UCR Physical Hazards Guide

Introduction

In addition to hazards associated with using chemicals, biological materials, radioactive materials, radiation producing machines, and lasers in laboratories there are also physical hazards. Physical hazards are included but not limited to: Noise, Ultraviolet Radiation (other than Lasers) Ergonomics, Lighting, Cryogens, and Electrical Use.

NOISE

Background Information

From a safety point of view, frequency and sound pressure level (intensity) are the two most important characteristics of noise that can result in a hazardous exposure. The human ear can detect sounds in frequencies ranging between 16 to 16,000 hertz (Hz). The decibel (dB) is a unit used to express the intensity of the sound wave.

Potential Hazards

Acute exposure

Acute forms of noise exposure occur from high levels of noise within a short period of time. This type of occupational exposure occurs during high noise level explosions and often affects only one ear. Noise level is the most important factor in this type of exposure. Acute exposure can lead to temporary hearing loss, permanent hearing loss, or even deafness.

Chronic Exposure

Long term exposure to high levels of noise can cause permanent irreversible hearing loss or deafness. Noise level, frequency, exposure duration, personal susceptibility, and age are all-important factors, which influence noise exposure effect from chronic exposure.
According to the OSHA standard for occupational noise exposure, the maximum permissible noise level for 8 hours per day is 90 dB. When daily exposure is composed of different noise levels, their combination effect should be considered as a TWA (time weighted average). The 8 hours TWA should not exceed the limit value of 90 dB.

Listing of Noise Levels in the Workplace

Noise description	Noise Level (dB)
Whisper	30
Normal Conversation	60
Ringing Telephone	80

Any concerns regarding noise levels in the laboratory can be directed to the campus industrial hygienist at 951-827-5528 or at www.ucr.edu.

Non- Ionizing Radiation –Ultraviolet

Background Information

Ultraviolet radiation is a part of electromagnetic spectrum with wavelength of 200 to 400 nm. The most common sources of UV in laboratories are germicidal lamps in biosafety cabinets nucleic acid transillumination boxes, and nucleic acid crosslinkers.

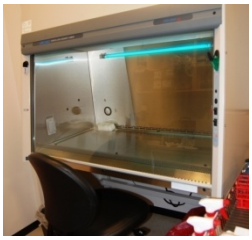
Potential Hazards:

There are no immediate warning symptoms to indicate overexposure. Symptoms of overexposure include varying degrees of erythema (sunburn) or photokeratitis (welder's flash) typically appear hours after exposure has occurred.

- **Skin injury**: Wavelengths below 320 nm are primarily responsible for reddening and burning. These symptoms may vary from a simple reddening at the site of exposure to sever blistering and desquamation.
- **Eye Injury**: UV exposure can injure the cornea, the outer protective coating of the eye. Symptoms include a sensation of sand in the eye that may last up to two days. Chronic exposure to acute high energy radiation can lead to the formation of cataracts.

Special Work Practices

Never allow the skin or eyes to be overexposed to UV radiation sources. UV radiation generated by some of the laboratory equipment can exceed recommended exposure limits and cause injury with exposures as brief as three seconds in duration.



Biological Safety Cabinet

Never work in a biological safety cabinet while the germicidal lamp is on. If possible, close the sash while the lamp is on.

Transilluminators

Never use a transilluminator without the protective shield in place. Shields must be kept clean and replaced when damaged

Crosslinkers

Crosslinkers must not be used if the door safety interlock is not working properly

Equipment Labeling

Many overexposures to UV radiation have occurred as a result of individuals not knowing the hazards associated with UV-emitting equipment. To help prevent eye and skin injuries, any equipment that emits UV radiation must be conspicuously labeled with a caution label. Below are some examples of UV labels:

Personal Protective Equipment

Protective Clothing

Wear standard laboratory apparel including a fully buttoned lab coat, long pants, and closed toe shoes. While working with UV radiation sources, lab workers must be particularly careful to prevent gaps in protective clothing that commonly occur around the neck and wrist areas.

Eye/Face Protection

If there is any potential for the eyes and face to be exposed to UV radiation, a polycarbonate face shield stamped with the ANSI Z87.1-1989 UV certification or polycarbonate safety glasses must be worn to protect the eyes and face. Ordinary prescription eyeglasses may not block UV radiation. UV certified goggles and safety glasses will protect the eyes, but it is not uncommon for lab workers to suffer facial burns in the areas not covered by the goggles or glasses.

