code of Federal Regulations, 29CFR 1910, Washington, DC (latest edition).

National Research Council, Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Academy Press, Washington, DC, 1981.

National Research Council, Prudent Practices for Disposal of Chemicals from Laboratories, National Academy Press, Washington, DC, 1983.