

# ES&H manual

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## Environment, Safety, and Health

### Volume II

#### Part 11: General H&S Controls—Personnel

## Document 11.2 Hazards—General and Miscellaneous

Recommended for approval by the ES&H Working Group

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New document or new requirements

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## 11.2

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## Terms and Definitions

Barrier	An object that demarcates a hazard and impedes or separates personnel from the hazard (e.g., fence, machine guard, rope, hood, and locked door).
Hazard	A source of danger (i.e., material, energy source, or operation) with the potential to cause illness, injury, or death to personnel or damage to a facility or the environment.
Interlock	A device to prevent an action from occurring when injury or property damage may result. Interlocks are classified into three main types: key-operated, mechanical, and electrical. A specific interlock, however, may involve more than one of the above types.
Run/safe box	An interlock system component that houses a push-to-safe button and a sweep interlock switch.
Push-to-safe switch	A switch that enables a person trapped inside an exclusion area to prevent or terminate operation of hazardous equipment.
Sweep interlock switch	A switch that is activated during a complete tour of an exclusion area prior to operating hazardous equipment.

## 11.2

### Hazards—General and Miscellaneous

#### 1.0 Introduction

This document contains information on health and safety hazards that are general in nature, have a potential to cause injury or property damage, and do not currently warrant separate documentation within the *Environment, Safety, and Health (ES&H) Manual*. This document is not intended to address general environmental hazards. Each section of this document covers a discrete topic, including responsibilities and Work Smart Standards (WSSs).

Several documents in Volume II of the *ES&H Manual* contain requirements pertaining to specific hazards as shown in Table 1. The requirements in these documents are not reproduced in this document. Refer to these hazard-specific documents for information about those hazards.

**Table 1. Hazard-specific documents in Volume II of the *ES&H Manual*.**

Topic	Document
Electric, Magnetic, and Radio-Frequency/ Microwave Radiation	Document 20.7, "Nonionizing Radiation and Fields (Electromagnetic Fields and Radiation with Frequencies Below 300 GHz)"
Working on or Around Energized Equipment and Systems	Document 12.6, "LLNL Lockout/Tagout Program" Document 16.1, "Electrical Safety"
Working in Confined Spaces	Document 18.7, "Working in Confined Spaces"
Entry Through Barriers	Document 12.6, "LLNL Lockout/Tagout Program" Document 12.1, "Access Control, Safety Signs, Safety Interlocks, and Alarm Systems" Document 16.1, "Electrical Safety" Document 20.1, "Occupational Radiation Protection"
Roof Access	Document 15.1, "Roof Access"

#### 2.0 Housekeeping

All areas controlled by LLNL shall be kept orderly and clean and used only for approved activities or operations. In addition:

- Keep stairs, corridors, aisles, doorways, electrical panels, and exits clear of obstructions.

- Store materials only in appropriate cabinets or designated storage areas.
- Avoid using equipment rooms, hallways, or fan lofts as general storage areas. Storage of frequently used spare parts and tools in appropriate cabinets in these areas is permitted.
- Arrange stored materials to prevent tipping, falling, collapsing, rolling, or spreading.
- Remove from work areas and put into storage any item not required for extended periods.
- Promptly clean up (or, where appropriate, arrange for the cleanup of) spilled materials to mitigate slip or fall hazards.
- Report to the Plant Engineering Labor Shop icy conditions or other slip hazard conditions (e.g., leaves or gravel) on walkways.

Oil-containing equipment, such as vacuum pumps and compressors, may be prone to leaking. Equipment that has been removed from service may also leak when stored. Oil that has leaked from equipment shall be promptly removed from walking surfaces or drip pans to avoid creating a slip or fall hazard to personnel. Leaking equipment should be repaired or replaced if necessary. Caution should be exercised when oil has been spilled on floors because safety shoes may not provide adequate traction. Workers and work supervisors shall:

- Inspect areas where equipment that could leak oil is operated or stored, and report all leaks to the Responsible Individual.
- Ensure that leaks are promptly cleaned up.
- Ensure that equipment that has been removed from service is properly stored, so that any oil remaining in the equipment will not leak out and become a hazard to personnel.
- Install drip pans under equipment that has the potential for leaking oil to prevent slip or fall hazards. When this is not practical, absorbent material should be placed around the equipment.

## 2.1 Responsibilities

**Work supervisors** shall be responsible for ensuring the areas under their control are kept orderly and clean, and used only for approved activities or operations.

**Employees** shall be responsible for performing their tasks and maintaining their work areas in a clean and orderly fashion.

## 2.2 Work Standards

29 CFR 1910, Subpart D, "Walking/Working Surfaces."

29 CFR 1926, Subpart C, "General Safety & Health Provisions."

## 2.3 Resources for More Information

The articles below are examples of lessons learned regarding housekeeping.

- "Vacuum Pump Oil Spills Result in Injuries."
- "Open Flame and Alcohol—A Dangerous Combination."

These and other articles can be found at the following Internet address:

[http://www-r.llnl.gov/es\\_and\\_h/lessons/lessons.shtml](http://www-r.llnl.gov/es_and_h/lessons/lessons.shtml)

## 3.0 Temporary Service Installations

All temporary service installations shall conform to appropriate LLNL requirements, be protected from accidental damage, and be used in a manner that will not cause a tripping hazard. (For all temporary wiring, refer to Document 16.1, "Electrical Safety," in the *ES&H Manual*.) Temporary service installations shall be permitted during periods of construction, remodeling, maintenance, repair, or demolition of equipment or structures. These temporary installations shall also be permitted during emergencies and for tests, experiments, and developmental work. Temporary services may only be used for a period noted on a temporary service tag (see Figure 1). Temporary services may be installed and used during an off-hour emergency, but approvals on the temporary service tag shall be obtained within the first normal workday afterward. A temporary service tag shall be filled out completely and attached to the positive control point of all temporary services on the date of installation. Switches, valves, or other means shall be installed to permit the disconnection of all hazardous energy sources.

**Note:** Temporary service is not a substitute for permanent service and shall be removed as soon as the work (e.g., construction or remodeling) is completed.

### 3.1 Responsibilities

**The area supervisor, Responsible Individual, construction inspector, or Plant Engineering shop supervisor** shall be responsible for reviewing and approving any temporary service tag prior to its use.

**ES&H Teams** shall be responsible for reviewing and concurring with any temporary service tag.

The figure shows two identical temporary service tags side-by-side. Each tag has a hole punch at the top. The word "NOTICE" is printed in white on a blue rectangular background. Below this, the text "TEMPORARY SERVICE (OTHER THAN ELECTRICAL)" is printed in black. The left tag includes an "APPROVED BY:" section with four checkboxes: FACILITY MANAGER, LEAD EXPERIMENTER, SHOP OR GROUP SUPERVISOR, and CONSTRUCTION INSPECTOR. A bracket labeled "CHECK ONE" is next to these options. Below the checkboxes are lines for "NAME" and "AND ES&H TEAM NAME". The right tag includes a section with four checkboxes: EMERGENCY, CONSTRUCTION, TEST, and RESEARCH & DEVELOP. Below this are lines for "INSTALLATION DATE", "EXPIRATION DATE", "NAME", "PHONE", and "PAGER". Both tags end with "SEE OTHER SIDE".