Gloves

Wear disposable nitrile gloves to protect exposed skin on the hands. Make certain wrists and forearms are covered between the tops of gloves and the bottom of the lab coat sleeves

If you start to experience symptoms of UV exposure, seek medical attention and notify EH&S at 951-827-5528.

Ergonomics in Laboratories

Background Information

Laboratories have a number of ergonomic issues which may need to be addressed depending on the individual's technique, work station design, equipment design, and work duration. The following is a list of potential ergonomic hazards found in laboratories:

Repetitive Pipetting

Some labs require many hours of pipetting. Tasks such as mixing or dispensing need evaluated since they require frequent repetitions. Symptoms such as pain in the forearm, thumb, neck, shoulder, or elbow should not be ignored since repetitive pipetting can lead to illnesses such as tendonitis, tenosynovitis, and trigger finger.

Microscopy

A microscope that is too low or not positioned properly puts undue stress on the neck and causes the shoulders and upper back to be rounded forward. Bad posture compromises blood flow, compresses nerves to the arms, and increases muscle strain. The arms should also be properly supported so that contact stresses are avoided.

Keyboarding and mouse use

Many researchers spend hours entering data into the computer and generating reports. Desks, keyboards, mouse pads, and chairs should be at proper heights, computers should be placed directly in front of the worker, and proper wrist support should be available. Improperly designed workstations with repetitive motion could lead to illnesses such as carpal tunnel syndrome, tendonitis, or back and neck pain.

Biosafety cabinets, work benches, glove boxes, and fume hoods

Factors such as a worker's posture, heights of cabinets and hoods, leg room, adjustability, metal edges, and technique such as working with arms outstretched all affect the worker's health and safety.

Micromanipulation & fine motor skills

Frequent pinching, dissecting, twisting or unscrewing caps and stoppers require the repetitive use of the small muscle groups of the fingers and wrist.

Microtome work & cryostat

Microtome work predominantly affects histology technicians. Some ergonomic hazards may include unsuitable seat and microtome heights; the use of a manual rotary microtome requiring repetitive flexion and extension of the wrist, elbow, and shoulder; pinch grips for slicing or cover slip applications; and contact stress on the bench.

Lifting centrifuge rotors

Some rotors weigh up to 35 pounds. Rotors are in the bottom of the centrifuge so the worker has to bend over and reach inside to lift it leading to lower back strain.

Overhead lifting

Many labs store supplies on overhead shelves. Lifting items overhead creates an awkward lifting posture and, depending on the frequency and load, results in back pain.

Standing in place

Static loading may be experienced while standing in place for long periods of time (especially if the floors are not padded) resulting in back and foot pain.

Flow cytometers

The worker must sit or stand in awkward positions to see the controls since the receiving port is on the bottom of the flow cytometer. This could require frequent bending of the neck and back as well as arm reaching.

Safety Measures

Repetitive Motion

Persons performing repetitive tasks should keep the body in the neutral position, use automated equipment whenever possible, take plenty of breaks to rest muscles, and rotate the work among a number of people to decrease exposure time.

Poor Posture

Furniture and equipment should be arranged to accommodate the worker's neutral posture. This involves the placement of furniture and adjusting it to appropriate heights.

Contact Stresses

To deter contact stress, provide padding or round sharp edges. Providing proper support and furniture heights also reduces stresses.

Repetitive Pipetting

Use ergonomically designed electronic pipettors. Electronic pipettors are generally lighter than manual pipettors, require less force to operate, and have improved grip designs. Rotating tasks between workers to decrease exposure time also helps.

Microscopy

There are many ergonomic factors to consider when using a microscope, and more and more companies are making microscopes that are ergonomically designed. Microscope stations should not be cramped or inflexible. The researchers should sit in a neutral position with the ears above the shoulders and shoulders above hips. Arms should rest comfortably on the desk at a right angle.

- **Eye Tube-** Look for microscopes with adjustable, extended eye tubes that extend over the front edge of the bench. This allows the worker to sit back in the chair and prevents them from bending their neck or back forward.
- **Microscope height**- The height of the microscope must be adjustable so that the eye piece is at the correct height. If it is not, use blocks or a stand to adjust the height or get a desk that is adjustable.
- **Desk or microscope stand** -The desk or table should allow the worker to rest his or her arms comfortably. Some labs provide padded support. The space under the desk should be cleared so that there is ample leg room.
- **Chairs** -The chair should be adjusted so that feet rest flat on the floor, and it should provide back support.

