



ENVIRONMENT, HEALTH, AND SAFETY

ELECTRICAL SAFETY

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Version Control

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1.0 POLICY

Sanford Underground Research Facility, (SURF, aka Sanford Laboratory) is committed to providing an electrically safe work environment by managing the risks associated with working on or near sources of electrical energy. This policy will ensure the safety of all users and workers at Sanford Lab by:

- Complying with Federal, State, and local requirements for workplace safety.
- Following established codes and standards for developing, upgrading, expanding and operating the facility.
- Eliminating hazardous electrical conditions, equipment and work practices where practical and feasible.
- Replacing or retiring electrical devices that are unsafe, do not meet Nationally Recognized Testing Laboratory (NRTL) standards, or have exceeded their useful life.
- Providing resources and training to recognize electrical hazards and facilitate reporting, work planning, hazard assessments (JHA), and the development of standard operating procedures (SOP).
- Providing appropriate personal protective equipment (PPE) required for performing electrical work, and training on the proper inspection, care, and use of the equipment.
- Training on Arc Flash protection and how to determine the required level of PPE.
- Continuously evaluate and improve established procedures, policies, and training to adapt to a changing facility and workplace conditions.

2.0 SCOPE

This policy applies to everyone affiliated with Sanford Lab including but not limited to: employees, managers, visitors, researchers, students, contractors and sub-contractors.

This policy is enforced at all properties that are managed, maintained, owned and operated by Sanford Lab.

The codes and standards referenced and adopted by the Sanford Lab electrical policy include:

- Department of Energy (DOE) 10 CFR Ch. III Part 851, Work Safety and Health Program
- Occupational Safety and Health Administration (OSHA) 29 CFR 1910 Subpart S and 29 CFR 1926 Subpart K
- National Electrical Code (NFPA 70)
- Handbook for Electrical Safety in the Workplace (NFPA 70E)
- American National Standards Institute (ANSI) C2
- International Building Code (IBC, currently 2009 edition)
- South Dakota Electrical Commission, SD Codified Law Chapter 36-16 and Article 20:44
- City of Lead Authority Having Jurisdiction

3.0 RESPONSIBILITIES

3.1. *Everyone* – is responsible for his or her own safety and the safety of others. Never undertake a task that you feel is unsafe. All workers are responsible for recognizing electrical hazards and stopping work until electrical hazards are mitigated. Each employee will:

- Receive training on recognizing electrical hazards and the safe use of electricity
- Inspect equipment, tools, and power cords before each use to assure they are in good working order.
- Perform work with or near electrical devices only when:
 - You are trained to recognize electrical hazards.
 - You are trained on the proper use of electric tools and equipment.
 - Potential hazards are adequately controlled.
 - You are trained to perform the task.
- Wear and use personal protective equipment (PPE) that is appropriate for the work being performed.
- Immediately report all injuries to the EH&S Department and their supervisor ([First Report and Incident Investigation Form](#)).

3.2. *Qualified Electrical Workers* – are responsible for safely installing, maintaining, repairing, and testing electrical systems and equipment, control systems and instrumentation, and radio communications equipment. They must possess significant knowledge and have verifiable experience in the electrical trades in accordance with SD Codified Law. Electrical workers must have extensive training in recognizing and mitigating electrical hazards, determining and utilizing appropriate electrical safety PPE, and conducting electrical work in a safe manner according to NFPA 70E, NEC, and OSHA regulations. Electrical workers will:

- Receive advanced training in recognizing electrical hazards
- Be properly trained and qualified to work with electricity
- Perform electrical work only when hazards are identified and adequately controlled.
- Pre-plan work by creating, reviewing, and following JHA's and SOP's for ALL work to be performed.
- De-energize electrical systems and/or equipment before performing work.
- Obtain an Energized Work Permit when de-energizing is not feasible.
- Know how to inspect and use electrical personal protective equipment (PPE) that is appropriate for the work being performed.
- Immediately report any electrical shock or burn to the EH&S Department and their supervisor ([First Report and Incident Investigation Form](#)).