**Figure 1. Temporary service tag (black text on white tag; white notice letters on blue background).**

### 3.2 Work Standards

29 CFR 1910, Subpart S, "Electrical" (1910.301 to 1910.399).

29 CFR 1926, Subpart K, "Electrical" (1926.400 to 1926.449).

National Electrical Code (NFPA 70), included in National Fire Codes (NFPA), Volumes 1-13.

### 3.3 Resources for More Information

The articles below are examples of lessons learned regarding temporary services.

- "Extension Cords and Power-Strip Protectors."
- "Search for Unsafe Plug Strips."

These and other articles can be found at the following Internet address:

[http://www-r.llnl.gov/es\\_and\\_h/lessons/lessons.shtml](http://www-r.llnl.gov/es_and_h/lessons/lessons.shtml)

## 4.0 Illumination and Emergency Lighting Systems

Adequate lighting is important to the safe performance of work. All work areas shall be illuminated to a level consistent with operating needs and Plant Engineering standards. The *IESNA* (Illuminating Engineering Society of North America) *Lighting Handbook* (see Section 4.4) is used as a reference. The area ES&H Team can provide assistance in determining the adequacy of lighting.

### 4.1 Emergency Lights

An emergency lighting or electrical system supplies light and power essential for safe egress in the event of regular power failure. Emergency lights shall be installed in accordance with the requirements of NFPA 101. The system shall activate within 10 seconds and sustain a minimum 1-foot-candle illumination at floor level for 90 minutes.

Required emergency lighting systems shall be inspected and maintained in accordance with NFPA 101. Lighting serviced by nonemergency power with rechargeable battery backup should be tested on a monthly basis.

Emergency lighting systems shall be tested in accordance with NFPA 70 and NFPA 101. Article 700 in NFPA 70 states:

Emergency systems are those systems legally required and classed as emergency by municipal, state, federal, or other codes, or by any governmental agency having jurisdiction. These systems are intended to automatically supply illumination and/or power to designated areas and equipment in the event of failure of the normal supply or in the event of accident to elements of a system intended to supply, distribute, and control power and illumination essential for safety to human life.

### 4.2 Responsibilities

**The area supervisor, Responsible Individual, or Plant Engineering shop supervisor** shall be responsible for:

- Ensuring lighting is adequate in the areas under his or her control.
- Ensuring emergency lights and systems are functioning properly.

**Employees** shall be responsible for:

- Ensuring adequate lighting to perform assigned tasks.
- Reporting problems with lighting and emergency lights and systems to their work supervisor.

**ES&H Teams** shall be responsible for periodically reviewing lighting and emergency lights and systems.

**The LLNL Fire Department** shall be responsible for monthly inspection of all battery powered emergency lighting systems required by NFPA 101.

**Plant Engineering** shall be responsible for annual testing of all required emergency lighting systems.

#### 4.3 Work Standards

29 CFR 1910, Subpart E, "Means of Egress" (1910.35 to 1910.38).

29 CFR 1910, Subpart S, "Electrical" (1910.301 to 1910.399).

National Electrical Code (NFPA 70), included in National Fire Codes (NFPA), Volumes 1-13.

Life Safety Code (NFPA 101), included in National Fire Codes (NFPA), Volumes 1-13.

#### 4.4 References

*IESNA Lighting Handbook*, (Ninth Edition) Illuminating Society of North America (July 2000).

## 5.0 Hand and Portable Power Tools

The Laboratory provides hand and portable tools that meet accepted national safety standards. However, these tools can still cause injury and shall be properly used and maintained. Responsibilities for these tools are listed below.

### 5.1 Responsibilities

**Work supervisors** shall be responsible for:

- Ensuring employees have the correct tools.

- Ensuring employees are properly trained to use the tools for the work assigned and are licensed by the manufacturer if they operate powder-actuated tools.
- Ensuring employees remove damaged tools from service and have them repaired.

**Employees** shall be responsible for:

- Selecting and using the proper tool for the job assigned. (Your work supervisor can provide guidance as necessary.)
- Inspecting all portable and hand tools prior to use to make sure they are not damaged and are in good working condition. The following questions will help determine items to look for during this inspection:
  - Is the tool appropriate for industrial use (i.e., is it UL-listed)?
  - If the tool is AC-powered, is it properly grounded with a wired three-prong plug or a double-insulated tool case?
  - Is there any damage to the tool's power cord or cord insulation? No cracks, cuts, swelling, fraying at the plug or tool connection points, or improper splices should be visible.
  - Are all manufacturer-provided or OSHA-required guards in place and functioning properly? (See 29 CFR 1910, Subpart O, "Machinery & Machine Guarding"; 29 CFR 1910.212, "General requirements for all machines"; and 29 CFR 1910, Subpart P, "Hand & Portable Powered Tools and Other Hand-held Equipment"; 29 CFR 1910.241 through 29 CFR 1910.244 provide further guidance.)
  - Are there any obvious loose parts?
  - Is the tool free of makeshift repairs or modifications that would make it unsafe for use?
  - Are electrical tools used in wet locations or outdoors plugged into a ground-fault circuit interrupter?

**Important: Immediately remove from service any tool that is damaged or unfit for use. Place a DANGER/DO NOT USE warning tag on the tool and notify your work supervisor.**

- Wearing the appropriate personal protective equipment (PPE) when working with portable and hand tools.
- Using a separate tool holder to support tools such as chisels, drift pins, aligning pins and puncher when hand safety would be improved by its use.

- Never leaving powder-actuated tools unattended, except when properly stored.
- Having their operator cards and licenses available for review if operating powder-actuated hand tools.

**ES&H Team** health and safety technicians shall be responsible for informally inspecting portable and hand power tools in designated work areas during routine walkthroughs of facilities.

**Authorizing organizations** shall be responsible for ensuring that portable power tools are inspected.

## 5.2 Work Standards

29 CFR 1910, Subpart O, "Machinery & Machine Guarding" (1910.211 to 1910.219).

29 CFR 1910, Subpart P, "Hand & Portable Powered Tools and Other Handheld Equipment" (1910.241 to 1910.244).

## 6.0 Ladders and Step Stools

Ladders (both fixed and portable) and step stools shall be in good condition, constructed of suitable material, and of the proper height and type for the work intended. Ladders shall meet American National Standards Institute (ANSI) standards (A14.1–14.5) and applicable LLNL WSSs. Portable wooden ladders shall be left unpainted so that their physical condition can always be inspected. A damaged ladder shall be promptly repaired or destroyed if repair is not cost-effective.

Only ladders of Type I or better (e.g., Type IA) are allowed at LLNL. All ladders shall have a capacity rating of at least 250 pounds. For additional information, contact the ES&H Team industrial safety engineer.

Ladders are sometimes used for complex tasks or in a situation that requires a worker to lean from the side of a ladder. In these instances, the task shall be evaluated for any potential fall hazard. The use of scaffolding or a work platform should be considered as an alternative solution to provide a safe approach to the planned task.

