Owner: occupational health & safety specialist DocuSigned by: Brian Moore 5/6/2021	**Original effective date:** 03/01/2018
Authority: safety manager DocuSigned by: Brant Duncan 5/10/2021 CBFE1F7EC957477...	**Current effective date:** 05/01/2021
Review frequency: Every 3 years	**Next review date:** 05/01/2024

Purpose:

The purpose of this program is to establish safe work practices intended to prevent or reduce risk of exposure to the electrical hazards of arc flash and electric shock. The program establishes requirements for training, pre-job planning, and authorization for performing work on exposed, energized equipment. The program and the procedures referenced within are designed to comply with the guidance found in the current NFPA 70E standards. Any interpretation or further guidance needed for subjects found in this program can be resolved by consulting that document.

Program:

Scope

All Platte River employees, subcontractors, and vendors who, as a result of work on and/or near energized electrical equipment, may be exposed to electrical hazards are subject to the requirements of this program. Contractors and vendors are required to ensure that each of their employees follow the work practices within this program.

Hazard control

Electrical operations will be conducted using the following hierarchy of controls. Control methods must be used in priority order to eliminate or mitigate risk and prevent occurrence of electricity-related incidents.

1. **Engineering controls**
   - All electrical distribution panels, breakers, disconnects, switches and junction boxes must be completely enclosed.
   - Water-tight enclosures must be used if any of these components could possibly be exposed to moisture.

- Structural barriers must be used to prevent accidental damage to electrical components.
- Conduits must be supported for their entire length, and non-electrical attachments to conduits are prohibited.
- Non-rigid electrical cords must have strain relief wherever necessary.

2. Administrative controls

- An approved Platte River energized work permit is required for any work on energized electrical circuits.
- Only trained, authorized employees may repair or service electrical equipment.
- Contractors must be licensed and qualified to perform electrical work.
- Physical barriers must be used to prevent unauthorized persons from entering areas where new installation or repair of electrical components or equipment is being performed.
- All electrical control devices must be labeled properly.

3. Work practice controls

- Employees who perform work on exposed electrical equipment must wear all appropriate electrically rated PPE.
- Use only tools that are properly insulated.
- Non-conductive gloves will be worn for work on electrical equipment.

Risk assessment

All electrical work must be conducted with the intent of limiting employee exposure to electrical hazards. Appropriate procedures must be in place prior to the employee starting work, and accomplish the following:

(1) Identify hazards

(2) Assess risks

(3) Implement risk control according to the hierarchy of risk control methods

PERSONAL PROTECTIVE EQUIPMENT (PPE)

For any work in which there is a potential for shock or arc flash, refer to the Platte River Arc Flash PPE Guideline. This document is in the Policies and Procedures section of the Platte River SharePoint site.

Platte River will provide personal protective equipment for use by employees working in areas where they could be exposed to electrical shock hazards. PPE used for shock hazards will be designed and constructed for the specific part of the body to be protected and for the work to be performed.

Employees are required to observe the following procedures for PPE use:

- PPE use is mandatory when contact with exposed electrical sources is possible
- Only use PPE that is designed for the work being performed
- Inspect and test all PPE prior to use
- Use a protective outer cover (leather, for example) if the work being performed might damage the PPE's insulation
- Wear non-conductive headgear if there is danger of electrical burns or shock from contact with exposed, energized equipment
- Wear hearing, eye and face protection any time there is danger of flying objects, flashes or electrical arcs produced by an electrical explosion.

EMPLOYEE TRAINING

Employees will be trained to understand the specific hazards associated with electrical energy and the specific equipment on which they work. The training will include safety related work practices and procedural requirements to provide protection from electrical hazards associated with their respective job or task assignments. Employees will be trained to identify and understand the relationship between electrical hazards and possible injury. Platte River electrical safety training must be completed as soon as possible upon hire and repeated every three years in or when new versions of NFPA 70E are released. Training is divided into the following three categories based on job assignment and associated tasks.

General employees (all departments):

Basic "awareness level" training designed to educate personnel about the potential hazards and risks associated with electricity and electrical equipment. Training consists of one hour of classroom instruction and includes the following:

1. Platte River Electrical Safety Program review
2. NFPA 70E overview
3. Electrical hazards/risks
4. General PPE selection and use guidelines
5. Labels, signs, and warnings

Non-Qualified Electrical Workers (personnel who perform task-specific functions on unexposed energized electrical equipment):

Training designed for personnel who interact with but are not exposed to energized electrical equipment (i.e. normal operation of a circuit breaker, switch, or starter). Training consists of eight (8) hours of combined classroom and hands on training and includes the following:

