DEPARTMENT OF LABOR AND INDUSTRY

MNOSHA Instruction **CPL 2-1.18C**
July 27, 2016
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SUBJECT: Enforcement of the Electric Power Generation, Transmission, and Distribution Standard, 29 CFR § 1910.269 and 29 CFR § 1926.950 thru 1926.968.

Purpose:

This directive provides information to assist OSHA compliance personnel in performing inspections of electric power generation, transmission, and distribution lines and equipment and other installations covered by § 1910.269 and 1926.950 through 1926.968.

Scope:

This instruction applies MNOSHA-wide.

References:

1. Federal OSHA Instruction CPL 2-1.38, "Enforcement of the Electric Power Generation, Transmission, and Distribution Standard," dated June 18, 2003.

2. MNOSHA Instruction STD 1-7.3, "29 CFR § 1910.147, Control of Hazardous Energy (Lockout/Tagout)--Inspection Procedures and Interpretive Guidance."

3. MNOSHA Instruction STD 1-16.7, "Electrical Safety-Related Work Practices--Inspection Procedures and Interpretive Guidelines," dated October 28, 2015. [Includes guidance on the scope/coverage of §§1910.331 through 1910.335 with respect to qualified and unqualified employees at power generation, transmission, and distribution installations.]

4. Federal OSHA Instruction CPL 2.42, "Interagency Agreement between MSHA and OSHA," dated March 29, 1979.

5. Federal OSHA Instruction CPL 2.86, "Memorandum of Understanding Between OSHA and the U.S. Nuclear Regulatory Commission," dated December 11, 1989.

6. MNOSHA Instruction CPL 2-2.100, "Application of the Permit-Required Confined Spaces (PRCS) Standard, 29 CFR § 1910.146," dated January 20, 2016.

7. MNOSHA Instruction STD 5-3.1B, "Enforcement of the Confined Spaces Standard for Construction, 1926.1201-1213 dated April 19, 2016."

8. NFPA 70E—2015 Edition, "Standard for Electrical Safety in the Workplace."

Cancellation:

This instruction cancels MNOSHA Instruction CPL 2-1.18B, "Enforcement of the Electric Power Generation, Transmission, and Distribution Standard, 29 CFR § 1910.269," dated May 16, 2003.

Background:

Minnesota OSHA adopted the Electric Power Generation, Transmission, and Distribution Standard (§ 1910.269) on July 25, 1994. This directive covers policy on § 1910.269, provides instructions to assist OSHIs in performing electric utility type inspections, and provides additional clarification on inspection resources and OSHI safety; conduct of inspections, including accident investigations; jurisdictional issues; construction vs. maintenance; and clarification of several major issues and definitions. A glossary of industry terms is included in Appendix A. Appendix B includes clarifications of major issues. Additionally, this directive covers policy on the new Construction regulations of Subpart V, including 1926.950 through 1926.968, along with Appendices A through G respectively.

ACTION:

A. Inspection Resources and OSHI Safety.

The OMT Director/Supervisor must ensure that an adequate number of appropriately trained and/or experienced OSHIs, and other resources, as required, are available for inspections at electric power generation, transmission, and distribution installations covered by § 1910.269 and 1926.950 through 1926.968.

1. General.

All OSHIs must, at a minimum, have received basic electrical safety training (OSHA Training Institute Course #3090 or equivalent) to enter an electric power generation facility. The following inspection activities require the additional (specialized) OSHI training in paragraph A.3. below and the OSHI must be accompanied by a qualified person when engaging in these activities, in accordance with Appendix B (Issue #17) of this Instruction:

a. Entry into room or space in a generation plant or substation that is restricted to qualified persons only. See §§ 1910.269(u)(4) and (v)(4). [Note: OSHIs are only to enter these rooms or spaces when absolutely necessary and only upon approval of the OMT.]
b. Inspections of electric power transmission or distribution work covered by § 1910.269 and 1926.950 through 1926.968.

2. OSHI Safety and Health.

OSHIs and their OMT Directors/Supervisors must evaluate the inspection assignments to determine, to the best of their ability, whether exposure to safety, fire, electrical, and/or health hazards may exist during the inspection process. In addition, the specific electric power generation, transmission, and/or distribution facility work areas involved in the inspection should be independently evaluated onsite by the OSHI before entering such areas to determine whether there are any other hazardous exposures. No OSHI may endanger himself or herself at any time. OSHIs must take appropriate precautionary measures based upon the site evaluations and their training.

3. Minimum Training.

The minimum training requirements for any OSHI who will be inspecting an electric power generation, transmission, and/or distribution facility or other site covered by § 1910.269 or 1926.950 through 1926.968 and who must enter an electrical restricted space as defined in A.1., are:

a. Completion of the Electric Power Generation, Transmission, and Distribution OSHA Technical Institute (OTI) course #3190, or its equivalent.

   NOTE: Some OSHIs have received electrical safety-related work practice training through utility or other industry work experience and training. This experience and outside training may be used to meet the minimum training requirements. Additionally, OSHIs who have outside training/experience or who have successfully completed the interim 3-day OTI course on § 1910.269 may perform such inspections; however, they are encouraged to attend the OTI #3190 course.

b. Depending upon the type of work assignments and associated hazards to be encountered, an OSHI may be required to take other training courses. OSHIs may encounter enclosed or confined spaces during an inspection. Enclosed spaces, are, by definition permit-required confined spaces, and OSHIs must treat them as such. OSHIs may not enter such spaces on a routine basis. When it is essential, they must adhere to the requirements in MNOSHA Instruction CPL 2-2.100, “Application of the Permit-Required Confined Spaces (PRCS) Standard, 29 CFR § 1910.146,” or MNOSHA Instruction STD 5-3.1B “Enforcement of the Confined Spaces Standard for Construction, 1926.1201-1213 dated April 19, 2016.”

Furthermore, OSHIs may enter enclosed spaces or confined spaces only if they have successfully completed the minimum OTI training courses, or their equivalent, for: (1) Confined Space Entry, (2) Respiratory Protection, and (3) Introduction to Industrial Hygiene for Safety Personnel.

4. Sources for Training.

The following are sources of (1) general and (2) site-specific training that OSHIs may receive:

General Training Sources.

a. OSHA Technical Institute
b. Utility companies
c. Trade unions
d. Trade associations

Site-Specific Training Sources

a. District Power Utility (DPU)
b. Establishment file/packages in the office
c. Inspection histories of firms and establishments, including results of any accident investigation.

5. Avoiding Exposure to Hazards.

Except as provided in the section on resources and safety, OSHIs must take reasonable measures to avoid any exposure to electrical and other hazards when performing inspection activities. Exposure may be avoided by such inspection techniques as interviewing employees or management representatives in a safe location, photographing from a safe location, and using engineering or similar drawings in lieu of obtaining direct measurements.

6. Hazardous Energy Control Procedures.

OSHIs may approach equipment that is properly locked or tagged out in accordance with § 1910.147, § 1910.269(d), § 1910.269(m) and (n), or § 1910.333(b). OSHIs must evaluate the adequacy of the safe work practices, which include the energy control procedures, and must not approach any machines or equipment that the employer considers de-energized if any practices are not in compliance with the referenced OSHA standards.

NOTE: OSHIs relying on an employer's energy control practices are considered "outside personnel" and must, per § 1910.147(f)(2) and § 1910.269(d)(8)(iv), understand and comply with the restrictions and prohibitions of the host employer's energy control program and safe work practices. For example, OSHIs must follow the group lockout or tagout provisions, which include verifying (or having the primary authorized employee verify) that the energy sources are effectively isolated, before inspecting machinery or equipment that may contain hazardous energy.

B. Conduct of Inspection.

The OSHI must comply with the § 1910.269 and 1926.950 through 1926.968 safe work practice requirements and stay out of (electrical and non-electrical) hazardous areas, unless it is essential for information gathering purposes. If it is necessary to enter hazardous areas, information must be obtained from the employer about the specific hazards in the area. Steps must be taken to eliminate or control the hazards prior to and during the inspection, including recommendations on safety-related precautions.

1. Electrical hazards.

OSHIs are not to enter restricted electrical areas as described in paragraph A,1., unless it is essential for information gathering purposes. If entry is necessary, the OSHIs must (1) be properly trained/experienced according to paragraph A.3., (2) be accompanied by a qualified person under § 1910.269 or 1926.950 through 1926.968 while they are in the restricted area, and (3) obtain OMT approval prior to entering the restricted area. (See Appendix B, Issue 17). Some examples of restricted rooms or spaces in electric power generation facilities or substations are:

a. Electrical vaults
b. Manholes
c. Switchgear rooms
d. Switch yards and
e. Transformer rooms

Because electricity is normally not observable, OSHIs are reminded to be cautious when approaching utility employees working with machinery, mechanical equipment (e.g., aerial lift “bucket” trucks; cranes), or electric equipment for their own safety and so as not to interrupt the employees before determining that it is safe to do so. Due to the presence of open busbars and other energized equipment in this industry, OSHIs should take caution not to touch anything that could be energized.

NOTE: Subsection 1910.269(p)(4), and “Appendix C to Section 1910.269, Protection from Step and Touch Potentials,” as well as Subpart V Appendix C, “Protection from Hazardous Differences in Electric Potential,” provide additional information on the protective measures needed for hazards resulting from differences in electric potential.