Step stools may lead to accidents if not properly designed, used, and maintained. New step stools purchased should have a minimum capacity rating of 250 pounds and (if equipped with wheels) an automatically locking base or wheel locks. Maintenance of step stools includes inspections to ensure that all parts are secure and that safety features (e.g., wheel locks, anti-slip treads, and rubber non-slip base rings) are intact and functioning properly.

## 6.1 Responsibilities

**Work supervisors** shall be responsible for:

- Ensuring proper ladders are available for the task.
- Ensuring that damaged ladders are promptly repaired or destroyed.
- Assuring that training is provided to employees on the proper use of ladders. This training may be provided either informally (e.g., as a toolbox or tailgate safety training session) or through Course HS5959-CBT, "Stairways and Ladders."

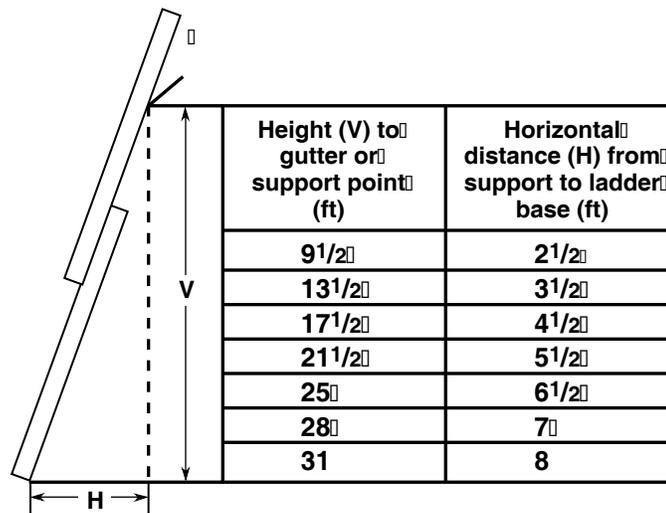
**Employees** shall be responsible for:

- Selecting the proper ladder for the task, using the following criteria.
  - Use only nonconductive ladders in the proximity of electrical wiring. (See Document 16.1, "Electrical Safety," for more information.)
  - Make sure the ladder is the proper height for the job. Extension ladders shall be at least 3 feet taller than the point of support (e.g., eave, gutter, or roofline). Stepladders shall be selected so the worker is never required to use the top two steps.
  - Use ladders of the type with the necessary weight capacity. (For instance, Type I ladders are rated for up to 250 pounds.) A ladder's weight capacity shall not be exceeded.
  - Use only ladders that can maintain secure footing.
- Inspecting portable ladders and step stools before use to determine if they are in good condition and suitable for the task. Items to look for during inspection include
  - Loose, cracked, or broken steps or rungs.
  - Broken, split, or cracked rails.
  - Loose nuts, bolts, and rivets.
  - Missing, broken, or damaged base shoes.
  - Condition of hinges and spreaders.
  - Defective rung locks on extension ladders.
  - Condition of rope and sheaves.
  - Oil, grease, or other slippery material on ladder parts.
  - Paint that could conceal defects in ladder parts.
  - The duty rating displayed on the side rail.
  - Nonfunctional locking bases or wheels.
  - Other conditions that could make the ladder or step stool unsafe for use.

**Note:** Remove any ladder or step stool from service if defective or unsuitable for use. Place an appropriate DANGER/DO NOT USE warning tag on the ladder

and notify your work supervisor to assure entry into the Deficiency Tracking (DefTrack) System as a priority 1A or 1B deficiency in accordance with Document 4.2, "Environmental, Safety, and Health Deficiency Reporting."

- Using ladders correctly. Maintain three points of contact on a ladder when climbing or descending. Use a rope or other mechanical means to raise or lower materials or tools. When setting up a straight or extension ladder, use the 4 to 1 vertical/horizontal rule (see Figure 2) and do the following:
  - Set the ladder at the proper angle by placing your toes against the bottom of the ladder.
  - Stand erect and extend your arms straight out. When your palms contact the top of the rung (which is about eye level), the ladder is at the proper angle. You may also check the ladder angle label for the correct setup if one is provided. Note that use of the proper angle will secure the ladder in position and maintain its strength, prevent foot slippage, and allow you to keep balance.



**Figure 2. Ladder setup with approximate 4 to 1 vertical/horizontal rule.**

- Securing the ladder. Secure all portable (i.e. straight and extension) ladders by tying them off, blocking, or otherwise securing them to prevent their being displaced. Tie off step ladders whenever possible.

**Note:** The support point at the top of the ladder should be at least 24 in. wide to maintain support in the event of sideways movement. For jobs of short duration, a fellow worker should support the ladder at the base.

- Storing ladders safely so they will not fall on employees or equipment.

**ES&H Team** health and safety technicians shall be responsible for informally inspecting ladders during routine walk-throughs of facilities.

**Authorizing organizations** shall be responsible for ensuring that ladders are inspected.

## **6.2 Work Standards**

### **6.2.1 Work Smart Standards**

29 CFR 1910, Subpart D, "Walking/Working Surfaces" (1910.21 to 1910.30).

29 CFR 1926, Subpart X, "Stairways and Ladders" (1926.1050 to 1926.1060).

### **6.2.2 Other Requirements**

ANSI A14.1 (1982) "Safety Requirements for Ladders - Portable Wood."

ANSI A14.2 (1982) "Safety Requirements for Portable Metal Ladders."

ANSI A14.3 (1984) "Ladders - Fixed - Safety Requirements."

ANSI A14.4 (1979) "Safety Requirements for Job-Made Ladders."

ANSI A14.5 (1982) "Ladders - Portable Reinforced Plastic - Safety Requirements."

## **6.3 Resources for More Information**

The articles below are examples of lessons learned regarding ladders.

- "Use Ladders Safely."
- "Ladder Nonslip Devices."
- "Step Stools with Retractable Casters—Safe if Maintained and Used Properly."
- "Step Stools Are Still Not Being Maintained Properly."
- "Worker Falls."
- "Portable Ladders Can Collapse If Overloaded."

These and other articles can be found at the following Internet address:

[http://www-r.llnl.gov/es\\_and\\_h/lessons/lessons.shtml](http://www-r.llnl.gov/es_and_h/lessons/lessons.shtml)

## 7.0 Offices

Offices are typically safe places to work; however, there are several hazards that may be present. Some of the most common are improper computer workstation ergonomics and at-risk work practices, which can result in cumulative trauma disorders (i.e., injuries and illnesses that result from sustained posture or repetitive motion). Most of these incidents can be prevented by completing a workstation evaluation and implementing corrective measures such as proper seat, keyboard, and monitor adjustments, as well as appropriate changes in employee behavior recommended in a workstation ergonomic evaluation or an ergonomic training courses (e.g., HS5316-W, "VDT Ergonomics—Key Moves"). Some individuals may also benefit from glasses made specifically for computer use. For information on specialty corrective glasses, contact the Safety Glasses Office. Contact the ES&H Team for assistance with workstation evaluations. Also refer to Document 19.1, "LLNL Ergonomics Program," for further information.

