

Potential Hazard Review

Physical Hazards

- Fire/explosion: Burns, death
- Electrical: Shock, burn, cardiac arrest, death

Related Safe Work Practices

- Site Emergency Action Plan
- Tree Work
- Trenching and Excavation

Authority

- CCR Title 8 Sections 1760, 2299-2989
- NFPA 70E Standard for Electrical Safety in the Workplace

| | |
|------------------------|--|
| Initially prepared by: | Treetopper SWP Working Group |
| Revisions by: | H. Stoermer, R. Jackson |
| Program Manager: | J. Bramlett, EHS Program Manager K. Gee, Director of Human Resources L. Banford, Superintendent of Recreation and Community Services E. Andersen, Superintendent of Parks and Open Spaces S. Shih, Superintendent of Structural Maintenance D. Chu, Director of Administration and Finance D. Kern, Director of Operations P. Ginsburg, General Manager |
| Issued: | 5/18/01 Revised 11/10/2016, 6/11/2019 |

This Safe Work Practice (SWP) is organized as follows:

- A. General Electrical Safety (for all employees)
- B. Overhead and Underground Electrical Lines
- C. Requirements for Electricians (600 V and under)

This SWP is dedicated to helping you avoid an injury or illness from known hazards. You are advised to follow these recommendations, read and follow this SWP and any related SWPs, complete any required or recommended training, and to obtain advice from a Qualified Person if you have any questions.

A Qualified Person is a person designated by the employer; and by reason of training, experience, or instruction who has demonstrated the ability to perform safely all assigned duties; and, when required is properly licensed in accordance with federal, state, or local laws and regulations.

All tasks require that you:

- Use the equipment in accordance with the guidelines set forth by the manufacturer. This includes following all signs and labels, and reviewing any manufacturer's operating manuals.
 - If the instructions provided in the operating manual conflict with this SWP, then follow the instructions in the manual. The manufacturer's instructions prevail over this SWP.
- Review the safety data sheets (SDSs) for each chemical.
- Be trained on this SWP and those listed above as related. Training on SWPs must be completed before initial assignment. It is also recommended that you complete refresher training every two years.

A. GENERAL ELECTRICAL SAFETY

1. Inspect cords, connections, and guards on electrical tools and equipment before use, ensuring integrity and appropriateness of each.
2. Ensure that covers or barriers are installed on boxes, fittings, and enclosures to prevent accidental contact with live parts.
3. Do not overload electrical outlets with more equipment than the outlet was designed for as this can result in a risk of fire or electrical shock. Be sure that the total of the ampere ratings on products plugged into an extension cord/strip does not exceed the extension cord/strip ampere rating.
4. Isolate electrical equipment from flammable or combustible materials storage.
5. Maintain at least 3' clearance around electrical equipment, including power panels.
6. Do not use extension cords as permanent power supply for equipment, tools, or appliances. Electrical appliances (i.e. computers, refrigerators, desk lamps, etc.) must be directly connected to a permanent power supply (a properly installed, hard-wired power supply such as a wall outlet with a face plate). Exceptions to this are:
 - a. Items needing surge protection
 - b. Items needing uninterruptable power supply (UPS)
7. If surge protectors or UPS are used, the permanent equipment must be plugged directly plugged into the permanent outlet.
8. If your computer has a voltage select switch, ensure that the switch is in the proper voltage position (115 VAC or 230 VAC) at the time of installation.

9. Computers should be situated away from heat sources such as radiators, heat registers, stoves, or other products (including amplifiers) that produce heat.
10. Protect electrical wires from mechanical damages and environmental damage. Do not hang extension cords and trailing cables shall over nails or metal having sharp edges, or place them where they will be run over by equipment.
11. Do not use safety devices for daily/permanent power control.
12. Never handle electrical equipment when hands, feet, or body are wet or perspiring or when standing on a wet floor. Do not clean electric motors with steam or water unless authorized by your supervisor. Do not use computers and other electrical equipment in moist environments such as a damp basement, near a swimming pool or sauna, or near a kitchen sink.
13. If you are working in an environment that is wet, such as a pool, bathroom, the Marina Yacht Harbor or outdoors, you must use GFCI device (i.e., power tool, or powered equipment) so as to prevent shorting or electrocution. If the device does not come equipped with GFCI, then you must plug it directly into a GFCI enabled power supply or extension cord¹. Using battery-operated tools is another safe alternative.
14. Immediately report any electrical wires with exposed copper ends to your supervisor.
15. Slots and openings in computers and other electrical equipment are provided for ventilation and should never be blocked or covered since these provide reliable operation of the product and protect it from overheating. The openings should never be blocked such as by placing the product on a carpet, chair, or similar inflexible surface. Computers should not be placed in a built-in installation such as a bookcase or rack unless proper ventilation is provided.
16. The plug shall not be removed from the receptacle while the machine is on or in motion, except in the case of an emergency as described later in this section. The plug must be set flush into the receptacle where no parts of the prongs are exposed.
17. Ground Fault Circuit Interrupters must be used whenever possible.
18. GCFI's are required on receptacles not connected to the site's permanent wiring, and have a rating of 15/20 ampere, 120 volts, AC, single phase.
19. Do the following if you find a person collapsed holding onto an electrical appliance:
 - a. Protect yourself. Never touch a person who is in contact with an electrical short. Do not touch the appliance.

