LLR
Electric, Inc.

SAFETY MANUAL

Table of Contents

INDUSTRIAL HEALTH AND SAFETY

SECTION I ..... General Requirements
- ARTICLE 1: Industrial Injury Reporting & Follow-Up
- ARTICLE 2: Close Call/Good Catch
- ARTICLE 3: Barricade Tape Practices
- ARTICLE 4: Contractor Safety

Section II ..... Work Practice and Facility Safety
- ARTICLE 1: Office Safety Practices
- ARTICLE 2: Housekeeping Practices
- ARTICLE 3: Walking/Working Surface Practices
- ARTICLE 4: Portable and Fixed Ladder Practices
- ARTICLE 5: Fire Prevention and Protection

SECTION III ..... Material Handling Equipment Safety
- ARTICLE 1: Hand Trucks and Carts
- ARTICLE 2: Forklift Industrial Truck Practices

SECTION IV ..... Tool Safety
- ARTICLE 1: General Tool Practices
- ARTICLE 2: Powder Actuated Tools
- ARTICLE 3: Pressure Washers
- ARTICLE 4: Fixed Power Tool Practices
- ARTICLE 5: Hand Tool Practices
- ARTICLE 6: Pneumatic and Hydraulic Tools
- ARTICLE 7: Fuel Powered Tools
- ARTICLE 8: 120v/240v Portable and Vehicle Mounted Generators

SECTION V ..... Material Safety
- ARTICLE 1: Material Handling and Storage Practices
- ARTICLE 2: Dropped Item Prevention Plan
- ARTICLE 3: Compressed Gas Cylinder Storage and Handling Practice

SECTION VI ..... Electrical Safety
- ARTICLE 1: Temporary Electrical Supply/Extension Cord Usage
- ARTICLE 2: 120/240 Volt Ground Fault Circuit Interrupters (GFCI)
  - ASSURED EQUIPMENT GROUNDING CONDUCTOR PROGRAM (AEGCP)
- ARTICLE 3: Overhead Electric Power Lines/Exposed Energized Equipment

SECTION VII ..... Mechanical Safety
- ARTICLE 1: Cutting and Welding Practices
- ARTICLE 2: Grinding Operations
- ARTICLE 3: Metal/Wood Working Practice

SECTION VIII..... Hazard Communication Program
SECTION VIIII .... Heat Stress Prevention
SECTION X..... Ergonomics
SECTION XI ..... Hearing Conservation Program
SECTION XII ..... Confined Space Program
SECTION XIII..... Fall Protection Program
SECTION XIIII .... Electrical Safety Awareness
SECTION XV..... Energy Control Procedure LOTO
SECTION XVI ..... Benzene Awareness Program
SECTION XVII .... Hydrogen Sulfide Program
SECTION XVIII... Lead Awareness Program
SECTION XVIIII . Written Respiratory Protection Program

INDUSTRIAL HEALTH AND SAFETY

Safety as a Value

The safety of all workers needs to be ingrained as a value, something never to be compromised. This approach to safety needs to start at the highest level of site leadership, and then continue to be reinforced throughout each and every front-line employee. Everyone has an important role in working safely. Senior Management must exert sustained leadership in establishing safety goals and demanding accountability for safety and health performance for a safety and health program to be effective. The role of management then becomes one of goal setters, enablers, problem solvers, and accountability reviewers. Proper safety and health management necessitates continuous involvement by direct supervision and management.

Everyone's Responsibilities

People are the most critical element of our safety and health program. People provide the solutions to our safety problems. Involvement is a dynamic learning and teaching process, which serves as a stimulus for employee cooperation and participation. Providing opportunities for individual participation enhances both the program's effectiveness and safety attitude of the employee. Every employee is involved in activities and decisions that impact their safety and the safety of others. LLR Electric is committed to sustaining living above OSHA expectations.

- Take responsibility for your own safety and the safety of your co-workers.
- Recognize, report, and correct unsafe conditions.
- Identify existing and potential hazards and take steps to correct or address before starting a task.
- Use appropriate personal protective equipment (PPE).
- Ensure that Task Previews are conducted and two-minute drills are conducted at the worksite.
- Recognize and reinforce co-workers for safe behaviors.
- Injuries, no matter how minor, shall be reported to the leader in charge immediately.
- Design safety into each task.
- Take action for immediate safety concerns.
- Mitigate or eliminate the hazard
- Stop work and place equipment in a safe condition
- Barricade the area to ensure personnel will not be injured
- Notify your immediate leader
- **Call 911 for all emergencies.**
- Contact Industrial Health and Safety

SECTION I GENERAL REQUIREMENTS

ARTICLE 1 INDUSTRIAL INJURY REPORTING & FOLLOW-UP

A) Injury Reporting

1. Injuries, no matter how minor, shall be reported to the leader in charge.

(a) The leader will escort the employee to the medical facility (on-site medical, fire protection nights & weekends, or off-site medical facility).

NOTE: If an injured employee's leader is unable to escort an individual, then the leader may delegate the authority to another leader.

(b) If duty restrictions are being considered by the medical professional, the leader shall get involved with the determination of restrictions to ensure:

- Employee's physical job duties, during the time frame for potential restrictions, are clearly explained and understood.
- The restrictions assigned shall not aggravate the employee's injury further.

(c) Leaders shall report the event/injury up their chain of command to the Senior Management level as soon as possible, but no later than the end of shift.

(d) Verbal notification to the on-call Industrial Health and Safety Consultant shall be made as soon as possible, but no later than the end of shift. The Safety report shall be completed for all LLR Electric Employees and OSHA recordable injuries.

(e) Once an injury has been reported and appropriate treatment provided, leaders shall document no later than the end of shift.

(f) Events determined to be the result of an unsafe act or a willful violation to safety rules will be evaluated via the positive discipline process and Discipline Review Board.

(g) Leaders shall report out on all industrial safety events, the following day. The briefing shall include a description of the event, lessons learned, any unsafe behaviors and actions taken or planned to prevent re-occurrence.

B) OSHA Log and Summary of Occupational Injuries/Illnesses

1. The Industrial Health and Safety Department shall maintain a log and summary of all recordable occupational injuries and illnesses of LLR Employees. The OSHA Form 300-A shall be used as the official log.
2. The annual summary of OSHA recordable cases, OSHA 300-A Form, shall be posted from February 1 through April 1 of the year after the reporting period.

ARTICLE 2 CLOSE CALL/GOOD CATCH

A. Close Call Determination

1. Definition: Any event that has taken place which has the potential for personal injury or equipment (property) damage, but resulted in no injury which presented a learning experience to support our zero accident culture.
2. The intent of reporting close calls is to find the causes of problems and solve them. Another important factor is learning from these events and hopefully preventing someone else from making a similar mistake.
3. The following guidelines shall be taken into consideration when determining if a close call occurred:

(a) Did the incident have the potential to have caused injury to employees or substantial property damage?
(b) Upon notification of the incident, does it appear that we can gain experience or insight as a result of an investigation?
(c) Are procedures/policies/guidelines, which are in effect relative to the incident, unclear?
(d) Could there be a lack of training for employees involved?
(e) Are there any circumstances involving the incident that are unclear and may have contributed to the close call?
(f) Are guidelines needed for the task and not available?

If the answer to any of these questions is yes, a close call is warranted.

Good Catch Determination

1. Definition: A behavior or condition that is corrected which mitigates the risk of a close call or injury from occurring.
2. The intent of reporting Good Catches is to develop Operating Experience (OE) for trending of low level safety issues before they become an injury.

ARTICLE 3 BARRICADE TAPE PRACTICES

A. General Barricade Tape Practices

1. It is the responsibility of the employee who erects barricade tape and boundary hazard tags to ensure they are maintained the entire time work is in progress and are removed immediately upon completion of the work or elimination of the hazard.
2. Barricade tape shall be placed to provide a safe clearance zone around the hazard to prevent contact with the hazard. (A minimum safe clearance zone of 6 feet is preferred.) When feasible, the tape should be hung approximately 3 feet off the ground to aid in the visibility of the barrier.
3. Boundary hazard tags are required on all accessible sides of the barricade taped area. Large barricade taped areas shall have boundary hazard tags placed at intervals of approximately 40 feet. Each tag shall bear the name of the employee in charge, contact phone or pager number, and brief description of hazard.

B. Red Barricade Tape Practices

1. Red barricade tape includes a signal word printed on the tape to designate “DANGER” and is a temporary method used to define a boundary around a recognized hazard. If not avoided, the hazard will likely cause death or serious physical harm.
2. It is the responsibility of every employee entering any RED (Danger) barricade taped area to: have a work-related need, obtain authorization of the employee in charge of the work area, determine the potential hazard(s) and then implement appropriate protective measures. All other personnel are restricted from the area.
    (a) Entry authorization may be granted by a leader from the department responsible for the red danger barricade if the employee in charge is not available. The responsible work group leader shall determine what hazards exist in the area.
    (b) An attempt must be made to find the employee in charge if red barricade tape is encountered with no boundary hazard tags or in a degraded condition. A responsible work group leader shall determine what hazards exist in the area if the employee in charge is not available. They shall also attach boundary hazard tags bearing his/her name on the barricade tape or have the tape removed if it is determined the hazard is no longer present.

3. Red barricade tape shall be removed immediately after the work is complete or hazards are eliminated. Removal of the barricade tape must be at the direction of the employee in charge or the responsible work group leader.

C. Yellow Barricade Tape

1. Yellow barricade tape is used to designate caution. This tape will include a signal word printed on the tape. Yellow barricade tape shall be used to define hazards which may cause injury to personnel, e.g., personnel working in the overhead, trenches/excavation, designated work/laydown areas or exposed hot surfaces.
2. Yellow barricade tape shall have boundary hazard tags attached to each accessible boundary. Each tag shall bear the name of the employee in charge of the project, contact phone number, along with a brief description of the hazard.
3. Prior to entry, personnel shall review the boundary hazard tag information, assess the work area hazards, and take appropriate action.
4. Yellow barricade tape shall be removed immediately after the work is complete or the hazard is eliminated.

NOTE: Yellow barricade tape with a hazard boundary tag and a biohazard sign may be used to designate a biological hazard. A biological hazard is defined as those infectious agents presenting a risk of death, or injury or illness to employees.

ARTICLE 4 CONTRACTOR SAFETY

A. General

1. At a minimum, Contractors, Service Providers, and Suppliers performing work For LLR Electric must comply with the requirements contained within the Safety Manual and referenced procedures.

B. Pre-job brief

1. Contractor leaders shall ensure that the employee in charge conducts a pre-job brief with the employees involved before they start each job and have a general understanding of the work.
2. If the work or operations to be performed during the workday or shift are repetitive and similar, at least one pre-job brief shall be conducted before the start of each day or shift. Additional briefings shall be held if significant changes, which might affect the safety of the employees, occur during the course of the work.
2. When a job includes any task, which could place personnel in proximity to hazards capable of serious injury, appropriate measures shall be established to eliminate or effectively control exposure to the hazard. A Job Hazard Analysis provides a systematic approach to identifying, evaluating and taking appropriate measures relative to hazard exposure, and shall be written.

C. Safety Program

1. The contractor shall prepare a comprehensive written site-specific safety program covering all aspects of onsite construction operations and including a detailed hazard analysis for each activity associated with its subcontract. In no case will work commence until the program and/or appropriate supplementary submittals have been presented to LLR Electric authorized representative. Acceptance of contractor initial and supplementary programs only signifies the submittals generally conform to the requirement contained and referenced herein. It does not relieve the contractor of the responsibility of providing employees with a safe and healthful work environment, or complying fully with all applicable statutory, regulatory, contractual or other requirements.

NOTE: Contractors may use their own safety programs or safety procedures with LLR Electric if they are approved for use by the Industrial Health & Safety Manager. These documents shall be submitted to the LLR Electric Industrial Health & Safety Department for review, and approved prior to starting work.

SECTION II WORK PRACTICE AND FACILITY

SAFETY

ARTICLE 1 OFFICE SAFETY PRACTICES

A. Floors

1. During inclement weather, look for wet floors.
2. Promptly clean up all water spilled.

B. Stairways

1. Use the handrails provided and maintain three points of contact when ascending or descending stairways.
2. Do not carry items in both hands that would prevent the use of handrails.

C. Drawers and File Cabinets

1. Close all desks or file drawers when not in use.

D. Sharp Objects

1. The blades of paper cutters shall be left in the down position when not in use.

ARTICLE 2 HOUSEKEEPING PRACTICES

A. General

In addition, housekeeping practices that shall be required of all personnel are as follows:

1. General housekeeping for non-warehouse areas concerning cabinets and shelving:
2. Cabinets and shelves shall not be overloaded or have improperly stacked items, to avoid falling object hazards. Owners of shop storage area shall follow the manufacturer's load rating recommendations and prominently display the weight rating for each shelf or display total weight rating of the unit.
3. The top of most cabinets is not designed for heavy loads or storage and must be kept free from accumulation of materials that constitute hazards from tipping, fire, or pest harborage.
4. Maintaining a 3-foot exclusion zone in front of certain equipment is required to facilitate the timely operation of components during an emergency. Examples of items needing this 3 foot exclusion zone are Fire Protection equipment (commonly identified by a painted red barrier), bullet resistant enclosures (BRE) which are not identified due to security concerns, and electrical equipment (such as breaker panels, switch boards, fuse boxes, safety disconnect switches, transfer switches, motor control centers, load centers, control switches).

B. Cable Ties

1. Cable ties (tie-wraps) present a safety hazard when cut off and sharp edges are left. At the same time, the portion of the cable tie removed can become a housekeeping issue and in some instances even present an FME concern. If a cable tie is cut, ensure the ends do not present a hazard to others. Tape the end or turn the cut portion away from travel paths. Pick up the cut off ends to help keep work areas clean and prevent an FME issue.

ARTICLE 3 WALKING/WORKING SURFACE PRACTICES

A. Sidewalks/Crosswalks

1. The clear and safe access to and from work locations within a facility and the protection of personnel from falls while working on elevated platforms is key to the facility safety program.

B. Where provided, sidewalks and crosswalks shall be used for access from one place to another.**Aisles/Walkways**

1. All designated walkways in general areas and work areas shall be kept clear and in good repair, with no obstruction across or in the pathway which creates a personal hazard. Obstructions in the work area that create a personal hazard should be eliminated if possible or properly identified using the appropriate barricade tape/tag.
2. Power cords and hoses can present a serious tripping hazard to personnel when allowed to lie across a walkway. Eliminate or mitigate trip hazards by using the following simple techniques:
    (a) Run and secure power cords and hoses in the overhead, beside, or under the walkway. When these are run in the walkway, use cable/hose protectors to mitigate the trip hazard and avoid damaging the hose or cord. A linebacker may be a useful alternative.

C. Floor Loading

1. Floors and roof load limitations shall be determined. Mezzanine load limits shall be determined and posted in conspicuous locations for each area throughout a facility. (OSHA 1910.22(d)(1)). It's your responsibility to know these loads rating when bringing material to the location.
2. The posted load ratings shall not be exceeded under any circumstances.
3. Load limit information can be obtained from the Specific Building Criteria Manual. Questions should be directed to your Civil Engineering.

D. Protection of Floor Openings

1. Stairway floor openings or ladderway floor openings where there is a fall potential greater than four (4) feet shall be guarded with standard railings and toe boards except for the entrance.
2. Ladderway floor openings or platform entrances shall be protected by a swing gate.
3. Hatchway, manhole or pit openings shall be covered at all times when not in use. When hatch covers are removed, removable railings with toe boards shall be installed.
4. Any temporary floor opening/hole shall be protected by either removable railings with toe boards, a floor hole cover of standard strength and construction that is secured against accidental displacement, or constantly be attended by someone.
5. Temporary floor opening cover shall be marked with a Danger sign and the word "hole" or "cover" to provide warning of the hazard.
6. Floor holes created for machinery, pipes, or other equipment in which personnel cannot accidentally walk into, but leave an opening greater than 1 inch in its least dimension shall be protected with a cover or toe board to prevent tools or material from falling through.

E. Protection of Wall/Window Openings

1. Wall openings where there is a fall potential greater than four (4) feet shall be guarded with standard railings and toe boards, except for window openings where the bottom of the opening is three (3) feet or more above the floor.

F. Protection of Stairways

1. Stairways with 4 or more risers or a vertical rise of 30 inches (whichever is less) shall be equipped with stair-railings and hand rail(s) so there is no fall hazard on either side of the stairway.

G. Ships Stairs (Ships Ladders)

1. A ships stair has a pitch range of 50 to 75 degrees to the horizontal, equipped with treads and stair rails.
2. When using ships stairs always ascend and descend facing the stairs and never carry anything in your hands so both handrails can be utilized. Although commonly referred to as a ships ladder, gloves are not required when using ships stairs.

3. Portable stairs having the same pitch as a ships stair will be treated as a ships stair.

ARTICLE 4 PORTABLE AND FIXED LADDER PRACTICES

A. Design and Construct

1. Straight, step and extension ladders shall be used as a means to reach locations that require inspection or work activities of short duration.
2. Only ladders constructed of non-conductive materials may be used for work on or in proximity to energized electrical equipment, circuits, cables, etc.
3. Portable straight ladders and stepladders shall have non-skid bases or safety feet.

B. Inspections

1. Personnel using a portable ladder shall visually inspect the ladder for any defects before and after each use. The ladder inspection shall include verifying the required vendor labels are attached. The vendor labels are of three types: (1) safety instructions, (2) weight rating, and (3) manufacturer's name. If these three specific labels are not present or are not legible, the ladder shall be immediately removed from service until replacement labels are applied.
2. Ladders are deemed removed from service when a completed out of service tag has been applied and the item removed from a serviceable location.
3. When a ladder falls or is severely struck, it shall be visually inspected for damage.

C. Precautions

1. Ladders shall not be used during a strong wind except in an emergency, and then only when they are securely tied.
2. Stepladder legs shall be fully spread with the spreading bars locked in place and shall not be used as a straight ladder.
3. The top three rungs of a straight ladder and the top two steps of a stepladder shall not be used for standing, climbing, or sitting.
4. Portable ladders should ideally be stored inside or in an area where direct sunlight will not damage the integrity of the ladder.

D. Placement

1. Ladders shall not be placed in front of doors opening toward the ladders unless the door is open, locked, or guarded.
2. Ladders shall not be placed on boxes, barrels, or other unstable bases to obtain additional height.
3. Portable ladders shall be placed so that both side rails have secure footing.
4. Straight or extension ladders shall be positioned at approximately a 75-degree angle. Use the four-to-one ratio; that is, place the ladder so its feet are one foot away from what it leans against for every four feet in height to the point where the ladder rests.
5. Straight or extension ladders shall be positioned so the top extends at least 3 feet above the work location or a 3-foot high (minimum height) grab rail shall be provided to assist employees in mounting and dismounting the ladder.

E. Securing Ladders

1. When working from a portable straight/extension ladder, the ladder shall be securely placed, held, tied or otherwise made secure to prevent slipping or falling.
2. When not in use, ladders shall be secured in place.

F. Ascending or Descending Ladders

1. Always face the ladder when ascending or descending and maintain a 3-point contact. If material must be handled, raise or lower it with a rope and/or a tool bag.
2. Ensure that shoes are not greasy, muddy, or slippery before climbing.
3. Gloves shall be worn while climbing ladders.

G. Working from a Ladder

1. When working from a ladder, the employee shall face the ladder. A hand-line (min. 1/8" diameter rope or cord) will be used to pass tools and equipment up or down.
2. Only one employee shall work from a ladder at one time unless it is specifically designed for use by more than one person.
3. When working from ladders, the worker shall ensure the center line of the upper chest remains within the side rails of the ladder.

ARTICLE 5 FIRE PREVENTION/PROTECTION

A. Evacuation Plans

1. All personnel are expected to know and comply with the Facility Emergency Evacuation Plan. Employees should familiarize themselves with evacuation routes applicable to their work area.

B. Temporary Unscheduled Loss of Power Building Evacuation Guidelines

1. In the event of a loss of power, the affected buildings are to be evacuated no later than the battery life of the emergency lighting/fire alarm systems.

C. Cooking

1. Cooking or open flames require prior approval from the Facility owner.
2. Outdoor cooking fires shall be a minimum of 25 feet from any building or structure.
3. Outdoor cooking fires shall be constantly attended by a competent person until the fire is properly extinguished. A fire extinguisher shall be readily available for use.

SECTION III MATERIAL HANDLING EQUIPMENT

SAFETY

ARTICLE 1 HAND TRUCKS AND CARTS

A. General Information

1. Hand trucks shall be pushed (whenever possible), not pulled, except for the four-wheel truck with swivel axle and tongue which is designed for pulling.
2. Gloves shall be used when operating hand trucks and pushing carts (material handling equipment) at some locations. Check with the Facilities owner for application.
3. Discuss with your leader the proper type glove, considering the type of material handling equipment being used.

ARTICLE 2 FORKLIFT INDUSTRIAL TRUCK PRACTICES

A. General

1. Use of forklift industrial trucks reduces the possibility of personnel injury resulting from lifting and carrying; however, their use creates other safety hazards that endanger both the operator and pedestrians.
2. Only trained and qualified personnel shall be authorized to operate forklifts.
3. Seat belts shall be worn at all times while operating a forklift.
4. An operational check of the forklift truck shall be performed daily prior to use (tires, lights, backup alarm, hydraulics, brakes, mirrors, etc.). If any safety deficiency is discovered, the forklift truck shall not be used.
5. If a Forklift is equipped with a Fire Extinguisher, part of the pre-use inspection shall be to ensure the Fire Extinguisher has a documented inspection. The documentation shall be attached to the Fire Extinguisher and signed on a monthly basis to show the inspection has been performed. This is usually done by the owner of the equipment in which you may need to notify them of the discrepancy.

B. Operational Practices

1. Do not attempt to exceed the posted capacity of your forklift by carrying loads which are too heavy or unbalanced.
2. When moving a load, the forks shall be held at a level approximately 6 inches from the floor in order to clear floor and yard obstructions or higher only as necessary to operate safely.
3. When ascending or descending grades in excess of 10 percent, the forklift shall be driven with the load upgrade.
4. Operators shall slow down at intersections or when view is obscured and sound the horn as a warning when approaching blind corners.
5. A forklift shall not be used as a personnel elevator unless a properly designed platform is attached.
6. Park the forklift with forks on the ground, brakes set, and engine off before you walk away from it. Never park a forklift in an aisle or doorway, or obstruct materials or equipment.

C. Pallets and Racks

1. Serviceable pallets shall be used and placed on storage racks squarely and firmly on bars.

D. Excessive overhang shall be avoided.

1. Idle pallets shall not remain inside or within 25 feet of a building.

E. Electric Forklift Battery Precautions

1. Proper identification and warning signs shall be posted in the area when the batteries in the electric forklifts are being charged. Open flames, tools that may generate sparks, or other sources of ignition are prohibited near the batteries during charging operations. Avoid causing a short across the batteries while using metal tools or objects.
2. Battery charging locations are to be designated as "NO SMOKING" or "NO OPEN FLAME" areas for a distance of 25' from the forklift.

SECTION IV TOOL SAFETY

ARTICLE 1 GENERAL TOOL PRACTICES

A. General

1. Inspect the equipment for indications of possible internal damage such as deformation of the cord cover, sharp bends in the cord, and looseness of the cord cover or any other conditions.
2. Defective tools shall be immediately removed from service.
3. New tools or equipment, which is significantly different in design or operation from those previously utilized, should be jointly evaluated by the 'user' department and the Industrial Health and Safety Department to ensure that manufacturer's manuals, recommendations and product warnings are reviewed and incorporated into initial and continuing training, as necessary.

B. Utility Knives/Cutting Tools

1. Only utility knives with self-retracting blades are approved for use. No work activity constitutes the use of a personal pocket knife, and therefore such use is prohibited.

NOTE: A retractable knife shall retract whether a finger is on the switch or not when contact is lost on a surface.

1. All tools used for cutting activities shall be the specific cutting tool for the work being performed (trade tool provided by LLR Electric or via variance approved by Industrial Health and Safety Manager). If there is any doubt, discuss with your leader on which type of cutting tool to use for a specific job or contact safety for consultation on the correct tool and applicable variance if necessary.
2. Sharps, i.e., utility knife blades, saw blades, and broken light bulbs shall be disposed of properly.

NOTE: Utility knives must be disposed of in scrap metal dumpsters or in blade disposal Containers. Other sharp items, such as broken light bulbs and saw blades, must be disposed of in a manner that prevents injury to any person who may have exposure to the sharp items or to the person who will be collecting the sharp items for final disposal. Proper disposal methods include wrapping or boxing the sharp items.

ARTICLE 2 POWDER ACTUATED TOOLS

A. General

1. A powder-actuated tool is a type of nail gun used to join materials to hard substrates such as steel and concrete relying on a controlled burst created by a small chemical propellant charge.
2. Only those employees who are qualified by training shall use these tools.
3. Tool cartridges shall be carried and transported in approved containers.
4. Cartridges shall not be stored with flammable liquids.
5. Tool users shall be safeguarded by means of eye protection (safety goggles and face shields), along with hearing protection and hard hats.

B. Safe Work Practices for Powder Activated Tools

1. Prior to use, the operator shall ensure that the protective shield is properly attached to the tool.
2. Powder-actuated tools shall not be loaded until just prior to the intended firing.
3. Tools and cartridges shall not be left unattended.
4. Tools shall not be pointed at any person.

ARTICLE 3 PRESSURE WASHERS

A. General

1. During any pressurized water cleaning activity, the correct operation and application of the pressurized water equipment is the responsibility of the operator.
2. Only personnel who have been trained and have demonstrated knowledge and skill of pressure cleaning equipment operation to their leader's satisfaction shall operate pressure water equipment.
3. Operators responsibility includes: Area set up and barricaded off (depending on the location and task). Ensure precautions have been taken to protect electrical equipment. Ensure all hoses and fittings are in accordance to the owner's manual. Inspect the conditions of all hose and fittings prior to operating. Ensure the filter on the pump suction is clean and in good operating condition.
4. Pressurized water cleaning systems shall include at least one valve that will allow the operator to rapidly shut down and depressurize the equipment by dumping the water to atmosphere. This valve shall be checked prior to each use (minimum once each shift). Defective valves shall be repaired/replaced prior to start of work.
5. Everyone working around pressurized water cleaning operations shall wear clothing to provide protection from water and debris that may be created. Personal Protective Equipment shall be evaluated and selected for each job condition.
6. Suitable barriers shall be erected to restrict access to the hazard area and signs shall be posted to warn personnel that they are entering a hazardous area. The barriers should be outside of the effective range of the jet wherever possible.

ARTICLE 4 FIXED POWER TOOL PRACTICES

A. General

1. Machine tools shall be operated only by trained/qualified operators.

2. Employees shall not work on or around mechanical operating equipment while wearing neckties, loose clothing, watches, rings, or other jewelry. Badge and lanyard shall be secured. Gloves shall also be removed. When operating lathes, drill presses or milling machines, short sleeve or long sleeve shirts with sleeves rolled up and secured above the elbow with shirt tail tucked in shall be worn. Refer to the machines owner's manual.
    (a) If long sleeves are required to protect forearms while operating lathes, milling machines or drill presses, leader approval is required and the first 2-inches above the cuff shall be taped or secured using similar means. Gloves shall be worn while setting up or changing tools on the machine, but gloves shall not be worn while operating the machine.
3. Operators shall not reach through any openings in the housing of machine or power tool while in operation.
4. If the fixed machinery is not currently anchored, evaluate the possibility of the equipment to walk or tip over during operation. Based on the assessment results, anchoring of the machinery may be required and should be completed via the Corrective Action Program as appropriate.
5. The hazards of exposed cutting edges, sharp points, catch or pinch points, live electric parts or other moving or energized components shall be protected by guards, shields, covers, location, storage, and other appropriate means.
6. Prior to mounting a grinding wheel, it shall be checked to see that the spindle speed of the machine does not exceed the maximum operating speed indicated on the wheel.
7. Where tool rests are required, they shall be adjusted to a maximum of 1/8" from the wheel. The distance between the wheel periphery and the adjustable tongue on the end of the peripheral member at the top shall not be made with wheel in motion. When using grinders, proper grinding procedures shall be followed. Apply work gradually to a cold wheel. Do not use a wheel that is worn out of round, cracked, or chipped. The peripheral tongue guard shall be maintained not more than 1/4 inch from the wheel. Do not adjust the tool rest or tongue guard while the wheel is in motion.

ARTICLE 5 HAND TOOL PRACTICES

A. General Safeguards

1. Tools shall be inspected before, during, and after use.
2. When not in use, tools shall be stored properly and in a manner, such that they do not present the hazards of falling.
3. When hand tool is not in use, it shall be unplugged from its power source.

B. Specific Tool Precautions

1. The insulation on hand tools shall not be depended upon to protect users from electric shock.
2. If tools such as chisels, punches, drift pins, etc., become mushroomed or cracked, they shall be dressed, repaired or replaced before further use.
3. Pipe or other such material shall not be used to extend handles for added leverage unless the wrench was designed for such use.
4. Tools with sharp edges shall be stored and handled so that they will not cause injury or damage. They shall not be carried in pockets.
5. A file or rasp shall be equipped with a handle fitted and secured to the end designed to accept a handle, when in use.
6. When using a post driver, pre-use inspection is required to ensure you have the right tool for the job. The appropriate type and size post driver shall be used for the size and type of the post being driven. If you are in doubt on which driver to use, have a discussion with your leader on which post driver is appropriate for the job.

ARTICLE 6 PNEUMATIC AND HYDRAULIC TOOLS

A. General Safeguards

1. Compressed air shall not be used for cleaning purposes except where reduced to less than 30 psi and then only with effective chip guarding and personal protective equipment.
2. Hearing protection shall be used by employees when operating any air power tool whose noise levels exceed 85 DBA.

B. Safe Work Practices

1. Pneumatic and Hydraulic tools shall be secured to the hose or whip by a positive means to prevent the tool from becoming accidentally disconnected. When using a pneumatic tool, whose air hose exceeds 1/2 inch inside diameter, a safety device (OSHA valve) shall be installed at the source of supply or branch line.
    a) The OSHA valve needs to be the same size as the hose.
    b) For a continuous run of hose, regardless of length, a single OSHA valve is needed at the source.
    c) Hoses attached to a manifold are considered branch lines and require their own OSHA valve.
2. Safety clips or retainers shall be securely installed and maintained on rotating or impact tools to prevent attachments from being accidentally expelled.

NOTE: If using a "Chicago" type coupling, the product data indicates the fitting should not be installed directly to air driven tools such as drills and impact wrenches. The

SECTION IV 24 Revision 44 manufacturer recommends the use of a 3'-10' whip hose connected to the tool using a steel (non-cast) fitting.

3. The Company's or manufacturer's safe operating pressure for hoses, pipes, valves, filters and other fittings shall not be exceeded.
4. Manufacturers of "Cam and Groove" couplings (commonly referred to as "Camlock" couplings) have stated that these couplings are not to be used for air/gas service. OSHA has also stated that breathing air systems must have a unique coupling that cannot be confused with other systems. The standard coupling for liquid systems will be Camlock couplings, for nonbreathable gas systems will be "Thor" couplings, and for breathing air systems, will be "Hansen couplings".

ARTICLE 7 FUEL POWERED TOOLS

A. General

1. A fuel-powered tool shall be stopped and allowed to cool prior to being refueled, serviced or maintained.
2. Where refueling is done with a portable container, the container shall be an approved safety metal can with an automatic closing cap and flame arrester.

ARTICLE 8 120V/240V PORTABLE AND VEHICLE MOUNTED GENERATORS

A. General

1. 120/240 volt portable and vehicle mounted generators provide temporary electrical power for numerous work-related activities, such as working in remote locations where permanent electrical power is not available, during power outages and emergency situations. This would also include engine powered portable welders and lighting units equipped with 120/240-volt receptacle outlets.

NOTE: For the purpose of this section a "vehicle" is defined as all motorized and non-motorized means of transportation to include pick-up and utility type trucks, trailers, skids, cranes, carts, etc.Authorized generator(s) shall be 3-wire, 120/240 volt, single-phase with grounding type receptacle outlets. The generator's frame and all non-current carrying metal parts shall be electrically bonded to the generator's neutral winding. If mounted to a vehicle, the bonding shall also extend to the vehicle's frame. See information below for specific direction for grounding and bonding.

B. Prohibited Portable Generators

1. 120-volt two wire single phase portable generators are prohibited from use.

C. General Safety Practices

1. Operate and store portable generators only on firm level surfaces.
2. Generators shall not be modified in any way without concurrent written approval from both the Industrial Health and Safety Department and the Electrical Maintenance Section.

D. Electrical Hazards

1. Ground Fault Circuit Interrupter (GFCI) protection shall be used with all 120/240-volt receptacle outlets.
2. Ensure the generator is properly bonded and if required grounded (AKA "Earthing") by:
   (a) Verifying the portable generator's neutral winding, frame and the vehicle's frame (if vehicle mounted) are properly bonded to all the receptacle outlets' grounding terminals. This can be verified by a label which effectively reads "NEUTRAL BONDED TO FRAME". If the label is missing or you're unsure, contact your Leader.

E. Carbon Monoxide Hazards

1. Portable generators shall never be used indoors or within other enclosed areas, regardless of ventilation.
2. Portable generators shall be operated outdoors, as far away as practical from doors, windows, crawl spaces, pits, confined spaces or ventilation intakes to prevent exhaust fumes from entering.
3. Personnel working in close proximity to the generator(s) should consider using portable carbon monoxide monitors for additional safety.

F. Fire and Burn Hazards

1. Never add fuel, handle, or move the generator while it is running or is hot. Only add fuel when the generator's engine is warm to the touch.
2. Do not operate portable generators in close proximity to combustible materials such as fuel containers, tall grass, oily rags, paper, cardboard boxes, etc.

G. Vibration and Rotating Parts Hazards

1. Ensure portable generators are properly secured so they do not "walk" due to operational vibration.
2. Ensure all guards are in place and all rotating and/or moving parts are adequately protected from accidental contact.

SECTION V MATERIAL SAFETY

ARTICLE 1 MATERIAL HANDLING AND STORAGE PRACTICES

A. Loading and Unloading Trucks at the Dock

1. Employees shall not place skids or materials near the edge of the platform or loading dock. Allow a working space of approximately 12" between the edge of the dock and the material.
2. Trucks shall be backed flush against the dock, the brakes set, and wheels chocked.

3. Materials shall be either passed from one person to another or carried in and out of the truck. It shall never be tossed or thrown.

B. Items of unusual size and shape shall be secured before movement.

C. Handling Barrels and Drums

1. To roll a drum or barrel, workers shall push against the side with the hands. They shall not grasp the end of the drum nor use their feet to push the drum or barrel to change direction of the roll.

D. Wire

1. When cutting a long length of wire with bolt cutters or pliers, secure both ends to prevent the wire from springing back. If a short piece of wire is to be cut off the coil, secure the end which is left on the roll to prevent springing.

E. Handling Conduit and Pipes

1. Pipes, conduits, reinforcing rods and other conducting material shall not be carried on the shoulders near exposed live electrical equipment or conductors.

F. Material Storage

1. Maximum safe floor loads shall not be exceeded.
2. All materials stored in tiers shall be tacked, stacked, blocked, interlocked or otherwise secured to prevent sliding, falling or collapse.
3. Designated aisles and passageways shall be kept clear approximately 3 feet to provide for the free and safe movement of material handling equipment and employees.
4. Barrels and drums shall be stored on end or securely blocked to prevent rolling.
5. When storage under or near energized lines or equipment is necessary, proper safe zone clearances shall be maintained and extreme care shall be taken when moving materials into and out of such storages. Contact your leader for determination of safe zone clearance or Safety.
6. Materials such as piping, metal bars and strips that are kept in racks shall not protrude into aisles and walk areas.
7. There shall be no storage of materials in stairwells or under stairs.

ARTICLE 2 DROPPED ITEM PREVENTION PLAN

A. General

1. This section outlines the basic requirements of leadership and front line employees to develop a Dropped Item Prevention Plan. The purpose of this Dropped Item Prevention Plan is to eliminate the exposure of falling objects. Collective measures shall be put in place when working at heights or, to stop the chain of events that can result in injury due to a dropped item. These measures or barriers may be herculite, netting, lanyards, etc. A dropped item is any item that is dropped and escapes the first level of containment/control. It is vitally important for anyone working at heights to properly secure tools and other objects so they won't fall.
2. The requirements detailed in the Dropped Item Prevention Plan are a minimum set of requirements. All employees are encouraged to use other means at their disposal to reduce the likelihood of a dropped item event.
3. Following a dropped item event, verbal notification to the on-call Industrial Health and Safety Consultant shall be made as soon as possible, but no later than end of shift. The Industrial Health and Safety Consultant shall be provided with the weight of the dropped item and the distance it was dropped.

B. Responsibilities

1. Site Management: Has a responsibility to ensure sufficient resources are available to develop, implement and maintain the Dropped Item Program. Specifically, Site Management is responsible for:
    (a) Promoting the Dropped Item Prevention Plan to all site personnel
    (b) Providing leadership and support for the plan

(c) Communicating the expectations of the Dropped Item Prevention Plan

2. Front Line Leaders: Front line leaders (typically team leaders) have the responsibility to ensure that all employees under their direct supervision have the resources to perform their work safely. The leader is responsible for:
    (a) Monitoring work locations to ensure compliance with the Dropped Item Prevention Plan
    (b) Ensuring that all hazards that could contribute to a dropped item event have been eliminated
    (c) Evaluating work locations for changing conditions
    (d) Engaging employees during pre-job briefs in discussion of the requirements of the Dropped Item Prevention Plan
    (e) Regularly checking on new employees until you are comfortable such workers can properly follow and adhere to the established Dropped Item Prevention plan
    (f) Educating employees on dropped item prevention tools
    (g) Developing enough barriers to reasonably interrupt the normal course of events that would lead to a dropped item when working at heights or above grating
    (h) Continually throughout the shift, inspecting working areas to ensure worker compliance with dropped item prevention tools and techniques
    (i) Making available and ensuring the use of tool lanyards when there is a possibility of working outside a barrier at heights or above grating
    (j) All personnel:
    (k) Accepting individual responsibility for their own safe behaviors
    (l) Maintaining a pro-active role in the implementation of the Dropped Item Prevention Plan
    (m) Complying with the requirements of the Dropped Item Prevention Plan to ensure a safe work place
    (n) Maintaining control of tools and materials to prevent items from falling
    (o) When working with small equipment, screws, bolts, nuts, etc., ensuring dropped item
    (p) prevention barriers are in place prior to performing work
    (q) Constantly monitoring and inspect the work area for additional dropped item barriers
    (r) Using tool lanyards when working at heights, i.e. working on or in scaffold, scissor lift,
    (s) ladders, JLG, buckets, etc. and when working above personnel

C. Material Handling

1. Employees shall utilize the “twist method” when passing material. The “twist method” allows for employees to twist the material upon receiving, prior to the sender releasing the material. This should ensure the receiver has control of the load prior to the sender releasing the load.
2. All material shall be raised or lowered using a securely fastened canvas bag. Inspect canvas bags for cuts in the rope handles, signs of the rope unraveling, and cuts or tears in the leather bottom.
3. Weight shall not exceed 150 pounds.
4. Plastic containers (e.g., buckets, pails, etc.) shall not be used to raise/lower material, however, such containers may be used for transporting tools and equipment to and from work locations.
5. Appropriate containers shall be available and used while climbing ladders to keep an individual’s hands free while climbing.
6. If material is of the size, shape or weight where a canvas bag is not appropriate, the material shall be securely fastened before raising or lowering.

7. Radios shall be secured in a radio holster attached to an individual's belt, clipped to the belt, taped securely, or attached to a lanyard.
8. Leaders shall determine which tasks require the use of tool lanyards. If it is determined that lanyards are not practical, leaders shall determine other controls to prevent personnel injury or property damage from dropped items.

D. Overhead Work

1. It is the responsibility of all employees working overhead to protect all personnel and equipment below them from overhead hazards by the use of defense in depth strategies for preventing a dropped item event (i.e., netting, toe boards, signs, lanyards, etc.).
2. If employees cannot be adequately protected, the leader shall eliminate the hazard by removing employees from beneath overhead work.
3. Employees shall erect barriers and signs or use spotters to prevent personnel from entering an area where the potential for a dropped item event is relatively high.