Poor housekeeping practices can present hazards in offices (see Section 2.0 of this document for more housekeeping information). One common type of incident in office environments is falls, from either tripping or slipping. Fall hazards include cords (both power and telephone), open file or desk drawers, and foreign objects on floors (e.g., liquids, boxes, and pencils). To prevent trip hazards, run electrical cords and other wiring away from designated walking areas. Avoid running any type of electrical wiring under rugs. Another common incident is cuts from sharp items. Always properly use, store, and dispose of sharp items such as knives, paper cutters, scissors, and broken glass.

Standing on chairs or other inappropriate items to reach an elevated storage area or clock is another potential source of injury. Always keep an appropriate step stool or ladder readily accessible to the work area to use in these instances. Refer to Section 6.0 for more information.

Improper material handling and storage can also lead to falls and lifting injuries. Never lift more than you can lift safely. Get help when moving heavy boxes or other objects. When deliveries are made to an office, they should go to a designated receiving area, not placed on a floor or other walking or working area. In storage cabinets, heavy items should generally be placed on the bottom shelves, with commonly used items within easy reach. Cabinets over 5 feet high shall be secured for seismic safety. Never allow materials to be stored in stairways or exit corridors.

Hazardous chemicals used for copiers, printers, and cleaning are often found in offices. Workers shall always follow the warnings and guidance on the product labels or in other procedures to properly and safely store and use these products.

Office chairs with five legs are generally more stable than those with four legs. Whenever possible, stable, ergonomically designed, five-legged chairs should be used.

Contact the ES&H Team for assistance with any office safety issues.

## 7.1 Responsibilities

**Work supervisors** shall be responsible for assuring that office spaces under their control are maintained and used in a safe and healthful manner.

**ES&H Teams** shall be responsible for:

- Periodically evaluating workspaces to assure that they are being properly maintained in a safe and healthful state.
- Providing information, when requested, about office safety issues.
- Providing guidance on modifying the workplace to minimize the potential for injuries and illnesses.
- Providing information about ergonomic issues to increase the awareness of employees, supervisors, and managers.
- Evaluating individual workstations, as requested by management.
- Advising employees and supervisors on the selection of ergonomically sound workstation furniture and equipment, as requested by management.

## 7.2 Resources for More Information

The articles below are examples of lessons learned regarding common office hazards.

- “Step Stools with Retractable Casters—Safe if Maintained and Used Properly.”
- “Step Stools Are Still Not Being Maintained Properly.”
- “Problems with the Herman Miller Aeron Chair.”
- “Reducing Chair Injuries.”

These and other articles can be found at the following Internet address:

[http://www-r.llnl.gov/es\\_and\\_h/lessons/lessons.shtml](http://www-r.llnl.gov/es_and_h/lessons/lessons.shtml)

## 8.0 Optical Radiation Other Than Lasers

The energy covered by this section includes infrared (IR), visible, and ultraviolet (UV) radiation. The CIE (Commission Internationale d’Eclairage, CIE, which translates into International Lighting Commission) nomenclature is summarized in Table 2.

**Table 2. CIE nomenclature.**

CIE Band	Wavelength (nm)	Non-CIE Nomenclature
Microwaves	>1 mm	
IR-c	3 $\mu\text{m}$ –1 mm	Far-IR: 25 $\mu\text{m}$ –1 mm
IR-b	1.4 $\mu\text{m}$ –3 $\mu\text{m}$	Intermediate-IR: 2500 nm–25 $\mu\text{m}$
IR-a	780 nm–1400 nm	Near-IR: 780–2500 nm
Visible	380 nm–780 nm	
UV-a	315 nm–380 nm	Near-UV, black light
UV-b	280 nm–315 nm	Middle-UV, actinic UV (with UV-c)
UV-c	100 nm–280 nm	Far-UV, actinic UV (with UV-b), Vacuum UV: <200 nm
Soft x rays	<100 nm	

IR energy produces harm by heating tissue. UV energy can cause injury by triggering chemical reactions in proteins and other biological molecules. This is termed photochemical injury. UV can also cause harm by heating tissue. Visible light can cause injury by heating, but visible energy with wavelengths below 550 nm can also produce photochemical injury. Although eye injury is more serious than skin injury, the skin and eyes are equally vulnerable to all wavelengths except those between 400 nm and 1400 nm. Energy with wavelengths between 400 and 1400 nm entering the eye can be focused by the lens and reach the retina at the back of the eye; therefore, retinal injury, which can lead to partial or even total loss of vision, is a serious concern at these wavelengths.

The sun is the primary natural source of IR, visible, and UV energy. Lamps, resistance heaters, lasers, and hot objects also produce IR energy. Arcs and lasers produce hazardous levels of visible energy (see Document 20.8, “Lasers,” for guidance about lasers). Arc welding, plasma-torches, and gas-discharge lamps (e.g., mercury vapor, germicide, and black light) are the principal manmade sources of UV. All welding processes can create IR and visible radiation; arc welding also produces UV. The oxygen in the air almost instantly absorbs vacuum UV from an arc to produce toxic ozone.

### 8.1 Standards

LLNL adheres to the threshold limit values (TLVs) for IR, visible, and UV radiation for all wavelengths covered by the TLVs (that is, 180 to 1400 nm). LLNL follows the

ANSI Z136.1 exposure standards for lasers, reproduced in Document 20.8, for wavelengths ranging from >1400 nm to 1 mm.

Sources of intense IR, visible, and UV shall be listed in the area Hazard Notice door sign in compliance with Document 10.2, "LLNL Health Hazard Communication Program." This includes identifying the following:

- Class 3a, 3b, and 4 lasers—these are hazardous to the eyes and skin if excessive exposure occurs.
- Infrared sources >10W—use of this equipment could result in excessive exposures in some cases.
- Arc lamps—use of this equipment could result in excessive exposures in some cases.
- Ultraviolet sources >1 W—use of this equipment could result in excessive exposures in some cases.

Household appliances and light bulbs or lamps used for area or task lighting are not sources of intense visible energy and therefore do not have to be listed on the Hazard Notice door sign. Likewise, storage locations do not have to be listed if the equipment is stored in a condition where it cannot emit energy. For example, high-power instrument lamps would not be inventoried at storage locations. However, when in doubt, equipment should be listed.

## 8.2 Exposure Evaluation

Exposures to UV energy can now be easily evaluated by measurement, using a protocol similar to that used for assessing noise hazards. This is done by comparing wavelength-adjusted measurement results to permissible exposure durations. Exposures to IR and visible energy are much more difficult to assess by measurement and it takes time to be sure the right instrument components are selected and assure the measurement protocol is correct. IR measurements beyond 1000 nm are not possible unless special equipment is used.

## 8.3 Controls

Controls include using shielding or absorbent coatings and maintaining appropriate distance. Surfaces that could increase exposures by reflecting energy should be coated with matte-textured absorbent material. Opaque, matte-textured materials, such as darkened sheet metal, are the best shields. Combustible materials, such as cardboard, can be used only if it can be assured that the shield will not be ignited or degraded by the energy it is blocking or other ignition sources. A matte-texture at visible wavelengths may be a smooth and mirror-like reflector at longer IR wavelengths.