2. Chemical and Atmospheric Hazards.

OSHIs are to inquire about the presence and any known levels of gases, fumes, and vapors, and the location of high pressure water and steam lines, for their own protection as well as that of facility employees. OSHIs may make a referral to a health investigator if concerns regarding chemical or atmospheric hazards are noted. Some examples of situations where such hazards may be present are:

a. Enclosed or confined spaces may contain various chemical (e.g., hydrocarbons, hydrogen sulfide) and hazardous atmospheres. For example, furnace effluents can contain particulate substances, coal tar pitch volatiles, sulphur dioxide, and carbon monoxide. Particulate from flash contains silica, and possibly arsenic, depending on the type of coal used. (A clue to the constant presence of sulphur dioxide is corroded metal structures or surfaces.)

b. Toxic material, such as hydrazine, and flammable liquids, gases, vapors, or combustible materials may be used or produced during the chemical cleaning of boilers and pressure vessels. (Hydrazine has a PEL of 1 ppm and may be absorbed through the skin.)

c. Ozone is produced in some high voltage electrical operations. For example, it may be present in high concentrations in electrostatic precipitators.

d. Chlorine is likely to be present in chlorine system enclosures and may be present in the surrounding area. As a consequence of water treatment, there may be hazardous toxic or reactive chemicals in drainage trenches in the lowest levels of the power plant.

e. High pressure steam leaks, which may be invisible, are hazardous energy sources to which exposure can be fatal. For example, steam from a pinhole leak could lance completely through the body of a person. The noise in the generation area may conceal this hazard. Experienced employees travel in these areas with a broom or a rag tied onto a stick held in front of them to detect such steam hazards.

f. Chrysotile asbestos is present in older power generation facilities. Amosite asbestos may be in use in valve packing

g. Mercury may be present in the flooring of the instrument repair area of the power plant.

h. Cadmium may be used to coat fish-screens in the intake caissons and to tip blades used to propel coal.

i. Polychlorinated biphenyls (PCBs) may be present in maintenance operations involving capacitors and transformers. Dioxin may be present where these compounds were overheated.

3. Other Potential Hazards

a. Water spaces may pose permit-required confined space engulfment hazards (CPL 2-2.100 and STD 5-3.1B address confined spaces).

b. During overhaul of boilers, inadequate scaffolding and boatswain chairs may present fall hazards; OSHIs should inspect for such fall hazards, particularly in the expansion spaces between the boilers and gratings.

c. Because of extremely high temperatures, eye protection must be used when looking into the flame of a boiler to avoid the potential for eye damage due to intense electromagnetic radiation in the optical range. Safety spectacles with side shields are used as primary protection to shield the eyes from heat hazards. To adequately protect the eyes and face from high temperature exposure, safety spectacles in combination with a heat-reflective face shield should be used.

d. Slag may be mechanically removed from fireside surfaces of boilers (e.g., tubes and furnace surfaces); protection from falling slag and other objects is required by § 1910.269(v)(9)(i).

   One particularly hazardous work activity involves the use of explosives to blast slag from inside boiler surfaces. Safe work practices associated with this activity may be addressed by the electric power generation (§ 1910.269), explosives and blasting agents (§ 1910.109), permit-required confined spaces (§ 1910.146), process safety management of highly hazardous chemicals (§ 1910.119), and other OSHA standards.

e. Areas where pulverized coal is transported, stored, or processed may contain explosive coal/air mixtures. Electric equipment in such areas must be approved for the hazardous (classified) location. Location of a safe means of egress must always be kept in mind.

f. There are noise hazards related to induction fans.

4. Personal Protective Equipment (PPE)

a. OSHIs must, at a minimum, wear flame-resistant or flame-retardant-treated (FR) clothing with a minimum arc thermal performance exposure value (ATPV) rating of 5 cal/cm2 in areas where electric arc or flame hazards exist. Additional PPE (e.g., face shields, goggles, hand protection) may be required depending upon the extent of the burn hazard. Appropriate clothing must be worn in areas with electric shock or electrical burn hazards, and FR clothing use is recommended for all other inspection activities to set a good example.

   NOTE: The 2015 edition of the National Fire Protection Association, Standard for Electrical Safety in the Workplace, NFPA 70E, establishes flash boundaries criteria with respect to the use of personal protective equipment (PPE) and other protective equipment. This design, construction, and use standard also provides risk tables and a PPE matrix that assist the user in selecting appropriate PPE, including protective clothing for common work tasks.

OSHIs should consult and comply with these recognized good practices for the particular hazards to be encountered and avoid exposure (as described in Section B.1.) whenever possible.

b. OSHIs are not to wear or don electrical protective equipment (e.g., rubber insulating gloves and sleeves), use live line tools (e.g., "hot stick"), or test instruments that are typically used by qualified employees in the power industry. Additionally, compliance personnel must not enter flash protection boundaries for work tasks with a "Hazard/Risk Category" of #4 without specific OMT Director/Supervisor authorization and the appropriate training because a FR flash protection suit would be required.

c. When inspecting power generation, transmission, or distribution facilities, OSHIs must wear non-conductive head protection (Class B helmets) and appropriate eye and face protection meeting the respective ANSI Z87.1 and ANSI Z89.1 standards whenever head and eye hazards exist (or in accordance with the company safety rules). Polycarbonate or cruzite safety glasses provide some measure of eye protection from flash-over.

d. When working in environments with elevated temperatures such as boiler rooms, OSHIs are encouraged to take heat illness precautions, including consuming plenty of water and adopting work-rest regimens.

e. Properly sized leather work gloves are useful to prevent injury when touching or grabbing hot or gritty surfaces or objects in the power plant.

5. Special Precautions When Obtaining Photographs and Recordings.

a. Documentation of worksite conditions and equipment during the walk around inspection normally can be conducted at a safe distance by using cameras with telephoto lenses. Cameras may be used in hazardous (classified) locations only after the area has been characterized as "safe" through use of a combustible gas indicator, reference to the employer's "hot" work permit system, or other appropriate methods.

b. Consult with qualified onsite personnel and determine how to safely obtain necessary documentation including photographs and recordings from restricted areas. In some situations, detailed sketches may be more appropriate than photographs/videos. Qualified onsite personnel will be able to draw sketches themselves as part of interview statements obviating the need, in some cases, for anyone to enter restricted areas for documentation purposes.

c. On-site personnel should not be asked to take inspection photographs/videos for OSHIs.

C. Information About the Facility.

1. ***General Information.*** OSHIs should consider general information about the facility, including size, layout, who built it, sources of incoming energy, maximum energy output, maximum fault currents, types and specifications of utilization equipment, method(s) of power generation (if applicable), maximum voltages developed, maximum amperes transmitted, maximum capacities of lines, location of PPE and tools, person(s) responsible for maintaining and testing the PPE and tools, etc.

2. ***Specific Information.*** Consider as much specific information as possible about the areas of the facility to be inspected, including but not limited to: job titles of the employees (such as power line workers in power transmission inspections; and maintenance electrician, watchmen [boiler end], watch electrician, and firemen in power generation plant inspections); plot plans and nomenclature of the equipment involved in the operations to be inspected; specific normal operating voltage, ampere and ohm/resistance/reactance/resistivity ranges of the equipment; potential maximum peaks of amperes and voltages in abnormal situations; maximum rated capacities of the equipment; and hazardous (classified) location designations.

   NOTE: During the walk-around inspection, additional information may be obtained by observation of signs, labels, equipment markings, nature of walking/working surfaces, vertical and overhead structures, etc., as well as through consultation with members of the walk-around party and other employees.

3. ***State Utility and District Power Utility (DPU) Standard References.*** Due to the performance-based nature of this work practices standard, in some cases it may be useful to obtain State Utility or DPU standard references. This will enable the OSHI to determine, as appropriate, if the facility is following certain safety-related guidelines.

D. Accident Investigations.

1. ***Photographs, Videotapes, and Other Recorded Evidence.*** Ask for photographs, videotapes, computer monitoring recordings/records, and dispatches made or taken near the time of the accident for the facility being inspected. There is often valuable information in the photographs/records/tapes that will be helpful in completing the investigation. Retain as part of the case file, only those photographs, records, etc., deemed necessary for determining the cause of the accident and/or needed to support a proposed violation.

2. ***Information from the Medical Examiner.*** Contact the medical examiner to obtain additional information if critical to the case.

E. Coordination with Other Agencies and Referrals.

OMT Directors/Supervisors must coordinate their inspection and hazard abatement activities with MSHA and/or NRC Field Offices to ensure the safety of affected employees. Referrals of hazards must be made as appropriate.

1. Mine Safety & Health Administration (MSHA)

The requirements in § 1910.269 and 1926.950 through 1926.968 apply to conditions and installations for which MSHA does not, "exercise statutory authority to prescribe or enforce standards or regulations." MSHA's jurisdiction relative to power generation plants generally covers the preparation of coal prior to final transport of the coal into the power generation building (where the coal is burned).

"Preparation" includes activities such as mixing, breaking, crushing, sizing, washing, cleaning, storing, loading, and mechanically-assisted drying. The location of these activities (whether on or off the property owned or leased by the power generation company) is not an issue. The following two scenarios are provided to assist in understanding the MSHA/OSHA interface:

a. Coal is stored outdoors in piles on the property of a power generation company. The coal is run through a crusher building, after which it is sized, washed, and artificially dried before it is dumped on a conveyor and transported into the power generation building. In this scenario, MSHA has jurisdiction until the prepared coal is dumped onto the conveyor which carries it into the power generation building.

b. Coal is stored outside the power generation building in silos, hoppers, or outdoor piles. Some of the coal is stored on the property of a power generation company, and some is stored on adjacent property not belonging to the power generation company. However, the power generation company has the contractual right to transport and use all of the coal in its facility. After arrival, the coal is not prepared in any way before use. It is loaded from the various storage areas on both properties onto conveyors, which deliver it directly into the power generation building. OSHA has jurisdiction over all of the activities described in this scenario, including the silos, hoppers, and outdoor piles.