E. Storage

1. Ensure that all material and equipment is properly secured at the end of each shift, or at the completion of the job, or when there is an extended period where the work station will be unattended.
   (a) Where equipment and material are commonly stored, the use of sheet metal, fire cloth, herculite, etc., shall be used to prevent small items from falling through grating.
   (a) Smaller material and equipment (i.e., grinders, hand tools, etc.) shall be stored and secured in appropriate containers to prevent them from tipping over.
   (a) Excess chain from chain falls shall be stored and/or secured in appropriate containers.

F. Worksite Evaluations

1. Use the two-minute drill to evaluate your workplace for dropped item hazards.
2. Ensure that scaffold has netting and toe boards, if appropriate.
3. Inspect work areas for gaps that tools and materials could fall through.
4. Check tarps and fire blankets for hidden tools or materials that could drop.
5. Ensure that tool lanyards are attached to all tools and materials as required.
6. Notify personnel below of any activity where there is a potential for a dropped item.
7. Determine if overhead protection should be installed in your workplace.
8. Ensure that all tools and materials be kept to a minimum and in a bucket or secured.

G. Tool Lanyard Safe Work Practices

1. All equipment shall be inspected prior to each use and routinely during use.
2. Any product exhibiting deformities, unusual wear or deterioration must be immediately removed from service and discarded.
3. The user shall know the working load limit of the product being used, and not exceed those limits.
4. Personnel shall not exchange, replace, or repair components of the lanyard.
5. Personnel shall not tie knots in the lanyard or attach multiple lanyards together.
6. In situations where tooling weighs more than 3 pounds, evaluate alternative approved attachment points other than your person.

ARTICLE 3 COMPRESSED GAS CYLINDER STORAGE AND HANDLING PRACTICES

A. General

1. Serious accidents may result from the misuse, abuse or mishandling or improper storage of compressed gas cylinders. Employees shall handle and store compressed gas cylinders so as to not create a toxic or explosive atmosphere in the work area.
2. Only non-sparking tools shall be used when working with flammable gas cylinders.

NOTE: Duster and other brands of compressed gas (small disposable cans), used to clean computers or other electronic equipment are exempt from the requirements of this section.

3. Damaged or leaking cylinders shall not be used but returned to the manufacturer for repairs as soon as possible.
4. A sign "Danger - No Smoking" shall be posted where oxygen or flammable gases are used or stored.

B. Storage Practices

1. Compressed gas cylinders, whether full or empty, whether in storage or in use, shall be stored in a protected, well-ventilated area and secured in an upright position such that they cannot fall or be upset. They shall not be secured to safety-related structures or components. The requirement for upright storage does not apply to cylinders containing breathing.
2. Compressed gas cylinders shall not be stored in the proximity of combustible materials, furnaces, radiators, etc.
3. Compressed gas cylinders shall not be stored inside of a flammable liquid storage cabinet.
4. Oxygen cylinders shall not be stored near highly combustible material, especially oil and grease; or near reserve stocks of carbide and acetylene or other fuel-gas cylinders, or near any other substance likely to cause or accelerate fire; or in an acetylene generator compartment.
5. Smoking, welding, or open flames are prohibited in the vicinity (20') of stored Oxygen and/or fuel Gas Cylinders or bulk storage areas.
6. Oxygen cylinders in storage shall be separated from fuel/gas cylinders or combustible materials (especially oil or grease) a minimum distance of 20 feet or by a 5 foot high non-combustible barrier having a fire-resistance rating of at least one-half hour.

C. Handling Practices

1. Always consider cylinders as being full and handle them with corresponding care. Ensure personnel have the appropriate gloves for the task.
2. Cylinders may be rolled on their bottom edge but never dragged. Cylinders weighing more than 40 pounds (18.2 kg) (total) shall be transported on a hand or motorized truck, suitably secured to keep them from falling.
3. When compressed gas cylinders are to be transported in vehicles, they shall be kept in the upright position. Valve protection caps shall not be used for lifting cylinders. Do not transport cylinders in closed vehicles.
4. When empty cylinders are to be returned to the vendor, tag them EMPTY. Close the valves and replace the valve protection caps, if the cylinder is designed to accept a cap.
5. Make sure the threads on a regulator or union correspond to those on the cylinder valve outlet. Do not force connections that do not fit.
6. Do not use a cylinder of compressed gas without a pressure-reducing regulator attached to the cylinder valve, except where cylinders are attached to a manifold, in which case the regulator will be attached to the manifold header.
7. Use regulators and pressure gauges only with gases for which they are designed and intended. Do not attempt to repair or alter cylinders, valves, or attachments. This work shall be done only by the manufacturer.
8. Never use oil or grease as a lubricant on valves or attachments of oxygen cylinders. Keep oxygen cylinders and fittings away from oil and grease, and do not handle such cylinders or apparatus with oily hands, gloves, or clothing.
9. Compressed gas cylinder valves shall be closed upon completion of work and prior to moving the cylinder. Before a regulator is removed from a cylinder valve, close the cylinder valve and release the gas from the regulator.

10. Never bring cylinders into tanks, unventilated rooms, or other closed quarters.
11. When recharging bulk systems with hydrogen or other gases, delivery trucks shall be properly grounded and care taken to eliminate sparks or other sources of ignition.
12. When using an elevator to transport a leaking compressed gas cylinder an O2/combustible gas monitor must be present.

SECTION VI ELECTRICAL SAFETY

ARTICLE 1 TEMPORARY ELECTRICAL SUPPLY/EXTENSION CORD USAGE

A. Extension Cord General Information (CRDRs 3076515, 3097356)

1. All extension cords used shall be installed in accordance with applicable sections of OSHA standards and the National Electric Code (NEC).
2. This section applies to all extension cords used at voltages less than 480 volts.
3. Only three wire extension cords with a grounding conductor are authorized for use.
4. The minimum wire size of extension cords shall be 14 AWG or larger however 12 AWG is preferred.
5. Only qualified individuals may repair, rework or fabricate extension cords. If an extension is to be fabricated, all materials used shall be listed and labeled for this specific application, e.g. metal receptacle boxes shall not be used, etc.
6. All factory assembled extension cords shall be approved by a Nationally Recognized Testing Laboratory (NRTL) such as Underwriters Laboratory (UL).
7. All extension cords shall be GFCI protected in accordance with Article 2.

B. Prohibited Use

1. Extension cords and cables shall not be used for the following:
    (a) As a substitute for the fixed wiring of a structure or in place of permanent wiring.
    (b) Where run through holes in walls, structural ceilings, suspended ceilings, dropped ceilings or floors as a permanent install.
    (c) Where concealed by walls, floors, carpets or ceilings or located above suspended or dropped ceilings.
    (d) Where installed in active raceways.
    (e) Where subject to physical damage, e.g. sharp corners, hot surfaces, heat sources, etc.
    (f) Connected to or fed from a Power Strip (Re-locatable Power Tap [RPT]).
2. Extension cords are permitted to be run through doorways, windows or similar openings but only when protection from damage is provided.
3. Extension cords shall not be overloaded, i.e. powering equipment which draws more current than the rating of the cord.

C. Extension Cord Safety Practices

1. The user shall visually inspect the extension cord prior to installation and before each use for the following:
    (a) External signs of damage, excessive wear or defects.
    (b) Loose, broken or missing male ground prong.
    (c) Signs of overheating or discoloration.
    (d) Exposed wires or lack of strain relief at the connectors.
    (e) Pinched or crushed outer cable jackets which could hide internal damage.
    — If any signs of compromise are discovered during the inspection, it shall not be used and immediately taken out of service.
2. Extension cords and cables shall not be placed across pedestrian or vehicular traffic areas without the use of adequate cord protectors.

3. Whenever possible, route extension cords overhead using securing means which will not damage the cable's jacket, e.g. tie wraps, rope, etc.
4. Extension cords shall be routed away from wet areas and water as much as practical.
5. Extension cords no longer in use shall be unplugged and removed from the area.
6. Ensure extension cords are fully plugged into the receptacle outlet.
7. Consideration should be given for using a connector protector such as the "Twist and Seal Maxx" when extension cords are used with electric tools or when installed outdoors or in damp/wet areas.

D. Power Strips (Re-locatable Power Taps [RPTs]) Safety Practices

1. Power strips shall be directly connected to a permanently installed receptacle outlet. They shall not be series-connected ("Daisy Chained") to other power strips or connected to extension cords.
2. Power strips are not designed for high power loads such as space heaters, refrigerators, microwave ovens, etc. They shall only be used with low power loads such as computers, their peripherals (e.g. printers, monitors, etc.), phone chargers, audio/video equipment, etc.
3. Power strips shall not be used outdoors or for construction or industrial maintenance activities.
4. The user shall visually inspect the power strip prior to installation and before each use for the following:
    (a) External signs of damage, excessive wear or defects.
    (b) Loose, broken or missing parts, especially the male ground prong.
    (c) Signs of overheating or discoloration.
    (d) Exposed wires or lack of strain relief at the connectors.
    (e) Pinched or crushed outer cable jackets which could hide internal damage.
    — If any signs of compromise are discovered during the inspection it shall not be used and immediately taken out of service.
5. Long term "in use" power strips should be periodically inspected by the user.

ARTICLE 2 120/240 VOLT GROUND FAULT CIRCUIT INTERRUPTERS (GFCI)

PART I

A. Purpose

GFCI protection lessens the dangers from electrical shock hazards to employees using extension cords, electric tools, test equipment, etc.

CAUTION: GFCIs do not protect personnel from shock hazards where contact is made between phase-to-neutral or phase-to-phase conductors.

1. Approved GFCI protection shall be UL listed and provided by one of the following:
    (a) Permanently wired GFCI receptacle outlets.
    (b) Receptacle outlets protected by GFCI breakers.
    (c) Portable GFCI "pig tails" devices rated for wet/outdoor use.
    (d) Tools or extension cords equipped with built in "hard wired" permanent GFCI devices rated for wet/outdoor use.
2. Application - GFCI protection shall be used with:
    (a) All extension cords and installed at the source end of the cord.
    (b) Portable electric tools and devices such as pumps, drills, saws, hand grinders, pressure washers, drop lights, vacuum cleaners, industrial sized fans (excludes small personal fans used in offices), portable HVAC equipment, welders, battery chargers, test equipment (including but not limited to breaker test sets, oscilloscopes, multi-meters, timers, power supplies, etc.) and portable monitoring equipment (including but not limited to RM-3 friskers, video monitors, recorders,

video cameras, Continuous Air Monitors, etc.) regardless if they are "Double Insulated" or not.

(c) Computers, laptops, their associated peripherals, kitchen appliances and uninterruptable power supplies (UPS) are required to be GFCI protected (input and output sides of UPS) when used in industrial environments outside of permanent conventional indoor office locations.

(d) Whenever electrical power is derived from portable generators.

(e) Whenever electrical power is used in damp or wet environments or used outdoors.

EXEMPTION: Equipment which is not compatible with GFCI protected circuits or if using GFCI protection would create a greater hazard if power is interrupted may be exempted from GFCI requirements through the implementation of the Assured Equipment Grounding Conductor Program (AEGCP) in accordance with Part II.

3. Usage, Inspection and Testing shall be conducted prior to each use as follows:

(a) Inspect the GFCI receptacle outlet or device for any signs of damage.

(b) Test the GFCI prior to use by following the testing sequence below. A UL approved GFCI tester may be used during the test.

- Push the "RESET" button to prepare the unit for testing.
- Plug a piece of electrical equipment (a light is suggested) into the GFCI circuit and turn it on. The equipment should go on.
- Push the "TEST" button and verify it trips off. The equipment should go off.
- Push the "RESET" button again and ensure the trip clears. The equipment should go on again.

CAUTION: If any damage is observed or if the GFCI fails the test, DO NOT USE and immediately remove it from service.

WARNING: The "TEST/RESET" button shall not be used as an "ON/OFF" control switch to energize or de-energize equipment unless the buttons are specifically marked "ON" and "OFF".

PART II

ASSURED EQUIPMENT GROUNDING CONDUCTOR PROGRAM (AEGCP)

A. Purpose

A written AEGCP has been established to allow personnel flexibility from mandatory GFCI protection as outlined in Part I for certain electrical/electronic equipment which by design is not compatible with such protection or where the use of GFCI protection would create a greater hazard to personnel if electrical power were interrupted, e.g. breathing air compressors. The AEGCP is valid for 6 months (180 days) from the date of the inspection.

1. Supervision/Safety shall:

(a) Verify and approve any exemption from GFCI protection is valid.

(b) Ensure only a competent person(s) implements the AEGCP in lieu of GFCI protection and approves such exemptions on a case by case basis.

(c) Ensure all AEGCP inspection and testing results are properly documented in the AEGCP log (Appendix A).

(d) Ensure the AEGCP log is retained by their responsible work group for the entire duration the equipment is in service.

(e) Be responsible for maintaining the "Official record" of the AEGCP for their work group. It shall be made available for inspection by OSHA/ADOSH inspectors and any employee upon demand. Competent Person is defined as "One who is capable of identifying existing and predicting hazards in the surroundings or working conditions that are unsanitary, hazardous or dangerous to employees and has authorization to take prompt corrective measures to eliminate them."

2. AEGCP User shall:
   (a) Be a Competent Person.
   (b) Verify all equipment to be tested IS NOT ENERGIZED prior to performing the AEGCP.
   (c) Visually inspect each cord set, attachment cap, plug and receptacle of cord sets and any equipment connected by the cord and plug for damage.
   (d) Ensure the equipment grounding conductor is correctly attached to its proper terminal.
   (e) Ensure all equipment grounding conductors are tested for continuity (≤ 1 ohm) and are electrically continuous.
   (f) Ensure the required inspection and testing is performed before first use, before equipment is returned to service following any repairs, after any incident which can reasonably be suspected to have caused damage and intervals not to exceed 6 months (180 days).
   (g) Ensures all inspections and testing results are properly documented in the AEGCP Log(Appendix A).

ARTICLE 3 OVERHEAD ELECTRIC POWER LINES/EXPOSED ENERGIZED EQUIPMENT

A. Procedures

1. When using cranes or similar mobile equipment near overhead electric power line and/or exposed energized equipment, refer OSHA CFR1926.960

SECTION VII MECHANICAL SAFETY

ARTICLE 1 CUTTING AND WELDING PRACTICES

A. General

1. Welding and cutting shall be performed only by properly trained employees wearing approved personal protective equipment. Long sleeves shall be worn as part of the personal protective equipment when welding, cutting, brazing, heating, or grinding. Personnel involved in welding may use any welding equipment for which they have been properly trained and qualified. Welder trainees or welder helpers shall be under the direction of the welder and the leader.
2. Hot Work Authorization Permits are required for all welding, cutting, brazing, heating or grinding in areas that have been determined and designated as a fire precaution area.
3. Safety signs, shields, or barricades shall be placed around welding and cutting jobs where needed to protect employees and the public from welding arc or flame.

B. Welding Operations

1. Welding helmets and hand shields shall be used during all arc welding or arc cutting operations, excluding submerged arc welding. Goggles shall also be worn during arc welding or cutting operations to provide protection from injurious rays from adjacent work, and from flying objects. The goggles may have either clear or colored glass, depending upon the amount of exposure to adjacent welding operations. Helpers or attendants shall be provided with proper eye protection.

2. Welding cables shall not be placed where they will block walkways or passageways. Welding cable shall not be allowed to lie in water or oil.
3. When not in use or workers are not in the vicinity, welding machine shall be turned off.

C. Eye Protection

1. While welding is taking place, personnel exposed to infrared or ultraviolet light are required to wear shaded lens appropriate for the welding operation.
2. Welding screens shall be used to prevent accidental exposure to the public.
3. Ordinary untreated plastic lenses do not adequately absorb ultraviolet light, and shall not be used to protect eyes from welding.

D. Welding in Confined Spaces

1. A cylinder or welding power source used in a confined space shall be placed and secured on the outside of the space where work is being performed. If welding is suspended for lunch, overnight or any prolonged period, the torch and hoses shall be removed from the space.
2. Non-sparking tools shall be used if there is a possibility of an explosive atmosphere.

ARTICLE 2 GRINDING OPERATIONS

A. General

1. Do not use a bench or floor-stand grinder when any of the following conditions exist:
    (a) Guard is not installed.
    (b) Grinder not securely anchored.
    (c) If the work rest exceeds 1/8” distance from the wheel.
    (d) If the adjustable tongue exceeds 1/4” distance from the wheel.
    (e) If excess wear is evident on the grinding wheel.
    (f) If the wheel is chipped, cracked, out of round, or otherwise defective.
2. Grinding wheel shall not be operated in excess of the rated safe speed.
3. Do not side-grind unless both the grinder and the grinding wheel are designed specifically for this type of grinding
4. Check the grinding wheel mounting flanges for equal sizes and correct diameters. Flanges are to be at least 1/4 diameter of the wheel diameter.
5. Do not stand directly in front of any grinder when first starting it up.
6. Never force grinding stock into the wheel of a fixed grinder or force a portable grinder into the work to the point where the motor slows noticeably or the work becomes excessively hot.
7. Shatter resistant bulbs shall be used for stand/bench mounted shop grinders.

B. Cut Off Wheels

1. This tool is designed to perform a specific function and the manufacturer provides specific guidance on how to use the tool safely. The more delicate the tool, the more care and instruction it requires.
2. The standard cut-off wheel to be used on a grinder is the 5/64 wheel.
3. When it becomes necessary to use a cut-off wheel smaller (thinner) than a 5/64 wheel, a job hazard analysis (JHA) shall be developed and implemented
    (a) The JHA shall include the manufacturer’s instructions for safe use of the tool, be approved by the employee’s leader and reviewed by the Industrial Health and Safety Department prior to use.

ARTICLE 3 METAL/WOOD WORKING PRACTICES

A. General

1. Machinery shall only be operated by authorized personnel.
2. Use a brush or other suitable means to remove chips, dust, or other material from machines.

3. Where the work must be held in position, it is securely bolted or clamped to the table or held in a vise or jig. Do not try to hold it by hand.
4. Ensure all guards are in place and properly adjusted before operating the machine.
5. Repairs and replacement of knives, blades, etc., shall only be performed by trained persons and only when the machine is powered off.
6. Do not use radial arm or swing saw if the blade will travel beyond the edge of the table.
7. Adjust anti-kickback fingers on both sides and the splitter before ripping materials on a radial or table saw.
8. Employees shall not work on or around mechanical operating equipment while wearing neckties, loose clothing, watches, rings, or other jewelry. Badge and lanyard shall be secured. Gloves shall also be removed. When operating lathes, drill presses or milling machines, short sleeve, or long sleeve shirts with sleeves rolled up and secured above the elbow with shirt tails tucked in shall be worn. If long sleeves are required to protect forearms while operating lathes, milling machines or drill presses, leader approval is required and the first 2-inches above the cuff shall be taped or secured using similar means. Gloves shall be worn while setting up or changing tools on the machine, but gloves shall not be worn while operating the machine.

SECTION VIII
HAZARD COMMUNICATION PROGRAM

A. Hazard Communication Program

1. Introduction

LLR Electric is committed to preventing accidents and ensuring the safety and health of our employees. We will comply with all applicable federal and state health and safety rules. Under this program employees are informed of the contents of the OSHA Hazard Communications Standard, the hazardous properties of chemicals with which they work, safe handling procedures and measures to take to protect themselves from these chemicals. These chemicals may be physical or health-related. This written hazard communication plan is available for review by all employees on line or located in your field office.

2. Identifying Hazardous Chemicals

A list is attached to this plan that identifies all hazardous chemicals with a potential for employee exposure at this workplace. Detailed information about the physical, health, and other hazards of each chemical is included in a Safety Data Sheet (SDS); the product identifier for each chemical on the list matches and can be easily cross-referenced with the product identifier on its label and on its Safety Data Sheet.

3. Identifying Containers of Hazardous Chemicals

The labeling system to be used by LLR Electric will follow the requirements in the 2012 revision of the OSHA Hazard Communication Standard to be consistent with the United Nations Globally Harmonized System (GHS) of Classification of Labeling of Chemicals. The label on the chemical is intended to convey information about the hazards posed by the chemical through standardized label elements, including symbols, signal words and hazard statements.

All hazardous chemical containers used at this workplace will have:

1. The original manufacturer's label that includes a product identifier, an appropriate signal word, hazard statement(s), pictogram(s), precautionary statement(s) and the name, address, and telephone number of the chemical manufacturer, importer, or other responsible party
2. A label with the appropriate label elements just described
3. Workplace labeling that includes the product identifier and words, pictures, symbols, or combination that provides at least general information regarding the hazards of the chemicals. Field leaders will ensure that all containers are appropriately labeled. No container will be released for use until this information is verified. Workplace labels must be legible and in English. Information in other languages is available on line. Small quantities intended for immediate use may be placed in a container without a label, provided that the individual keeps it in their possession at all times and the product is used up during the work shift or properly disposed of at the end of the work day. However, the container should be marked with its contents.

4. Keeping Safety Data Sheets (previously known as Material Safety Data Sheets)
   The manufacturer or importer of a chemical is required by OSHA to develop a Safety Data Sheet (SDS) that contains specific, detailed information about the chemical's hazard using a specified format. The distributor or supplier of the chemical is required to provide this SDS to the purchaser.
   SDS's are readily available to all employees during their work shifts. Employees can review SDS for all hazardous chemicals used at this workplace. Which can be sent to you via email or hard copies can be found in field locations. The SDS's are updated and managed by the LLR Electric Safety Manager. If a SDS is not immediately available for a hazardous chemical, employees can obtain the required information by calling Rusty Day 623-692-9743.
5. Training Employees about Chemical Hazards
   Before they start their jobs or are exposed to new hazardous chemicals, employees must attend a hazard communication training that covers the following topics:
   - An overview of the requirements in OSHA's Hazard Communication Standard.
   - Hazardous chemicals present in their workplace.
   - Any operations in their work area where hazardous chemicals are used.
   - The location of the written hazard communication plan and where it may be reviewed.
   - How to understand and use the information on labels and in Safety Data Sheets.
   - Physical and health hazards of the chemicals in their work areas.
   - Methods used to detect the presence or release of hazardous chemicals in the work area.
   - Steps we have taken to prevent or reduce exposure to these chemicals.
   - How employees can protect themselves from exposure to these hazardous chemicals through use of engineering controls/work practices and personal protective equipment.
   - An explanation of any special labeling present in the workplace.
     - o What are pictograms?
     - o What are the signal words?
     - o What are the hazard statements?
     - o What are the precautionary statements?
   - Emergency procedures to follow if an employee is exposed to these chemicals LLR Electric is responsible to ensure that employees receive this training. After attending the training, employees will sign a form verifying that they understand the above topics and how the topics are related to our hazard communication plan. Prior to introducing a new chemical hazard, each employee will be given information and training as outlined above for the new chemical hazard.
6. Informing Employees who do Special Tasks

Before employees perform special (non-routine) tasks that may expose them to hazardous chemicals, their leader will inform them about the chemicals' hazards. Their leader also will inform them about how to control exposure and what to do in an emergency. The employer will evaluate the hazards of these tasks and provide appropriate controls including Personal Protective Equipment all additional training as required.

7. Informing contractors and other employers about our hazardous chemicals
   If employees of other employer(s) may be exposed to hazardous chemicals at our workplace (for example, employees of a construction contractor working on-site) It is the responsibility of the LLR Electric Leader to provide contractors and their employees with the following information:
   - The identity of the chemicals, how to review our Safety Data Sheets, and an explanation of the container labeling system.
   - Safe work practices to prevent exposure. The LLR Electric Safety Manager will also obtain a Safety Data Sheet for any hazardous chemical a contractor brings into the workplace.

Health Hazard 	**Flame** 	**Exclamation Mark** 
• Carcinogen • Mutagenicity • Reproductive Toxicity • Respiratory Sensitizer • Target Organ Toxicity • Aspiration Toxicity	• Flammables • Pyrophorics • Self-Heating • Emits Flammable Gas • Self-Reactives • Organic Peroxides	• Irritant (skin and eye) • Skin Sensitizer • Acute Toxicity (harmful) • Narcotic Effects • Respiratory Tract Irritant • Hazardous to Ozone Layer (Non Mandatory)
Gas Cylinder 	**Corrosion** 	**Exploding Bomb** 
• Gases under Pressure	• Skin Corrosion/ burns • Eye Damage • Corrosive to Metals	• Explosives • Self-Reactives • Organic Peroxides
Flame over Circle 	**Environment *(Non Mandatory)** 	**Skull and Crossbones** 
• Oxidizers	• Aquatic Toxicity	• Acute Toxicity (fatal or toxic)

Section VIIII
Heat Stress Prevention Program

PURPOSE AND SCOPE

1. Purpose

1.1. The purpose of this procedure is to define the minimum practices and precautions necessary to perform work in hot environments. The goal is to help ensure the health and safety of personnel performing work in hot environments.

2. Scope

2.1. This procedure must be used for environments with unusually high humidity and when temperature exceeds 100°F.

2.1.1. Examples may include, but are not limited to, near cooling towers or working around steam leaks.

2.2. This procedure must be considered for all tasks using heavy or impermeable protective clothing (such as acid suits or plastics).

3. RESPONSIBILITIES

3.1. Worker

3.2. Cognizance of their current physical health and any factors which may increase their susceptibility to heat stress. These factors include, but are not limited to, the following:

- More than 50 years of age.
- Current personal illness.
- Elevated blood pressure (in excess of 160/100).
- Elevated pulse rate (in excess of 100 bpm resting pulse rate).
- Previous cases of heat illness.
- Recent extensive sunburn.
- Pulmonary disease.
- Current use of prescription as well as over the counter medications (diuretics, vasodilators, antihistamines, muscle relaxants, or beta blocking agents).

3.3. Personnel with risk factors shall discuss these issues with their Leader or with their medical physician prior to beginning any task governed by this procedure to determine if medical evaluation, countermeasures, or other precautions are warranted.

3.4. Notification of their Leader if any job presents a previously unrecognized heat stress potential.

3.5. Maintains proper hydration in potential heat stress situations.

3.6. Compliance with relevant aspects of the control measure chose (heart rate monitoring method or alternative method, including proper use of heart rate monitors, Fit bits, and recovery times).

3.7. Ensure to notify leader and co-workers when leaving the area due to self-determination.

3.8. Leader

3.9. Reviews jobs in relation to work environment, work load and clothing worn to determine if potential heat stress conditions exist.

3.10. Discussion of susceptibility factors with any workers who make them aware of such issues to determine if medical evaluation or other precautions are warranted.
3.11. Determination of the prevention strategy (heart rate monitoring method, Fit bits or alternative method) to be used.
3.12. If the heart rate monitoring/fit bits method is utilized, ensure the following:
- All workers are familiar with the operation of the heart rate/fit bits monitors.

3.13. If the Alternative Evaluation method is utilized, ensure the following:
- Ensure that a completed form is available.
- Ensure that employees are familiar with the method and any limitations that may exist.

3.14. Contact Industrial Health and Safety for additional assistance as necessary
3.15. Reviews jobs in relation to work environment, work load and clothing worn to determine if potential heat stress conditions exist.
3.16. Management/Job Scheduling
3.17. Considers potential heat stress conditions for tasks.
3.18. Determines if tasks with a high heat stress potential can be scheduled to reduce heat stress potential.

4. Industrial Safety

4.1. Provides oversight and consultation regarding the Heat Stress Procedure.
4.2. Reviewing and evaluating the Heat Stress Prevention Program on a semiannual basis to incorporate lessons learned. The semiannual evaluation shall consist of a review of heat stress cases since the last evaluation, including:
- Type of control method utilized.
- Recommendations to prevent recurrence.

4.3. Assists Leaders and Workers as necessary in the evaluation of potential heat stress situations.
4.4. Assists Leaders, Project Managers, or Workers as necessary in the determination of countermeasures and subsequent stay time extensions.

5. Medical Physician

5.1. Determines individual physical qualifications for working High Heat Stress Potential Tasks.
5.2. Restriction of personnel from working High Heat Stress Potential Tasks, as necessary, based on physical qualifications.

6. Management

6.1. Provides resources to ensure compliance with this procedure.

7. DEFINITIONS

7.1. **Acclimation** — A physiological change which occurs as an adaptation to working in hot environments over a period of time. This adaptation results in increased sweating, earlier onset of sweating, more even distribution of sweating, decreased salt loss, a lower basal core temperature and decreased cardiovascular demands. Both heat and physical labor are required to initiate this change. Usually a minimum of two hours per day of labor in a hot environment over a period of eight to ten days is required for the complete process to occur.
7.2. **Dry Bulb Temperature** — Ambient air temperature in degrees Fahrenheit measured with a standard thermometer.

7.3. **Emergency Operations** — Activities performed that are related to an immediate safety issue to protect personnel or the public. This includes rescue, fire suppression, emergency medical care, emergency site security incidents, and placing plant equipment in a safe condition. Using the provisions of this emergency contingency shall not be invoked for operational or maintenance convenience.

7.4. **Globe Temperature** — A temperature measurement which calculates contributions of radiant heat using a specially designed thermometer encased in a blackened copper globe.

7.5. **Heat Related Illness** — An adverse physiological effect due to the inability of the body to remove excess heat from the body's core. It encompasses a range of progressive conditions including heat cramps, heat exhaustion, heat syncope (fainting), and heat stroke.

7.6. **Heat Stress** — The elevation of the body's core temperature above 100.4°F.

7.7. **Heat Stress Environment** — An environment with extreme environmental factors.

7.8. **High Heat Stress Potential Task** — A task with a regulated "stay time" of 30 minutes or less.

7.9. **Hold Point** — A period of time, when reached, where Workers will conduct a Two Minute Drill to ensure all personnel remain fit for work before continuing with the task. Hold points can vary depending on the work environment, task, and type of PC worn, but will generally be from 45-90 minutes. See Appendix D for further information.

7.10. **Recovery Time** — The time period required for a person's physiological state to return to normal following exposure to a heat stress environment. For personnel using the heart rate method, recovery time is the time necessary for the person's heart rate to return to its resting level. For the stay time calculation method, the recovery time calculation is (time spent in the hot environment ÷ stay time) x 60 minutes. During recovery times personnel should remove any outer protective garment and only engage in light work load activities.

7.11. **REP** — Radiation Exposure Permit.

7.12. **Self Determination** — The method by which an individual may begin to recognize the early warning signs of heat related illness. Self determination can and should be used to shorten assigned stay times, but never to lengthen them.

7.13. **Stay Time** — The maximum amount of time a worker can remain in a heat stress environment without physiological monitoring. It is dependent on the work environment, work load being performed, and clothing worn. Personnel are not compelled to remain in the hot environment for the entire assigned stay time and may leave at any time due to self-determination.

7.14. **Wet Bulb Globe Temperature (WBGT)** — A heat stress index calculated from an environment's wet bulb temperature, globe temperature, and (for outdoor environments) dry bulb temperature. The calculated value is 70% wet bulb/30% globe temperature for indoor environments, and 70% wet bulb/20% globe temperature/10% dry bulb for outdoor environments.

7.15. **Wet Bulb Temperature** — A temperature measurement which calculates effects of evaporation and convection by taking into account temperature, relative humidity, and air movement.

7.16. Work Activity — For the purposes of this procedure, a work related activity that raises metabolism beyond that of a normal walking pace.

8. INSTRUCTIONS

8.1. Potential heat stress situations should be avoided whenever possible. Strategies or countermeasures that may be used to avoid /prevent heat stress related tasks include:

- Administrative controls, such as scheduling tasks during cooler parts of the day or year.
- Engineering controls, such as portable air conditioning units or evaporative coolers, Canopies, Cool Rags etc.….
- Personal protective equipment.

8.2. If countermeasures are not feasible, Project Managers, Leaders, and Workers must determine if heat stress will potentially affect Workers when performing a task. This includes (but is not limited to) such tasks as:

- Tasks performed in areas where the normal dry bulb temperature exceeds 100°F, including tasks performed outdoors when the temperature exceeds 100°F.
- Tasks performed in areas of unusually high humidity or when the normal dry bulb temperature exceeds 80°F.
- Tasks performed using heavy protective garments such as acid suits or electrical arc flash protective clothing.

8.3. If a potential heat stress condition exists, then the Leader responsible for the work group must determine an appropriate strategy to preclude a heat related incident.The Leader may choose one of the following strategies:

- Individual heart rate monitoring/personal Fit Bits method
- Stay time calculation method
- Alternative evaluation method

8.4. Individual heart rate monitoring method

8.5. Individual heart rate monitoring method uses the Polar FT1 heart rate monitor to allow the individuals to monitor their personal heart rates as a surrogate measure for core temperature.

8.6. A heart rate monitor must be used for each individual in the work group utilizing this method. One group member cannot act as “representative” of other group members.

8.7. If there are any individuals in the work group who do not have a heart rate monitor, for any reason, then, one of the other two strategies, per Step 9, must be implemented for those individuals who do not have a heart rate monitor.

8.8. All members of the work group must be covered by one of the two strategies per Step 9.

8.9. All personnel using the heart rate monitoring method must be given a briefing as to the details of the method.

8.9.1. It is recommended that the heart rate monitoring method briefing be included as part of the Pre-job Brief.

8.10. For multiple work load tasks, the work group Leader in conjunction with the Workers must use professional judgment in determining an overall work load.

8.11. The different task components, their work load severity, and relative frequency and duration should be considered in estimating the overall work load.

8.12. The completed Heat Stress Evaluation Worksheet shall be reviewed by all Workers performing the task and must be available for review during performance of the task.

9. Alternative evaluation method.

9.1. Alternative evaluation methods may be used by the work group leader as appropriate.

9.2. Any strategy or combination of strategies may be considered in performing the alternative evaluation.

9.3. Examples of potential strategies include, but are not limited to:

- Standard use of countermeasures
- Abbreviated task durations
- Use of individual core temperature monitoring devices

9.4. Alternative evaluation methods shall be documented using Alternative Evaluation Method Documentation form.

9.5. For routine or repetitive tasks, an accepted alternative evaluation method may be performed and re-used for as long as the conditions upon which the method was based remain in effect.

9.6. If for any reason the alternative evaluation method is shown to be non-protective, then the alternative evaluation method is no longer allowed.

9.7. To be reinstated, the alternative evaluation method must be reapplied for.

9.8. Personnel performing tasks governed by an Alternative Evaluation Method must review the method periodically, to ensure they are familiar with the method and its conditions.

9.9. For tasks outlined in the Heat Stress Evaluation Worksheet or Alternative Evaluation Method Documentation considered “High Heat Stress Potential Tasks”, defined by having calculated stay times of 30 minutes or less, the following precautions must be used:

9.10. A medical evaluation is required for all personnel performing the task.

9.11. Medical evaluations shall be performed, as necessary, by Health Services personnel if possible.

9.12. Evaluations should be performed as close to the onset of the task as practical.Medical evaluations are valid for the period of time determined by the approving medical professional. The period of time may vary depending upon extenuating personal factors.

9.13. Two persons or more are assigned to the task.

9.14. There is radio or voice communication between the Workers and personnel who would be able to summon emergency response personnel if required.

9.15. There is a designated person to monitor stay times and keep Workers apprised of their exposure time.

9.16. Tasks with assigned stay times are measured:

- From the time the work activity, as defined in Step 3.14, begins for tasks using normal work clothes.
- From the time the garment is donned for tasks using heavy protective clothing (acid suit, arc flash protective clothing,etc.) or plastics.

9.17. Workers performing tasks, governed by this procedure, with assigned stay times shall be instructed to maintain proper hydration.

9.18. Proper hydration is one of the most critical factors in avoiding heat related illness.

9.19. Hydration should begin with Workers drinking approximately eight ounces of water 1-2 hours before starting the task.

9.20. Drinking water must be provided in the work area if possible and Workers encouraged to drink frequently (approximately one cup every 20 minutes) in order to maintain hydration.
9.21. Workers should be instructed to continue to hydrate after task completion.
9.22. Workers performing tasks, governed by this procedure, shall be instructed to use self determination continuously while performing the task.
9.23. Workers shall review Signs and Symptoms of Heat Stress if they are not familiar with symptoms of heat related illness.
9.24. If self-determination indicates onset of heat related illness prior to reaching their target heart rate (for the personal heart rate monitoring method/ Fit Bit) or assigned stay time (using the stay time calculation method), then personnel shall:
9.25. Notify co-workers.
9.26. Be escorted from the work area to a recovery area immediately.
9.26.1. The affected worker must be escorted to ensure that they reach the recovery area safely.
9.27. Notify their leader.
9.27.1. The leader must re-evaluate the task being performed to ensure that other members of the work group are not at risk including, but not limited to, workers checking heart rate monitors frequently and ensuring work load has been properly classified.
9.28. Workers performing tasks, governed by this procedure, with assigned stay times shall be instructed that stay times may not be appropriate if personnel have factors that might make them more susceptible to heat stress.
9.28.1. Workers who may be more susceptible to heat stress shall consult with their Leader to determine an appropriate course of action.
9.29. Following work, governed by this procedure, workers must go to a recovery area.
9.29.1. The recovery area must be subjectively cool, shaded, and have drinking water available. Air movement to facilitate evaporative cooling is strongly recommended.
9.29.2. During recovery times personnel should remove any outer protective garment to the extent possible and only engage in light work load activities.
9.29.3. Recovery time for personnel using the heart rate method is the time necessary for the person’s heart rate to return to its resting level.
9.29.4. Recovery time for personnel using the stay time calculation method is calculated using the formula:(time spent in the hot environments / stay time) X 60 minutes.
A. Although the stay time calculation method or alternative evaluation method may be used when necessary, the heart rate method should be used whenever possible.
B. A suggested list of questions is included as - Heat Stress Peer Check Modes. Subject matter will include, but is not limited to the following:
- Verification that employees are ready for work.
- Heat stress pre-job brief.
- Workers are medically clear.
- Workers are familiar with the operation of heart rate monitors.

EVALUATION METHOD DOCUMENTATION

Work Group:

Task Description: _____

Evaluation method: _____

Work Group Representative: _____ **Date:**

Alternative evaluation method is: _____ **Accepted**

_____ **Not Accepted**

Safety Representative: Date:

Conditions	**Symptoms**	**Initial First Aid**
Heat Stroke (MEDICAL EMERGENCY)	A life-threatening emergency that occurs when the body's temperature regulating mechanisms fail during excessive exposure to heat.	Immediately contact EMS
	Skin is hot, usually dry red or spotted. Victim is confused, delirious or may be unconscious.	Attempt to cool the body. Soak clothing with water and vigorously fan the body.
Heat Exhaustion	A mild form of shock caused by the loss of body fluids and minerals. Skin is clammy and moist. Victim is pale and experiences fatigue, extreme weakness, giddiness, nausea, or headache	Immediately contact EMS Get victim to a cool place and give them plenty of liquids.
Heat Cramps	A cramping condition brought on by loss of body fluids and minerals due to profuse perspiration.	Get victim to a cool place and give them plenty of liquids. Provide an electrolyte replacement drink (such as Squincher or Gatorade) if possible. Contact Health Services.
Heat Rash	Rash appears in areas that are persistently wet with unevaporated sweat and where clothing is restrictive.	Get worker to a cool place. Wash and dry skin in affected areas. Contact Health Services
Heat Syncope	Sudden weakness or fatigue, pale skin, blurred vision, momentary blackouts normally caused by prolonged static posture with high environmental temperatures and vapor barrier clothing.	Have worker lie down or sit with their head between their knees. Provide drinking water or other replacement fluids as needed. Contact Health Services.

ERGONOMICS

INTRODUCTION

Ergonomics is the study of people and their interaction with the elements of their job or task including equipment, tools, facilities, processes, and environment. It is a multidisciplinary field of study integrating industrial psychology, engineering, medicine, and design.
In a more practical sense, ergonomics is the science of human comfort. When aspects of the work or workplace exceed the body's capabilities, the result is often a musculoskeletal disorder (MSD). To help avoid MSDs, work demands should not exceed the physical capabilities of the worker. MSDs are also known by several other names including:

- CTDs (cumulative trauma disorders)
- RSIs (repetitive stress or repetitive strain injuries)
- RMIs (repetitive motion injuries)
- Overuse syndrome

The most common, recognizable name for MSDs is cumulative trauma disorders or CTDs. Whatever the name used, these injuries belong to a family or group of wear and tear illnesses that can affect muscles, nerves, tendons, ligaments, joints, cartilage, blood vessels or spinal discs of the body. MSDs do not include slips, trips and falls, cuts, motor vehicle accidents or other similar accidents; although a close look at the reasons for acute injuries often reveals design problems that can be corrected.