View ports are sometimes needed and shall provide proper shielding. Filter material for optical radiation shielding is available, although it can be expensive. Tinted glass and tinted plastic have been used to provide low-cost shielding for lasers. In some cases, particularly for broadband visible radiation (as compared to narrow-band laser light), neutral density filters can be used. (Neutral density means all visible wavelengths are blocked equally.) Blocking UV-a can be difficult because common glass and clear plastics allow a significant amount of UV-a to pass with the visible energy. In light of the problems associated with shielding, uses of shielding shall be evaluated by the building ES&H Team, who can call on the laser safety officer for assistance, as needed.

Nonlaser sources often follow the inverse square law, making distance an effective control if barriers or other means cannot be used to ensure adequate separation is maintained between people and energy sources.

### 8.3.1 Eye Protection

Proper goggles or lens shades shall be used to prevent overexposure of the eye. For low levels of UV radiation, special glass or plastic goggles will suffice. The building ES&H Team will support you in selecting the appropriate eye protection.

### 8.3.2 Skin Protection

Measures shall be taken to protect the skin from wavelengths that are capable of producing skin burns. All apparel that is worn absorbs IR, visible, and UV and serves as a protective layer, but certain wavelengths are capable of decomposing fabrics such as cotton. Other measures to protect the skin include the use of ointments and face shields. (See also Document 11.1, "Personal Protective Equipment.")

## 8.4 Responsibilities

**Work supervisors** shall be responsible for evaluating all sources of IR, visible, and UV radiation in the areas under their control to determine if there are potentials for overexposure to these radiation sources and applying appropriate controls.

**Employees** shall be responsible for working with IR, visible, and UV radiation sources using applicable procedures and standards.

**ES&H Teams** shall be responsible for reviewing and evaluating IR, visible, and UV radiation sources and recommending appropriate controls upon request.

## 8.5 Work Standards

29 CFR 1910, Subpart Q, "Welding, Cutting, and Brazing" (1910.251 to 1910.255).

ANSI Z49.1 (1994), "Safety in Welding, Cutting, and Allied Processes."

ACGIH TLVs and BEIs: *Threshold Limit Values for Chemical Substances and Physical Agents, 1998* (excluding TLVs for Chemical Substances, Ergonomics, Ionizing Radiation, and Lasers ).

## 9.0 Contact Lenses

Contact lens users shall wear required eye protection (i.e., glasses, goggles, or face shields) in hazardous areas. Soft contact lenses may absorb and be contaminated by chemical vapors or gases. Contact lenses provide little protection to the eye from external forces; they may even compound the severity of an injury. They may trap toxic or dangerous substances that are harmful to the eye and decrease the effectiveness of emergency eyewash fountains.

Contact lenses may be worn with respirators, as long as the precautions in this document are followed. For additional information on eye, face, and respiratory protection, refer to Document 11.1.

### 9.1 Responsibilities

**Work supervisors** shall be responsible for:

- Requesting a workplace evaluation by the area ES&H Team if there are questions regarding the safe use of contact lenses in the work environment. Unacceptable environments may include chemical fumes, vapor, or splashes; intense heat; or a very dusty atmosphere. Work supervisors who judge the work environment to be unacceptable for contact lens use shall inform employees of that judgment.
- Asking workers if they wear contact lenses before work is started in areas where the potential for hazardous atmospheres exists.
- Notifying emergency medical care providers that a contact lens wearer may be wearing contact lenses.

**Employees** shall be responsible for:

- Informing the work supervisor that they wear contact lenses if they work in hazardous locations.
- Following restrictions on contact lens use when working in hazardous locations.

**ES&H Teams** shall be responsible for providing workplace evaluations on the safe use of contact lenses when requested.

## 9.2 Work Standards

29 CFR 1910, Subpart I, "Personal Protective Equipment" (1910.132 to 1910.138), July 1, 2000.

29 CFR 1910, Subpart Z, "Toxic & Hazardous Substances" (1910.1000 to 1910.1450 Appendix B).

*ACGIH TLVs and BEIs: Threshold Limit Values for Chemical Substances and Physical Agents, 2002, (excluding Biological Exposure Indices, TLVs for Physical Agents, and Biologically Derived Airborne Contaminants).*

# 10.0 Water Safety and Boating

## 10.1 Responsibilities

**Work supervisors** of employees who work around bodies of water or will operate or ride in boats while on a work assignment shall be responsible for ensuring that the:

- Cognizant ES&H Team is involved in planning the operation.
- Boat is in serviceable condition and supplied with all required emergency equipment and tools.
- Boat operators are trained to operate the boat, trained in first-aid techniques and fire extinguisher operation, and familiar with applicable boating laws.
- Personal safety equipment is appropriately selected and worn.
- LLNL Risk Manager is notified before any offsite use of boats.
- Required life-saving skiff shall be immediately available over or adjacent to water at location where employees are working over or adjacent to water.
- Ring buoy(s) are provided and readily available for emergency rescue operations.

**Employees** shall be responsible for:

- Operating the boat in a safe manner.
- Wearing personal flotation devices at all times while in the boat, or working over or near water where the danger of drowning exists.

## 10.2 Work Standards

46 CFR 25.25, "Life Preservers and Other Life Saving Equipment" (25.25-1 to 25.25-15).

## 10.3 Resources for More Information

29 CFR 1926.106 "Working Over or Near Water"

# 11.0 Diving

Work supervisors of employees who are required to perform diving tasks as part of their work assignment shall prepare a safety plan (see Document 2.2, "Managing ES&H for LLNL Work"). The exception is snorkel diving, which requires only supervisory permission. A reference guide, *LLNL Diving Safety Program*, is available through the ES&H Team.

In addition to all diving operations being reviewed and approved in accordance with Document 2.2, the Diving Control Board shall review and approve diving operations. The Diving Control Board consists of members of the Hazards Control Department and the Health Services Department and at least one certified diver. This board establishes the certification procedure, approves equipment, and maintains records. Call your area ES&H Team to contact the Diving Control Board.

## 11.1 Responsibilities

**Work supervisors** shall be responsible for preparing safety plans.

**Employees** are responsible for performing work according to the requirements in safety plans and the *LLNL Diving Safety Program*.

**The Hazards Control Department** shall be responsible for maintaining the Diving Control Board and the *LLNL Diving Safety Program*.

**ES&H Teams** shall be responsible for providing guidance when requested.

## 11.2 Work Standards

29 CFR 1910, Subpart T, "Commercial Diving Operations" (1910.401 to 1910.441).

## 11.3 Resources for More Information

Diving Control Board

ES&H Team

## 12.0 Working Alone

Working alone means performing any activity out of sight or communication for more than a few minutes at a time. For work on exposed, energized electrical equipment, an individual is considered to be working alone if not within sight of someone else. The major danger in working alone is sustaining an illness or injury that precludes self-rescue. The most common working-alone situations arise during nights, weekends, and holidays; however, working-alone conditions also may occur during normal daytime working hours.