1. Electrical breakers (arc flash labels, arc flash PPE requirements racking procedures, safe working distances, racking tools and equipment, hazards)
2. NFPA 70E overview
3. Pre-job planning and briefings
4. Review of switching orders
5. Review of Interconnected System Clearance (ICS) procedure

Qualified Electrical Workers (personnel who perform diagnostic or repair work on exposed energized electrical equipment):

Training designed for personnel who are required to perform work on or near exposed energized electrical equipment as a function of their job. Training consists of eight (8) hours of classroom instruction combined with eight (8) hours of hands-on instruction and includes:

1. NFPA 70E Training
2. Hazard recognition and risk assessment
3. Work on energized electrical parts 50V or higher
4. Appropriate PPE
5. Insulated tool inspection and usage
6. Protective grounding - hazards, procedures, and tools
7. Batteries - hazards, procedures, and tools
8. Pre-job briefings

Energized work permit

Work performed within the limited approach boundary or the arc flash boundary of exposed energized electrical conductors or circuit parts that are not placed in an electrically safe work condition is considered energized electrical work and may only be performed under an approved energized work permit (Appendix A). Energized Work Permits may only be approved under the following conditions:

- De-energizing the electrical circuit would result in an increased or additional hazard.
- De-energizing the electrical circuit is infeasible due to equipment design or operational limitations.

Energized work permits are maintained by the I&E supervisor or designee and retained for a minimum of one year.

Exemptions to energized work permit

Tasks which may be performed inside the limited approach boundary but are not considered energized electrical work are as follows:

- Testing, troubleshooting, or voltage measuring.
- Thermography, ultrasound, or visual inspections if the restricted approach boundary is not crossed.
- Access to and egress from an area with energized electrical equipment if no electrical work is performed and the restricted approach boundary is not crossed.

Pre-job planning

Job planning is necessary to ensure that hazards are identified prior to the commencement of work. Additionally, proper planning will help to eliminate error, identify equipment needs, and enable work to be done more efficiently.

Supervisors should engage their crews in pre job planning using task SOPs, hazard analysis tools, pre-job briefings, or any other applicable method. Special consideration for worksite conditions, job-specific hazards, and emergency contingencies should be discussed with the crew. Once work is complete, the crew should discuss the job and document any lessons learned that may aid in making similar tasks more successful in the future.

Grounding

Personal protective grounding is a necessary safety practice intended to protect a worker on de-energized equipment and circuits in the event unplanned energization occurs. This manual is intended to provide the worker with the maximum protection currently available. Grounding will reduce the injury from potentially hazardous voltage by limiting the voltage at the work location under most circumstances.

Platte River grounding procedures are found in the personal protective grounding procedure located in Platte River Policies and Procedures on SharePoint as well as applicable department SOPs.

Control of hazardous energy (lockout/tagout and clearance) Rawhide

All sources of electrical energy will be controlled in such a way as to minimize employee exposure to electrical hazards.

Rawhide Lockout/Tagout procedures and requirements are found in Control of Hazardous Energy (Clearance and Lockout/Tagout) located in the Policies and Procedures section on Platte River SharePoint.

Control of Hazardous Energy (Lockout/Tagout) Headquarters and Substation Maintenance procedures and requirements are located in the Policies and Procedures section on Platte River SharePoint.

Working on 50-600 volt secondary circuits and relay equipment

Working on energized low voltage relay/control wiring and equipment in restricted spaces where the work requires a sensitive feel due to the small size of conductors and terminals, a qualified employee may work on energized circuits without gloves but shall use insulated hand tools and insulated instruments rated for the voltage involved. The employee shall avoid touching exposed conductors as well as conductive parts of hand tools or instruments, which are contacting energized conductors.

On voltages from 50v to 600V (other than control circuits as noted above), approved rubber gloves shall be worn as a minimum.

Annual audit

The Safety Manager or their designee inspects this program and its implementation annually. If the audit determines that the principles and procedures of this program are not being followed, appropriate revisions will be made.

The annual audit must:

- Include a review of this program's procedures and requirements to ensure alignment with NFPA 70E.
- Include a review of electrical field work and associated personnel training.
- Determine whether the requirements of the program are implemented properly. Deviations from the program must be identified, documented, and corrected.

Electrical system information

1. **Drawings**

   It is the responsibility of plant electrical engineers and I&E techs to make sure drawings are updated in a timely manner.

2. **Rawhide SKM model**

   Both Engineering and I&E must work together to keep the Rawhide SKM model up to date. The following listed equipment is included in the model and must be updated if changed or replaced: relay type/settings, breaker type/settings, conductor size, transformers, motors, fuses, large 480V loads. Updating equipment in the model ensures that the short-circuit analysis is accurate and arc flash labels are up to date. The SKM model applies to all equipment 480V and up.

