The authority vested in the Commissioner of Internal Revenue by Treasury Order Nos. 150–04 and 150–09, 26 CFR 301.7122–1 and 26 CFR 301.7701–9, and Treasury Order No. 150–13 is hereby delegated as follows:

1. The Deputy Assistant Commissioner (International); Regional Counsel; Regional Directors of Appeals, and Chiefs and Associate Chiefs, Appeals Offices; are delegated authority under section 7122 of the Internal Revenue Code to accept offers in compromise and to reject and acknowledge withdrawal of offers in compromise for matters under their respective jurisdictions regardless of the amount of the liability sought to be compromised.

2. Chiefs, Compliance Division, in service centers and Chief, Collection Division, in Austin Compliance Center are delegated authority under section 7122 of the Internal Revenue Code to accept offers in compromise and to reject and acknowledge withdrawal of offers in compromise for matters under their respective jurisdictions regardless of the amount of the liability sought to be compromised. Division chiefs may redelegate to service center and Austin Compliance Center Collection Branch chiefs the authority to reject and acknowledge withdrawal of all offers in compromise, regardless of the amount of the liability sought to be compromised, and to accept offers in compromise where the amount of the liability (including interest, penalty, additional amount, or addition to tax) is less than $100,000.

3. Chiefs, Collection Division, in districts are delegated authority under section 7122 of the Internal Revenue Code to accept offers in compromise and to reject and acknowledge withdrawal of offers in compromise for matters under their respective jurisdictions regardless of the amount of the liability sought to be compromised. Division chiefs may redelegate to any Collection branch chief, including Automated Collection and Collection Support Branch Chiefs the authority to reject and acknowledge withdrawals of all offers in compromise regardless of the amount of the liability sought to be compromised and to accept offers in compromise regardless of the amount of the liability sought to be compromised. Division chiefs may redelegate to Automation Collection Assistant Branch Chiefs the authority to reject and acknowledge withdrawals of all offers in compromise regardless of the amount of the liability sought to be compromised. Division chiefs may redelegate to group managers in the Collection Field function and to Automation Collection Assistant Branch Chiefs the authority to accept offers in compromise where the amount of the liability (including interest, penalty, additional amount, or addition to tax) is less than $100,000.

4. Chief, Field branch, and Chief, Special Procedures, are delegated the authority to accept offers in compromise where the amount of the liability (including interest, penalty, additional amount, or addition to tax) is less than $100,000 and to reject and acknowledge withdrawal of all offers in compromise regardless of the amount of the liability sought to be compromised.

5. Collection Field function group managers in districts are delegated the authority to reject and acknowledge withdrawals of all offers in compromise for matters under their respective jurisdictions regardless of the amount of the liability sought to be compromised.

6. The authority delegated to division chiefs, branch chiefs, and group managers does not include the authority to reject offers in compromise for public policy reasons. Authority to reject offers in compromise for public policy reasons is restricted to the Deputy Assistant Commissioner (International); Associates Chief Counsel; Regional Counsel; Regional Directors of Appeals; Chiefs and Associate Chiefs, Appeals Offices; District Directors; Service Center Directors; and Director, Austin Compliance Center. This authority may not be redelegated. The authority delegated to Regional Counsel may not be redelegated, except that the authority to reject offers in compromise for other than public policy reasons may be redelegated, but not lower than to District Counsel. Regional Directors of Appeals and Chiefs and Associate Chiefs, Appeals Offices, may not redelegate this authority.

7. The authority in this delegation order may not be redelegated except as indicated.

8. To the extent that the authority previously exercised consistent with this Order may require ratification, it is hereby approved and ratified.

9. Delegation Order No. 11 (Rev. 22), effective January 30, 1992, is superseded.

Dated: December 7, 1993.

Phil Brand,

Chief Compliance Officer Designee.

[FR Doc. 94–1983 Filed 1–28–94; 8:45 am]

BILLING CODE 4830–01–U

OFFICE OF THE UNITED STATES TRADE REPRESENTATIVE

Trade Policy Staff Committee (TPSC); Notice of the Effective Date, with respect to the Republic of Uzbekistan, of the Agreement of Trade Relations Between the United States of America and the Union of Soviet Socialist Republics

AGENCY: Office of the United States Trade Representative.

ACTION: Notice of the Effective Date, with respect to the Republic of Uzbekistan, of the Agreement on Trade Relations Between the United States of America and the Union of Soviet Socialist Republics.

SUMMARY: In Proclamation 6352 of October 9, 1991 (56 FR 51317), the President proclaimed that the "Agreement on Trade Relations Between the United States of America and the Union of Soviet Socialist Republics" would enter into force and nondiscriminatory treatment would be extended to products of the U.S.S.R. in accordance with the terms of the Agreement on date of exchange of written notices of acceptance in accordance with Article XVII of the Agreement. Subsequently, the U.S.S.R. was succeeded by twelve independent states, including the Republic of Uzbekistan. An exchange of diplomatic notes with the Republic of Uzbekistan in accordance with Article XVII of the Agreement, as modified by technical adjustments and retitled "Agreement on Trade Relations between the United States of America and the Republic of Uzbekistan," took place in Tashkent, Uzbekistan on January 13, 1994. Accordingly, the Agreement became effective on January 13, 1994, with respect to the Republic of Uzbekistan, and nondiscriminatory treatment is extended to products of the Republic of Uzbekistan as of January 13, 1994 in accordance with the Agreement and as provided for in Proclamation 6352 of October 9, 1991.

Frederick L. Montgomery,

Chairman, Trade Policy Staff Committee.

[FR Doc. 94–2083 Filed 1–28–94;8:45am]

BILLING CODE 3190–01–M

Sunshine Act Meetings

Federal Register

Vol. 59, No. 20

Monday, January 31, 1994

This section of the FEDERAL REGISTER contains notices of meetings published under the "Government in the Sunshine Act" (Pub. L. 94-409) 5 U.S.C. 552b(e)(3).

BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM

"FEDERAL REGISTER" CITATION OF PREVIOUS ANNOUNCEMENT: 59 FR 3408, January 21, 1994.

PREVIOUSLY ANNOUNCED TIME AND DATE OF THE MEETING: Approximately 11:00 a.m., Wednesday, January 26, 1994, following a recess at the conclusion of the open meeting.

CHANGES IN THE MEETING: Addition of the following closed item(s) to the meeting:

Proposed Federal Reserve Bank personnel action.

CONTACT PERSON FOR MORE INFORMATION: Mr. Joseph R. Coyne, Assistant to the Board; (202) 452-3204.

Dated: January 26, 1994.

Jennifer J. Johnson,

Associate Secretary of the Board.

[FR Doc. 94-2138 Filed 1-27-94; 8:45 am]

BILLING CODE 6210-01-P

LEGAL SERVICES CORPORATION

Board of Directors Meeting Changes

"FEDERAL REGISTER" CITATION OF PREVIOUS ANNOUNCEMENT: 58 FR 3931.

PREVIOUSLY ANNOUNCED TIME AND DATE: A meeting of the Legal Services Corporation Board of Directors will be held on January 29, 1994. The meeting will commence at 10 a.m.

PREVIOUSLY ANNOUNCED LOCATION OF MEETING: The Wyndham Bristol Hotel, 2430 Pennsylvania Avenue NW., The William Penn Room, Washington, DC 20037, (202) 955-6400.

CHANGES IN THE MEETING:

Status of Meeting:

Open. No business will be conducted in closed session.

Matters to be considered:

The language announced previously for agenda item number one has been changed as reflected below.

Open Session:

1. Consideration of the Mission and Objectives of the Corporation and the Respective Roles of its Board of Directors and President.
2. Consider and Act on Other Business.

CONTACT PERSON FOR INFORMATION: Patricia D. Batie, Executive Office, (202) 336–8800.

Upon request, meeting notices will be made available in alternate formats to accommodate visual and hearing impairments.

Individuals who have a disability and need an accommodation to attend the meeting may notify Patricia Batie at (202) 336–8800.

Dated issued: January 27, 1994.

Patricia D. Batie,

Corporate Secretary.

[FR Doc. 94–2167 Filed 1–27–94; 10:22 am]

BILLING CODE 7050–01–M

federal register

Monday
January 31, 1994

Part II

Department of Labor

Occupational Safety and Health Administration

29 CFR Part 1910

Electric Power Generation, Transmission, and Distribution; Electrical Protective Equipment; Final Rule

DEPARTMENT OF LABOR

Occupational Safety and Health Administration

29 CFR Part 1910

[Docket No. S–015]

Electric Power Generation, Transmission, and Distribution; Electrical Protective Equipment

AGENCY: Occupational Safety and Health Administration (OSHA), Department of Labor.

ACTION: Final rule.

SUMMARY: OSHA is issuing a new standard addressing the work practices to be used during the operation and maintenance of electric power generation, transmission, and distribution facilities. The standard includes requirements relating to enclosed spaces, hazardous energy control, working near energized parts, grounding for employee protection, work on underground and overhead installations, line-clearance tree trimming, work in substations and generating plants, and other special conditions and equipment unique to the generation, transmission, and distribution of electric energy. Compliance with these requirements will prevent injuries to employees working on electric power systems.

OSHA is also revising the electrical protective equipment requirements contained in the General Industry Standards. The current standards for the design of electrical protective equipment adopt several national consensus standards by reference. The revision replaces the incorporation of these out-of-date consensus standards with a set of performance-oriented requirements that are consistent with the latest revisions of these consensus standards. Additionally, OSHA is issuing new requirements for the safe use and care of electrical protective equipment to complement the equipment design provisions. These revisions will update the existing OSHA standards and will prevent accidents caused by inadequate electrical protective equipment.

EFFECTIVE DATE: The Final Rule, except for § 1910.269(a)(2), is effective on May 31, 1994. Paragraph (a)(2) of § 1910.269 is effective on January 31, 1995.

ADDRESSES: In compliance with 28 U.S.C. 2112(a), the Agency designates for receipt of petitions for review of the standard the Associate Solicitor of Labor for Occupational Safety and Health, Office of the Solicitor, room S4004, U.S. Department of Labor, 200 Constitution Ave., NW., Washington, DC 20210.

FOR FURTHER INFORMATION CONTACT: Mr. James F. Foster, U.S. Department of Labor, Occupational Safety and Health Administration, room N3647, 200 Constitution Ave., NW., Washington, DC 20210 (202–523–8148).

SUPPLEMENTARY INFORMATION:

I. Background

A. Need for Regulation

Employees performing operation or maintenance work on electric power generation, transmission, or distribution installations are not adequately protected by current OSHA standards, though these employees face far greater electrical hazards than those faced by other workers. The voltages involved are generally much higher than voltages encountered in other types of work, and a large part of electric power generation, transmission, and distribution work exposes employees to energized parts of the power system.

The existing electrical regulations contained in subpart S of the General Industry Standards address electric utilization systems—installations of electric conductors and equipment which use electric energy for mechanical, chemical, heating, lighting, or similar purposes. Subpart S protects most employees from the hazards associated with electric utilization equipment and with the premises wiring that supplies this equipment. However, subpart S does not contain requirements protecting employees from the hazards arising out of the operation or maintenance of electric power generation, transmission, or distribution installations.[1]

In contrast, telecommunications workers, who face similar hazards, are covered under a specific telecommunications standard in § 1910.268. This regulation protects employees performing communications work from the two major hazards of falling and electric shock. These are the same two hazards accounting for most of the accidental deaths in electric power transmission and distribution work.

Employees engaged in the construction of electric power transmission or distribution systems are protected by the provisions of subpart V of the Construction Standards (Part 1926). However, this standard does not address operation or maintenance work, nor does it cover work in electric power generating plants.

Electric utility industry trade associations requested several times that OSHA adopt a set of rules on the operation and maintenance of power generation, transmission, and distribution systems. Toward this end, representatives of Edison Electric Institute (an association of investor-owned electric utilities) and of the International Brotherhood of Electrical Workers (a union representing electric utility workers) developed a draft standard, submitted it to OSHA, and suggested that it be used as a proposed rule. The Agency accepted the draft standard and used it to begin the development of a proposal on electric power generation, transmission, and distribution.

B. Accident Patterns

To establish a basis for the development of safety standards, accident data must be collected and analyzed. OSHA has looked to several sources for information on accidents in the electric utility industry. Besides OSHA's own accident investigation files, statistics on injuries are compiled by the Edison Electric Institute (EEI) and by the International Brotherhood of Electrical Workers (IBEW). Additionally, the Bureau of Labor Statistics (BLS) publishes such accident data as incidence rates for total cases, lost workday cases, and lost workdays. Analyses of accident data for electric utility workers can be found in the following documents, which (like all exhibits and hearing transcripts) are available for inspection and copying in Docket S–015 in the Docket Office:

(1) "Preparation of an Economic Impact Study for the Proposed OSHA Regulation Covering Electric Power Generation, Transmission, and Distribution", June 1986, Eastern Research Group, Section 4 (Ex.[2] 4).

(2) "Assessment of the Benefits of the Proposed Standard on Electric Power Generation, Transmission, and Distribution—Coding Results and Analysis", October 5, 1990, Eastern Research Group (Ex. 6–24).

Overall accident incidence rates for the electric services industry (that is, the

[1] Electric power generation, transmission, and distribution installations under the exclusive control of an electric utility (§ 1910.302(a)(2)(v)) are specifically not covered by the electrical installation requirements contained in Subpart S §§ 1910.303 through 1910.308. Industrial generation, transmission, and distribution installations, even though they are not included in the language of § 1910.302(a)(2)(v), are also not covered under the Subpart S utilization requirements if they are the same type as those of electric utilities (46 FR 4039). Additionally, the safety-related work practice requirements of Subpart S exempt work performed by qualified persons on or directly associated with electric power generation, transmission, and distribution installations regardless of who owns or controls them (§ 1910.331(c)(1)).

[2] Exhibit.

electric utility industry, SIC 491) are slightly lower than corresponding rates for the private sector as a whole. Furthermore, these rates are much lower than the traditionally more hazardous manufacturing, construction, and mining industries. However, although accident incidence rates can be used to compare relative risk between industries, they are not specific enough to be used to determine the types of hazards that need to be addressed by an occupational safety standard.

OSHA realized during the development of the standard that, except for electrical and fall hazards, electric utility employees face hazards that are similar in nature and degree to those encountered in many other industries. At the same time, OSHA recognized that the risk faced by some employees during certain electric-utility-type operations is greater than the risk faced by other general industry employees. For example, the risk of electric shock to an electric power line worker or cable repairer performing his or her routine duties is far greater than that faced by any other occupational group.[3] It is the uniquely hazardous operations that are being addressed by OSHA's standard.