A. POLICY

1. It is the policy of LLR Electric to provide all employees with a safe and healthy workplace. A proactive ergonomics program is integrated into our company's written safety and health program.
2. Records documenting the identification, prevention, and control of employee exposure to ergonomic risk factors will be maintained pursuant to all regulations.
3. This program is a collaborative effort that includes managers, supervisors, and labor. The Ergonomics Program Coordinator is responsible for the program's implementation, management, and recordkeeping requirements.

B. ERGONOMICS PROGRAM

The purpose of an ergonomics program is to apply ergonomic principles to the workplace in an effort to reduce the number and severity of MSDs, thus decreasing workers' compensation claims and, where possible, increase productivity, quality, and efficiency. An ergonomically sound work environment maximizes employee comfort while minimizing the risk of undue physical stress.
A proactive approach focuses on making changes when risks have already been identified, as well as incorporating ergonomics into the design phase of a new facility or process, into purchasing new equipment or tools, and into the contemplation of scheduling changes. LLR Electric has such a program which includes the following components:

C. Management Leadership.

The management of LLR Electric is committed to the ergonomics process. Management supports the efforts of the Ergonomics Program Coordinator and the Ergonomics Committee by pledging financial and philosophical support for the identification and control of ergonomic risk factors. Management will support an effective MSD reporting system and will respond promptly to reports. Management will regularly communicate with employees about the program.

D. Employee Participation.

An essential element to the success of the ergonomics program, employees will be solicited for their input and assistance with identifying ergonomic risk factors, worksite evaluations, development and implementation of controls, and training. Employee participation in the program will occur only during company time.

C. Identification of Problem Jobs.

Collecting data that identifies injury and illness trends is called surveillance. Surveillance can be either passive or active. Conducting a records review is an example of passive surveillance, which looks at existing data such as OSHA Logs, workers' compensation claims, trips to the medical facility, and absentee records. Active surveillance uses observations, interviews, surveys, questionnaires, checklists, and formal worksite evaluation tools to identify specific high-risk activities. LLR Electric will be using both passive and active surveillance to identify problem jobs.

D. Worksite Evaluations.

Triggers for a worksite evaluation:

(a) When an employee reports an MSD sign or symptom.
(b) Jobs, processes, or work activities where work-related ergonomic risk factors have been identified which may cause or aggravate MSDs.
(c) Any change of jobs, tasks, equipment, tools, processes, scheduling, or changes in work shift hours (for example, going from a traditional 5-day, 8 hour shift to a compressed 4-day, 10 hour shift).
(d) When a safety walk-through or scheduled inspection or survey has uncovered potential MSD hazards.

(2) Work-related risk factors to be considered in the evaluation process include, but are not limited to:

(a) Physical risk factors including force, postures (awkward and static), static loading and sustained exertion, fatigue, repetition, contact stress, extreme temperatures, and vibration.
(b) Administrative issues including job rotation/enlargement, inadequate staffing, excessive overtime, inadequate or lack of rest breaks, stress from deadlines, lack of training, work pace, work methods, and psychosocial issues.
(c) Environmental risk factors including noise, lighting, glare, air quality, temperature, humidity, and personal protective equipment and clothing.
(d) Combination of risk factors such as, but not limited to, highly repetitive, forceful work with no job rotation or precision work done in a dimly lit room.

E. Setting Priorities.

Worksite evaluations will be scheduled based upon the following:

(a) Any job, process, operation, or workstation which has contributed to a worker's current MSD;
(b) A job, process, operation, or workstation that has historically contributed to MSDs;
(c) Specific jobs, processes, operations, or workstations that have the potential to cause MSDs.

F. Worksite Evaluations Methods.

Various methods will be used to evaluate problem jobs including:

(a) Walk-through and observations
(b) Employee interviews
(c) Surveys and questionnaires
(d) Checklists
(e) Detailed worksite evaluations

G Control of the Ergonomic Risk Factors.

LLR Electric will take steps to identify ergonomic risk factors and reduce hazards by using a three-tier hierarchy of control (in order of preference):

(1) Engineering controls. The most desirable and reliable means to reduce workplace exposure to potentially harmful effects. This is achieved by focusing on the physical modifications of jobs, workstations, tools, equipment, or processes.

(2) Administrative controls. This means controlling or preventing workplace exposure to potentially harmful effects by implementing administrative changes such as job rotation, job enlargement, rest/recovery breaks, work pace adjustment, redesign of methods, and worker education.

(3) Personal protective equipment (PPE). Although not recognized as an effective means of controlling hazards and do not take the place of engineering or administrative controls, there are acceptable forms of PPE, which include kneepads and anti-vibration gloves.

Training. Training is intended to enhance the ability of managers, Leaders, and employees to recognize work-related ergonomic risk factors and to understand and apply appropriate control strategies. Training in the recognition and control of ergonomic risk factors will be given as follows:

(1) To all new employees during orientation.
(2) To all employees assuming a new job assignment.
(3) When new jobs, tasks, tools, equipment, machinery, workstations, or processes are introduced.
(4) When high exposure levels to ergonomic risk factors have been identified.

The minimum for all managers, supervisors, and employees will include the following elements:

(1) An explanation of LLR Electric ergonomics program and their role in the program;
(2) A list of the exposures which have been associated with the development of MSDs;
(3) A description of MSD signs and symptoms and consequences of injuries caused by work and non work-related risk factors;
(4) An emphasis on the importance of early reporting of MSD signs and symptoms and injuries to management, and;
(5) The methods used to minimize work and non work-related risk factors.

Training will be provided in one, or a combination, of the following formats:

(1) Oral presentations
(2) Videos
(3) Distribution of educational literature
(4) Hands-on equipment and work practice demonstrations

Trainers will be experienced in delivering training programs that address all work and non work-related risk factors, and will be familiar with LLR Electric operations. Training will be provided from one, or a combination, of the sources listed below:

(1) Internally developed resources
(2) The workers' compensation carrier
(3) An outside consultant

All training will be documented:

(1) All employees will be required to sign a training sign-in roster.

I. MSD (Medical) Management and Early Return-to-Work.

Pursuant to the law, LLR Electric provides medical care to all employees injured at work. LLR Electric maintains a good working relationship with our health care provider, AIM Clinic. All work-related injuries and illnesses will be referred to AIM Clinic unless the injured employee has notified LLR Electric in writing that other provisions have been made prior to an injury or illness.

In the event of a work-related injury or illness, the health care provider will:

(1) provide diagnosis and treatment for LLR Electric employees;
(2) determine if reported MSD signs or symptoms are work-related;
(3) comply with LLR Electric Early Return-to-Work program by recommending restricted, modified, or transitional work duties when appropriate;
(4) refer LLR Electric injured employees to other clinical resources for therapy or rehabilitation;
(5) provide LLR Electric with timely work status reports, and;
(6) develop a positive working relationship with LLR Electric workers' compensation carrier, Cincinnati insurance policy number ewc0319083 Compensation Insurance Carrier.

LLR Electric has an aggressive Early Return-to-Work program and will offer return-to-work opportunities to all injured employees in accordance with work restrictions identified by a recognized health care provider.

J. Program Evaluation and Follow-Up. In order to ensure that issues have been addressed and that new problems have not been created, monitoring and evaluation will be conducted on an on-going basis. The methods include use of individual interviews and checklists to reevaluate the job/task to ensure that risks have been reduced, minimized, or eliminated.

4. INDIVIDUAL RESPONSIBILITIES

A. Ergonomics Program Coordinator.

The Ergonomics Program Coordinator will report directly to upper management and be responsible for this policy and program. All evaluations, controls, and training will be coordinated under the direction of the Ergonomics Program Coordinator in collaboration with management. The Ergonomics Program Coordinator will monitor the results of the program to determine additional areas of focus as needed.

The Industrial Safety will:

(1) ensure that evaluators performing worksite evaluations and training are properly trained;
(2) ensure that control measures are implemented in a timely manner;
(3) ensure that a system is in place for employees to report MSD signs or symptoms and suspected work-related risk factors to managers and supervisors;
(4) ensure that accurate records are maintained and provide documentation upon request;
(5) schedule manager, Leaders, and employee training and maintain records to include date, name of instructor, topic, and materials used, and;

monitor the program on a quarterly basis and provide an annual review.
follow-up with any ergonomics strategy and/or solutions.

B. Managers.

Duties of all managers will include:

(1) accountability for the health and safety of all employees within their departments through the active support of the ergonomics program;
(2) allocating human and/or financial resources;
(3) attending ergonomics training to familiarize themselves with the elements of the program, recognition and control of work-related ergonomic risk factors, MSD signs and symptoms, early reporting requirements and procedures, and medical management;
(4) ensuring that supervisors and employees have received the appropriate training;
(5) ensuring that ergonomics practices and principles are considered when conducting worksite evaluations, and;
(6) ensuring that recommended controls are implemented and/or used appropriately through active follow-up.

C. Leaders.

Duties of all supervisors will include:

(1) attending ergonomics training to familiarize themselves with the elements of the program, recognition and control of work-related ergonomics risk factors, MSD signs and symptoms, early reporting requirements and procedures, and medical management;
(2) ensuring that employees have received the appropriate training;
(3) ensuring that employees are provided with and use the appropriate tools, equipment, parts, and materials in accordance with ergonomic requirements;
(4) ensuring that employees understand the MSD signs and symptoms and early reporting system;
(5) responding promptly to employee reports;
(6) providing appropriate workers' compensation documentation to employees as required by all regulations;
(7) seeking clarification from Human Resources when return-to-work directives from the health care provider are unclear, and;
(8) maintaining clear communication with managers and employees.

D. Employees.

Every employee of LLR Electric is responsible for conducting himself/herself in accordance with this policy and program.

When provided, use the appropriate tools, equipment, parts, materials, and procedures in the manner established by managers and supervisors;

ensure that equipment is properly maintained in good condition and when not, report it immediately;

(1) provide feedback to supervisors regarding the effectiveness of design changes, new tools or equipment, or other interventions;
(2) attend ergonomics training as required and apply the knowledge and skills acquired to actual jobs, tasks, processes, and work activities;
(3) report MSD signs or symptoms and work-related MSD hazards to the supervisor as early as possible to facilitate medical treatment and initiate proactive interventions, and;
(4) take responsibility in their personal health and safety.

Section XI

Hearing Conservation Program

1910.95

Hearing Conservation Program

Table of Contents

I. Objective
II. Assignment of Responsibility
  A. Management
  B. Employees
III. Procedures
  A. Noise Monitoring
  B. Employee Training
  C. Hearing Protection
  D. Audiograms/Hearing Tests
IV. Attachments
  A. Hearing Conservation Training Log
  B. Record of Hearing Protection Needs

Hearing Conservation Program
for
LLR Electric

I. OBJECTIVE

Hearing Conservation Program is to minimize occupational hearing loss by providing hearing protection, training, and annual hearing tests to all persons working in areas or with equipment that have noise levels equal to or exceeding an eight-hour time-weighted average (TWA) sound limit of 85 dBA (decibels measured on the A scale of a sound level meter). A copy of this program will be maintained by all affected Leaders.

II. ASSIGNMENT OF RESPONSIBILITY

A. Management
1. Use engineering and administrative controls to limit employee exposure.
2. Provide adequate hearing protection for employees.
3. Post signs and warnings in all high noise areas.
4. Conduct noise surveys annually or when new equipment is needed.
5. Conduct annual hearing test for all employees.
6. Conduct hearing conservation training for all new employees.
7. Conduct annual hearing conservation training for all employees.

B. Employees
1. Use company-issue approved hearing protection in designated high noise areas.
2. Request new hearing protection when needed.
3. Exercise proper care of issued hearing protection.

III. PROCEDURES

A. Noise Monitoring
1. Monitoring for noise exposure levels will be conducted. It is the responsibility of the individual Leaders to notify Industrial Safety when there is a possible need for monitoring. Monitoring will be performed with the use of sound level at the discretion of Leaders.
2. Monitoring will also be conducted whenever there is a change in equipment, process or controls that affect the noise levels. This includes the addition or removal of machinery, alteration in building structure, or substitution of new equipment in place of that previously used. The responsible supervisor must inform Industrial Safety when these types of changes are instituted.

B. Employee Training
1. Affected employees will be required to attend training concerning the proper usage and wearing of hearing protection. The training will be conducted by Nantel.org or a designated representative annually.
2. Training shall consist of the following components:
    a. how noise affects hearing and hearing loss;
    b. review of the OSHA hearing protection standard;
    c. explanation of audiometric testing;
    d. rules and procedures;

e. locations within company property where hearing protection is required; and how to use and care for hearing protectors.

3. Training records will be maintained by Nantel.org.

C. Hearing Protection

Management, supervisors, and employees shall properly wear the prescribed hearing protection while working or traveling through any area that is designated as a high noise area.

1. Hearing protection will be provided at no cost to employees who perform tasks designated as having a high noise exposure and replaced as necessary. It is the supervisor's responsibility to require employees to wear hearing protection when noise levels reach or exceed 85 dBA. Those employees will have the opportunity to choose from at least two different types of hearing protection.
2. Personal stereo headsets, or "Walk-men," are not approved for hearing protection and are not permitted in any operating area of company property.
3. Signage is required in areas that necessitate hearing protection. It is the responsibility of the site Leader to provide signage to the appropriate areas.
4. Earplugs and earmuffs should be washed periodically and stored in a clean area. Foam inserts should be discarded after each use. Hands should be washed before handling preformed earplugs and foam inserts to prevent contaminants from being placed in the ear.

D. Audiograms/Hearing Tests

1. Employees subject to the Hearing Conservation Program who have time-weighted average (TWA) noise exposures of 85 dBA or greater for an eight (8) hour work shift will be required to have both a baseline and annual audiogram. The audiograms will be provided by the LLR Electric and conducted by a medical facility with no cost to the employee.
2. The baseline audiogram will be given to an employee within one (1) month of employment and before any exposure to high noise levels. Annual audiograms will be performed within one year from the date of the previous audiogram. It is the responsibility of the individual and Industrial Safety to schedule the annual audiogram.
3. If an annual audiogram shows that an employee has suffered a standard threshold shift, the employee will be retested within thirty (30) days of the annual audiogram. If the retest confirms the occurrence of a standard threshold shift, the employee will be notified in writing within twenty-one (21) days of the confirmation. Employees who do experience a standard threshold shift will be refitted with hearing protection and provided more training on the effects of noise.

Section XII
Confined Space Entry

1. PURPOSE AND SCOPE

1.1. Purpose

1.1.1. The purpose of this procedure is to establish safety requirements to be followed when entering, exiting, and working in confined spaces.

1.1.2. This procedure supports implementation of the Industrial Health and Safety Program, within the Loss Prevention Program Area.

1.2. Scope

1.2.1. This procedure applies to all LLR Electric employees, supplemental employees, vendors, and visitors.

1.2.2. This procedure provides confined space training for hazard assessment and management, Non-Permit Required and Permit Required Confined Space criteria, Confined Space emergencies, and disposition of documentation relating to Confined Space entry activities.

2. RESPONSIBILITIES

2.1. Industrial Safety and Health Department

2.1.1. Provide oversight & training to the Confined Space Entry program. All documented training will be provided in NANTEL.ORG.

2.2. Entry Supervisor

2.2.1. Plan and authorized Confined Space work and ensure safety inside and around the entrance to the Confined Space.

2.3. Confined Space Attendant

2.3.1. Continuously monitor the conditions in and around the Confined Space and the Confined Space entrants, to ensure safety.

2.4. Confined Space Authorized Entrant

2.4.1. Ensure completion of required training, use PPE required, and stay alert to hazards in and around a Confined Space.

2.5. Fire Protection

2.5.1. Take command during Confined Space emergency and rescue operations.

3. DEFINITIONS

3.1. **Attendant** — An individual stationed outside one or more permit spaces. The attendant monitors the authorized entrants and performs all attendants' duties assigned in the employer's Confined Space program.

3.2. **Authorized Entrant** — An employee trained to work in confined spaces authorized by the Entry Supervisor to enter a Confined Space.

3.3. **Confined Space** — Is large enough and so configured that an employee can bodily enter and perform assigned work, has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry), and is not designed for continuous employee occupancy.

3.4. **Engulfment** — The surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by crushing.

3.5. **Entry** — The action by which a person passes through an opening into a Confined Space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.
3.6. **Entry Supervisor** — The person (such as the employer, foreman, or crew chief) responsible for determining if acceptable entry conditions are present at a Confined Space where entry is planned, for authorizing entry, overseeing, and terminating entry operations.
3.7. **Hazardous Atmosphere** — An atmosphere in which at least one condition recognized as a serious safety or health hazard exists.
3.8. **Incident Commander** — Highest ranking Fire Officer or Firefighter in command of the Fire Operations.
3.9. **Non-Permit Required Confined Space (NPRCS)** — A Confined Space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.
3.10. **Non-Permit Required Confined Space Work Authorization Form** — The document that is provided by LLR ELECTRIC, INC. to allow and control entry to, and contains specific information pertinent to accomplishing safe work within, the Non-Permit Required Confined Space.
3.11. **Oxygen Deficient Atmosphere** — At atmosphere containing less than 19.5 percent oxygen by volume.
3.12. **Oxygen Enriched Atmosphere** — An atmosphere containing more than 23.5 percent oxygen by volume.
3.13. **Permit Required Confined Space (PRCS)** — A Confined Space which contains, or has the potential to contain, a serious safety or health hazard
3.14. **Permit Required Confined Space Work Authorization Form** — The document that is provided by LLR ELECTRIC, INC. to allow and control entry to, and contains specific information pertinent to accomplishing safe work within, the Permit Required Confined Space.
3.15. **Retrieval System** — The equipment (including a retrieval line, chest or full-body harness, wristlets, if appropriate, and a lifting device or anchor) used for non-entry rescue of persons from permit spaces.
3.16. **Testing** — The process by which the hazards that may confront entrants of a Confined Space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space.

4. INSTRUCTIONS

4.1. Confined Space Criteria
4.1.1. Any work space that meets all of the criteria listed below is considered a Confined Space:
A. The space is large enough and configured so that an employee can bodily enter and perform assigned work.
1. An employee must be able to fit the entire body within the space.
a) If an employee cannot enter the space with the entire body due to the size of the diameter of the space, then the space is not considered a Confined Space.
b) When performing the assessment, consider the size of the smallest employee.
4.2. An employee may be injured as a result of an atmospheric hazard within a space, however, the Confined Space procedure is not intended to address all locations that pose atmospheric hazards.
4.3. A Job Hazard Analysis (JHA) should be considered for any location which has the possibility of an atmospheric hazard.
4.4. A space is considered to have limited or restricted means of egress if a Confined Space Authorized Entrant's ability to escape in an emergency situation would be hindered.

4.5. Limited or restricted egress includes any space where an occupant must crawl, climb, twist, be constrained in a narrow opening (such as a man-way or man-hole), follow a lengthy path or otherwise exert unusual effort to enter or leave.
4.6. Spaces that require a ladder to obtain entry are considered a restricted means of egress.
4.7. Convergent walls have an internal configuration that could entrap an individual by walls that slant inward or by a floor which slopes downward and tapers to a small section. For example, the Lime Silos located in the Water Reclamation Facility.
4.8. The ability to entrapment or prevent self-egress due to an internal configuration such that an entrant could be trapped or asphyxiated by such things as:
- Inwardly converging walls - A floor which slopes downward and tapers to a smaller cross-section.
- Use of a “bosun's chair” or other device requiring a second person to assist with egress.
- Excessive obstacles, tortuous paths, or other circumstances which would unduly hinder self-egress.
- The space is not designed for continuous employee occupancy.

4.9. Confined spaces are not designed for employees to enter and perform work during normal operating conditions.
4.9.1. Due to the size of the space or the entrance opening, the space may be designed to store a product, enclose materials and processes, or transport products or substances.
4.9.2. The entrance to some spaces may be sealed under normal operating conditions with a concrete plug, covered with grating or a metal hatch preventing employee access.
4.10. Because the spaces are not designed for continuous occupancy, the spaces may not have adequate ventilation or lighting.
4.10.1. Occasional employee entry for inspection, maintenance, repair, cleanup, or similar tasks, may pose serious safety or health hazard.
4.10.2. For information regarding excavations, trenches, and trench boxes, see OSHA 1926 Sub Part P, Excavation.

5. Hazard Assessment and Management

5.1. Hazard Assessment
5.2. A hazard assessment should be completed prior to any entry into a Confined Space.
5.3. The hazard assessment must identify the following:
5.4. Sequence of work to be performed in the Confined Space.
5.5. Specific hazards, known or anticipated.
5.6. Control measures to be implemented to eliminate or reduce each of the hazards to an acceptable level.
5.7. No entry should be permitted until the hazard assessment has been reviewed and discussed by all persons engaged in the activity.
5.8. Prior to entering confined spaces, personnel must be informed of known or potential hazards associated with the confined space and the entry permit must be completed before entering an confined space
5.9. A Hazard Assessment should also consider any additional uncontrolled safety hazards that may be likely to exist. Hazards include, but are not limited to, the following:
- Devices that could injure, maim or kill, such as agitators, fans, or any other device that has electrical moving parts.
- Electrical shock hazards including, but not limited to, electrical circuits, lighting, ventilation equipment. Great care must be taken when working around electrical

components. Any electrical component that may present even the slightest hazard must be evaluated.

- Overhead low hanging energized electrical cables could pose a hazard when trying to position a ladder for entry into a Confined Space.
- The area around a Confined Space including the location of permanent and portable equipment in close proximity that can cause a hazardous atmosphere to the space.

Entry into confined spaces without the proper precautions could result in injury, impairment, or death due to the following:

- An atmosphere that is flammable or explosive.
- Lack of sufficient oxygen to support life.
- Contact with or inhalation of toxic materials.
- General safety or work area hazards such as steam or high pressure materials.
- Engulfment.

5.9.1. LLR Electric employees shall not Work in confined spaces where IDLH conditions are present.6S

6. Hazard Controls

6.1. Hazard controls include changes in the work processes or working environment with the objective of:

- Controlling the health hazards either by eliminating the responsible agents (such as electricity, water engulfment, hazards).
- Reducing health hazards below harmful levels.
- Preventing the contaminants from coming into contact with the workers.

6.2. The following order of precedence should be followed in reducing Confined Space risks:

1. Engineering controls such as ventilation to limit exposure to hazards.
2. Work practice controls, such as wetting of hazardous dusts or frequent cleaning.
3. Use of PPE such as air purifying or supplied-air respirators.

7. Engineering Controls

7.1. Engineering controls eliminate or reduce hazards.

7.2. Ventilation is one of the most common engineering controls used in Confined Space.

7.2.1. If ventilation is used to remove atmospheric contaminants from the Confined Space, then the space should be ventilated until the atmosphere is within acceptable range for human occupancy.

7.2.2. Ventilation should be maintained during the occupancy if there is a potential for the atmospheric conditions to move out of the acceptable range.

7.3. If ventilation is not possible or feasible, then alternate protective measures or methods to remove air contaminants and protect occupants should be determined by the Entry Supervisor prior to authorizing entry.

7.4. Conditions regarding continuous forced air ventilation should be used per the following:

7.4.1. Employees shall not enter the space until the forced air ventilation has eliminated any hazardous atmosphere.

7.4.2. Forced air ventilation should be directed to ventilate the immediate areas where an employee is or will be present within the space.

7.4.3. Continuous ventilation is maintained until all employees have left the space.

7.4.4. Air supply for forced air ventilation shall be from a clean source.

7.4.5. Ventilation exhaust or discharge must be directed to an area where the ventilation exhaust or discharge will not cause a hazard to other workers.

8. Work Practice (Administrative) Controls

8.1. Work practice (administrative) controls are controls which eliminate or reduce the hazard through changes in the work practice (for example, rotating workers, reducing the amount of worker exposure, and housekeeping). LLR Electrical employees shall not work in confined spaces where IDLH conditions are present

8.2. Confined spaces should be cleaned of hazardous materials to the extent feasible before entry.

8.3. Cleaning is the preferred method of reducing exposure to hazardous materials.

8.3.1. When cleaning is not practical, PPE should be worn by the entry personnel to provide appropriate protection against the hazards which may be present.

9. Personnel Protective Equipment (PPE)

9.1. If the hazard cannot be eliminated or reduced to a safe level through engineering or work practice controls, then PPE should be used.

9.2. A qualified person should determine PPE needed by all personnel entering the Confined Space including rescue teams.

9.2.1. PPE which meets the specifications of required standards should be selected per the requirements of the job to be performed.

9.3. Pre-Entry and Follow Up Test Prior to Confined Space Entry

9.3.1. Atmospheric test data shall be performed prior to entry into any Confined Space and the results recorded on the Confined Space Work Authorization Form.

A. Atmospheric testing is required for two distinct purposes:

- Evaluation of the hazards of the permit space.
- Verification that acceptable conditions exist for entry into a Confined Space.

9.3.2. Atmospheric testing must be performed by those personnel that have successfully completed Confined Space Training.

9.3.3. Testing equipment must be:

- Able to give direct readings of atmospheric conditions.
- Appropriately calibrated.
- Of sufficient specificity and sensitivity to verify that acceptable entry conditions exist.
- Rated for use in specialty areas, when used (such as potentially explosive atmospheres).

9.3.4. Use of Oxygen/Gas Monitors

A. Oxygen/combustible gas monitors must have been bump tested at least once within the previous 24 hours prior to use. (Instructions for performing the bump test may be found at the bump test location.)

9.3.5. If a monitor is issued more than once per day, then the unit must be bump tested each time the monitor is issued.

9.3.6. If the monitor is subjected to a physical shock (dropped), then the unit must be bump tested again prior to use to ensure proper operation.

B. Atmospheric testing shall be performed without entering the space.

9.3.6.1. Extensions, remote sampling pumps, or lowering the instrument into the space (if conditions will allow the tester to hear any audible alarms and the instrument is moved slowly enough to allow response time) can be used.

- The instrument must be lowered slowly in case the atmosphere in the space is not consistent and "pockets" or "layers" exist.
- If the instrument is placed at a remote location where the readout cannot be seen but the audible alarm can be heard, then the readings must be recorded on Confined Space Work Authorization Form, Pre-Entry and Follow-Up Test Results relative to the instrument's alarm level for oxygen level and flammable limit: Between 19.5% and 23.5% for Oxygen. Less than 10% Lower Flammability Limit (LFL) for Combustible Gas.

9.4. Atmospheric testing should be performed in the following sequence:

9.4.1. Oxygen content

9.4.2. Flammable gases and vapors

9.4.3. Potentially toxic air contaminants

10. Atmospheric testing

Results of atmospheric testing must be recorded on the Confined Space Work Authorization Form, including, but not limited to the following:

- Results must be reviewed to ensure that acceptable entry conditions exist.
- Each test, even multiple tests taken simultaneously with the same instrument, are separate tests and must be entered, signed/initialed, and date/time separately.
- Acceptable ranges for oxygen level and combustible gas are listed on the Confined Space Work Authorization Form.
- Evaluation and interpretation of potentially toxic materials results shall be performed or reviewed by a technically qualified professional (for example, certified industrial hygienist, certified safety professional, registered safety engineer, or ADOSH consultation service).
- The atmosphere should be periodically re-tested to verify that atmospheric conditions remain within acceptable entry parameters.

A. If the following atmospheric test results are not within acceptable limits, then entry is prohibited until appropriate controls are implemented.

- Oxygen - outside a range of 19.5% -23.5%.
- Combustible Gas - If the atmosphere is found to contain 0.1 - 10% LFL, then entry may be made if continuous ventilation is provided and the atmosphere is continuously monitored.
- Toxic Gas - above levels established by the American Conference of Governmental Industrial Hygienists, OSHA, or other recognized organization, then the source should be eliminated, if possible. If the work is the source, mechanical ventilation or respiratory protection may be required.

10.1.1. If the Confined Space is vacated for any period of time, then the atmosphere must be re-tested to verify that atmospheric conditions remain within acceptable limits.

10.1.2. If entry into a Confined Space is necessary to collect additional testing data or inspections for hazards, then all provisions for safe entry listed on the Confined Space Work Authorization Form must be implemented.

10.1.3. If the Confined Space Authorized Entrant will be entering a space but working at a remote location, and there is a possibility that the atmosphere of the remote location may be different than that of the atmosphere at the entry point, then readings must be taken at the entry point to verify safe entry and at the work location to ensure safe working conditions.

11. Control of Hazardous Energy

11.1. All energy sources which are potentially hazardous to the Confined Space Authorized Entrant should be secured, relieved, disconnected, or restrained before personnel are permitted to enter the Confined Space. Equipment systems or processes should be locked or tagged out per one of the following procedures:

- Energy Control Procedure (Lock Out/Tag Out)

11.2. In confined spaces where complete isolation is not possible, provisions should be made for as rigorous isolation as practical.

11.3. Special precautions should be taken when entering double walled, jacketed or internally insulated confined spaces that may discharge hazardous material through the vessel's internal wall.

11.4. Where there is a need to test position or activate equipment by temporarily removing the lock/tag, removal must be done per the relevant energy control procedure.

11.5. For elimination of potential Confined Space hazards, such as engulfment, posed by flowable materials (finely divided solid, liquid, steam, vapor or gas) single valve isolation, even if the valve is locked or tagged, is not considered adequate. Blanking, blinding, misaligning, removal of sections of lines or pipes, or use of a double block and bleed system are required for hazard elimination.

11.5.1. If one of the methods named in Step 4.3.3.B is not used, then the potential hazard is considered to remain.

12. Confined Space Classifications

NOTE

The Permit and Non-Permit Confined Space Work Authorization Forms are important tools contributing to safety during entry in confined spaces with known hazards or unknown potentially hazardous atmospheres. The Permit and Non-Permit Confined Space Work Authorization Forms guides the Entry Supervisor performing a systematic evaluation of the space to be entered and is used to establish appropriate conditions. SWMS may be used for obtaining and completing a Confined Space Work Authorization Form

12.1.1. When a work area is determined to be a Confined Space, a Confined Space Work Authorization Form shall be obtained and completed.

12.1.2. All confined spaces are initially classified as a Permit Required Confined Space.

12.1.3. A Permit Required Confined Space may be reclassified as a Non-Permit Required Confined Space through use of the Confined Space Work Authorization Form.

12.1.4. Development of Permit and Non-Permit Confined Space Work Authorization Forms

13. Confined Space Parameters. Include the following information.

13.1. Location / Name of Confined Space.

13.1.1. Energy Control Procedure (Lock Out/Tag Out)

13.2. Date the Confined Space form is filled out.

13.3. Chemical names, if chemicals will be used or brought into the Confined Space.

13.4. Chemical Trade Name, if chemicals will be used or brought into the Confined Space.

13.5. Work Order #.

13.6. Brief Description of Work.

13.7. Work Group Name.

13.8. Expiration Date and Time.

13.8.1. Expiration dates for Confined Spaces, relating to routine entries in Non-Permit Required Confined Spaces, may be assigned a maximum of 12 months duration, provided tasks and hazards do not change and expiration dates do not exceed the end of the calendar year in which the work permits are generated.

13.8.2. The Entry Supervisor's signature is only valid for one shift. A new copy of the Confined Space Work Authorization Form, atmospheric testing, and subsequent Entry Supervisor signature is required per shift when the space is entered.

14. Confined Space Entry Requirements.

14.1. This section shall be carefully evaluated.

14.2. All requirements shall be stated on the Confined Space Work Authorization Form, used for the space, and must be followed at all times while occupying the space.

15. Confined Space Classification

15.1. If the answer to all four questions in “1) Can entrants become trapped inside the space due to shape? 2) Can entrants become engulfed by the contents in the space? 3) Any additional serious safety hazards likely to be found in the space? 4) Contains or has the potential to contain hazardous atmosphere?” are marked “NO”, then the space is classified as a Non-Permit Required Confined Space. Go to Section 4.5, Non-Permit Required Confined Space (NPRCS).

15.1.1. When a Non-Permit Required Confined Space is identified, then complete Form.

15.2. If the answer to any four questions "YES”, then the space is classified as a Permit Required Confined Space.

15.2.1. When a Permit Required Confined Space is identified, then complete Form.

15.3. Non-Permit Required Confined Space (NPRCS)

NOTE

16. Industrial Health and Safety does not sign the Non-Permit Required Confined Space Work Authorization Form.

16.1. Determine specific safety requirements.

17. If any questions arise, then the initiator will consult with an Industrial Safety and Health.
18. The Entry Supervisor will ensure a boundary is maintained and the Non-Permit Required Confined Space Work Authorization Form is prominently placed at the entrance of the Non-Permit Required Confined Space.
    18.1. The Non-Permit Required Confined Space Work Authorization Form is posted to communicate, to persons outside the space, the following:
        18.1.1. The Non-Permit Required Confined Space is occupied.
        18.1.2. Who to contact for questions when an Attendant is not utilized or available
19. Determine if additional ventilation in the Non-Permit Required Confined Space is required.
20. Determine the required extent and frequency of atmospheric testing in the Non-Permit Required Confined Space based on existing, anticipated, or potential atmospheric conditions in the Non-Permit Required Confined Space.
    20.1. Oxygen and combustible gas level testing are always required.
        20.1.1. Any additional materials to be sampled for, based on the type of space, materials used, or work being performed, should be recorded on the Non-Permit Required Confined Space Work Permit Form.
    20.2. Additional testing after initial testing, prior to entry, may not be necessary if the task will be of short duration and conditions will not change.
        20.2.1. The Entry Supervisor shall dictate frequency of testing.
        20.2.2. Examples of increased frequency include, but are not limited to, “Prior to Entry” if multiple entries are made during a given shift, or “Continuous While Occupied” as a conservative measure.
21. Determine the need for respiratory protection equipment.
22. Determine the need for additional eye/face protection.
23. Determine if additional protective clothing is required.
24. Determine if a Job Hazard Analysis has been developed for the Non- Permit Required Confined Space Work Authorization work scope.
25. Determine the general safety considerations such as fall protection, lighting, heat stress, or water removal.
26. Determine if there is the potential for outside contaminants entering the Non-Permit Required Confined Space. Any operations such as coating, welding, or the use of internal combustion engines within 40 feet of the space must be considered as potentially affecting the space.
    26.1. Actions must be taken to prevent any operations or generated contaminants from affecting the Non-Permit Required Confined Space.
    26.2. The determination and mitigation of outside contaminants shall be performed at the job site prior to entry of the Non-Permit Required Confined Space.
        26.2.1. This Entry Supervisor’s evaluation shall be performed at the job site.
        26.2.2. The Entry Supervisor shall not sign the Non-Permit Required Confined Space Work Authorization Form until the determination and mitigation of outside contaminants is performed.

26.2.3. Submit the Non-Permit Required Confined Space Work Authorization Form to the Industrial Health and Safety Department for review.

26.2.4. Prior to entry, the atmosphere inside the Non-Permit Required Confined Space shall be tested for atmospheric hazards and the results entered in the appropriate fields in the Non-Permit Required Confined Space Work Authorization Form, Section IV.

27. If entry into a Non-Permit Required Confined Space is necessary to collect additional testing data or inspect for hazards, then all provisions for safe entry listed on the Non-Permit Required Confined Space Work Authorization Form must be implemented.

27.1. The individual performing the pre-entry atmospheric testing shall complete the Non-Permit Required Confined Space Work Authorization Form, by entering the results in appropriate fields.

27.2. If initial testing indicates the space contains a hazardous atmosphere or there is a potential for outside contaminants, then immediately stop the entry process and contact Industrial Health and Safety.

27.3. If initial testing indicates the anticipated atmospheric hazards are within the allowable limits listed, then entry may proceed.

27.4. The Entry Supervisor shall verify that the Non-Permit Required Confined Space Work Authorization Form, has been completed with dates and testing personnel initials correctly applied indicating that pre-entry atmospheric monitoring tests have been performed.

28. After verifying that pre-entry atmospheric testing has been performed and indicated on the Form, the Entry Supervisor may sign the Non-Permit Required Confined Space Work Authorization Form

28.1. Natural ventilation, in lieu of mechanical ventilation, is acceptable provided the atmosphere of the Non-Permit Required Confined Space can be maintained in a safe condition.

28.2. Perform follow-up atmospheric testing and record results using the Non-Permit Required Confined Space Work Authorization Form Follow-Up portion, Pre-Entry & Follow-Up Test Results

28.3. If follow-up atmospheric testing indicates contaminants exceed the limits specified in Non-Permit Required Confined Space Work Authorization Form, then immediately perform the following:

29. Stop work.
30. Exit the Non-Permit Required Confined Space.
31. Contact Industrial Health and Safety.

NOTE

Hazardous substances that are produced by activities in the general area of a Non-Permit Required Confined Space can migrate to, and accumulate in the space, creating an unseen hazard to an unsuspecting entrant.

31.1. Personnel entering a Non-Permit Required Confined Space shall:

32. Notify the supervisor in charge of the area where the space is located that an entry will take place.
33. Enter the space under the direction of the supervisor.

34. Determine if there has been any change in the use or configuration of the space that will change the classification.
35. Determine if any activities in the area could cause a hazardous atmosphere to build up in the space.
36. Only enter the Non-Permit Required Confined space alone, if accompanied to the space by at least one other non-entrant.
    36.1. The Confined Space non-entrant shall remain in the immediate area until the Confined Space entrant has exited the Confined Space
37. Only perform activities, previously identified on the Non-Permit Required Confined Space Work Authorization Form, which could not change the hazards within the space.
    37.1. For example, only using chemicals specified on the Non-Permit Required Confined Space Work Authorization Form.
        37.1.1. Following completion of work in a Non-Permit Required Confined Space, the entrance shall be secured and the Non-Permit Required Confined Space Work Authorization Form shall be removed from the work site.
        37.1.2. Send the Non-Permit Required Confined Space Work Authorization Form to Industrial Safety and Health within 30 days of work completion.
    37.2. Permit Required Confined Space
        37.2.1. A Permit Required Confined Space (PRCS) is a space with one or more of the following characteristics:
38. •Contains, or has a potential to contain, a hazardous atmosphere.
39. •Contains a material that could engulf (cover up) an entrant.
40. •Has an internal configuration such that an entrant could be trapped by inwardly converging walls.
41. •Contains any other recognized serious safety or health hazard.
        41.1.1. The Entry Supervisor shall consult with Industrial Health and Safety when completing Permit Required Confined Space Work Authorization Form, at the location of the Confined Space.
42. The Entry Supervisor and the Industrial Health and Safety Department representative shall verify the expiration date of the Permit Required Confined Space Work Authorization Form.
    42.1. The duration of a Permit Required Confined Space Work Authorization Form shall not exceed the anticipated time required to complete the description of the work scope described.
    42.2. The Industrial Health and Safety review and signature authorization may be accomplished per telephone conversation.
    42.3. During evenings, weekends, and holidays. The Industrial Health and Safety may be contacted for review and signature authorization.
        42.3.1. Prior to entry, the atmosphere inside the Permit Required Confined Space shall be tested for atmospheric hazards and the results entered in the appropriate fields in the Permit Required Confined Space Work Authorization Form.
43. If entry into a Permit Required Confined Space is necessary to collect additional testing data or inspect for hazards, then all provisions for safe entry listed on the Permit Required Confined Space Work Authorization Form must be implemented.

43.1. The individual performing the pre-entry tests shall record the results of the atmospheric tests by completing the required initial block portion of the Permit Required Confined Space Work Authorization Form.

43.2. If initial testing indicates the space contains a hazardous atmosphere, then immediately stop the entry process and contact the Industrial Health and Safety Department.

43.3. If initial testing indicates the anticipated hazards are within the allowable limits listed in the Permit Required Confined Space Work Authorization Form, then entry may proceed.

44. Record the results of the initial testing in the Permit Required Confined Space Work Authorization Form.

44.1. Prior to initial entry of the Permit Required Confined Space, the Entry Supervisor shall review the conditions of the permit and the requirements for safe entry with all employees involved with the Permit Required Confined Space entry. The Entry Supervisor shall also ensure that the following is accomplished:

45. Instructions have been given to Assigned Attendants regarding the hazards associated with the Permit Required Confined Space and communication methods to be established with Confined Space Authorized Entrants.