If you will be working alone on a nonhazardous activity, advise a spouse, family member, co-worker, or work supervisor that you will be doing so and when you expect to return.

It is the responsibility of all Laboratory personnel to perform work safely and to be accountable for their own safety. This includes:

- Exercising prudent judgment regarding whether or not to perform potentially hazardous activities alone.
- Obtaining prior authorization from work supervisors or Laboratory contacts before beginning planned hazardous-for-working-alone operations to ensure that all hazards have been thoroughly evaluated from the perspective of working alone. (See Document 2.2 for further details.)

### 12.1 Operations Classified As Hazardous-For-Working-Alone

Examples of operations that could be classified as hazardous-for-working-alone may include work:

- With high-energy, highly reactive, highly flammable, or acutely toxic materials.
- With lasers and related high-power supplies.
- With highly toxic materials.
- With high-pressure or glass vacuum systems.
- With unguarded, high-powered, fast-moving equipment or machinery.
- With exposed, energized electrical systems.
- Near radiation sources that could cause acute disabling injuries.
- In congested or confined spaces.
- In extreme environmental conditions (e.g., heat or cold).

- Involving underwater diving.
- Requiring the use of
  - Self-contained breathing apparatus or supplied air equipment.
  - Fall arrest systems.
  - Off-road, heavy equipment.
  - Hoisting or rigging equipment to lift or move heavy equipment.
- On uneven work surfaces.
- With any equipment, material, or process that could pose a significant hazard to employee.
- Requiring off-road or other unusual driving conditions.

Before authorizing work-alone operations, work supervisors shall evaluate the hazards of each activity that could be classified as hazardous-for-working-alone. The work supervisor shall ensure that adequate help can be made available quickly in an emergency. Additional controls or procedures may need to be implemented. Work supervisors are encouraged to consult with the area ES&H Team for support with safety evaluations and selection controls.

Authorization to perform potentially hazardous activities alone shall be given on a case-by-case-basis for each activity, unless the hazards of working alone have been specifically addressed by a current, documented, and approved Integration Work Sheet (IWS), IWS/Safety Plan (SP)), permit, or set of work practices. Standing approvals are not permitted when changing conditions may be anticipated.

**Note:** An individual assigned to accompany another worker so he or she can work on a hazardous activity (for which working alone is not permitted) shall clearly understand that he or she has that role. This requirement is necessary to assure that the companion does not become distracted or leave in the middle of the activity.

## 12.2 Responsibilities

**Work supervisors** shall be responsible for ensuring that an IWS is prepared for activities classified as hazardous-for-working-alone and that the hazards are addressed in the work planning process. Consult with area ES&H Team for support.

**Employees** shall be responsible for performing work safely and for being accountable for their safety. This includes:

- Exercising prudent judgment regarding performance of potentially hazardous activities alone.

- Obtaining prior authorization before beginning planned hazardous-for-working-alone operations.
- Ensuring that a companion is available and understands his or her responsibilities.

**ES&H Teams** shall be responsible for providing support with safety evaluations and selecting controls for activities that are classified as hazardous-for-working alone.

### 12.3 Work Standards

29 CFR 1910, Subpart E, "Means of Egress" (1910.35 to 1910.38).

29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response."

29 CFR 1910.269, "Electric Power, Transmission, and Distribution."

29 CFR 1926.65, "Hazardous Waste Operations and Emergency Response."

40 CFR 264, "Standards for Owners and Operators of Hazardous Waste, Treatment, Storage, and Disposal Facilities."

### 12.4 Resources for More Information

29 CFR 1910.268, "Telecommunications."

In addition, the articles below are examples of lessons learned regarding working alone.

- "Don't Work Alone on Things That Can Hurt You."
- "Electric Shock Injures Student."
- "Worker Falls Through Fiberglass Roof."

These and other articles can be found at the following Internet address:

[http://www-r.llnl.gov/es\\_and\\_h/lessons/lessons.shtml](http://www-r.llnl.gov/es_and_h/lessons/lessons.shtml)

## 13.0 High-Speed Cameras

The Site 300 camera shop controls the use of high-speed framing and streaking cameras at the Livermore site and Site 300. Personnel desiring to use or operate such equipment shall contact the camera shop supervisor to arrange for either instruction in the safe use of high-speed cameras or demonstration of competence.

The primary hazard of these cameras is the release of energy in a catastrophic failure. In addition, in the event of failure, the rotors can be damaged and release airborne

beryllium. For more information on beryllium hazards, refer to Document 14.4, "Implementation of the Chronic Beryllium Disease Prevention Program Requirements."

High-speed cameras are only to be used in remote areas where such use is covered by the IWS/SP. The use of high-speed cameras in other areas shall require adequate shielding, an engineering safety note for the shielding, and a safety plan covering the operation.

## 14.0 Machine Guarding

All machines shall be operated with all guards in place, except during maintenance or repair. Unguarded machinery and machine tools may cause severe and disabling injuries such as lacerations, fractures, and amputations. To prevent these injuries, guards shall be installed on all hazardous moving parts of machines. Examples of hazardous moving parts include V-belts, rotating spindles and shafts, chains and sprockets, gears, and rotating saw blades or abrasive wheels. Contact the ES&H Team for guidance on machine-guarding requirements and methods. Additional information on guarding can also be found in the OSHA general industry standards and many ANSI safety standards.

Guarding hazardous parts of machinery significantly reduces the risk of injury to the operator. In addition, the following safe work practices shall always be used when operating machinery or machine tools:

- Guards shall not be removed for any reason unless specifically authorized by the work supervisor.
- When guards are removed for repair or maintenance of machinery, all power supplies shall be secured and mechanical energy sources blocked (see Document 12.6, "LLNL Lockout/Tagout Program"). Exceptions to this guidance are allowed only when necessary for the performance of required maintenance or servicing.
- Missing or defective guards shall be reported to the work supervisor immediately to assure that the hazard is mitigated or corrected and to assure entry into the DefTrack System as a priority 1A or 1B deficiency in accordance with Document 4.2, "Environmental, Safety, and Health Deficiency Reporting."
- Operators shall not wear loose clothing or finger rings. Accessories (e.g. badge lanyards, neckwear, wrist bracelets, or watches and other jewelry) should be breakaway. Long hair should be secured to prevent becoming entangled in machine parts such as rotating spindles and gears.

- Appropriate eye and face protection shall be worn while operating machinery or machine tools.
- Individuals who work directly with machine tools in a shop environment, enter machine shop areas regularly, or are exposed to machine tool hazards are required to complete HS5410-CBT, "Machine and Equipment Safety," or a Hazards Control Department-approved alternate course.

### 14.1 Responsibilities

**Work supervisors** shall be responsible for ensuring that machine guards are installed and maintained in the areas under their control.

**Employees** shall be responsible for respecting and using machine guards and shall report missing or defective guards to their work supervisors. Employees shall conform to clothing and accessory requirements given above.

**ES&H Teams** shall be responsible for reviewing machine operations and evaluating the need for and adequacy of machine guards on a periodic basis and upon request and for making appropriate recommendations.

