

Title: Electric Power Generation, Transmission, and Distribution Procedure

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Issuing Authority: VP, Facilities and Construction Management

Responsible Officer: Director Environmental Health and Safety

### **PURPOSE OF THE PROCEDURE**

The purpose of this policy is to prevent injuries to New York University Central Plant (Plant) employees who work on electric power systems associated with electric power generation, transmission, and distribution systems, where voltages encountered are generally much higher than voltages encountered in other types of work, and where a large part of electric power generation, transmission, and distribution work exposes employees to energized parts of the power system. This policy is intended to comply with 29 CFR 1910.269, the Occupational Safety and Health Administration (OSHA) standard on Electric Power Generation, Transmission, and Distribution.

### **SCOPE OF THIS PROCEDURE**

#### **WHO NEEDS TO KNOW THIS PROCEDURE**

New York University Central Plant

#### **PROCEDURES FOR IMPLEMENTATION**

##### **Responsibilities:**

##### **Department of Environmental Health and Safety**

##### **Directors or Department Chairs**

##### **Facilities Manager, Department Manager, Construction Manager and Supervisors**

##### **Maintenance and Housekeeping Personnel**

##### **Medical Surveillance**

##### **Complaint Response**

# PROCEDURE DEFINITIONS

**Affected employee.** A Plant employee whose job requires him or her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout/tagout, or whose job requires him or her to work in an area in which such servicing or maintenance is being performed.

**Attendant.** A Plant employee assigned to remain immediately outside the entrance to a confined or other space to render assistance as needed to Plant employees inside the space.

**Authorized Employee.** A Plant employee who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance covered under this policy.

**Automatic Circuit Recloser.** A self-controlled device for interrupting and reclosing an alternating current circuit with a predetermined sequence of opening and reclosing followed by a resetting, hold-closed, or lockout operation.

**Barricade.** A physical obstruction such as tapes, cones, or A-frame type wood or metal structures intended to provide a warning about and to limit access to a hazardous area.

**Barrier.** A physical obstruction, which is intended to prevent contact with energized lines or equipment or to prevent unauthorized access to a work area.

**Bond.** The electrical interconnection of conductive parts designed to maintain a common electrical potential.

**Bus.** A conductor or a group of conductors that serve as a common connection for two or more circuits.

**Bushing.** An insulating structure, including a through conductor or providing a passageway for such a conductor, with provision for mounting on a barrier, conducting or otherwise, for the purposes of insulating the conductor from the barrier and conducting current from one side of the barrier to the other.

**Cable.** A conductor with insulation, or a stranded conductor with or without insulation and other coverings (single-conductor cable), or a combination of conductors insulated from one another (multiple-conductor cable).

**Cable Sheath.** A conductive protective covering applied to cables. A cable sheath may consist of multiple layers of which one or more is conductive.

**Circuit.** A conductor or system of conductors through which an electric current is intended to flow.

**Clearance (between objects).** The clear distance between two objects measured surface to surface.

**Clearance (for work).** Authorization to perform specified work or permission to enter a restricted area.

**Conductor.** A material, usually in the form of a wire, cable, or bus bar, used for carrying an electric current.

**Covered Conductor.** A conductor covered with a dielectric having no rated insulating strength or having a rated insulating strength less than the voltage of the circuit in which the conductor is used.

**Current-carrying part.** A conducting part intended to be connected in an electric circuit to a source of voltage. Non-current-carrying parts are those not intended to be so connected.

**Deenergized.** Free from any electrical connection to a source of potential difference and from electric charge; not having a potential different from that of the earth. The term is only used with reference to current-carrying parts, which are sometimes energized (alive).

**Designated employee (designated person).** A Plant employee who is designated by the Plant to perform specific duties under the terms of this policy and who is knowledgeable in the construction and operation of the equipment and the hazards involved.

**Electric supply equipment.** Equipment that produces, modifies, regulates, controls, or safeguards a supply of electric energy.