46. Verify that any Rescue Plan required equipment is staged and in place.

47. Instructions have been given to Permit Required Confined Space Authorized Entrants regarding all of the following:

- Hazards involved.
- Precautions to be taken.
- Use of equipment associated with work in the Permit Required Confined Space.

48. Prior to entering the Permit Required Confined Space, the Entry Supervisor is responsible to ensure that all the Permit Required Confined Space Work Authorization Form Sections listed below are completed and contain all required names and signatures:

Confined Space Parameters
Confined Space Entry Requirements
Confined Space Classification
Pre-Entry & Follow-Up Test Results
Entry Supervisor’s Verbal Verification of Attendant's Rescue and Communication Responsibilities
Attendant Acknowledgement of Responsibilities
Entrant Acknowledgement of Responsibilities

48.1. An attendant shall be posted at the entrance to the Permit Required Confined Space whenever a Confined Space Authorized Entrant is working in the Confined Space. Attendants shall:

48.2. Understand the hazards that may be encountered during the entry.
48.3. Sign the Attendant Acknowledgment field on the Permit Required Confined Space Work Authorization Form, indicating understanding of assigned responsibilities and potential hazards associated with the Permit Required Confined Space.
48.4. Be aware of possible behavioral effects on entrants due to hazard exposure.
48.5. Communicate with the entrants in the Permit Required Confined Space at all times.
48.6. Remain outside the Permit Required Confined Space until relieved by another attendant.
48.7. The attendant is not permitted to enter the Permit Required Confined Space.
49. Control access to the Permit Required Confined Space.
50. Maintain an accurate count of entrants and record the count using the Permit Required Confined Space Work Authorization Form, Responsible Attendant's In/Out Log.
50.1. The attendant orders the evacuation of the Permit Required Confined Space, as necessary.
51. Ensure authorized entrants review the Permit Required Confined Space Work Authorization Form and sign Entrant Acknowledgment of Responsibilities.
52. Summon rescue services when escape assistance is needed.
53. Perform no other duties that may interfere with the primary duty to monitor and protect the authorized entrants.
- Attendants are only authorized to monitor one man hole at a time.

53.1. The Entry Supervisor and Industrial Health and Safety will sign the Permit Required Confined Space Work Authorization Form, indicating that all conditions and precautions for pre-entry have been met and are in place.
53.2. The Entry Supervisor will ensure a boundary is maintained and the Permit Required Confined Space Work Authorization Form is prominently placed at the entrance of the Permit Required Confined Space.
54. The Permit Required Confined Space Work Authorization Form is posted to communicate the following, to persons outside the confined space:
55. •The Confined Space is occupied.
56. •Who to contact for questions.
56.1. The atmosphere inside the Permit Required Confined Space shall be continuously tested for oxygen, explosive levels, and other toxins as required by the Permit Required Confined Space Work Authorization Form.
57. The atmosphere inside the Permit Required Confined Space shall be tested for atmospheric hazards and the results entered in the appropriate fields in the Permit Required Confined Space Work Authorization Form.
57.1. If entry into a Permit Required Confined Space is necessary to collect additional testing data or inspect for hazards, then all provisions for safe entry listed on the Permit Required Confined Space Authorization Form Pre-Entry and Follow Up Test Prior to Confined Space Entry, must be implemented.
58. Record the results of any follow-up testing on the Permit Required Confined Space Work Authorization Form, Follow-Up Atmospheric Testing section.
59. If atmospheric testing indicates contaminants above the limits specified in the Permit Required Confined Space Work Authorization Form then perform the following activities:
59.1. Immediately stop work.

59.2. Exit the space.
59.3. Contact the Industrial Health and Safety.
59.3.1. If a Permit Required Confined Space is discovered to pose no actual or potential air quality hazards and all physical hazards within the space have been eliminated, then the Permit Required Confined Space may be reclassified as a Non-Permit Required Confined Space by the Industrial Health and Safety.
59.3.2. Each Authorized Entrant shall use and/or wear retrieval equipment.

60. Wearing of a retrieval device/line is not required if either of the following occurs:
- The retrieval device/line would increase the overall risk of entry
- The retrieval device/line would not contribute to the rescue of the entrant.

61. The determination to wear retrieval device/line shall be made in conjunction with Industrial Health and Safety.
61.1. Following completion of work in a Permit Required Confined Space, the entrance shall be secured and the Permit Required Confined Space Work Authorization Form shall be canceled.

62. The canceled Permit Required Confined Space Work Authorization Form shall be returned to the Industrial Health and Safety within 30 days of work completion.
62.1. Permit Required Confined Space Equipment

63. Each crew shall make available any equipment necessary for the safe entry into a Permit Required Confined Space, including, but not limited to, the following:
Note: Employees, or their representatives, are entitled to request additional monitoring at any time.
- Testing and monitoring equipment
- Ventilation equipment
- Communications equipment
- Personal Protective Equipment
- Lighting
- Barriers and shields
- Ladders
- Specialized tools

63.1. Confined Space Entry
63.1.1. Section 4.7 applies to both Non-Permit Required and Permit Required Confined Spaces unless otherwise specified.
63.1.2. Upon opening the Confined Space, the Confined Space shall be posted with a "DANGER" sign at all potential entrances.

64. The Confined Space "DANGER" posting shall also state "Confined Space, Trained and Authorized Personnel Only", or similar language.
65. The Confined Space "DANGER" posting shall remain in place until the Confined Space permanent cover is reinstalled.
66. If there is a stenciled "CAUTION" sign present, then the Confined Space "DANGER" posting shall be placed directly on top of the "CAUTION" sign in such a manner that the term "CAUTION" cannot be seen when the Confined Space "DANGER" posting is in place.
66.1.1. Any conditions making removal of an entrance cover unsafe should be eliminated before the cover is removed.

67. When the Confined Space entrance is at grade level (such as a manhole or pit), the opening should be promptly guarded upon cover removal by a railing, temporary cover, or other temporary barrier that will prevent anything from falling through the opening.
68. The barrier or cover should protect each employee working in the space from foreign objects entering the space.
69. If the Confined Space is in a traffic area, then traffic barriers should be erected.
    69.1. Prior to entry into a Confined Space, the following shall be accomplished:
70. The Confined Space shall have an approved Confined Space Work Authorization Form in effect.
71. A copy of the Confined Space Work Authorization Form shall be prominently posted at the designated entrance to the Confined Space.
72. The Entry Supervisor's signature is only valid for one shift.
    72.1. For subsequent shifts, the following conditions for Confined Space Work Authorization Forms, must be met:
        72.1.1. A qualified person should verify all precautions and other measures called for are still in effect.
        72.1.2. Only operations or work originally approved should be conducted in the Confined Space.
        72.1.3. The Entry Supervisor for each subsequent shift must complete a new form, signifying that all testing has been performed, precautions are in place, and the space is ready for entry.
73. If changing work conditions or work activities increase existing hazards or introduce new hazards into the Confined Space, then a new Confined Space Work Authorization Form shall be completed.
74. When conditions change, Confined Spaces should be re-evaluated to ensure the following:
    74.1. New or unforeseen hazards have not been introduced into the Confined Space.
    74.2. Ensure the existing Confined Space Work Authorization Form precautions are still protective.
    74.3. If reevaluation shows that hazards within the space have changed, then the following actions shall be performed:
        74.3.1. Workers must exit the space.
        74.3.2. Cancel the Confined Space Work Authorization Form.
        74.3.3. Generate a new Confined Space Work Authorization Form.
        74.3.4. Implement all new precautions.
        74.3.5. Brief workers on all changes prior to resuming work.
75. All personnel shall be briefed, by the Entry Supervisor, regarding specific assignments and responsibilities. For example, personnel assigned to perform and record results of pre-entry atmospheric testing.

75.1. Personnel shall be briefed on the following items associated with the Confined Space, including, but not limited to:

- Specific hazards.
- Precautions.
- Required equipment
- Confined Space Work Authorization Form

76. If entry into a Confined Space is necessary to collect additional testing data or inspect for hazards, then all provisions for safe entry listed on the Confined Space Work Authorization Form shall be adhered to.

76.1. Signage

76.1.1. Identification signs should be placed on all confined spaces that could be inadvertently entered. Perform all of the items below:

- Signs shall be maintained in a legible condition and indicate the space is a Confined Space.
- Signs shall contain a warning that a permit is required before entry.
- Signs shall be posted prominently at accesses to all confined spaces.

76.1.2. If multiple groups work and enter into a Confined Space using the same Confined Space Work Authorization Form, then the Confined Space Entry Supervisors are responsible to coordinate work with each other ensuring that one work group does not create a hazardous environment for the other.

77. Multiple groups may work in a Confined Space using the same Confined Space Work Authorization Form, provided both of the following occur:

- All entrants are properly trained and briefed.
- All hazards are addressed to all entrants by the responsible Entry Supervisor.

77.1.1. A Confined Space opening, such as a manhole or equivalent size opening that creates a fall hazard, shall be guarded to prevent an individual from falling into the opening.

78. Guarding can be accomplished by having one worker remain at the opening entrance to warn others of the hazard or by placing a standard railing system around the opening.

78.1. Electrical and Welding Work Practices

78.1.1. If a welder must enter a Confined Space through a manhole or other small opening, then means shall be provided for quickly removing the welder in case of emergency.

79. If lifelines are used for quick removal of a welder, then the lifelines shall be attached to the welder's body so that the body cannot be jammed in the exit opening.

80. To ensure the safety of individuals working within the Confined Space, a Confined Space Attendant shall be stationed outside to observe the welder at all times and be capable of initiating rescue operations.

80.1. The Confined Space Attendant shall ensure the removal equipment is available and be familiar with the use of the equipment in order to initiate welder removal in case of emergency while waiting for rescue team members.

80.1.1. If the employee is protected from all electrical hazards, then the employee may enter a manhole for the purpose of performing tasks, including, but not limited to any of the following:

- •Inspection.
- •Working near energized cables.
- •Taking readings.

80.1.2. Confined Space entry and exit openings shall be maintained free and clear of obstructions to facilitate entry and exit of the space.

80.2. Transfer of Ownership

80.2.1. The Entry Supervisor may transfer Entry Supervisor duties to another Entry Supervisor during the course of an entry operation by completing all the following actions:

81. Conduct a turnover briefing with the new Entry Supervisor to ensure the operations continue per the conditions of the and the safety of the entrants is maintained.
82. Cross out the previous Entry Supervisor's name from the Confined Space Work Authorization Form in the Entry Supervisor's signature field and add the new Entry Supervisor's signature if the same form is used.
83. Determine if the current Confined Space Work Authorization Form will be re-used or if a new Confined Space Work Authorization Form is required.
    - 83.1. If the current Confined Space Work Authorization Form will be re-used, then perform the following actions before work resumes:
        - 83.1.1. Cross out the previous Entry Supervisor's name from the Confined Space Work Authorization Form, Entry Supervisor's signature field.
        - 83.1.2. Add the new Entry Supervisor's name to the Confined Space Work Authorization Form, Entry Supervisor's signature field.
    - 83.2. If a new Confined Space Work Authorization Form is required, then a new Confined Space Work Authorization Form must be initiated and completed by the Entry Supervisor.
        - 83.2.1. The new Entry Supervisor must print name, and sign, the Confined Space Work Authorization Form, Entry Supervisor's signature field.
    - 83.3. Work may resume only after the reused, or new, Confined Space Work Authorization Form is completed and signed by the Entry Supervisor.
    - 83.4. Termination of Confined Space
        - 83.4.1. If work within any Confined Space is terminated for reasons regarding employee safety, then the following actions shall be performed immediately:
84. Exit the Confined Space by all entrants and remove the Confined Space Work Authorization Form.
85. Barricade the entrance to the space with "Red-Danger" barrier ribbon..
86. Consult with the Industrial Health and Safety.
    - 86.1. Confined Space Emergencies
        - 86.1.1. The Leader or Industrial Health and Safety shall determine if a Confined Space incident is an emergency.
    - 86.2. Disposition of Confined Space Work Authorization Form
        - 86.2.1. Industrial Health and Safety shall perform an annual review of, during the first quarter of the year, the previous year's Non-Permit Required Confined Space Work Authorization Forms and Permit Required Confined Space Work Authorization Forms.
87. The annual review should focus on administrative correctness (form filled out correctly and has all required signatures) and to monitor the effectiveness of the Confined Space Entry Program.
    - 87.1. If no Confined Space entry is performed during the year, then no review is necessary.
    - 87.2. Cancelled Confined Space Work Authorization Forms shall be retained by Industrial Health and Safety until the end of each calendar year.
88. Documentation of the review and any findings shall be recorded for trending.
89. Reviewed Confined Space Work Authorization Forms should be retained by Industrial Health and Safety for one calendar year.
    - 89.1. Reviewed forms are not required to be retained by Industrial Health and Safety longer than one year.

89.2. Noncompliance

89.2.1. Noncompliance with this procedure will result in the following:

90. All work within the Confined Space will be stopped and all personnel removed from the Confined Space.
91. Communicate non-compliance issues to Confined Space Entry Supervisor, Attendants, and Entrants.

91.1. Notification must be made to an Industrial Safety Department representative.

92. The Confined Space Work Authorization Form will be cancelled and removed from the Confined Space.

92.1. The canceled Confined Space Work Authorization Form will be returned to the Industrial Safety Department Leader/Designee.

93. The Industrial Health and Safety Department Leader/Designee must concur that all issues have been addressed and corrective actions have been taken before re-establishing work in the Confined Space.

93.1. All corrective actions have been taken before work in the Confined Space is resumed.

94. The responsible organization shall retrain for non-compliance issues.
95. After an event, Confined Space Entry retraining shall be successfully completed by the Confined Space Entry Supervisor, Confined Space Attendants, and Confined Space Entrants before re-entering a Confined Space.

95.1. After successful completion of Confined Space Entry retraining by the Confined Space Entry Supervisor, Confined Space Attendants, and Confined Space Entrants, Confined Space qualifications will be administratively reinstated for the affected personnel.

96. A new Confined Space Work Authorization Form shall be completed, granted, reviewed, and approved prior to re-entering the Confined Space to complete work.

Permit Required Confine Space Date:		
Site location or description:		
Purpose of entry: _____		
Supervisor(s) in charge of crews:	Type of crew (welding, plumbing, etc)	Phone #:
Permit duration:		
Communication procedures (including equipment): _____ _____		
Rescue procedures (also see emergency contact phone numbers at end of form): _____ _____		

REQUIREMENTS COMPLETED (Put N/A if item doesn't apply)	**DATE**	**TIME**	**REQUIREMENTS COMPLETED (Put N/A if item doesn't apply)**	**DATE**	**TIME**
Lockout/De-energize/Try-out			Supplied Air Respirator (N/A if alternate entry)		
Line(s) Broken-Capped-Blank			Respirator(s) (Air Purifying)		
Purge-Flush and Vent			Protective Clothing		
Ventilation			Full Body Harness w/ "D" ring		
Secure Area (Post and Flag)			Emergency Escape Retrieval Equip		
Lighting (Explosive Proof)			Lifelines		
Hotwork Permit			Standby safety personnel (N/A if alternate entry)		
Fire Extinguishers			Resuscitator—Inhalator (N/A if alternate entry)		
Add other specific information, if needed, or attach additional instructions or requirements. See the following examples in bold print.					
Line(s) to be bled/blanked:					
Ventilation equipment:					
PPE clothing:					
Respirator(s):					
Fire extinguisher(s):					
Emergency retrieval equipment:					

AIR MONITORING										
Substance Monitored		**Permissible Levels**		**Monitoring Results**						
Time monitored (put time) Percent Oxygen		Record the time 19.5% to 23.5%								
LEL/LFL		Under 10%								
Toxic 1:		_____ PEL	____STEL							
Toxic 2:		_____ PEL	____STEL							
Toxic 3:		_____ PEL	____STEL							
Toxic 4:		_____ PEL	____STEL							

REMARKS:

_____

_____

Air Tester Name	ID#	Instrument(s) Used (For example: oxygen meter, combustible gas indicator, etc.)	Model # or Type	Serial# or Unit

ATTENDANTS AND ENTRANTS

Attendant(s) (Required for all confined space work except alternate entry)*Attendants are not allowed to monitor more than one hole.	ID#	Confined Space Entrant(s)	ID#

REMARKS:

_____

_____

SUPERVISOR AUTHORIZATION - ALL CONDITIONS SATISFIED

Department or phone number: _____

EMERGENCY CONTACT PHONE NUMBERS:

AMBULANCE: _____ FIRE: _____ SAFETY: _____ RESCUE TEAM: _____ OTHER: _____

Section XIII

Fall Protection

PURPOSE AND SCOPE

A. Purpose
- A.1. This procedure describes the requirements for safely working at heights for fall protection and aerial devices.
- A.2. This procedure complies with Occupational Safety and Health Administration (OSHA) Fall Protection requirements.
- A.3. Scope
  - A.3.1. This procedure applies to all employees using fall protection.

B. RESPONSIBILITIES
- B.1. Authorized Person(s)
  - B.1.1. Complies with the requirements of this procedure.
- B.2. Competent Person
  - B.2.1. Supervises, implements, and monitors procedure implementation.
  - B.2.2. Completes Fall Protection training.
- B.3. Leaders
  - B.3.1. Ensures employees have current training, and retraining is performed as necessary or on an annual basis. Training shall be documented in Nantel.org
  - B.3.2. Completes Fall Protection training.

C. DEFINITIONS
- C.1. **Anchor Point** — A structure which withstands forces exerted by fall arrest and fall restraint. Anchor points used for fall arrest or fall restraint have different strength requirements.
- C.2. **Authorized Person** — A person who can work safely at heights by reason of training or experience in the proper selection and use of fall protection equipment.
- C.3. **Competent Person** — Individual who has been trained and is capable of identifying existing and predictable hazards in the surroundings or working conditions which are hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate these conditions.
- C.4. **Deceleration Device** — A device that reduces force applied to the body during a fall. The two types used are shock absorbing lanyard and a self-retracting lifeline.
- C.5. **Free Fall** — The distance before a personal fall arrest system begins to apply force to arrest the fall.
- C.6. **Full Body Harness** — Required device for fall arrest and restraint.
- C.7. **Horizontal Lifeline** — An approved system consisting of a rope or cable stretching from one anchor point to another
- C.8. **Lanyard** — Either a fixed-length or retractable connective device between the anchor and the user's harness.
- C.9. **Personal Fall Arrest System (PFAS)** — A system used to arrest a person in a fall from a working level and that minimizes the potential for compounding injury. It consists of an anchorage, full body harness and a deceleration device.
- C.10. **Self-retracting Lifeline (SRL)** — A device containing a drum-wound line which can be slowly extracted under slight tension during normal movement which, after onset of a fall, automatically locks the drum and arrests a fall.
- C.11. **Shock Absorber** — Device to limit deceleration force on the body during fall arrest.

C.12. **Standard Rail System** — Consists of a top rail (42" +/-3") and mid-rail (~1/2 distance from top rail to floor), capable of withstanding at least 200 lbs. of force to the top rail. [Depending on the location, plant equipment such as piping or structural steel may qualify as a standard rail system (top and/or mid-rail)].

C.13. **Vertical Lifeline** — A vertically suspended flexible line, connected to an anchor point along which a deceleration device travels.

C.14. **Warning Line** — A barrier erected on a roof to warn employees that they are approaching an unprotected roof side or edge and which designates an area in which work may take place without the use of standard railing system, harness belt, or safety net systems to protect employees in the area.

C.15. **General industry**-- OSHA uses the term "general industry" to refer to all industries not included in agriculture, construction or maritime. General industries are regulated by OSHA's general industry standards, directives, and standard interpretations.

C.16. **New Construction**-- OSHA's regulations define "construction work" as "construction, alteration, and/or repair, including painting and decorating." at 29 CFR 1926.32(g) and 29 CFR 1910.12(b). They further provide that OSHA's construction industry standards apply "to every employment and place of employment of every employee engaged in construction work." id. at 1910.12(a). In interpreting definitional provisions in these regulations, the Occupational Safety and Health Review Commission and the courts have looked to similar definitional provisions in other federal laws and regulations. For example, OSHA's regulations make specific reference to definitions in the Davis-Bacon Act and regulations promulgated under that Act. The Davis-Bacon Act regulations issued by the Department of Labor broadly define construction work or activity as follows:

C.16.1. The terms "building" and "work" generally include construction activity as distinguished from manufacturing, furnishing of materials, or servicing and maintenance work. The terms include, without limitation, buildings, structures, and improvements of all types, such as bridges, dams, plants, highways, parkways, streets, subways, tunnels, sewers, mains, power lines, pumping stations, heavy generators, railways, * * excavating,* * .

D. INSTRUCTIONS

D.1. General

D.1.1. Any employee not protected by a Standard Rail System and subject to a fall greater than four feet shall be protected by either a Fall Restraint or a Personal Fall Arrest System (PFAS).

D.1.2. Any new construction project is subject to a fall six feet or greater shall be protected by either a Fall Restraint or a Personal Fall Arrest System. .

D.1.3. All workers shall be protected (tied off) before leaving the security of a Standard Rail System and continuously (100%) thereafter. A site specific Fall Protection plan shall be 67 developed by a qualified person

D.1.4. 100% tie-off may require use of two lanyards.

D.1.5. Fall protection is required when working on top of C-vans or on boxes on trailers.

NOTE
Fall protection not required when working from, or climbing, ladders (typically for temporary use) or rolling stock (such as semi-trailer flat beds, floats, and flat rail cars). Unless the job site request that employees use fall protection when performing the task above.

D.1.6. Whenever possible, the use of stake bed sides (vertical stake sides) should be employed to prevent falls from tractor trailers and stake beds.
D.1.6.1. Remove only those stakes required to remove cargo.
D.1.7. Fall protection is required when climbing, or descending, ladders with a ladder climbing device installed.

D.2. Standard fall protection equipment is rated for a maximum combined weight of worker, equipment, and tools of 310 lbs.
- Workers whose combined weight exceeds 310 lbs. shall obtain a fall protection harness/lanyard with the proper weight rating, or that person shall not be assigned the task.
- Lanyards shall not be doubled to obtain the perceived correct weight rating.
- Contact Safety for assistance when necessary

D.3. Fall protection equipment shall be used for no other purpose than personal fall protection.
D.4. For example, beam wraps, sliding clamps and lanyards shall not be used to lift, rig, or restrain material equipment.
D.5. Fall protection equipment shall be protected from hot surfaces, flames, sparks, chemicals, etc. that could damage this equipment.

E. **Anchor Points**
E.1. Fall Arrest Anchor Points
E.2. An anchor point for Personal Fall Arrest Systems (PFAS) shall be a structural member capable of supporting a minimum weight of 5,000 pounds per employee, for example:
- Structural (building) steel
- I-beams
- Angle iron (used as structural support)
- Tube steel
- Round stock

E.3. Structures and components that shall NOT be used for Fall Arrest:
- Ladder rungs
- Guardrails/handrail
- Small diameter pipe, electrical conduits, etc.
- Projections, exposed bolts, and the lips of I-beam flanges
- Grating (if secured with grating clips)
- Fixed ladder rungs
- Heavy wall electrical conduit

E.4. Fall Restraint Anchor Points
E.5. Anchor points for fall restraint shall be capable of supporting a force of two times the load up to 1000 pounds.
E.5.1. If the supporting force is unknown, then an engineering evaluation prior to use is required. Examples include, but are not limited to, the following:
- Guardrail/handrail
- Single uni-strut
- Structural (building) steel
- I-beams
- Angle iron (used as structural support)
- Tube steel
- Round stock

F. Fall Protection Systems

F.1. The two standard types of Fall Protection Systems are:

- Fall arrest
- Fall restraint

G. Free Fall Distance

- Fall arrest – Refer to the Fall Clearance Chart and Requirements.
- Fall restraint - NO free fall is permitted, restraint shall prevent any fall from heights.

H. Personal Fall Arrest System (PFAS)

H.1. A PFAS is used to arrest an employee's fall. All fall protection equipment shall meet ANSI industry or regulatory standards

H.2. A PFAS system consists of an anchor point, full body harness, and a deceleration device.

- A vertical lifeline with rope grab can be used in lieu of a deceleration device.
- An 18" D-ring extension is the only device that may be attached between the back D-ring of the harness and rope grab.
- If a chest D-ring is available, then attach rope grab directly to chest D-ring.
- Any Falls while using PFAS will be investigated by Safety Personal and will include inspection of all mechanical uses including anchor points.

I. Anchor points

I.1. Anchor points should be secured at, or above, the back D-ring on the harness when possible.

I.2. If the anchor point is below the back of the D-ring, and the free fall is greater than six feet, then perform the following.

- Contact a Leader or Industrial Safety
- Refer to Appendix C - Fall Clearance Chart and Requirements

J. Types of Deceleration Device

NOTE A higher (vertical) anchor point allows more travel distance (horizontal) from 0° to 15°.

J.1. Self-Retracting Lifeline (SRL)

- The swing fall radius should be less than 15° (unprotected edge/side) from the overhead anchor point.
- Contact a Leader or Industrial Safety if anchor point is greater than 15°.

J.2. Shock Absorbing Lanyard

- The "shock pack" end should be attached to harness back D-ring
- Adding extensions, beams straps, etc., where the free fall distance or length of lanyard exceeds six feet from shoulder level is prohibited.
- Adding a second shock absorbing lanyard is prohibited.
- Only lanyards specifically designed to allow tie back to itself may be attached to itself.

K. **Restraint Systems**

K.1. A Restraint System re-strains an individual by preventing them from going beyond an unprotected edge.

K.2. Restraint Systems consist of:

- Fall restraint anchor point
- Full body harness
- Lanyard or SRL

K.3. The length of the lanyard (including connection to anchor point and harness shall not permit a fall from the unprotected edge at any point.

K.4. The lanyard may be connected to any harness D-ring.

L. **Horizontal Lifelines**

L.1. Horizontal lifelines shall be designed and installed under the direction of a Competent Person.

L.2. Ratcheting horizontal lifelines have a maximum capacity of two persons when used for fall arrest.

L.3. Fixed horizontal lifelines shall be labeled as to its maximum capacity.

M. **Warning Line Systems**

M.1. The warning line designates the area in which work may take place without the use of guardrails, fall restraint or a PFAS.

M.2. The warning line shall be erected no less than 15 feet from unprotected edge.

M.3. Warning Line Systems shall meet the following criteria:

- Rope, wire or chain with minimum tensile strength of 500 pounds
- Line height positioned between 34 inches to 39 inches from walking/working surface, including any sag/slack.
- High-visibility flagging on line at intervals of less than or equal to six feet
- Stanchions with a minimum tipping force equal to or greater than 16 pounds when system is completed

M.4. Articulating Boom and Scissor Lifts

M.5. Personnel will follow the manufacturer's guidelines to determine if fall protection is required.

M.6. Safety Net Systems

M.7. Contact Safety for assistance.

N. **Rescue**

N.1. Leaders shall ensure personnel using a Personal Fall Arrest System can be promptly rescued or rescue themselves should a fall occur.

N.2. Rescue options shall be determined and discussed with each affected employee during the pre-job briefing and JHA (if used).

O. DONNING

O.1. Perform pre-use inspection- Equipment Inspection and Care.

O.2. Lift the harness up by grabbing the back D-ring.

O.3. Shake the harness while holding the D-ring to let the straps fall into place below it.

O.4. Unbuckle any leg, chest, or waist straps that were buckled while the harness was not in use.

O.5. Put the shoulder straps on over the shoulders. (They are correctly positioned when the D-ring settles over the wearer’s back between the wearer’s shoulder blades.)

O.6. Buckle a leg strap around each leg by passing the back part of each strap between the wearer’s legs and buckling it to the front section.

O.7. Buckle the waist belt (if the harness has a waist belt).

O.8. Buckle the chest strap and pull it tight it until the wearer feels that the shoulder straps are secure and in no danger of slipping from the shoulders.

O.9. Tighten the straps on all the other buckles until they are comfortably snug, but not so far as to restrict the wearer's range of motion.

O.10. Tuck away any excess straps by passing it through the slotted metal pieces (called "loop keepers") on each strap.

P. **DOFFING**

P.1. Leaving the chest strap for last, loosen the limb straps.

P.2. Unbuckle each limb strap.

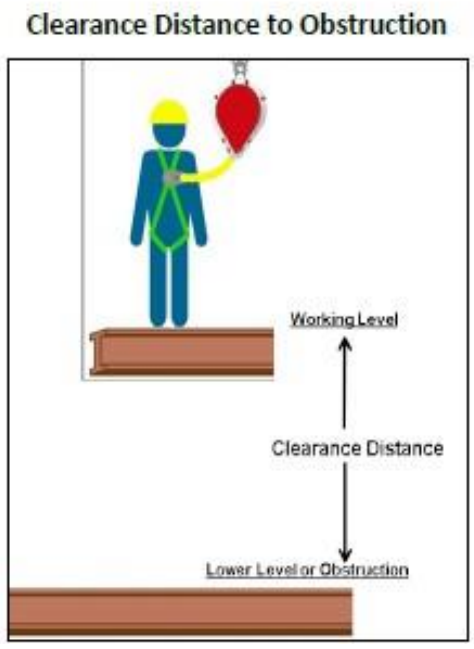
P.3. Unbuckle the chest strap and slide the harness off the shoulders.

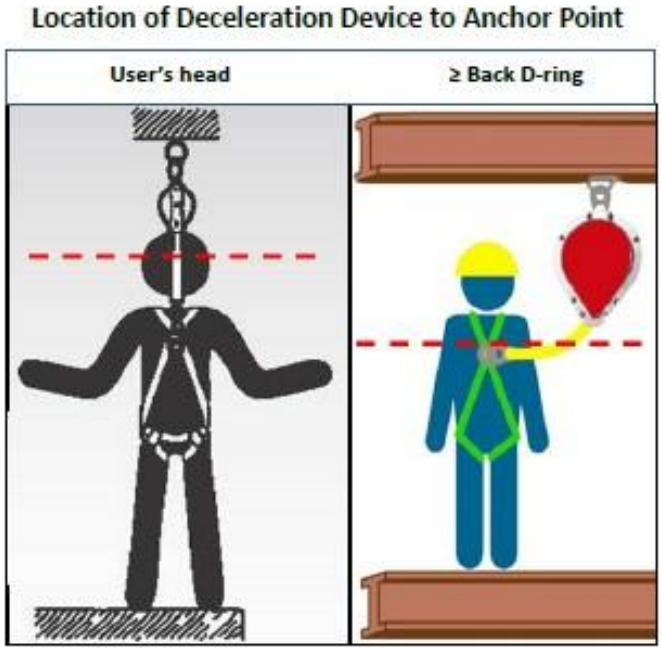
P.4. Once the harness is off, reengage buckles again to keep them from tangling.

P.5. Visually inspect the harness after use.

P.6. Hang up the harness to be ready for the next user.

clearance Distance to Lower Level or Obstruction (in Feet) (see below)	**type of Deceleration Device**	**Location of Deceleration Device Attachment to Anchor Point (see below)**	**Free Fall Distance (in Feet)**
4 to <8	SRL	User's head	0
8 to <14	SRL	≥ back D-ring	2
14 to <18	RL / 4' Shock absorbing lanyard	≥ back D-ring	4
≥ 18	RL / 6' Shock absorbing lanyard	≥ back D-ring	6





Q. PRE-USE INSPECTION

Q.1. Perform the following equipment pre-use inspection items:

- Check for wear, tears, mold, mildew or distortion.
- Ensure that no straps are cut, torn, or scraped.
- Check for undue stretching.
- Check ropes for wear, broken fibers, pulled stitches and discoloration.
- Check hardware for distorted hooks or faulty springs. Buckles must work properly.
- Identify, tag, and dispose of defective equipment.
- Ensure annual inspection is completed.

R. CLEANING NYLON OF POLYESTER FULL-BODY HARNESSES

R.1. Use a dampened sponge or cloth to remove loose surface dirt.

R.2. Using a mild solution of soap and warm water, such as dish washing liquid, take a soft bristle and scrub the entire harness. Do not use abrasive pads or stiff bristle brushes which could cut or unbraid the harness stitching.

R.3. Rinse the harness with plain water, then towel dry to remove excess water from the webbing and hardware.

R.4. Hang to air dry in an area that is not exposed to excessive sun light, heat, chemicals, etc.

Section XIV

Electrical Safe Work Awareness

APPENDIX PAGE Appendix
Appendix A - Safe Working Distances
Appendix B - PPE/EPE Matrix
Appendix C - Arc Flash Protection Apparel Selection
Appendix D - Policy, Checklists & Permit For Working within the Restricted Approach Boundary of Exposed Energized Equipment
Appendix E - Risk Assessment of Work on Energized Equipment

A. PURPOSE AND SCOPE
  A.1. Purpose
    A.1.1. The purpose of this procedure is to provide standards and expectations to safely work while exposed to electrical hazards.
    A.1.2. This procedure supports implementation of the Industrial Health and Safety Program, within the Loss Prevention Program Area.
  A.2. Scope
  A.2.1. This procedure applies to all LLR Electric Personnel, Non-Utility Workers, Contractors and Vendors working within the Limited Approach Boundary of energized exposed electrical conductors or circuit parts operating at 50 volts or greater or work activities that could potentially produce an electrical fault or other electrical related hazard.

  A.2.2. This procedure does not apply to the following work activities performed on the following:
    A.2.2.1. Equipment with voltage output of 50 volts or more where less than three (3) milliamps exist.
    A.2.2.2. Some electronic components may operate at high voltages but due to low amperage (less than three [3] milliamps), the electronic components do not have the potential of creating a hazardous arc flash nor do the components pose a shock hazard that would cause bodily harm. However, special caution shall be used when amperage is greater than one (1) milliamp (mA). At 1 mA, the current passing through the body can cause an involuntary reaction. Preventive measures, such as wearing voltage rated gloves or installing barriers, may be used.
    A.2.2.3. De-energized and grounded equipment.
B. RESPONSIBILITIES
  B.1. Electrical Leader
  B.2. Personnel
    B.2.1. Use knowledge, skills, and experience to perform jobs safely.
    B.2.2. Understand and comply with electrical safe work practices and any associated procedures or policies.

B.2.3. Wear the proper PPE and EPE.
B.2.4. Ensure others working in the area comply with electrical safe work practices.
B.2.5. Stop work when discrepancies are identified and contact supervision.

B.3. Training Personnel
B.3.1. Provide the necessary training to ensure all workers understand the specific hazards associated with job or task assignments.

B.4. Project Managers/Construction Managers
B.4.1. Provide specific electrical safety information to contractors as required.

C. DEFINITIONS

C.1. **Approved Insulated Tool** — A hand tool or instrument used to work on energized equipment that is clearly marked with voltage rating symbols and meets all the codes and standards. Reference Step 4.7.2.

C.2. **Arc Rated Face Shield** — May also be called Arc Flash Shield. A Face shield designed to protect from electrical arc blast/flash with a ATPV rating suitable for the arc flash exposure shall be worn in combination with a hardhat, ear protection and safety glasses or goggles. The face shield has wrap-around guarding to protect not only the face, but also the forehead, ears and neck. Flash suit hood can be used as an alternative. Arc Rated Face Shield is worn for arc flash hazard related work activities greater than 4 but less than 12 cal/cm2. An acceptable alternative to the arc rated face shield with arc rated balaclava or the arc flash hood is an arc rated pair of goggles with arc rated balaclava combination with the appropriate ATPV rating for the task.

C.3. **Arc Flash Hazard** — A dangerous condition associated with the release of energy caused by an electric arc. An arc flash hazard may exist when a person is interacting with energized electrical conductors or circuit parts, for example, opening the door of any electrical cabinet/component, racking breakers, lift land leads, etc.

C.4. **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 and the appropriate levels of PPE/EPE.

C.5. **Arc Rating** — The maximum incident energy resistance demonstrated by a material (or a layered system of materials) prior to break open or at the onset of a second-degree skin burn. Arc rating is normally expressed in ATPV cal/cm2 or Ebt.

C.6. **ATPV** — The Arc Thermal Performance exposure Value rating for a garment and is listed in cal/cm2. Also see Ebt.

C.7. **Avoid Contact** — A worker shall use Situational Awareness or any other means necessary to prevent the intentional or unintentional touching, of any part of the body, with a potentially energized source of 50 - 300 volts to ground.

C.8. **Breaker Manipulation** — Any human interaction remotely or locally which causes the breaker to change state, which includes racking/insertion of a breaker. Auto start functions are not considered "breaker manipulations" in regards to activities performed within this procedure.

C.9. **Circuits** — A combination of lines and exposed live parts and also refers to the current carrying parts of conductors, equipment, apparatus, etc.

C.10. **Dead Front** — Without live parts exposed to a person on the operating side of the equipment.

C.11. **De-Energized** — Isolated from all known sources of power. Free from any electrical connection to a source of potential difference and from electrical charge; not having a potential different from that of the earth.

C.12. **Ebt** — The average of five (5) highest incident energy exposures value below the Stoll curve where the specimens do not exhibit break-open. Ebt is used when ATPV cannot be measured due to flame resistant fabric break-open.

C.13. **Electrical Hazard** — A dangerous condition such that contact or equipment failure can result in electrical shock, arc flash burn, thermal burn or blast.

C.14. **Electrical Protective Equipment (EPE)** — Equipment designed to protect a worker against electrical contact, electrical flash/blast. The equipment includes, but is not limited to, the following: voltage rated rubber gloves with leather protectors; rubber insulating matting/blankets and voltage rated roll blanket; arc rated face shields; 100 percent cotton clothing; Nomex jackets; and gauntlet style welding gloves for flash protection.

C.15. **Electrically Safe Work Condition** — A state in which the conductor or circuit part has been isolated/disconnected from the energized sources, locked out/tagged out per approved procedures, live-dead-live tested to ensure absence of potential and grounded, as necessary. Employee determines all possible sources of electrical supply and uses the applicable current drawings and diagrams. Where possible, the employee visually verifies that all blades of the disconnecting devices are fully open or that draw-out type circuit breakers are withdrawn to the fully disconnected position.

C.16. **Enclosed** — Surrounded by a case, housing, fence, or walls that prevents individuals from accidentally contacting energized parts.

C.17. **Enclosed Spaces** — A work space, such as a manhole, vault, tunnel or shaft, that has a limited means of egress or entry, that is designed for periodic employee entry under normal operating conditions, and that under normal condition does not contain a hazardous atmosphere, but that may contain a hazardous atmosphere under abnormal conditions.

C.18. **Enclosure** — The case of housing of apparatus, or the fence or walls surrounding an installation to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage.

C.19. **Energized** — Electrically connected to or having a source of voltage.

C.20. **Exposed Live Parts** — Any device having voltage (potential) which is not suitably guarded or isolated.

C.21. **Exposed Movable Conductor** — A conductor is considered “Movable” if the exposed electrical source is moving or movable, for example, overhead lines, pulling fuses, lifting leads etc.

C.22. **Exposed** — Capable of being inadvertently touched or approached nearer than a safe distance by a person. As applied to parts that are not suitably guarded, isolated or insulated.

C.23. **Extension/Drop Cords/Cables** — Any electrical cord/cable that extends the boundary of a fixed electrical source (that is, 120 VAC outlets or 480 VAC welding outlets).

C.24. **Fixed Electrical Source** — A power source installed per plant design or plant modification, not a temporary installation.

C.25. **Flame Resistant (FR)** — The property of a material whereby combustion is prevented, terminated, or inhibited following the application of a flaming or non-flaming source of ignition, with or without subsequent removal of the ignition source.

C.26. **Flash Protection Boundary** — 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.

C.27. **Flash Suit/Gear** — A complete FR clothing and equipment system that covers the entire body, except for the hands and feet. The flash suit/gear includes pants, jacket, and bee-keeper-type hood fitted with a face shield.

C.28. **Grounded** — A large conducting body, such as the earth or an electric circuit connected to the earth, used as an arbitrary zero of potential.

C.29. **Grounds (including static)** — A temporary connection between a circuit or component of electrical equipment and the plant grounding system.

C.30. **Guarded** — Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach or contact by persons or objects to a point of danger.