3.3. *Supervisors* – All supervisors have the responsibility of ensuring a safe working environment. They must:

- Determine if a qualified electrical worker is required for a particular job.
- Assess the need for establishing, implementing, and maintaining procedures and/or work practices that will ensure the safe conduct of electrical work.
- Pre-plan electrical work to insure that hazards are recognized and mitigated.
- Take corrective action on any potentially hazardous operation or condition.
- Ensure that approved, maintained, and tested PPE is provided and used properly.
- Assign only trained, qualified, and authorized employees to perform electrical work.

- Conduct a pre-job briefing before work begins.
- Ensure that all injuries are treated promptly and reported appropriately.

3.4. Electrical Engineering – The Electrical Engineer interprets the NEC (National Electrical Code, NFPA 70) and other codes and approves construction, installations, and installed electrical equipment for Code compliance. The Electrical Engineer provides oversight of the construction, installation, and modification of electrical equipment and systems to assure that design criteria, codes, policies, and procedures are followed.

An electrical engineer will be appointed by the Director of Engineering to serve as the chair for the Electrical Safety Committee.

3.5. EHS Director – is responsible for the documentation of Laboratory-wide electrical safety policies and procedures, training, and EHS field support. The EHS Director will:

- Perform periodic assessments of electrical safety compliance at Sanford Laboratory.
- Provide feedback, incident reports, and recommendations to the Electrical Safety Committee.
- Appoint an EHS Representative to serve as a member of the Electrical Safety Committee.

3.6. Electrical Supervisor – has the responsibility to ensure that electrical work is conducted in a safe manner according to Sanford Lab policies and procedures. The Electrical Supervisor is delegated the responsibility to assure all research and scientific equipment is compliant with ANSI, UL, NFPA, NRTL, or other standards as appropriate to establish the safety of the equipment.

The Electrical Supervisor will:

- Provide coordination for the Sanford Laboratory electrical safety program, working in close cooperation with the Electrical Safety Committee.
- Ensure that employees doing electrical work meet the criteria for being qualified electrical workers, have the necessary training, and are authorized to perform electrical work.
- Apply 29 CFR 1910 Subpart S and 29 CFR 1926 Subpart K in evaluating workplace conditions.
- Evaluate existing workplace safety by inspecting or assisting in the inspections of the workplace for National Electrical Code (NEC) and NFPA 70E compliance.
- Ensure that JHA's and SOP's are developed before electrical work begins.
- Approve Energized Electrical Work Permits, (EEWP).
- Provide assistance to research divisions by evaluating the acceptability of experimental electrical wiring and apparatus. In this capacity, the Electrical Supervisor will, as needed:
 - Review drawings, tests, and other documentation provided by the project engineers, principal investigators (PIs), or other responsible parties for compliance with accepted safety criteria and code intent.
 - Inspect power systems and incidental wiring related to the experiment.
 - Conduct other inspections and analyses as necessary to verify the acceptability of the apparatus involved.

- Serve as the first contact within Sanford Laboratory, which will provide formal interpretations of OSHA electrical safety requirements and NFPA 70E.
- Assist the Electrical Engineer with interpretations of NFPA 70.
- Serve as a member of the Electrical Safety Committee.

3.7. Electrical Safety Committee – The Electrical Safety Committee (ESC) is comprised of the Electrical Engineer, the Electrical Supervisor, and an EHS representative appointed by the EHS Director. The ESC serves as a sub-committee to the EHS Committee. The ESC is the Electrical Authority Having Jurisdiction (EAHJ) at Sanford Lab and is responsible for:

- Promoting electrical safety at Sanford Lab
- Assisting the EHS department in developing electrical safety policies and training.
- Providing advice and recommendations on electrical safety matters.
- Approving requests for policy exclusions or waivers
- Determining if an employee is qualified to perform electrical work.
- Evaluating incident reports involving electrical procedures, equipment, and systems.
- Addressing issues and/or conflicts concerning the Electric Safety Policy.
- Reviewing major facility and research project proposals and designs for electrical safety and electrical policy compliance.
- Developing an Electrical Safety Program.

