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Chapter 6.7 Laboratory Safety and Health

This could be you . . .

Hydrofluoric acid overflowed from a container. A worker tried to clean it up with paper towels and only caused more vapors. The worker experienced delayed symptoms and received severe chemical burns to his hands and lungs.

A glass separator funnel ruptured from being shaken and sprayed a chemical on a chemist. The chemist was wearing safety glasses, lab coat, and gloves. After washing off the chemical, the chemist was okay.

A laboratory worker broke a glass laboratory device he was working on and cut his finger.

6.7.1. Applicability of this chapter

You are required to follow this chapter if you work in a laboratory, as described in paragraph 6.7.2, or supervise those who work in a laboratory.

6.7.2. What this chapter covers

This chapter contains JSC requirements for the safe operation of laboratories that meet or exceed OSHA Standard 29 CFR 1910.1450, "Occupational exposure to hazardous chemicals in laboratories." Per the OSHA standard, the term "laboratory" means "a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis for analysis or research." It involves "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."

6.7.3. Requirements for working in a laboratory

6.7.3.1 Laboratory workers shall:

- a. Use engineering and administrative hazard controls as much as possible.
- b. Follow the laboratory's chemical hygiene plan and standard operating procedures.
- c. Follow the ventilation requirements in Chapter 4 of NPR 1800.1.

6.7.4. Chemical hygiene plans

6.7.4.1 If the laboratory uses hazardous chemicals, the laboratory supervisor shall make sure the laboratory has a written Chemical Hygiene Plan (CHP). The laboratory may have its own CHP, or it may use a CHP covering several laboratories in the organization. Review the CHP and evaluate its effectiveness at least yearly, update it as necessary, and document the review was conducted. Send the initial written CHP and any updates to Occupational Health for review. A CHP shall include:

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- a. Methods to protect workers from chemical hazards in the laboratory and keep exposure levels below OSHA or NASA permissible exposure limits (PELs) or below any American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLVs).
- b. Methods to provide additional protection from reproductive toxins, as required.
- c. Operating procedures for safely using hazardous chemicals in the laboratory.
- d. Criteria to decide what control measures to use to reduce the chance of a dangerous chemical exposure. Control measures may include engineering controls, PPE, or safe work practices.
- e. Requirements to make sure laboratory safety equipment such as fume hoods, emergency showers, and eyewashes work properly.
- f. Provisions for worker information and training, as described in paragraph 6.7.12.
- g. Criteria to decide when a particular laboratory activity requires prior approval from the laboratory supervisor.
- h. Provisions for workers to get medical help, as described in paragraph 6.7.13.
- i. A list of personnel responsible for implementing the plan, to include chemical hygiene officers.

6.7.5. Safe practices for working in a laboratory

6.7.5.1 Laboratory workers shall:

- a. Follow the CHP and operating procedures. See paragraph 6.7.4 for more details.
- b. Follow these requirements for exhaust hoods:
 - (1) Use hazardous chemicals under an exhaust hood.
 - (2) Position sashes open between 12"-18" while maintaining 100-120 lfpm [linear feet per minute] air velocity at the sash opening when working in the hood.
 - (3) Always wear required PPE, even when working under a hood.
 - (4) Make sure exhaust hoods are evaluated by Occupational Health annually .
 - (5) Get approval from the Safety and Test Operations Division and Occupational Branch before using other exhaust methods.
- c. Keep exposure to hazardous chemicals in the laboratory to the lowest level practical. Never exceed the OSHA- or NASA-permissible exposure level for any chemical.
- d. Keep aisles and areas around safety equipment (e.g., eyewash stations and emergency showers) clear.
- e. Keep Safety Data Sheets (SDSs) for each chemical in your laboratory. Develop SDSs for each chemical developed in the laboratory for use outside the laboratory as described in Chapter 9.2, "Hazard Communication."
- f. Review any experiment involving storing energy (e.g., mechanical, electrical, or chemical) for hazards before conducting it.
- g. Take precautions to prevent injuries from broken glass. Use the safety guide in the chemical laboratory, Manufacturing Chemists Association Inc., "Handling Glassware."

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- h. The laboratory safety representative or Chemical Hygiene Officer should review changes in laboratory operations and chemicals before a procedure is conducted for the first time.
- i. Recipes for mixed chemical reagents should be scaled down whenever possible to the minimum quantity for the task.

6.7.6. Storing chemicals in a laboratory

6.7.6.1 Employees storing chemicals in a laboratory shall:

- a. Label all containers of laboratory chemicals, samples, and other materials using the labeling criteria in Chapters 9.1 and 9.2. Never remove or tear labels on incoming chemical containers. If a label on a chemical container becomes unreadable, put a new label on the container to identify the chemical and its hazards. If you move a chemical to another container, properly label the new container.
- b. Keep SDSs for hazardous chemicals where laboratory workers can easily find them during all duty hours.
- c. Keep an up-to-date inventory of the names and amounts of all hazardous chemicals in the laboratory at a given time.
- d. Keep only the smallest amount of chemicals possible in the laboratory. If the laboratory uses a large amount of chemicals in a short time, designate an internal chemical storage area with the following:
 - (1) Enough ventilation.
 - (2) Physically separation from workrooms.
 - (3) Separate storage for potentially reactive chemicals and incompatible materials.
 - (4) A readily available listing of all chemicals in the storage area.
 - (5) Fire protection.
- e. Never use an exhaust hood for permanent chemical storage.
- f. Never store food or drink in any refrigerators or freezers where chemicals, reagents, or samples are stored.