C.31. **Incident Energy** — The amount of energy impressed on a surface, a certain distance from the source, generated during an electrical arc event. One of the units used to measure incident energy is calories per centimeter squared (cal/cm2). An incident energy exposure level equal to 1.2 cal/cm2 would be considered a curable injury, (that is, less than a second degree burn).

C.32. **Intrusive Data Gathering** — Requires physical connection to an electrical circuit or direct contact with the system process fluid. Examples include volt/ohm meter on points other than test/terminal points or panel meters, chart recorder, pressure temperature gauges subjected to process fluid. Includes operation of component or equipment per an approved procedure to obtain data without endangering evidence preservation.

C.33. **Isolated/Insulated** — Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current.

C.34. **Limited Approach Boundary** — A shock protection boundary from an exposed energized source to be crossed by only qualified personnel. When there is a need for an unqualified person(s) to cross this boundary area, a qualified person shall advise the unqualified person(s) of the possible hazards and continuously escort this person while inside the Limited Approach Boundary.

C.35. **Live Front** — With live parts exposed to a person on the operating side of the equipment.

C.36. **Live Line Tool** — Tools such as a hot stick, shot gun stick, disconnect stick, or rescue hook, which are designed and used to work on energized high voltage equipment.

C.37. **Live Parts** — Energized conductive components.

C.38. **Load Equipment** — Refers to 600V and below equipment feed from electrical sources such as Motor Control Centers (MCC) and Load Centers, for example, motors, valves, weld machines, construction power panels, monorail cranes, distribution panels, control panels, disconnect connects, and receptacles. This does not include MCCs, Load Centers, and Switchgear.

C.39. **Minimum Approach Distance (MAD)** — Refer to Restricted Approach Boundary.

C.40. **Non-Intrusive Data Gathering** — Does not normally require physical connection to an electrical circuit or direct contact with the system process fluid. Example include vibration diagnostic equipment, thermographic equipment, clamp on ammeter, contact pyrometer, acoustical diagnostic equipment, and volt/ohm meter on test/terminal points or panel meters.

C.41. **Personnel Protective Equipment (PPE)** — Equipment designed to be worn or used by an employee to provide protection from specific hazards. For purposes of this procedure, PPE should include hearing protection, leather shoes, safety glasses and hard hat.

C.42. **Qualified Employee/Worker** — A Qualified Person familiar with the construction and operation of the equipment and the hazards involved. Sometimes an individual may be considered "qualified" with regard to certain equipment in the workplace and "unqualified" as to other equipment. Reference Step 4.2.3.

C.43. **Rescue Equipment** — Rescue Equipment used for the removal of a person from an energized source. This may include but is not limited to an insulated rescue hook, rope, hardhat, wood or any non-conductive material.

C.44. **Restricted Approach Boundary** — A shock protection boundary to be crossed by only qualified personnel at a distance from a live part which requires the use of shock protection techniques and equipment. The closest distance qualified employees can take a conductive object without insulating/isolating the object from contact with live parts. Unqualified persons shall not cross the boundary. This is the equivalent of OSHA 1910.269, Minimum Approach Distance (MAD).

C.45. **Shock Hazard** — A dangerous condition associated with the possible release of energy caused by contact or approach to live parts.

C.46. **Shock Hazard Analysis** — An analysis performed to determine the voltage involved, protective boundary requirements and what PPE/EPE is required to minimize the possibility of electrical shock.

C.47. **Stoll Curve** — Used in many tests to predict the thermal protective performance of textile materials for FR apparel. A stoll curve is a plot of thermal energy and time used to predict the onset of pain sensation and a second degree burn, in human tissue

C.48. **Switching** — Operation of a device designed to close or open one or more electrical circuits, such as, breakers, cutouts, disconnects, isolating devices, or interrupter switches.

C.49. **Temporary Power/Service** — A temporary service, such as cables, panels, disconnects used to provide power to various electrically driven equipment/apparatus.

C.50. **Two Man Rule** — Any task that requires working on or within the Limited Approach Boundary of an exposed energized source greater than 600 V will be assigned two qualified workers, each worker to watch the movement of the other to warn of near contact with an exposed energized source. Although similar to the Safety Observer role, when invoking the two man rule, both workers can be involved in the associated work. Reference Step 4.1.10.

C.51. **Unqualified Employee** — A worker without the knowledge and skills described in Step 3.43 for a Qualified Employee.

C.52. **Voltage Detection Equipment** — A voltmeter, detex, or similar equipment capable of measuring or detecting voltage. Proximity testers, such as tic Tracers, shall not be used to determine a circuit de-energized prior to working on that circuit.

C.53. **Voltage Levels** — All voltages within this procedure are nominal.

C.54. **Working Near (exposed live parts)** — Any activity inside a Limited Approach Boundary.

C.55. **Working On (exposed live parts)** — Coming in contact with live parts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the PPE a person is wearing.

D. **INSTRUCTIONS**

D.1. General Safe Work Practices

D.1.1. All electrical equipment and circuits shall be considered energized at full voltage potential until tested or otherwise determined to be de-energized.

D.1.2. Any contact with energized components or circuits which results in a shock or arc flash, can be potentially hazardous to health.

D.1.2.1. If contact with energized components results in shock or arc flash, then immediately report the incident to supervision and have the condition evaluated by a medical professional.

D.1.3. Prior to any planned remote breaker manipulation for 4.16 kV (NB only) and 13.8 kV Switchgear the following shall be performed:

D.1.3.1. Arc Flash Protection Boundary area shall be cleared of all personnel.

D.1.3.2. Establish applicable boundaries per Section 4.11, Barrier, Guards, and Posting Practices, and Appendix A - Safe Working Distances, per the table entitled, Incident Energy Levels for Arc Flash Hazard Related Work.

D.1.4. Prior to any local breaker manipulation, the following shall be performed:

D.1.4.1. Arc Flash Protection Boundary area shall be cleared of all personnel not involved with the task. Personnel performing the task must wear the appropriate Arc Flash apparel.

D.1.4.2. Establish applicable boundaries per Section 4.11, Barrier, Guards, and Posting Practices, and Appendix A - Safe Working Distances, per the table titled, Incident Energy Levels for Arc Flash Hazard Related Work.

D.1.5. When possible, all circuits or equipment should be placed in an Electrically Safe Work Condition (that is, de-energized, permit tagged, and grounded, as required), before work is performed.

NOTE Prior to using this procedure, a review of the definitions listed in Section 3.0 is encouraged so as to better understand the terminology used in the Instructions

D.1.5.1. If de-energizing the equipment or circuit is not possible due to equipment design or operational limitations, then proper protective devices shall be installed on all adjacent circuits and the necessary EPE shall be worn to protect the worker and equipment.

D.1.5.2. Prior to performing work within the Restricted Approach Boundary of exposed energized components or circuits, the requirements of Section 4.13, Working within the Restricted Approach Boundary of Energized Equipment, shall be performed to identify any hazardous conditions.

D.1.6. If a condition is found that is beyond the worker’s ability to handle safely, then perform the following:

D.1.6.1. Stop work.

D.1.6.2. Ensure conditions are safe.

D.1.6.3. Call for assistance.

D.1.7. Push buttons, selector switches, and interposing relay contacts are not acceptable as a sole means of energy isolating circuits.

D.1.8. When work is to be performed within the Limited Approach Boundary of exposed energized components or circuits operating at 50 V or more, then only qualified personnel may perform the work. Only qualified personnel may work in areas which contain unguarded, uninsulated, energized conductors or circuits.

D.1.9. At voltage levels greater than 600 V, at least two employees (Two Man Rule) shall be present when there is a potential that individuals could come in contact with exposed energized components or circuits.

D.1.9.1. The only exceptions to the Two Man Rule are routine switching when individuals are positioned in a way in which an individual cannot reach or come in contact with exposed energized parts or emergency repair work when necessary to safeguard the public.

D.1.10. A Safety Observer is required when work is being performed within the Limited Approach Boundary of exposed energized components or circuits greater than 600 V (for example, Live-Dead-Live checks on 4.16 kV [kilovolts] conductors in the back of the switchgear cubicle or cleaning switchgear with exposed live parts). A Safety Observer is not required when racking switchgear breakers. The Safety Observer can be the second person used for the Two Man Rule, or a member of the team or crew performing the work. However, at the point duty changes from worker to Safety Observer, the sole duty of the Safety Observer is to observe the other worker and ensure the worker's safety. The Safety Observer shall:

- Be a qualified employee.
- Be qualified in first aid and CPR.
- Be knowledgeable in and understand the work activity to be performed.
- Be aware of all exposed energized components or circuit parts at the work location.
- Wear the appropriate PPE and EPE (that is, PPE/EPE will mirror the person being observed).
- Have rescue equipment available and initiate any emergency notification.
- Not be involved in work activity. The sole duty of the Safety Observers is to observe the worker.

D.1.11. Qualified employees shall not take any conductive object closer to exposed energized components or circuits than the Restricted Approach Boundary set forth in Appendix A - Safe Working Distances, unless insulated from live parts. Voltage Rated (VR) rubber gloves and VR sleeves or insulating material can be used for protection, in addition to approved insulated tools.

D.1.11.1. If VR rubber gloves are used, then VR rubber sleeves or approved insulating material are also required, unless there is reasonable assurance that the employee's upper arm will not be exposed to energized parts. Flash apparel may also be required if performing arc flash hazard related work.

D.1.12. No bare hand contact is to be made with exposed energized components or circuit parts energized above 50 V. For voltages less than 50 V, consideration should be given to the capacity of the source, any overcurrent protection between the energy source and the employee, and whether the work task related to the source operating at less than 50 V increases exposure to electrical burns or to explosion from an electric arc.

D.1.13. When wearing an arc rated face shield to rack in or out breakers or while performing any activity that could produce an electrical arc, stand off to the side and face the component. If the head is turned away from the component and an arc should occur, then no protection from the flash/blast would be provided by the face shield.

D.1.14. When racking in or out 4.16 kV or 13.8 kV breakers with the door open, and when positioned in the flash protection boundary, if an arc flash/blast should occur, then holding the breath would preclude the possibility of inhaling hot gasses.

D.1.15. Qualified employees shall work from a position from which a slip or shock will not result in the body contacting an uninsulated exposed energized live part.

D.1.16. Unqualified employees shall not come any closer to any exposed energized conductors or circuit parts than the Limited Approach Boundary delineated in Approach Boundaries to Exposed Live Parts, unless escorted by a qualified employee and under no circumstances shall an unqualified employee cross the Restricted Approach Boundary.

D.1.16.1. When an unqualified employee comes near overhead lines, the employee must maintain a minimum safe work distance. This includes any conductive material being handled, such as scaffold tubes, pipe, brooms, etc. There are three (3) different voltages associated with the overhead lines. The minimum safe work distance for each is:

- 12.5 kV = 10 feet
- 13.8 kV = 10 feet
- 525 kV = 25 feet

D.1.17. Before exciter or generator brushes are changed, while the generator is in service, the exciter or generator field shall be checked to determine whether a ground condition exists. The brushes shall not be removed while the generator is energized if a ground condition exists.

D.1.18. If a breaker is de-energized (tripped) by the circuit protection device, then the breaker shall not be re-energized until the cause of the fault is known and corrected. The circuit can be reset if determined that the trip was due to overload rather than a fault.

D.1.19. If rework of an electrical cord is required, then the entire length shall be identified and both ends must be in sight.

D.1.19.1. Damaged 120V extension cords shall be removed from service and tagged for repair or replacement.

D.1.19.2. 480V extension cords shall only be repaired by a Qualified Electrician.

D.1.20. The appropriate fuse handling tools shall always be used when removing or installing fuses.

D.1.21. When performing maintenance on equipment with metallic frame or cases, always ensure the equipment is properly grounded.

D.1.22. Work on any Load Center compartment with an energized cross-tie breaker requires a physical barrier (for example, rubber matting), when practical, to protect from inadvertent contact.

D.2. Safety Training

D.2.1. All employees shall be trained in and familiar with the safe work practices and procedures, including any emergency procedures related to the work performed.

D.2.2. Qualified employees shall be trained and knowledgeable in the construction and operation of the equipment or a specific work method and be trained to recognize and avoid electrical hazards that might be present with respect to the electrical equipment or work method.

D.2.3. Qualified employee shall also be familiar with the proper use of the special precautionary techniques, PPE, including, for example, arc flash, insulating and shielding materials, insulated tools and test equipment.

D.2.4. A person can be considered Qualified with respect to certain equipment and methods but still be Unqualified for others. Qualified personnel must know:

- What is and what is not safe to touch in the specific areas to be entered.
- The maximum voltage of the area.
- The Restricted Approach Distances for the maximum voltage within the area.
- Be trained in the recognition and proper use of protective equipment which will be used to provide protection and in the work practices necessary for performing specific work assignments within the area.

D.2.5. An employee in on-the-job training demonstrating an ability to perform duties safely at the level of training and under the direct supervision of a qualified person shall be considered to be a qualified person for the performance of the duties.

D.2.6. Qualified persons permitted to work within the Limited Approach Boundary of exposed live parts operating at 50 volts or more shall, at a minimum, be additionally trained in all of the following:

- The skills and techniques necessary to distinguish exposed live parts from other electric equipment
- The skills and techniques necessary to determine the nominal voltage of exposed live parts.
- The Approach Boundaries specified in Appendix A - Safe Working Distances, which correspond to the voltages to which the employee will be exposed.
- The decision-making process used to determine the degree and extent of the hazard and proper use of the special precautionary techniques, PPE, insulating and shielding materials, and approved insulated tools for working within the Limited Approach Boundary of exposed energized parts of electric equipment.

D.2.7. Only Qualified employees may install insulating equipment within the Limited Approach Boundary of energized parts.

D.2.8. Unqualified personnel shall be trained in and familiar with any electrical safety-related practices that might be applicable to work performed.

D.3. Conductive Material

D.3.1. When performing work within the Restricted Approach Boundary of electrical equipment whether energized or not, all exposed conductive articles, such as jewelry, watches, rings, bracelets, belt buckles, and keys, etc. shall be removed. If an item cannot be removed, then the item must be rendered non-conductive.

D.3.1.1. Metal-framed eyeglasses are to be restrained with a non-metallic lanyard. However, if the work activity will cause the position of the eyeglasses to come within the Restricted Approach Boundary to energized conductors or circuits, as set forth in Appendix A - Safe Working Distances, appropriate safety glasses/goggles shall be worn over the eyeglasses.

D.3.2. There shall not be any exposed metal buttons, snaps, zippers, or brads on apparel used for flash protection. However, for shock protection, metal button, zippers and brads are not a concern as long as the items will not come in contact with energized circuits. Electrical tape can be used to cover the items, if needed.

D.3.3. If an ID Badge lanyard contains exposed metal rings, clips or other parts, then restrain the rings, clips, or other parts or render nonconductive to avoid coming in contact with exposed energized sources.

D.3.4. Safety Harnesses used for fall protection use metal buckles and clips.

D.3.4.1. Care shall be used to ensure that metal buckles and clips will not come in contact with live parts. Cover the energized parts or use tape or other non-conductive material to cover metal buckles and clips to preclude possible electrical contact.

D.4. Housekeeping Duties

D.4.1. When performing housekeeping duties inside the Limited Approach Boundary where voltage levels are greater than 600 V and where the possibility of contact with exposed energized conductors or circuit parts exists, at least two employees shall be present per Step 4.1.9 (Two Man Rule).

D.4.2. Electrically conductive cleaning materials, including conductive solids such as steel wool, metallized cloth and silicone carbide, as well as liquid solution shall not be used inside the Limited Approach boundary

D.5. Methodology

D.5.1. The known energy source used to perform the “Live” portions of the Live-Dead-Live checks must be either AC or DC voltage, as applicable, but is not required to be of the same nominal voltage as the electrical conductors or circuit parts being verified de-energized.

D.5.2. If no exposed conductor is available to perform the Live-Dead-Live check, wearing VR gloves, the conductor may be cut, insulation on the wire can be nicked or the use of piercing tool may be used. Any conductor which is cut, insulation nicked or pierced shall be reworked or repaired per approved methods.

D.5.3. Special care shall be taken when performing Live-Dead-Live checks on ungrounded systems.

D.5.3.1. Do not rely on one leg to ground measurements for this check. Check at the source across the “positive to negative” for ungrounded DC systems or “hot and common” for ungrounded AC systems.

D.5.4. Live-Dead-Live verification testing shall not be performed using a multimeter in the “auto-range” mode on AC/DC voltages. Instead, set to the range of the voltage expected on the circuit on which work is to be performed and verify against a known energy source.

D.5.5. The Live-Dead-Live must be performed in sequence without turning the meter off or changing the range of the meter.

D.5.5.1. Live

D.5.5.1.1. Verify that the voltage detection equipment, which will be used to test for nominal voltage, is functional by testing the equipment on a known energized source or approved test device. A battery may be used as the source to verify the meter is functioning for DC.

D.5.5.1.2. Verify that the chosen voltage detector is adequately rated and ensure the instrument is on the correct scale.

D.5.5.1.3. Do not set multimeter on “auto-range”.

D.5.5.2. Dead

D.5.5.2.1. Check the conductor or equipment to be worked on and verify that zero voltage is present.

D.5.5.2.2. Test each phase conductor or circuit part phase to phase and phase to ground to verify that the equipment is de-energized.

D.5.5.2.3. Check every exposed conductor or circuit part within the defined boundary of the work area.

D.5.5.3. Live

D.5.5.3.1. Re-verify that the voltage detection equipment, which has been used to test for nominal voltage, is still functional by testing on a known energized source or approved test device.

D.6. Live-Dead-Live Checks

D.6.1. All electrical equipment and circuits 50 volts or greater shall be considered energized at full voltage potential until tested (Live-Dead-Live) or otherwise determined to be de-energized.

D.6.1.1. Verify that a physical separation of the electrical circuit exists and is controlled. For example, visually verify that all blades of the disconnecting devices are fully open, draw-out type circuit breakers are withdrawn to the fully disconnected position, and 4.16/13.8 kV breakers are racked down to the disconnected position.

D.6.2. All electrical equipment and circuit parts physically connected to potentially energized sources of 50 volts or greater shall have a Live-Dead-Live check performed prior to starting work.

D.6.3. Live-Dead-Live voltage checks should be re-performed prior to starting work, each instance (for example, start of shift, after breaks, after lunch), and as needed to maintain positive control.

D.6.4. After the initial LDL has been performed, step 4.5.2 may be accomplished by re-verifying the clearance boundaries and equipment (DCID). If this method is chosen instead of re-performing the LDL, then a peer check is required.

D.6.5. Live-Dead-Live voltage checks shall be performed whenever changes to the isolation boundaries (clearance) are made which reduces protection (for example, clearance tag(s) removed, closing a breaker or disconnect, etc.) Always use the latest revision of design output documents to identify potential sources of electrical energy.

D.6.6. All electrical equipment and circuits are considered energized at full voltage potential until verified de-energized using the Live-Dead-Live method. Proximity testers such a tic tracers shall not be used as definitive proof a circuit is de-energized.

D.6.7. Where there is the possibility of induced voltages or stored electrical energy, ground the phase conductors or circuit parts prior to touching the surface. Special care shall be given to capacitors and other equipment or components that have the capability to store electrical energy. A means of capacitive discharge shall be used and time given to fully discharge.

D.6.8. Special caution shall be used to determine any potential source of electrical energy such as temporary power and back-feeds.

D.6.9. The Live-Dead-Live check shall be used to test each and every exposed electrical conductor or circuit part before touching within the Restricted Approach Boundary. All personnel involved in the work activity must witness the Live-Dead-Live check.

D.6.10. Multiple-crew or additional personnel shall be briefed in the same manner as the original crew and perform or witness the Live-Dead-Live checks as required by Step 4.6.9.

D.6.11. When performing Live-Dead-Live checks on electric motors, all phases of the motor being de-termed will be accomplished using the PPE and EPE required by the PPE/EPE Matrix, until the Live-Dead-Live test can be performed and verifies the motor is de-energized. Exceptions include the following:

D.6.11.1. On 4.16 and 13.8 kV electric motors only, Live-Dead-Live checks are not required if all the requirements listed below are met/performed. This does not apply to any associated motor space heater, immersion heater, etc.

D.6.11.1.1. Individual performing task is signed on the clearance.

D.6.11.1.2. At the switchgear, perform the following:

D.6.11.1.2.1. Verify the DCID is correct (self-check and peer check).

D.6.11.1.2.2. Verify the breaker is not racked in and grounds are properly installed.

D.6.11.1.2.3. Verify clearance tag is correct.

D.6.11.1.3. At the equipment, perform the following:

D.6.11.1.4. Verify the DCID is correct (self-check and peer check).

D.6.11.1.5. Verify the equipment is not operating. If the equipment is operating, then stop and contact the leader.

D.6.12. When performing Live-Dead-Live checks on molded case breakers, if there is no starter in the circuit the Live-Dead-Live can be performed at the load equipment. If a starter is present, then perform the Live-Dead-Live at the line side of the starter or verify circuit deenergized by other means, that is, voltage verification (Live-Dead-Live) performed at the rail of the bucket, both line and control.

D.6.13. When performing mid span cable cuts a Live-Dead-Live check shall be performed prior to de-terming the cable. If the entire length of the cable cannot be verified visibly or "Hand-over-Hand" to the point of the cut then one of the following shall be performed:

D.6.13.1. The cable to be cut can be pulled back to the point of the cut to ensure positive identification.

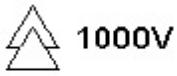
D.6.13.2. A tone/signal can be used to positively identify the correct cable at the location of the cut.

D.7. Insulated Hand Tools

D.7.1. Qualified employees shall use insulated tools when working within the Restricted Approach Boundary of exposed live parts. The tools must be rated for the voltage to be used on. Insulated tools are to be used as "secondary protection" and are not meant to be used in place of the user's protective equipment. Therefore, voltage rated rubber gloves should always be worn when using the tools.

D.7.2. Approved insulated hand tools must be clearly labeled with the voltage rating. An example of the International 1,000 volt symbol is show in Figure 1 below and the symbol signifies that this tool meets the requirements of the International Electro Technical Commission (IEC) 900 standards and American Society for Testing and Materials (ASTM) F-1505, Standard Specification for Insulated and Insulating Hand Tools.

FIGURE 1 - EXAMPLE OF VOLTAGE RATING



D.7.3. If the insulated hand tools are subject to being damaged during use, then use non-conductive material to protect the insulation on the tools.

D.7.4. Although the insulation on insulated tools is impact resistant and flame retardant, each tool should be inspected prior to each use for cracks, cuts, or other damage. Should the inner insulation become visible through the outer layer, the tool should be removed from service immediately.

D.7.5. For "Arc Flash Protection Only", an exception to Step 4.7.1 may be granted in the case of limited access or unavailability. A non-insulated tool may be covered with insulating tape or Raychem. Voltage rated rubber gloves shall be worn when using this tool.

D.7.6. Flashlights, used for electrical work, shall be a non-conductive type.

D.7.7. Test instruments and equipment and all associated test leads, cables, power cords, probes, and connectors shall be visually inspected for external defects and damage before the equipment is used.

D.7.8. 1 If there is a defect or evidence of damage that might expose an employee to injury, then the defective or damaged item shall be labeled as "Out of Service" tag and may not be used until all necessary repairs have been made.

D.7.8.1. Qualified employees shall not take non-insulated tools and equipment closer than the Restricted Approach Boundary to live parts, without insulating/isolating the tools and equipment from contact with live parts.

D.8. Live Line Tools

D.8.1.1. Live line tools shall be designed and constructed to provide an ample margin of safety for the voltage recommended for use.

D.8.1.2. Live line tools shall be of sufficient length to allow the user to remain outside the Restricted Approach Boundary to live parts.

D.8.1.3. Live line tools shall be used by workers performing work on energized lines in excess of 600V.

D.8.1.4. Live line tools shall not be used when rain, fog, or any other factor is sufficient to reduce insulating qualities to the extent that leakage can be felt.

D.8.1.5. Live line tools shall be kept clean. A good work practice to follow, when cleaning, is to wipe in a twisting motion perpendicular around the shaft. Conversely, if cleaned in a back and forth motion, parallel to the shaft, dirt and grime can be extended along the length of the shaft and can create a path for electrical energy to extend along the shaft and cause personal injury.

D.8.1.6. Live line tools shall be used while handling or removing foreign materials or objects that are in contact with high voltage equipment or conductors energized in excess of 600 V.

D.8.1.7. Live line tools shall be inspected and tested at least every two (2) years or as frequently as necessary to ensure the tools remain in a safe condition.

D.8.1.8. Live line tools shall be visually inspected prior to each use and the surface finish shall be kept free from scratches and abrasions.

D.8.1.9. Live line tools shall be handled carefully, properly maintained, and kept in a dry place.

D.8.1.10. Live line tools shall not be placed directly on the ground.

D.9. Arc Flash Protection Apparel

D.9.1. The boundaries shall not be crossed by any personnel not wearing the appropriate PPE/EPE, when arc flash hazard related work activities are being performed.

D.9.2. At voltages less than 208 V, Flash Protection apparel is not required. At voltages 208 V and above, Flash Protection apparel is required when crossing the Restricted Approach Boundary if energized electrical components or circuit parts are exposed and a conductive object could accidentally cross the Restricted Approach Boundary.

D.9.2.1. Take special caution even if a conductive object is physically located outside the Restricted Approach Boundary. A conductive object such as a wrench, screwdriver, piece of angle iron, or a removed electrical panel, could accidentally cross the boundary. Additionally, tripping, slipping, falling, or being bumped with a conductive object in hand could cause an electrical arc flash.

D.9.2.2. Use protective barriers or body positioning to prevent inadvertent contact with exposed live parts.

D.9.3. Flash Protection apparel is also required when performing any activity that could produce an electrical arc (for example, racking breakers, and Live-Dead-Live checks).

D.9.4. If performing any activity that is arc flash hazard related, then PPE/EPE rated for the maximum incident energy exposure level that could be encountered must be worn.

D.9.5. When any arc flash hazard related activities are performed, a Flash Protection Boundary shall be determined and barriers established to keep all individuals, not involved in the activity, at a safe distance from the potential arc flash and blast (that is, outside the Flash Protection Boundary). All workers within the Flash Protection Boundary shall wear the PPE/EPE rated for the maximum incident energy exposure level that could be encountered.

D.9.6. The Flash Protection Boundaries and Incident Energy Exposures are determined by performing a Flash Hazard Analysis. Engineering has performed this analysis. To determine the actual Flash Protection Boundary, see Incident Energy Levels for Arc Flash Hazard Related Work.

D.9.6.1. Electrical Design Engineering has performed calculations on 480 V load equipment (for example, motor, valve) terminal boxes and determined the incident energy levels will not exceed 4 cal/cm2. Flash protection boundary is 4 feet for 240 V locations as well as 480 V load equipment terminal boxes to be in compliance with NFPA 70E-2009 Article 130, paragraph 130.3 (A). For any additional questions regarding component level incident energy levels, contact an Electrical Design Engineer.

D.9.7. Employees working in an area in which there may be exposure to hazards of an electrical arc or flash shall wear flame resistant (FR) apparel or flash gear.

D.9.7.1.1. Non-FR clothing made from acetate, nylon, polyester or rayon fabrics, either alone or in blends, shall not be worn. The fabrics are made of mutable synthetic fibers. When these garments are exposed to an electrical arc or related thermal hazard, the garments could ignite, melt, or drip.

D.9.7.1.2. Clothing with silk screening or heat transfer designs embodied in the fabric is prohibited, even when worn as undergarments.

D.9.7.1.3. Clothing shall be loose fitting. Loose fitting clothing provides additional thermal insulation due to the air space. Layering of garments adds protection. A typical layering system may include an undershirt and pants, a shirt, trouser and coverall.

D.9.7.1.4. Prior to donning, FR garments shall be visually inspected for damage or soiling that could affect the garment's ability to protect from thermal hazards. Garment shall be removed from service for cleaning, repair or disposal, as necessary.

D.9.7.1.5. When arc flash hazard related work is to be performed, any exposed skin should be protected. This can be accomplished by wearing an arc flash face shield or hood to cover the face, head, and neck, VR gloves to cover the hands, garment collar buttoned closed, the FR shirt sleeves rolled down, and cuffs buttoned closed. Use the same process for coveralls and lab coats. Coveralls and lab coats should also be buttoned or zipped closed.

D.9.7.1.6. FR shirt tails should be tucked into pants.

D.9.7.1.7. FR garments shall be kept clean. New garments should be washed or dry-cleaned at least once prior to initial use to remove any excess remnants from the manufacturing process. Cleaning shall be performed as listed below or per the manufacturer's recommendations. Dry cleanable only items must be dry cleaned.

D.9.7.1.8. Care of Flame Resistant Garments

D.9.7.2. Flame resistant garments shall be laundered or dry cleaned with such frequency so as to prevent build-up of contaminants that reduce flame resistance. Shared departmental FR clothing shall be laundered with such frequency to prevent personal hygiene issues.

D.9.7.2.1. Wash in Cold or Warm Water only.

D.9.7.2.2. Tumble Dry on Low/Permanent Press.

D.9.7.2.3. Use a Popular Brand Name Detergent.

D.9.7.2.4. Do Not Use Liquid Chlorine Bleach.

D.9.7.2.5. Do Not Use Fabric Softener.

D.9.7.2.6. Do Not Use Detergent with Fabric Softener.

D.9.8. When arc flash hazard related work activities are being performed, Outer Layers, such as jackets or rainwear shall also be made of FR material (that is, Non-FR apparel shall not be worn over FR apparel).

D.9.9. Underlayers, such as underwear made from 100% cotton, wool or silk are permitted. Acetate, nylon polyester, polypropylene, and spandex are not permitted. An incidental amount of elastic used on non-melting fabric underwear or socks is permitted.

D.9.10. When work is performed in a radiological contaminated area and the work activity is arc flash hazard related, the Indura® (orange) PCs shall be worn. The Indura® PCs, Style 451 (supplied by Frham Safety Products, Inc.) have an ATPV rating of 11.1 cal/cm2 and can be worn over normal non-FR clothing (for example, 100% natural fabric T-shirt and shorts).

D.9.10.1. If the work to be performed exceeds 11 cal/cm2, then additional FR apparel shall be worn. Refer to Appendix C - Arc Flash Protection Apparel Selection, for assistance in determining what additional FR apparel will be needed. The elastic wristbands, rubber gloves, rubber shoe covers, rubber protective gloves, which are normally worn when working in contaminated areas are permitted.

D.9.11. Arc Rated Face Shields with an arc rated balaclava are to be worn when performing arc flash hazard related work activities where the Incident Energy Levels are greater than or equal to 4 cal/cm2. Arc Rated Face Shields must be rated for the maximum cal/cm2 which could be encountered. A Flash Hood shall be worn when the maximum cal/cm2, which could be encountered, exceeds the rating of the Arc Rated Face Shield. In addition to the face shields, safety glasses or goggles and hearing protection shall also be worn. An acceptable alternative to the arc rated face shield with arc rated balaclava or the arc flash hood is an arc rated pair of goggles with arc rated balaclava combination with the appropriate ATPV rating for the task.

D.10. PPE and EPE

D.10.1. When working in areas where there are potential electrical hazards, EPE appropriate for the specific parts of the body to be protected and for the work to be performed shall be worn. This protective equipment shall be used solely for that purpose.

D.10.2. PPE/EPE requirements are defined in PPE/EPE Matrix in Appendix B. Safety glasses and other PPE shall always be worn as required. Hearing Protection, when required, can be the inserting type; however, the over the ear type of hearing protection is recommended.

D.10.3. Hardhats shall be non-conductive. Approved hardhats will be marked either “Class B” or “Class E”. Hardhats made since 1997 are marked “Class E”. Hardhats made before 1997 are marked “Class B”. Check hardhat and replace if not properly marked.

D.10.4. The tasks listed in the PPE/EPE Matrix are commonly performed work tasks, but are not intended to be all inclusive.

D.10.4.1. If planning to perform a work activity that is not identified in the PPE/EPE Matrix, then perform the following:

D.10.4.1.1. Stop and place the work in a safe condition.

D.10.4.1.2. Contact supervision and Electrical Design Engineering, as needed to assist in determining the PPE/EPE requirements to safely perform the task.

D.10.5. If the component being worked on has been verified de-energized but there are exposed energized components or circuit parts within the Limited Approach Boundary (that is, what an individual could reasonably expect to come in contact with), then VR roll or rubber blankets can be used to cover all the exposed energized parts and then the use of rubber protective gloves would not be required.

D.10.6. All rubber protective equipment shall have the rating clearly marked and applied so as not to impair the insulating qualities of the equipment.

D.10.7. All protective equipment shall be free of harmful physical irregularities which can be detected by thorough testing and inspection. All equipment shall be carefully inspected as required, properly used as needed and properly stored and cared for.

D.10.8. Rubber gloves, rubber sleeves, and rubber mats are periodically inspected and tested. The date tested and the due date for the retest is clearly marked on each item.

D.10.8.1. Verify equipment inspection is current prior to use.

D.10.8.2. Do not use if no date is present.

D.10.9. Use of Protective Equipment

D.10.9.1. When crossing the Restricted Approach Boundary to exposed energized electrical component or circuit parts, shock protection is required for voltage levels greater than or equal to 50 V and flash protection is required for voltage levels greater than or equal to 208V.

D.10.9.2. Voltage rated [VR] rubber gloves are to be rated for the voltage being worked on or which could be contacted. If VR rubber gloves are used, then rubber sleeves or approved insulating material may also be used if other parts of the body may come in contact with exposed energized component or circuit parts. The combination of rubber insulating gloves with leather protectors satisfies the arc flash protection requirements.

Rubber Glove Classification, Color and Maximum Voltage

Glove Ratings (Class)	color (label on cuff)	Maximum AC Use Voltage	Maximum DC Use Voltage
Class 00	Beige	500	750
Class 0	Red	1,000	1,500
Class 1	White	7,500	11,250
Class 2	Yellow	17,000	25,500

D.10.9.2.1. To maintain an adequate flashover distance, the top of the leather protector's gloves shall be shorter than the rolled top of the cuff of the rubber insulating glove by at least the distance listed in the table below:

Distance between Gauntlet and Cuff

Glove Class	Minimum
00 and 0	1/2 inch
1	1 inch
2	2 inches

D.10.9.3. VR rubber gloves and sleeves shall be wiped clean of any oil, grease, or other damaging substances. Gloves can be cleaned with mild soap and water. Gloves and sleeves must be dry prior to use.

D.10.9.4. Leather glove protectors shall always be worn over VR rubber gloves to protect the gloves from damage, except as provided in Step 4.10.9.6. Leather glove protectors shall not be used for any other purpose. Protector gloves shall not be used if there are holes, tears or any other defect that could affect performance. Prior to use, check the inside of the protectors for any sharp or pointed objects that could damage the rubber glove.

D.10.9.5. If there is no possibility of physical damage to the gloves, then all class of gloves may be used without leather protectors, where additional finger dexterity is needed to manipulate small equipment and parts. All gloves shall be electrically retested after use without the leather protectors.

D.11. Class 00 may be used without protectors if the voltage does not exceed 250 VAC or 375 VDC.

D.12. Class 0 gloves may be used without protectors if the voltage does not exceed the rating.

D.13. All other classes of gloves may be used without protectors if the class of glove is one class higher than the voltage being exposed to.

D.13.1.1. VR rubber blankets or ground mats should be used, as needed, to protect personnel from accidental contact with exposed energized equipment up to 15,000V and to insulate the worker from ground.

D.13.1.2. Ropes and hand-lines used near exposed energized parts shall be non-conductive and must be clean and dry.

D.13.1.3. VR roll Blanket, appropriate for the voltage, may be used in lieu of rubber blankets. The roll blankets can be cut to fit to isolate the employee from contacting exposed energized parts or equipment.

D.13.2. Storage Practices

D.13.2.1. When not in use, EPE shall be stored in locations as cool, dark, and dry as possible. EPE should also be shielded from sunlight, heat, ozone, oil, physical damage from sharp or rough objects, and other harmful agents.

D.13.2.2. Flexible equipment should always be stored in a relaxed position. VR rubber gloves and sleeves shall not be stored folded, creased, inside out, compressed, or in any manner that will cause stretching or compression. Sleeves may be loosely rolled lengthwise inside a sleeve roll up.

D.13.2.3. VR rubber gloves and VR rubber sleeves shall be cleaned, as needed, allowed to dry and then stored in storage bags provided for that purpose. Do not use compressed air to dry the rubber gloves. Rubber gloves shall be stored in the storage bag with the fingers up.

D.13.2.4. VR roll blankets must be stored, rolled up, or laid flat. The use of storage tubes helps extend the service life. Folding the blankets could cause abnormalities in the material that could lead to injury.

- RLB00, 500 VAC maximum
- RLBPVC1, 7500 VAC maximum

D.13.2.5. Protective VR rubber blankets shall be stored either hanging from a rack or rolled up and placed in storage tubes.

D.13.3. Inspection and Testing

D.13.3.1. Prior to each use, voltage rated rubber gloves, sleeves, VR roll and rubber blankets shall be visually inspected over the entire surface, for the following:

- Holes, tears, punctures, or cuts
- Ozone cutting or ozone checking
- Embedded foreign objects

- Texture changes, such as swelling, softening, hardening, stickiness or lack of elasticity
- Other defects that damage the insulating properties

D.13.3.2. Prior to use, VR Rubber gloves shall be given a roll and air test by rolling the cuff tightly over the palm in such a manner that air is entrapped inside the glove. Puncture detection may be enhanced by listening for escaping air or holding the glove against the face cheek to feel for escaping air.

D.13.3.3. Rubber gloves/sleeves shall be exchanged at any time the glove/sleeves become damaged or the employee assigned the gloves is suspicious of the glove's viability for use.

D.13.3.3.1. Damaged gloves/sleeves shall be destroyed, that is, gloves shall be cut from the fingers up through the gauntlet, sleeves shall be cut length wise from top to bottom.

D.13.3.3.2. Rubber protective equipment that becomes damaged shall be immediately removed from service for repair or disposal.

D.14. Roll blankets shall be discarded if defects or damage are noticed.

D.14.1.1. Rubber protective equipment which comes into contact with petroleum based inhibitors or any other contaminants shall be cleaned as soon as possible.

D.14.1.2. Rubber protective equipment (that is, rubber gloves, sleeves and rubber blankets) must be tested prior to placing into initial service. Rubber protective equipment shall be placed on a routine protective maintenance test schedule and returned for re-qualification every six (6) months for gloves and 12 months for sleeves and blankets or any time there is reason to believe the equipment may be unsafe.

D.14.1.3. All rubber protective equipment shall be capable of withstanding the proof testing voltages as rated. The test shall reliably indicate that the equipment can withstand the voltage involved.

D.14.1.4. Rubber protective equipment shall be shipped and stored in containers specifically designed for that purpose.

D.15. Barrier, Guards, and Posting Practices

D.15.1. When performing work on de-energized equipment and there is energized equipment adjacent to the work being performed, positive barriers, guards, barricades and/or postings shall be positioned at the energized electrical equipment to protect all employees from inadvertent contact with any energized sources. For example, if personnel performing inspect and clean activities on Calvert Bus and there are energized sources, alternate or cross feeds in the adjacent cubicle or electrical bus duct, the cubicle or electrical bus duct shall be barricaded.

D.15.2. Positive barriers, guards, barricades and/or postings shall be positioned at electrical equipment to protect all employees from contacting any exposed energized circuit. The use of barriers, guards and barricades is also applicable to activities performed in a shop environment, where exposed energized conductors or circuit parts are present or arc flash hazards exist.

D.15.3. When energized electrical components are exposed, personnel in constant attendance can be used in lieu of barriers to keep unqualified personnel from crossing the applicable boundary area. If personnel are used in lieu of barriers, then ensure the work activities will not interfere with the responsibility of guarding unqualified personnel from the electrical hazard. If personnel need to leave the area unattended for any reason, barriers shall be installed or replaced to guard unqualified personnel from the exposed live parts.

D.15.4. When arc flash hazard related work is performed, either barriers or an attendant shall be used to prevent unqualified persons from entering the Flash Protection Boundary. If the work activity is performed in a room, (for example, switchgear room or switchgear enclosures), then the walls, floor, roof and doorways can be used as the barrier. The switchgear cubicles are not considered a barrier. Doors are to be Red barrier taped and posted with Danger signs or have an attendant present to secure the area.