4.0 DEFINITIONS

Arc Flash Hazard – A dangerous condition associated with the possible release of energy caused by an electric arc.

Arc Flash Hazard Analysis – A study investigating a worker’s potential exposure to arc-flash energy, conducted for the purpose of injury prevention and the determination of safe work practices, arc flash protection boundary, and the appropriate levels of personal protective equipment (PPE).

Arc Rating – The maximum incident energy resistance demonstrated by a material (or a layered system of materials) prior to breakopen or at the onset of a second-degree skin burn. Arc rating is normally expressed in calories per centimeter squared (cal/cm^2).

Electrical Authority Having Jurisdiction (EAHJ) - NFPA 70 defines the AHJ as an organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation or a procedure. The Sanford Lab EAHJ is the Electrical Safety Committee. The authority of the ESC does not supersede the authority of the Local AHJ (City of Lead), South Dakota Electrical Commission or OSHA.

Electrically Hazardous – A condition within the Limited Approach Boundary or Arc Flash Protection Boundary where exposed energized electrical conductors or circuit parts are operating per the following energy levels:

1. 50 Volts or more, with the ability to produce at least 5mA current
2. Capacitors storing more than 1J (Joules) at 50 Volts or greater; 1000J at less than 50V.

Electrically Safe Work Condition (see also Verified De-energized) – A state in which the circuit part to be worked on or near has been disconnected from energized parts, locked/tagged in accordance with established standards, tested to ensure the absence of voltage, and grounded if determined necessary.

Flash Protection Boundary (FPB) – An approach limit at a distance from exposed live parts within which a person could receive a second degree burn if an electrical arc flash were to occur.

Limited Approach Boundary (LAB) – An approach limit at a distance from an exposed live part within which a shock hazard exists.

Prohibited Approach Boundary (PAB) – An approach limit at a distance from an exposed live part within which work is considered the same as making contact with the live part.

Qualified Electrical Worker – One who has skills and knowledge related to the construction, installation, maintenance, and operation of the electrical/electronic equipment and installations and has received safety training to recognize and avoid the hazards involved. Such a person is familiar with the proper use of precautionary techniques, personal protective equipment, insulating and shielding materials, insulated tools, and test equipment in addition SURF specific procedural requirements.

Restricted Approach Boundary (RAB) – An approach limit at a distance from an exposed live part within which there is an increased risk of shock, due to electrical arc over combined with inadvertent movement, for personnel working in close proximity to the live part.

Working On (energized electrical conductors or circuit parts) – Coming in contact with energized electrical circuit parts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the personal protective equipment a person is wearing.

5.0 REQUIREMENTS

5.1. General Practices

1. All research or test devices operating at a voltage greater than 50 volts with the ability to produce 5mA or more of current, or having capacitors greater than 1J (joules), or 1000 Joules if less than 50 volts, must be protected by an enclosure with secured or interlocked covers, or isolated in a manner that will prevent inadvertent contact with exposed live parts.
2. Project personnel, unqualified or untrained for electrical work, are not permitted to replace blown fuses or reset tripped circuit breakers rated more than 20 Amps at 120 Volts. Project Personnel, unqualified or untrained for electrical work, shall be permitted to reset single pole 120 Volt circuit breakers rated 20 Amps or less provided:
 1. It is verified that the affected circuit breaker is a 120 Volt single pole breaker marked as 20 Amp (or less) and is not otherwise tagged out. GFCI circuit breakers shall be treated as normal circuit breakers.

2. The circuit has been examined and a readily apparent cause for the over-current condition has been identified. If there is no apparent cause of overload, the breaker cannot be reset.
3. Any readily apparent cause of the overcurrent condition has been corrected (disconnected from the circuit, repaired, or replaced.)
4. The circuit breaker has not been previously reset for this occurrence.