BLS's Supplementary Data System (SDS) provides some detail on the characteristics of accidents in the electric service industry. SDS files indicate that the three major sources of injury within SIC 491 are falls, overexertion, and being struck by or against an object. Information on the nature of injuries also can be obtained from SDS. For example, from these data, sprains/strains, cuts/lacerations, and contusions/bruises are the most frequent injuries encountered in the electric services industry. Similar data can be found throughout general industry. It is noteworthy that electric shock cases do not constitute a major injury category and are grouped under "all other classifiable." Although these data do indicate hazards that must be addressed by a standard, they provide little guidance with respect to the content of the standard.

More specific information on fatal and other serious accidents was gathered from IBEW, EEI, and OSHA files. Contrasting with the SDS data, these files indicate that electrical accidents are the most frequent type of fatal and other serious injuries, accounting for approximately one half of these. According to EEI and IBEW data, other accident types that occur frequently include motor vehicle accidents, falls, and "struck by/crushed."

OSHA also collected information on accidents in non-utility electric power generation, transmission, and distribution installations (Ex. 6–25). These data indicate that accidents involving such installations are similar in nature and degree to those in the electric utility industry.

C. Significant Risk

OSHA must show that the hazards the Agency addresses in a safety regulation present significant risks to employees. As part of the regulatory analyses for this standard, OSHA has determined the population at risk, the occupations presenting major risks, and the incidence and severity of injuries attributable to the failure to follow established standards. In keeping with the purpose of safety standards to prevent accidental injury and death, OSHA has estimated the number of accidents that would be prevented by the new regulation.

Although nearly all workers in the electric utility industry are exposed to various hazards common to the industry, some are at much greater risk than others. Eastern Research Group, Inc. (ERG), in their "Preparation of an Economic Impact Study for the Proposed OSHA Regulation Covering Electric Power Generation, Transmission, and Distribution", June 1986 (Ex. 4), characterized the frequency with which accidents occur in the industry and tabulated the relative risk among electric utility occupations. According to the ERG report, "there were more accidents associated with transmission and distribution [lines] than with substations or power generation [installations]." Within the first category, more fatal and serious lost-time accidents occurred among line workers, apprentice line workers, and working line foremen. Within the latter two categories, substation electricians and general utility mechanics experienced the most accidents. (See p. 4–23 of the ERG report.)

The hazards that are directly covered by the standard are those of an electrical nature, causing electrocution and injuries due to electric shock. In addition, the standard directly addresses fatalities and injuries associated with four other types of accidents: (1) Struck by or struck against; (2) fall; (3) caught in or between; and (4) contact with temperature extremes. (A few requirements of the standard address some hazards common to general industry work. These provisions deal with hazards that are not currently addressed in the General Industry Standards but that are causing injuries in electric power generation, transmission, and distribution work.)

OSHA has estimated that an average of 12,976 lost-workday injuries to and 86 fatalities of electric power generation, transmission, and distribution employees occur annually. (See Section V of this preamble.) Using these figures, OSHA has also estimated the number of injuries which could be prevented by the new regulations. Taking into account such factors as existing regulation and the differences in training levels among utilities, OSHA estimated that 1,634 lost-workday injuries and 61 deaths could be prevented each year through compliance with the provisions contained in or referenced by the standard. (A detailed analysis of the benefits of the standard and a description of the methodology used can be found in the Final Regulatory Impact Analysis of the Electric Power Generation, Transmission and Distribution and the Electrical Protective Equipment Final Rules (RIA) for the standard, which is available for inspection and copying in the Docket Office.) Based on this analysis, OSHA has made a determination that hazards of work on electric power generation, transmission, and distribution installations pose a significant risk to employees and that the standard is reasonably necessary and appropriate to deal with that risk.

II. Development of Standard

A. Present Standards

OSHA adopted regulations applying to the construction of power transmission and distribution lines and equipment in 1972 (Subpart V of part 1926). The term "construction" is broadly defined in § 1926.950(a)(1) to include alteration, conversion, and improvement, as well as the original installation of the lines and equipment. However, subpart V does not apply to the operation or maintenance of transmission or distribution installations.

OSHA found, in reviewing the construction regulations, that the provisions of Subpart V of part 1926 were suitable for use as a base in the development of rules for operation and maintenance work. Important safety considerations for electric utility employees are currently addressed in Subpart V including tools and protective equipment, mechanical equipment, grounding for employee

[3] JACA Corp., "Regulatory Assessment of the Impact of the Proposed Electrical Safety-Related Work Practices Standard, Final Report," October 1983, pp. 4–8 to 4–10 (Ex. 2–6).

protection, and overhead and underground installations. These are topics that also need to be addressed in a comprehensive standard for the operation and maintenance of electric power transmission and distribution installations.

However, the construction rules do have some disadvantages. During the 15 years subpart V has been in effect, areas of ambiguity have developed, making parts of the standard difficult for employees and employers to understand and for OSHA compliance officers to enforce. Additionally, some subpart V requirements are specifically related to the initial construction of lines and equipment and are not readily adaptable to maintenance operations. Lastly, subpart V contains no provisions specifically addressing power generation work.

The National Electrical Safety Code (American National Standards Institute Standard ANSI C2;[4] also known as the NESC) must also be taken into consideration in the development of rules for the operation and maintenance of electric power generation, transmission, and distribution systems. This national consensus standard contains requirements specifically addressing this type of work. The latest version of ANSI C2 is much more up-to-date than subpart V of the Construction Standards. However, ANSI C2 is primarily directed to the prevention of electric shock, although it does contain a few requirements for the prevention of falls. Other hazards common to the electric power generation, transmission, and distribution work are not discussed.

Another related OSHA standard is § 1910.268, pertaining to telecommunications work. Much of the field work covered in this regulation 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 the same in both industries. In any situation in which the hazards are the same and in which there is no clear coverage in the other existing standards, the provisions in the telecommunications standard have been used as a basis for developing requirements to protect employees performing electric-utility-type work.

B. Industry-Union Draft Standard

As previously noted, representatives of EEI and IBEW developed a draft standard, submitted it to OSHA, and represented it as being a negotiated standard that could be used in a rulemaking activity. (EEI and IBEW submitted separate versions of the draft standard. These documents are available for inspection and copying in the Docket Office as Ex. 2–3 and 2–4.) This draft standard was essentially a continuation of the existing requirements of Subpart V of Part 1926 in which the hazards addressed are those found in transmission and distribution installations after the construction phase is completed and the electrical system becomes operational. Additionally, based on existing industry practice, EEI and IBEW added provisions addressing generating plants, substations, confined spaces, and hazardous energy control to supplement the rules on transmission and distribution work.

In the development of this proposal, OSHA evaluated the drafts submitted by EEI and IBEW to determine their suitability as a base document. In areas which overlapped existing OSHA standards, the drafts were reviewed to see if equivalent safety was provided. For example, provisions in the draft standard dealing with ladders were compared to the regulations in Subpart D of part 1910. OSHA also reviewed the drafts to determine if their requirements were as effective as the requirements of national consensus standards addressing the same hazards and to determine if definitions of terms common to several other OSHA standards were identical. For example, the draft provisions on line-clearance tree trimming were checked against the equivalent ANSI standard, ANSI Z133.1–1982 (Ex. 2–29), to be sure that OSHA's regulations would better effectuate safety than the national consensus standard.

The EEI and IBEW draft standards included a section on electrical protective equipment. This equipment is an integral part of electric power generation, transmission, and distribution work, and its use (or lack of use) directly affects the safety of employees performing this type of work. In fact, many of the accidents mentioned earlier were related to electrical protective equipment. Because § 1910.137 already addresses electrical protective equipment, OSHA believes it is appropriate to revise that section rather than include separate protective equipment requirements in § 1910.269.

After thoroughly analyzing the EEI/IBEW drafts, OSHA determined that, together with ANSI C2 and Subpart V of part 1926, they could provide a basis from which a proposal could be developed. OSHA met with representatives of EEI and IBEW several times to obtain their advice. OSHA then clarified some of the language involved, revised unenforceable wording, and resolved conflicts with other OSHA regulations and with national consensus standards.

History of the Regulation

On January 31, 1989, OSHA published the proposed standard on electric power generation, transmission, and distribution work and on electrical protective equipment (54 FR 4974). This proposal was intended to supplement the existing electric power transmission and distribution requirements for construction contained in 29 CFR part 1926, subpart V, and to update the provisions of § 1910.137 on electrical protective equipment. The proposed rules were based, in part, on the provisions of the EEI/IBEW draft standard, on subpart V, and on the NESC.

Interested parties were originally given until May 1, 1989, to submit written comments on the proposal, to file objections, and to request a hearing. In response to requests from the public, the deadline for receipt of comments was subsequently extended to June 1, 1989 (54 FR 18546).

OSHA received 83 comments on the proposal by June 1, 1989, and one request for a hearing by the earlier May 1 deadline. Five late requests for a hearing were also received. In response to the hearing requests and in accordance with section 6(b)(3) of the Occupational Safety and Health Act, OSHA published a notice announcing an informal public hearing and listing the issues to be discussed at the hearing (54 FR 30401, corrected at 54 FR 31970).

The hearing began on November 28, 1989, in Washington, DC. It was adjourned on December 5, 1989, and was reconvened on December 12, 1989, in Los Angeles, CA. The hearing concluded on December 14, 1989.

At the close of the public hearing, Administrative Law Judge Robert Feldman set the deadlines for the submission of additional information and for the filing of briefs by the participants to be March 14 and April 13, 1990, respectively. At the request of some of the hearing participants, Judge Feldman subsequently extended the deadlines to July 1 and August 1, 1990 (Ex. 50).

Section 1910.269 was proposed to apply only to installations under the exclusive control of electric utilities. One of the issues listed in the notice of hearing was whether the scope of the standard should be extended to include work on all electric power generation,

[4] The 1984 and 1987 editions (ANSI C2–1984 and ANSI C2–1987) were entered into the rulemaking record as Ex. 2–8.

transmission, and distribution installations regardless of who owned or operated the installations.

The original regulatory impact analysis for the proposal did not consider the impact of the standard beyond electric utilities and their contractors. Based on its review of the record, the Agency decided to evaluate the economic impact of applying the rule to employers other than electric utilities. Therefore, OSHA contracted for a study (performed by Eastern Research Group, Inc.) of the regulatory impact of applying § 1910.269 to companies which generate or distribute their own electric power. This study was placed in the rulemaking record on the proposal (Ex. 6–25), and OSHA published a notice in the **Federal Register** reopening the record on the proposal for a period of 60 days (November 9, 1990, 55 FR 47074). At the request of several interested parties, the deadline was extended until February 8, 1991 (January 10, 1991, 56 FR 976).

Two of the hearing participants had additional information to be entered into the record and requested a reopening of the hearing record. This information represented the outcome of a relevant consensus standards committee action. During the hearing, the participants had promised to provide these data at the request of the Agency. In response to this request, Administrative Law Judge Robert Feldman reopened the record until March 1, 1991 (Ex. 63).

Judge Feldman issued an order receiving the post-hearing comments and closing the record on July 23, 1992. At that time, he certified the record to the Assistant Secretary of Labor for OSHA.

The comments received in response to the notices of proposed rulemaking, of public hearing, and of the reopening of the record, the written transcript of the hearing, and the exhibits submitted at the hearing and during the post-hearing period allowed for such submissions constitute the rulemaking record for this proceeding. The entire record was carefully considered in the preparation of this final rule.

III. Summary and Explanation of The Final Rule

This section discusses the important elements of the final standard, explains the purpose of the individual requirements, and explains any differences between the final rule and existing standards. This section also discusses and resolves issues that were raised at the public hearing, significant comments received as part of the rulemaking record, and substantive changes from the language of the proposed rule. References in parentheses are to exhibits and transcript pages [5] in the rulemaking record.

A. Section 1910.137

Electrical protective equipment is in constant use during electric power generation, transmission, and distribution work; and, appropriately, the EEI/IBEW draft standard contained provisions related to this equipment. Because the existing OSHA standards for electrical protective equipment are contained in § 1910.137, the Agency determined that relevant requirements based on the portion of the EEI/IBEW draft relating to such equipment should be incorporated into the format of the existing OSHA personal protective equipment standards rather than in new § 1910.269. Further, OSHA believes that these updated personal protective equipment provisions should apply throughout industry, wherever such equipment is necessary for employee safety, and that improvements in the electrical protective equipment provisions should not be limited to the use of this equipment in electric power generation, transmission, and distribution work. Therefore, OSHA is revising § 1910.137, which formerly incorporated by reference the following six American National Standards Institute (ANSI) standards:

Item	ANSI standard
Rubber insulating gloves.	J6.6–1967
Rubber matting for use around electric apparatus.	J6.7–1935 (R1962)
Rubber insulating blankets.	J6.4–1970
Rubber insulating hoods.	J6.2–1950 (R1962)
Rubber insulating line hose.	J6.1–1950 (R1962)
Rubber insulating sleeves.	J6.5–1962

These ANSI standards were originally developed and adopted as American Society for Testing and Materials (ASTM) standards. (In fact, the latest revisions of these standards use the ASTM designations, rather than using separate designations for both standards-writing organizations.) As is typical of national consensus standards, the ASTM standards are filled with detailed specifications for the manufacture, testing, and design of electrical protective equipment. Additionally, these standards are revised frequently, making former § 1910.137 up to a quarter century out of date. For example, the most recent ANSI standard listed in the former OSHA requirement is dated 1970. The most recent ASTM version available is a 1990 edition of specifications on rubber insulating gloves. The complete list of current ASTM standards corresponding to the ANSI standards is as follows:

ASTM D120–87, Specification for Rubber Insulating Gloves.
ASTM D178–88, Specification for Rubber Insulating Matting.
ASTM D1048–88, Specification for Rubber Insulating Blankets.
ASTM D1049–88, Specification for Rubber Insulating Covers.
ASTM D1050–90, Specification for Rubber Insulating Line Hose.
ASTM D1051–87, Specification for Rubber Insulating Sleeves.