D.15.5. Protective equipment can be used to protect against shock, burns, or other electrically related injuries while working within the Limited Approach Boundary of exposed live parts that might be accidentally contacted or where dangerous electric heating or arcing might occur.

D.15.6. Voltage rated plastic guard material can be used for protection of employees from accidental contact with live parts or for protection of employees from energized equipment or from contact with the ground.

D.15.7. Non-insulated physical or mechanical barriers shall not be installed closer than the Restricted Approach Boundary.

D.15.8. Danger signs and Red “DANGER” tape shall be placed at open cubicles, cubicle doors and back panels to prevent unauthorized entry. Protective shields such as roll blankets, plastic sheeting, and flexible synthetics can be used as temporary covers to guard live parts when temporary power is installed or when performing servicing or maintenance activities. Physical barriers shall be positioned outside the Limited Approach Boundary given in Appendix A - Safe Working Distances, to protect all employees from contacting any exposed energized components or circuit parts. Follow the LLR Electric Safety Manual guidelines for Barricade and Barrier Tape use.

D.15.9. As required by the Safety Manual, Danger signs shall identify the name of the employee in charge of the work, contact phone number/pager number and a brief description of the hazard. Examples include Electrical Flash or Shock Hazard. Only Qualified Personnel may proceed past this point. Unqualified Personnel must be escorted by a Qualified Person.

D.15.10. Post of Warning Signs

D.15.10.1. Entrances to rooms and other guarded locations containing exposed energized parts shall be marked with conspicuous warning signs forbidding unqualified employees from entering.

D.15.10.1.1. Entrances to the rooms and spaces shall be kept locked when not under the observation of an attendant.

D.15.10.1.2. Unqualified persons may not enter the rooms or spaces while the electric supply lines or equipment are energized unless barriers are installed which would prevent unintentional contact with exposed energized conductors or circuit parts.

D.16. Grounding Practices

D.16.1. Grounding for Maintenance Work (Working Grounds)

D.16.1.1. PPE and EPE requirements are defined in the PPE/EPE Matrix.

D.16.1.2. Working Grounds (for example, grounds used on less than 600 V), if used, shall be a flexible standard conductor. The cables shall be sized to the circuit and shall have a capacity greater than or equal to that of No. 2 American Wire Gauge (AWG) copper. Cables shall be equipped with clamps that properly fit conductors and grounding points and shall apply firm pressure. The installation and removal of Working Grounds will be documented on a determ/reterm sheet.

D.16.1.3. When truck or equipment is barricaded and considered energized, employees standing on the ground shall avoid coming in contact with the truck or equipment, unless suitable protective equipment is used for voltage involved. An insulated access must be used for personnel getting on and off the truck or equipment.

D.16.2. Grounding for Working on Underground Circuits

D.16.2.1. Work on underground circuits shall follow work procedures common to overhead areas. The standards for working on electrical equipment apply to this type of work just as the standards do for overhead work - de-energizing, permit tagging and grounding are equally applicable to each area.

D.16.2.2. Electrical equipment such as transformers, switches, potheads and other equipment shall be considered energized until Live-Dead-Live checks prove that the electrical equipment is de-energized and the equipment is grounded.

D.16.2.3. After being disconnected from the power source, a cable may retain a capacitive charge. Discharge and ground before making physical contact.

D.16.2.4. All cable or equipment not tested and grounded shall be worked with adequate protective devices as though the cable or equipment were energized.

D.16.2.5. Ensure all grounds have been removed before equipment which has been grounded is put back into service.

D.17. Working within the Restricted Approach Boundary of Energized Equipment

D.17.1. Work may be performed within the Restricted Approach Boundary of energized systems or equipment provided the following precautions are taken:

D.17.1.1. An evaluation per Appendix D - Policy, Checklists & Permit For Working within the Restricted Approach Boundary of Exposed Energized Equipment, and Appendix E - Risk Assessment of Work on Energized Equipment, shall be performed to identify any hazardous conditions. The Energized Electrical Work Permit shall be completed and signed by all workers assigned to perform the work, and the Leader or designee must authorize the work. If the original job/work scope changes for any reason, then Appendix D & E, including the Energized Electrical Work Permit, shall be re-performed.

D.17.1.1.1. Exemptions:

D.17.1.1.1.1. Completion of Appendix D & E including the Energized Electrical Work Permit is not required for non-intrusive activities such as testing, troubleshooting, Live-Dead-Live checks, voltage/current measuring, establishing/verifying clearance conditions, establishing safe work conditions (for example, hanging protective barriers to isolate exposed energized conductor or circuit parts, etc.), as long as the person is qualified and the appropriate PPE/EPE is used.

D.17.1.1.1.2. If the work is exempt from completing Appendix D & E, including the Energized Electrical Work Permit, then a Shock & Flash Hazard analysis shall still be performed to determine the voltage involved, protective boundary requirements, etc., to determine what PPE/EPE is required. This shall be included in the pre-job brief discussion.

D.17.1.1.1.3. Ensure the work area has been made as safe as reasonably practicable by the installation of protective equipment to protect the worker and tools from accidental contact with the energized portion of the system.

D.17.1.1.1.4. Personnel are to wear rubber gloves, face shields and other protective equipment as dictated by job requirements, leader's directions and the PPE/EPE Matrix.

D.17.1.1.1.5. Ensure barrier tape and signs have been installed around the work area, as dictated by job requirements, at the supervisor's direction and per Section 4.11, Barrier, Guards, and Posting Practices.

D.18. Battery Rooms and Banks

D.18.1. Batteries can produce and emit a mixture of hydrogen and oxygen gas that are very explosive. No smoking, open flames, or unapproved lights shall be used in battery rooms or banks.

D.18.2. Battery rooms shall be kept locked and only accessible to qualified personnel.

D.18.3. Battery rooms shall be ventilated. If battery rooms are not ventilated, O2 monitors shall be used and all electric devices shall be explosion proof.

D.18.4. Extreme caution shall be exercised to prevent short circuiting batteries cell to cell, or cell to ground with tools or other conducting equipment. Caution shall be taken against physical damage to the battery housing while lifting or maneuvering tools/materials around batteries.

D.18.5. Tools and equipment used for work on batteries shall be a non-sparking type and rated for the voltage to be encountered.

D.18.6. Discharge body static electricity through a local ground prior to touching the batteries.

D.18.7. Prior to starting work on or around “flooded cell” batteries, ensure an eyewash station is in the vicinity and is working.

D.18.8. Exposing skin and eyes to electrolyte can cause severe burns and blindness. Safety glasses/goggles and face shields, chemical resistant gloves, protective overshoes, and rubber aprons or acid resistant coveralls as applicable shall be used when taking specific gravities, handling electrolyte, or when handling “flooded cell” batteries.

D.18.9. Chemically rated protective equipment is not designed for electrical shock safety. For example, gloves rated for corrosive chemical protection usually are not the same as gloves rated for electrical shock protection. Assess which hazard is most likely to be encountered prior to selecting what PPE/EPE should be worn.

D.18.10. When electrolyte is being prepared, always pour acid into water, not water into acid.

D.18.11. If electrolyte does get on the skin or eyes, then flush with fresh water for at least 15 minutes. Seek immediate medical attention.

D.18.12. Baking soda should be on hand in case of an emergency.

D.18.13. If electrolyte has been absorbed by clothing, then perform the following:

D.18.13.1. Immediately remove clothing.

D.18.13.2. Flush area with water for 15 minutes.

D.18.13.3. Seek immediate medical attention.

D.18.14. Do not use a petroleum base solvent or cleaner on battery cases, as this type of solvent or cleaner can cause the case to crack and break.

D.19. Standard Method for Working on Unscheduled Circuits (120 and 277V)

D.19.1. Because unscheduled circuits are field run, there are no detailed drawings nor. Therefore, ensure the correct circuit is being worked on.

D.19.2. Circuits shall be clearance tagged.

D.19.3. Always wear the appropriate PPE/EPE.

D.19.4. Verify the correct breaker(s) is tagged or LOTO out and is in the open position.

D.19.5. Verify the tie-wrap is properly installed through the breaker handle hasp and the hole in the clearance tag.

D.19.6. Verify equipment is de-energized:

D.19.6.1. If working on a light, verify the light is off. During demo operations ensure the lights bulbs are in place for verification.

D.19.6.2. If there is a local light switch, then cycle the switch on and off and verify the light does not illuminate.

D.19.6.3. Once the cover is removed, perform a Live-Dead-Live check.

D.19.6.4. If working on a receptacle, use the meter and perform a Live-Dead-Live check.

D.19.6.5. If working on a J-box, do not rely solely on the DCID written on the J-box cover.

D.19.6.6. Wearing appropriate PPE, carefully remove the J-box cover.

D.19.6.7. Perform a Live-Dead-Live check on the “Line” wire.

D.19.6.7.1. If checking the “Neutral” wire, the “Neutral” wire could be back-fed, which would give a “live” indication and could lead the individual checking the wires to conclude that the incorrect J-box has been accessed.

D.19.6.7.2. Next, check the “Neutral” wire. If energized and the wire cannot be de-energized, then work the circuit “HOT”. All “HOT” work shall be performed per Section 4.13, Working within the Restricted Approach Boundary of Energized Equipment.

D.19.7. Always refer to the pre job briefings and error precursors.

D.19.7.1. If anomalies are found, perform the following:

D.19.7.1.1. Stop work.

D.19.7.1.2. Place work area in a safe condition.

D.19.7.1.3. Notify Team Leader for further direction.

D.20. Illumination

D.20.1. Sufficient illumination shall be provided to enable the employee to perform the work safely to avoid coming in contact with exposed energized electrical cables/equipment.

D.20.1.1. Obtain and install temporary lighting prior to starting work, as necessary.

D.20.1.2. Do not perform any activity near energized parts where a lack of illumination or an obstruction precludes observation of the work to be performed.

D.20.1.3. Never reach blindly into areas that could potentially contain live parts.

D.21. Working in Enclosed Spaces (Manholes, Ductbanks, or Other Confined Spaces)

NOTE

The instructions listed below are based on the assumption that the manhole, ductbank, or other confined space being entered contains energized electrical cables/equipment.

D.21.1. Any work performed on energized electrical cables/equipment located in enclosed spaces requires special rescue techniques per Confined Space Entry Training and a Confined Space Entry permit.

D.21.2. Prior to entering, contact the leader and Industrial Safety with the exact location of the manhole where entry will be made.

D.21.3. Prior to removal of entrance cover, check for atmospheric pressure or temperature differences and evaluate whether there might be a hazardous atmosphere in the space. Eliminate any conditions that would make removing the cover unsafe before removing the cover.

D.21.4. An attendant (qualified in confined space, first aid and CPR) shall be immediately available outside the enclosed space, at all times, and be capable of notifying the Fire Department in case of an emergency. Attendant may perform other duties as long as the duties do not interfere with monitoring the employees in the enclosed space.

D.21.5. If entering for visual inspection only (no moving of cables permitted), then no EPE is required.

D.21.6. If entering for visual examination, maintenance or any activity which would or could result in movement of energized cables, then the following requirements apply:

D.21.6.1. Flash gear rated for the Incident Energy Level must be worn if activity being performed will require moving energized cables.

D.21.6.2. If fall protection harness is required, then the fall protection harness shall be FR rated.

D.21.6.3. Check all cables for abnormalities that could indicate a potential defective cable.

D.21.6.3.1. De-energize any potentially defective cables.

D.21.6.3.2. All cables with splices should be de-energized.

D.21.6.4. If Live-Dead-Live checks are performed in the manhole, VR gloves shall be worn when cutting or nicking the splice or cable insulation.

D.21.6.5. When verifying voltage, VR gloves shall be worn unless the manufacturer of the voltage tester requires bare hand contact for proper indication. Flash gear rated for the Incident Energy Level shall be worn when spiking the cable. Any conductor which is cut, insulation nicked or pierced shall be reworked per approved methods.

D.21.6.6. If unable to de-energize the equipment or unable to verify the spliced or defective cable is de-energized, then refer to Section 4.13 for additional requirements.

D.21.7. When employees perform work on buried cable or on cables in a manhole or vault, the employee shall maintain metallic-sheath continuity, or the cable sheath shall be treated as energized. If sheath continuity cannot be maintained, then the sheath continuity shall be treated as energized until an adequate bond jumper between the two (2) cable sheath ends is installed.

D.22. General Guidelines for Determining EPE Requirements

D.22.1. Exposure to Live Parts (Shock Hazards)

D.22.1.1. Shock Protection is applicable where there are exposed energized sources 50 volts or greater.

D.22.1.2. Choose the VR gloves rated for the maximum voltage to be encountered. Use VR Sleeves to cover forearms and shoulders or use approved insulating material to cover exposed live parts.

D.22.2. Exposure to Arc Flash Hazard Related Work Activities

D.22.2.1. Flash Protection is applicable at voltages of 208 V and greater when arc flash hazard related work activities are being performed.

D.22.2.2. Based on the Flash Hazard Analysis, determine the Incident Energy Levels (cal/cm2) for the equipment to be worked on. Refer to Appendix A - Safe Working Distances, Flash Hazard Analysis or Appendix F - as applicable. For specific applications, contact an Electrical Design Engineer.

D.22.2.3. After determining Incident Energy Levels, refer to Appendix C - Arc Flash Protection Apparel Selection or Appendix F –

D.22.2.4. If the door on the disconnect, distribution panel, MCC, Load Center (LC), Switchgear, etc., is closed and secured, then the Incident Energy Levels can be reduced by one-half. The Flash Protection Boundary can also be reduced. Refer to Flash Hazard Analysis. For specific applications, contact an Electrical Design Engineer.

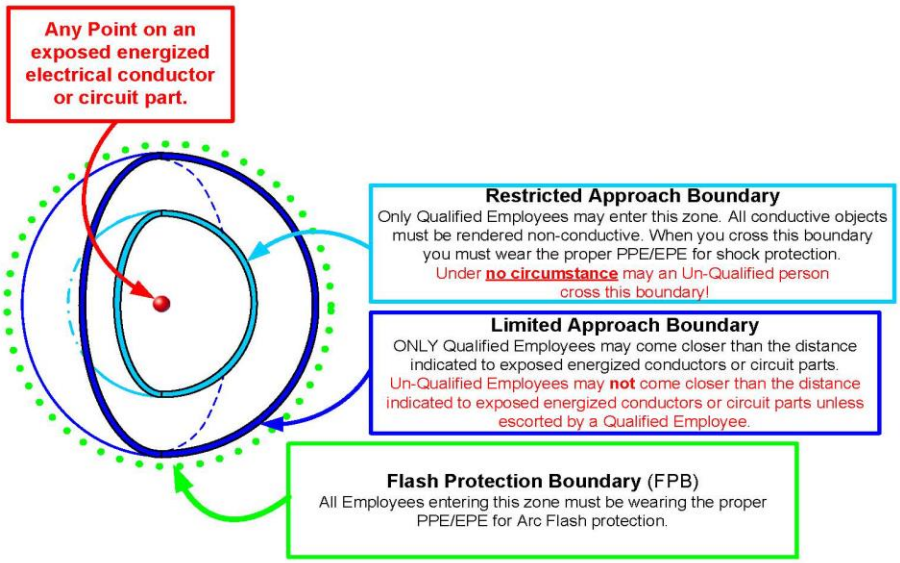
D.23. Emergency Contingency

D.23.1. In the event of a safety issue, where immediate action is needed to protect personnel or place equipment in a safe condition, actions may be taken to perform necessary manipulations for buses, loads, feeders without donning the suggested PPE/EPE provided no reasonable alternatives exist. Using the provisions of the emergency contingency shall not be invoked for operational or maintenance convenience.

Appendix A - Safe Working Distances

Approach Boundaries to Exposed Live Parts			
	Only Qualified employees may cross this boundary. Unqualified employees must be escorted by a Qualified Employee.		Only qualified Employees may cross this boundary.
Nominal System Voltage Range, Phase to Phase	Limited Approach Boundary		Restricted Approach Boundary (MAD)
	Exposed Movable Conductor	Exposed Fixed Circuit Part	
0 to 50 V	Not Specified	Not Specified	Not Specified
50 - 300 Vac/Vdc	10 ft. 0 in.	3 ft. 6 in.	Avoid Contact
301 - 750 V	10 ft. 0 in.	3 ft. 6 in.	1 ft. 2 in.
751 V - 15 kV	10 ft. 0 in.	5 ft. 0 in.	2 ft. 3 in.
15.1 - 36 kV	10 ft. 0 in.	6 ft. 0 in.	3 ft. 0 in.
500 - 550 kV	25 ft. 0 in.	25 ft. 0 in.	16 ft. 3 in.

*Exposed Movable Conductor" is defined as overhead lines, pulling fuses, lifting leads, etc.
Note: Approach Boundary Distance is based on site altitude.



A.1 Aerial Lift Equipment

A.1.1. When any vehicle or mechanical equipment is being operated near energized overhead lines, follow the requirements of, Commercial Truck Mounted Cranes and Aerial Lifts, Mobile Crane Operation, Field Use of Rigging, as applicable. Refer to OSHA 1926 Sub Part V Electrical Power and Transmissions and Distribution for direction

A.1.2. If the equipment is an aerial lift insulated for the voltage involved, and the work is performed by a qualified person, then the clearance distances listed below shall be maintained between the uninsulated portion of the aerial lift and the power line.

Voltage	**Minimum Distance**
12.5 / 13.8 kV	2 ft. 3 in.
525 kV	16 ft. 3 in.

A.2. Flash Hazard Analysis

A.2.1. Flash Hazard Analysis was performed by engineering and documented in Calculations 01, 02. Engineering has determined the following:

A.2.1.1. At voltages below 208 V flash protection is not required.

A.2.1.2. The room where the electrical equipment is located can be used as the Flash Protection Boundary. Refer to Step 4.11.4 for additional information.

Incident Energy Levels for Arc Flash Hazard Related Work			
Door/Cover Open		**Door/Cover Closed & Secured**	
TPV (Minimum Cal/cm^2)	**Flash Protection Boundary (Minimum Feet)**	**TPV (Minimum Cal/cm^2)**	**Flash Protection Boundary (Minimum Feet)**
13.8 kV Switchgear			
30	80	15	40
40	108	20	53
47	128	24	63
7	17	4	9
4.16 kV Switchgear			
50	138	25	68
12	30	6	15
480 V Load Centers			
24	16	12	10
480 V Motor Control Centers			
11	6	6	4
208 - 480 V Load Equipment (for example, Motors, Valves, Construction Power Panels, Receptacles)			
4	4	2	3

A.2. PPE/EPE Matrix to determine if the task requires arc flash protection. Once the task has been determined to require arc flash protection, use the table above for the appropriate APTV level (cal/cm2).

Appendix B

B. General PPE/EPE Matrix Notes Tasks listed here are commonly performed work tasks, but not intended to be all inclusive. If performing a work activity that is not identified or if there are any questions regarding the PPE/EPE requirements listed for the identified task, then perform the following:

B.2.2. Stop work.

B.2.3. Place the work in a safe condition.

B.2.4. Contact the Leader to assist in determining the PPE/EPE requirements needed to safely perform the task. The PPE/EPE requirements listed in the matrices are the suggested requirements. Other apparel or flash gear, alone or in layers, can be worn as long as the additive values of the ATPV ratings meet or exceed the incident energy requirements (cal/cm2) identified in Appendix A - Safe Working Distances on the table entitled, Incident Energy Levels for Arc Flash Hazard Related Work. Refer to Appendix C - Arc Flash Protection Apparel Selection for assistance in determining the additive values of flash protection apparel.

B.3. The PPE requirements specified in the Task Matrix are in addition to general PPE requirements of the LLR Electric Safety Manual. Hard Hats, Safety Glasses, leather shoes, etc. are to be worn as required.

B.4. The tasks listed on the following matrices are based on the assumption that there are energized conductors or circuit parts and the work is performed within the Restricted Approach boundary and within the Flash Protection Boundary.

B.5. When voltage rated gloves are required, the gloves are to be rated for the voltage being worked on or which could be contacted. The combination of rubber insulating gloves with leather protectors satisfies the arc flash protection requirements.

B.6. After equipment is placed in an “electrically safe work condition,” PPE/EPE requirements suitable for the area apply. (Shock or Flash protection may not be needed)

B.7. If VR rubber gloves with protectors are used, then VR rubber sleeves or approved insulating material are also required, unless there is reasonable assurance that the employee’s upper arm is not exposed to energized parts.

B.8. If there is no shock potential present, the appropriate arc rated gloves can be worn with FR apparel in lieu of VR Gloves. Refer to Appendix A - Incident Energy Levels for Arc Flash Hazard Related Work in determining appropriate arc rated FR gloves.

B.9. An acceptable alternative to the arc rated face shield with arc rated balaclava or the arc flash hood is an arc rated pair of goggles with arc rated balaclava combination with the appropriate ATPV rating for the task.

50 - 300 V (AC or DC) (Phase to Phase or Phase to Ground)										
PPE/EPE Requirements (Refer to General PPE/EPE Matrix Notes, Appendix B, Page 1 of 11)										
Task	Hearing Protection	Arc Face Shield with Balaclava	VR Gloves (Refer to B.1)	FR Gloves (Refer to B.1)	FR Shirt	**FR Pants**	FR Coveralls	Flash Hood w/o suit	Flash Suit/Hood	Comments
Miscellaneous Electrical Equipment/Components										
Tag Placement/Verification										No breaker manipulation.
Manipulation of Circuit Breaker/Disconnects (Cover ON)										
Manipulation of Circuit Breaker/Disconnects (Cover OFF)	X	X		X	X	X				Only at greater than or equal to 208V
Removing/Installation Fuse Cartridge/Block	X	X	X		X	X				Only at greater than or equal to 208V
Remove/Install Circuit Breakers	X	X	X		X	X				Only at greater than or equal to 208V
Live-Dead-Live Check	X	X	X		X	X				Only at greater than or equal to 208V VR gloves or VR Insulated tools

50 - 300 V (AC or DC) (Phase to Phase or Phase to Ground)										
PPE/EPE Requirements (Refer to General PPE/EPE Matrix Notes, Appendix B, Page 1 of 11)										
Task	Hearing Protection	Arc Face Shield with Balaclava	VR Gloves (Refer to B.1)	FR Gloves (Refer to B.1)	FR Shirt	FR Pants	FR Coveralls	Flash Hood w/o suit	Flash Suit/Hood	Comments
Voltage Readings	X	X	X		X	X				Only at greater than or equal to 208V VR gloves or VR Insulated tools
Verifying Current w/Clamp-on amp probe or across shunt	X	X			X	X				Only at greater than or equal to 208 V
Installing/Removing Test Equipment	X	X	X		X	X				Only at greater than or equal to 208V
Lifting or Landing Leads	X	X	X		X	X				Only at greater than or equal to 208V
Relay Testing										
Removing/Installing, Bolted Covers to Expose Live Parts	X	X		X	X	X				Only at greater than or equal to 208 V
Opening/Closing, Hinged Covers to Expose Live Parts										Do not cross Restricte Approach Boundary.
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	X	X		X	X	X				Only at greater than or equal to 208 V Not required if thermography window is used.
Note: VR gloves req'd if crossing Restricted Approach Boundary of any exposed energized component; if not crossing the Restricted Approach Boundary of any exposed energized components then FR gloves can be used in lieu of VR Gloves. Refer to Appendix A page 1 of 4 for the Restricted Approach Boundaries and Incident Energy Levels for Arc Flash Hazard Related Work in determining appropriate arc rated FR gloves.										

301 - 600 V (Phase to Phase or Phase to Ground)										
PPE/EPE Requirements (Refer to General PPE/EPE Matrix Notes, Appendix B, Page 1 of 11)										
Task	Hearing Protection	Arc Face Shield with Balaclava	VR Gloves (Refer to B.1)	FR Gloves (Refer to B.1)	FR Shirt	FR Pants	FR Coveralls	Flash Hood w/o suit	Flash Suit/Hood	comments
Miscellaneous Electrical Equipment/Components										
Removing/Installing Fuse Cartridge/block	X	X	X		X	X				
Voltage Readings	X	X	X		X	X				
Live-Dead-Live	X	X	X		X	X				
Verifying Current w/Clamp-on amp probe	X	X	X		X	X				
Installing/removing Test Equipment	X	X	X		X	X				
Relay Testing	X	X	X	X	X	X				Refer to Note Below
Removing/Installing, bolted Covers to Expose Live Parts	X	X	X	X	X	X				Refer to Note Below
Opening/Closing Hinged Covers to Expose Live parts										
Connecting/Disconnecting Equipment From an Energized Receptacle (Arc containing type connectors)										Equipment in OFF position. Up to 200 Amp. Refer to PVSM Section XII for clarification
Connecting/Disconnecting Equipment From an Energized Receptacle (Non-arc containing type connectors)	X	X		X	X	X				Equipment in OFF position. Refer to PVSM Section XII for clarification.
Operating local disconnect/breakers for Load Equipment (Cover Closed)										Ensure cover/door is secure and stand off to side while operating.
Operating local disconnect/breakers for Load Equipment (Cover Open)	X	X		X	X	X				Stand off to side while operating.
Perform infrared thermography and other non- contact inspections outside the restricted approach boundary	X	X		X	X	X				Refer to Note below. Not required if thermography window is used.
Insulation Resistance testing (Meggering) (After Live-Dead-Live Check)										
Note: VR gloves req'd if crossing Restricted Approach Boundary of any exposed energized component; if not crossing the Restricted Approach Boundary of any exposed energized components then FR gloves can be used in lieu of VR Gloves. Refer to Appendix A page 1 of 4 for the Restricted Approach Boundaries and Incident Energy Levels for Arc Flash Hazard Related Work in determining appropriate arc rated FR gloves.										

301 - 600 V (Phase to Phase or Phase to Ground)										
PPE/EPE Requirements (Refer to General PPE/EPE Matrix Notes, Appendix B, Page 1 of 11)										
Task	Hearing Protection	Arc Face Shield with Balaclava	VR Gloves (Refer to B.1)	FR Gloves (Refer to B.1)	FR Shirt	FR Pants	FR Coveralls	Flash Hood w/o suit	Flash Suit/Hood	Comments
Installing (After LDL Check) or Removal of Working Grounds.	X	X	X		X	X				
Motor Control Center										
Tag Placement/Verification										No breaker manipulation.
Removal/Install Circuit Breaker/MCC bucket	X	X	X		X	X	X			
Breaker Manipulations (Door Open)	X	X		X	X	X	X			
Breaker Manipulations (Door Closed)	X	X		X	X	X				Not required when using 4ft extension breaker manipulation tool
Light Bulb Replacement										No broken bulbs.
Voltage Readings	X	X	X		X	X	X			
Live-Dead-Live Check	X	X	X		X	X	X			
Installing/Removing Test Equipment	X	X	X		X	X	X			
Verifying Current w/Clamp-on amp probe	X	X	X		X	X	X			
Relay Testing	X	X	X	X	X	X	X			Refer to Note Below
Removing/Installing, Bolted Covers to Expose Live Parts	X	X	X	X	X	X	X			Refer to Note Below
Insulation Resistance Testing (Meggering) (After Live-Dead-LIve Check)										
Installing (After Live-Dead-Live Check) or removal of Working Grounds	X	X	X		X	X	X			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	X	X			X	X	X			Not required if thermography window is used.
Note: VR gloves req'd if crossing Restricted Approach Boundary of any exposed energized component; if not crossing the Restricted Approach Boundary of any exposed energized components then FR gloves can be used in lieu of VR Gloves. Refer to Appendix A page 1 of 4 for the Restricted Approach Boundaries and Appendix A page 3 of 4 for Incident Energy Levels for Arc Flash Hazard Related Work in determining appropriate arc rated FR gloves.										

301 - 600 V (Phase to Phase or Phase to Ground)										
PPE/EPE Requirements (Refer to General PPE/EPE Matrix Notes, Appendix B, Page 1 of 11)										
Task	Hearing Protection	Arc Face Shield with Balaclava	VR Gloves (Refer to B.1)	FR Gloves (Refer to B.1)	FR Shirt	FR Pants	FR Coveralls	Flash Hood w/o suit	Flash Suit/Hood	Comments
Tripping and Resetting Thermal Overloads (Breaker Closed and Energized)	X	X	X		X	X	X			
Load Center										
Tag Placement/Verification										No breaker manipulation.
Breaker Manipulation (Door Open)	X		X	X	X	X	X	X		Refer to Note Below
Breaker Manipulations (Door Closed	X	X		X	X	X	X			
Racking Breaker (Door Open)	X		X	X	X	X	X	X		Refer to Note Below
Racking Breaker (Door Closed)	X	X		X	X	X	X			
Operating the Disconnect via the “Kirk” Key Interlock	X			X	X	X	X	X		
Light bulb replacement										No broken bulbs.
Voltage Readings	X		X		X	X	X	X		
Live-Dead-Live Check	X		X		X	X	X	X		
Installing/Removing Test Equipment	X		X		X	X	X	X		
Verifying Current w/Clamp-on amp probe	X		X		X	X	X	X		
Removing/Installing Control Power Fuses	X		X	X	X	X	X	X		Refer to Note below
Relay Testing	X			X	X	X	X	X		
Removing/Installing, Bolted Covers to Expose Live Parts	X		X	X	X	X	X	X		Refer to Note below
Opening/Closing Hinged Covers to Expose Live Parts	X		X	X	X	X	X	X		Refer to Note below

Note: VR gloves req’d if crossing Restricted Approach Boundary of any exposed energized component; if not crossing the Restricted Approach Boundary of any exposed energized components then FR gloves can be used in lieu of VR Gloves. Refer to Appendix A page 1 of 4 for the Restricted Approach Boundaries and Appendix A page 3 of 4 for Incident Energy Levels for Arc Flash Hazard Related Work in determining appropriate arc rated FR gloves.

301 - 600 V (Phase to Phase or Phase to Ground)										
PPE/EPE Requirements (Refer to General PPE/EPE Matrix Notes, Appendix B, Page 1 of 11)										
Task	Hearing Protection	Arc Face Shield with Balaclava	VR Gloves (Refer to B.1)	FR Gloves ((Refer to B.1)	FR Shirt	FR Pants	FR Coveralls	Flash Hood w/o suit	Flash Suit/Hood	Comments
Installing (After Live-Dead-Live Check) or Removal of Working Grounds	X		X		X	X	X	X		
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	X			X	X	X	X	X		Not required if thermography window is used.
Note: VR gloves req'd if crossing Restricted Approach Boundary of any exposed energized component; if not crossing the Restricted Approach Boundary of any exposed energized components then FR gloves can be used in lieu of VR Gloves. Refer to Appendix A page 1 of 4 for the Restricted Approach Boundaries and Appendix A page 3 of 4 for Incident Energy Levels for Arc Flash Hazard Related Work in determining appropriate arc rated FR gloves.										

4.16 kV and 13.8 kV										
	PPE/EPE Requirements (Refer to General PPE/EPE Matrix Notes, Appendix B, Page 1 of 11)									
Task	Hearing Protection	Arc Face Shield with Balaclava	VRGloves (Refer to B.1)	FR Gloves (Refer to B.1)	FR Shirt	FR Pants	FR Coveralls	Flash Hood w/o suit	Flash Suit/Hood	Comments
Opening Breaker Door for Tag Placement/Verification/ Inspection	X			X					X	Not required if breaker is racked down
Manipulating 135 Vdc Molded Case Circuit Breakers	X			X					X	Not required if breaker is racked down.
Tripping “86” Relay	X			X					X	Not required if breaker is racked down.
Light Bulb Replacement										No broken bulbs*
Breaker Manipulations (NA & NB) (Door Open)	X			X					X	
Breaker Manipulations (NA & NB) (Door Closed)	X			X	X	X	X	X		
Racking Breaker (NA & NB)	X			X					X	
Breaker Manipulation (PB ONLY) (Door Closed)	X	X		X	X	X				
Breaker Manipulations (Door Open) Racking Breaker (PB ONLY)	X	X		X			X			
Removing/Installing control Power Fuses (PB ONLY)	X	X		X			X			Not required if breaker is racked down.
Opening/Closing Potential Transformer (PT) Compartment (PB ONLY)	X	X		X			X			
Opening/Closing Potential Transformer (PT) compartment (NA & NB)	X			X					X	
Insulation Boot Removal in the back of switchgear			X							Breaker racked down.
Live-Dead-Live Check			X							Per glow stick Mfg. Instructions
Insulation Resistance Testing (Meggering) or Hi Pot Testing										After Live-Dead-Live Check
Removing/Installing Control Power Fuses	X			X					X	Not required if breaker is racked down.
Removing bolted Covers to Expose Live parts	X		X	X					X	Refer to Note below
Opening Hinged Covers to Expose Live Parts	X		X	X					X	Refer to Note Below

4.16 kV and 13.8 kV										
	PPE/EPE Requirements (Refer to General PPE/EPE Matrix Notes, Appendix B, Page 1 of 11)									
Task	Hearing Protection	Arc Face Shield with Balaclava	VR Gloves (Refer to B.1)	FR Gloves (Refer to B.1)	FR Shirt	FR Pants	FR Coveralls	Flash Hood w/o suit	Flash Suit/Hood	Comments
Energized Cable Examination, in Enclosed Spaces	X		X						X	Refer to Section 3.16.
Energized Cable Examination, in Cable Tray	X		X						X	
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	X			X					X	Not required if thermography window is used.
Note: VR gloves req'd if crossing Restricted Approach Boundary of any exposed energized component; if not crossing the Restricted Approach Boundary of any exposed energized components then FR gloves can be used in lieu of VR Gloves. Refer to Appendix A page 1 of 4 for the Restricted Approach Boundaries and Appendix A page 3 of 4 for Incident Energy Levels for Arc Flash Hazard Related Work in determining appropriate arc rated FR gloves.										

24 kV and 525 kV

	PPE/EPE Requirements (Refer to General PPE/EPE Matrix Notes, Appendix B, Page 1 of 11)									
Task	Hearing Protection	Arc Face Shield with Balaclava	VR Gloves (Refer to B.1)	FR Gloves (Refer to B.1)	FR Shirt	FR Pants	FR Coveralls	Flash Hood w/o suit	Flash Suit/Hood	Comments
Standing in the Vicinity of breakers or the MOD when opening or closing to verify correct operations	X									Stay as far away as possible.
Verifying breaker position locally following switch yard operations										
Startup Transformer low side disconnect operation	X	X		X	X	X	X			
Removing/Installing Bolted Covers to Expose Live Parts	X			X					X	
Opening/Closing Hinged Covers to Expose Live Parts	X			X					X	
Live-Dead-Live Check			X							Per Glow stick Mfg. Instructions
Insulation Resistance Testing (Meggering) or Hi Pot Testing										After Live-Dead-Live Check
Opening/Closing Potential Transformer [PT) Compartment	X			X					X	
Perform Infrared thermography and other non-contact inspections outside the restricted approach boundary	X			X					X	Not required if thermography window is used.

Note: VR gloves req'd if crossing Restricted Approach Boundary of any exposed energized component; if not crossing the Restricted Approach Boundary of any exposed energized components then FR gloves can be used in lieu of VR Gloves. Refer to Appendix A page 1 of 4 for the Restricted Approach Boundaries and Appendix A page 3 of 4 for Incident Energy Levels for Arc Flash Hazard Related Work in determining appropriate arc rated FR gloves.

Appendix C - Arc Flash Protection Apparel Selection

C. Worker, qualified or not, entering a Flash Protection Boundary shall wear PPE/EPE which will provide the required level of protection for the area being entered. Face and Neck protection is provided by an arc rated face shield with arc rated balaclava, arc rated goggles with arc rated balaclava or arc flash hood as required by the PPE/EPE Task Matrix. Hand Protection is provided by VR Gloves with protectors. If no shock potential is present, then the appropriate Arc Rated gloves can be used for arc flash protection in lieu of VR gloves.

C.2. If rubber insulating gloves with leather protectors are required by Appendix B - PPE/EPE Matrix, then additional leather or arc-rated gloves are not required. The combination of rubber insulating gloves with leather protectors satisfies the arc flash protection requirements.

C.3. The following table provides an example of additive values for layering FR apparel. Double the lowest ATVP rating of FR apparel.

Neck to Foot Protection	
Apparel	**ATVP Rating Provided**
FR Shirt	6.0
FR Pants	12
FR Coveralls	12
Add lowest ATVP rating for layering FR Apparel	6.0
Total	24.0 cal/cm^2

Appendix D - Policy, Checklists & Permit For Working within the Restricted Approach Boundary of Exposed Energized Equipment

D. POLICY STATEMENT

NOTE

The following information provides maintenance personnel working within the Restricted Approach Boundary of exposed energized equipment a set of tools to aid in the planning and implementation of work on energized equipment. Refer to Section 4.13, Working within the Limited Approach Boundary of Energized Systems/Equipment, for exemptions.

D.1.1. All equipment shall be placed in the safest possible state prior to performing work. Equipment should be de-energized whenever feasible, to ensure the safety of personnel and equipment. However, plant conditions and equipment design may require work to be performed on energized equipment.

D.1.2. Every job will be evaluated for methods to de-energize equipment prior to work. When de-energizing the equipment is not practical, consideration should be given to scheduling the work in another plant mode, alternate equipment lineups, putting equipment in a bypass configuration, or performing temporary modifications. If work on energized equipment is required, then appropriate measures shall be taken.

D.1.3. When work is required within the Restricted Approach Boundary of exposed energized equipment, a management review shall take place by a Team Leader or higher to identify measures which will minimize risk to personnel and equipment.

D.1.4. When work is required within the Restricted Approach Boundary of exposed energized equipment, management shall maintain cognizance of the activities, from the planning stages through completion, to ensure minimum risk to personnel/equipment and a maximum probability of success. Personnel performing work on energized equipment will maintain a heightened sensitivity to the work, never assume anything, and approach the equipment with a questioning attitude. Work will be stopped and supervision shall be consulted when unexpected conditions are encountered.

D.2. EXPECTATIONS/INTENT

D.2.1. The checklists provided are not intended to be all inclusive, to replace skill of the craft, or to eliminate good judgment, as not all situations can be covered. The checklists are a tool to augment the decision making process when dealing with energized equipment, and are not intended for record retention.

D.2.2. The checklists and work permit shall be used when work is performed within the Restricted Approach Boundary of exposed energized equipment where there is personal safety hazard, danger to/from equipment, or a Unit trip hazard.

D.2.3. The Section Leader is to aid in the field preparation of work to be performed within the Restricted Approach Boundary of exposed energized equipment. The level of planning is commensurate with the risk involved.

D.2.4. A Pre-Job Briefing checklist for work within the Restricted Approach Boundary of exposed energized equipment is provided to aid in the pre-job brief process and should be used as a guideline in the performance of the briefing.

D.2.5. The Energized Electrical Work Permit shall be completed by the technicians performing the work activity. The Department Leader or designee shall review and approve the work permit prior to the start of work within the Restricted Approach Boundary of exposed the exposed energized component or circuit part.

D.2.6. If the original job/work scope changes for any reason, then Appendix D and Appendix E shall be re-performed including the Energized Electrical Work Permit.

D.3. PRE-JOB PLANNING CHECKLIST D.3.1 Initial Evaluation

D.3.1.1. The Team Leader will evaluate the work activity (scheduled or emergent) and determine if the work activity will need added concurrence from supervision due to job concerns or safety issues.

D.3.2. Equipment and System

D.3.2.1. If the equipment must be energized or remain in service during performance of the work, then the following safe work practices shall be used. The Leader will use the information gathered to formulate the pre-job brief.

D.3.2.1.1. The Work Package:

- Establishes or identifies circuits and equipment that will be energized or in service during the performance of the work. Applicable prints and technical manuals are referenced, or included with the package
- Controls lifting, landing, and jumper placement, removal of circuit cards, etc.
- Establishes, in the precaution statement or body of the work order, the risk involved or the unique situations
- Establishes controls which will limit effects on other plant components or systems
- Suggests the use of clearance permits for affected equipment and circuits

The Team Leader should ensure emphasis is placed on job specific issues such as:

- Establishing expectations for control of leads, or jumpers (that is, tape leads, tie wrap, strain reliefs, proper test leads, etc.).
- Assessing the voltage and current levels and circuit function and purpose.
- Related equipment that will be affected is in a safe condition or is tagged out to preclude adverse effects to equipment or to personnel.
- Considering job continuity between shifts or disciplines.
- Verifying that materials and M&TE to be used for the job are correct.