**Electric utility.** An organization responsible for the installation, operation, or maintenance of an electric supply system.

**Energized (alive, live).** Electrically connected to a source of potential difference, or electrically charged so as to have a potential significantly different from that of earth in the vicinity.

**Energy isolating device.** A physical device that prevents the transmission or release of energy, including, but not limited to, the following: a manually operated electric circuit-breaker, a disconnect switch, a manually-operated switch, a slide gate, a slip blind, a line valve, blocks, and any similar device with a visible indication of the position of the device. (Push buttons, selector switches, and other control-circuit-type devices are **not** energy isolating devices.)

**Energy source.** Any electrical, mechanical, hydraulic, pneumatic, chemical, nuclear, thermal, or other energy source that could cause injury to personnel.

**Equipment (electric).** A general term including material, fittings, devices, appliances, fixtures, apparatus, and the like used as part of or in connection with an electrical installation.

**Exposed.** Not isolated or guarded.

**Ground.** A conducting connection, whether intentional or accidental, between an electric circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

**Grounded.** Connected to earth or to some conducting body that serves in place of the earth.

**Guarded.** Covered, fenced, enclosed, or otherwise protected, by means of suitable covers or casings, barrier rails or screens, mats, or platforms, designed to minimize the possibility, under normal conditions, of dangerous approach or accidental contact by persons or objects. Wires, which are insulated, but not otherwise protected, are **not** considered as guarded.

**Insulated.** Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current. When any object is said to be insulated, it is understood to be insulated for the conditions to which it is normally subjected. Otherwise, it is, within the purposes of this policy, uninsulated.

**Insulation (cable).** That which is relied upon to insulate the conductor from other conductors or conducting parts, or from ground.

**Lines, communication.** The conductors and their supporting or containing structures which are used for public or private signal or communication service, and which operate at potentials not exceeding 400 volts to ground or 750 volts between any two points of the circuit, and the transmitted power of which does not exceed 150 watts. If the lines are operating at less than 150 volts, no limit is placed on the transmitted power of the system. Under certain conditions, communication cables may include communication circuits exceeding these limitations where such circuits are also used to supply power solely to communication equipment. Telephone, telegraph, railroad signal, data, clock, fire, police alarm, cable television, and other systems conforming to this definition are included. Lines used for signaling purposes, but not included under this definition, are considered as electric supply lines of the same voltage.

**Lines, electric supply.** Conductors used to transmit electric energy and their necessary supporting or containing structures. Signal lines of more than 400 volts are always supply lines within this policy, and those of less than 400 volts are considered as supply lines if so run and operated throughout.

**Manhole.** A subsurface enclosure which Plant personnel may enter and which is used for the purpose of installing, operating, and maintaining submersible equipment or cable.

**Manhole steps.** A series of steps individually attached to or set into the walls of a manhole structure.

**Minimum approach distance.** The closest distance to an energized or a grounded object that a Plant employee is permitted to approach.

**Qualified employee (qualified person).** A Plant employee knowledgeable in the construction and operation of the electric power generation, transmission, and distribution equipment involved, along with the associated hazards. A Plant employee must have the training required by paragraph 1.2 of this policy in order to be considered a qualified employee. A Plant employee, who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who is under the direct supervision

of a qualified Plant employee is considered to be a qualified employee for the performance of those duties.

**Step bolt.** A bolt or rung attached at intervals along a structural member and used for foot placement during climbing or standing.

**Switch.** A device for opening and closing or for changing the connection of a circuit. Under this policy, a switch is understood to be manually operable, unless otherwise stated.

**Vault.** An enclosure, above or below ground, which Plant personnel may enter and which is used for the purpose of installing operating, or maintaining equipment or cable.

**Vented vault.** A vault that has provision for air changes using exhaust flue stacks and low-level air intakes operating on differentials of pressure and temperature providing for airflow.