   Federal OSHA Instruction CPL 2.42, the Interagency Agreement Between MSHA and OSHA, should be consulted for guidance on the delineation of interagency authority. Because the above information may not be sufficient to delineate jurisdictional boundaries in some situations, after discussion with their OMT Director/Supervisor, the inspecting OSHI or OMT Director/Supervisor should contact the local MSHA office for a determination regarding the applicability of the Mine Safety and Health Act in situations in which OSHA may be preempted from exercising its inspection authority.

2. Nuclear Regulatory Commission (NRC).

Both the NRC and OSHA have jurisdiction over occupational safety and health at NRC-licensed facilities, many of which are electric power generation plants fueled by nuclear energy. At such facilities OSHA covers plant conditions which result in occupational hazards, but which do not affect the safety of the licensed radioactive material. For example, OSHA covers exposures to toxic non-radioactive material and other non-radioactive related hazards throughout the facility. Specifically, § 1910.269 and 1926.950 through 1926.968 applies throughout such facilities except in areas directly involved in the support and/or the production of nuclear energy.

Federal OSHA Instruction CPL 2.86, the Memorandum of Understanding Between the Occupational Safety and Health Administration and the U.S. Nuclear Regulatory Commission, should be consulted for guidance on the interface between OSHA and the NRC and general areas of responsibility of each agency.

F. Construction vs. Maintenance.

1. Definition of Construction.

A general definition of "construction" is given in § 1910.12(b) as follows: "for purposes of this section, construction work means work for construction, alteration, and/or repair, including painting and decorating."

2. Examples.

Following are some examples of situations in which the issue of construction vs. maintenance may arise:

a. The building of new power lines and towers, generation plants, underground distribution facilities and power stations is construction. Additions to or extensions of existing equipment or lines is also construction.

b. Moving an existing power line and supporting poles, even without alteration or replacement of parts, a few feet to the side to allow for the widening of a roadway is construction and covered under Part 1926, Subpart V, because this is a layout alteration. If there were violations, the company moving the power lines, (in this scenario the contractor working on the roadway) would be cited under Part 1926. If further down the road, longer power lines (with longer power line spans) or different sized poles (e.g., 35 feet to 40 feet pole replacement) had to be installed to cross the widened span of the roadway, this operation would also be covered under the construction standards due to the design specification changes involved.

c. Generally speaking, reconfiguration of space or installation of new equipment (such as equipment capable of carrying higher voltages) is construction; refurbishing (replacement "in kind") equipment and space is maintenance and covered under the general industry standards.

d. Scheduled touch-up and spot painting that is done to maintain equipment or structures is not construction. Therefore, maintenance painting for power generating, transmission, and distribution equipment is covered by § 1910.269. Painting to complete newly built structures and buildings is construction covered by Part 1926. Additionally, a complete repainting job in one room or on a major portion of a structure or building is construction and removal of lead-based paint is also construction. (Note: Painting is not covered by Part 1926, Subpart V.)

e. The repair of specific limited portions of electrical systems with "replacement in kind" parts to keep them in operation is maintenance and covered by the general industry standards.

G. Other Related Standards.

All other general industry standards (e.g., permit-required confined spaces) continue to apply to installations covered by these electrical safe work practices unless an exception is given by § 1910.269 or the other standards. References in this work practice standard to other sections of Part 1910 are provided only for emphasis. [See § 1910.269(a)(1)(iii)]

The OSHA standard at § 1910.268 pertains to telecommunications work. Much of the field work related to § 1910.268 is similar in nature to the type of field work performed by electric utility employees, and the hazards faced in the performance of this type of work are frequently similar but may differ in magnitude. The standard's applicability would be determined by the activity being performed by the employee(s).

Furthermore, § 1910.269 and 1926.950 through 1926.968 primarily addresses electrical safety-related work practices for **qualified employees** only; it contains very few equipment design and installation requirements. Electric power generation, transmission, and distribution installations typically are designed to conform to the National Electrical Safety Code (ANSI/IEEE C-2) and/or National Electrical Code (ANSI/NFPA 70).

Work activities by **unqualified employees** on, near, or with electric power generation, transmission, or distribution lines or equipment are covered by Subpart S, Safety-related Work Practices. An employee who is undergoing on-the-job training, but is not under the direct supervision of a qualified person, is considered an unqualified employee for the performance of those duties.

Additionally, the electrical safety-related work practices in Subpart S of 29 CFR 1910 apply if the work does not meet the line clearance tree trimming definition in § 1910.269(x) and 1926.968 or if the line clearance tree trimming work is performed by an employee other than a qualified employee or line-clearance tree trimmer. In other words, a work activity is considered a line-clearance tree trimming operation covered by § 1910.269 if:

1. The operation meets the definition of line-clearance tree trimming (i.e., tree or brush must be closer than 10 feet to the line or equipment); and

2. The employee doing the tree trimming is a line-clearance tree trimmer or a § 1910.269 qualified employee.

   NOTE: Paragraphs § 1910.269(a)(2), (b), (c), (g), (k), (p), and (r) apply to line-clearance tree trimming operations performed by line-clearance tree trimmers who are not qualified employees. The entire § 1910.269 standard, except for paragraph (r)(1) applies to line-clearance tree trimming operations performed by qualified employees.

The determining factor in this definition is the location of the tree or brush with respect to an electric power transmission or distribution line or equipment, not the location of the work. Thus, if an employee is trimming a tree and any part of that tree is less than 10 feet from the line or equipment, the work meets the definition of line-clearance tree trimming.

Furthermore, other general industry standards, as well as ANSI Z133.1-2000, Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush – Safety Requirements, may be referenced for tree trimming safety practices and procedures for tree trimming work regardless of whether electrical hazards are present.

H. Reference Documents.

Appendix E to § 1910.269 provides a list of reference documents and national consensus standards that can be helpful in understanding and complying with the § 1910.269 performance-oriented requirements. Appendix G to 1926.950 through 1926.968 also provides reference documents.

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For the MNOSHA Management Team

Distribution: OSHA Compliance and WSC Director

Attachments: Appendix A - Glossary of Industry Terms
Appendix B - Clarification of Major Issues
Appendix C - Side by Side Comparison 1910.269 to 1926 Subpart V
Appendix D - Additional Resources

NOTICE: Minnesota OSHA Directives are used exclusively by MNOSHA personnel to assist in the administration of the OSHA program and in the proper interpretation and application of occupational safety and health statutes, regulations, and standards. They are not legally binding declarations and they are subject to revision or deletion at any time without notice.

APPENDIX A: GLOSSARY OF INDUSTRY TERMS

Air gap withstand voltage: A voltage which corresponds to a 1 in 1000 probability, approximately, of flashover as determined by the statistical method described in § 1910.269 Appendix B, paragraph IV.A.4.

Ampacity: The current-carrying capacity of electric conductors expressed in amperes.

Anchorage: A secure point of attachment for personal fall arrest equipment which is independent of the means of supporting or suspending employees.

Applied load: The working load to which mechanical equipment is subjected when lifting and/or moving lines or other materials.

Atmospheric pressure or temperature differences: The differences between the pressure or temperature inside, relative to the temperature or pressure outside an enclosed space.

AWG: American Wire Gauge (also called Brown and Sharpe gauge). AWG refers to wire size, that is the diameter of a wire.

Backfeed: Energizing an otherwise deenergized circuit by a power source other than the deenergized power source.

Body belt (safety belt): A strap with the means both for securing it about the waist and for attaching it to a lanyard, lifeline, or deceleration device.

Body harness: A design of straps which may be secured about the employee in a manner to distribute the fall arrest forces over at least the thighs, pelvis, waist, chest and shoulders with means of attaching it to other components of a personal fall arrest system.

Bonding: Joining of conductive parts to form an electrically conductive path designed to maintain a common electrical potential.

Breakdown voltage: The voltage at which a disruptive discharge takes place through or over the surface of insulation.

Brush: A conductor, usually composed, in part, of some form of the element carbon, serving to maintain an electric connection between stationary and moving parts of a machine or apparatus.

Buckling: A lateral deflection. For example, a power or telephone pole which deflects in a horizontal direction, that is, perpendicular to the length of the pole, such that the pole is bowed relative to its ends.

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

Capacitor: An electrical device which stores an electric charge. It consists of two conducting plates of metal separated by an insulating material called a dielectric. Capacitance (C) is the ability to store an electric charge where C=Q/V and Q is the amount of charge and V is voltage. The unit for capacitance is the Farad (F).

Capacitor bank: A group of electrically connected capacitors. A capacitor bank is used to raise the power factor, that is, it tends to bring the voltage and current in phase. When the voltage and current are perfectly in phase, the power factor is unity (one).

Catch-off point: An attachment point on supporting structures to which load bearing hardware and accessories, rigging and hoists are attached to install or remove line conductors.

Central location under the exclusive control of a system operator: (Reserved pending republication]

Circuit transient: A change in the steady state condition of voltage or current or both. It is the transition period during which the current and voltage change from their former value to new ones. This transition interval is called the transient; before and after which, the circuits are said to be in the steady state condition. Transients may be caused by lightning, by faults, or by switching operations and may be transferred readily from one conductor to another by means of electrostatic or electromagnetic coupling.

Climbers: A pair of hooked shaped devices which are used by an employee to ascend, maintain working positions and descend wooden poles. Climbers are worn over the work shoes such that the curved part of the hook fits under the shoe between the heel and sole and the stem of the hook fits against the inside of the lower leg. Climbers are strapped on the leg below the knee and on the foot at the ankle.

Closed circuit: An unbroken conductive path for current to flow from the electromotive force (emf) through loads and back to the emf source.

Coal bunker: An open bin in which coal is stored. A bunker has a four-sided cross section; whereas a coal silo, also used to store coal, has a circular cross section.