Additionally, ASTM has adopted standards on the in-service care of insulating line hose and covers (ASTM F478–92), insulating blankets (ASTM F479–88a), and insulating gloves and sleeves (ASTM F496–91), which have no current counterparts in the existing OSHA electrical protective equipment standard.[6]

In an attempt to retain the quality of protection afforded by the ASTM standards, OSHA has developed a revision of § 1910.137 which has been derived from the ASTM documents but which has been written in performance terms. OSHA recognizes the importance of the ASTM standards in defining basic requirements for the safe design and manufacture of electrical protective equipment for employees. The revision of § 1910.137 maintains the protection presently afforded to employees by the referenced ANSI/ASTM standards. While carrying forward ASTM provisions which are considered necessary for employee safety, OSHA is providing greater flexibility for compliance with these provisions to the extent that worker safety warrants. OSHA has determined, therefore, that the requirements contained in this revision of § 1910.137 are reasonably

[5] DC—Transcript of the hearing held in Washington, DC.
LA—Transcript of the hearing held in Los Angeles, CA.

[6] The relevant ASTM standards are contained in the record as Exhibits 2–9 through 2–17. In several cases, the version of the consensus standard in the record is older than the version listed in the preamble. However, final § 1910.137 is based only on the ASTM documents and other data in the record. The preamble lists editions of the consensus standards not in the record because they have been evaluated for consistency with OSHA's final rule. It has been determined that these later ASTM standards do indeed conform to the requirements of final § 1910.137. See the discussion of the notes following paragraphs (a)(3)(ii)(B) and (b)(2)(ix) for the significance of this determination.

necessary to protect employees from electrical hazards posing significant risks in the workplace.

There are several reasons why adopting the ASTM standards *in toto* would be inappropriate in this rulemaking. First, ASTM has revised each of the currently referenced standards several times since they were adopted in the former OSHA regulation. Because of the continual process by which ASTM periodically revises its standards, any specific editions that OSHA might adopt would likely be outdated within a few years. Additionally, since the rulemaking process is lengthy, a complete revision of OSHA's electrical protective equipment requirements every three years or so to keep pace with the changes in the consensus standards is not practical. (In fact, some of the ASTM standards were revised again during the rulemaking period.) To remedy this problem, OSHA has adopted a revision of § 1910.137 to make the standards flexible enough to accommodate changes in technology, obviating the need for constant revision. Where possible, the new standard has been written in performance terms in order to allow alternative methods of compliance if they provide comparable safety to the employee.

Another difficulty with incorporation of the ASTM standards by reference is that they contain details which go beyond the purposes of the OSHA standard or which are not directly related to employee safety. In the revision of § 1910.137, OSHA has tried to carry forward only provisions which are relevant to employee safety in the workplace. Furthermore, OSHA has attempted to simplify those provisions to make the requirements easier for employers and employees to use and understand. Because the revision places all relevant requirements in the text of the regulations, employers would no longer have to refer to the ASTM documents to determine their obligations under OSHA.

In striving for this degree of simplification, the Agency has tried to use an approach that will accept new methods of protection which may appear in future editions of the ASTM standards. OSHA recognizes that such future editions of these standards might contain technological advances providing significant improvement in employee safety, which might not be permitted under the revised § 1910.137. However, due to the performance-oriented nature of the OSHA standard as compared to the ASTM standards, conflicts between the two standards in areas affecting employee safety are expected to be infrequent.

An employer who follows future versions of ASTM standards will be covered by OSHA's *de minimis* policy as set forth in OSHA Instruction CPL 2.45A (Field Operations Manual). Under that policy, a *de minimis* condition[7] exists (1) where an employer's workplace has been updated in accordance with new technology or equipment as a result of revisions to the latest consensus publications from which OSHA standards were derived, (2) where the updated versions result in a "state of the art" workplace, technically advanced beyond the requirements of the applicable OSHA standard, and (3) where equal or greater safety and health protection is provided.

Several commenters objected to OSHA's adoption of requirements on the design of electrical protective equipment (Ex. 3–33, 3–44, 3–54, 3–58, 3–71). These comments suggested leaving former § 1910.137 as it was, because "[d]esign requirements are a manufacturer's specification standard, not an employer/employee standard [Ex 3–71]."

Others, however, supported OSHA's performance-oriented proposal (Ex. 3–34, 3–50, 3–51, 3–64). ASTM, itself, stated, "Concerning [§ 1910.137] and with the exception of the few items with which we disagree or feel can be improved, we feel OSHA has adequately accomplished its goal of protecting workers in performance-oriented language [Ex. 3–51]." At the hearing, Mr. Arthur Lewis, OSHA's expert witness, testified, "I feel OSHA has done an excellent job in accomplishing its goal of protecting workers through performance oriented language in the proposed standard [DC Tr. 352]."

In the development of this performance language, OSHA attempted to avoid conflicts between the Agency's requirements and the ASTM standards, and the notice of proposed rulemaking requested comments on whether or not the Agency had achieved this objective. The International Brotherhood of Electrical Workers, who expressed support for the proposal, agreed that the proposed standard was written in performance-oriented language (Ex. 3–107). As noted earlier, ASTM itself supported the OSHA proposal and suggested ways in which the final rule could be made more consistent with their standards. OSHA's expert witness, Mr. Arthur Lewis (who is a long-term member of the ASTM F–18 Committee), stated, "I find the proposed revision of 1910.137 to reflect the requirements of the relevant ASTM standards accurately with the exception of the few items of the proposal with which I disagree or which I feel can be improved [DC Tr. 352]." Because of the Agency's desire to maintain consistency with the consensus standards (which was not opposed by any party in this rulemaking) OSHA has relied heavily on Mr. Lewis's and ASTM's suggestions for improving the proposal. The Agency believes the final rule does achieve the goal of protecting employees through the use of performance language that is consistent with and retains the intent of the ASTM standards from which the rule was derived.

In view of the limitations imposed by the continued incorporation by reference of the outdated ASTM standards, OSHA has determined that relevant requirements for electrical protective equipment for workers should be placed within the body of § 1910.137 and that these provisions should be updated and clarified to facilitate their application to workplaces. The Agency believes the rulemaking record supports this action and has made some revisions to the language contained in the proposal, as suggested by the comments and as summarized later in this section of the preamble.

There currently exist several relatively new ASTM standards on other types of electrical protective equipment. For example, ASTM has adopted specifications for fiberglass-reinforced plastic rod and tube used in live-line tools. However, the standards writing organization has not developed corresponding requirements on the use and care of this equipment. Similarly, ASTM Standards F712 and F968 set forth test methods and design specifications, respectively, for electrically insulating plastic guard equipment for the protection of workers, but this standard does not contain provisions on the use or care of the guards. ASTM is currently working on standards for the use and care of some of this equipment and on additional specifications for still other types of equipment.

Most electrical protective equipment presently being manufactured meets existing ASTM standards. Because of this, OSHA's adoption of these newer ASTM design and test specifications would have little impact on employee safety without the adoption of corresponding requirements on the use

[7] OSHA considers a *de minimis* condition to be a technical violation of a standard only. However, because the employer is considered to be in substantial compliance with the standard, the Agency issues no citations or penalties, nor is the employer required to bring his or her workplace into compliance with the older standard.

and care of the equipment. Therefore, to maximize efficient use of the Agency's available resources, this revision does not include ASTM requirements for these other types of electrical protective equipment, but such provisions are being considered for future rulemaking. In this way, all of the newer types of equipment can be dealt with at one time, and provisions on care and use can be included.

Paragraph (a). Paragraph (a) of the revision to § 1910.137 addresses the design and manufacture of insulating blankets, matting, covers, line hose, gloves, and sleeves made of rubber (either natural or synthetic). For the reasons noted earlier, other types of equipment are not covered. However, the standard does not preclude their use.

Under paragraph (a)(1)(i), blankets, gloves, and sleeves have to be manufactured without seams. This method of making the protective equipment minimizes the chances of separation of the material. Because they are used to permit workers to handle energized lines, gloves and sleeves are the only defense an employee has against electric shock. Additionally, blankets, gloves, and sleeves need to be seamless because of the stresses placed on the equipment by the flexing of the rubber during normal use. The other three types of electrical protective equipment (covers, line hose, and matting) generally provide a more indirect form of protection—they insulate the live parts from accidental, rather than intended, contact—and they are not usually subject to similar amounts or types of flexing.

Two commenters were concerned that existing sleeves were not manufactured by a seamless process (Ex 3–42, 3–112). They recommended exempting existing stocks of these items or eliminating the application of this requirement to sleeves. However, Mr. Arthur Lewis noted that all equipment addressed in proposed paragraph (a)(1)(i) has been "made utilizing a seamless process [DC Tr. 354]." He further stated:

> Items made in a mold process frequently have a raised portion along the juncture of the two halves of the mold. This is not a seam. Examination of a cross-section of the material at that point will show it to be homogeneous. To the best of my knowledge, there is no equipment used in industry today * * * that would be in violation of the proposed 1910.137 standard or the relevant ASTM standards [DC Tr. 354].

On the basis of Mr. Lewis's testimony, OSHA believes that there is no reason to exempt existing sleeves from the requirement that they be manufactured by a seamless process. Therefore, no change has been made to the language contained in § 1910.137(a)(1)(i).

Paragraph (a)(1)(ii) requires electrical protective equipment to be marked to indicate its class and type. The class marking gives an indication of the voltage with which the equipment can be used; the type marking indicates whether or not the equipment is ozone resistant. This will enable employees to know the uses and voltages for which the equipment is suited. Paragraph (a)(1)(ii) also permits equipment to contain other relevant markings.

Paragraph (a)(1)(iii) requires all markings to be nonconductive and to be applied so that the properties of the equipment are not impaired. This will ensure that no marking interferes with the protection to be provided by the equipment.

Paragraph (a)(1)(iv) requires markings on gloves to be provided only in the cuff area. Markings in other areas could possibly be worn off. Moreover, having the markings in one place will allow the employee to determine the class and type of glove quickly. Paragraph (b)(1)(vii) of § 1910.137 normally requires rubber gloves to be worn under protector gloves. Because a protector glove is almost always shorter than the corresponding rubber glove with which it is worn and because the cuff of the protector glove can easily be pulled back without removal, it is easy to see markings on the cuff portion of the rubber glove beneath. Any marking provided on the rubber glove in an area outside of the cuff could not be seen with the protector glove in place.

Under the national consensus standards (both the formerly referenced and the newer versions), electrical protective equipment must be capable of passing certain electrical tests. In § 1910.137(a)(2), OSHA is continuing these requirements. The tests specified in the ASTM standards are very detailed. This is not the case in the OSHA standard. Through the use of performance language, the final rule establishes the same level of protection without a lengthy discussion of test procedures.

Paragraph (a)(2)(i) requires electrical protective equipment to be capable of withstanding the a-c proof-test voltages in Table I–2 or the d-c proof-test voltages in Table I–3 (depending, of course, on whether an a-c proof test or an equivalent d-c proof test is performed). The proof-test voltages listed in these tables have been taken from the current ASTM standards, which also contain details of the test procedures used to determine whether electrical protective equipment is capable of withstanding these voltages. These details have not been included in the final rule. Paragraph (a)(2)(i)(A) replaces them with a performance-oriented requirement that whatever test is used must reliably indicate that the equipment can withstand the proof-test voltage involved. (This provision was contained in the text of proposed paragraph (a)(2)(i).) To meet the requirements of the OSHA performance standard, employers would have to get the assurance of the manufacturer that the equipment is capable of withstanding the appropriate proof-test voltage. The manufacturer, in turn, would normally look to the ASTM standards for guidance in determining the testing procedure.

Paragraph (a)(2)(i)(B) requires the proof-test voltage to be applied for 1 minute for insulating matting and for 3 minutes for other insulating equipment. (This provision was also part of the text of proposed paragraph (a)(2)(i).) These times are based on the proof-test times given in the ASTM design standards and are appropriate for testing the design capabilities of electrical protective equipment.

Some commenters suggested adding a requirement for gloves to be able to withstand the proof-test voltage after a 16-hour water soak (Ex. 3–50, 3–57). Siebe North, Inc., tested rubber insulating gloves of some manufacturers and found them to absorb water, causing a reduction in insulating properties (Ex. 3–50). They claimed that water absorption is a critical property because exposure to perspiration or rain is quite common while lineman's gloves are in use. These commenters also noted that provisions for a proof test after a water soak are included in ASTM D120–87. OSHA's expert witness also supported the inclusion of a moisture absorption/proof test in the final standard (Ex. 17; DC Tr. 357).

The reduction of insulation that may be caused by absorption of moisture is a legitimate concern, one that is addressed in ASTM D120 but was not covered in the OSHA proposal. Although a requirement for a soak test was not included in the proposal, the inclusion of such a rule in the final standard is a natural outgrowth of the requirement proposed in paragraph (a)(2)(i) that electrical protective equipment be tested and that the proof test reliably indicate that the equipment can withstand the voltage involved. Electrical work is sometimes performed in the rain, and an employee's perspiration is often present while the gloves are in use (Ex. 3–50). The soak test is needed to ensure that electrical protective equipment can withstand the voltage involved under these conditions. Therefore, the Agency has accepted the suggestion that rubber gloves also be capable of passing the proof test after a 16-hour water soak (consistent with the ASTM standard) and has added such a requirement as paragraph (a)(2)(i)(C) in the final rule.

When an a-c proof test is used on gloves, the resulting proof-test current gives an indication of the validity of the glove make-up, the dielectric constant of the type of material used, its thickness, and the total area under test. Paragraph (a)(2)(ii) prohibits the a-c proof-test current from exceeding the current allowed in Table I–2. Again, the currents listed in the table have been taken from ASTM D120–87.

Under paragraph (a)(2)(ii)(A), the maximum current for a-c voltages at frequencies other than 60 hertz would be computed from the direct ratio of the frequencies. This provision was contained in the text of paragraph (a)(2)(ii) in the proposal.

Gloves are filled with and immersed in water during the a-c proof test, and the water inside and outside the glove forms the electrodes. Several commenters noted that the a-c proof-test current was dependent on the length of the portion of the glove that was out of water (Ex. 3–50, 3–57, 3–112). Mr. Arthur Lewis, OSHA's expert witness stated:

> Additionally, the proof-test limits specified in Table I–2 depend upon specific immersion depths specified in the ASTM standard. Less immersion results in lower leakage current. Unless the OSHA regulation controls clearance above the water line, gloves which would fail ASTM D–120 or F–496 could pass the OSHA requirement, resulting in substantially lower level of protection. [DC Tr. 358–359]

Mr. Lewis and two of the commenters, Siebe North, Inc. (Ex. 3–50), and W. H. Salisbury and Co. (Ex. 3–57), suggested adding a table for water immersion depths derived from ASTM D120. OSHA has accepted this suggestion. The Agency agrees that, because the proof-test current is a function of immersion depth, it is important to specify the depth in the regulation. Otherwise, employee safety could be compromised. Therefore, paragraph (a)(2)(ii)(B) in the final standard specifies that gloves to be tested must be filled with and immersed in water to the depth given in Table I–4. This table was taken directly from ASTM D120–87 and is valid for the proof-test currents listed in Table I–2.