3. **HQ drawings and arc flash studies**

   It is the responsibility of facility maintenance electrician, electrical engineering staff and outside consults to maintain and update when necessary, all electrical drawings and arc flash studies.

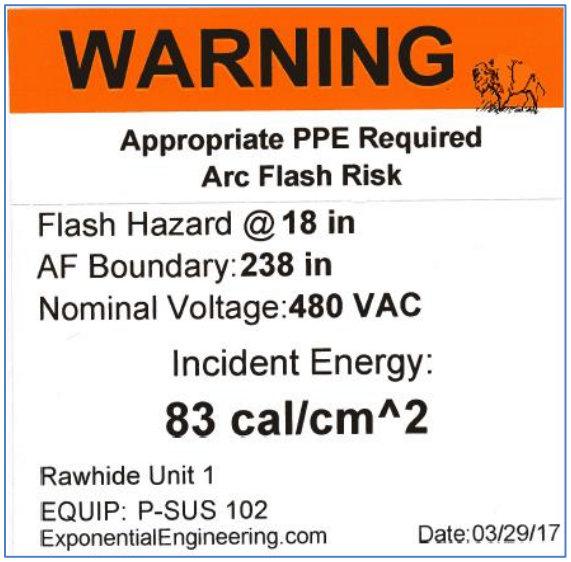
4. **Labeling**

   As required by the NEC, Article 110.6, switchgear, panelboards, industrial control panels, motor control centers, disconnects, and other electrical equipment that are likely to require examination, adjustment, servicing, or maintenance while energized, are field marked/labeled to warn qualified employees of potential shock and arc flash hazards.

   - Labels are placed in a location visible to qualified employees before examination, adjustment, servicing, or maintenance of the equipment.
   - After an arc flash analysis has been completed for electrical equipment by a qualified person in accordance with NFPA 70E, permanent equipment labels are affixed to the equipment which summarizes the flash protection information. The

results of an assessment performed by the qualified person are maintained on file by the engineering services department, and the equipment label is updated when any major modification or renovation takes place.

- At a minimum, labels include the nominal system voltage, the arc flash boundary, the incident energy, and the flash hazard. Other information such as the equipment name and the date the label was created may be included on labels moving forward.
- Example of arc flash labels:



Implementing parties and assigned responsibilities:

Safety

- Oversee and monitor implementation of this program to ensure compliance.
- Advise appropriate to the risks associated with electrical hazards.
- Revise and edit this program as required.
- Organized and assist with training.

Substation maintenance:

- Perform work in accordance to this program and administer all aspects of pre-job planning as it relates to Energized Electrical Work.
- Maintain training to serve as Qualified Electrical Workers (QEW) as outlined in OSHA standard 29 CFR 1910.331 – 1910. 335 and 1910.269 and in the training section of this program.

I&E

- Perform work in accordance to this program and administer all aspects of pre-job planning as it relates to Energized Electrical Work
- Maintain training to serve as Qualified Electrical Workers (QEW) as outlined in OSHA standard 29 CFR 1910.331 to 1910.335 and in the training section of this program.

Operations

- Perform work in accordance to this program
- Maintain training to serve as Non-Qualified Electrical workers as outlined in the training section of this program

Electrical Engineering

- Provides technical analysis of electrical systems and their design.
- Performs or coordinates arc flash hazard analysis.

HQ Facilities Electrician:

- Perform work in accordance to this program and administer all aspects of pre-job planning as it relates to Energized Electrical Work
- Maintain training to serve as Qualified Electrical Workers (QEW) as outlined in OSHA standard 29 CFR 1910.331 to 1910.335 and in the Training section of this program.

Platte River Employees (General Employees)

- Do not operate, tamper with, or otherwise interact with energized electrical equipment
- Attend General Electrical Safety Awareness training as outlined in the training section of this program

Associated Documents:

NFPA 70E Electrical Safety in the Workplace (current edition)

NFPA 70 National Electrical Code (current edition)

NFPA 70B Recommended Practice for Electrical Equipment Maintenance

ARC Flash Personal Protective Equipment (PPE) Guideline

SUS 101-108 Maintenance Mode Procedure

Unit 1 Arc Flash / Coordination Study – March 2017

OSHA 1910.331 to 1910.339

Definition and Acronyms:

Note: The definitions below are the most commonly used and applicable to this program. Additional definitions are found in NFPA 70E Article 100.

Accessible, Readily (Readily Accessible). Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to actions such as to use tools, to climb over or remove obstacles, or to resort to portable ladders, and so forth.

Arc Flash Hazard. A source of possible injury or damage to health associated with the release of energy caused by an electric arc.

Arc Rating. Value attributed to materials that describes their performance to exposure to an electrical arc discharge

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

Boundary, Limited Approach. An approach limit at a distance from an exposed energized electrical conductor or circuit part within which a shock hazard exists.

