Occupational Health and Safety Programs

ELECTRICAL SAFETY

Contents

1.0 PURPOSE

The purpose of the Electrical Safety Program is to specify requirements for the prevention of injuries that could result from working on or near live electrical circuits, power tools, cords and cables, electrical installations and associated equipment.

2.0 SCOPE

This program applies to all StFX work sites, including contractor operations. All legislative jurisdictional, StFX and contractor requirements will be reviewed, and the more stringent requirements will be applied.

3.0 RESPONSIBILITY

3.1 Manager

Managers will monitor operations for compliance with:

- Requirements specified in this operating procedure;
- Manufacturer's specifications and recommendations;
- Site specific requirements;
- Applicable legislative jurisdictional requirements; and
- Only competent workers who require little or no supervision are assigned to tasks.

3.2 Supervisors

Supervisors must verify that:

- Requirements specified in this operating procedure are followed by all workers;
- Manufacturer's specifications and recommendations are followed by all workers;
- Site specific requirements area followed by all workers;
- Applicable legislative jurisdictional requirements are followed by all workers; and
- Only competent workers who require little or no supervision are assigned to tasks.

3.4 Workers

Workers must understand and follow:

- Requirements specified in this operating procedure;
- Manufacturer's specifications and recommendations;
- Site specific requirements; and
- Applicable legislative jurisdictional requirements.

4.0 REFERENCES

- Legislative Jurisdictional Requirements
- NFPA 70E, Standard for Electrical Safety in the Workplace
- tCSA Z462, Workplace Electrical Safety

5.0 DEFINITIONS

5.1 Arc Flash Hazard

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

5.2 Arc Flash Suit

A complete FR clothing and equipment system that covers the entire body, except for the hands and feet. This includes pants, jacket, and beekeeper-type hood fitted with a face shield.

5.3 Boundary, Arc Flash Protection

When an arc flash hazard exists, an approach limit at a distance from a prospective arc source within which a worker could receive a second degree burn if an electrical arc flash were to occur.

5.4 Deenergized

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.

5.5 Disconnecting/Connecting

Open or close a switch that feeds the breaker or contactor.

5.6 Electrical Hazard

A dangerous condition such that contact or equipment failure can result in electric shock, arc flash burn, thermal burn, or blast.

5.7 Electrical Live Work

Working on equipment and systems that are either energized, or in a situation where there is nothing to prevent them being energized.

5.8 Electrical Work

The installation, alteration, repair, testing, or maintenance of electrical equipment or system.

5.9 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.

5.10 Ground Fault

An unintentional, electrically conducting connection between an ungrounded conductor or an electrical circuit and the normally non-current-carrying conductors, metallic enclosures, metallic raceways, metallic equipment, or earth.

5.11 Ground-Fault Circuit-Interrupter (GFCI)
A device intended for the protection of workers that functions to deenergize a circuit or portion thereof within an established period of time.

5.12 Grounding
Making a direct, low-impedance, physical connection between the normally energized, but presently isolated, parts of devices or systems and ground. The connection has sufficient capacity to carry the expected fault currents until protection operates.

5.13 Insulated
Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current.

5.14 Isolation (Electrical)
Physically disconnecting a device or system from sources of supply in such a way that inadvertent re-energization cannot take place.

5.15 Lockout (Electrical)
Placing locks on power-isolating devices in the de-energized position to prevent these or other devices or systems from being operated and energized.

5.16 Minimum Safe Clearance
The minimum boundary for qualified electrical personnel around an exposed energized conductor is the innermost shock hazard distance and minimum air separation to avoid flashover between bare energized parts and adjacent grounded surfaces.

5.17 Qualified Electrical Person
A journeyman electrician, who has proven technical knowledge, competency and experience to avoid danger in order to carry out operations in power systems and work on electrical equipment.

5.18 Racking Out/In
Physical movement of a circuit breaker or removable contactor from or to the connected position inside a switchgear cell.

5.19 Safe Limit of Approach
The boundary around an exposed energized conductor representing the outermost shock hazard distance from the conductor, and is the line that may only be crossed by qualified electrical persons.

5.20 Tagout (Electrical)
Attaching an identifying marker to a locking device that identifies the worker(s) who attached the lock, the date and time of placing the lock, the purpose of the lock, and as a warning to other persons not to remove the lock.

5.21 Withdrawing/Inserting
Physical removal of a circuit breaker or removable contactor from a switchgear cell or replacement into a cell.

6.0 PROCEDURE

6.1 Hazards

- Electrocution or electrical shock;
- Electrical arcing resulting in explosion, fire, damage to equipment and injuries; and
- Failure of electrical equipment.