The allowable proof-test current must be increased for proof-tests on gloves after a 16-hour water soak. ASTM D120–87 allows an increase in the proof-test current of 2 milliamperes. OSHA has adopted this provision, recommended by Mr. Lewis (Ex. 17, DC Tr. 359), as paragraph (a)(2)(ii)(C).

Since the relatively high voltages used in testing electrical protective equipment for minimum breakdown voltage can actually damage the insulating material under test (even if it passes), paragraph (a)(2)(iii) prohibits protective equipment that has been subjected to such a test from being used to protect employees from electrical hazards. Some comments suggested defining the term "minimum breakdown voltage test" (Ex. 3–21, 3–50, 3–112, 3–120). Most of these comments agreed that the standard should refer to the ASTM specifications for this test.

OSHA agrees that the intent of the standard is to prohibit the use of equipment that has been tested under conditions equivalent to those in the ASTM standards for minimum breakdown voltage tests. However, the standard already references the ASTM standards as a reference in a note following paragraph (a)(3)(ii)(B). Rather than reference these standards every place a different test is mentioned in the OSHA regulation, the Agency has decided to clarify the note to indicate that all the tests given in § 1910.137(a) are described in the consensus documents. Towards this end, the following paragraph has been added to the note:

> These [ASTM] standards contain specifications for conducting the various tests required in paragraph (a) of this section. For example, the a–c and d–c proof tests, the breakdown test, the water soak procedure, and the ozone test mentioned in this paragraph are described in detail in the ASTM standards.

This does not mean that OSHA is adopting the ASTM standards by reference. In enforcing § 1910.137, the Agency will accept any test that meets the requirements of the OSHA standard. However, the final rule states explicitly that the ASTM tests listed in the note are acceptable; and, if the ASTM specifications are met, an employer has assurance that he or she is complying with § 1910.137. If an employer uses other test methods, the Agency will determine, on a case-by-case basis, whether or not they meet the Federal standard.

Around high voltage lines and equipment, a luminous discharge, called electric corona, can occur due to ionization of the surrounding air caused by a voltage gradient which exceeds a certain critical value. The blue corona discharge is accompanied by a hissing noise and by ozone, which can cause damage to certain types of rubber insulating materials. Therefore, when there is a chance that ozone may be produced at a work location, electrical protective equipment made of ozone-resistant material is frequently used. To ensure that ozone-resistant material will, in fact, be resistant to the damaging effects of the gas, paragraph (a)(2)(iv) requires this type of material to be capable of withstanding an ozone test.

Two commenters were concerned that the ozone test was not specified or defined in proposed § 1910.137(a)(2)(iv) (Ex. 3–50, 3–57). To address this concern, OSHA has included, in paragraph (a)(2)(iv) of final § 1910.137, a requirement that the ozone test reliably indicate that the material will resist ozone exposure in actual use. As noted earlier, standardized ozone tests are given in the ASTM specifications. The final rule also lists signs of failure of the test, such as checking, cracking, breaks, and pitting.

Paragraph (a)(3) applies to the workmanship and finish of electrical protective equipment. Because physical irregularities can interfere with the insulating properties of the equipment, paragraph (a)(3)(i) prohibits the presence of harmful defects that can be detected by the tests or inspections required under § 1910.137. However, some minor irregularities are nearly unavoidable in the manufacture of rubber goods, and these imperfections may be present in the insulating materials without significantly affecting the insulation. Paragraph (a)(3)(ii) lists the types of imperfections that are permitted. Even with these imperfections, electrical protective equipment is still required to be capable of passing the electrical tests specified in paragraph (a)(2).

Proposed paragraph (a)(3)(i) referred to "harmful physical irregularities which can be detected by thorough test or inspection." OSHA has revised this phrase to read "harmful physical irregularities that can be detected by the tests or inspections required under this section." The Agency intended "thorough test or inspection" to be those required under § 1910.137, but this was not explicit in the proposed text. The language contained in the final rule clearly reflects the intent of this provision.

Two commenters objected to proposed paragraph (a)(3)(ii)(C) (Ex. 3–50, 3–57). They claimed that this provision dealt only with the cosmetics of the gloves and not with their safety. These commenters were joined by OSHA's expert witness, Mr. Arthur Lewis (Ex. 17), in citing the ASTM D120–87 requirement that was the basis for this paragraph, which states:

(Section 11.2) The working area of the glove on both the inner and outer surfaces shall also be free of nonharmful physical irregularities * * * [Ex. 2–9]

This language, they noted, prohibited "nonharmful" irregularities only. They argued that omitting the provision would have no effect on employee safety, because harmful abnormalities would be prohibited under proposed paragraph (a)(3)(ii) generally. For example, a color splash on the surface of the glove may not interfere with the insulating capabilities or the mechanical characteristics of the glove. The two commenters and OSHA's expert witness believed that, although such an irregularity would affect the appearance of the glove, the imperfection would not adversely impact employee safety. OSHA has accepted this reasoning and proposed paragraph (a)(3)(ii)(C) is not contained in the final rule.

Since paragraph (a) of § 1910.137 is written in performance-oriented language, OSHA believes that it is important for employees, employers, and manufacturers to have some guidance in terms of what is acceptable under the final standard. OSHA also realizes that the current ASTM specifications on electrical protective equipment are accepted by industry as providing safety to employees and that existing electrical protective equipment is normally made to these specifications. Furthermore, the final rule is based on the provisions of these national consensus standards, although the requirements are stated in performance terms. OSHA has therefore included a footnote at the end of paragraph (a) stating that rubber insulating equipment meeting the requirements of the listed ASTM standards for this equipment are considered as conforming to the requirements contained in § 1910.137. The lists of ASTM standards in the final rule (in the notes following paragraphs (a)(3)(ii)(B) and (b)(2)(ix)) contain the latest revisions of the standards listed in the proposal. The Agency has reviewed these documents and has found them to provide suitable guidance for compliance with the OSHA standard.

Paragraph (b). Although former § 1910.137 does not contain provisions for the care and use of insulating equipment, OSHA believes provisions of this type can contribute greatly to employee safety. Electrical protective equipment is, in large part, manufactured in accordance with the latest ASTM standards. This would probably be the case even in the absence of OSHA regulation. However, improper use and care of this equipment can easily reduce, or even eliminate, the protection afforded by this equipment. Therefore, OSHA is adding new requirements on the in-service care and use of electrical protective equipment to the design standards already contained in former § 1910.137. These new provisions will help ensure that these safety products retain their insulating properties.

Paragraph (b)(1) requires electrical protective equipment to be maintained in a safe and reliable condition. This general, performance-oriented requirement, which applies to all equipment addressed by revised § 1910.137, helps ensure that employees are fully protected from electric shock.

Detailed criteria for the use and care of specific types of electrical protective equipment are contained in the following ASTM standards:

ASTM F 478–92, Specification for In-Service Care of Insulating Line Hose and Covers.
ASTM F 479–88a, Specification for In-Service Care of Insulating Blankets.
ASTM F 496–91, Specification for In-Service Care of Insulating Gloves and Sleeves.

Paragraph (b) (2), which has been derived from these ASTM standards, applies only to rubber insulating blankets, covers, line hose, gloves, and sleeves. These are the only types of electrical protective equipment addressed by consensus standards on the care and use of such equipment. Rubber insulating matting, which is addressed by the material design specifications in paragraph (a), is not covered by any ASTM standard on its in-service care or by § 1910.137(b)(2). This type of equipment is generally permanently installed to provide supplementary protection against electric shock. Employees stand on the matting, and they are insulated from ground, which protects them from phase-to-ground electric shock. However, because this type of equipment is normally left in place after it is installed and because it is not relied on for primary protection from electric shock (the primary protection is provided by other insulating equipment or by insulating tools), it is not tested on a periodic basis and is not subject to the careful inspection before use that other insulating equipment is required to receive. It should be noted, however, that rubber insulating matting is required to be maintained in a safe, reliable condition under paragraph (b)(1).

Although the rubber insulating equipment addressed in § 1910.137(a) is currently designed to be capable of withstanding voltages of up to 40 kilovolts, such equipment is actually intended to be used at lower voltages (Ex. 2–10 through 2–17). The use of insulating equipment at voltages less than its actual breakdown voltage provides a margin of safety for the employee. In paragraph (b)(2)(i) and Table I–5, the final rule has adopted the margins of safety recognized in the ASTM standards, restricting the use of insulating equipment to voltages lower than the proof-test voltages given in Table I–2 and Table I–3. (Table I–5 in the final rule was originally proposed as Table I–4.)

Several comments addressed Note 1 to proposed Table I–4 (Ex. 3–23, 3–51, 3–64, 3–112). The proposed note read as follows:

The maximum use voltage is the a–c voltage (rms) classification of the protective equipment that designates the maximum nominal design voltage of the energized system that may be safely worked. The nominal design voltage is equal to the phase-to-phase voltage on multiphase circuits. If there is no multiphase exposure in a system area and if the voltage exposure is limited to the phase-to-ground potential, the phase-to-ground potential is considered to be the nominal design voltage.

This language was taken from comparable provisions in the ASTM standards on the in-service use and care of electrical protective equipment (for example, ASTM F496–85, section 4.15). However, the ASTM standards had an additional provision for recognizing the phase-to-ground voltage as the nominal design voltage. Typically, this provision read as follows:

If electrical equipment and devices are insulated, or isolated, or both, such that the multiphase exposure on a grounded wye circuit is removed, then the nominal design voltage may be considered as the phase-to-ground voltage on that circuit. [ASTM F496–85, section 4.15.2; Ex. 2–17]

In proposing the original note, OSHA interpreted the language as already recognizing the elimination of multiphase exposure through the use of insulation or other means. In other words, assuming that the multiphase exposure was eliminated before an employee had to rely on the insulation provided by the electrical protective equipment, OSHA was permitting the phase-to-ground voltage to be considered as the maximum use voltage. For example, a three-phase, Y-connected overhead distribution system could be run as three phase conductors with a neutral or as three single phase circuits with one phase conductor and a neutral each. If only one phase conductor is present on a pole, there is no multiphase exposure. If all three phase conductors are present, the multiphase exposure can be removed by insulating two of the phases or by isolating[8] two of the phases. After the insulation is in place or while the employee is isolated from the other two phase conductors, there is no multiphase exposure.

The commenters universally interpreted the proposal differently and mistakenly believed that OSHA was eliminating the option of removing an existing multiphase exposure. They argued that the consensus wording should be included to differentiate the case in which there is no multiphase exposure initially present from the case in which the exposure has been removed. ASTM, itself, suggested adding this language to provide for consistency with the referenced standard and accepted industry practice (Ex. 3–51).

OSHA has modified the language of Note 1 to Table I–5 in order to recognize explicitly the removal of multiphase exposure as a means of reducing the nominal design voltage. Although the proposed language meant the same thing as the final regulatory text, OSHA has included the ASTM language for consistency with the consensus standards. The Agency believes that this will make the final standard easier to use by those who are familiar with the ASTM standards and will minimize the confusion that might otherwise result. (It should be noted that, until the multiphase exposure has actually been removed, the phase-to-phase voltage remains the maximum use voltage.)

Paragraph (b)(2)(ii) requires insulating equipment to be visually inspected before use each day and immediately after any incident which might be suspected of causing damage. In this way, obvious defects can be detected before an accident occurs. Possible damage-causing incidents would include exposure to corona and exposure to possible direct physical damage. Additionally, rubber gloves must be subjected to an air test along with the inspection. In the field, this test usually consists of rolling the cuff towards the palm so that air is entrapped within the glove. In a testing facility, a mechanical inflater may be used. In either case, punctures and cuts can easily be detected.

During use, electrical protective equipment may become damaged and lose some of its insulating value. Paragraph (b)(2)(iii) lists types of damage which would cause the insulating value to drop. The equipment may not be used if any of these defects are present.

Defects other than those listed in paragraph (b)(2)(iii) may develop during use of the equipment and could also affect the insulating and mechanical properties of the equipment. If such defects are found, paragraph (b)(2)(iv) requires the equipment to be removed from service and tested in accordance with other requirements in paragraph (b)(2). The results of the tests determine if it is safe to return the items to service.

Foreign substances on the surface of rubber insulating equipment can degrade the material and lead to damage to the insulation. Paragraph (b)(2)(v) requires the equipment to be cleaned as needed to remove any foreign substances.

Over time, certain environmental conditions can also cause deterioration of rubber insulating equipment. Paragraph (b)(2)(vi) requires insulating equipment to be stored so that it is protected from injurious conditions and substances, such as light, temperature extremes, excessive humidity, and ozone. This requirement helps the equipment retain its insulating properties as it ages.

Several electric utility representatives objected to this provision (Ex. 3–11, 3–33, 3–44, 3–58, 3–123). They claimed that rubber protective equipment was stored on trucks and that it was impossible, in many parts of the country, to protect it from temperature extremes and excess humidity. However, this is the method utilities use to transport the equipment to the worksite; OSHA does not consider carrying the equipment on trucks for the use of employees during the course of work to be storage. Furthermore, the Agency does not believe that it is safe to store the equipment on trucks for extended periods between use if such storage would expose the equipment to extremes of temperature or humidity. It may be necessary, under some circumstances, to store equipment indoors during prolonged periods when employees would not be using it. Workers are dependent upon electrical protective equipment for their safety, and all reasonable means of protecting it from unnecessary damage must be employed. Therefore, OSHA has retained this requirement as proposed.

Rubber insulating gloves are particularly sensitive to physical damage during use. Through handling conductors and other electrical equipment, an employee can damage the gloves and lose the protection they provide. For example, a sharp point on the end of a conductor could puncture the rubber. To protect against damage, protector gloves (made of leather) are worn over the rubber gloves. Paragraph (b)(2)(vii) recognizes the extra protection afforded by leather gloves and requires their use over rubber gloves, except under limited conditions.