D.3.3. Personnel Safety

D.3.3.1. Jobs which present a high risk of shock hazard to personnel should be de-energized prior to working on the job.

D.3.3.2. Personnel selected for critical jobs should possess the skills and shall be qualified to work on the equipment and system. Consideration for a high degree of skill of the craft should also be considered.

D.3.3.3. The risk factor of the work should be assessed when scheduling the work. If the work is high risk, then the work should not be performed during late night hours or by fatigued personnel.

D.3.3.4. Establish controls for access to the area where work is to take place.

D.3.3.5. Special work practices for the work, or because of work space conditions, should be initiated.

D.3.3.6. Assess the job for any special safety equipment (PPE/EPE) that should be used to minimize personnel risk (that is, rubber mats, insulated blankets, grounding devices, hot sticks, VR gloves, and personal safety equipment).

D.3.3.7. Test set-ups shall not be left unattended unless installed by a T-Mod.

D.3.3.8. Actions which are not covered in the work package should be initiated and addressed by the Team Leader (that is, amend package, add clearance, etc.).

D.3.3.9. Cover information and job expectations in the pre-job briefing. D.3.3.10 Communications between job performance personnel shall be clear and concise.

D.4. PRE-JOB BRIEFING CHECKLIST

D.4.1. All individuals involved with work on energized equipment shall be present in the pre-job briefing. A lead person in charge of the work shall be identified.

D.4.2. Perform a walkdown of the job (as required).

D.4.3. A comprehensive review of work scope, intent, and contingencies shall be discussed.

D.4.4. Review the work document to determine work scope and intent.

D.4.5. Review the work document impact statement.

D.4.6. Discuss possible contingencies in the event of actions not planned.

D.4.7. Consider use of special precautions to avoid dropping test leads, jumpers, screws, etc.

D.4.8. Discuss the impact of the work on the equipment.

D.4.9. Discuss notifications to operations to restore equipment or systems.

D.4.9.1. Limitations:

- Training
- Overtime
- Heat Stress
- Chemicals and hazardous materials

D.4.9.2. Discuss personnel safety requirements (PPE/EPE):

- Safety glasses
- Hard hat
- Conductive items and reaching in areas containing exposed energized parts
- Flash Protection apparel
- Rubber gloves/sleeves (including pre-job examination for defects)
- Rubber blankets (including pre-job examination for defects)
- VR roll blankets (including pre-job examination for defects)

D.4.10. Discuss proper tools and test equipment required to perform work

D.4.10.1. Consider the use of insulated tools.

D.4.10.2. Prior to starting work, perform a functional test on tools and equipment to verify proper operation.

D.4.10.3. Ensure proper test equipment range setting and setup are made prior to making a connection.

D.4.10.3.1. All soldering should be performed on de-energized circuits and preferably with the component removed or isolated. Soldering may be performed in energized circuits providing that a battery operated soldering iron is used. In addition, extreme caution shall be exercised to ensure that no equipment could or can be affected by the commencement of the soldering activity. Engineering concurrence is required for all soldering activities on energized circuits.

D.4.10.3.2. If using AC powered M&TE or tools, consider the use of isolation transformers and ground fault interrupters.

D.4.11. Discuss actual job site conditions:

D.4.11.1. Identify other equipment in the surrounding work area.

D.4.11.2. Consider the use of barriers to isolate the work area.

D.4.11.3. Ask whether other disciplines will be working in the areas in which complications may arise.

D.4.11.4. Augment the lighting if necessary.

D.4.11.5. Discuss recent Occupational events incidents and related industry operating events.

Appendix E - Risk Assessment of Work on Energized Equipment

E. INTRODUCTIONThe following information is used to help assess the risk of any work activity within the Restricted Approach Boundary of exposed "energized equipment" prior to the planning of the activity and during all phases of the work. Refer to Section 4.13 for exemptions.

E.1.2. Energized equipment as used in this appendix has two (2) separate risk considerations:

- Personnel risks relate to any electrical hazards associated with work within the Restricted Approach Boundary of exposed energized electrical circuits or components
- Equipment risks relate to an increased potential for unintentional trips or "cycling" of systems or the unit due to work within the Restricted Approach Boundary of "in service" equipment

E.1.3. Energized electrical circuits or components shall be all circuits that have not been verified to be de-energized, that is, if the circuit has not been proven to be de-energized using the Live-Dead-Live methodology per Section 4.6, Live-Dead-Live Checks, or have not been insulated or isolated, shall be treated as "energized".

E.1.4. "In-service" equipment shall mean equipment that remains functionally in-service or operable.

E.2. RISK ASSESSMENT

E.2.1. Risk Assessment and associated responsibilities may be broken down into two activities - risk identification and risk evaluation:

E.2.1.1. Risk identification is consideration of the possible impact, particularly "worst case" events, a work activity may have on the personnel performing the work, or upon associated equipment, systems, or the unit.

E.2.1.1.1. "Risk identification" shall be practiced throughout all phases of a work activity and all parties involved with that activity.

E.2.1.1.2. Most risks associated with an activity should be identified during the work planning process. During the work planning phase of a work activity, "risk identification" is primarily the responsibility of the team, although support may be obtained from Engineering, and/or the Work Groups.

E.2.1.2. Risk evaluation is weighing the identified risks associated with a work activity against the benefits to be gained by performing the work while the risk exists. The responsibility for "risk evaluation" depends upon the risk and significance of a work activity:

E.2.1.2.1. Lower risk activities may require evaluation only by the party that identified the risk.

E.2.1.2.2. When an activity has more potential for hazard to personnel or equipment, or if there is doubt about the authority required for a given risk evaluation, assistance (approval to proceed) is to be obtained from management - Team Leader or above. Assistance from Engineering may be required.

E.3. DISCUSSION

E.3.1. The risk associated with any activity is to be assessed when planning, scheduling, or commencing that work activity.

E.3.2. The following risk types should be considered during a risk assessment. The type risks listed are not intended to be all inclusive or to eliminate good judgment. Instead, this should stimulate decision making during all phases of the work activity.

E.3.3. Personnel Risk considerations:

Section XV
Energy Control Procedure (Lock Out / Tag Out)

1.0 PURPOSE AND SCOPE

1.1 Purpose

1.1.1 The purpose of this procedure is to establish minimum guidelines as referenced in OSHA 29 CFR 1910.147 ensuring the safety and health of personnel who may be required to work on any type of Facilities System, Structure or Component (FSSC) capable of being energized or harboring stored energy.

1.2.1 This procedure will be used to ensure FSSCs are isolated from all potentially hazardous energy sources and locked out before employees perform any work where the unexpected energization, start-up or release of stored energy could cause injury.

2.1 Scope

2.1.1 This procedure applies to all LLR Electric LOTO qualified employees, who may be exposed to the release of hazardous energy while working on ancillary facilities, systems, structures, or components.

Minor tool changes, adjustments, troubleshooting and other minor servicing activities, which take place during normal production operations, are not covered by this standard if they are routine, repetitive and integral to the use of the equipment for production, provided that the work is performed using alternative measures which provide effective protection.

2.0 RESPONSIBILITIES

1.1 Industrial Health and Safety

1.1.1 Industrial Health and Safety Department shall monitor implementation of this procedure for compliance. Non-compliance will be reported to responsible supervision for appropriate action.

3.0 DEFINITIONS

3.1 **Affected Employee/Worker** — An Employee/Worker whose job requires the operation of a machine or equipment on which servicing, or maintenance is being performed under Lock Out or Tag Out, or whose job requires work in an area in which servicing, construction, or maintenance is protected by a LOTO. An Affected Employee becomes an Authorized Employee when that employee's duties include performing servicing or maintenance covered under the LOTO.

3.2 **LLR Representative** — The individual who is designated by Management to oversee work at a facility.

3.3 **Authorized Employee/Worker:** — A person who Locks out or Tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment.

3.4 **Competent Person** — A person capable of identifying existing and predictable hazards in the surroundings or working conditions which are hazardous to employees, and has authorization to take prompt corrective measures to eliminate the hazard.

3.5 **Construction Work** — 29 CFR 1926.32 (g) defines “Construction Work” as work for construction, alteration, and/or repair, including painting and decorating.

3.6 **Component/System Isolation (CSI) LOTO** — Lockable single or multiple FSSC’s at which hazardous energy flow can be effectively and positively blocked so transmission or release of hazardous energy is prevented.

3.7 **Coordinator** — Job-associated employee given the responsibility to coordinate activities and processes. The employee is knowledgeable in the construction and operation of the project, facilities equipment and the associated hazards.

3.8 **Energy Isolation Device** — A mechanical device that physically prevents the transmission or release of energy.

3.9 **Energy Source** — Any electrical, mechanical, hydraulic, pneumatic, chemical, nuclear, thermal, or other energy source that could cause injury to personnel.

3.10 **FSSC** — Facilities System, Structure or Component

3.11 **Hazardous Energy** — Any energy, including mechanical (for example, power transmission apparatus, counterbalances, springs, pressure, or gravity), pneumatic, hydraulic, electrical, chemical, nuclear, and thermal energies (for example, high or low temperature, heat trace), that could cause injury to employees. Danger is only present when energy may be released in quantities or at rates that could injure employees:

- Greater than or equal to 60 psig hydraulic pressure (with the exception of in place instrument calibrations)
- Greater than or equal to 10" Hg vacuum (with the exception of in place instrument calibrations)
- Greater than or equal to 120°F temperature (with the exception of in place instrument calibrations)
- Greater than or equal to 50 volts (AC or DC) (with the exception of in place instrument calibrations)
- The presence of a caustic, acidic, or corrosive material
- The presence of a flammable, explosive, or oxygen displacing gas in a concentration that poses a potential to combust, explode, or create an atmosphere that is Immediately Dangerous to Life and Health (IDLH), (with the exception of in place instrument calibrations)The presence of liquefied gases such as CO_2 or N_2 (with the exception of in place instrument calibrations
- Pneumatic systems greater than or equal to 60 psig (with the exception of in place instrument calibrations)
- Work in CO_2 protected areas when immediate egress is not possible

3.12 **Lock Out/Tag Out** — The placement of a Lock Out device and identification tag on an energy isolating device to ensure that the energy isolating device and the equipment being controlled may not be operated until the Lock Out device is removed.

3.13 **Lock Out Device** — A device that utilizes a positive means such as a Lock, either key or combination type, to hold an energy isolating device in the safe position and prevent the energizing of a machine or equipment.

3.14 **LOTO Owner** — Authorized Individual that installs and holds ultimate responsibility for the LOTO.

3.15 **Other** — Individuals that may come in contact with LOTO activities during their normal routine activities.

3.16 **Program Coordinator** — The LLR Electric individual with overall responsibility for the implementation, control and documentation of the LOTO program.

3.17 **Project Manager/Project Leader** —Job-associated employee who is performing a maintenance activity or is given the overall responsibility to manage projects or construction activities and the workers involved. The Project Manager/Leader does not have to be a qualified leader but does have to demonstrate expertise in Facilities work

3.18 **Qualified Employee** — An individual with a recognized degree, professional certificate, or extensive knowledge and experience in the subject field, and capable of maintenance, construction, design, analysis, evaluation and/or specifications in the subject work, project or product.

3.19 **Qualified Electrical Employee** — An individual who has received training in and has demonstrated skills and knowledge in the construction, operation, and installation of electric equipment and associated hazards, or an individual who has documented training on the provisions of 29CFR 1910.331 through 1910.335 for electrical safety work practices of both qualified and unqualified persons.

3.20 **Tag Out** — The placement of a Tag on an energy isolating device to indicate that the energy isolating device and the equipment being controlled may not be operated until the Tag Out device is removed.

4.0 INSTRUCTIONS

4.1 General

4.1.1 Safety policies, procedures and rules in the company are designed and implemented to help employees avoid incidents which can result in injury, death and/or equipment damage. The Lock Out/Tag Out procedure is the most sacred because of the potential seriousness of an incident related to failure to comply with this procedure.

4.1.2 All employees are required to comply with the restrictions and limitations imposed on them during the use of Lock Out. Authorized employees are required to perform the Lock Out in accordance with this procedure.

4.1.3 Failure to comply with this procedure may result in disciplinary action up to and including termination.

4.1.4 Job Hazard Analysis (JHA) shall be performed and concurrence by the Leader shall be obtained and documented.

4.1.5 All employees, upon observing a machine or piece of equipment that is Locked Out for servicing or maintenance, shall NOT attempt to start, energize or use that machine or equipment.

4.1.6 Additional Affected Workers working under the protection of a LOTO must be trained or briefed in the Lock Out/Tag Out process and briefed.

4.1.7 Only qualified electrical employees may work on or in close proximity to exposed electric circuits or equipment that has not been de-energized. Such persons must be capable of working on energized circuits and will be familiar with the proper use of special precautionary techniques, personal protective equipment, insulated tools, insulating and shielding materials.

4.1.8 If the employee must leave the area for any reason before the activity is completed, the equipment must be placed in a safe condition.

4.1.9 All reasonable attempts must be made to de-energize live parts to which an employee may be exposed before the employee works on or near them. In limited cases, Energized Electrical Work Authorization, may be used provided ALL of the following conditions are met:

- De-energizing would introduce additional or increased hazards or is infeasible due to equipment design or operational limitations. Live parts that operate at less than 50 volts (AC/DC) to ground need not be de-energized if there will be no increased exposure to electrical burns or to explosion due to electric arcs.
- Physical or operational conditions exist where boundary isolation is not practical or other conditions have been established to provide equivalent protection to prevent sudden energy release. The Work Group Leader and the Affected Employee concur a LOTO is not required.
- A pre-job brief is held prior to beginning the activity that contains adequate instructions for isolating the equipment while the task is being performed.
- If the employee must leave the area for any reason before the activity is completed, the equipment must be placed in a safe condition.

- Energized Electrical Work Authorization (Sample) has been approved and attached to the work document.

4.2 Requesting a LOTO

4.2.1 The Requester for LOTO Request and Modification must be completed and then routed to owner to initiate the LOTO process. All stored energy must be released after a lockout device is installed

4.3 Energy Isolating Devices (Locks & Tags)

4.3.1 General

A. Standardized Lock Out/Tag Out Devices shall be implemented within the facility in the following formats:

- Administrative control tags in the color and format shown on Appendix H - LOTO Administrative Control Tag.
- Additionally, in the case of Tag Out devices, print and format shall be standardized.
- LOTO standards shall be maintained by LLR Management.

B. A Lock Out/Tag Out log, shall be utilized to identify the location and status of a Lock Out/Tag Out while in use. Originals may also be kept on file or in electronic format to suffice as a log.

C. All Locking devices and Tags shall be pre-approved and issued by the Qualified LLR, Electrical Employee. Tags shall identify the individual applying the device

D. All Supplemental Workers or Service Provider Devices and Tags shall be pre-approved by the Qualified LLR, Electrical Employee.

4.3.2 Locks

A. A Lock and a Tag shall be placed on each disconnecting means used for the removal of energy to circuits and equipment on which work is to be performed. The Lock shall be attached so as to prevent persons from operating the disconnecting means unless they resort to undue force or the use of tools.

B. Locks must be individually keyed and while in use, the key shall remain in the possession of the individual who placed the Lock or in a lock-box.C. Locks used for the purpose of isolating an energy source shall not be used for any other purpose.

D. OSHA vents and drain valves are to have yellow locks attached.

4.3.3 Tags

A. If a Lock cannot be applied, or if the employer can demonstrate that Tagging procedures will provide a level of safety equivalent to that obtained by the use of a Lock, a Tag may be used without a Lock.

B. A Tag used without a Lock shall be supplemented by at least one additional safety measure (known as “Tag Plus”) that provides a level of safety equivalent to that obtained by use of a Lock and require two actions to re-energize.

C. Tags must indicate the identity of the employee applying the device(s), warn against hazardous conditions if the machine or equipment is energized and shall include a legend such as the following: Do Not Start. Do Not Open. Do Not Close. Do Not Energize. Do Not Operate.

D. Tags used for the purpose of LOTO shall not be used for any other purpose.

E. When a LOTO is attached as an energy isolating means, the LOTO is not to be removed without authorization of the authorized responsible person and is never to be bypassed, ignored, manipulated or otherwise defeated.

1. Individual LOTO devices may be removed as noted in, LOTO Owner Override Removal.

F. Individualized Tags are to be requested from the employee's Work Group Leader.

G. Tag Out device attachment means shall be of a non-reusable type, attachable by hand, self-locking, non-releasable with a minimum unlocking strength of greater than or equal to 50 lbs. and have the general design and basic characteristics of being at least equivalent to a one-piece, all environment-tolerant nylon cable tie.

H. The Tag Out device shall be attached at the same location the Lock Out device would have been attached.

I. Where a Tag cannot be affixed directly to the energy isolating device, the Tag shall be located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.

4.4 LOTO Installation/Removal/Modification Process

4.4.1 CSI LOTO Install

A. Complete the Owner/Preparer - LOTO Request and.

B. Verbally contact the Project Manager for approval.

C. The Authorized Employee shall notify all Affected Employees of the energy control activities before the Lock Out/Tag Out Device is attached.

D. The Authorized Employee designated to execute the LOTO shall install the Lock Out/Tag Out device designated on the LOTO Request and Modification form and sign the 'installed by' after the LOTO has been hung.

E. The Authorized Employee shall verify that the equipment conditions are set for the work to be performed.

F. Affected employee/workers working under the protection of a LOTO must "Sign On" after the LOTO devices have been installed.

4.4.2 LOTO Removal

A. The Authorized Employee designated to execute the LOTO shall contact the Project Manager for approval to remove the Lock Out/Tag Out Devices.

1. Affected employee/workers working under the protection of a LOTO must "Sign Off" prior to any LOTO device removal.

B. The Authorized Employee or Designee shall notify all Affected Employees of the energy control activities before the Lock Out/Tag Out device is removed.

C. The Authorized Employee designated to execute the CSI LOTO shall remove the devices as designated on LOTO Request and Modification (Sample).

D. The Authorized Employee shall perform any restart activities and verify the equipment is fully operational.

4.5 Establishing Removal of Energy

4.5.1 Facility drawings/prints shall be reviewed and/or the appropriate Leader and/or Subject Matter Expert and consulted prior to performing maintenance. In cases where configuration cannot be verified, the use of live-dead-live and other methods shall be utilized to verify that a machine or equipment is stopped and isolated from all potentially hazardous energy sources.

4.5.3 The Affected Employee is to Lock Out all energy sources involved by applying a personal Lock and personal Tag. De-energizing may include, but is not limited to, opening a disconnect switch, removing a fuse, closing a valve, bleeding the line, or placing a block in the equipment (such as blocking a spring or fan blade).

4.5.4 Machinery or equipment to be isolated shall be turned off or shut down using the procedures established for the machine or equipment and shall be done in the following sequence:

A. Step 1: Preparation for shutdown. Before an Authorized or Affected Employee turns off a machine or equipment, the Authorized employee shall have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy.

B. Step 2: Machine or equipment shutdown. The machine or equipment shall be turned off or shut down using the procedures established for the machine or equipment. An orderly shutdown must be utilized to avoid any additional or increased hazard(s) to employees as a result of the equipment stoppage. If a documented shut down procedure does not exist for the affected component, then one should be documented during the initial shut down.

C. Step 3: Machine or equipment isolation. All energy isolating devices that are needed to control the energy to the machine or equipment shall be physically located and operated in such a manner as to isolate the machine or equipment from the energy source(s).

4.6 Verifying Removal of Energy

4.6.1 The requirements of this section shall be met, as applicable, before any circuits or equipment can be considered and worked as de-energized.

A. Facility drawings/prints shall be reviewed and/or the appropriate Leader and/or Subject Matter Expert (SME) consulted prior to performing steps 4.6.1.B through 4.6.1.G.

B. A qualified electrical person shall operate the equipment operating controls or otherwise verify that the equipment cannot be restarted or have control circuits that may activate when power is restored.

C. A qualified electrical person shall use test equipment to test the circuit elements and electrical parts of equipment to which employees will be exposed and shall verify that the circuit elements and equipment parts are de-energized (Live-Dead-Live). The test shall also determine if any energized condition exists as a result of inadvertently induced voltage or unrelated voltage back-feed even though specific parts of the circuit have been de-energized and presumed to be safe.

D. All potentially hazardous stored or residual energy shall be relieved, disconnected, restrained, and otherwise rendered safe before servicing equipment.

E. Open all drain valves, bleed off air from a system, and eliminate stored hydraulic pressure.

F. Test the equipment/machine to assure that all energy was disconnected or released. (Ensure all employees are safely positioned away from equipment.)

G. Additional methods to safely release existing energy may be necessary. Procedures and methods may be found in the operating procedure/manual for each piece of equipment.

4.7 Equipment Connected via Cord & Plug

4.7.1 Machinery/equipment where the only source of energy is from connection to an electrical outlet cord and plug shall be considered to be in compliance with Lock Out/Tag Out procedure if ALL the following conditions are met:

A. The plug is removed from the electrical source.
B. The person servicing the equipment can be in control of the cord and plug, at all times during the servicing.
C. All Affected Employees shall be notified of the equipment being serviced.

4.7.2 An alternative means of compliance is to have a plug cap device in which Lock Out/Tag Out devices are affixed to the plug.

4.8 LOTO Owner Override Removal

4.8.1 In the event the LOTO Owner cannot be reached to remove a personal Lock and it is necessary to unlock the equipment, only the Leader of the LOTO installer may authorize the removal of the Lock.

4.8.2 The Leader shall complete - LOTO Owner Override Removal, prior to removal of the Lock Out/Tag Out devices and restoration of power.

4.8.3 If the LOTO Owner is not on-site, and cannot be located or is unable to report to the site, the Leader shall check the machine or process to be sure it is clear before removing the Lock.

4.8.4 The Leader who removes the Lock Out/Tag Out devices is responsible for following all of the requirements for restoring power.

4.8.5 Prior to the LOTO Owner starting work following override removal, the Leader is responsible for contacting and advising the LOTO Owner of the removal of the Lock Out/Tag Out devices.

4.9 Shift Change

4.9.1 Shift or personnel changes. Specific procedures shall be utilized during shift or personnel changes to ensure the continuity of Lock Out/Tag Out protection, including provision for the orderly transfer of Lock Out/Tag Out device protection between off-going and oncoming employees.

4.9.2 If the piece of equipment is Locked out at shift change, the person on the next shift transferring the LOTO must apply the Lock Out/Tag Out devices at the same time the employee who is leaving removes the device from the Lock Out/Tag Out devices or Lock box.

4.9.3 Once the LOTO is established and approved, the LOTO Owner need not be on site during work.

4.9.4 The owner’s devices need not be removed for on-going work through multiple shift changes, but the owner must be on site to perform any transfers, modifications or removal.

4.10 Outside Supplemental Workers and/or Service Providers

4.10.1 Supplemental Workers and/or Service Providers LOTO shall be processed in accordance with this procedure to ensure adequate oversight, review and approval is provided.

4.10.2 All Supplemental Workers and/or Service Providers shall furnish a written/electronic form documenting their companies LOTO program for review by the site Issuing Authority prior to starting any work activity.

4.10.3 The Supplemental Workers and/or Service Providers shall have an OSHA “Competent Person” [29CFR 1926.32(f)] and LOTO program that meets 29 CFR 1910.147, Control of Hazardous Energy (LOTO); 29 CFR 1910.333, Selection and Use of Work Practices; 29 CFR 1926.417, Lockout and Tagging of circuits and 29 CFR 1910.331 through 1910.335 provisions for electrical safety work practices for both qualified and unqualified persons.

A. This requirement shall be contained in the contracts Terms and Conditions.

4.10.4 Prior to the Supplemental Workers and/or Service Providers performing work, a designated Single Point of Contact (SPOC) will be made within the Supplemental Workers and/or Service provider's organization for the purpose of interfacing and coordinating the Lock Out/Tag Out procedures.

4.10.5 Whenever outside service personnel are to be engaged in activities covered by the scope and application of this procedure, the on-site employer and the outside employer shall inform each other of their respective Lock Out/Tag Out procedures.

4.10.6 The on-site employer shall ensure employees understand and comply with the restrictions and prohibitions of the outside employer's energy control program.

4.10.7 Supplemental Workers and/or Service Providers are to be informed that any de-energization of company equipment is to be approved by the Management & Group Leader or Project Manager/Project Leader having project oversight responsibilities.

4.10.8 Any equipment that is required to be Locked out by a Supplemental Worker and/or Service Provider is to be administratively controlled by the Issuing Authority or designee. The "LOTO Administrative Control Tag" is to be applied to one or more of the Supplemental Workers and/or Service Provider Lock Out/Tag Out device or Lock Box and then removed upon verification of work completion.

4.11 Specific Procedures for Individual Equipment and Areas

4.11.1 Each department that owns and operates equipment should develop internal procedures for the isolation of specific equipment in order to perform work. These procedures should be updated continuously and checked against drawings/prints each time a Lock Out/Tag Out is performed to incorporate system Modifications that may affect the isolation process.

4.11.2 The employer need not document the required procedure for a particular machine or equipment, when ALL of the following elements exist:

A. Prior approval is attained from the Management.

B. The machine or equipment has no potential for stored or residual energy or re-accumulation of stored energy after shut down which could endanger employees.

C. The machine or equipment has a single energy source which can be readily identified and isolated.

D. The isolation and Locking out of the energy source will completely de-energize and deactivate the machine or equipment.

E. The machine or equipment is isolated from the energy source and Locked out during servicing or maintenance.

F. A single Lock Out device will achieve a Lock Out/TagOut condition.

G. The Lock Out device is under the exclusive control of the authorized employee performing the servicing or maintenance.

H. The servicing or maintenance does not create hazards for other employees.

I. No accidents have occurred involving the unexpected activation or re-energization of the machine or equipment.

J. Single Point Isolation is within direct line of sight and in the immediate location of the individual performing the work.

K. Scope of work is in an isolated area with limited access and minimal traffic, such as a roof top. Other examples may include:

- Replacement of air filters.
- Instrument and/or control(s) adjustments, including calibrations.

- Activities that, because of a LOTO, would prevent workers from effectively troubleshooting to assess the condition of equipment.

L. Activities of this nature shall not be abandoned without complete restoration of equipment/machines, or establishing a LOTO condition.

4.12 Large Zone/System Breach Controls

4.12.1 Physical barriers are used to isolate areas where LOTO protection is required to ensure worker safety.

4.12.2 Large Zone areas are established when work is conducted on systems or components in areas where personnel not signed on to the LOTO might come in contact with the isolated equipment or be exposed to a hazardous environment that is not normally accessible. Examples of Large Zones include, but are not limited to:

A. An electrical panel where plates or wiring covers have been removed and exposed conductors or connectors are present.

B. Cabinets de-energized for work that are large enough to be entered by personnel. (example: Switchgear Cubicle)

C. Open piping that could be accessed by personnel not signed on to LOTO additional worker form(s).

4.12.3 LOTO LLR Electric Leader approval is required if physical barriers are not used to establish a Large Zone Boundary.

4.12.4 The work group that initially breaches the system boundary or exposes the isolated components or equipment is responsible for establishing a positive physical boundary around the opening or exposed equipment. Examples of boundaries include, but are not limited to, the following:

A. Chains

B. Caution tape

C. Cones

4.12.5 Signs shall be placed on or near the physical boundaries stating that LOTO Sign-On is required to enter the area.

4.12.6 When the work is complete and the LOTO is ready for removal, the signs and barriers shall be removed by the work group closing the breach or restoring the work site.

4.13 Training

4.13.1 All LLR Electric Affected personnel must receive a briefing on the purpose of this procedure to ensure they have a clear understanding of the meaning of equipment Locks and Tags, and they are not to be altered in any way.

4.13.2 All Authorized personnel must receive formal training on the requirements of this procedure so that they can effectively Lock Out/Tag Out equipment as needed. The training will include the following:

- How to recognize energy sources, the type and of the energy available in the workplace.
- Tags are essentially warning devices affixed to energy isolating devices and do not provide the physical restraint on those devices that is provided by a Lock.
- Tags may evoke a false sense of security and their meaning needs to be understood as part of the overall energy control program.
    - How to perform an equipment shutdown.
    - How to isolate equipment.
    - Demonstrate the acceptable boundaries required for safe work practices.
        - How to safely release stored energy to reach a zero energy state.
        - How to apply and remove Lock Out/Tag Out devices.

- Procedures/requirements for over-ride removal of Lock Out/Tag Out devices.
- Awareness of the communication responsibilities prior to requesting a LOTO.
- The Requirements for requesting LOTO through the Issuing Authority.
- How to return equipment/components to their desired or original configuration.

4.13.3 Retraining shall be provided for all authorized and Affected Employees whenever there is a change in their job assignments, a change in machines, equipment or processes that present a new hazard, or when there is a change to this procedure.

4.13.4 Retraining shall also be provided when the annual inspection reveals, or whenever there is reason to believe, that there are inadequacies in employee's knowledge or use of the energy control procedures.

4.13.5 Documentation of all training is to be maintained by LLR Safety.

4.14 Documentation

4.14.1 All logs, LOTOs, forms, etc. shall remain on file for 3 years.

4.14.2 LOTO Logs will be controlled and tracked by Management. Originals may be kept on file or in electronic format to suffice as a log.

5.0 REFERENCES

5.1.1 CFR 1926.417 Lockout and Tagging of Circuits

6.0 RECORDS

6.1 The following records are generated by this procedure:

6.1.1 Record name: All logs, LOTOs, forms generated by this procedure

- Classification: Good business practice
- Retention: Three (3) years
- Turnover instruction: Maintained in department files

LOTO Pre-Job Brief LOTO #	Lock Box#
A Pre-Job Brief is a clear communication between the Issuing Authority, the Employee Designated to attach the LOTO, and all affected workers/employees. If there are questions they shall be answered prior to taking further action. *** NOTE *** In order to prevent disturbances and distractions, anyone not essential to the LOTO process or creating a disturbance shall be asked to leave during the Lock Out/Tag Out (LOTO) Pre-Job Brief, during hanging, Modification or removal of the LOTO.	
o Review the job scope specified in the LOTO request as a part of this Lock Out/Tag Out Procedure	
o The piece of equipment of system which is to be placed on Lock Out/Tag Out, exact Unit identification, and Location.	
o The purpose of the Lock Out/Tag Out.	
o The boundaries necessary to ensure the safety of personnel and equipment involved in the Lock Out/Tag Out.	
o Any other equipment or system which might be affected by the Lock Out/Tag Out.	
o Are accurate Drawings available?	☐ Yes ☐ No
o Will System/Circuit Tracing be required?	☐ Yes ☐ No
o Will a Grounding Tag be required?	☐ Yes ☐ No
o Explain the LOTO boundary, what is isolated and what is required to modify, alter or release it.	
o Discuss who is the SPOC for the LOTO	
o Discuss the need to do the job as planned	
o Arc flash, PPE. Flash Protection, Restricted Approach, Limited Approach and Prohibited Approach Boundary requirements	
o Discuss LOTO Sign On/Sign Off requirements	
o The fact that there is a Lock Out/Tag Out does not guarantee all hazards have been eliminated. Discuss that valves, dampers, etc. may leak through.	
o Any items require the cooperation of Operations, Maintenance, Security, Support personnel.	
LOTO Owner Signature:	Date:
Project Manager/Project Leader/Designee Signature:	
Print Name:	Date:

Pre Job Brief/Additional Affected Worker
LOTO Notification

LOTO #	LOTO box #
Requestor:	Company:
Work Number:	Cell Number:
Facility:	Equipment ID/Description:

Reason for LOTO:
_____
_____
_____
_____
_____

By signing this document, I acknowledge receiving a Pre-Job Brief describing the LOTO boundaries and the LOTO conditions required to ensure safe performance of the specified work and that these boundaries and conditions have been set. Furthermore, I understand that I always have the right to Independently walk-down the LOTO boundaries for adequacy.

Company	**Print Name**	**Signature**	**Date/Time**	**Sign off**	**Date/Time**

Requestor:	**Energized Electrical Work Authorization**	Date:

Work Document:	Equipment ID/Description

Work Description:

Justify why the work must be performed in an energized condition:

Hazard and Compensatory Measures

Energized Electrical Work Authorization

Is work area accessible to unqualified workers No Yes

IF yes, then Restrict access by one of the following: Barrier Signs Door Attendant Other

Comments:

Nominal Voltage:	ATPV Value:
Flash Protection Boundary: ft. in:	Restricted Approach Boundary: : ft. in
Limited Approach Boundary: ft. in:	Prohibited Approach Boundary: ft. in:
Other Hazards:	Compensatory Measures:

PPE/EPE

Hearing Protection, FR Shirt, Arc Flash Suit w/Hood, Arc Flash Shield, FR Pants, VR Tools (w/Lanyard) FR Coveralls, Arc Flash Hood, VR Gloves – Class:_____ FR Lab Coat, VR Sleeves, Rubber Blankets

All Qualified Electrical Workers who will perform the work agree this work can be performed safely.

Name	**Date**	**Name**	**Date**

Leader initial: _____ **Date:** _____

LOTO OWNER OVERRIDE REMOVAL

LOTO #:	LOTO Box #:

- The Facilities Management Work Group Leader and Issuing Authority are notified.
- The LOTO Owner Group Leader has verified the person who applied the LOTO is not on site.
- All reasonable efforts are made to contact the Authorized Employee or Contract Company.
- The Facilities Management Work Group Leader and Issuing Authority (or designee) verifies that the equipment is restored and ready to return to service. All Affected Employees are notified.
- The Facilities Management Work Group Leader and/or Issuing Authority shall then authorize removal of the LOTO with concurrence of the LOTO owner Work Group Leader.
- The Authorized Employee or Contract Company Representative who originally affixed the lock is made aware that their lock was removed when they report back to work.

Reason for Removal by Person other than the Authorized employee:_____
_____
_____
_____
_____

Authorized Employee Notified By:	Date:

LOTO removal approval by Facilities Management Work Group Leader: _____	Date: _____
LOTO removal approval by Issuing Authority: _____	Date: _____
LOTO removal approval by LOTO Owner Work Group Leader: _____	Date: _____

LOTO Removed by: _____

Authorized Employee comments and concurrence of LOTO removal: _____

Comments:
_____
_____
_____
_____

Signature: _____	Date: _____

Section XVI

BENZENE AWARENESS PROGRAM

1. **REGULATORY STANDARD**: OSHA - 29 CFR 1910.106 and 1926.55
2. **Purpose:** The Benzene Awareness Program is essential to the safety of all LLR Electric, Inc employees and to inform personnel of the dangers of Benzene.
3. **Synonyms**: Benzol, benzole, coal naptha, cyclohexatriene, phene, phenyl hydride, pyrobenzol. (Benzin, petroleum benzin, and Benzine do not contain Benzene)
4. **Scope**: LLR Electric, Inc has chosen to establish a Benzene Awareness Program for emergencies that could arise from exposure to Benzene Working in several locations example.. Power Plants.
5. **Physical and Chemical Characteristics**
   - 5.1. Benzene is a clear, colorless liquid with a distinctive sweet odor. Its boiling point is 176 degrees F and its flash point is 12 degrees F. The flammable limits in the air are 1.3% for the low end and 7.5% for the high end. Benzene is a flammable liquid. Its vapors can form explosive mixtures. All ignition sources must be controlled when Benzene is used, handled, or stored. Where liquid or vapor may be released, such areas shall be considered as hazardous locations (commonly found in petroleum refining sites, tank gauging, field maintenance, Power Plants etc..)
   - 5.2. Benzene vapors are heavier than air; thus the vapors may travel along the ground and be ignited by open flames or sparks at locations remote from the site at which Benzene is handled.
   - 5.3. Benzene is classified as a 1 B flammable liquid for the purpose of conforming to the requirements of 29 CFR 1910.106. A concentration exceeding 3,250 ppm is considered a potential fire explosion hazard. Location where Benzene may be present in quantities sufficient to produce explosive or ignitable mixtures are considered Class I Group D for the purpose of conforming to the requirements of 29 CFR 1910.309.
6. **Health Effects**
   - 6.1. Benzene is primarily an inhalation hazard. Systemic absorption may cause depression of the hematopoietic system, pancytopenia, aplastic anemia, and leukemia. Inhalation of high concentrations can affect the central nervous system function. Aspiration of small amounts of liquid Benzene immediately causes pulmonary edema and hemorrhage of pulmonary tissue. There is some absorption through the skin. Absorption may be more rapid in the case of abraded skin, and Benzene may be more readily absorbed if it is present in a mixture or as a contaminant in solvents that are readily absorbed. The defatting action of Benzene may produce primary irritation due to repeated or prolonged contact with the skin. A high concentration is irritating to the eyes and the mucous membranes of the nose, and respiratory tract.
   - 6.2. Direct skin contact with Benzene may cause erythema. Repeated or prolonged contact may result in drying, scaling dermatitis, or development of secondary skin infections. I addition, there is Benzene absorption through the skin. Local effects of Benzene vapor or liquid on the eye are slight. Only at very high concentrations is there any smarting sensation in the eye. Inhalation of high concentrations of Benzene may have an initial stimulatory effect on the central nervous system characterized by exhilaration, nervous excitation, and/or giddiness, followed by a period of depression, drowsiness, or fatigue.

A sensation of tightness in the chest accompanied by breathlessness may occur and ultimately the victim may lose consciousness. Tremors, convulsions and death may follow from respiratory paralysis or circulatory collapse in a few minutes to several hours following severe exposure.

6.3. The detrimental effect on the blood-forming system of prolonged exposure hematopoietic system is the chief target for Benzene's toxic effects that are manifested by alterations in the levels of formed elements in the peripheral blood. These effects have occurred at concentrations of Benzene that may not cause irritation of mucous membranes, or any morbidity is varied, often not readily noticed and non-specific. Subjective complaints of headache, dizziness, and loss of appetite may precede or follow clinical signs. Rapid pulse and low blood pressure, in addition to a physical appearance of anemia, may accompany a subjective complaint of shortness of breath and excessive tiredness. Bleeding from the nose, gums, or mucous membranes, and the development of purpuric spots (small bruises) may occur as the condition progresses. Clinical evidence of leukemia, anemia, and thrombocytopenia, singly or in combination, has been frequently reported among the first signs.

6.4. Bone marrow may appear normal, aplastic, or hyperplastic, and may not, in all situations, correlate with peripheral blood forming tissues. Because of variations in the susceptibility to Benzene morbidity. There is no "typical" blood picture. The onset of effects of Benzene exposure may be delayed for many months or years after the actual exposure has ceased and identification or correlation with Benzene exposure must be sought out in the occupational history.

7. **General Requirements**. LLR Electric, Inc will establish Benzene operational procedures through the use of this document.

7.1. Facility Evaluation. This employer shall evaluate facility(s) to determine if any work area meets the criteria for designation as a Regulated Benzene Hazard Area.

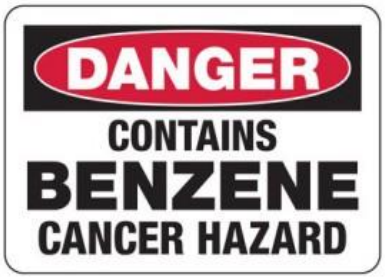
7.2. Regulated areas. This employer shall establish a regulated area wherever the airborne concentration of benzene exceeds or can reasonably be expected to exceed the permissible exposure limits, either the 8-hour time weighted average exposure of 1 ppm or the short-term exposure limit of 5 ppm for 15 minutes.

7.3. Benzene liquid is highly flammable and vapors may form explosive mixtures in air. Fire extinguishers must be readily available. Smoking is prohibited in areas where benzene is used or stored.