**Voltage.** The effective (rms) potential difference between any two conductors or between a conductor and ground. Voltages are expressed in nominal values unless otherwise indicated. The nominal voltage of a system or circuit is the value assigned to a system or circuit of a given voltage class for the purpose of convenient designation. The operating voltage of the system may vary above or below this value.

# UNIVERSITY PROEDURE

## RESPONSIBILITIES

### Training:

#### 1. Content of Training

Plant employees shall be trained in and familiar with the safety-related work practices, safety procedures, and other safety requirements that pertain to their respective job assignments. Plant employees shall also be trained in and familiar with any other safety practices, including applicable emergency procedures that are related to their work and are necessary for their safety.

- a. The training required shall be of the classroom or on-the-job type.
- b. The training shall establish employee proficiency in the work practices required by this policy and shall introduce the procedures necessary for compliance with this policy.

#### 2. Qualified Employees

- a. Qualified employees shall also be trained and competent in:
  - i. the skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment;
  - ii. the skills and techniques necessary to determine the nominal voltage of exposed live parts;
  - iii. the minimum approach distances corresponding to the voltages to which the qualified employee will be exposed (see Tables 1 through 5); and
  - iv. the proper use of the special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electric equipment.

#### 3. Additional Training Requirements

- a. A Plant employee shall receive additional training (or retraining) under any of the following conditions:
  - i. If regular supervision and annual inspections (see paragraph 1.4) indicate that the employee is not complying with the safety-related work practices required by this policy;
  - ii. if new technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices that are different from those that the employee would normally use;
  - iii. if the employee must employ safety-related work practices that are not normally used during his or her regular job duties; or
  - iv. if the employee must perform a task that he or she has not performed within the past year

#### 4. Regular Supervision and Inspections

The Plant Manager shall determine, through regular supervision and through inspections conducted on at least an annual basis that each Plant employee is complying with the safety-related work practices required by this policy.

5. Certification of Training

The Plant Manager shall certify in writing that each Plant employee has received the training required by paragraphs 1.1, 1.2, and 1.3. This certification shall be made when the employee demonstrates proficiency in the work practices involved, and shall be maintained for the duration of the employee's employment.

**Existing Conditions:**

Existing conditions related to the safety of the work to be performed shall be determined before work on or near electric lines or equipment is started. Such conditions include: the nominal voltages of lines and equipment, the presence of hazardous induced voltages, the presence and condition of protective grounds and equipment grounding conductors, environmental conditions relative to safety, and the locations of circuits and equipment, including power and communication lines and fire protective signaling circuits.

**Medical Services and First Aid:**

1. Cardiopulmonary Resuscitation (CPR) and First Aid Training

- a. When Plant employees are performing work on or associated with exposed lines or equipment energized at 50 volts or more, persons trained in first aid including CPR shall be available as follows:
  - i. for fieldwork involving two or more Plant employees at a work location, at least two trained persons shall be available. However, only one trained person need be available if all Plant employees are trained in first aid, including CPR, within three months of their hiring dates; and
  - ii. for fixed work locations (such as the Central Heating Plant, Refrigeration Plant or Cogeneration Plant), the number of trained persons available shall be sufficient to ensure that each Plant employee exposed to electric shock can be reached within four minutes by a trained person. However, where the existing number of employees is insufficient to meet this requirement (at a remote substation, for example), all Plant employees at the work location shall be trained

2. First Aid Supplies

First aid supplies shall be placed in a weatherproof container if the supplies could be exposed to the weather or detrimental conditions (e.g., heat, humidity, etc.). Each first aid kit shall be well maintained, ready for use, and inspected frequently enough to ensure that expended items are replaced and at least once per year.

**Job Briefing:**

The Plant Manager shall ensure that the Plant employee in charge conducts a job briefing with the Plant employees involved before they start each job. The briefing shall cover at least the following subjects: hazards associated with the job, work procedures involved, special precautions, energy source controls, and personal protective equipment requirements.