Protector gloves would not be required with Class 0 gloves if high finger dexterity is needed for small parts manipulation. The maximum voltage on which Class 0 gloves can be used is 1000 volts. An employee is protected against electric shock at this voltage as long as a live part does not puncture the rubber and contact the employee's hand. The type of small parts encountered in work on energized circuits, such as small nuts and washers, are not likely to do this. While the exception is necessary to allow work to be performed on small energized parts, extra care is needed in the visual examination of the glove and in the avoidance of handling sharp objects (Ex. 17). (A note to this effect has been added in the final rule.)

The other exception to the requirement for protector gloves is granted if the employer can demonstrate that the possibility for damage is low and if gloves at least one class higher than required for the voltage are used. For example, if a Class 2 glove is used at 7500 volts or less (the maximum use voltage for Class 1 equipment), if high dexterity is needed, and if the possibility of damage is low, then protector gloves need not be used. In this case, the additional thickness of insulation provides a measure of additional physical protection. This exception does not apply when the possibility of damage is significant, such as when an employee is using a knife to trim insulation from a conductor or when an employee has to handle moving parts, such as conductors being pulled into place. To ensure that no loss of insulation has occurred, the standard requires any gloves used under this exception to be tested before being used at a voltage higher than that permitted for the lower class of insulating equipment.

Paragraph (b)(2)(viii), Table I–5, and Table I–6 (proposed Tables I–4 and I–5) require insulating equipment to be tested periodically so that electrical protective equipment retains its insulating properties over time. Table I–5 lists the retest voltages that are required for the various classes of protective equipment, and Table I–6 presents the testing intervals for the different types of equipment. These test voltages and intervals were taken from the relevant ASTM standards.

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[8] Depending on the configuration of the system, an employee could be isolated from two of the phases on the pole by approaching one of the outside phase conductors and working on it from a position where there is no possibility of coming too close to the other two phase conductors. Isolation of the employee may be impossible for some line configurations.

Proposed Table I–4 contained a note allowing for the reduction in test voltages for equipment used at voltages lower than the maximum use voltages given in the table. A formula for determining the appropriate test voltage was given in proposed Note 2.

Three commenters expressed concern with this proposed note (Ex. 3–51, 3–64, 3–107). ASTM recommended the removal of this note from the standard, stating:

Note 2 under Table [I–4] provides for proof-test voltages less than those listed in the relevant ASTM standards, if nominal voltages are less than the maximum use voltages. This provision and formula was provided in the ASTM standards during an interim transition period while users' equipment changed from the old voltage classes to the new voltage classes. For instance, Class 2 gloves made to the J–6 set of standards were thinner and rated at 15,000 volts. If repeatedly tested to the current proof-test voltage of Class 2 material of 20,000 volts there would have been the possibility of above normal loss of protective equipment during tests. The same was true of equipment made to the two higher voltage classes. Such equipment has now been almost completely removed from use and equipment manufactured since about 1975 has been manufactured to withstand the proof-test voltages of the new voltage classes without excessive failure rates. This note either has been or is in the process of being removed from all the relevant ASTM standards. [Ex. 3–51]

The other two commenters and OSHA's expert witness, Mr. Arthur Lewis, supported the elimination of this note (Tr. DC–357). OSHA accepts the reasoning in these comments, and the proposed note does not appear in the final rule.

The proposal did not address the amount of time the test voltage was to be applied to the protective equipment. Applying the voltage for too short a period of time might allow marginal goods to pass the test, while longer test times would cause good equipment to fail at a higher than normal rate. Several commenters alluded to this problem (3–51, 3–64, 3–65, 3–107, 3–123, 17). A test interval of from 1 to 3 minutes was suggested for consistency with the ASTM in-service standards. OSHA has accepted this suggestion and has included it as a note to Table I-5.

Paragraph (b)(2)(ix) sets forth a performance-oriented requirement that the method used for the periodic tests give a reliable indication of whether or not the electrical protective equipment can withstand the voltages involved. In a performance-oriented standard, it would not be appropriate to spell out detailed procedures for the required tests, which vary depending on the type of equipment being tested. On the other hand, OSHA believes that it is important for employees, employers, and testing laboratories to have some guidance in terms of what is acceptable under the proposed standard. Therefore, under paragraph (b)(2)(ix), OSHA has included a note stating that electrical test methods given in the various ASTM standards on rubber insulating equipment meet the performance requirement. As noted earlier, this does not mean that OSHA is adopting the ASTM standards by reference. In enforcing § 1910.137(b)(2), the Agency will accept any test that meets the requirements of the OSHA standard. However, the final rule states explicitly that the listed ASTM tests are acceptable; and, if the ASTM specifications are met, an employer has assurance that he or she is complying with § 1910.137. If an employer uses other test methods, the Agency will determine, on a case-by-case basis, whether or not they meet the Federal standard.

In the notice of proposed rulemaking, OSHA requested comments qn whether the listed ASTM standards were appropriate and on whether there were other acceptable test methods that should also have been listed. The comments were nearly universal in support of the consensus standards (Ex. 3–50, 3–51, 3–57, 3–64, 3–107). Countering these comments, the Edison Electric Institute claimed that there were other acceptable test methods not recognized by ASTM and suggested that OSHA remove the list of their standards from the regulation (3–112). However, EEI did not submit any other test methods into the record for evaluation by the Agency. Therefore, OSHA is not listing any references in addition to those given in the proposal. As noted earlier, OSHA will accept other test methods meeting the performance requirements set out in § 1910.137. Also, the Agency believes that referencing acceptable test methods within the standard will benefit employees, employers, and testing laboratories in their efforts to comply with the standard. The mere existence of other acceptable methods of testing electrical protective equipment does not justify removing the list of methods that OSHA does recognize.

Once the equipment has been tested, it is important to ensure that any failed equipment is not returned to service. Paragraph (b)(2)(x) prohibits electrical protective equipment that failed the required tests from being used by employees, unless the defects can be safely eliminated.

For electrical protective equipment that fails the test, paragraph (b)(2)(x) also lists acceptable means of rendering the equipment fit for use. Sometimes defective portions of rubber line hose and blankets can be removed. The result would be a smaller blanket or a shorter length of line hose. Obviously, gloves and sleeves cannot be repaired in this manner; however, there are methods of patching them if the defects are minor. Rubber blankets can also be patched. The patched area must have electrical and physical properties equal to those of the material being repaired. To minimize the possibility that a patch will loosen or fail, the standard does not permit repairs to gloves outside the gauntlet area. In response to requests for a definition of the term "gauntlet area" (Ex. 3–44, 3–58, 3–65, 3–112), OSHA has replaced that term from paragraph (b)(2)(x)(D) of the proposal with the expression "the area between the wrist and the reinforced edge of the opening". This language was taken directly from ASTM F496–85 (Ex. 2–17).

Several commenters objected to allowing patches to rubber protective equipment (3–50, 3–57, 3–66, 3–69). However, they provided no evidence that patched gloves have failed. Additionally, the ASTM standards recognize such repairs, and the standard requires repaired equipment to pass a retest before being placed back into service. For these reasons, OSHA has retained the provision allowing patches to rubber protective equipment in the final rule.

Once the insulating equipment has been repaired, it must be retested to ensure that any patches are effective and that there are no other defects present. Such retests are required under paragraph (b)(2)(xi).

Employers, employees, and OSHA compliance staff must have a method of determining whether or not the tests required under paragraphs (b)(2)(viii) and (b)(2)(xi) have been performed. Paragraph (b)(2)(xii) requires this to be accomplished by means of certification by the employer that equipment has been tested in accordance with the standard. The certification is required to identify the equipment that passed the test and the date it was tested. Typical means of meeting this requirement include logs and stamping test dates on the equipment.

Many commenters suggested that OSHA clarify this requirement (Ex. 3–11, 3–33, 3–39, 3–44, 3–45, 3–58, 3–69). In general, they objected to the use of the words "certify" and "certification" in the rule and recommended the words "document" and "documentation" in their stead. In support of these comments, Mr. Arthur Lewis stated:

Many employers have independent testing facilities and these facilities do certify their test results. The employer can only maintain the documentation of those testing programs and the records of the results. Since *employers* do not perform the actual tests, even in their own companies, I recommend that a note be added after this requirement to read as follows:

Note: This certification may be in the form of logs or test records commonly found in industry. Such logs or other records shall identify the equipment that passed the test and the date it was tested. [Ex. 17]

OSHA believes that the intent of the proposed standard may not have been clear with respect to what forms of documentation are acceptable means of "certification". Therefore, the Agency has decided to add a explanatory note to paragraph (b)(2)(xii) in the final rule. The note, which is patterned after the first sentence in Mr. Lewis's recommendation, reads as follows:

Note: Marking of equipment and entering the results of the tests and the dates of testing onto logs are two acceptable means of meeting this requirement.

B. Section 1910.269

OSHA is adding a new section to the General Industry Standards. This new section is being added to Subpart R, Special Industries, and is designated § 1910.269. New § 1910.269 contains requirements for the prevention of injuries to employees performing operation or maintenance work on electric power generation, transmission, or distribution installations.

Two issues listed in the hearing notice affect the entire standard. Additionally, two other issues raised at the hearing and in the comments are general in nature. These four issues are as follows:

(1) Whether or not a provision should be included to "grandfather" all existing equipment and installations from the specifications in the standard;

(2) Whether or not the standard should be more performance oriented;

(3) Whether OSHA should more closely follow the EEI/IBEW draft standard; and

(4) Whether or not health issues, such as exposure to electromagnetic radiation or asbestos, should be addressed in this standard.

These four issues will be discussed first. Individual provisions contained in the new standard and related issues are discussed immediately afterwards.

Grandfathering. Many commenters, representing affected employers, requested some general form of exemption for existing power generation, transmission, and distribution installations from § 1910.269 (Ex. 3–26, 3–42, 3–62, 3–80, 3–110, 3–112, 3–123, 56; DC Tr. 718, 831–838, 1144–1146; LA Tr. 409). Such an exemption is commonly referred to as "grandfathering". The objections listed proposed paragraph (h)(4) on step bolts and manhole steps, paragraphs (u)(1) and (v)(3) on access and working space about electric equipment, and paragraphs (u)(4) and (v)(4) on guarding of live parts as requirements that would force extensive modification of existing installations. The commenters were also concerned that OSHA's economic analysis did not fully account for the cost of "retroactively" applying the requirements of the standard to existing installations.

The American Public Power Association (APPA), whose arguments were cited by several other commenters, presented the best evidence supporting a general grandfather provision, as follows:

Certain provisions of the proposed rule could be interpreted to require extensive modification of existing utility work practices, and installations and equipment which, when originally constructed, complied with applicable regulatory requirements. The retroactive application of the requirements in the proposed rule to these facilities is unfair and will impose a tremendous financial burden upon the electric utility industry. The Agency has not adequately considered, much less justified, this aspect of the proposed rule. The Agency has made no effort to demonstrate that the safety benefits, if any, of retrofitting existing installations and equipment justify the substantial costs involved in such efforts.

* * * * *

APPA therefore recommends that existing installations and equipment should be exempted (*i.e.*, "grandfathered") from the requirements of the rule. [Ex. 3–80]

EEI supported the adoption of the language contained in the "grandfather" provision of the EEI/IBEW draft standard, which read as follows:

Existing facilities are not required to be modified to conform to the requirements of applicable standards in this section, provided the maintenance and operation are performed in accordance with the work rules and regulations of this section to the extent existing physical facilities permit. Where existing facilities do not permit compliance with this standard, the employer shall so far as possible provide employment and places of employment which are as safe and healthful as those which would prevail if the employer complied with this standard. [Ex. 2–3]

EEI argued that they did not intend for the grandfathering concept to deprive electric utility employees of the protection that would otherwise be provided by the standard (Ex. 56). They claimed that this EEI/IBEW draft provision, which was taken in part from the general duty clause of the OSH Act,[9] would require employers "to provide employees with a level of protection equivalent to that which the standard would require in those instances in which a utility does not want to modify existing facilities to comply with the final standard [Ex. 56]."

One commenter opposed the adoption of an omnibus exemption for existing installations (Ex. 3–122). He maintained that "grandfathering" would result in additional deaths with no responsibility on the part of industry.

OSHA has concluded that applying final § 1910.269 without a general exemption is reasonably necessary and appropriate for employee safety. This does not mean, however, that OSHA is not providing any relief for employers with existing installations that do not meet the design criteria proposed in specific provisions of § 1910.269. The Agency is "grandfathering" these installations wherever the record supports an exemption from the specific requirement involved.

The standard consists largely of work practice requirements that are necessary for employee safety. The Agency believes that it is important to apply these work practices in full to existing installations, as well as to conductors and equipment that are installed in the future. Some of the rules apply to equipment or installations; however, they are few in number.

Additionally, the standard typically provides alternative means of compliance for many requirements. If the lines or equipment being worked do not permit a specific compliance method to be used, another approach is normally available. For example, final § 1910.269(l)(2) sets forth minimum approach distances to be maintained from exposed energized parts. If the installation does not provide sufficient clearance for this distance to be maintained during certain operations (as is sometimes the case), alternative means of protecting employees, such as insulation, are spelled out in the rule.

With respect to work practices, OSHA believes that it is important for the rule to accept all currently recognized work methods that provide an adequate degree of protection, regardless of the age of the installation involved. The

[9] Section 5(a)(1) of the OSH Act, known as the General duty clause, reads as follows: [Each employer] shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious harm to his employees . . .

exemption suggested by the commenters implies that other equally effective protective measures are available, but are not recognized in the standard. This should not be the case.

Equipment design and installation presents different problems. Once equipment has been installed, it can be very costly to modify. For example, switchboards and control panels that were installed 20 years ago may not provide as much clearance around energized parts as those installed under current consensus standards. Any requirement that imposed clearances equalling those of the newer equipment would force the older equipment to be modified or replaced. In some cases, an entire installation would have to be completely redone. Such retrofitting can result in large capital outlays with limited benefits.

On the other hand, some older equipment may pose such hazards to employees that the benefits of retrofitting or rebuilding the installation outweigh the costs involved. For example, some switchboards that could not be taken out of service (that is, deenergized) may have such small clearances around energized parts that it would be hazardous to perform any maintenance on the switchboard. Safety considerations may indeed dictate modification of the equipment.