¹ EHS Suspected Occupational Hazard Report (SOHR), File 1462

- b. Have someone call 911.
 - c. Shut off the flow of electricity by switching off the circuit breaker or pulling the plug. Do not try to shut off the appliance with its switch as that may be the problem.
 - d. Check the person for breathing and pulse. Check for burns from contact with the appliance and with the ground.
 - e. Administer first-aid as needed.
20. Remove electrical cords, debris, and all trip hazards at the end of each shift: always maintain a clean work site (see *Housekeeping*).
21. Do not fold or bend cords/cables in a manner that damages or stresses their insulation. Do not stack materials (weight) on cords.
22. To avoid electrical shock problems, unplug the equipment from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth.
23. If your computer is in need of service, contact members of the MIS Division. Do not attempt to work on your own computer. Doing so can result in electric shock or even explosion if, for instance, the laser module, power supply, or internal batteries are mishandled.

B. OVERHEAD AND UNDERGROUND ELECTRICAL LINES

24. All overhead and underground electrical conductors and all communication wires and cables shall be considered to be energized with potentially fatal voltages.
25. Every employee that is reasonably expected to come in contact with overhead/underground electrical lines shall be instructed that:
- a. A direct contact is made when any part of the body touches or contacts an energized conductor or other energized electrical fixture or apparatus.
 - b. An indirect contact is made when any part of the body touches any object in contact with an energized electrical conductor or other energized fixture or apparatus
 - c. An indirect contact can be made through conductive tools, tree branches, trucks, equipment, or other conductive objects, or as a result of communication wires and cables, fences or guy wires being accidentally energized.
 - d. Electric shock will occur when an employee, by either direct or indirect contact with an energized conductor, energized tree limb, tool, equipment, or other object, provides a path for the flow of electricity to a grounded object or to the ground itself. Simultaneous contact with two energized conductors will also cause electric shock that may result in serious or fatal injury

26. An inspection shall be made to determine whether an electrical hazard exists before climbing, or otherwise entering, or performing any work in the tree.
27. No employee shall be assigned to the work if it is found that an electrical hazard exists.
28. Before digging, call the power company to locate underground power lines (see *Trenching and Excavation*).
29. Branches hanging on a conductor may be removed using nonconductive equipment.
30. Footwear and rubber gloves shall NOT be considered as providing any measure of safety from electrical hazards.
31. While working near power lines, maintain the minimum distance as required by law. This applies to all objects, including hand tools, ladders, scaffolds etc:

| Voltage | Min. Req. Clearance (Ft.) |
|-------------------|---------------------------|
| 600-50,000 | 6 |
| 50,001-345,000 | 10 |
| 345,001-750,000 | 16 |
| 750,001-1,000,000 | 20 |

32. Boom-type lifting or hoisting equipment clearances required from energized overhead high-voltage lines must maintain further distances:

| Voltage | Min. Req. Clearance (Ft.) |
|-------------------|---------------------------|
| 600-50,000 | 10 |
| 50,001-75,000 | 11 |
| 75,001-125,000 | 13 |
| 125,001-175,000 | 15 |
| 175,001-250,000 | 17 |
| 250,001-370,000 | 21 |
| 370,001-550,000 | 27 |
| 550,001-1,000,000 | 42 |

33. Neither you nor your equipment should touch or come close to power lines.
34. Use proper cords with your power tools.
35. Never touch a downed wire – it could be fatal.

C. REQUIREMENTS FOR ELECTRICIANS (600 V and under)

36. This section presumes that no electrical equipment exceeds 600 volts, and the only energized equipment that will be worked on live is for diagnostic purposes only. If you are working on equipment that exceeds 600 volts, or doing work other than diagnostics, work with EHS to establish safe work practices for that equipment.