6.2 Hazard Controls

6.2.1 Established Procedures

- OHS Orientation and Training, prescribes requirements for worker safety orientations and training;
- Hazard Identification and Control Program, which describes requirements for the completion of hazard assessments, Job Safety Analysis (JSAs) and Field Level Risk Assessments (FLRAs).
- Energy Isolation Program, which specifies requirements for energy isolation and lockout and tagout.
- NFPA 70E, Standard for Electrical Safety in the Workplace. This essential standard prescribes, among other safeguards, requirements for arc-flash protection.

6.2.2 General Requirements

- Working on live electrical equipment or circuits will only be done by a qualified electrician.
- Conductive clothing, metal-framed glasses or jewelry must not be worn when working on live electrical equipment or circuits.
- All electrical work, installation, training and circuit and equipment capacities will be in accordance with legislative jurisdictional requirements.
- Only non-conductive fiberglass portable ladders will be used on StFX projects.
- No worker is permitted to work in any circumstance where an energized electrical circuit or energized equipment with exposed live contacts may be touched, unless he is protected against electric shock by de-energizing and locking out the circuit and grounding it or by guarding it by an effective means such as insulating the circuit.

- You must notify the service provider if your work or equipment, or any inadvertent movement of persons or equipment located outside the limits of approach, could possibly result in encroachment of the limits of approach.
- The service provider will work with you to determine what steps are required to protect you, your workers and the service provider distribution system. If necessary, they will assist you to complete the appropriate documentation.

6.2.3 General Electrical Equipment Requirements

- Electrical equipment must be maintained and serviced according to manufacturer's requirements.
- Electrical equipment must be approved for the intended service per legislative jurisdictional requirements.
- All electrical equipment must bear evidence of approval (i.e. markings/labels).
- Flammable material must never be stored in dangerous proximity to electrical equipment.
- Never conduct work on live electrical circuits or equipment when clothing and gloves are wet or when any part of the body is in contact with water.
- Electrical equipment must be tagged out if it is deficient and must be reported to supervision.
- All electrical equipment must be classified for the service for which it is being used.
- Use only explosion-proof electrical equipment near flammable environments.

6.2.4 Portable Electrical Tools

- Portable hand electrical tools must be grounded or double insulated.
- Guards and handles must be in place at all times, unless temporarily waived due to constraints of access by the foreman.

6.2.5 Assured Grounding

- All 120V, single phase 15 and 20 amp receptacle outlets on construction sites, which are not a part of the permanent wiring of the building or structure and which are in use by workers, will have approved ground fault circuit interrupters for personal protection.
- Receptacles on a two wire, single phase portable or vehicle mounted generator rated not more than 5kW, where the circuit conductors of the generator are insulated from the generator frame and all other grounded surfaces, need not be protected with ground fault circuit interrupters.
- All ground fault circuit interrupters will have test buttons. The user will test the ground fault circuit interrupter before work begins by depressing test button to verify power interruption.
- The following tests will be performed on all cord sets and receptacles that are not part of the permanent wiring of the building or structure, and cord and plug connected equipment required to be grounded:

- All equipment grounding conductors will be tested for continuity and will be electrically continuous;
- Each receptacle, attachment cap and plug, and receptacle of cord sets will be tested for correct attachment of the equipment grounding conductor;
- The equipment grounding conductor will be connected to its proper terminal. Each plug end shall be inspected for worn, deformed, or damaged pins that may allow for improper connection to connectors; and
- Special attention will be given to twist lock plugs.
- All required tests will be performed as follows:
  - Before first use;
  - Before equipment is returned to service following any repairs;
  - Before equipment is used after any incident which can be reasonably suspected to have caused damage (for example, when a cord set is run over); and
  - At intervals not to exceed three months.

- Following quarterly (or more frequent) tests, cords and equipment will be marked with colored tape or similar durable markings or plastic tiewrap.
  January – March color is Green;
  April – June color is Orange;
  July –September color is Red;
  October – December color is Yellow.
  Remember G-O-R-Y.
- Do not make available or allow workers to use any equipment that has not passed the required tests.

6.2.6 Electrical Cords and Cables

- Cords must have heavy-duty insulation, of the three-wire type and be designed for hard or extra hard usage. These types include S, ST, SO, STD, SJ, SJT and SJTO. All will be supplied with a ground connector and be free of splices or damage to insulation except hard service flexible cords #12 or larger which may be repaired by a qualified electrician and spliced if the splice retains the insulation, outer sheath properties and usage of the cord being spliced.
- Cords and cables must be elevated at least 7 feet (2.134 m) overhead, only suspended by non-metallic ties and protected from sharp edges of beams and metal framing.
- Portable cords and cables must never be placed in aisles or stairs.
- Cords must never be placed where closing doors could pinch and damage the cord.
- When cords and cables must be run on the ground they must be protected from crushing and cutting.
- Where different voltages, frequencies or types of current (AC or DC) are to be supplied by portable cords, receptacles will be of such design that attachment plugs used on these circuits are not interchangeable.