Therefore, while the argument that older equipment needs special treatment has merit, a complete exemption of existing equipment from all the requirements contained in § 1910.269 is not in the best interest of employee safety. In fact, OSHA rarely provides a complete exemption from its standards for older equipment or installations; rather, a more limited form of "grandfathering" is usually provided. In some cases, employers are granted delays of several years to allow existing equipment to be modified in accordance with the relevant requirements.[10] Other standards apply to existing equipment only in part.[11]

As there are relatively few equipment and installation design requirements in § 1910.269, the Agency has decided to provide exemptions for existing equipment and installations on a case-by-case basis, based on the record. For example, final paragraph (v)(11)(x) allows coal conveying systems installed before the effective date of the standard to use other protective measures instead of audible devices to warn employees of startup of the system. This "exemption" is based on the record with respect to the proposed requirement for audible warning devices. (See the discussion of this requirement later in this preamble.) Each provision in the proposed standard that would have resulted in substantial capital outlays has been reevaluated in light of the record. The Agency's determination in each case is given in the preamble discussion of the relevant provision of the final rule.

OSHA has also decided not to adopt the alternative "exemption" suggested by EEI. As noted earlier, the Agency believes that all generally acceptable alternatives included in the rulemaking record should be provided for in the standard. Unique safety techniques adopted by a given employer should be handled under OSHA's variance procedures. In this manner, all interested parties have an opportunity to provide relevant information, and employee safety can be assured. Additionally, this approach minimizes enforcement difficulties.

Performance-oriented requirements. One of the hearing requests objected to the lack of performance language in some of the proposed regulations (Ex. 3-80). In the hearing notice, public comment was invited on the issue of whether any of the proposal's requirements were too specification oriented.

The APPA was concerned about the lack of performance-oriented language in certain parts of the proposed rule (Ex. 3–80, 3–119). They believed that these parts of the standard could be written to allow alternative ways of achieving the same safety-related goals.

The Agency believes that the proposed rule was written largely in performance-oriented terms. The proposal also frequently allowed several alternative methods of providing protection from specific hazards. For example, proposed § 1910.269(i)(2)(ii) provided three alternative methods of protecting employees from ground-fault hazards posed by cord- and plug-connected equipment.

On the other hand, the proposal was not written in vague, general language, which can be difficult to enforce. Words such as "adequate", "appropriate", and "suitable", which appeared in several of the source documents (that is, the EEI/IBEW draft,[12] Subpart V, and consensus standards), were not used in the proposed standard. Rather, specific performance goals were stated in enforceable terms.

OSHA has reviewed the record on the proposal and has modified the language of the proposed rules as appropriate. The discussion of individual requirements indicates when the provisions have been rewritten in a more performance-oriented manner or have been revised to allow additional alternatives.

EEI/IBEW draft standard. Some commenters and hearing participants supported the EEI/IBEW draft standard on electric power generation, transmission, and distribution work, and many of them recommended that OSHA adopt it, either in part or in its entirety (Ex. 3–26, 3–42, 3–66, 3–80, 3–112, 3–120, 3–123, 56; DC Tr. 786–792, 818, 831–832, 980; LA Tr. 216). EEI argued that the EEI/IBEW draft should be used by the Agency in drafting the final rule (Ex. 3–112, 56). Their reasoning was stated in their prehearing comments as follows:

> As explained more fully below, EEI strongly believes that the EEI/IBEW draft, prepared by experienced industry and union experts, is superior to the OSHA proposal because it provides more appropriate protection for electric utility workers, explains the principles and requirements involved in more understandable language, and would provide everyone affected by the standard with a comprehensive document. Indeed, because the draft was prepared by those who know the most about safety in electric utilities—those who operate and work in the industry each day—EEI submits that OSHA should give considerable deference to the EEI/IBEW draft. This is especially so given that the other representatives of electric utility employers—the American Public Power Association and the National Rural Electric Cooperatives Association—supported the EEI/IBEW draft. [Ex. 3–112]

The other major union representing electric power generation, transmission, and distribution workers, the Utility Workers Union of America (UWUA), which represents approximately one third of the unionized electric utility work force (DC Tr. 457), did not endorse the EEI/IBEW draft standard (DC Tr. 498). Additionally, a significant contingent of affected employers, industrial establishments that generate, transmit, or distribute their own electric power, did not participate in the development of the EEI/IBEW draft.

EEI represented their draft standard as minimum safety rules that were being met under current industry practices (DC Tr. 782, 793, 1109–1110). They argued that electric power generation, transmission, and distribution work poses a significant risk of serious injury, but that electric utility workers do not face a significant risk under current

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[10] See, for example, § 1910.67(b)(1) on aerial lifts and § 1926.1000(c) on roll-over protective structures.

[11] See, for example, § 1910.302(b)(1), which specifies which requirements of Subpart S apply to all installations regardless of their age.

[12] The IBEW removed much of this type of language from their version of the draft (Ex. 2–4).

industry practice as reflected in their proposal (LA Tr. 316–317).

The Agency believes that the record clearly demonstrates that the EEI/IBEW draft standard represents current practices in the electric utility industry, at least to the extent that nearly all electric utility employers comply with the rules in that draft. OSHA does not, however, agree that electric utility employees are protected from significant risk under current industry practices. The final regulatory analysis has found 61 fatalities occurring each year in the industry under these practices. Many of these deaths are preventable.

In the case of § 1910.269, the Agency has determined that employees are presently facing significant risk. The risk that an electric utility employee will be seriously injured or die from a fall or an electric shock is significant. OSHA has determined that that risk can be reduced by adopting a standard that requires the industry to change existing protective measures in certain cases. The areas for which this holds true are explained in the discussion of individual provisions.

There are many accident descriptions in the record. The Agency has relied heavily on analyses of these accidents in determining the content of the final rule. These analyses were used by OSHA to make necessary modifications to the EEI/IBEW draft, which was based primarily on current industry practice and anecdotal evidence (Ex. 3–123, 56; DC Tr. 1108–1110). OSHA believes that, because the standard is an attempt to reduce the number of injuries and fatalities, thorough study of relevant accidents is a necessary part of the standards development process.

Additionally, the OSH Act requires the Agency to look to consensus standards for guidance in setting occupational safety standards. Section 6(b)(8) of the OSH Act states:

> Whenever a rule promulgated by the Secretary differs substantially from an existing national consensus standard, the Secretary shall, at the same time, publish in the **Federal Register** a statement of the reasons why the rule as adopted will better effectuate the purposes of this Act than the national consensus standard.

Thus, OSHA relies heavily on consensus standards in developing requirements for employee safety and health.

Several consensus standards generally apply to the work covered under final § 1910.269: ANSI C2, the "National Electrical Safety Code;" ANSI Z244.1, "American National Standard for Personnel Protection—Lockout/Tagout of Energy Sources—Minimum Safety Requirements;" and ANSI Z133.1, "American National Standard for Tree Care Operations—Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and Cutting Brush—Safety Requirements." (The preamble discussion of the individual paragraphs indicates where other consensus documents have been used.) Under the OSH Act, the Agency must demonstrate that any deviations from these standards will better protect employees. Therefore, in developing the proposal, OSHA deferred to the national consensus standards whenever such standards appeared to be more protective than provisions of the EEI/IBEW draft.

Existing OSHA standards also apply to much of the work addressed by § 1910.269. For example, Subpart D of Part 1910 provides requirements for walking and working surfaces, including fixed ladders. Proposed § 1910.269(h) also contained provisions on ladders. The final rule includes only requirements that the record demonstrates provide better protection for electric power generation, transmission, and distribution workers than those set forth in current Subpart D. Also, Subpart V of Part 1926 covers the construction of electric transmission and distribution lines. Similarly, final § 1910.269 is no less protective than subpart V where identical hazards are addressed in the two standards.

OSHA believes that new standards must build on existing requirements. Provisions in the EEI/IBEW draft that were less protective than current regulations have not been adopted in the final rule.

For these reasons, OSHA has not simply adopted the EEI/IBEW draft standard verbatim. However, the Agency has used the document as a foundation for the development of final § 1910.269, modifying it as necessary to best protect employees and to meet the requirements of the OSH Act. The final rule, based on the record considered as a whole, provides reasonably necessary and appropriate protection from significant risks faced by electric power generation, transmission, and distribution workers. Substantial issues raised in the record as a result of the difference between the EEI/IBEW draft and the proposal are discussed in the explanation of the individual provisions.

Health considerations. Several persons claimed that the proposal did not adequately address issues affecting the health of electric power generation, transmission, and distribution workers (Ex. 3–21; DC Tr. 420–421, 429–431, 475–476). They referred to hazardous exposures to lead, asbestos, and electromagnetic radiation as matters that were not covered at all. Mr. Eugene Briody of the UWUA noted:

> work on electrical transmission involves a lot more than electrical [shock] related hazards * * *. I must stress that over the last several years that the overwhelming majority of safety complaints and occupational related disabilities reported by our members working in electrical transmission relate to asbestos, PCBs and lead rather than shock, explosions or burns. We must also begin to pay attention to the growing evidence concerning the occupational hazards of electromagnetic radiation [DC Tr. 420–421].

OSHA realizes that there are hazards faced by electric power generation, transmission, and distribution workers that are not addressed by § 1910.269. However, the health hazards discussed by Mr. Briody, which are found throughout general industry, are more appropriately regulated under Subpart Z of part 1910 (for asbestos, polychlorinated biphenyls, and lead) and under § 1910.97 (for non-ionizing radiation) rather than in a standard specific to a particular industry sector. Indeed, asbestos and lead have been subjects of extensive rulemaking throughout OSHA's history.

Further, § 1910.269 was proposed as a safety standard, and the notices of proposed rulemaking and of public hearing portrayed it this way. Most of the commenters were not aware that issues relating to health effects of exposures to harmful chemicals or physical agents would be raised at the hearing, and most of the hearing participants (including the Agency, itself) were not prepared to respond to these issues at the hearing. Additionally, the record contains very little information on levels of exposure or rates of illness for any toxic chemical or harmful physical agent to which electric power generation, transmission, and distribution workers are exposed. Accordingly, at this time, the Agency has no basis on which to expand the scope of § 1910.269 to cover health hazards that may be unique to utility work. Should such data become available, OSHA will consider whether further action is warranted.

Paragraph (a). Paragraph (a)(1) of § 1910.269 sets forth the scope of the standard. Under the terms of paragraph (a)(1)(i), the provisions of § 1910.269 apply to the operation and maintenance of electric power generation, transmission, and distribution systems, to electrical testing of such systems, and to line-clearance tree trimming. Although the regulation does not define "operation" or "maintenance", OSHA intends that the standard cover activity, other than construction work covered by

Part 1926, associated with electric power generation, transmission, and distribution installations. The standard primarily covers the following types of work operations:

(1) Inspection,

(2) Switching (connection and disconnection of facilities),

(3) Maintenance of lines and equipment,

(4) Line-clearance tree trimming,

(5) Testing and fault locating,

(6) Streetlight relamping,

(7) Chemical cleaning of boilers, and

(8) Other operation and maintenance activities.

According to proposed § 1910.269(a)(1)(ii)(B), OSHA would only have applied the regulation to installations for the generation, transmission, or distribution of electric energy that are owned or operated by electric utilities and to work performed on such installations owned by a utility. The scope of the draft proposal submitted by EEI and IBEW was limited to utilities only, and OSHA decided to propose that the standard be applied in the same manner. However, the notice of proposed rulemaking noted that consideration was being given to expanding the scope of the standard. In the preamble to the proposal, in the hearing notice, and in the notice reopening the record, OSHA solicited comments on the appropriateness of extending coverage of the standard to all power generation, transmission, and distribution systems. OSHA also requested data on the costs and benefits of expanding the scope in this manner.

Many industrial generation, transmission, and distribution systems are essentially the same as those of a utility, and the work performed on these systems is nearly identical to that performed on electric utility installations. One might assume that electric utility systems are of larger capacity than those operated by industrial plants. In general this is true, but not always. For example, one generating facility for a large steel plant in Sparrows Point, Maryland, has a generating capacity of 140 megawatts with a generating voltage of 13 kilovolts and with distribution voltages of 34.5 and 69 kilovolts. This system is larger than those of many rural electric cooperatives that would have been covered by the proposal. Additionally, the existing OSHA and national consensus standards, Subpart V of part 1926 and ANSI C2, respectively, do extend their coverage to anyone doing electric-utility-type work.

OSHA received many comments on this issue, from utilities, from electrical contractors, from other industries, and from unions. In general, the utilities supported extending coverage to all generation, transmission, and distribution installations (Ex. 3–27, 3–40, 3–59, 3–82, 3–102, 3–112). For example, the New York State Electric and Gas Corporation stated that their personnel perform work on transmission and distribution interconnect facilities as well as inspect, oversee, and approve protection system design, installation, testing, and maintenance on non-utility protection systems (Ex. 3–40). Their employees also provide assistance to industrial customers under emergency conditions.

Unions also supported extending the scope of § 1910.269 (Ex. 3–9, 3–76, 3–107). The International Brotherhood of Electrical Workers stated that the hazards, training, and work practices are the same for electric power generation, transmission, and distribution facilities regardless of who owns or operates them (Ex. 3–107). Therefore, they argued, the safety and health requirements should be the same.

The National Electrical Contractors Association (NECA) represents the contractors who perform work on utility and on industrial power generation, transmission, and distribution installations. NECA agreed with IBEW that these installations were the same, no matter who owned or operated them, and that the accident prevention measures should be the same (Ex. 3–60). The contractors' association also believed that the scope should be expanded.

Countering these comments, many large industrial companies and trade associations argued that the standard should apply only to utilities (Ex. 3–34, 3–45, 3–88, 3–131, 62–2). These commenters generally argued that portions of § 1910.269 overlapped other OSHA standards. Union Carbide Corp. noted that the proposal contained provisions relating to boilers and railroad equipment (Ex. 3–34). They were concerned that these requirements could be read to apply to equipment and operations that are unrelated to a power generation installation. The Amoco Corp. made similar comments about the proposed regulations on hazardous energy control and on enclosed spaces (Ex. 3–73).

S. C. Johnson and Son, Inc., argued that the "hazards posed by electric utilization systems at industrial facilities do not warrant two separate work practice standards [§ 1910.269 and § 1910.331 et seq., Ex. 3–4]". Monsanto Company noted that, while a few industrial plants have large electric power generation, transmission, and distribution systems resembling a small utility company, most industrial power systems are on a much smaller scale than any utility system (Ex. 3–34). They compared a 50-kilowatt cogeneration unit that is part of an industrial facility's steam plant to a 1000-megawatt utility generating station. Monsanto reasoned that there was a significant difference in the hazards posed by the two installations.