8. **Employee Notification and Signage**. This employer shall post signs at entrances to regulated areas. The signs shall bear the following legend:



9. **Containers**. This employer shall ensure that labels or other appropriate forms of warning are provided for containers of benzene within the workplace. There is no requirement to label pipes. The labels shall comply with the requirements of 29 CFR 1910.1200 (Hazard Communication Standard) and in addition shall include the following legend:



10. **Training.**
    10.1. Types of training. The company will determine whether training required for specific jobs will be conducted in a classroom or on-the-job. The degree of training provided shall be determined by the complexity of the job and the Benzene exposure hazards associated with the individual job.
        10.1.1. Initial Training. Prior to job assignment, this employer shall provide training to ensure that the hazards associated with Benzene are understood by employees and that the knowledge, skills and personal protective equipment required are acquired by employees. The training shall as a minimum include the following:
            10.1.1.1. Each authorized employee shall receive training in the recognition of applicable hazards involved with the particular job and job site, as well as the methods and means necessary for safe work.
            10.1.1.2. The specific nature of the operation which could result in exposure to Benzene.
            10.1.1.3. The purpose, proper selection, fitting, use and limitation of personal protective equipment (PPE).
            10.1.1.4. The adverse health effects associated with excessive exposure to Benzene.
            10.1.1.5. The engineering controls and work practices associated with the employee's job assignment, including training of employees to follow relevant good work practices.
            10.1.1.6. The contents of any compliance plan in effect.
            10.1.1.7. The requirements of the Hazard Communication Standard under 29 CFR 1910.1200.
            10.1.1.8. The employee's right of access to records under 29 CFR 1910.20.
            10.1.1.9. The medical surveillance program in place at the facility used to determine Benzene exposure.

11. **Retraining**.
    11.1. Retraining shall be provided for all affected employees as a minimum whenever:
        11.1.1. There is a change in job assignments.
        11.1.2. There is a change in personal protective equipment.
        11.1.3. There is a change in equipment that presents a new hazard.
        11.1.4. There is a change in processes that presents a new hazard.
        11.1.5. Their work takes them into hazardous or regulated area.
        11.1.6. There is a change in Benzene safety procedures.
        11.1.7. Safety procedure fails resulting in a near-miss, illness, or injury.
    11.2. Additional retraining. Additional retraining shall also be conducted whenever a periodic inspection reveals, or whenever this employer has reason to believe, that there are deviations from or inadequacies in the employee's knowledge of known hazards, or use of equipment or procedures.
    11.3. The retraining shall reestablish employee proficiency and introduce new equipment, or revised control methods and procedures, as necessary.
    11.4. Certification. This employer shall certify that employee training has been accomplished and is being kept up to date. The certification shall contain a synopsis of the training conducted, each employee's name, and dates of training.
12. **Monitoring and Medical Surveillance**. This employer shall monitor our workplace and work operations to determine accurately the airborne concentrations of benzene to which employees may be exposed.
    12.1. Initial monitoring. Initial monitoring will be completed within 30 days of the introduction of benzene into the workplace.
    12.2. Periodic monitoring and monitoring frequency. If the monitoring reveals employee exposure at or above the action level but at or below the TWA, the monitoring will be repeated each such employee at least every year.
    12.3. Exposures above TWA. If the monitoring reveals employee exposure above the TWA, the monitoring will be repeated for each such employee at least every six (6) months.
    12.4. Exposures at or below the TWA. The monitoring schedule may be reduced from every six months to annually for any employee for whom two consecutive measurements taken at least 7 days apart indicate that the employee exposure has decreased to the TWA or below, but is at or above the action level.
    12.5. Termination of monitoring. If the initial reveals employee exposure to be below the action level, the monitoring may be discontinued for that employee, except as otherwise required.
13. **Spill and Leak Procedures**. Spills and leaks will be under the supervision of the Leader. The following apply:
    13.1. Persons not wearing protective equipment and clothing will be restricted from areas of spills or leaks until cleanup has been completed by a third party.
    13.2. Emergency Containment. Benzene exposure can be hazardous. Only authorized and trained emergency response personnel should attempt containment. If you are not trained in containment of Benzene, evacuate the area in accordance with established procedures. If Benzene is spilled or leaked the following steps as a minimum should be taken.
        13.2.1. Remove all ignition sources.

13.2.2. Ventilate the area of the spill or leak to disperse vapors.
13.2.3. If possible, allow to vaporize.
13.2.4. Use containment equipment such as dikes, compatible absorbent materials, etc. Most areas likely to be seen with Benzene will have containment dikes such as the Turbine units at Palo Verde
13.2.5. Use non-sparking tools and explosion proof equipment at all times in the spill area.
13.2.6. Leaders and Safety Management shall be aware of Owners contingency plan provisions. Employees must be informed where benzene is used in host facility and aware of additional plant safety rules

14. **Emergency First Aid Procedures**. In the event of an emergency, institute first aid procedures and send for first aid or medical assistance in accordance with local procedures. Dial 9-1-1 or (6233934444 Palo Verde Response) for emergency response personnel.
    14.1. Eye Exposure: Wash immediately with large amounts of water for at least 15 minutes. Lifting the lower and upper lids occasionally, get medical attention as soon as possible.
    14.2. Skin Exposure: Immediately flush with copious amounts of water. Remove any clothing contaminated, and flush exposed skin areas, get medical attention as soon as possible.
    14.3. Swallowing Exposure: If benzene has been swallowed and the patient is conscious, do not induce vomiting. Call for medical assistance or a doctor immediately.
    14.4. Respiratory Exposure: Get the victim to open, fresh air immediately. If breathing has stopped perform CPR. Keep the victim warm and at rest. Get medical attention as soon as possible.
    14.5. Rescue Considerations. Don't become a second victim. Move the affected person from the hazardous area. If the exposed person has been overcome, initiate local emergency notification procedures. Never enter any vessel or confined space where the benzene concentration might be high enough to displace air or create an explosive atmosphere without proper training, equipment and procedures. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.
15. **Protective Clothing and Personal Protective Equipment (PPE).** Where engineering controls, administrative controls, and job hazard analyses do not eliminate all job hazards, employees will (where appropriate) wear personal protective equipment (PPE).
    15.1. These include items such as caps, hair nets, face shields, safety goggles, glasses, hearing protection, foot guards, gloves, sleeves, aprons, respirators etc. Leaders will ensure that equipment selected will meet the following requirements:
        15.1.1. It will be appropriate for the particular hazard.
        15.1.2. It will be maintained in good condition.
        15.1.3. It will be properly stored when not in use, to prevent damage or loss.
        15.1.4. It will be kept clean, fully functional and sanitary.
    15.2. Hazards associated with wear of protective clothing, PPE, personal clothing and jewelry. Protective clothing and PPE can present additional safety hazards. Leaders will ensure workers wear appropriate clothing and PPE. These items will be worn so as not create additional hazards. Contact Industrial Health and Safety for recommendations.

15.2.1. Personal clothing and jewelry. Personal clothing and jewelry will be monitored by the immediate Leader. Clothing or jewelry that could become entangled in tools, equipment or machinery or of an excessively flammable nature will be prohibited.

15.3. Respirators. Respirators are required for those operations in which engineering controls or work practice controls are not feasible to reduce exposure to the permissible level. If it can be documented that benzene is present in the workplace less than 30 days a year, respirators may be used in lieu of engineering controls. If you experience difficulty breathing while wearing a respirator, you may request a positive pressure respirator. Contact your Leader immediately.

15.4. Protective Clothing. You must wear appropriate protective clothing (such as boots, gloves, sleeves, aprons, etc.) over any parts of your body that could be exposed to liquid benzene.

15.5. Eye and Face Protection. You must wear splash-proof safety goggles if it is possible that benzene may get into your eyes. In addition, you must wear a face shield if your face could be splashed with benzene liquid.

16. **Tool Selection, Evaluation and Condition**. The greatest hazards posed by tools usually result from misuse and/or improper maintenance. Tool selection sometimes is not considered a priority when arrangements are made to begin work. All employees will consider the following when selecting tools:

16.1. Is the tool correct for the type work to be performed?

16.2. Are grounding methods sufficient when working in wet conditions?

16.3. Does the tool create sparks or heat? Has this been considered when working around flammable substances?

16.4. Are tools stored properly when not being used?

17. **Regulatory Limits**: The permissible exposure limits for Benzene are as follows:
Airborne: The maximum time-weighted average (TWA) exposure limit is 1 part of Benzene vapor per million parts of air (1 ppm) for an 8 hour workday and the maximum short-term exposure limit (STEL) is 5 ppm for any 15 minute period.
An airborne concentration of benzene of 0.5 parts per million (ppm) calculated as an 8-hour time-weighted average.

Section XVII
Hydrogen Sulfide Program

1. **Introduction.** Hydrogen Sulfide or sour gas (H2S) is a flammable, colorless gas that is toxic at extremely low concentrations. It is heavier than air, and may accumulate in low-lying areas. It smells like "rotten eggs" at low concentrations and causes you to quickly lose your sense of smell. Many areas where the gas is found have been identified, such as well-heads, oil tanks, water tanks, or gas and oil sampling ports. Flaring operations associated with H2S production will generate Sulfur Dioxide (S02), another toxic gas.
   Active monitoring for hydrogen sulfide gas and good planning and training programs for workers are the best ways to prevent injury and death.

2. **Purpose.** This Program provides LLR Electric personnel with the procedures to ensure the safety and health of those employees working in environments in which they may have a risk of being exposed to Hydrogen Sulfide (H2S).

3. **Scope**. This Program applies to all LLR Electric employees, who work in environments in which they have a risk of being exposed to Hydrogen Sulfide (H2S), or other dangerous gases. Example.. Palo Verde Water Rec.

4. **Responsibilities.**
   4.1. Safety Manager The HSE Manager is responsible for developing and maintaining LLR Electric Hydrogen Sulfide Program. The Program is available for review and is kept at the HSE office in Sterling.
   4.2. Area Manager. The Area Manager will provide training to individuals requiring training at the request of the HSE Manager. Training may be conducted by others with the HSE Manager's prior approval.
   4.3. Employees. All employees are required to attend training before entering any area in which H2S concentrations are known or suspected to exist. Employees are also required to follow other procedures listed under the next section.

5. **Procedure.**
   5.1. No LLR Electric employee is permitted to enter an area where H2S exists or is suspected to exist without prior and current H2S training by a qualified instructor. Training is good for one year or per customer requirements.
   5.2. All LLR Electric employees are required to wear a personal hydrogen sulfide monitor with audible and visual alarms when on location. Alarms will be set at 10 and 15 ppm. Employees will leave areas in which the H2S concentration exceeds 10 PPM & don the appropriate PPE required for the amount of H2S present before resuming work. All monitors will be bump tested and calibrated pursuant to the manufacturer's specifications or after an alarm event. All bump tests & calibrations will be documented & emailed to the LLR Electric Safety Manager where the record will be retained on file by the HSE Manager.

5.3. No LLR Electric employee is permitted to enter any area in which the H2S concentrations are known or suspected to be greater than 10 ppm without the appropriate PPE.

5.5 No LLR Electric employee will enter an H2S area until all relevant testing and training required for that level of PPE required has been completed. Example… If H2S is 20 ppm employee will not enter area until they have satisfied all the requirements of LLR Electric respiratory protection program in order to wear the full face mask and appropriate H2S cartridges.

5.6 Employees are not permitted to open any tank, line, flange, etc. which may release hydrogen sulfide to the atmosphere greater than 10 ppm without the proper PPE.

6. **Training.**

6.1. All covered employees will be trained initially and then annually in Hydrogen Sulfide operations. Training must occur before an employee is allowed to enter any area that is known or suspected to contain hydrogen sulfide. The following topics shall be covered in this training at a minimum:

- The characteristics, sources, and hazards of Hydrogen Sulfide, oxygen deficiency, oxygen ornitrogen enrichment, and carbon monoxide.
- Proper use of the Hydrogen Sulfide detection methods, portable and fixed, used on the site.
- Use and operation of personal and analytical Hydrogen Sulfide monitoring systems.
- Proper donning and doffing techniques of respiratory equipment.
- Proper inspection, hook up and maintenance techniques of location provided or portable breathable air systems.
- Recognition of, and proper response to, Hydrogen Sulfide warnings and gas alarms.
- Proper rescue techniques and first-aid procedures to be used in a Hydrogen Sulfide exposure.
- Proper use and maintenance of personal protective equipment. Demonstrated proficiency in using PPE and participate in emergency evacuation drills.
- Wind direction awareness and site-specific contingency/emergency plans.
- Locations and use of safety equipment.
- Emergency response procedures, corrective action, and shutdown procedures.
- Effects of Hydrogen Sulfide on the components of the Hydrogen Sulfide handling system.
- The importance of drilling fluid treating plans prior to encountering Hydrogen Sulfide.

7. Recordkeeping. The HSE Manager will keep records of all training, evaluation & monitor testing

Section XVIII

Lead Awareness Training Program

1. **Purpose**
   1.1. The purpose of this procedure is to advise employees in areas where lead is suspected on an awareness level basis about the properties and dangers of lead, general guidelines and training requirements.
2. **Scope**
   2.1. This procedure applies to LLR Electric operations where employees whose work activities may contact lead containing materials but do not disturb the material during their work activities. When work is performed on a non-owned or operated site, the operator's program shall take precedence, however, this document covers LLR Electric employees and contractors and shall be used on when an operator's program doesn't exist or is less stringent.
3. **Responsibilities**
   3.1. Managers and Leaders
      3.1.1. In coordination with the Safety Manager, develop and implement annual lead awareness training.
      3.1.2. Ensure personnel are aware of work that has the potential of exposure to lead.
      3.1.3. Identify possible locations where lead in the workplace may be found.
      3.1.4. Inform the Safety Manager of upcoming work involving known or suspected lead-containing materials, allowing the Safety Manager to provide any necessary monitoring or other required actions.
      3.1.5. Ensure employees comply with the lead awareness requirements.
   3.2. Safety Manager:
      3.2.1. Coordinate annual lead awareness training activities.
      3.2.2. Comply with the lead awareness requirements and direct any questions or concerns to the Safety Manager.
      3.2.3. Attend required annual training.
      3.2.4. Review material safety data sheets or consult with the Leader to identify any container with lead-containing material.
4. **Procedure**
   4.1. Whenever possible, substitute lead material with non-leaded material.
   4.2. Respirators shall be used during the time period required to install or implement control if engineering and work practices are insufficient as well as for emergency use.
   4.3. If respirators are required, they will be NIOSH certified and all employees will follow the LLR Electric Respiratory Protection Program.
5. **Health Effects of Lead**
   5.1. Common symptoms of acute lead poisoning are loss of appetite, nausea, vomiting, stomach cramps, constipation, difficulty in sleeping, fatigue, moodiness, headache, joint or muscle aches, and anemia. Long term (chronic) overexposure to lead may result in severe damage to the blood-forming, nervous, urinary, and reproductive systems.

6. **Locations**

6.1. Each worksite shall create a list of possible locations of lead containing materials such as leaded paints, leaded solders, pipes, batteries, circuit boards, cathode ray tubes, leaded glass, and demolition/salvage materials.

6.2. The list is to be provided to the Safety Manager on a quarterly basis and revised as lead containing materials are added or eliminated from the previous list.

7. **General Requirements**

8. Employees must abide by any signs/labels/assessment reports indicating the presence of lead containing materials and will not disturb the lead containing material. Appropriate work practices shall be followed to ensure the lead containing materials are not disturbed. Regulated access signs are to demarcate the lead exposure regulated work areas. The signs should read as follows:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

9. **General Work Practices**

9.1. When working on multi-contractor worksites LLR Electric employees shall be protected from exposure. If employees working immediately adjacent to a lead abatement activity are exposed to lead due to the inadequate containment of such job, The Leader shall either remove the employees from the area until the enclosure breach is repaired or perform an initial exposure assessment.

9.2. Employees will wash hands and face if lead materials are contacted. Employees' hands and faces shall be washed if lead containing materials are contacted. Any possible contact with lead containing material must be reported immediately to the Leader or Safety Manager.

9.3. If air is re-circulated back into the workplace, the system must be equipped with a HEPA (high efficiency particulate air) and backup filter, and a system to monitor the lead level will be installed.

9.4. When using mechanical means to remove lead-containing paints or coatings, use equipment which is equipped with a HEPA collection system.

9.5. Whenever possible, use a wet system to reduce airborne dust.

9.6. Whenever possible, substitute lead material with non-leaded material.

9.7. Respirators shall be used during the time period required to install or implement control if engineering and work practices are insufficient as well as for emergency use.

9.8. If respirators are required, they will be NIOSH certified and all employees will follow the Respiratory Protection Program.

10. **Training**
    - 10.1. Lead awareness training is required at time of hire, during orientation or before initial assignment in areas where lead is suspected and annual refresher training is conducted. Lead awareness training is required for employees whose work activities may contact lead containing materials but do not disturb the material during their work activities. Lead awareness training is required at time of hire, during orientation, or before assignment to areas containing lead.
    - 10.2. Refresher training must be given annually.
    - 10.3. Documentation of training - Lead awareness training shall be documented including dates of training, location of training, employee name and trainer name.
    - 10.4. Training will include the health effects of lead, how to report suspected locations of lead containing material and not to disturb any possible lead containing material.
    - 10.5. Training records shall be provided upon request all materials relating to the employee information and training program to regulatory agencies.

Section XVIIII
Written Respiratory Protection Program











1. Introduction

2. Respirators are used to protect employees from inhaling hazardous chemicals in the air. These chemicals can be in the form of gases, vapors, mists or dust. If you provide respirators to your employees to protect them from airborne chemical hazards, you must have a written respiratory protection program. The written program must spell out how you do the following at your workplace:
   2.1. How the proper respirators for the particular hazards are selected and issued (include a list of respirators used),
   2.2. When and how respirators will be used in routine work activities, infrequent activities, and foreseeable emergencies such as spill response, rescue or escape situations,
   2.3. How medical evaluations of respirator wearers is provided,
   2.4. How respirator fit-testing is done,
   2.5. How respirators in use are cleaned, stored, inspected and repaired or discarded,
   2.6. How sufficient high purity air is provided for air-supplied respirators (if you use them),
   2.7. How employees are trained about respiratory hazards at your workplace,
   2.8. How employees are trained on the proper use of the respirators used at your workplace,

   To provide proper protection, respirators must be the right type, must be worn correctly at all times, and must be maintained properly. They are prone to leakage, depend on the correct behavior of individual employees and may require much maintenance and management oversight. This is why they are considered as a last resort to protect employees from airborne chemical hazards.
   Respirators shall be used in three different situations – routine or regular exposure to processes or activities involving chemicals, infrequent, but predictable occasions where there is chemical exposure, or emergencies where there is a chemical leak or spill. The written respiratory program must address all these situations if they occur or could occur at your facilities.

3. Respiratory Protection Program for LLR Electric.
   3.1. Our respirator program administrator is Rusty Day, Safety Manager for LLR Electric.
   3.2. Our administrator's duties are to oversee the development of the respiratory program and, make sure it is carried out at the workplace. The administrator will also evaluate the program regularly to make sure procedures are followed, respirator use is monitored and respirators continue to provide adequate protection when job conditions change.

4. Selection Of Respirators
   4.1. We have evaluated our use of chemicals at this facility and found respirators must be used by employees in the following locations or positions or doing the following duties, tasks or activities:

5. Medical Evaluations
   5.1. Every employee of this company who must wear a respirator will be provided with a medical evaluation before they are allowed to use the respirator. Our first step is to give the attached medical questionnaire to those employees. Employees are required to fill out the questionnaire in private and send or give them to AIM Clinic. Completed questionnaires are confidential and will be sent directly to medical provider without review by management.
   5.2. If the medical questionnaire indicates to our medical provider that a further medical exam is required, this will be provided at no cost to our employees AIM Clinic. We will get a recommendation from this medical provider on whether or not the employee is medically able to wear a respirator.

6. Additional medical evaluations will be done in the following situations:
   - our medical provider recommends it,
   - our respirator program administrator decides it is needed,
   - an employee shows signs of breathing difficulty,
   - changes in work conditions that increase employee physical stress (such as high temperatures or greater physical exertion).

7. Respirator Fit-testing
   7.1. All employees who wear tight-fitting respirators will be fit-tested before using their respirator or given a new one. Fit-testing will be repeated annually. Fit-testing will also be done when a different respirator face piece is chosen, when there is a physical change in an employee's face that would affect fit, or when our employees or medical provider notify us that the fit is unacceptable. No beards are allowed on wearers of tight-fitting respirators.
   7.2. Our respirators will be checked for proper sealing by the user whenever the respirator is first put on, using the attached seal check procedures:

8. Respirator storage, cleaning, maintenance and repair
   8.1. Respirators will be cleaned and sanitized before and after they are used. This (does not apply to paper dust masks which are disposed daily). Respirators will be cleaned according to the attached instructions (either the manufacturer's instructions or the Respirators Rule cleaning procedures.)
   8.2. All respirators will be inspected before and after every use and during cleaning. In addition, emergency respirators and self-contained tank-type supplied air respirators in storage will be inspected monthly.
   8.3. Respirators will be inspected for damage, deterioration or improper functioning and repaired or replaced as needed. Repairs and adjustments are done by Industrial Health and Safety who is trained in respirator maintenance and repair. Supplied air respirators will be checked for proper functioning of regulator and warning devices and amount of air in tanks where used.
   8.4. When supplied air respirators are used, any needed repairs or adjustments will be done by the manufacturer or technician trained by the manufacturer. On respirators with vapor or gas cartridges, the cartridges will be regularly replaced before use.

9. Respirator Use
   9.1. The Program Administrator will monitor the work area in order to be aware of changing conditions where employees are using respirators.
   9.2. Employees will not be allowed to wear respirators with tight-fitting face pieces if they have facial hair (e.g., stubble, bangs) absence of normally worn dentures, facial deformities (e.g., scars, deep skin creases, prominent cheekbones), or other facial features that interfere with the face piece seal or valve function. Jewelry or headgear that projects under the face piece seal is also not allowed.
   9.3. If corrective glasses or other personal protective equipment is worn, it will not interfere with the seal of the face piece to the face.
   9.4. A seal check will be performed every time a tight-fitting respirator is put on.
   9.5. The program administrator will make sure that the NIOSH labels and color-coding on respirator filters and cartridges remain readable and intact during use.

10. Employees will leave the area where respirators are required for any of the following reasons:
    - to replace filters or cartridges,
    - when they smell or taste a chemical inside the respirator,
    - when they notice a change in breathing resistance
    - to adjust their respirator,
    - to wash their faces or respirator,
    - if they become ill,
    - if they experience dizziness, nausea, weakness, breathing difficulty, coughing, sneezing vomiting, fever or chills.

11. Where any area or confined space is designated as IDLH, we will provide two standby attendants outside the area. These standby attendants will be in constant visual, voice or signal line communication with the employees in the IDLH area. The standby attendants will notify the administrator before entering the IDLH area, and shall the necessary assistance when notified.

12. Breathing Air Quality for Supplied Air Respirators (if used)
    12.1. Only Grade D breathing air will be supplied to compressed air tanks for respirators.

13. Respirator Training
    13.1. Training is done by Industrial Health and Safety before employees wear their respirators and annually thereafter as long as they wear respirators. Our Leaders who wear respirators or supervise employees who do, will also be trained on the same schedule.
    13.2. Additional training will also be done when an employee uses a different type of respirator or workplace conditions affecting respiratory hazards or respirator use have changed.
    13.3. Training will cover the following topics:
    - Why the respirator is necessary
    - The respirator’s capabilities and limitations

- How improper fit, use or maintenance can make the respirator ineffective
- How to properly inspect, put on, seal check, use, and remove the respirator
- How to clean, repair and store the respirator or get it done by someone else
- How to use a respirator in an emergency situation or when it fails
- Medical symptoms that may limit or prevent respirator use
- Our obligations under the Respirators Rule

14. Respiratory Program Evaluation
    14.1. We evaluate our respiratory program for effectiveness by doing the following steps:
    14.2. Checking results of fit-test results and health provider evaluations.
    14.3. Talking with employees who wear respirators about their respirators – how they fit, do they feel they are adequately protecting them, do they notice any difficulties in breathing while wearing them, do they notice any odors while wearing them, etc.
    14.4. Periodically checking employee job duties for changes in chemical exposure.
    14.5. Periodically checking maintenance and storage of respirators.
    14.6. Periodically checking how employees use their respirators.

15. Recordkeeping
    15.1. The following records will be kept:
        15.1.1. A copy of this completed respirator program
        15.1.2. Employees' latest fit-testing results
        15.1.3. Employee training records
        15.1.4. Written recommendations from our medical provider
    15.2. Employees will have access to these records.

16. How to Select the Correct Respirator
    16.1. The type and brands of respirators vary widely ranging from simple dust masks to supplied air respirators like the kind firemen wear. Following is description of the main types of respirators.





17. Dust Masks (filtering facepieces)

17.1. These simple, two-strap disposable dust masks are designed only for dusts. They are not as protective as other respirators, but do an adequate job in many cases, unless the dust is really toxic or copious. Don't confuse these two-strap masks with the less protective one-strap dust mask designed only for pollen or non-toxic dust.



18. **Half-Face Air-Purifying Respirator**

18.1. These respirators are sometimes called "half-face" or "half-mask" respirators since they cover just the nose and mouth. They have removable cartridges that filter out either dust, chemicals or both. Selecting the correct cartridges is essential since they are designed for particular types of chemicals or dust. A reputable respirator vendor can assist you in selecting the correct cartridges. These cartridges are typically removable and sometimes interchangeable. Cartridges are available for solvents, ammonia, chlorine, acids and other chemicals. The cartridges must be changed out or replaced periodically, especially for chemicals, since they can absorb only so much contaminant before breakthrough occurs. A few cartridges are equipped with end-of-service indicators that show when a cartridge should be replaced. Most cartridges don't have this indicator and you must develop a change-out schedule to prevent breakthrough. The change-out schedule is based on the chemical concentration, physical work effort, temperature and humidity. Many respirator manufacturers have cartridge change schedule calculators available on the Internet.



19. **Full-Face Air-Purifying Respirator**
    19.1. In some situations, you may need or want to use full-face respirators. This type of respirator is used when the air contaminant irritates the eyes. They also provide somewhat higher protection to the lungs since they tend to fit tighter and are less prone to leaking. These respirators also have replaceable cartridges that must be changed on a regular basis as described above for half-face respirators.



20. **Powered Air Purifying Respirator (PAPR)**
    20.1. Powered Air Purifying Respirators have a battery pack that draws air through replaceable cartridges and blows into a full face piece, helmet or hood. These respirators are often more comfortable in hot weather and some can provide more protection, depending on the type. The cartridges must be changed regularly as describe for half-face respirators above.





21. **Airline Respirator** **Tank-type respirator (SCBA)**

21.1. Supplied Air Respirators and Self-Contained Breathing Apparatus (SCBA)

21.1.1. In a few situations, you may need to provide a supplied air respirator to your employees. These situations include large chemical spills or leaks, entering a confined space where there is lack of oxygen or high levels of air contaminants, or working around extremely toxic chemicals. They may also be necessary working at hazardous waste sites, during sandblasting or in some spray painting operations. “Supplied air,” means that clean air is provided by means of an air hose from a compressor or a pressurized air tank.

21.1.2. Supplied air respirators are required when a respiratory hazard is considered “immediately dangerous to life or health” (also called “IDLH”). Respiratory hazards are classified as IDLH as follows:

- There is a lack of oxygen (less than 19.5% oxygen)
- There is too much oxygen (more than 23.5% - a fire hazard)
- You know there are toxic chemicals in the air, but you don’t know how much
- The amount of chemical in the air is known or expected to be above the IDLH level for that chemical

21.2. Levels of chemicals above IDLH can occur in confined spaces, or enclosed spaces where there is little or no ventilation as well as and in around water Rec facilities.



22. **Emergency Escape Respirators**
    22.1. Emergency escape respirators, as the name implies, can only be used for one thing – to escape or exit from a room or building in an emergency, usually a large chemical release, leak or spill, or when a supplied air respirator fails or runs out of air. An escape respirator is typically a small bottle or tank of air connected to a face piece that supplies 5-10 minutes of air. Some supplied air respirators will have an auxiliary bottle of air for escape that connects to the existing face piece.
    22.2. How do you decide which type of respirator to select? First, it must be the correct type for the air contaminant. Second, it must fit properly. Third, it must provide adequate protection for the amount of chemical in the air. The more toxic or more concentrated the chemical is in the air, the higher the level of protection the respirator must provide.
    22.3. Different respirators provide different protection. Depending on the amount of chemical in the air, you may need to use a respirator that provides more protection. Respirators are rated by their "assigned protection factor" (APF) which is a number between 10 and 10,000. The higher the number, the greater the protection. A respirator with a protection factor of 10 will provide adequate protection to levels of the chemical in the air 10 times the safe limit of that chemical. See Table 5 below.

Table 5 Assigned Protection Factors (APF) for Respirator Types	
If the respirator is a(n)	**Then the APF is**
Air-purifying respirator with a:	
• Quarter-mask	5
• Half-facepiece. This category includes filtering facepiece and elastomeric facepiece	10
• Full-facepiece	50
Powered air-purifying respirator (PAPR) with a:	
• Loose-fitting facepiece	25
• Half-facepiece	50
• Full-facepiece	1000
• Hood or helmet	25/1000 (see note)
Note: PAPRs with helmets/hoods may receive an APF of 1000 only when you have evidence that testing of these respirators demonstrates performance at a level of protection of 1,000 or greater. Such evidence must be provided by the respirator manufacturer. This level of performance can best be demonstrated by performing a workplace protection factor (WPF) or simulated workplace protection factor (SWPF) study or equivalent testing.	
Air-line respirator with a:	
• Half-facepiece and designed to operate in demand mode	10
• Loose-fitting facepiece and designed to operate in continuous flow mode	25
• Half-facepiece and designed to operate in continuous-flow mode	50
• Half-facepiece and designed to operate in pressure-demand or other positive-pressure mode	50
• Full-facepiece and designed to operate in demand mode.	50
• Full-facepiece and designed to operate in continuous-flow mode	1000
• Full-facepiece and designed to operate in pressure-demand or other positive-pressure mode.	1000
• Helmet or hood and designed to operate in continuous-flow mode	25/1000 (see note)
Note: Air-line respirators with helmets/hoods designed to operate in continuous-flow mode may receive an APF of 1000 when you have evidence that testing of these respirators demonstrates performance at a level of protection of 1,000 or greater. Such evidence must be provided by the respirator manufacturer. This level of performance can best be demonstrated by performing a workplace protection factor (WPF) or simulated workplace protection factor (SWPF) study or equivalent testing.	
Self-contained breathing apparatus (SCBA) with a tight fitting:	
• Half-facepiece and designed to operate in demand mode	10
• Full facepiece and designed to operate in demand mode	50
• Full-facepiece and designed to operate in pressure-demand mode or other positive pressure mode (e.g. open/closed circuit)	10,000
• Helmet or hood and designed to operate in demand mode	50
• Helmet or hood and designed to operate in pressure-demand or other positive-pressure mode (e.g., open/closed circuit).	10,000
Combination respirators:	
• When using a combination respirator, such as an air-line respirator with an air-purifying filter, you must make sure the APF is appropriate to the mode of operation in which the respirator is used.	
Escape respirators:	
• APFs in this table do not apply to respirators used solely for escape. To select escape respirators, go to Step 8 of this section.	

Use **Table 6** below to select air-purifying respirators for particle, vapor, or gas contaminants.

Table 6
Requirements for Selecting Air-purifying Respirators

If the contaminant is a:	Then
Gas or vapor 	Provide a respirator with canisters or cartridges equipped with a NIOSH-certified, end-of-service-life indicator (ESLI) (*note: there just a few of these)* **or** If a canister or cartridge with an ESLI is **not** available, develop a cartridge change schedule to make sure the canisters or cartridges are replaced before they are no longer effective (*note: most cartridge respirators fit in this category)* **or** Select an air-supplying respirator
Particle, such as a dust, spray, mist, fog, fume, or aerosol 	Select respirators with filters certified to be at least 95% efficient by NIOSH. For example, N95s, R99s, P100s, or High Efficiency Particulate Air filters (HEPA) **Or** You may select respirators NIOSH certified as “dust and mist,” “dust, fume, or mist,” or “pesticides.” You can only use these respirators if particles primarily have a mass median aerodynamic diameter of at least 2 micrometers *Note: These latter respirators are no longer sold for occupational use, but some employers may still be using them.*

23. How to Evaluate your Workplace for Employee Exposure to Chemicals
    23.1. Respirators are required when employees are exposed (can inhale) chemicals or dust in the air that are at harmful levels. These can include vapors from handling solvents, spray-painting, dust from grinding or sanding, or welding fumes. Your employees may have told you that the chemical odors or dust bothered them or that they were worried about their chemical exposure. You may have switched to less hazardous chemicals. Or you may have no alternative but to use more hazardous chemicals to do the job or make your product. But without some knowledge of the amount of chemical or dust in the air in the workplace, you cannot know whether your employees are exposed to harmful amounts of chemicals they use.

23.2. Just about every chemical has its toxic amount or level that will make person sick. Even too much table salt can be harmful. On the other hand, highly toxic chemicals can be used without harm to employees if handled properly. Most commonly used chemicals have safe limits or "permissible exposure limits" in the air that if exceeded will cause harm. If these limits are exceeded, you are required to take steps to protect your employees from that air exposure. If the levels cannot be reduced below the permissible exposure limits by ventilation, changes in the process or reduction in the length of time of exposure, than you must provide respirators to exposed employees.

23.3. The best way to accurately determine the levels of chemicals or dust in the air is to do air sampling. There are a variety of instruments and devices for measuring air contaminants.

23.4. The material safety data sheets for products used also provide information about the hazards of the chemicals, permissible exposure limits, methods of controls and recommended respirators.

Respirator Fit Test Record

Name: _____ **Initials**: _____

Type of qualitative/quantitative fit test used: _____

Name of test operator: _____ **Initials**: _____

Date: _____

Respirator Mfr./Model/Approval no. Size Pass/Fail or Fit Factor
Note: "Fit factor" is numerical result of quantitative fit test from instrument reading

1. _____S M L P F _____

2. _____S M L P F _____

3. _____S M L P F _____

4. _____S M L P F _____

Clean Shaven? Yes___ No___ (Fit-test cannot be done unless clean-shaven)

Medical Evaluation Completed? Yes___ No___

NOTES: _____

_____

_____

_____

This record indicates that you have passed or failed a qualitative or quantitative fit test as shown above for the particular respirator(s) shown. Other types will not be used until fit tested.

Respirator Training Record

_____

Employee Name (printed)

I certify that I have been trained in the use of the following respirator(s):

This training included the inspection procedures, fitting, maintenance and limitations of the above respirator(s). I understand how the respirator operates and provides protection. I further certify that I have heard the explanation of the respirator(s) as described above and I understand the instructions relevant to use, cleaning, disinfecting and the limitations of the respirator(s).

_____

Employee Signature

_____

Instructor Signature

_____

Date

Employer-Provided Information for Medical Evaluations

Specific Respirator Use Information

Employee Name: _____

Company name: _____

Employee job title: _____

Company Address: _____

Company contact person and phone

#:_____

1. Will the employee be wearing protective clothing and/or equipment (other than the respirator) when using the respirator?
   Yes/No _____ If "Yes," describe protective clothing and/or equipment:

   _____

   _____

   _____

   _____

2. Will employee be working under hot conditions (temperature exceeding 77°F)?
   Yes/No _____ If "Yes", describe nature of work and duration:

   _____

   _____

   _____

   _____

3. Will employee be working under humid conditions? Yes / No_____

4. Describe any special or hazardous conditions the employee could encounter when using the respirator (for example, confined spaces, life-threatening gases).

_____

_____

_____

24. Specific Respirator Use Information, Continued

Check Box	Respirator Type	Face / Head Cover Type (half or full face, helmet, or hood)	Frequency of Use (hours per day, week, or month)	Work Effort Light, Moderate, Heavy (see descriptions below)	Respirator Wt.
	Disposable face piece particulate filter (N, R or P series)	1/2 face piece			
	Mask with replaceable filter or cartridge				
	Mask with canister				
	Powered air-purifying respirator (PAPR)				
	Air line, continuous flow				
	Air line, negative pressure demand				
	Air line, positive pressure demand				
	SCBA, negative pressure demand	Full face piece			
	SCBA, positive pressure demand	Full face piece			

25. Work Effort Descriptions
    25.1. Examples of a light work effort are sitting while writing, typing, drafting, or performing light assembly work; or standing while operating a drill press (1-3 lbs.) or controlling machines.
    25.2. Examples of moderate work effort are sitting while nailing or filing; driving a truck or bus in urban traffic; standing while drilling, nailing, performing assembly work, or transferring a moderate load (about 35 lbs.) at trunk level; walking on a level surface about 2 mph or down a 5-degree grade about 3 mph; or pushing a wheelbarrow with a heavy load (about 100 lbs.) on a level surface.
    25.3. Examples of heavy work effort are lifting a heavy load (about 50 lbs.) from the floor to your waist or shoulder; working on a loading dock; shoveling; standing; standing while bricklaying or chipping castings; walking up an 8-degree grade about 2 mph; climbing stairs with a heavy load (about 50 lb.).

26. Seal Check Procedures (from Respirators Rule)

Table 21
User Seal Check Procedure

Important Information for Employees:

- You need to conduct a seal check each time you put your respirator on before you enter the respirator use area. The purpose of a seal check is to make sure your respirator (which has been previously fit tested by your employer) is properly positioned on your face to prevent leakage during use and to detect functional problems.
- The procedure below has 2 parts; a positive pressure check and a negative pressure check. You must complete both parts each time. It should only take a few seconds to perform, once you learn it.
  - If you can't pass both parts, your respirator is not functioning properly, see your supervisor for further instruction.

Positive Pressure Check:

1. Remove exhalation valve cover, if removable.
2. Cover the exhalation valve completely with the palm of your hand while exhaling gently to inflate the facepiece slightly.
3. The respirator facepiece should remain inflated (indicating a build-up of positive pressure and no outward leakage).
   - If you detect no leakage, replace the exhalation valve cover (if removed), and proceed to conduct the negative pressure check .
   - If you detect evidence of leakage, reposition the respirator (after removing and inspecting it), and try the positive pressure check again.

Negative Pressure Check:

4. Completely cover the inhalation opening(s) on the cartridges or canister with the palm(s) of your hands while inhaling gently to collapse the facepiece slightly.
   - If you can't use the palm(s) of your hands to effectively cover the inhalation openings on cartridges or canisters, you may use:
     - Filter seal(s) (if available)

       or

     - Thin rubber gloves
5. Once the facepiece is collapsed, hold your breath for 10 seconds while keeping the inhalation openings covered.
6. The facepiece should remain slightly collapsed (indicating negative pressure and no inward leakage).
   - If you detect no evidence of leakage, the tightness of the facepiece is considered adequate, the procedure is completed, and you may now use the respirator.
   - If you detect leakage, reposition the respirator (after removing and inspecting it) and repeat both the positive and negative fit checks.

27. Respirator Cleaning Procedures

Table 20
Respirator Cleaning Procedure

Step	Task
1.	Remove filters, cartridges, canisters, speaking diaphragms, demand and pressure valve assemblies, hoses, or any components recommended by the manufacturer. • Discard or repair any defective parts.
2.	Wash components in warm (43°C [110°F] maximum) water with a mild detergent or with a cleaner recommended by the manufacturer. • A stiff bristle (not wire) brush may be used to help remove the dirt. • If the detergent or cleaner doesn't contain a disinfecting agent, respirator components should be immersed for 2 minutes in one of the following: - A bleach solution (concentration of 50 parts per million of chlorine). Make this by adding approximately one milliliter of laundry bleach to one liter of water at 43°C (110°F) - A solution of iodine (50 parts per million iodine). Make this in 2 steps: • First, make a tincture of iodine by adding 6-8 grams of solid ammonium iodide and/or potassium iodide to 100 cc of 45% alcohol approximately. • Second, add 0.8 milliliters of the tincture to one liter of water at 43°C (110°F) to get the final solution. - Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer
3.	Rinse components thoroughly in clean, warm (43°C [110°F] maximum), preferably, running water. Note: The importance of thorough rinsing can't be overemphasized. Detergents or disinfectants that dry on facepieces could cause dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts, if not completely removed.
4.	Drain components.
5.	Air-dry components or hand dry components with a clean, lint-free cloth.
6.	Reassemble the facepiece components. • Replace filters, cartridges, and canisters, if necessary (for testing)
7.	Test the respirator to make sure all components work properly.