

2.0 CONTROL MEASURES

The OSHA Lab Standard requires that laboratory personnel implement appropriate control measures to ensure that chemical exposures are maintained below regulatory limits and as low as reasonably achievable. In general, control measures can be categorized as administrative controls, engineering controls, procedural controls (i.e., standard operating procedures), or personal protection.

2.1 Administrative Controls

Administrative controls consist of various policies and requirements that are established at an administrative level (e.g., by the principal investigator, laboratory supervisor, department chair, department safety committee, or University Office of Environmental Health and Safety) to promote safety in the laboratory. They may include:

- Ensuring that all laboratory personnel have been provided with adequate training to enable them to conduct their duties safely (see Section 4.0 *Information and Training*).
- Requiring prior approval and additional control measures for certain particularly hazardous operations or activities.
- Restricting access to areas in which particularly hazardous chemicals are used.
- Posting appropriate signs to identify specific hazards within an area.
- Requiring that various standard practices for chemical safety and good housekeeping be observed at all times in the laboratory.

2.1.1 Prior Approval of Hazardous Operations

The OSHA Lab Standard requires that activities involving certain particularly hazardous chemicals be reviewed and approved in advance by an appropriate individual or group. Depending upon the specific department, this approving entity could be a department safety committee, the Laboratory Chemical Safety Officer, or the department chair. At the time of approval, any additional required control measures for the project should be specified. Examples of the types of operations that should receive prior approval are those involving the use of select carcinogens, reproductive toxins, acutely toxic chemicals, highly reactive or shock sensitive chemicals, or highly corrosive or oxidizing chemicals (see Appendix C). In addition, any operation that produces unknown, but potentially hazardous results, should receive prior approval.

2.1.2 Laboratory Entrance Signs

The entrance to each laboratory in which chemicals are used or stored shall be posted with the names and phone numbers of the principal investigator (or lab supervisor) and any other designated personnel who can be contacted in the event of an emergency. In addition, laboratory entrance postings should indicate the presence of certain specific hazards (see Figure 2-1 below).

EMERGENCY INFORMATION		
Department/Building: _____	Room #: _____	
PI/Supervisor: _____	Office: _____	
Office Phone: _____	Home Phone: _____	
Dept. Laboratory Chemical Safety Officer: _____		
Office Phone: _____	Home Phone: _____	
Laboratory Occupants	Home Phone	
_____	_____	
_____	_____	
_____	_____	
_____	_____	
SPECIAL HAZARDS:		
<input type="checkbox"/> Water-Reactive Chemicals	<input type="checkbox"/> Corrosives	<input type="checkbox"/> Carcinogens/Reproductive Toxins
<input type="checkbox"/> Air-Reactive Chemicals	<input type="checkbox"/> Biohazards	<input type="checkbox"/> Flammable Liquids/Explosives
<input type="checkbox"/> Acutely Toxic Chemicals	<input type="checkbox"/> Radioisotopes	<input type="checkbox"/> X-ray/UV/Laser, etc.
<input type="checkbox"/> Other _____		
Environmental Health and Safety	Phone: _____	
IU Police Department	Phone: _____	

Figure 2-1. Laboratory Entrance Sign

2.2 Engineering Controls

Engineering controls consist of various measures for reducing a hazard at its source or for separating personnel from the hazard. In the laboratory, examples of engineering controls include the substitution of less hazardous chemicals in an operation, isolating a particular chemical operation, enclosing a potentially explosive reaction, or utilizing local exhaust such as a fume hood for an operation that produces airborne chemicals (see Section 6.1 *Chemical Fume Hoods*). Because engineering controls function to reduce or eliminate a hazard at its source *before* it is created, they should be fully considered and utilized whenever possible as the *first* step in chemical hazard control within the laboratory.

2.3 Procedural Controls

Procedural controls (or work practice controls) are typically in the form of standard operating procedures (SOPs) that define the *manner* in which certain types of chemicals are to be handled, or the manner in which specific operations involving chemicals are to be conducted, in order to minimize hazards. Section 3.0 of this Plan contains a number of SOPs, which are generally applicable to all laboratories. It is the responsibility of personnel in each laboratory, however, to develop (and incorporate into the LCSP) specific SOPs that reflect the operations and experimental protocols performed in their laboratory.

2.4 Personal Protective Equipment

For many laboratory operations, the risk of chemical exposure cannot be totally eliminated through the use of engineering and procedural control measures. For this reason, it is necessary to supplement such measures with the use of personal protective equipment and apparel (PPE). Because PPE functions as a barrier between the laboratory worker and the chemical hazard, rather than by actually reducing or eliminating the hazard, its use should always be in addition to (and never as a substitute for) appropriate engineering and procedural controls. It is the responsibility of the principal investigator (or supervisor) of the laboratory to ensure that appropriate personal protective equipment is provided to, and used by, all laboratory personnel. Such equipment should be adequate to ensure personnel are protected from chemical exposure to the eyes, skin, and respiratory tract.

2.4.1 Eye Protection

Appropriate PPE for the eyes is *required* whenever there is a reasonable probability that the eyes could be exposed to chemicals. Vented safety goggles are the preferred eye protection to be worn when chemicals are handled in the laboratory. These should be worn *over* prescription glasses.

All protective equipment for the eyes must bear the stamp Z87, which indicates that it meets the performance guidelines established by the American National Standards Institute in ANSI Z87.1 “Practice for Occupational and Educational Eye and Face Protection.”

2.4.2 Face Protection

A face shield is *required* whenever there is a potential for severe chemical exposure from splashes, fumes, or explosions. Because a face shield alone does not adequately protect the eyes, it must be worn over safety goggles. In general, any operation that requires a face shield should be conducted inside a hood with the sash down as an additional barrier.

2.4.3 Hand Protection

Because the hands are typically the part of the body in closest contact with chemicals in the laboratory, they are particularly vulnerable to chemical exposures. For this reason it is essential that laboratory personnel select appropriate protective gloves and wear them whenever handling chemicals. Because different glove materials resist different chemicals, no one glove is suited for all chemical exposures. Glove selection guides are available from most manufacturers and should be consulted before choosing a glove.

2.4.4 Foot Protection

Safety shoes or other specialized foot protection are generally not required for most laboratory operations. However, footwear that completely covers the skin of the feet must be worn whenever chemicals are being used (sandals and open-toed shoes are prohibited in the laboratory).

2.4.5 Body Protection

By virtue of its large surface area, the skin is at considerable risk of exposure to chemicals in the laboratory. To lessen this risk, it is essential that laboratory personnel wear clothing, which, to the extent possible, covers all skin surfaces (shorts and skirts are inappropriate attire for the laboratory). In addition, a fully buttoned lab coat should be worn during chemical manipulations. Clothing and lab coats should be regarded, not as means of preventing exposure, but as means of lessening or delaying exposure. The effectiveness of clothing as a protective barrier for the skin depends upon its prompt removal in the event that it becomes contaminated.

2.4.6 Respiratory Protection

The implementation of appropriate engineering and procedural controls should always be the preferred strategy for ensuring that any airborne levels of chemicals within the laboratory are well below regulatory limits. However, in rare circumstances where such control measures are not sufficient, laboratory personnel may need to utilize respirators for a particular operation. In such instances, personnel must participate fully in the university's *Respiratory Protection Program*, which requires a medical exam, respirator fit-testing, and training prior to respirator use. Contact the University Office of Environmental Health and Safety for more information.