1. Number of Briefings

- a. If the work or operations to be performed during the workday or shift are repetitive and similar, at least one job briefing shall be conducted before the start of the first job of each day or shift. Additional job briefings shall be held if significant changes, which might affect the safety of Plant employees, occur during the course of the work.

2. Extend of Briefings

- a. A brief discussion is satisfactory if the work involved is routine and if the Plant employee, by

virtue of training and experience, can reasonably be expected to recognize and avoid the hazards involved in the job. A more extensive discussion shall be conducted if:

- i. the work is complicated or particularly hazardous; or
- ii. the Plant employee cannot be expected to recognize and avoid the hazards involved in the job.

### 3. Working Alone

- a. A Plant employee working alone need not conduct a job briefing. However, the Plant Manager shall ensure that the tasks to be performed are planned as if a briefing were required.

### Lockout/Tagout Procedures:

All provisions of the Central Plant's written Lockout/Tagout Program shall be adhered to during all work on electric power systems associated with electric power generation, transmission, and distribution systems

### Confined Space Entry

All provisions of the Central Plant's written Confined Space Entry Program shall be adhered to during all work on electric power systems associated with electric power generation, transmission, and distribution systems.

### Personal Protective Equipment

Personal protective equipment shall meet the requirements of 29 CFR 1910, Subpart I, "Personal Protective Equipment" (see Appendix A).

### Ladders

Ladders shall meet the requirements of 29 CFR 1910, Subpart D, "Walking-Working Surfaces" (see Appendix B).

#### 1. Conductive Ladders

- a. Portable metal ladders and other portable conductive ladders shall not be used near exposed energized lines or equipment.

### Hand and Portable Power Tools

#### 1. Cord-Connected and Plug-Connected Equipment

##### a. Premises Wiring

- i. Cord-connected and plug-connected equipment supplied by premises wiring shall meet the requirements of 29 CFR 1910, Subpart S, "Electrical" (see Appendix C).

##### b. Non-Premises Wiring

- i. Any cord-connected or plug-connected equipment supplied by other than premises wiring shall comply with one of the following:
- ii. it shall be equipped with a cord containing an equipment grounding conductor connected to the tool frame and to a means for grounding the other end (however, this option shall not be used where the introduction of the ground into the work environment increases the hazard to a Plant employee); or
- iii. it shall be of the double-insulated type conforming to 29 CFR 1910, Subpart S, "Electrical" (see Appendix C); or
- iv. it shall be connected to the power supply through an isolating transformer with an



ungrounded secondary.

## 2. Portable and Vehicle-Mounted Generators

- a. Portable and vehicle-mounted generators used to supply cord-connected and plug-connected equipment shall meet the following requirements:
  - i. the generator shall only supply equipment located on the generator or the vehicle, and cord-connected and plug-connected equipment through receptacles mounted on the generator or the vehicle;
  - ii. the non-current-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles shall be bonded to the generator frame;
  - iii. in the case of vehicle-mounted generators, the frame of the generator shall be bonded to the vehicle frame; and
  - iv. any neutral conductor shall be bonded to the generator frame.

## 3. Hydraulic and Pneumatic Tools

- a. Safe operating pressures for hydraulic and pneumatic tools, hoses, valves, pipes, filters, and fittings shall not be exceeded. In the absence of defects, the maximum rated operating pressure is the maximum safe operating pressure.
- b. If any hazardous defects are present, there is no safe operating pressure and the hydraulic or pneumatic equipment involved shall not be used.
- c. A hydraulic or pneumatic tool used where it may contact exposed live parts shall be designed and maintained for such use.
- d. The hydraulic system supplying a hydraulic tool used where it may contact exposed live parts shall provide protection against the loss of insulating value for the voltage involved due to the formation of a partial vacuum in the hydraulic line. Hydraulic lines without check valves having a separation of more than 35 feet between the oil reservoir and the upper end of the hydraulic system promote the formation of a partial vacuum.
- e. A pneumatic tool used on energized electrical lines or equipment, or used where it may contact exposed live parts, shall provide protection against the accumulation of moisture in the air supply.
- f. Pressure shall be released before connections are broken, unless quick-acting, self-closing connectors are used. Hoses shall not be kinked.
- g. Plant employees shall not use any part of their bodies to locate or attempt to stop a hydraulic leak.