6.2.7 Distribution Panels and Junction Boxes

- Each district must determine the legislative jurisdictional requirements that pertain to safeguarding workers around distribution panels and junction boxes.
- Entrances to rooms and other enclosed locations containing exposed live electrical components will be marked with conspicuous warning signs prohibiting unqualified persons to enter.
- Distribution panels must have a lockable front cover to protect from hot terminals and be properly constructed and grounded.
- Wiring enclosures, such as switch and circuit breaker cases, motor controllers, panel boards, junction boxes, busways, gutters, fittings and similar equipment in locations exposed to rain, oil, excessive moisture,
  steam, vapors or similar substances that could deteriorate electrical equipment must be of a type approved for the purpose or will be installed in housings, enclosures or guards suitably designed to protect the equipment or conductors. Boxes, fittings and lamp holders installed in damp or wet locations will be of weatherproof construction.

6.2.8 Temporary Lighting

- When used in damp or hazardous locations including confined spaces, lighting must be operated at a maximum of 12 volts unless protected with GFCIs and in such a case, 120 volt lights may be used.
- Guards or cages must be installed over all temporary lighting bulbs unless the bulb is sufficiently recessed in the fixture or reflector to provide impact protection.
- No electrical outlets shall be installed on temporary lighting strings.
- Temporary and portable lighting is not to be energized by the same circuits that are used to supply tools.
- Fluorescent tubes subject to breakage will be protected by means of a protective guard or will be shatterproof.

6.2.9 Arc-Flash Protection

- All electrical work, installation, training and wire capacities will be in accordance with the pertinent provisions of the current edition of NFPA 70E as well as all pertinent legislative jurisdictional requirements. Note: All references to NFPA 70E in this revision are to the 2009 Edition of the Standard.
- No worker is permitted to work in any circumstance where an energized electrical power circuit or energized equipment with exposed live contacts may be touched, unless the worker is protected against electric shock by deenergizing and locking out the circuit and grounding it or by guarding it by effective insulation, barriers or other means.
- A qualified and authorized journeyman level (or equivalent) electrician must perform the isolation of energized electrical circuits or equipment.

- Each location that may do work on or near energized/live electrical circuits or equipment with live contacts must either maintain a copy of the latest NFPA 70E, Standard for Electrical Safety in the Workplace, or be capable of opening a copy on line.
- Flash protection boundaries around energized circuits and equipment must be established. (Refer to NFPA 70E, Annex C, Limits of Approach and Table 130.2(C), Approach Boundaries to Energized Electrical Conductor).
- Before working on or near live electrical circuits, a hazard assessment must be completed to identify hazards, develop corrective actions and specify PPE. Hazard levels due to proximity and voltage must be determined by engineering calculations or from published tables from similar equipment items. Arc flash hazards have been calculated for major electrical distribution systems. (Refer to NFPA 70E, Annex D, Incident Energy and Flash Protection Boundary Calculation Methods). Refer to NFPA 70E, Annex F, Hazard/Risk Evaluation Procedure to understand the hazards and aid in the conduct of the JSA.
- Reference to NFPA Table 130.7(C)(9), Hazard/Risk Category Classifications and Use of Rubber Insulating Gloves and Insulated and Insulating Hand Tools is required while planning and conducting the work.
- PPE must comply with NFPA 70E, Table 130.7©(10), Protective Clothing and Personal Protective Equipment (PPE) for the assigned Hazard Risk Category Classification as determined in the previous paragraph.
- Conductive jewelry, including conductive eye glass frames or clothing of any type that may melt or do not meet flammability requirements are prohibited. Examples of such clothing are some hard hat liners, polyester under garments and outer wear.
- Use the NFPA 70E Annex I, Job Briefing and Planning Checklist, to prepare for work on or near live circuits or equipment.

6.3 Training

All workers must be trained to understand and follow electrical procedural requirements according to this procedure and legislative jurisdictional requirements.

REVISION SUMMARY		
DATE	**REVISION**	**SUMMARY**
21 Nov 17	1	New program
15 Apr 19	2	Updated Program # to 05, formatting changes.
30 Nov 23	3	Updated to new OHS programs format.