Cogeneration: Two or more power generating stations supplying electric energy to the same distribution-transmission system.

Commingled: (Reserved pending re-publication).

Condenser: A heat exchange where latent heat is removed from, for example, turbine exhaust steam without changing the steam temperature. The steam passes over tube bundles through which water flows. Heat from the steam is conducted through the tubes to the water which carries the heat away.

Conductor grip: A device designed to permit the pulling of conductor without splicing on fittings, eyes, etc. It permits the pulling of a continuous conductor where threading is not possible. The design of these grips varies considerably.

Current transformer: An instrument transformer intended to have its primary winding connected in series with the conductor carrying the current to be measured or controlled.

Dead end: The end of an electric wire or cable which may or may not be energized.

Dielectric: A medium in which it is possible to maintain an electric field with little or no supply of energy. Examples of dielectric materials are air, teflon, paper, Bakelite and ceramic (electrolyte type).

Dielectric Strength: The maximum potential gradient a dielectric material can withstand without breakdown, that is, becoming a conductor.

Direct supervision: (Reserved pending re-publication.]

Drawhead: The body of an automatic coupler used to connect railroad (coal and ash carrying) cars and locomotives. (See Knuckle.)

Dropline: A vertical lifeline.

Drop starting: Starting a portable saw by holding the saw away from the body in one hand and with no other means of support, pulling the starting cord (rope) with the other hand.

Elasticity of synthetic rope: The ratio of ["A" minus "B"] to "B" or alternatively [(A – B):B] where:

1. "A" equals the elongated length of the rope when fully supporting the load.
2. "B" equals the stretched full length of the rope before supporting any of the load.
3. The rope length is measured from the anchor connection to the safety belt or harness connection.
4. The load is the combined tool and body weight of the climber.

Electric generators: Machines which convert mechanical power into electric power; whereas, electric motors are machines which convert electric power into mechanical power.

Electromagnetic radiation: The flow of energy consisting of orthogonally vibrating electric and magnetic fields lying transverse to the direction of propagation. X-rays, ultraviolet, visible, infrared, and radio waves occupy various portions of the electromagnetic spectrum and differ only in frequency and wavelength.

Electromagnetic wave: A wave characterized by variations of electric and magnetic fields.

Electrostatic shielding: A ground wire or static wire mounted above and strung along the line conductors, in similar fashion to the line conductors, to protect or shield the circuit from lightning.

Employee proficiency: The employee, through training required by §1910.269(a)(2), has the knowledge and skills necessary to perform work practices mandated by § 1910.269 in a safe manner.

Energized: For the purpose of § 1910.269(d), "energized" means connected to an energy source or containing residual or stored energy. Otherwise § 1910.269Ix) defines energized as electrically connected to a source of potential difference, or electrically charged so as to have a potential significantly different from that of the earth in the vicinity.

Equipotential zone: A three dimensional space in which temporary protective grounds are placed (located and arranged) to eliminate hazardous step potentials and touch potentials (See definitions in §1910.269 Appendix C, paragraph II.C.1.)

> NOTE: See ANSI/IEEE Standard 1048-1990, IEEE Guide for Protective Grounding of Power Lines for guidance on safe protective grounding methods for persons engaged in de-energized transmission and distribution line maintenance.

Exciter: The source of all or part of the field current for the excitation of an electric machine.

> NOTE: Familiar sources include direct-current commutator machines; alternating-current generators whose output is rectified; and batteries.

Exothermic: A chemical reaction that releases energy, for example, heat. Oxidation and Reduction Chemical reactions are exothermic. For example, Sodium (Na) atoms combined with Chlorine (Cl_2) molecules react to form salt (NaCl) and emit heat by the following equation:

$$2Na \text{ (reducing agent)} + Cl_2 \; \text{?} \; 2NaCl$$

Expulsion-type fuse: A vented fuse in which the expulsive effect of gases produced by the arc or burning of the fuse holder, either alone or aided by a spring, extinguishes the arc. The arc erodes the tube of the fuse holder, producing a gas that ignites causing an explosion that blasts the arc out through the fuse tube vent(s) and thereby opens the circuit.

Extra high voltage (EHV): Voltage levels higher than 240,000 volts.

Fault: A partial or total local failure in the insulation or continuity of a conductor.

Fault current (general): (Reserved pending re-publication.).

Flashover (gap sparkover) voltage: A disruptive discharge through air around or over the surface of solid or liquid insulation, between parts of different potential or polarity, produced by the application of voltage wherein the breakdown path becomes sufficiently ionized to maintain an electric arc.

Flume: An artificial channel or chute that transports and directs the flow of water, for example, to the hydroelectric turbine. Flumes may be open or closed. A canal is an example of an open flume and a penstock is an example of a closed flume.

Forced air ventilation: Mechanical ventilation such as a permanent or portable blower (as opposed to natural ventilation).

Forebay: An open basin, that is, a small reservoir to take care of variations in water flow demand at the turbine. A forebay is located between the canal on the upper end and the penstock on the lower end of a hydroelectric power plant installation which directs water from the upper reservoir to the hydraulic turbine below.

Free-fall: The act of falling before the personal fall arrest system begins to apply force to arrest the fall.

Gaff: The metal spur part of climbers. The gaff is attached to the bottom of the hook stem and protrudes toward the other foot. (See **Climbers**.)

Gap: The clear air space between objects.

Hazardous energy: A voltage at which there is sufficient energy to cause injury. If no precautions are taken to protect employees from hazards associated with involuntary reactions from electric shock, a hazard is presumed to exist if the induced voltage is sufficient to pass a current of 1 milliampere through a 500 ohm resister. (The 500 ohm resistor represents the resistance of an employee. The 1 milliampere current is the threshold of perception.) If employees are protected from injury due to involuntary reactions from electric shock, a hazard is presumed to exist if the resultant current would be more than 6 milliamperes (the let-go threshold for women).

Hazardous (induced) voltage: 50 volts (rms) or more.

High power testing: Using fault currents, load currents, magnetizing currents, or line dropping currents for testing, either at the rated voltage of the equipment under test or at lower voltages.

Impedance (z): The ratio of voltage to current expressed in complex terms. It represents the opposition that a circuit offers to ac current. z = v ¸ i measured in ohms where v = voltage and i = current.

Induced voltage: A voltage produced around a closed path or circuit by a change in magnetic flux linking that path.

Jumper: A short length of cable used to make electric connections within, between, among, and around circuits and their associated equipment.

NOTE: Electrical connections made with jumpers are usually temporary.

Knuckle: The movable arm that connects with the drawhead to form the coupling on railcars and locomotives. (See Drawhead.)

Laser: Light Amplification by Simulated Emission of Radiation. Any of several devices that convert incident electromagnetic radiation of mixed frequencies to one or more discrete frequencies of highly amplified and coherent radiation may be called a laser.

Line Insulator: A device that prevents the flow of an electric current by direct contact or flashover and is used to support electric conductors. A function of an insulator is to separate the energized conductors from the poles or towers. Insulators are fabricated from porcelain, glass, clay and fiberglass.

Live-line bare-hand work (technique): Work performed by a qualified employee or person in an equipotential zone established at the potential of a line conductor.

Live-line tool rods, tubes, and poles (hot sticks): Insulating tools used by employees to perform live-line servicing and maintenance. These tools insulate the employee from an energized part and enable the employee to work a safe distance from an energized part.

Loadline: A rope or line that bears the weight of a mass, for example, a tower or a tower sections during erection or removal.

Maximum rated load (or load rating): The maximum applied load for which the mechanical equipment is designed and built by the manufacturer and identified on the nameplate of the equipment.

Maximum rated operating pressure: The maximum operating pressure for which a hydraulic or pneumatic tool is designed and built by the manufacturer and identified on the nameplates of these tools.

Metering (meter installation inspection): Examination of the meter, auxiliary devices, connections, and surrounding conditions, for the purpose of discovering mechanical defects or conditions that are likely to be detrimental to the accuracy of the installation. Such an examination may or may not include an approximate determination of the percentage registration of the meter.

Microwave (data transmission): A term generally used to signify radio waves in the frequency range from about 1000 megahertz (MHZ) upwards. Microwave radio signals are used for point-to-point communication between substations and other power system facilities and specifically, for communication channels, protective relaying, supervisory control and remote metering.

Normal (Gaussian) distribution: A continuous probability distribution which is defined by

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-½(x-\mu)^2/\sigma^2}$$

The standard normal distribution or curve is obtained by substituting t = (x - μ) into f(x) above or

$$\Phi(t) = \frac{1}{\sqrt{2\pi}} e^{-½t^2}$$

which has a mean $\mu = 0$, and a variance, Var = $\sigma = 1$.
The above normal (Gaussian) distribution curve is a bell-shaped curve, which is symmetrical about the positive y-axis (at which $\Phi(t)$ has its maximum value) of an x-y graph. The ends of the curve approach the x-axis as x increases and as -x decreases.
In one standard deviation ($\sigma = 1$), there is 68.2% of the area under the curve, that is, there is a 68.2% probability that the random variable lies within one standard deviation. Likewise, there is a 95.4% and 99.6% probability within $\sigma = 2$ and $\sigma = 3$, respectively.

Open circuit: A break in the circuit so that a complete conductive path is not provided for current to flow.

Overhead lines: Electric transmission or distribution line conductors installed overhead either inside or outside of a building.

Overvoltage: A voltage above the normal rated voltage or the maximum operating voltage of a device or circuit.

Parallel circuit: A circuit in which two or more (for example, resistor) components are connected across the same voltage source.

Partial vacuum: The pressure inside a vessel is less than the atmospheric pressure surrounding the vessel.