## Live-Line Tools

### 1. Design of Tools

- a. Live-line tool rods, tubes, and poles shall be designed and constructed to withstand the following minimum tests:
  - i. 100,000 volts per foot (3281 volts per centimeter) of length for 5 minutes if the tool is made of fiberglass-reinforced plastic (FRP) (live-line tools using rod and tube that meet ASTM F711-89, *Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live-Line Tools*, conform to this criterion); or
  - ii. 75,000 volts per foot (2461 volts per centimeter) of length for 3 minutes if the tool is made of wood; or
  - iii. other tests that the Plant can demonstrate are equivalent.

### 2. Condition of Tools

- a. Each live-line tool shall be wiped clean and visually inspected for defects before use each day.
- b. If any defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live-line tool is present after wiping, the tool shall be removed from service, examined and tested according to paragraph 10.2.3 before being returned to service.
- c. Live-line tools used for primary employee protection shall be removed from service every two years,

and whenever required under paragraph 10.2.2, for examination, cleaning, repair, and testing as follows:

- i. each tool shall be thoroughly examined for defects;
- ii. if a defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live-line tool is found, the tool shall be repaired and refinished or shall be permanently removed from service;
- iii. the tool shall be tested after it has been repaired or refinished;
- iv. if no such defect or contamination is found, the tool shall be cleaned and waxed, and the tool shall be tested unless the tool is made of fiberglass-reinforced plastic (FRP) rod or foam-filled FRP tube and the Plant can demonstrate that the tool has no defects that could cause it to fail in use;
- v. the test method used shall be designed to verify the tool's integrity along its entire working length and, if the tool is made of FRP, its integrity under wet conditions;
- vi. the voltages applied during testing shall be as follows:
  - 75,000 volts per foot (2461 volts per centimeter) of length for 1 minute if the tool is made of fiberglass; or
  - 50,000 volts per foot (1640 volts per centimeter) of length for 1 minute if the tool is made of wood; or
  - other tests that the Plant can demonstrate are equivalent

Guidelines for the examination, cleaning, repairing, and in-service testing of live-line tools are contained in the Institute of Electrical and Electronics Engineers Guide for In-Service Maintenance and Electrical Testing of Live-Line Tools, IEEE Std. 978-1984

### **Materials Handling and Storage**

Materials handling and storage shall conform to the requirements of 29 CFR 1910, Subpart N, "Materials Handling and Storage" (see Appendix D).

### **Deenergizing Lines and Equipment for Plant Employee Protection**

All provisions of the Central Plant's written Lockout/Tagout Program shall be adhered to during all work on electric power systems associated with electric power generation, transmission, and distribution systems.

### **Grounding for the Protection of Plant Employees**

For a Plant employee to work on lines or equipment as deenergized, the lines or equipment shall be deenergized under the provisions of the Central Plant's written Lockout/Tagout Program and shall be grounded as specified in paragraphs 14.2 through 14.8 of this policy. However, if the Plant can demonstrate that installation of a ground is impracticable or that the conditions resulting from the installation of a ground would present greater hazards than working without grounds, the lines and equipment may be treated as deenergized provided all of the following conditions are met

- i. the lines and equipment have been deenergized under the provisions of the Central Plant's written Lockout/Tagout Program;
- ii. there is no possibility of contact with another energized source; and
- iii. the hazard of induced voltage is not present.

#### **1. Equipotential Zone**

- a. Temporary protective grounds shall be placed at such locations and arranged in such a manner as to

prevent each Plant employee from being exposed to hazardous differences in electrical potential.