An occurrence is defined as a problem or situation, which is causing a circuit breaker to trip, that has not been resolved.

If all conditions 1 - 4 cannot be satisfied, the circuit breaker is to be tagged out and a Qualified Electrical Worker must be contacted to assist in evaluating the situation. The Qualified Electrical Worker will determine what is required to troubleshoot and resolve the problem.

3. GFCI outlets detect ground fault currents (5mA or greater) that may result in electrical shock. All personnel are encouraged to routinely "TEST" GFCI outlets and may reset them as needed. If a GFCI outlet trips, all devices plugged-in to the affected outlet should be inspected for damage and/or exposure to wet conditions. Suspicious devices should be removed (unplugged) before attempting to reset the GFCI outlet. Be aware that there may be other outlets in the area connected to and protected by a GFCI outlet. After the cause of the ground fault condition is determined and eliminated, notify everyone working in the area before resetting the GFCI outlet. Never reset a GFCI without first notifying others in the work area. If a tool or device is found to be causing a GFCI to trip, the device must be immediately tagged "Do Not Use" and the reason why, and taken out of service.
4. Design and fabrication of research and test equipment will be accomplished following prescribed design and engineering requirements, and must be approved by a SURF Electrical Engineer.
5. All electrical equipment brought to the Sanford Lab must be inspected and approved for use by SURF qualified electrical personnel.
6. Any potentially electrically hazardous work will be performed following Lockout/Tagout rules as described in the *Lockout/Tagout Policy*.
7. Work will only be performed on hazardous electrical components when it can be demonstrated that de-energizing introduces additional or increased hazards or is infeasible due to equipment design or operational limitations.
8. When work on hazardous components is justified and approved, controls (guards, covers, shields, insulated tools & probes, remote methods) must be used to reduce the potential for contact with energized components.

9. All employees who work within the LAB or FPB of hazardous components must be qualified and authorized by the Electrical Supervisor, or *Contractor Electrical Safety Workbook* prior to performing such work.
10. Work within the LAB or FPB of hazardous components will be done in accordance with the requirements of NFPA 70E.
11. Contract employers will ensure their employees comply with NFPA 70 and NFPA 70E. Laboratory points-of-contact for the contract will inform the contract employer of any additional information needed by the contract employer to ensure a Contractor Electrical Safety Workbook and if necessary, an Energized Electrical Work Permit (see section 5.2) is completed.
12. All electrical work must be conducted with GFCI protection. Because we employ a GFCI policy, Sanford Laboratory does not follow the OSHA Assured Grounding Program.

5.2. Hazard Controls When Performing Electrical Work

The following hazard control hierarchy will be used to mitigate electrical hazards before approaching within the LAB or FPB of energized circuit parts:

1. Place the circuit parts into an Electrically Safe Working Condition, (see *Lockout/Tagout Policy*).
 - Appropriate PPE (see section 5.2.1) is required to confirm an Electrical Safe Working Condition.
2. If work must be performed on a Electrically Energized System (i.e., one not able to be placed into an Electrically Safe Working Condition):
 - An ***Energized Electrical Work Permit (EEWP)*** must be filled out and approved (see the Electrical Supervisor for guidance on how to fill out this permit.) Exemptions to this requirement are discussed in section 5.3.

5.2.1. Elements of the EEWP may include:

- Assignment of a Safety Watch (to be specified in the EEWP)
- Application of supplemental physical controls, such as panels, shields or barriers, to isolate employees from energized components.
- Determination of required PPE to isolate workers from exposed hazardous circuit parts (see section 5.2.2).

5.2.2. Personal Protective Equipment

Qualified workers who are exposed to electrical hazards that cannot be controlled through engineering or administrative means must be provided with and use PPE that is appropriate for the specific work to be performed and the associated hazard level. NFPA 70E defines PPE requirements. PPE is required for any work within the LAB or FPB.

5.2.3. Electrical Safe Work Rules

Note: A summary of the Sanford Laboratory electrical safe work rules are provided below.