Penstock: The closed conduit which transports water at the upper reservoir level to the (tail-water reservoir) level below at a hydroelectric power plant. A penstock is located between a forebay at the end of the canal on the upper level and a hydraulic turbine in the powerhouse on the lower level.

Personal fall arrest equipment: Consists of a body belt or body harness, connectors and may include a lanyard, deceleration device, lifeline or suitable combination.

Personal fall arrest system: A system used to arrest an employee in a fall from a working level. It consists of an anchorage and personal fall arrest equipment.

Personal tagout devices: Prominent warning devices, secured to energy isolating devices in accordance with an established procedure that uniquely identify each employee performing the servicing/maintenance activity and that indicate that the energy isolating device(s), and the machines or equipment being controlled, cannot be operated until the personal tagout device is removed. Master tags, sign-in/sign-out logs, personal identification cards, and other personal accountability devices are personal tagout devices as long as (1) they identify each authorized employee being protected and (2) the person in charge (principal and primary authorized employees), system operator, and other relevant persons reliably can ascertain the identity of, and account for, each authorized employee who is being protected by each respective device.

Phase-to-ground voltage: The voltage measured by a voltmeter between a conducting transmission line and a ground wire, for example the electrostatic shielding conductor to the ground (earth).

Phase-to-phase voltage: The voltage measured by a voltmeter between conducting transmission lines.

Phasing out: Live-line maintenance to determine whether the phase of a given electric line (or apparatus) corresponds with the phases of another line (or apparatus) when a new line is to be paralleled with another line, new or old, and after repairs or changes have been made on either of two lines which have previously operated in parallel. When a phasing out voltmeter, connected across corresponding lines or phases reads zero voltage, the phases of the two lines are properly installed in-phase.

Power line carrier: Using radio frequency energy, generally below 600 kHz, to transmit information over transmission lines whose primary purpose is the transmission of electric power.

Pull rig: A rig used to install or remove a line conductor. The pull rig consists of a take-up reel and carriage, a pulling rope and a puller.

Relaying: Remote operation of electric control relays by microwave radio signals, by power line carrier signal, or by pilot wire communications.

Resistance (r): The physical property of an element, device, branch, network, or system that is the factor by which the mean-square conduction current must be multiplied to give the corresponding power lost by dissipation as heat or as other permanent radiation or loss of electromagnetic energy from the circuit. In short, resistance means the opposition to current flow.

RMS: An acronym for root mean square. It is the square root of the average square of the instantaneous magnitude of the voltage or current taken throughout one period. A RMS value is the effective value. Effective values are specific values of voltages and current to which time varying, periodic (alternating) voltages and currents (ac) are associated. By definition, the effective value of a periodic direct voltage and current, Veff and Leff respectively, is the positive direct voltage and current (dc) that produces the same average power (Pav) in a resistor (R) or Pav = Veff2/R and Pav = Ieff2R.

NOTE: Electric appliances are rated in effective (RMS) values. Also, most ac ammeters and voltmeters give readings in effective values.

Example of how to calculate RMS values:

For a sinusoidal voltage, the average power loss is
$P_{av} = V_M^2/2R$, where V_M is the peak value of the sinusoidal voltage.
Then $P_{av} = V_{eff}^2/R = V_M^2$ and $V_{eff} = V_M/\sqrt{2} = 0.707\ V_M$.
Summarizing, the effective voltage (V_{eff}) equals 0.707 times the peak voltage (V_M) of the sinusoidal at voltage.
A similar calculation yields: $I_{eff} = I_M/\sqrt{2} = 0.707\ I_M$.

NOTE: Different periodic (alternating) voltages and currents have different effective values. For example, a saw tooth (or triangular wave) has effective values equal to the peak values divided by the square root of 3. Effective values must be calculated (using calculus) for each different periodic wave configuration.

Safety (climber's) saddle: A harness used as part of a climbing system to secure a climber aloft. The safety saddle consists of a body belt, with an additional strap or straps fitting around the lower buttocks or upper thighs to support the climber in a sitting position. It connects to the climbing rope with a locking rope snap, double-locking carabiner or a knot attached to a designated anchor point on the safety saddle, approximately opposite the climber's navel. The climber is secured by a taut-line hitch, another suitable climbing hitch, or mechanical device.

Safety strap: A strap used to support employees in a working position on poles, towers and platforms. Integral snaphooks on each end of the strap connect to different D-rings of a body belt. The strap is adjustable for length by means of a buckle in the strap to suit the workman and the support, for example, the pole, it fits around.

Series circuit: A circuit in which there is only one path for current to flow along.

Short circuit: An abnormal connection (including an arc) of relatively low impedance, whether made accidentally or intentionally, between two points of different potential.

Skirt (petticoat): The outer skirt-like portion of a line insulator.

Snaphook: A connector comprised of a hook-shaped member with a normally closed keeper, or similar arrangement, which may be opened to permit the hook to receive an object and when released, automatically closes to retain the object. Snaphooks are generally one of two types:

1. The locking type with a self-closing, self locking keeper which remains closed and locked until unlocked and pressed open for connection or disconnection, or

2. The non-locking type with a self-closing keeper, which remains closed until pressed open for connection or disconnection.

Standard deviation (σ) : The square root of variance (Var) which measures the spread or dispersion of a random variable (x) with respect to the mean (μ) or expected value. Where,

$$\mu = \sum_{\infty}^{-\infty} x \; f(x) \; dx$$

Stored energy: Residual mechanical, thermal or electric energy possessed by a machine or equipment after powering and controlling energy source(s) have been isolated. Also, stored electric energy (W) means the electromagnetic energy and the electrostatic energy stored in a transmission line at any instant, or W = ½ L i2 + ½ C e2 where, C is capacitance, L is inductance, and i and e are instantaneous current and voltage, respectively.

Stringing (pilot line): A lightweight rope used to pull the pulling rope to which a line conductor is attached typically for pole installation through the stringing blocks of travelers.

Stringing sheave: A sheave which is used to redirect the travel of a line conductor during its installation or removal. The sheave is mounted on a string block attached to a supporting (pole, tower) structure.

Stringing sock or board: A device which is used to pull multiple line conductors simultaneously by one pulling line.

String insulators: Multiple insulators mounted one upon the other to provide the required spread distance between the line conductors and pole or tower supporting components. The number of insulator units in a string depends largely on the voltage of the line, that is, the higher the voltage the more insulator units in a string.

Substation: A high-voltage electric system facility used to switch generators, equipment, and circuits or lines in and out of the system, change ac voltages from one level to another, and/or change AC to DC or DC to AC.

Surge arrestor: A device that prevents high voltages (overvoltages) from building up on a circuit by discharging or by passing surge current from lightning or transient voltages and then restores normal circuit conditions.

Surge (transients): A transient wave of current, potential, or power in an electric circuit. Surges can be caused by direct lightning strokes or induced charges as a result of lightning strokes to ground or can be caused by circuit-switching operations as well as the operation of devices connected to the lines.

Switching surge: Transient voltage (overvoltage) caused by opening, closing or short circuiting an electrical system.

Taps: Connecting deenergized conductors to live lines by special live (hot) line tapping clamps. (See ANSI/IEEE Std. 100-1988, IEEE Standard Dictionary of Electrical and Electronic Terms.)

Tension stringing: The use of pullers and tensioners to keep the conductor under tension and positive control during the stringing phase, thus keeping it clear of the earth and other obstacles which could cause damage.

Test observer: An employee who guards a high-voltage or high-power testing area to prevent unauthorized entry.

Transformer: An electromagnetic device having two or more stationary coils coupled through a mutual flux. Basic components of a transformer are the core and primary and secondary coils (windings). These coils are electrically insulated from each other. Electric energy is transferred from one coil to the other coil using magnetic coupling. The coil receiving energy from an ac source is called the primary and the coil delivering energy to the ac load is called the secondary.

Transient voltage: Over voltage or under voltage with respect to steady state voltage.

Travel restricting equipment (restraint system): (Reserved pending re-publication.]

Voltage Regulator: A device that maintains constant voltage. A voltage regulator is used to vary alternating current (ac) supply or source voltage to keep the voltage within the limits desired.

Waveguide: A system of material boundaries or structures, for example, a hollow cylinder (circular cross section) made of a good conducting material, for guiding electromagnetic waves. Waveguides are used to transfer very high frequency energy at high power levels from place to place. Energy conveyed by the waveguide is contained in the electric and magnetic fields established within the guide.

Web-type lanyard: A strap of woven synthetic fibers.

Work-positioning equipment: Equipment used in a positioning device system that is used by an employee for support in an elevated position on a vertical object, for example, a power pole, or on a vertical surface, for example the side of a building, so that both hands are free to perform work.

APPENDIX B: CLARIFICATION OF MAJOR ISSUES

1. Generation or transmission: §1910.269(d) and (m)

Electric power generation plants typically have the electrical output of the generators feeding a substation. The generating plant substation, in turn, steps up the voltage and supplies a transmission line. Thus, the question arises as to where generation stops and transmission begins.

Section 1910.269 does not define "generation," "transmission," or "distribution." Generally, with respect to the application of §1910.269, the distinction between transmission and distribution is immaterial; the same rules apply to both systems. However, lockout and tagging of electrical power in installations for the generation of electric power is covered under paragraph (d), whereas the deenergizing of transmission and distribution lines is covered under paragraph (m). Therefore, the distinction between "generation" and "transmission and distribution" is important in the application of hazardous energy control (lockout/tagout) and de-energizing requirements.

It is common for electric utilities to consider everything on the load side of the disconnects for the output side of the generator step-up transformers to be part of the transmission system and for everything else in the substation, including the electrical installation back to the generator, to be part of the generating installation. However, some utilities (and many industrial generators) treat everything from the load side of the disconnect for the generator itself as transmission (or, in the case of industrial generators, in-plant distribution). In such cases, everything within the substation would be considered to be part of the transmission system.