Boundary, Restricted Approach. An approach limit at a distance from an exposed energized electrical conductor or circuit part within which there is an increased likelihood of electric shock, due to electrical arc-over combined with inadvertent movement, for personnel working in close proximity to the energized electrical conductor or circuit part.

Conductor, Bare. A conductor having no covering or electrical insulation whatsoever.

Conductor, Covered. A conductor encased within material of composition or thickness that is not recognized by NFPA 70, National Electric Code as electrical insulation.

Conductor, Insulated. A conductor encased within material of composition and thickness that is recognized by NFPA 70, National Electric Code as electrical insulation.

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

Note: Class 2 power supplies, listed low voltage lighting systems, and similar sources are examples of circuits or systems that are not considered an electrical hazard.

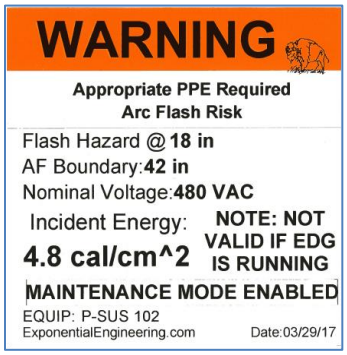
Electrically Safe Work Condition. A state in which an electrical conductor or circuit part has been disconnected from energized parts, locked/tagged in accordance with established standards, tested to verify the absence of voltage, and, if necessary, temporarily grounded for personal protection.

Exposed (as applied to energized electrical conductors or circuit parts). Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to electrical conductors or circuit parts that are not suitably guarded, isolated, or insulated.

Grounded (Grounding). Connected (Connecting) to ground or to a conductive body that extends the ground connection.

Incident Energy. The amount of thermal energy impressed on a surface, a certain distance from the source, generated during an electrical arc event. Incident energy is typically expressed in calories per square centimeter (cal/cm2).

Maintenance Mode. Certain equipment with high incident energy has been equipped with a setting in an upstream relay that enables a maintenance mode in energized equipment. The intent of this mode is to lower the incident energy to a level where safe work may be performed. It is required for an electrical worker to use maintenance mode on available equipment for any of the following actions: opening a door on a breaker cubicle, racking a breaker in/out, performing maintenance/inspection on live 480V equipment, locally operating a breaker. Equipment where this is available will have two arc flash labels; a standard label for normal operating conditions and one that applies when maintenance mode is enabled. An example of an arc flash maintenance mode label may be seen in the following:



Nominal Voltage. The voltage at which equipment in a system is operated.

Qualified Electrical Worker. One who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to identify and avoid the hazards involved.

Risk Assessment. An overall process that identifies hazards, estimates the likelihood of occurrence of injury or damage to health, estimates the potential severity of injury or damage to health, and determine if protective measures are required.

Shock Hazard. A source of possible injury or damage to health associated with current through the body caused by contact or approach to exposed energized electrical conductors or circuit parts.

Working On (energized electrical conductors or circuit parts). Intentionally coming in contact with energized electrical conductors or circuit parts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the personal protective equipment (PPE) a person is wearing. There are two categories of “working on”: *Diagnostic (testing)* is taking readings or measurements of electrical equipment with approved test equipment that does not require making any physical change to the equipment; *repair* is any physical alteration of electrical equipment (such as making or tightening connections, removing or replacing components, etc.).

Appendix A – Energized Electrical Work Permit & Flowchart

PRPA ENERGIZED ELECTRICAL WORK PERMIT

PART 1: FILLED OUT BY REQUESTOR

Description of cicuit/equipment, job location, and nominal voltage: _____

_____

Detailed scope of work: _____

_____

_____

Justification (explain):

☐ De-energizing the electrical circuit would result in an increased or additional hazard: _____

_____

☐ De-energizing the electrical circuit is infeasible due to equipment design or operational limitations: _____

_____

PART 2: FILLED OUT BY QUALIFIED ELECTRICAL WORKER PERFORMING WORK

Required safe work practices: _____

Results of shock hazard analysis:

Voltage: _____ AC / DC

Approach Boundaries: Arc Flash _____

Required PPE: _____

Required Voltage Rated Tools: _____

Results of Flash Hazard Analysis:

Incident Energy (Cal/Cm2): _____

Flash Protection Boundary: _____

Required PPE: _____

Job briefing discussion summary and attendiees:

_____

_____

_____

List specific hazards and methods used to mitigate them: _____

_____

_____

_____ _____

Qualified Electrical Worker Date

_____ _____

Qualified Electrical Worker Date

PART 3: MANAGEMENT APPROVAL

_____ _____

Operations Supervisor Date

_____ _____

Maintenance Manager or designee Date

_____ _____

Safety Department Date

Appendix A – Energized Electrical Work Permit & Flowchart