1. Positively ensure the correct circuit is identified before lockout and tagout.
2. The employee in charge must conduct a briefing before all energized electrical work.

3. Resist “hurry-up” pressure.
4. Don’t hesitate to use the *Stop Work Policy*.
5. Know how to shut down equipment in an emergency.
6. Know the Sanford Laboratory emergency procedures.
7. Never drill into a wall or floor slab without Operations Department approval

Note: For a listing and description of other electrical safety considerations, see the *Electrical Safety Considerations* section below.

5.3. *Energized Electrical Work Requirements*

Energized electrical work is any activity inside the LAB or FPB of electrically hazardous circuit parts. Circuit parts are considered hazardous if they operate at a level that could cause injury to a worker through contact or exposure to an Arc Flash Hazard. Verification of absence of voltage for lockout/tagout is considered to be energized electrical work, although an EEWP is not required. Authorization is required for all energized electrical work.

It is Sanford Laboratory standard practice to de-energize electrically hazardous circuit parts, whenever possible, before an employee works on or near them (see *Lockout/Tagout Policy*). This is the preferred method for protecting workers from hazards. Workers are permitted to work on or near exposed energized circuit parts only if it can be demonstrated, and documented, that de-energizing would introduce additional or increased hazards or is infeasible due to equipment design or operational limitations. Energized parts that are not hazardous need not be de-energized if there will be no increased exposure to electrical burns or to explosion blast due to electric arcs.

5.3.1. **Electrical Work Authorization**

All Project Personnel (employees, contractors & users)

Note: The requirements for exposed electrical work (i.e. NFPA 70E) are in a phase-in-pilot program. Full implementation is expected August 1, 2010.

Electrical testing, troubleshooting, and inspection activities are authorized by a Standard Operating Procedure, (SOP). Any work that is not specifically authorized in an SOP requires an EEWP. Depending on the risk, complexity, or severity of the task, additional controls may be necessary.

5.3.2. **Job Briefing**

Before starting a task that might expose a worker to an electrical hazard, the person in charge shall brief the worker of the hazards involved, necessary PPE, work practices required, and other information necessary to minimize the possibility of an electrical injury. The extent of the briefing depends on the risk and complexity of the task. If the work is authorized under an SOP, the briefing will usually consist of simple direction by the supervisor noting any unique hazards associated with the assignment.

Work authorized by an EEWP requires a more extensive briefing. The training and qualification currency of the worker should be verified and any potential emergency response actions discussed. Work should be released only when the supervisors and all workers know the scope of the work, hazards associated with the work, appropriate controls to manage the identified hazards, and all are confident that the work can be done safely.

5.4. *Qualifying and Authorizing Personnel*

Only those persons who are both qualified and authorized may install, fabricate, repair, test, calibrate, or modify electrical or electronics wiring, devices, systems, or equipment.

A qualified and authorized person is an individual formally recognized by Sanford Laboratory management as:

- having completed the required classroom training;
- having sufficient understanding of a device, system, piece of equipment, or facility to be able to recognize and positively control any hazards it may present;
- who have completed site, area, facility, equipment, and apparatus-specific training;
- who possesses the work experience and formal training necessary to execute the work according to recognized and accepted technical standards; and
- whose qualifications are documented by his supervisor

A person can be considered qualified and authorized with respect to certain equipment and methods but not authorized for others.

5.4.1. **General Guidelines for Qualification**

Qualification for electrical work is determined by the employee's supervisor and is based on a combination of classroom training (including required periodic retraining), formal electrical trade, military, college, or other training, work experience, and on-the-job training.

5.4.2. **General Guidelines for Authorization**

Authorization to perform electrical or electronics work by an employee is determined by the employee's line management or supervision and is based on the skills, knowledge, and ability of the employee to perform a specific task safely and correctly.