### 14.2 Work Standards

29 CFR 1910, Subpart O, "Machinery & Machine Guarding" (1910.211 to 1910.219).

### 14.3 Resources for More Information

The articles below are examples of lessons learned regarding machine guarding.

- "Lathe Guards Need Periodic Maintenance."
- "Near Miss when Grinding Stone Disintegrates."

These and other articles can be found at the following Internet address:

[http://www-r.llnl.gov/es\\_and\\_h/lessons/lessons.shtml](http://www-r.llnl.gov/es_and_h/lessons/lessons.shtml)

## 15.0 Projects Involving Aircraft Flight Operations

### 15.1 Terms

**Aircraft.** Any apparatus intended for flight in the air, except missiles, rockets, or artillery projectiles. The term encompasses manned or unmanned vehicles such as balloons (large volume), fixed-wing or rotary-wing aircraft, unmanned aerial vehicles (UAVs), remotely piloted vehicles (RPVs), and optionally piloted vehicles (OPVs).

**Aviation Service.** Any activity involving an agreement or arrangement with an outside vendor or other entity (e. g., military, DOE, or DOE contractor) that involves the use of an aircraft or involves the airborne transportation of DOE, LLNL, or subcontractor personnel, equipment, or experiments. This definition does not include regularly scheduled commercial flights.

**Flight Operation.** Any activity during which the aircraft, including tethered balloons, can intentionally or unintentionally be launched into the air (i.e., leave contact with the ground).

### 15.2 Requirements

#### 15.2.1 General

The use or acquisition of any aircraft or aviation service by LLNL personnel shall conform to both the Laboratory's mission and DOE Contract W-7405-ENG-48. The LLNL aviation point of contact (POC) shall concur with all aviation activities that fall within this document's scope before final approval by the DOE-OAK aviation manager (AM). Inform the Laboratory's aviation POC or the LLNL aviation safety officer (ASO) as soon as you determine that a project will involve flight operations. In addition, contact the Risk Manager's Office for assistance in obtaining or ensuring adequate insurance coverage for the operation.

#### 15.2.2 Aviation Safety Documentation

The appropriate project personnel shall prepare an aviation safety document (ASD) if the aviation POC or ASO determines that a flight operation may involve risks that are not normally accepted by the public. (The aviation POC or ASO can provide guidance in preparing the ASD.) LLNL management (similar to that for IWS/SPs) shall review and accept this mandatory document before submittal to the DOE Livermore Site Office for review and approval. No flight operation may be carried out without the written approval of DOE Aviation Manager (AM).

If any change is made in the aviation activity from what is described in the approved ASD, or other documentation, all aviation activities shall cease until new written approval is received from the DOE AM or DOE ASO.

Use of LLNL employee-owned, -rented, or -piloted aircraft on official business or official travel is prohibited.

For more specific and complete information see *Lawrence Livermore National Laboratory Aviation* (UCRL-MI-137787), available at the following Internet address:

[http://www-r.llnl.gov/es\\_and\\_h/policies/aviation\\_policy\\_2000.pdf](http://www-r.llnl.gov/es_and_h/policies/aviation_policy_2000.pdf)

or in Document 21.6, "Aviation Safety."

### 15.3 Work Smart Standards

DOE O 440.2B, "Aviation Management and Safety", Paragraphs 1, 2, and 3, and Attachment 1, "Contractor Requirement Document," Parts A and B.

14 CFR 21, "Certification procedures for products and parts."

14 CFR 23, "Airworthiness standards: normal, utility, acrobatic, and commuter category airplanes."

14 CFR 25, "Airworthiness standards: transport category airplanes."

14 CFR 27, "Normal Category Rotocraft."

14 CFR 29, "Airworthiness standards: transport category rotorcraft."

14 CFR 33, "Airworthiness standards: aircraft engines."

14 CFR 43, "Maintenance, preventive maintenance, rebuilding, and alteration."

14 CFR 91, "General operating and flight rules."

14 CFR 125, "Certification and operations: Airplanes having a seating capacity of 20 or more passengers or a maximum payload capacity of 6,000 pounds or more."

14 CFR 135, "Operating requirements: Commuter and on-demand operations."

### 15.4 Resources for More Information

#### 15.4.1 Contacts

Direct questions or concerns regarding aircraft operations to the:

- LLNL aviation POC.
- LLNL ASO.
- LLNL risk & insurance manager.

- Procurement and Materiel aviation contract administrator.

#### 15.4.2 Other Sources

For further information, also see *Lawrence Livermore National Laboratory Aviation* (UCRL-MI-137787, February 2000).

## 16.0 Heat Stress

Operations involving high air temperatures, radiant heat sources, high humidity, direct physical contact with hot objects, or strenuous physical activities have a high potential for inducing heat stress in workers engaged in such operations. Outdoor operations conducted in hot weather (such as roofing, construction, asbestos removal, and hazardous waste activities), especially those that require workers to wear semi-permeable or impermeable protective clothing, are also likely to cause heat stress among exposed workers. (Refer to Section 19.0 for additional information.)

Exposure limits for heat stress conditions are given in ACGIH TLVs and BEIs: Threshold Limit Values for Chemical Substances and Physical Agents (1998).

### 16.1 Responsibilities

**Work supervisors** shall be responsible for evaluating their operations for potential employee exposures to heat stress and imposing controls as appropriate.

**Employees** shall be responsible for performing work with a potential for heat stress in accordance with appropriate controls and requirements.

**ES&H Teams** shall be responsible for evaluating work tasks for potential heat stress exposures and recommending appropriate controls when requested. During hot summer days, the ES&H Team shall continually monitor conditions to evaluate the need for heat stress controls.

### 16.2 Work Standards

*ACGIH TLVs and BEIs: Threshold Limit Values for Chemical Substances and Physical Agents, 1998* (excluding TLVs for Chemical Substances, Ergonomics, Ionizing Radiation, and Lasers ).

## 17.0 Walking and Working Surfaces

The surfaces that employees stand or work on can be hazardous if not properly designed or maintained. Indeed, some of the most common and serious injuries are from falling (both from elevated and same-level surfaces) or stepping in or on unguarded floor holes, depressions, or skylights. In this section, proper walking and working surfaces pertain to both the actual surface conditions and the need for proper railings, handrails, and guardrails. This section addresses surfaces in and around buildings. For information about working safely on unpaved surfaces, refer to Document 21.3, "Vehicle Operations and Traffic."

Proper maintenance of floors includes:

- Ensuring that open-sided floors and floor openings (including pits, raceways, drains, skylights, and holes) to which workers may be exposed are equipped with proper guardrails or adequate covers.
- Ensuring that all spills or foreign materials are promptly removed.
- Using appropriate wax or floor coating agents to maintain slip resistance.
- Ensuring that any accessory mats, runners, or rugs are properly designed, fitted, and maintained to sit properly.
- Maintaining rugs properly.
- Installing rubber or other slip-resistant mats in entryways or other locations that may accumulate water.

Any access to elevated locations, or work at heights, requires guardrails, railings, an administrative control system, fall protection, or personal fall arrest systems devices.