NOTE: The "load side" of a disconnect is the portion of the circuit that is deenergized when the disconnect is open. It includes parts of the disconnect that also become deenergized when it is open. In the networked type of installation used by electric utilities, the "load side" might be energized through downstream sources of electric power. However, for the purposes of this definition (as applied in generating stations), these downstream sources should be ignored.

With respect to electrical systems that might become energized during the course of work, OSHA considers paragraph (m) to provide the same level of protection to employees as that provided by paragraph (d). Under paragraph (m)(3), normally energized lines and equipment are not to be treated as deenergized until after:

a. system clearance has been obtained,
b. disconnect switches have been opened,
c. tags have been applied,
d. lines and equipment have been tested to ensure deenergization, and
e. protective grounds have been installed.

The protective grounds [which must meet the requirements of paragraph (n)] ensure that the safety of employees in case the system accidentally becomes energized. Paragraph (d), on the other hand, is intended to prevent the release of potentially hazardous energy during maintenance and servicing activities.

For the purpose of training employees in a single set of procedures for deenergizing electric equipment at a generating plant, employers may wish to designate certain portions of the transmission system as "generation" or to designate certain portions of the generation system as "transmission." At a generating station, OSHA will accept an employer's determination of what is considered to be generation and what is considered to be transmission or distribution under the following conditions:

a. The demarcation of where the transmission (or distribution) system begins lies somewhere between the load side of the generator disconnects and the load side of the disconnects for the output side of the generator step-up transformers, inclusive of those points;

b. The employer has clearly identified this demarcation point in his or her hazardous energy control program;

c. Unqualified employees do not have access to the disconnects or to protective grounds for the transmission system;

d. Hazards posed by non-electrical energy sources are addressed by the employer's hazardous energy control program under paragraph (d); and

e. Affected employees are trained in the interface between the generation system and the transmission system and in the associated hazardous energy control procedures.

2. Hazardous energy control: § 1910.269(d)(1) [Reserved pending re-publication]

3. Supplemental electric generating equipment: § 1910.269(a)(1)(i)(A)

The standard’s scope is intended to address both utility and equivalent industrial systems that generate power. Supplemental generating equipment used to generate electrical power is considered an equivalent industrial system that is covered by § 1910.269 requirements. However, supplemental generating equipment, such as emergency and standby generators, used to provide temporary power at a workplace are not covered by § 1910.269, but they are addressed by Subpart S, electric utilization system requirements.

4. Retrofitting of machines or equipment to accept locks: §1910.269(d)(2)(ii)(C)

Existing controls in electric power generating stations are not always designed to accept a lock. Paragraph (d)(2)(ii)(C) of §1910.269 requires any controls that are "energy isolating devices" to be replaced with devices that will accept locks whenever a machine or equipment is replaced (or new machines or equipment installed) and whenever major repair, renovation, or modification of a machine or equipment is performed. To meet this requirement, an employer may fabricate adapters that enable the energy isolating devices to accept a lock. Energy isolating devices for which adapters have been fabricated meet §1910.269(d)(2)(ii)(C) provided:

1) The adapters meet the requirements for tagout device attachment means contained in §1910.269(d)(3)(ii)(D), except that the adapter may be reusable;

2) The adapters are used when the energy isolating device is locked out or tagged out;

3) The adapters can accommodate a lock;

4) The adapters are designed to prevent the operation of the energy isolating device when a lockout device is attached; and

5) The energy isolating device itself is not being replaced, or, if it is, it cannot be replaced with one that will accept a lock without replacing other unaffected energy isolating devices or the equipment that it isolates.

5. Strength of attachment device: §1910.269(d)(3)(ii)(D)

Paragraph (d)(3)(ii)(D) of §1910.269 requires tag attachment means to have an unlocking strength of at least 50 pounds. This requirement is based on the specified strength of a standard ¼-inch nylon cable tie.

> NOTE: A ¼-inch nylon cable tie has a published unlocking strength of about 75 pounds. Section 1910.147 (on which § 1910.269(d) is based) adopted a 50-pound unlocking strength criterion to allow a smaller tie or one with a lower strength.

In cases where a ¼-inch cable is too large to fit through the tag attachment fitting on the energy isolating device, OSHA will consider the use of a thinner cable tie tagout device attachment means, which does not meet the 50-pound unlocking strength requirement of §1910.269(d)(3)(ii)(D) as a de minimis violation provided:

a. The point of attachment for the energy isolating device will not accept a cable tie with an unlocking strength of at least 50 pounds;

b. The tagout device attachment means is as strong as permitted by the point of attachment (for example, the largest size cable tie that will fit through the point of attachment is used);

c. The tagout device attachment means is strong enough to prevent unintentional or accidental removal and is attached in such a manner as to prevent inadvertent operation of the energy isolating device; and

d. The tagout device and its attachment means otherwise meet the requirements of §1910.269(d)(3)(ii)(D).

6. Employees placing lockout or tagout devices, group lockout/tagout, and master tagging programs: §1910.269(d)(4), (d)(6), (d)(7), and (d)(8)(ii) [Reserved pending re-publication.]

7. Central control of energy isolating devices: § 1910.269(d)(8)(v) [Reserved pending re-publication.]

8. Outside rescue services: §1910.269(e)(3)

Paragraph (e)(3) of §1910.269 requires employers to "provide equipment to ensure the prompt and safe rescue of employees" from enclosed spaces. Prompt rescue must be considered service that is available immediately or in a time period appropriate for the hazards faced by those entering the enclosed space. To meet this requirement, employers should follow the OSHA guidance outlined in § 1910.146, Appendix F, paragraph A.II. and applicable OSHA policy as specified in MNOSHA Instruction CPL 2-2.100.

NOTE: In 1998, OSHA amended the existing confined space standard in order to clarify and strengthen certain requirements. The revisions to paragraphs (k)(1) and (k)(2) clarified an employer's obligations to select a rescue service that is trained, equipped, and available to respond to emergencies that occur during confined space entries. The emphasis of the revised language is on the employer's evaluation of potential rescue providers, and on the factors that the employer must consider in determining whether a particular provider is capable of providing effective rescue services for the particular situations that its confined space entrants may face.

Enclosed spaces are, by definition, also permit-required confined spaces under the confined spaces standard. During electric power generation, transmission, and distribution work, enclosed spaces may be entered by qualified employees under the procedures set out in §1910.269(e) and (t) rather than those specified by § 1910.146(d) through (k). However, if the hazards remaining in the space after the procedures required by § 1910.269(e) and (t) are followed endanger the life of the entrant or could interfere with escape from the space, then the entry must conform to paragraphs (d) through (k) of § 1910.146. Because of the possibility that an enclosed space will have to be entered as a permit space under § 1910.146, employers will necessarily plan their enclosed space entry procedures taking both standards into consideration.

If the need for rescue from the space arises, two possible scenarios will be present. In the first scenario, the space would continue to be an enclosed space; no actual atmospheric hazard would be present; and entry could continue under §1910.269. In the second scenario, the space would no longer be an enclosed space, and the full permit-entry procedures required by § 1910.146 would have to be followed.

In the first scenario, the attendant could summon rescue services, enter the enclosed space, and administer first aid. For example, the entrant could suffer an electric shock. The attendant would first summon a rescue service and then check the atmosphere and other conditions in the space to ensure that it is still safe to enter. The attendant could subsequently enter the space to administer first aid and cardiopulmonary resuscitation, if necessary, to the injured entrant. In this scenario, the need to remove the entrant from the space will not arise until the rescue service arrives to treat the injured employee further and transport him or her to the hospital.

In the second scenario, the attendant would be prohibited from entering the confined space by § 1910.146. Unless a non-entry retrieval system was in place, the injured employee could not be removed from the space until the rescue service arrived.

Under either scenario, an injured entrant would not be removed from the space until rescue services arrive. Additionally, many rescue services will use their own rescue equipment rather than that provided by an employer. For these reasons, OSHA will accept an employer's reliance on rescue equipment owned by rescue services for the purpose of compliance with § 1910.269(e)(3) under the following conditions:

a. The employer complies with § 1910.146(d)(4)(viii), (d)(9), and (k);

b. The employer has evaluated a rescue service, has determined that it has the necessary rescue equipment, and can demonstrate that the service can provide for prompt and safe rescue of employees from enclosed spaces;

c. The employer arranges with this rescue service to provide for prompt and safe rescue of employees from enclosed spaces; and

d. The employer provides such additional rescue equipment as the rescue service needs to provide for prompt and safe rescue of employees from enclosed spaces.

NOTE: The employer normally will supply such personal rescue equipment as harnesses and retrieval lines, as well as first aid kits. The rescue service will normally provide mechanical lifting devices and initial response medical equipment. This will usually provide for the safest, quickest, and most effective rescues. However, if the employees will enter enclosed spaces that present obstacles to the effective use of the rescue service's normal equipment, the employer will have to supply rescue equipment that meets the particular needs of such spaces.

9. Fall protection: § 1910.269(g)(2)

Paragraph (g)(2) sets forth requirements for fall protection. The "duty to have fall protection" is specified in paragraph (g)(2)(v) which requires personal fall arrest equipment, work positioning equipment, or travel restricting equipment to be used by employees working at elevated locations more than four feet above the ground on poles, towers, or similar structures (if other fall protection, such as guardrails, has not been provided).

As explained in Note 1 to paragraph (g)(2)(v) of § 1910.269, this requirement applies only to structures that support overhead generation, transmission, and distribution lines and equipment and the note refers the reader to other OSHA fall protection requirements for walking and working surfaces (Subpart D) and aerial lifts (§ 1910.67). Furthermore, fall protection requirements for line-clearance tree trimming operations are contained in § 1910.269(r)(8).