5.4.3. **Specific Qualification and Authorization Criteria**

Task-Specific Training Criteria

Supervisors shall use the following guidelines to determine whether an individual is qualified to perform specific electrical work. Different subsets of these criteria shall be selected according to the exact nature of the task; however, some analysis must always be performed, no matter how minor the job. Tasks that are performed less often than once per year shall require retraining before the performance of the work practices involved. See NFPA 70E Section 110.6 for additional details.

5.5. *Training*

5.5.1. **Electrical Safety Training Courses**

- Laboratory course *Lockout/Tagout-OSHA* is required for anyone who for any reason needs to remove shielding or barriers on electrical equipment.
- Adult Cardiopulmonary Resuscitation and First Aid training is required for all persons working in electrically hazardous areas, and for persons serving as Required Safety Watch.
- Various levels of electrical safety training are offered by the laboratory on an as-needed basis. Contact the EHS Department for classes or refresher training.

5.5.2. Training Matrix by Job Task

	LOTO	NFPA 70E	First Aid Safety	Adult CPR	Basic Electrical Safety	Qualified Electronic Techs	Qualified Electrician
Facilities Electricians	X	X	X	X	X		X
HVAC, Plant Maintenance Technicians, & Lighting Technicians	X	X	X	X	X		
Electronic Technicians	X	X	X	X	X	X	
Other General Lab Population performing authorized electrical work above 50V	X	X	X	X	X		

5.5.3. Electrical Two-Person Rule

Certain work requires two qualified people. This occurs when work is considered electrically hazardous. When the “Two-Person Rule” is required, both workers must be present at the work site, and each worker must be aware of the other worker’s tasks and must:

- be a qualified worker;
- be able to de-energize equipment;
- know the location of the nearest telephones and how to alert emergency response personnel;
- be able to free an injured worker from the hazard;
- be trained and current in cardiopulmonary resuscitation and First Aid;
- remain in visual and audible contact with the workers performing the work.

Note: Both workers may perform separate work tasks so long as safety is not compromised.

5.5.3.1. Exemption to Two Qualified Persons

Under limited conditions, the Electrical Two-Person Rule may allow for a second person that is not a qualified person. All of the requirements of section (5.5.3) apply, and in addition the following must be met:

- Management must approve this exemption.
- During the briefing process, the qualified person will assess the qualifications of the second person to determine that the work may proceed safely.
- The second person may enter the LAB or the FPB, with proper PPE.
- The electrical disconnect must be located outside the RAB.
- The electrical disconnect must be located within 50 feet of the second person.

- The second person must be briefed in emergency procedures and the electrical work being performed.

Note: This exemption only applies to the Two Person Rule and shall not be used when a Safety Watch is required.

5.5.4. Electrical Safety Watch

A Safety Watch is a *more stringent* hazard control measure than the Two-Person Rule and must be implemented when there are grave consequences from a failure to follow safe-work procedures. This occurs when work is considered high-hazard electrical work, as established by the work supervisor. When a Safety Watch is required, the Safety Watch must be a qualified person who is responsible for monitoring the qualified person(s) doing the work. A Safety Watch must:

- have no other duties that preclude continually observing, coaching, and monitoring for potential hazards and mistakes;
- have a thorough knowledge of the specific working procedures to be followed and the work to be done;
- be close enough to the work in progress to safely monitor the progress and methods of the persons doing the work: the Safety Watch must use clothing and PPE appropriate to the hazard and the distance from the work in progress. In no case should the Safety Watch be more than 50 feet from the person(s) performing the work;
- ensure only qualified persons are allowed to enter the LAB;
- ensure that the LAB is properly barricaded and controlled. If signs and barricades do not provide sufficient warning and protection for the LAB, an attendant (third person) shall be stationed to warn and prevent unqualified persons from entering.

5.5.5. Service or Maintenance Contracts (Equipment Contractors)

Any contractor that will be performing work involving a potentially hazardous electrical exposure shall submit a Contractor Electrical Safety Workbook for approval two weeks prior to beginning work at the Laboratory. In addition, the specific electrically exposed tasks shall be authorized with an SOP or EEWP.