Union Carbide Corp. presented the following four reasons for not extending the application of the final standard to industrial power generation, transmission, and distribution:

(a) Utility electrical systems are normally operated at much higher voltage than are industrial electrical systems. They also differ drastically from industrial systems with respect to grounding, physical size, aerial conductors, and lightning protection. The hazards of the two kinds of systems and the best methods of controlling these hazards differ.

(b) The proposed rule addresses a number of hazards which are peculiar to utility systems but not to industrial systems. These include tree trimming and access to the system by the unauthorized, untrained general public. Fortunately, industrial electrical systems seldom have those problems. It would be inappropriate to impose on industrial systems requirements which address those hazards.

(c) Traditionally, industrial electrical systems have been based upon the National Electrical Code ("NEC") in their design and operation. Utility electrical systems, on the other hand, have always been based upon the National Electrical Safety Code ("NESC") in their design and operation. While the NEC and NESC use many of the same concepts, they are entirely different documents. The proposed rule is based upon the NESC (see 54 Fed. Reg. at 4975–76). Accordingly, applying the proposed rule to industrial electrical systems could create many compliance problems not related to safety.

(d) Application of the proposed rule to industrial electrical systems would establish the need to comply with two separate sets of requirements at a single facility, creating a training nightmare. For example, a piece of switchgear feeding a production unit may be adjacent to a piece of switchgear serving a generating facility. The regulations in 29 C.F.R. Part 1910, Subpart S would apply to the production unit switchgear, while the proposed rule would apply to the generator switchgear. This would create great practical difficulties for operating personnel in trying to decide which set of rules to apply. [Ex. 3–45]

The installation safety requirements in Subpart S of Part 1910 (§§ 1910.302 through 1910.308) do not cover "installations under the exclusive control of electric utilities * * * for the generation, control, transformation, transmission, and distribution of electric energy" (§ 1910.302(a)(2)(v)). Additionally, OSHA has interpreted the Subpart S installation requirements to exempt industrial power generation and distribution systems that are similar to electric utility installations.[13] This exclusion reflects the unique hazards and work practices involved in generation, transmission, and distribution of electric energy. The work practice requirements in Subpart S of Part 1910 (§§ 1910.332 through 1910.335) are designed to complement the installation safety provisions in Subpart S and do not cover work practices for qualified persons who work on or near electric generation, transmission, or distribution installations. Also, because electric power generation, transmission, and distribution installations involve similar hazards and work practices whether or not they are controlled by electric utilities, the Subpart S work practices standard does not apply to qualified persons who work on or near any such installation, regardless of who owns or controls the installation.

OSHA believes that there are hazards related to electric power generation, transmission, and distribution work that are not adequately addressed elsewhere in the General Industry Standards. The hazards related to transmission systems are the same whether the system is owned by a steel plant, a chemical plant, or an electric utility. There are currently no OSHA standards governing the design or installation of these systems, and the electrical standards in Subpart S of Part 1910 do not apply.

Coverage of electric power generation and distribution systems is slightly different from the coverage of transmission systems. Utility-type generation and distribution installations are not covered by the provisions of §§ 1910.303 through 1910.308 or (if the work is performed by a qualified employee) by §§ 1910.332 through 1910.335. Commercial-type systems,[14] however, are covered by the Subpart S requirements. Additionally, some employers voluntarily comply with OSHA's electrical standards in Subpart S for their large-scale generation and distribution installations.

From an electrical viewpoint, the hazards faced by employees working on an installation that conforms to the design requirements of §§ 1910.303 through 1910.308 are different from those faced by employees working on an installation that was designed to conform to the National Electrical Safety Code. OSHA believes that whether an employer should comply with the subpart S work practice requirements or with the provisions of § 1910.269 depends on the hazards faced by an employee. The hazards posed by an installation are related to the type of installation involved and to whether or not it conforms to the design standards in subpart S. The risk faced by an employee working on the installation depends on what the hazards are and on whether or not the employee is trained to recognize and avoid the hazards. Therefore, the Agency has made application of most of the electrical requirements in the new standard dependent on whether or not the installation conforms to §§ 1910.303 through 1910.308 and on whether or not the employee is qualified to perform the work, not on whether or not the work is performed by an employee of an electric utility.

OSHA has determined which provisions of final § 1910.269 address electrical hazards that are already addressed in §§ 1910.332 through 1910.335 of subpart S for electrical installations that meet the design requirements in §§ 1910.302 through 1910.308 of subpart S. In short, when qualified employees work on such installations, the Agency will consider these installations and work practices conforming to §§ 1910.332 through 1910.335 to be in compliance with the provisions of § 1910.269 that are identified in Table 1 of Appendix A–2.

OSHA has also identified requirements in § 1910.269 that are not adequately addressed in subpart S, and these requirements must be followed at all times. These provisions are listed in Table 1 of Appendix A–2 as well. It should be noted that, if unqualified employees are working on, near, or with electric power generation, transmission, and distribution installations, §§ 1910.332 through 1910.335 apply in any event. Appendices A–1 and A–2 illustrate the application of § 1910.269 and Subpart S to the various types of electrical installations.

The non-electrical provisions in § 1910.269 (for example, paragraph (g)(2) on fall protection and paragraph (p)(1) on mechanical equipment) address only unique aspects of electric power generation, transmission, and distribution work. As noted in paragraph (a)(1)(iii), the requirements of § 1910.269 supplement those elsewhere in part 1910, unless an exception is specifically mentioned. The non-electrical requirements in this section have been handled individually throughout the standard to allow alternative methods of compliance already recognized in the General Industry Standards. For example, the lockout and tagging provisions of paragraph (d) recognize compliance with the generic standard on control of hazardous energy sources in § 1910.147. (See the discussion of this paragraph later in this preamble.) Each of these cases is discussed in detail in the portion of this preamble relating to the requirement in question.

Paragraph (a)(1)(i)(A) sets forth the scope of § 1910.269 as it relates to industrial and utility power generation, transmission, and distribution. This paragraph reads as follows:

* * * These provisions apply to:

(A) Power generation, transmission, and distribution installations, including related equipment for the purpose of communication or metering, which are accessible only to qualified employees;

Note: The types of installations covered by this paragraph include the generation, transmission, and distribution installations of electric utilities, as well as equivalent installations of industrial establishments. Supplementary electric generating equipment that is used to supply a workplace for emergency, standby, or similar purposes only is covered under Subpart S of this part. (See paragraph (a)(1)(ii)(B) of this section.)

OSHA believes that this language will effectively extend the scope of the standard to the types of installations that the standard is intended to cover, namely, electric power generation, transmission, and distribution systems of electric utilities and equivalent industrial systems. It also makes it clear that supplementary generating equipment, such as emergency and standby generators used to provide temporary power at a workplace, is not covered. These installations are considered to be part of the utilization system rather than separate generation installations and are addressed by the

[13] The preamble to the final rule revising the Subpart S electrical standards stated:

In the situations where the industrial operation may be the same as that of an electric utility, there would not be an overlap [of electrical standards] since ANSI C-2 contains the provisions which would apply and neither the NEC nor OSHA's Subpart S contain provisions which would be applicable. [46 FR 4039, January 16, 1981]

[14] OSHA is using the terms "utility-type" and "commercial-type" to distinguish between covered and excluded generation and distribution systems. As noted earlier, industrial generation and distribution installations that are similar to those of an electric utility are not covered under the Subpart S installation requirements. These systems have voltages and generating capacity equivalent to those of an electric utility. Additionally, the operators of these installations typically sell excess power to an electric utility. OSHA is referring to these systems and those of electric utilities as "utility-type" electric power generation and distribution systems.

On the other hand, industrial generation and distribution "systems" that are not like an electric utility system are covered under Subpart S. These installations, which are considered to be part of the electric utilization system, have more limited capacity, and their generating capability is limited to an emergency or backup role. OSHA is referring to these systems as "commercial-type" electric power generation and distribution systems.

existing Subpart S regulations. Additional clarification as to the application of the electrical safety requirements of § 1910.269 is contained in paragraph (a)(i)(ii)(B), as discussed later in this preamble.

Section 1910.269 applies to the parts of a facility that are directly involved with the generation, transmission, or distribution of electric power. Installations not used for one of these purposes are not covered by the standard. For example, office buildings, warehouses, machine shops, and other installations which are not integral parts of generating plants, substations, or control centers are not covered by final § 1910.269. Work performed on these installations is not of a type addressed by the standard. However, paragraph (a)(1)(i)(B) lists installations that are not integral to the generation of electric power, but that are covered nonetheless. Such installations include the fuel handling operations and water and steam spaces.

Edison Electric Institute objected to the proposed restriction in scope to installations within a generating plant that are for the purpose of electric power generation (DC Tr. 803–805). Speaking on EEI's behalf, Mr. J. Frederick Doering stated, "We continue to believe that all power plant work for operation and maintenance should be covered by this standard." (DC Tr. 804) Mr. John Bachofer displayed many slides showing that widely varied and dispersed portions of an electric generating plant were all maintained and operated by a single resident crew (DC Tr. 806–813). These slides showed that similar equipment is involved both in installations used specifically for power generation and in installations used for other purposes within the same plant. These witnesses argued that it would be safer to have a single set of standards applying to employees at these plants than to have multiple standards regulate utility work.

OSHA agrees that it is generally beneficial for employees to be using one set of rules for the work they do. However, this does not mean that it is always best to have a single standard governing all safety considerations in every industry. This would not be practical given the Agency's limited resources and the diversity of industries in the United States. In explaining OSHA's position, Mr. Thomas Seymour stated, "We would not want to see ourselves getting into a posture where we have to do a specific standard for each and every industry because we would then have thousands and thousands of books for each industry, repeating the same materials over and over and over again." (DC Tr. 177)

While OSHA believes that it may be important to cover the unique safety aspects of an industry in an industry-specific standard, it would be wasteful for the Agency to duplicate other general industry regulations already addressing common safe working conditions. For example, the existing generic lockout and tagging standard, § 1910.147, presently applies to the control of hazardous energy sources of an installation that is not for the purpose of electric power generation, transmission, or distribution. Additionally, OSHA's electrical standards in subpart S also apply to such installations within an electric utility's generating plant. OSHA is not able to address all working conditions in a single rulemaking, especially where there is adequate coverage in the existing General Industry Standards. The utility industry must show that unique considerations within the industry necessitate different requirements from those that apply generally. Where there is adequate coverage, there is simply no need to open up the record on rules with respect to which there is nothing unique in the electric utility industry.

Furthermore, the Agency is expanding the scope of the rule so that non-utility electric power generation, transmission, and distribution are covered. Including general safety provisions within this standard would create problems for industries that generate power as a by-product of the manufacturing process. These companies would have two full sets of standards applying in one workplace, instead of one set of general rules and one set that applied to the unique aspects of electric power generation.

For these reasons, OSHA has decided that § 1910.269 should cover only those aspects of electric power generation plants that pose unique hazards to employees or that are not covered adequately in other General Industry Standards. Thus, for example, this section includes requirements on boiler maintenance safety, conveyors, and water and steam installations that are not contained in any other subpart of Part 1910. Other provisions that seemingly duplicate other general industry requirements are contained in § 1910.269 either because the hazards are not within the scope of the general regulations, or because unique circumstances of electric power generation, transmission, or distribution work necessitate different or additional rules. OSHA believes that this approach will maximize employee safety, as well as the effective use of Agency resources.

Two comments discussed the application of § 1910.269 to coal handling activities. These comments noted that the Mine Safety and Health Administration (MSHA) was asserting jurisdiction in some areas involving coal crushing and conveying (Ex. 3–109, 56). They argued that it was more appropriate for OSHA to regulate these installations than for them to be subject to MSHA's authority. Edison Electric Institute stated, "to exclude those facilities from this final standard, and thereby to impose inconsistent regulatory requirements, would compromise employee safety [Ex. 56]." They urged OSHA to incorporate provisions on coal handling, as proposed. Messrs. Nicholas Reynolds, Scott DuBoff, and Allen Flowers, representing a number of electric utilities, recommended appropriate interagency coordination and corresponding adjustments to the agencies' respective regulations (Ex. 3–109).

While OSHA proposed requirements dealing with coal handling facilities within a power plant, the Agency has no desire (indeed, not even the legal authority) to regulate working conditions that are being regulated by other Federal agencies. Section 4(b)(1) of the Occupational Safety and Health Act of 1970 states:

> Nothing in this Act shall apply to working conditions of employees with respect to which other Federal agencies * * * exercise statutory authority to prescribe or enforce standards or regulations affecting occupational safety or health.

Therefore, to the extent that MSHA asserts jurisdiction over areas at an electric power plant, MSHA's exercise of that authority preempts OSHA's. For example, the Mine Safety and Health Act (30 U.S.C. 801, et seq.) provides that "structures, facilities, equipment, machines, tools or other property * * * used in, or to be used in, or resulting from the work of preparing coal" are within the definition of "coal or other mine" and are thereby subject to MSHA jurisdiction. In section 802(i) of the Mine Safety and Health Act, the "work of preparing coal" is defined as "breaking, crushing, sizing, cleaning, washing, drying, mixing, storing, and loading of bituminous coal, lignite or anthracite, and such other work of preparing such coal as is usually done by the operator of the coal mine." In *Pennsylvania Electric Company* v. *Federal Mine Safety and Health Review Commission*, 969 F.2d 1501 (3d Cir. 1992), the Court of Appeals found that conveyor head drives of conveyor belts used to transport coal from mine head scales to a processing station constitute the work of preparing coal and that MSHA had promulgated rules preempting OSHA.

The requirements in this final rule are only intended to apply to conditions and installations for which MSHA does not in fact "exercise statutory authority to prescribe or enforce standards or regulations." Because the mine safety agency assumes enforcement responsibility for the coal handling operations noted earlier, OSHA and MSHA will work together, coordinating their standards and inspection activities, in a manner consistent with their respective rulemaking and enforcement authorities, to assure the safety of affected employees.

Paragraph (a)(1)(i)(C) of final § 1910.269 states that this section applies to testing associated with electric power generation, transmission, and distribution systems. This paragraph is the same as the corresponding provision in the proposal, except that the reference to electric utilities has been removed. This change was made for consistency with OSHA's decision to expand the scope of the standard to cover non-utilities.

In the proposal, the first three paragraphs under § 1910.269(a)(1)(i) referred only to installations. However, the introductory statement prefacing these paragraphs stated that the section also covered work practices associated with electric power generation, transmission, and distribution lines and equipment. To clarify the scope of the final rule, OSHA has added paragraph (a)(1)(i)(D) to extend the application of § 1910.269 explicitly to work practices on or directly associated with the installations listed in the first three paragraphs. It should be noted that work performed near one of these installations is not covered simply because of its proximity to the installation; the work must be directly associated with the covered installation as well.