With respect to aerial lift fall protection, employees working from a "basket" or "bucket" must, at a minimum, wear a body belt and lanyard attached to the boom or basket. [See § 1910.67(c)(2)(v).] Employers should be mindful that body harnesses are generally superior to body belts in preventing injuries from falls.

10. Tagging network protectors: §1910.269(m)(3)(ii) and (m)(3)(iii)

Paragraph (m)(3)(ii) of §1910.269 requires all switches, disconnectors, jumpers, taps, and other means through which known sources of electric energy may be supplied to the particular lines and equipment to be deenergized to be opened and tagged. Paragraph (m)(3)(iii) requires automatically and remotely controlled switches to be tagged at the point of control.

An AC network system consists of feeders, step-down transformers, automatic reverse-current trip breakers called network protectors, and the network grid of street mains. The network grid is made up of a number of single conductor cables tied together at street intersections to form a solid grid over the area they serve. This grid is typically energized at 120/208 volts from the secondary windings of the distribution transformers serving a particular area.

A network protector, placed between the secondary side of the transformer and the secondary mains, is provided for each transformer. The primary windings of the transformer are connected to a feeder cable that is energized from a substation at voltages ranging from 13 to 33 kilovolts. Each feeder cable is connected to the substation through an automatic circuit breaker.

Network protectors are placed between the network transformer and the secondary network to protect against reverse power flow through the network transformer into the supply feeders. Reverse power protection is necessary because fault current would continue to flow into a short circuit in a network transformer or primary feeder. Backfeed from the network grid would continue to flow into the fault even after the primary feeder circuit breaker trips. The other primary feeders would continue to supply power to their network transformers, which are interconnected with the faulted circuit through the network grid.

Under normal conditions, switches at the substation are used to deenergize the primary conductors to the distribution transformers. When the primary conductors become deenergized, the network protectors operate to disconnect the secondary side of the transformers and to prevent backfeed from energizing the primary conductors. The network protectors are automatic devices and are not normally opened or closed manually.

Not tagging a network protector for work on the primary feeder to its associated network transformer is considered a de minimis violation of §1910.269(m)(3)(ii) under the following conditions:

1) The line is deenergized as otherwise required by paragraph (m)(3)(ii);
2) Any switches or disconnecting means (other than network protectors) used to deenergize the line are tagged as required by paragraph (m)(3)(ii);
3) The line is tested to ensure that it is deenergized as required by paragraph (m)(3)(v);
4) Grounds are installed as required by paragraph (m)(3)(vi);
5) The network protectors are maintained so that they will immediately trip open if closed when a primary conductor is deenergized;
6) The network protector cannot be manually placed in a closed position without the use of tools, and any manual override position must be blocked, locked, or otherwise disabled; and
7) The employer has procedures for manually overriding the network protector that incorporate provisions for ensuring that the primary conductors are energized before the protector is placed in a closed position and for determining if the line is deenergized for the protection of employees working on the line.

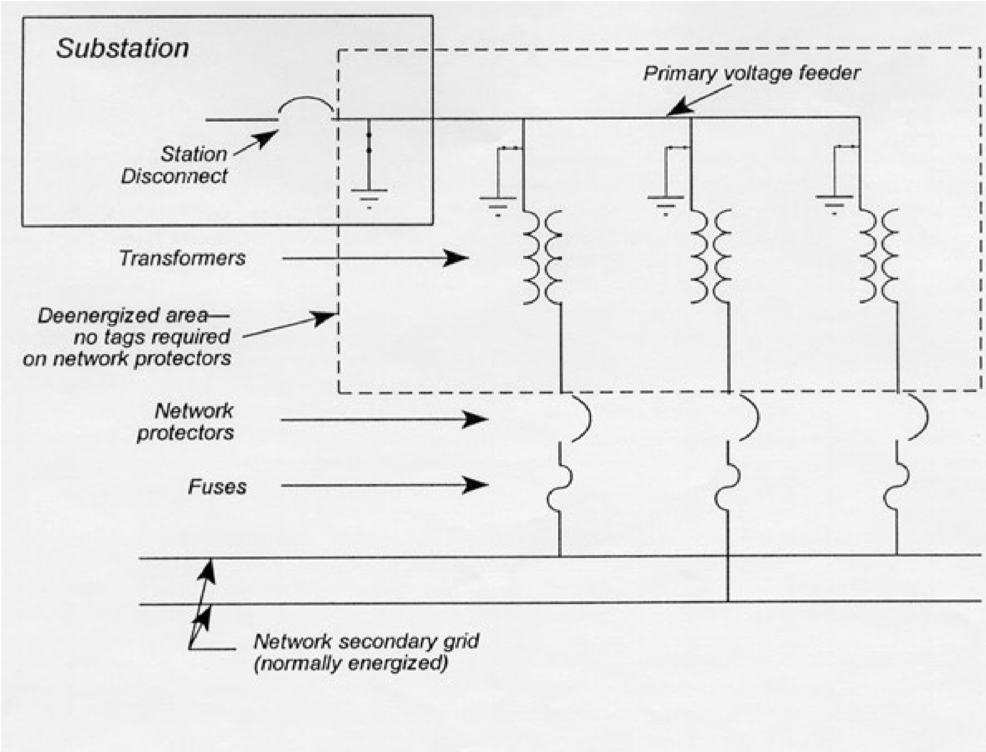

Figure 6—Network Protectors

11. Application of grounding requirements to lines and equipment rated at 600 volts or less: §1910.269(n)(1), (n)(4)

Paragraph (n)(1) of §1910.269 applies the grounding requirements of paragraph (n) to electric power transmission and distribution lines and equipment, regardless of voltage. Lines and equipment operating at 600 volts or less present certain problems with respect to compliance with paragraphs (n)(4)(i) and (n)(4)(ii).

Paragraph (n)(4)(i) requires protective grounding to be capable of conducting the maximum fault current that could flow at the point of grounding for the time necessary to clear the fault. The maximum fault current on electric power distribution lines operating at 600 volts or less is typically high enough to melt the phase conductors carrying the fault current.

NOTE: Available fault currents on 600-volt systems may be in the range of 13,000 to 80,000 amperes.

If protective grounding equipment were required to carry the maximum amount of fault current without regard to whether the phase conductors would fail, the size of the grounding equipment would be impractical. However, the standard does not require the protective grounding equipment to be capable of carrying more current than necessary to allow the phase conductors to fail. Thus, a protective grounding jumper sized slightly larger than a phase conductor would be sufficient to meet paragraph (n)(4)(i).

NOTE: While it is possible for the phase conductor to fail at a point that allows the line or equipment which the employee is working to remain energized after the failure, judicious placement of protective grounds can minimize this possibility.

Paragraph (n)(4)(ii) requires protective grounding equipment to have an impedance low enough to cause immediate operation of protective devices in case of accidental energizing of the lines or equipment. This requirement is intended to ensure that the protective grounding equipment itself does not contribute to any delay in the operation of the devices protecting the circuit. For lines and equipment operating at 600 volts or less, the design of the system allows some ground faults to occur without the operation of the circuit protection devices regardless of the impedance of the grounding equipment. However, if the impedance of the grounding equipment does not contribute to delay in the operation of the circuit protection devices and if the impedance of this equipment is low enough to provide a safe work zone for employees [as required by paragraph (n)(3)], the employer will be in compliance with paragraph (n)(4)(ii).

12. Temporary protective grounds: §1910.269(n)(3)

Paragraph (n)(3) of §1910.269 requires "temporary protective grounds" to be placed at such locations and arranged in such a manner as to prevent each employee from being exposed to hazardous differences in electrical potential. The word "temporary" in this requirement refers to the fact that the grounds are applied temporarily, while employees are working. Temporary protective grounds may include fixed as well as portable grounds, provided the fixed grounds meet the following conditions:

a. Enclosed switches that apply the grounds have a visible indicator to show when the ground has been applied; and

b. The grounds are inspected and maintained to ensure that they are fully operational.

NOTE: The **IEEE Guide for Protective Grounding of Power Lines**, ANSI/IEEE Standard 1048-1990, contains industry-recognized good engineering practices and these safe protective grounding methods should be referenced by persons engaged in the de-energization of transmission and distribution lines.

13. Testing for absence of nominal voltage: §1910.269(n)(5)

Paragraph (n)(5) of §1910.269 requires lines and equipment to be tested for the absence of nominal voltage before any ground is installed.

NOTE: The hazards presented by lines or equipment becoming energized include hazards:

(1) related to the rise in step and touch potentials;

(2) related to electric arcs; and
(3) associated with the mechanical forces that can be generated by fault current.

Some fixed grounding devices have handles that operate grounding switches from a remote position. These devices typically isolate employees from hazards associated with installing a ground on an energized line. An employer would not be in violation of paragraph(n)(5) under the following conditions even though a test for the presence of nominal voltage is not performed:

a. If grounds are installed through the use of fixed grounding switches; and

b. If the employee operates the switch from a remote position where he or she will not be exposed to the hazards of applying a ground to energized lines or equipment.

In this case, there would be no violation since no employee would be exposed to the hazards regulated by the standard.

14. Grounding at remote cable terminals: §1910.269(n)(8)

Paragraph (n)(8) of §1910.269 reads as follows:

> ***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.***

Under line-to-ground fault conditions (as would happen if a cable were accidentally reenergized while it was grounded), the difference in potential between the conductor and the ground varies from point to point along the conductor. If the cable is grounded at a location remote from where the work is being performed, the potential on the conductor at the work location would be higher than it would be at the grounding location. The design of the system and the location of the ground with respect to the work will determine whether or not the potential at the work location, under worst case conditions, will be high enough to pose a hazard to the employees working on the cable.