37. Definitions

- a. Arc Flash Boundary: the distance at which an electrical arc can flash outward, and which may endanger employees working on electrical equipment. All employees must wear arc rated garments to protect all parts of the body within this boundary.
- b. Limited Approach Boundary: the distance from an exposed conductor or circuit where a shock hazard exists. It is within the Arc Flash Boundary. No unqualified persons allowed here without a Qualified person as an escort.
- c. Restricted Approach Boundary: the distance from an exposed conductor circuit part where there is an increase in shock potential. It is within the Limited Approach Boundary. Only Qualified Persons are allowed here.
- d. Qualified Person: an employee who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to identify the hazards and reduce the associated risks.

38. Electricians must have completed the following training to be considered a Qualified Person:

- a. This SWP, those SWPs listed above as related. Training on SWPs must be completed before performing the work. It is also recommended that you complete refresher training on SWPs every two years.
- b. Initial and refresher training on the NFPA 70E Standard for Electrical Safety in the Workplace. Refresher training is required every three years.

39. Determine if both a Shock Risk Assessment and an Arc Flash Risk Assessment have been performed.

- a. If the equipment has a NFPA 70E compliant label on it, then those assessments have been conducted and you should follow the label requirements for boundaries and PPE.
- b. If the equipment is not labeled then you will need to perform both a Shock Risk Assessment and an Arc Flash Risk Assessment.
 - i. Shock Risk Assessment
 1. This SWP presumes that no electrical equipment will exceed 600 volts. This means that the Limited Approach Boundary will be 3'6", and the Restricted Approach Boundary will be 1'. Category 0 insulated rubber gloves will be used.
 - ii. Arc Flash Risk Assessment
 1. In order to complete an Arc Flash Risk Assessment, it must be established that the electrical equipment is operating normally. To be in normal operating condition, the equipment must:
 - a. Be properly installed.

- b. Be properly maintained.
 - c. Used in accordance with instructions included in the listing and labeling and in accordance with manufacturer's instructions.
 - d. Have doors closed and secured.
 - e. Have covers in place and secured.
 - f. Not show evidence of impending failure.
 2. If normal operation cannot be met, then Category 4 PPE must be used until it can be established that the equipment has been de-energized, or until the work is completed.
 3. If normal operation can be verified, then the arc flash boundary and incident energy can be calculated using the NFPA 70E tables in the standard. Alternatively, a suggested unofficial [online calculator](#) can be used.
 - a. Then use the NFPA 70E tables to determine which category of PPE shall be worn. (130.7(C)(15)(a), 130.7(C)(15)(b), or 130.7(C)(15)(c)).
 - b. Complete an NFPA 70E compliant label and attach it to the equipment.
40. Complete a Job Safety Plan (link to form to be provided) prior to doing the work. This must be completed by a Qualified Person.
 - a. Review this with any person working with you.
 - b. As per the current Union MOU, there must be a minimum of two persons working on a system exceeding 277 volts.
 - c. If you are working alone, you must contact your supervisor before and after the job is completed.
 - d. If task is routine and repetitive, you can establish a standard Job Safety Plan for that task.
41. Establish your outermost boundary, and install barricades, signs or caution tape at an appropriate distance to warn other of the hazards.
 - a. If you are working inside a facility where the public is present (e.g. Recreation Center), let the site manager know what you are doing, and ask their assistance in keeping people, especially children, away from the work area.
42. Don your PPE as established in the Job Safety Plan.
 - a. Arc rated protective clothing shall be inspected before each use. Any damaged or contaminated apparel shall not be worn. Follow the manufacturer's instructions for care and maintenance.
 - b. Rubber gloves should be tested for leakage prior to use. They must also be replaced every 6 months (or tested by the manufacturer).
43. Whenever possible, establish an electrically safe work condition via Lockout and Tagout (see Lockout and Tagout SWP) so that you are working on de-energized systems. Once you have confirmed that the system is de-energized, you can remove your PPE.

44. Where de-energizing is in feasible due to equipment designs or operational limitations, remain in your PPE while doing the work.
- a. Use insulated tools and equipment, rated for at least 600 volts.

References:

1. National Fire Protection Association (NFPA) 70E Standard for Electrical Safety in the Workplace guidelines
2. Cal OSHA Guide to Electrical Safety, Cal OSHA Consultation Services, Revised October 2012.

For any questions, please contact EHS at 415-831-2780.