5.6. Electrical Safety Considerations

5.6.1. General Considerations

- **Ground Fault Circuit Interrupter (GFCI):** The NEC, OSHA, and NFPA 70E require installation or use of GFCI devices at all times. GFCI protection for personnel shall be used when temporary wiring (e.g., extension cord sets) are used for activities such as: construction, remodeling, maintenance, repair, or demolition.
- **Personal Protective Equipment (PPE):** Treat it well. Keep it clean and oil free. Perform an air leakage test of rated gloves before every use. Flame Retardant (FR) clothing requires special laundering to maintain its protection.
- **Joining a job in progress:** When you are assigned to a job in progress with lockout and tagout devices applied, you have an obligation to follow the LOTO Policy and verify what has been locked out.

- **Document your work:** An up-to-date set of documentation adequate for operation, maintenance, testing, and safety should be available to anyone working on potentially hazardous equipment.
- **Choose safe test equipment:** The test equipment you use is considered personal protective equipment (PPE). Each instrument will have the actual category and maximum working voltage marked near the input terminals.

The categories and ratings for intended service are:

- Category I: Protected electronic equipment
- Category II: Appliances, portable tools, branch circuit receptacles
- Category III: Feeders, switchgear, large motors
- Category IV: Service entrance, metering, utility transformers.

Test equipment must be calibrated yearly.

5.6.2. Extension Cords

Extension cords provide a convenient method of bringing AC power to a device that is not located near a power source. They are used as temporary power sources.

Guidelines for the Safe Use of Extension Cords:

- Use only approved and properly maintained extension cords that have no exposed live parts, damage, or splices.
- Use only heavy-duty or extra heavy-duty rated 12 AWG minimum cords.
- Ensure that the extension cord is of sufficient current-carrying capacity to power the device.
- Use either permanent or temporary GFCI devices when using extension cords.
- Best practices dictate that cord sets of proper length be used. Every effort should be made to plan work in such a manner to ensure the appropriate length cord set is available. Daisy chaining of cords is not strictly prohibited. However, this practice should be used on a limited basis, and corrected as soon as feasible.

Avoid Misuse of Extension Cords: Observe the following restrictions to avoid misuse of extension cords:

- **DO NOT** use extension cords in place of permanent facility wiring.
- **DO NOT** use extension cords with a ground conductor that has less current-carrying capacity than the other conductors.

5.6.3. Re-locatable Power Taps

A re-locatable power tap (also referred to as a power strip) is a variation of an extension cord, where the cord terminates in a row or grouping of receptacles. Re-locatable power taps are commonly used in offices to provide multiple receptacles to office equipment. In general, all rules pertaining to extension cords apply to re-locatable power taps.

Additional considerations are:

- Do not permanently mount re-locatable power taps to any facility surface. It is acceptable to hang them from screws or hooks if they are manufactured with slots or keyholes. It is acceptable to attach them with Velcro or any means that will not require the use of a tool to remove.

- In equipment racks, the preferred method of supplying 120/208V utility power to rack-mounted instruments is via a special re-locatable power tap specifically designed to be rack-installed.
- Daisy chaining of power strips is not permitted.

5.6.4. Portable Heating Units

Temporary use of portable heating units is allowed on Laboratory property. These units will need to be approved, prior to use, by the EHS Department. They are to be UL listed and listed and include a “tip switch” which shuts down the unit in the event that the heater is knocked over. Additionally, the location of the heater needs to be reviewed by a qualified person to avoid overloading the circuit.

6.0 REFERENCE AND RELATED DOCUMENTS

6.1. Standards

- 29 CFR Part 1910, *Occupational Safety and Health Standards*, Department of Labor
- 29 CFR Part 1926, *Safety and Health Regulations for Construction*, Department of Labor
- NFPA 70, *National Electrical Code*
- NFPA 70E, *Standard for Electrical Safety in the Workplace*
- NFPA 101, *Life Safety Code*