Paragraph (n)(8) is not intended as a general prohibition on grounding an underground cable at remote terminals (such as the source station). In fact, it is common industry practice to require station grounds for the protection of employees when work is performed on underground cable systems. Only when the hazard of having the grounds in place exceeds that of omitting the remote grounds is remote terminal grounding prohibited.

15. Testing and test facilities - visible grounds: §1910.269(o)(4)(ii)

Paragraph (o)(4)(ii) of §1910.269 requires the application of visible grounds to high voltage circuits after they are deenergized and before work is performed on the circuit. Protective grounds required by paragraph (o)(4)(ii) may include fixed as well as portable grounds, provided the fixed grounds meet the following conditions:

a. Enclosed switches that apply the grounds have a visible indicator to show when the ground has been applied; and

b. The grounds are inspected and maintained to ensure that they are fully operational.

16. Line-clearance tree trimming in bad weather: §1910.269(r)(1)(vi)

Paragraph (r)(1)(vi) of §1910.269 prohibits line-clearance tree trimmers from performing line-clearance tree-trimming work when adverse weather conditions make the work hazardous in spite of the work practices required by §1910.269

NOTE: Paragraph § 1910.269(r)(l) does not apply to qualified employees.

The note following paragraph (r)(1)(vi) describes the types of weather conditions intended to trigger this prohibition. Work in less severe weather conditions, including rain or drizzle (unless accompanied by high winds, by freezing conditions, or by thunder and lightning), is not prohibited by paragraph (r)(1)(vi). Additionally, tree trimming work is not prohibited if all electric power lines in the area to be cleared have been deenergized under §1910.269(m).

17. Access by unqualified persons to areas containing unguarded energized parts: §1910.269(u)(4) and (v)(4)

Electric power generating stations and transmission and distribution substations typically have areas containing energized electric lines and equipment. Unless the energized lines or equipment are guarded sufficiently, it is unsafe for unqualified persons to enter these spaces. Paragraphs (u)(4) and (v)(4) describe spaces within substations and generating stations, respectively, that are not acceptable for unqualified persons to enter.

Employers may train employees as qualified employees for the purposes of entering and working within restricted areas of generating stations and substations. While the training for these employees must meet §1910.269(a)(2)(ii), it need not be as comprehensive as the training normally provided to a qualified electrical worker.

NOTE: A qualified electrical worker normally undergoes a multi-year apprenticeship training program before he or she becomes fully qualified to perform all the different types of work that he or she would be expected to perform. This training includes not only these safety aspects of working on or near exposed energized circuit parts, but also training in the actual performance of specific tasks so that the work is of an acceptable level of workmanship.

These "qualified" (non-electrical) employees must have the following minimum training:

1) They must know what is safe to touch and what is not safe to touch in the specific areas they will be entering [paragraph (a)(2)(ii)(A)];

2) They must know what the maximum voltage of the area is [paragraph (a)(2)(ii)(B)];

3) They must know the minimum approach distances for the maximum voltage within the area [paragraph (a)(2)(ii)(C)]; and

4) They must be trained in the recognition and proper use of protective equipment that will be used to provide protection for them and in the work practices necessary for performing their specific work assignments within the area [paragraph (a)(2)(ii)(D)].

Until these "qualified employees" have demonstrated proficiency in the work practices involved, they are considered to be employees undergoing on-the-job training and must be under the direct supervision of a qualified employee at all times.

Rescue services and fire departments might have to enter restricted areas under emergency conditions. In such cases, where there would be a greater hazard if the rescue service or fire department personnel could not enter, a de minimis violation is considered to exist if one or more qualified employees directly supervise the operation and employees involved.

18. Chlorine repair kits: §1910.269(v)(8)(iii)

Paragraph (v)(8)(iii) of §1910.269 requires emergency repair kits to be available near chlorine system shelters or enclosures for the prompt repair of leaks in chlorine lines, equipment, or containers. Paragraph (q) of §1910.120 allows employers to evacuate their employees in lieu of complying with the provisions of that paragraph provided the employer has an emergency action plan conforming to §1910.38(a).

Employers who meet this exception, contained in §1910.120(q)(1), are not in violation of §1910.269(v)(8)(iii). In this case, there would be no violation since no employee would be exposed to the hazards regulated by paragraph (v)(8)(iii).

Paragraph (q) of §1910.120 also allows employers to rely on an outside hazardous materials response (HAZMAT) team to handle releases of hazardous materials (in this case, chlorine). If an employer does not evacuate his or her employees, the employer will be deemed to be in compliance with §1910.269(v)(8)(iii) even though chlorine repair kits are not available at the shelter or enclosure, provided the following conditions are met:

a. The employer relies on an outside HAZMAT team to respond to chlorine leaks; and

b. The employer complies with the applicable requirements of §1910.120(q).

19. Chlorine system purging: §1910.269(v)(8)(iv)

Paragraph (v)(8)(iv) of §1910.269 requires dry air to be used to purge chlorine tanks, pipes, and equipment. The purpose of this requirement is to prevent the chlorine gas from reacting with moisture in the gas used to purge the system. The use of an inert gas for this purpose is considered to be a de minimis violation of this requirement, as the use of such a gas would preclude the presence of moisture.

20. Hydrogen leaks: §1910.269(v)(10)(ii)

Paragraph (v)(10)(ii) requires excessive hydrogen makeup or abnormal loss of pressure to be considered an emergency and to be corrected immediately. The presence of hydrogen in concentrations of 10 percent of the lower flammable limit outside the hydrogen system or the loss of sufficient hydrogen to create such a concentration outside the hydrogen system is considered sufficient to trigger this requirement.

21. Hazardous (classified) locations in coal- and ash-handling areas: §1910.269(v)(11)(xii)

Paragraph (v)(11)(xii) requires the control of ignition sources in coal- and ash-handling areas where a combustible atmosphere might be produced. The note following this paragraph refers to the requirements for electrical installations in hazardous (classified) locations contained in §1910.307. The note is intended as a reference only, and §1910.269(v)(11)(xii) is not intended to add to or subtract from the duties required under §1910.307 for electrical utilization installations.

Section 500-2 of the National Electrical Code reads, in part, as follows:

> ***Location and General Requirements. Locations shall be classified depending on the properties of the flammable vapors, liquids or gases, or combustible dusts or fibers that may be present and the likelihood that a flammable or combustible concentration or quantity is present. Each room, section, or area shall be considered individually in determining its classification.***

This guidance must be used in classifying possible hazardous (classified) locations for determining compliance with §1910.269(v)(11)(xii) and §1910.307.

APPENDIX C Side by side Comparison 1910.269 to 1926 Subpart V

Major Paragraph in §1910.269	Corresponding Section in Subpart V
(a) General	§1926.950 General
(b) Medical services and first aid	§1926.951 Medical services and first aid
(c) Job briefing	§1926.952 Job briefing
(d) Hazardous energy control(lockout/tagout) procedures [applies only to work involving electric power generation installations]	§1926.950(a)(3)-Subpart V applies §1910.269 to work involving electric power generation installations
(e) Enclosed spaces	§1926.953 Enclosed spaces
(f) Excavations	§1926.967(f) Excavations.
(g) Personal protective equipment	§1926.954 Personal protective equipment
(h) Portable ladders and platforms	§1926.955 Portable ladders and platforms
(i) Hand and portable power equipment	§1926.956 Hand and portable power equipment
(j) Live-line tools	§1926.957 Live-line tools
(k) Materials handling and storage	§1926.958 Materials handling and storage
(l) Working on or near exposed energized parts	§1926.960 Working on or near exposed energized parts
(m) Deenergizing lines and equipment for employee protection	§1926.961 Deenergizing lines and equipment for employee protection
(n) Grounding for the protection of employees	§1926.962 Grounding for the protection of employees
(o) Testing and test facilities	§1926.963 Testing and test facilities
(p) Mechanical equipment	§1926.959 Mechanical equipment
(q) Overhead lines and live-line bare hand work	§1926.964 Overhead lines and live-line bare hand work
(r) Line-clearance tree-trimming operations	§1926.950(a)(3)-Subpart V applies §1910.269 to line-clearance tree-trimming operations.
(s) Communication facilities	§1926.967(k) Communication facilities
(t) Underground electrical installations	§1926.965 Underground electrical installations
(u) Substations	§1926.966 Substations
(v) Power generation	§1926.950(a)(3)-Subpart V applies §1910.269 to work involving electric power generation installations
(w) Special conditions	§1926.967 Special conditions
(x) Definitions	§1926.968 Definitions
Appendices A through G	Appendices A through G, respectively

APPENDIX D: ADDITIONAL RESOURCES

Questions and Answers on 29 CFR 1910.269 and 29 CFR Part 1926, Subpart V

This 33 page document covers many aspects including Training, Information Transfer, Job Briefing, Enclosed Spaces, Minimum Approach Distances, Protection from Electric Arcs, Fall Protection, Grounding, Line-Clearance Tree Trimming, Underground Installations and Manholes and Underground Vaults.

https://www.osha.gov/dsg/power_generation/QandAFinal.pdf

Summary and Explanation of the Final Rule

This 900 page document provides extensive discussion of all aspects of the final rules in detail.

https://www.osha.gov/dsg/power_generation/SumEx_Corrected.pdf

1910.269 Side by Side Comparison - Prior Standard v. Final Rule Issued April 11, 2014

Because the 1910.269 Standard was updated and a new final version was issued in April 2014, this comparison provides an easy means of identifying changes made to the new version.

http://e-hazard.com/arc-flash-resources/articles/pdf/OSHA-269-Table-Comp-A1.pdf