2. Protective Grounding Equipment
  - a. Protective grounding equipment shall be capable of conducting the maximum fault current that could flow at the point of grounding for the time necessary to clear the fault. This equipment shall have an ampacity greater than or equal to that of No. 2 AWG copper. (Note: guidelines for protective grounding equipment are contained in the American Society for Testing and Materials, *Standard Specifications for Temporary Grounding Systems to be Used on Deenergized Electric Power Lines and Equipment*, ASTM F855-1990.)
  - b. Protective grounds shall have an impedance low enough to cause immediate operation of protective devices in case of accidental energizing of the lines or equipment.
3. Testing
  - a. Before any ground is installed, lines and equipment shall be tested and found absent of nominal voltage, unless a previously installed ground is present.
4. Order of Connection
  - a. When a ground is to be attached to a line or to equipment, the ground-end connection shall be attached first, and then the other end shall be attached by means of a live-line tool.
5. Order of Removal
  - a. When a ground is to be removed, the grounding device shall be removed from the line or equipment using a live-line tool before the ground-end connection is removed.
6. Additional Precautions
  - a. When work is performed on a cable at a location remote from the cable terminal, the cable may not be grounded at the cable terminal if there is a possibility of hazardous transfer of potential should a fault occur.
7. Removal of Grounds for Test
  - a. Grounds may be removed temporarily during tests. During the test procedure, the Plant shall ensure that each Plant employee uses insulating equipment and is isolated from any hazards involved, and the Plant shall institute any additional measures as may be necessary to protect each exposed Plant employee in case the previously grounded lines and equipment become energized

### Underground Electrical Installations

This paragraph provides additional requirements for work on underground electrical installations.

#### 1. Access

A ladder or other climbing device shall be used to enter and exit a manhole or subsurface vault exceeding 4 feet (122 cm) in depth. No Plant employee shall climb into or out of a manhole or vault by stepping on cables or hangers.

#### 2. Lowering Equipment into Manholes and Vaults

- a. Equipment used to lower materials and tools into manholes or vaults shall be capable of supporting the weight to be lowered and shall be checked for defects before use. Before tools or materials are lowered into the opening of a manhole or vault, each Plant employee working in the manhole or vault shall be clear of the area directly under the opening.

#### 3. Attendants for Manholes and Vaults

- a. While work is being performed in a manhole or vault containing energized electric equipment, a Plant

employee with first aid and CPR training meeting paragraph 3.1 of this policy shall be available on the surface in the immediate vicinity to render emergency assistance.

- b. Plant employees entering manholes or vaults containing unguarded, uninsulated energized lines or parts of electric equipment operating at 50 volts or more are required to be qualified Plant employees under paragraph 12.1 of this policy.
- c. Reliable communications, through two-way radios or other equivalent means, shall be maintained among all Plant employees involved in the job.

#### 4. Duct Rods

- a. If duct rods are used, they shall be installed in the direction presenting the least hazard to Plant employees. A Plant employee shall be stationed at the far end of the duct line being rodded to ensure that the required minimum approach distances are maintained.

#### 5. Multiple Cables

- a. When multiple cables are present in a work area, the cable to be worked on shall be identified by electrical means, unless its identity is obvious by reason of distinctive appearance or location, or by other readily apparent means of identification. Cables other than the one being worked on shall be protected from damage.

#### 6. Moving Cables

- a. Energized cables that are to be moved shall be inspected for defects.

#### 7. Defective Cables

- a. Where a cable in a manhole or vault has one or more abnormalities that could lead to or be an indication of an impending fault (i.e., oil or compound leaking from the cable or joints, broken cable sheaths or joint sleeves, hot localized surface temperatures of cables or joints, or joints that are swollen beyond normal tolerance), the defective cable shall be deenergized before any Plant employee may work in the manhole or vault, except when service load conditions and a lack of feasible alternatives require that the cable remain energized. In that case, Plant employees may enter the manhole or vault provided they are protected from the possible effects of a failure by shields or other devices that are capable of containing the adverse effects of a fault in the joint.