6.7.7. Monitoring chemical exposures in a laboratory

6.7.7.1 Occupational Health is responsible for determining whether to monitor chemical exposures during yearly inspections or because of complaints or requests. They will provide written reports of any exposure monitoring to the supervisor or Facility Manager. They will:

- a. Sample chemical exposures to workers if they believe chemical exposures could exceed PELs.
- b. Monitor chemical exposures periodically if earlier samples or monitoring shows exposures over PELs.
- c. Keep accurate records on any monitoring results. Employees have access to these records as described in 29 CFR 1910.20, "Access to Employee Exposure and Medical Records."

NOTE: Your supervisor must tell you the results immediately after he or she receives them.

Verify correct version before use at [Center Directives Management System](#).

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6.7.8. Design requirements for laboratories

6.7.8.1 Laboratory designs shall meet these requirements:

- a. Follow NFPA 45, "Standard on Fire Protection for Laboratories Using Chemicals," and applicable federal and state requirements.
- b. Install permanent pipes and tubing as much as possible to reduce the use of flex hoses and temporary tubing. Label all pipes and tubing.
- c. Provide permanent gas-venting where venting of gases is needed.
- d. Provide blast and fragment protection for operations that may cause explosions, implosions, or flying fragments, such as high-pressure equipment, high-vacuum equipment, or explosive reactions.
- e. Include other relevant design requirements and engineering controls (e.g., appropriate laboratory ventilation systems, from 29 CFR 1910.1450).
- f. Meet the requirements in paragraph 3.9 of NPR 8715.3, "NASA General Safety Program Requirements." Laboratories shall also provide emergency eyewashes or showers when hazard assessments by Occupational Health indicate the need.

6.7.9. Emergency planning for laboratories

Laboratory supervisors shall make sure their laboratories have written emergency action plans covering any possible emergencies in the laboratory and also make sure all workers know what to do in an emergency. This includes making sure the laboratory has enough emergency equipment and supplies to deal with possible emergencies.

6.7.10. Protective equipment to use when working in a laboratory

Laboratory workers shall use personal protective equipment as required by a hazard assessment or SDS. See Chapter 5.6, "Personal Protective Equipment," for more requirements on protective equipment.

6.7.11. Training to work in a laboratory

6.7.11.1 Briefings or training are important when first starting work in the laboratory and whenever changing a work assignment in the laboratory. See Chapter 4.1, "Safety and Health Training," for more information. Laboratory workers shall:

- a. Know the following information (per 29 CFR 1910.1450(f)(3)):
 - (1) Where to find the CHP and needed reference material.
 - (2) Exposure limits for hazardous chemicals in the laboratory.
 - (3) Signs and symptoms of exposures to the chemicals in the laboratory.
 - (4) Where you can find MSDSs/SDSs for laboratory chemicals.
 - (5) How to get medical consultation if employees suspect exposure to chemical levels above PELs or experienced symptoms (see Chapter 3.6, "Occupational Healthcare Program").

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- b. Have initial and refresher training in the items required by 29 CFR 1910.1450(f)(4) and the following:
- (1) The physical and health hazards of chemicals in the laboratory.
 - (2) Hazard controls such as exhaust hoods, respirators, or special procedures for protection.
 - (3) How to detect the presence of a hazardous chemical.
 - (4) How to enter and leave contaminated areas and how to decontaminate yourself and others.
 - (5) Details of the laboratory CHP.
 - (6) Yearly emergency response training.
 - (7) Employee hazard reporting systems.

6.7.12. When to get medical help

6.7.12.1 JSC has a “Clinic First” policy for any injury or illness occurring at JSC, Sonny Carter Training Facility (SCTF), Ellington Field (EF), or White Sands Test Facility (WSTF). We encourage all NASA civil servant and contractor employees to use the JSC Clinic, as this clinic is tasked to provide occupational medicine evaluations to all employees. You or your supervisor should ensure you get to the JSC Clinic for medical evaluation and treatment. Using the JSC Clinic will ensure you are seen by a licensed health care professional. If the exposure could be life-threatening, call your emergency number for an ambulance. The emergency numbers are:

JSC, SCTF, or EF: x33333 or (281) 483-3333

Any off-site facility: 911

White Sands Test Facility (WSTF): x5911

Follow these rules for medical help:

- a. You need medical help if:
 - (1) You notice signs or symptoms associated with a hazardous chemical to which you may have been exposed.
 - (2) Repeated exposure monitoring indicates exposure levels above PELs.
 - (3) You have a spill, leak, explosion, or other event in your laboratory that may have exposed you to a chemical above its PEL.
- b. Your supervisor or co-worker shall give the doctor the following information:
 - (1) What chemicals you may have been exposed to
 - (2) How the possible exposure happened, and any quantitative data on the exposure
 - (3) What signs and symptoms you have, if any
- c. Your doctor will provide an opinion, as described in 29 CFR 1910.1450(g)(4). The opinion will only cover job-related exposures and will include the examination results and recommendations for further medical action.
- d. JSC will keep accurate records on any medical help you receive as a result of a possible chemical exposure. You may see your records as described in 29 CFR 1910.20.

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6.7.13. For more information on laboratory safety and health

- a. *Patty's Industrial Hygiene, Volumes 1–4*, 5th Ed., John Wiley & Sons, Inc., New York, NY, 2000
- b. *The Occupational Environment: Its Evaluation, Control, and Management*; 3rd Edition, American Industrial Hygiene Association, 2011
- c. *Accident Prevention Manual for Business and Industry, Administration and Programs*, 13th Edition; National Safety Council, 2009
- d. *Prudent Practices for Handling Hazardous Chemicals in Laboratories*, National Research Council, National Academy Press, Washington, DC, 1981
- e. ANSI/AIHA Z9.5-2012, "American National Standard for Laboratory Ventilation," 2012
- f. *Industrial Ventilation, a Manual of Recommended Practice*, 27th Ed., The American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio, 2010