Biosafety cabinets, work benches, glove boxes, and fume hoods

Make sure there is ample legroom under the bench and an adjustable chair is provided. If bench heights are high, provide a sit/stand stool. Floors should be padded with mats. Edges of benches need to be rounded or padded.
For guidance on Ergonomic issues in laboratories, contact EH&S at 951-827-5528 or www.ehs.ucr.edu.

Lighting

Background Information

Adequate lighting differs depending on the task being performed. Too little light will result in the individual not being able to see well enough to comfortably accomplish a task. On the other hand, too much light may cause the same problem because of glare, brightness or contrast and may also cause eye fatigue or strain over a period of time. Light is measured in units called a lux. Units of lux are equal to 1 lumen per square meter.
Lighting guidelines are concerned with the amount of light needed to carry out job functions. Lighting issues surface if there is not enough light, too much light, improperly positioned light, and excessive levels of contrast/shadows.

Potential Hazards

1. Increased risk of injury from other hazards.
   - Slips, trips and falls
   - Impact and/or puncture wounds; bump into objects, unable to see moving parts, etc.
2. Makes the task at hand more difficult.

Safety Measures

- Be sure lighting is adequate and placed properly.
- Ensure that lighting is adequate for the task at hand.
- Use protective glasses to filter out harmful wavelengths.
- Do not have light sources aimed at the worker's eyes.
- Position light sources to the sides and above the work.
- Position lights so that shadows are not created.
- Ensure that background surfaces will not reflect or refract indirect light sources adversely on the work area.

Contact the Campus Industrial Hygienist at 951-827-5528 for guidance regarding proper lighting for your work area.

Cryogenic Materials

Potential Hazards

The primary hazard of cryogenic materials is their extreme coldness. They, and all surfaces they cool, can cause severe burns if allowed to contact the skin.

Safety Procedures

A. Cryogenic fluids shall be stored or handled only in containers designed for such use.
B. When personal contact with a cryogenic fluid is possible, (as when preparing cold baths or dispensing liquid nitrogen) full face shields should be worn. Wearing of watches, rings, or other items that may trap the cryogenic material should be avoided.
C. When gloves are worn while handling cryogenic materials, they should be dry, impervious and loose enough to be easily tossed off the hands. Potholders are preferred for handling cryogenic materials.

D. Lab coats should be worn while handling cryogenic materials. Open toe shoes and sandals should not be worn.
E. Cryogenic materials should be dispensed and used in areas with good ventilation. Laboratory workers should avoid lowering their head into dry ice chests or directly over cooling baths. When transporting dry ice, or materials packaged in dry ice, the package should not be carried in the passenger compartment of the vehicle.
F. Cryogenic material may provide an oxygen-enriched atmosphere by condensing and fractionating air. This situation may increase the fire and explosion hazard of flammable and combustible materials being cooled or materials located in the vicinity of the operation.
G. Dry ice should be added to cooling baths (or liquid added to dry ice) in small increments, allowing the foaming to stop before each addition.

Electrical Equipment

A. General
   1. Extension cords shall not be used for more than 60 days. Power strips that are equipped with an overcurrent protection device (circuit breaker) may be used. A power strip will not be plugged into another power strip.
   2. Power cords on appliances should be inspected for damage regularly. Frayed or otherwise damaged cords should be replaced before using.
   3. To eliminate exposed wiring, outlet boxes or junction boxes shall be provided with cover plates, and receptacles shall be provided with faceplates.
   4. Ground-fault circuit interrupters should be used over sinks and in other wet areas. Ground-fault circuit interrupters should be actuated every 6 months to insure proper function.
   5. Overcurrent protection devices (circuit breakers) on panels shall be individually labeled to indicate the equipment or location of equipment served by the device.

Laboratory Refrigerators

Laboratory refrigerators used for storing or cooling flammable liquids will be in compliance with NFPA 45 - Fire Protection for Laboratories Using Chemicals, section 9.2.2.2 and A.9.2.2.2. Self-defrosting refrigerators, either modified or unmodified, will not be used for storing or cooling flammable liquids.

B. Electrical apparatus
   1. Unattended electrical heating equipment should be provided with a manual reset overtemperature shutoff switch, in addition to normal temperature controls.
   2. Electric motors used to drive blenders or stirrers in open containers of flammable liquids or combustible liquids heated above their flash points should be suitable for Class I, Division 2 locations as defined in Article 500-5 of the National Electrical Code.
   3. Electrical equipment and apparatus in cold rooms should be protected from moisture due to condensation.

C. Exposed live current
   Only experienced researchers who have been trained to work safely with test instruments and equipment on energized circuits may remove enclosures and guards to perform testing on an energized electrical circuit.