#### 8. Sheath Continuity

- a. When work is performed on buried cable or on cable in a manhole or vault, metallic sheath continuity shall be maintained or the cable sheath shall be treated as energized.

### Substations

This paragraph provides additional requirements for substations and for work performed in them.

#### 1. Access and Working Space

- a. Sufficient access and working space shall be provided and maintained around electrical equipment to permit ready and safe operation and maintenance of such equipment. Guidelines for the dimensions of access and working space around electrical equipment in substations are contained in American National Standard - National Electrical Safety Code, ANSI C2-1987. Installations meeting the ANSI provisions comply with this paragraph. An installation that does not conform to the ANSI standard will, nonetheless, be considered as complying with this paragraph if the Plant can demonstrate that the installation provides ready and safe access based on the following evidence:
  - i. the installation conforms to the edition of ANSI C2 that was in effect at the time the installation was made;
  - ii. the configuration of the installation enables employees to maintain the minimum approach

distances required by paragraph 12.2 of this policy while they are working on exposed, energized parts; and

- iii. the precautions taken when work is performed on the installation provide protection equivalent to the protection that would be provided by access and working space meeting ANSI C2-1987.

## 2. Draw-Out-Type Circuit Breakers

- a. When draw-out-type circuit breakers are removed or inserted, the breaker shall be in the open position. The control circuit shall also be rendered inoperative, if the design of the equipment permits.

## 3. Substation Fences

- a. Conductive fences around substations shall be grounded. When a substation fence is expanded or a section is removed, fence-grounding continuity shall be maintained, and bonding shall be used to prevent electrical discontinuity.

## 4. Guarding of Rooms Containing Electric Supply Equipment

- a. Rooms and spaces in which electric supply lines or equipment are installed shall meet the requirements of paragraph 16.4.1 through 16.4.4 of this policy under the following conditions:
  - i. if exposed live parts operating at 50 to 150 volts to ground are located within 8 feet of the ground or other working surface inside the room or space;
  - ii. if live parts operating at 151 to 600 volts and located within 8 feet of the ground or other working surface inside the room or space are guarded only by location, as permitted under paragraph 16.5.1 of this policy; or
  - iii. if live parts operating at more than 600 volts are located within the room or space, unless:
  - iv. the live parts are enclosed within grounded, metal-enclosed equipment whose only openings are designed so that foreign objects inserted in these openings will be deflected from energized parts, or
  - v. the live parts are installed at a height above ground and any other working surface that provides protection at the voltage to which they are energized corresponding to the protection provided by an 8-foot height at 50 volts.
- b. The rooms and spaces shall be so enclosed within fences, screens, partitions, or walls as to minimize the possibility that unqualified persons will enter.
- c. Signs warning unqualified persons to keep out shall be displayed at entrances to the rooms and spaces.

## 5. Guarding of Energized Parts

- a. Guards shall be provided around all live parts operating at more than 150 volts to ground without an insulating covering, unless the location of the live parts gives sufficient horizontal or vertical or a combination of horizontal and vertical clearance to minimize the possibility of accidental Plant employee contact. Guidelines for the dimensions of clearance distances around electric equipment in substations are contained in American National Standard - National Electrical Safety Code, ANSI C2-1987. Installations meeting the ANSI provisions comply with this paragraph. An installation that does not conform to the ANSI standard will, nonetheless, be considered as complying with this paragraph if the Plant can demonstrate that the installation provides sufficient clearance based on the following evidence.
  - i. the installation conforms to the edition of ANSI C2 that was in effect at the time the installation was made;
  - ii. each Plant employee is isolated from energized parts at the point of closest approach; and
  - iii. the precautions taken when work is performed on the installation provide protection equivalent to the protection that would be provided by horizontal and vertical clearances

meeting ANSI C2-1987.