Additional information can be found in Document 15.1, "Roof Access," and Document 11.1, "Requirements for Personal Fall Arrest Systems."

### 17.1 Responsibilities

**Supervisors** shall be responsible for:

- Assuring that walking and working surfaces where workers may be exposed are maintained in accordance with safe practices.
- Reporting any unsafe walking and working surfaces to the appropriate facility point of contact, building coordinator, or ES&H team. All walking and working surface hazards shall be reported to assure entry into the DefTrack

System in accordance with Document 4.2, "Environmental, Safety, and Health Deficiency Reporting." The three 1B compliance code topics that relate to walking and working surfaces are:

- Required guardrails are not provided.
- Floor holes, pits, or unguarded openings are not covered.
- Skylights do not have adequate fall protection.

**Workers** shall be responsible for:

- Using handrails and following training procedures.
- Using personal fall arrest equipment when required.
- Cleaning up (or reporting and marking) all spills or other slipping or tripping hazards (e.g., holes and ice). All spills shall be reported to a supervisor.

**ES&H Teams** shall be responsible for providing review and design recommendations for floors and working surfaces, upon request.

## 17.2 Work Standards

29 CFR 1910, Subpart D, "Walking/Working Surfaces" (1910.21 to 1910.30).

29 CFR 1926, Subpart L, "Scaffolds" (1926.450 to 1926.454).

29 CFR 1926, Subpart M, "Fall Protection" (1926.500 to 1926.503).

## 17.3 Resources for More Information

The article below is an example of lessons learned regarding walking and working.

"Fall Prevention"

This and other articles can be found at the following Internet address:

[http://www-r.llnl.gov/es\\_and\\_h/lessons/lessons.shtml](http://www-r.llnl.gov/es_and_h/lessons/lessons.shtml)

## 18.0 Concrete Penetration and Soil Excavation

Operations involving the penetration of concrete slabs or concrete structures and the excavation of soil are controlled by Plant Engineering procedures MOP-03001 and MOP-02003, respectively. These procedures cover the institutional requirements, including the permit process that shall be completed prior to beginning any excavation or penetration action in concrete floors, slabs, walls, or ceilings in LLNL buildings or other concrete areas or soil throughout the Laboratory. Anyone planning excavation or

penetration of slabs on a grade shall contact the Plant Engineering Permit Desk for permit requirements prior to the slab excavation or penetration. Of particular concern is the prevention of contact with live electrical conductors or other significant hazards (e.g., natural gas lines, water lines, air lines, and other like hazards). The permit process includes a review by the LLNL wildlife biologist and the archaeologist, as required. The intent is to minimize the chance of injury or death to personnel, prevent disruption of essential services, and to protect sensitive species and cultural resources.

### 18.1 Applicability

This section is only applicable to work performed within the exterior perimeter fence of the Laboratory at both the Livermore site and Site 300, including the buffer zone, which extends to 10 feet outside the fence at Greenville Road. It applies to all employees and contractors working at both Site 300 and the Livermore site. It shall be followed prior to any of the following operations:

- Excavation or penetration of soil surface areas, including digging, grading, cutting, drilling, jack-hammering, and using power and pneumatic-activated tools.
- Penetrations of concrete structures, including saw cutting, core drilling, jack hammering, and use of power and pneumatic-activated tools.

Penetrations related to replacement of existing appurtenances (fence posts, sprinkler repairs, sign posts, and like items) within original space are exempted.

Gardeners performing routine landscape repairs (e.g., irrigation and replacement of turf or other groundcovers and shrubs or other small plants) within original space and less than 2.5 feet deep are exempted.

For penetration actions planned for offsite, contact the LLNL Procurement and Materiel Office or the Plant Engineering Technical Administration Group Manager for special instruction.

### 18.2 Responsibilities

The **Responsible Individual** is responsible for:

- Following the appropriate procedure.
- Obtaining the permit.
- Assuring that all work is performed using the proper PPE.
- Safely performing the soil excavation or penetration.

### 18.3 Work Standards

29 CFR 1926, Subpart K, "Electrical" (1926.400 to 1926.449).

29 CFR 1926, Subpart P, "Excavation" (1926.650 to 1926.652).

### 18.4 Resources for More Information

#### 18.4.1 Contacts

For copies of Plant Engineering Maintenance Operations Procedures, contact the Technical Administration Group of the Plant Engineering Facilities Maintenance Management Division.

#### 18.4.2 Lessons Learned

The article below is an example of lessons learned regarding concrete excavation and soil penetration.

"Excavation of Electrical Conductors"

This and other articles can be found at the following Internet address:

[http://www-r.llnl.gov/es\\_and\\_h/lessons/lessons.shtml](http://www-r.llnl.gov/es_and_h/lessons/lessons.shtml)

## 19.0 Working Outdoors

Exposure to sunlight can cause sunburn, pain, injury to the eyes, and skin cancer. Evidence suggests that the incidence of skin cancer in the U.S. is increasing. In this section, guidance is given to help protect workers from overexposure to sunlight. (Refer to Section 16.0 for requirements to protect workers from heat outdoors.)

Proper protection for outdoor workers includes the following:

- Minimizing exposure to sunlight, particularly during the time of day when sunlight is most intense (generally considered to be between 10 a.m. and 3 p.m.).
- Using proper sun protection (e.g., wide-brimmed hats, long-sleeve shirts, UV-resistant glasses, and sun screen or sun block for exposed areas of skin).
- Installing shade structures (e.g., temporary umbrellas) for people assigned to a given area.

- Getting prompt evaluation of any suspicious mole or skin growth. The Health Services Department maintains the “Mole Patrol” program to assist in the evaluation of suspicious moles. Refer to Document 10.1, “Occupational Medical Program,” or contact the Health Services Department for additional information.

For additional information on PPE, see Document 11.1.

## 19.1 Responsibilities

**Supervisors** shall be responsible for:

- Reviewing all jobs before the start of work and identifying hazards and controls to determine the need for skin protection.
- Ensuring that all skin protection methods are available and properly used.

**Workers** shall be responsible for:

- Using PPE and other available protection control methods.
- Promptly reporting sunburn or other skin conditions to their supervisor in accordance with the requirements of Document 4.5, “Incidents—Notification, Analysis, and Reporting.”

## 19.2 Work Standards

29 CFR 1910, Subpart I, “Personal Protective Equipment” (1910.132 to 1910.138), July 1, 2000.

## 19.3 Resources for More Information

The articles listed below provide additional information:

“OSHA Offers Tips to Protect Workers in Hot Summer Weather.”

<http://www.osha.gov/media/oshnews/may01/trade-20010524.html>

“OSHA Recommends Protective Measures for Outdoor Workers Exposed to UV Radiation.”

<http://www.osha.gov/media/oshnews/july00/trade-20000706.html>

“Melanoma/Skin Cancer Prevention”

<http://www.va.gov/vasafety/OSHPgmDocs/DASHO-Letters/00S-97-8.htm>

Additional articles can be found at the following Internet address:

<http://www.pp.okstate.edu/ehs/a&m/sunsafety.htm>