- b. Except for fuse replacement and other necessary access by qualified persons, the guarding of energized parts within a compartment shall be maintained during operation and maintenance functions to prevent accidental contact with energized parts and to prevent tools or other equipment from being dropped on energized parts.
  - c. When guards are removed from energized equipment, barriers shall be installed around the work area to prevent Plant employees who are not working on the equipment, but who are in the area, from contacting the exposed live parts.
6. Substation Entry
- a. Upon entering an attended substation, each Plant employee other than those regularly working in the station shall report his or her presence to the employee in charge in order to receive information on special system conditions affecting Plant employee safety
  - b. The job briefing required by paragraph 4.0 of this policy shall cover such additional subjects as the location of energized equipment in or adjacent to the work area and the limits of any deenergized work area.

## Power Generation

This paragraph provides additional requirements and related work practices for power generating plants

1. Interlocks and Other Safety Devices
  - a. Interlocks and other safety devices shall be maintained in a safe, operable condition
  - b. No interlock or other safety device may be modified to defeat its function, except for test, repair, or adjustment of the device.
2. Changing Brushes
  - a. 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 changed while the generator is energized if a ground condition exists.
3. Access and Working Space
  - a. See paragraph 16.1 of this policy.
4. Guarding of Rooms Containing Electric Supply Equipment
  - a. See paragraph 16.4 of this policy
5. Guarding of Energized Parts
  - a. See paragraph 16.5 of this policy
6. Water or Steam Spaces
  - a. The following requirements apply to work in water and steam spaces associated with boilers:
    - i. a designated Plant employee shall inspect conditions before work is permitted and after its completion. Eye protection, or full face protection if necessary, shall be worn at all times when condenser, heater, or boiler tubes are being cleaned; and
    - ii. where it is necessary for Plant employees to work near tube ends during cleaning, shielding shall be installed at the tube ends.
7. Chemical Cleaning of Boilers and Pressure Vessels
  - a. Areas where chemical cleaning is in progress shall be cordoned off to restrict access during cleaning. If flammable liquids, gases, or vapors or combustible materials will be used or might be produced

during the cleaning process, the following requirements also apply:

- i. the area shall be posted with signs restricting entry and warning of the hazards of fire and explosion; and
  - ii. smoking, welding, and other possible ignition sources shall be prohibited in the restricted area.
- b. The number of Plant personnel in the restricted area shall be limited to those necessary to accomplish the task safely.
  - c. There shall be ready access to water or showers for emergency use.
  - d. Plant employees in restricted areas shall wear protective equipment meeting the requirements of 29 CFR 1910, Subpart I, "Personal Protective Equipment" (see Appendix A) and including, but not limited to, protective clothing, boots, goggles, and gloves.
8. Boilers
- a. Before internal furnace or ash hopper repair work is started, overhead areas shall be inspected for possible falling objects. If the hazard of falling objects exists, overhead protection such as planking or nets shall be provided.
  - b. When opening or operating a boiler door, Plant employees shall stand clear of the opening of the door to avoid the heat blast and gases which may escape from the boiler.

### **Special Conditions**

1. Current Transformer Secondary
  - a. The secondary of a current transformer may not be opened while the transformer is energized. If the primary of the current transformer cannot be deenergized before work is performed on an instrument, a relay, or other section of a current transformer secondary circuit, the circuit shall be bridged so that the current transformer secondary will not be opened.
2. Illumination
  - a. Sufficient illumination shall be provided to enable the Plant employee to perform work safely
3. Backfeed
  - a. If there is a possibility of voltage backfeed from sources of cogeneration or from the secondary system (for example, backfeed from more than one energized phase feeding a common load), the requirements of paragraph 12.0 of this policy apply if the lines or equipment are to be worked on as energized, and the requirements of paragraphs 13.0 and 14.0 of this policy apply if the lines or equipment are to be worked on as deenergized.
4. Hydraulic Fluids
  - a. Hydraulic fluids used for the insulated sections of equipment shall provide insulation for the voltage involved.

## **RELATED POLICIES**

NYU Environmental Health and Safety Policy

## **RELEVANT RESOURCES**