Paragraph (a)(1)(i)(E) of § 1910.269 explains the application of the standard to tree-trimming operations. The entire section, except paragraph (r)(1), applies to tree-trimming operations performed by qualified employees (that is, employees who are knowledgeable in the operation of electric power generation, transmission, or distribution equipment and the hazards involved). These employees typically perform tree-trimming duties as an incidental part of their normal work activities. However, only paragraphs (a)(2), (b), (c), (g), (k), (p), and (r) apply to line-clearance tree-trimming work performed by other employees (line-clearance tree trimmers).

Most tree-trimming operations, which are often performed by employees of outside contractors, do not involve routine line-maintenance activities. Although these tree-trimming employees work near the power lines, they do not work directly on them. For activities other than the actual tree-trimming work, these employees are not "qualified employees" for the purposes of this standard. Therefore, many of the requirements set forth in § 1910.269 are not relevant to their work. Since these employees are not trained as qualified linemen, OSHA feels that the application of rules written expressly for electric utility-type work could expose these other types of workers to hazards that they are not adequately trained to face. For example, paragraph (1) allows qualified employees to come closer than 2 feet to a 7600-volt overhead distribution line if the employee is wearing electrical protective equipment (such as rubber insulating gloves and sleeves). By contrast, paragraph (r)(1) requires line-clearance tree trimmers to maintain a minimum approach distance from energized overhead power lines regardless of any other protective techniques that might be employed. Line-clearance tree-trimming work does not require these employees to come closer to power lines, nor does their training [15] typically encompass all the information and skill needed to work on or closer than 2 feet to the line, regardless of whether electrical protective equipment is used. For these reasons, OSHA has adopted special electrical safety-related work practice provisions for line-clearance tree trimmers that are more stringent than those that apply to "qualified employees". These provisions are contained in paragraph (r)(1).

On the other hand, if employees performing line-clearance tree-trimming work are also "qualified employees", with the necessary training and experience in dealing with power lines, all of final § 1910.269, except paragraph (r)(1), applies to their work.

Paragraphs (a)(2), (b), (c), (g), (k), and (p), are general requirements addressing training, medical services and first aid, job briefing, personal protective equipment, material handling, and mechanical equipment, respectively. OSHA has determined that the requirements in these areas are necessary and appropriate for line-clearance tree-trimming work performed by other than qualified employees. The remaining provisions of final § 1910.269 are not necessary for the safety of these employees and are not related to the type of work they perform.

The proposal would also have applied entire paragraph (a) (covering the scope of the standard, training, and the determination of existing conditions) to line-clearance tree trimming operations. Mr. Robert Felix, Executive Vice President of the National Arborist Association, argued that proposed paragraph (a)(3) was not appropriate for line-clearance tree trimming work (Ex. 3–113). This paragraph would have required the inspection of existing conditions before work is started and set forth a list of items that would have to be checked. These items (switching transients, induced voltages, integrity of grounds, etc.) relate to maintenance of electric power generation, transmission, and distribution lines and equipment. Mr. Felix asserted that these conditions were not applicable to tree trimming work and that a provision covering conditions directly related to tree trimming would be more appropriately located in paragraph (r)(1), where the proposal addressed the electrical hazards of line-clearance tree trimming. OSHA has adopted this suggestion and is applying only paragraph (a)(2), which covers training, rather than entire paragraph (a) to tree trimming operations. Because paragraph (a)(1) is the scope of the standard, the relevant portion of paragraph (a)(3) has been placed in paragraph (r)(1).

Standards on the construction of transmission and distribution lines and equipment are contained in 29 CFR part 1926, subpart V. So as not to overlap these regulations in the Construction Standards, final § 1910.269 published today does not apply to operations involving construction work. This "exemption" is set forth in § 1910.269(a)(1)(ii)(A). "Construction work" is defined in § 1910.12(b) as "work for construction, alteration, and/or repair, including painting and decorating." In § 1910.12(d), the term is further defined as including "the erection of new electric transmission and distribution lines and equipment, and the alteration, conversion, and improvement of existing transmission and distribution lines and equipment." None of the types of work covered by these two definitions are covered by § 1910.269.

Several commenters and witnesses at the hearing were concerned with having to comply with two separate standards (that is, § 1910.269 and 29 CFR part

[15] Of course, if these employees do receive the appropriate training, then they become "qualified employees".

1926, subpart V) governing essentially the same work (Ex. 3–60, 3–85, 3–102, 3–112, 56; DC Tr. 717–718, 794–800). These persons gave examples of work operations that could be covered under either standard depending on slightly different circumstances. Mr. Eugene Trombley of Consumers Power Company gave the most detailed accounting of such situations, presenting a video tape of an employee performing distribution work (DC Tr. 794–800). In one case, the employee was replacing an insulator of the same type (§ 1910.269 applies); in the other he was installing an upgraded insulator (Subpart V applies). Similar examples were given of lightning arrester and transformer replacement. In each case, the hazards involved were identical, but the standard that applied was different—sometimes it was § 1910.269, sometimes subpart V.

Mr. Trombley, testifying on behalf of EEI, stated his concerns and his suggested solution as follows:

In view of what we have seen here, I believe that it is safe to say that the work practices and procedures that we have used to work on existing equipment are identical, whether OSHA calls the job construction or maintenance.

Because the label dictates the OSHA standard that will apply, however, I am concerned about the problems that will be created if conflicting standards are applied to the same work.

I am concerned that this is going to complicate my company's safety rules which we work hard to keep simple and direct. This in turn is going to make it more difficult for me as a trainer to give clear direction to my linemen as to what they are to do in specific circumstances.

This is going to place them at greater risk, and I am sure that linemen trainers throughout the industry would feel the same.

I would recommend strongly that the distinction between construction and maintenance for electric utilities be eliminated completely, as it affects work on existing equipment. So that alterations, conversions and improvements of existing equipment required for operation of the system will be considered, as it should be, maintenance work. [DC Tr. 799–800]

OSHA has not accepted this suggestion. The scope of subpart V cannot be altered without first submitting the revision to the Advisory Committee for Construction Safety and Health and subsequently publishing a notice of proposed rulemaking. EEI claimed that consultation with the Advisory Committee would be unnecessary if the scope of § 1910.269 was simply extended to alterations, conversions, and improvements of existing equipment required for operation of the system. However, under the present definitions of construction work, all alterations, improvements, and conversions of electric transmission and distribution lines and equipment are considered to be construction work and, therefore, covered under subpart V. The Agency cannot adopt their suggestion without revising the definition of construction in § 1910.12 and the scope of subpart V in § 1926.950(a)(1) to eliminate this double coverage. This type of action would require further rulemaking.

Others suggested that OSHA make the standards for equivalent hazards the same. Mr. Charles J. Hart of the National Electrical Contractors Association stated, "we believe that all of the requirements that apply to electrical power generation, transmission and distribution, whether it be construction or maintenance and operation, be included in one document and that the rules pertaining to similar situations be identical [Ex. 3–60]." Mr. Joseph Van Name, testifying for the ANSI C2 Subcommittee 8 on Work Rules, supported this view and stated, "to the extent possible, consistency with subpart V is essential; to have different clearance tables and paragraphs seems inappropriate [DC Tr. 717]."

OSHA believes that it is important for employees to use consistent work practices for jobs posing equivalent hazards. It may, indeed, introduce dangers if an employee has to vary the work practices used for a job depending on slightly different circumstances unrelated to safety. The Agency attempts to make its standards consistent across industries for similar situations, but it is not always possible to make them identical. The employer should ensure that the work rules are the same for similar jobs even though different regulations may apply.

Subpart V is about 20 years old, and it is based on technology and practices that reflect its age. If OSHA were to promulgate a standard identical to subpart V, it would not be possible for the Agency to incorporate new technology or to correct deficiencies without first revising the older standard. Therefore, in some cases, § 1910.269 applies different requirements to the same work than subpart V. The Agency believes it is more important to extend coverage of an electric power generation, transmission, and distribution standard to areas where employees are not now protected than it is to revise an existing standard that is already protecting employees to a great degree. This alternative provides greater protection to employees.

OSHA plans to develop a proposal that would revise subpart V to incorporate the improvements promulgated here and to provide for consistency between the two standards. Meanwhile, however, employers will have to comply with two different standards on electric power generation, transmission, and distribution work. OSHA expects that employers will choose to comply with new § 1910.269, as it provides greater protection to employees than subpart V, and will generally accept such compliance for all work involving electric power generation, transmission, and distribution installations, whether it be general industry or construction work. However, where subpart V provides requirements that relate specifically to construction and where § 1910.269 contains no corresponding provisions, the subpart V requirements will continue to apply. For example, § 1926.955(b) contains provisions relating to metal tower construction. Final § 1910.269 contains no corresponding requirements. Therefore, § 1926.955(b) will continue to apply *in toto*. The Agency will provide compliance directives to its compliance staff incorporating this concept.

Proposed § 1910.269(a)(1)(ii)(B) would have excluded electric power generation, transmission, and distribution installations of non-utilities from coverage under § 1910.269. As noted earlier, OSHA has decided to provide coverage for these installations. Therefore, this proposed paragraph was not carried forward into the final rule.

Existing regulations contained in Subpart S of Part 1910 apply to the design and installation of electric utilization systems. Although § 1910.302(a)(2)(v) states that electric utility "installations * * * for the purpose of communication or metering; or for the generation, control, transformation, transmission, and distribution of electric energy" are not covered by subpart S, electric utility installations used for other purposes (that is, those for the electric utilization systems) are covered by subpart S. Generation includes the conductors and equipment that are used for generation, such as the generator itself, the boiler feedwater pumps, and control circuits for the generator. On the other hand, utilization includes premises wiring leading to lighting, convenience outlets, and heating, ventilating, and air conditioning equipment. Where it is difficult to distinguish between generation and utilization within an electric power generating installation, utilization begins at the point where circuits become independent of generating circuits. This distinction, which was thoroughly explained in the preamble to the electrical safety-related work practices standard (55 FR 31993–31997), is consistent with the National Fire Protection Association's (NFPA) National Electrical Code (NFPA 70) and Electrical Safety Requirements for Employee Workplaces (NFPA 70E), OSHA enforcement policy, and the installation safety requirements in Subpart S. Moreover, the Court of Appeals, by upholding OSHA's interpretation of the electrical installation requirements of Part 1926, Subpart K, upheld OSHA's interpretation of utilization and generation within an electric power generation facility. (See *Edison Electric Institute* v. *Occupational Safety and Health Administration,* 849 F.2d 611 (D.C. Cir. 1988).) This current differentiation in coverage between electric utilization installations, which are covered by subpart S, and generation, transmission, and distribution installations, which are not covered by subpart S, is carried forward in § 1910.269(a)(1)(ii)(B), which states that § 1910.269 does not apply to electrical installations, safety-related work practices, or maintenance considerations covered by subpart S.

Many utility industry representatives restated the arguments made in the electrical safety-related work practices rulemaking opposing any application of subpart S to their industry and any language in § 1910.269 referencing subpart S (Ex. 3–26, 3–42, 3–80, 3–82, 3–102, 3–112). Most of these comments cited their desire to follow one standard rather than two. Charles T. Autry of Oglethorpe Power Company specifically recommended including work covered under subpart S as being covered by § 1910.269 (Ex. 3–102). Others also argued that the requirements of Subpart S were inappropriate and that the work was performed by the same highly qualified employees, whether or not generating equipment was involved (Ex. 3–80, 3–82). EEI claimed that, within electric utility power plants, there was no distinction between installations used as opposed to those not used for the generation of power (Ex. 3–112).

The distinction between generation and utilization in a power generation facility was thoroughly considered in the electrical safety-related work practices rulemaking, which resulted in a standard for work practices for general industry (55 FR 31984, August 6, 1990). While the electrical safety-related work practices standard itself dealt only with work practices, comments to that rulemaking and OSHA's rationale in applying the final standard to work on utilization systems in electric power generation facilities addressed the application of OSHA's electrical installation requirements of subpart S as well.

The Agency carefully considered all comments related to applying the electrical safety-related work practices standard to electric utility generating plants. Every argument made with respect to the issue of applying all Subpart S requirements, whether related to installation or work practices, was discussed in detail in the preamble to the Final Rule. (For a full discussion of OSHA's decision in this matter, see the full text of the **Federal Register** notice at 55 FR 31990–31997.) Briefly, the Agency's rationale was:

(1) The distinction, made under the scope of Part I of subpart S, between installations used and those not used for the generation of electric power at utility plants is one that can be readily determined. OSHA realizes that all circuits for utilization equipment installed in generating stations must originate in the same area as the circuits for the generating installation. However, at some point, circuits that are not an integral part of the generating installation must become independent of the generating circuits, except to the extent that they may share common cable trays or perhaps raceways. Otherwise, it would be impossible to control the lighting, for example, independently of the generator itself. With respect to the existing requirements of Part I of subpart S, OSHA considers the "covered" installation to begin where it becomes electrically independent of conductors and equipment used for the generation of electric power. In most cases, it is a simple matter of tracing the wiring back from the utilization equipment itself until a point is reached where generation circuits are also supplied. Generally, branch circuits supplying utilization equipment (other than that used for the generation process) are covered; feeders supplying only "utilization" branch circuits are covered; feeders supplying "generation" circuits, alone or in combination with "utilization" circuits are not covered by subpart S.

(2) Although installations not used for power generation are covered by subpart S, installations of conductors and equipment used for power generation have not been regulated to date by OSHA standards. Because of the installation requirements of subpart S, the conductors and equipment covered by subpart S can be expected to present a minimum level of safety, under normal operating conditions. The subpart S installation requirements are sufficiently comprehensive that only a few basic safety-related work practices are necessary to supplement them (basically, those contained in § 1910.334). For example, under subpart S, live parts of electric circuits are not generally exposed to contact by employees (especially unqualified employees), so that employees can perform their jobs without consideration of touching an energized part. Also, metal frames of electric equipment are grounded if employees would likely be in contact with a grounded surface, when touching the equipment. In this way, employees are protected from ground faults. To protect employees from fire and ground-fault hazards, conductors and equipment are provided with overcurrent protection. Thus, the installation safety requirements contained in Subpart S protect employees to a great degree already (and this is the preferred method of protection given the inevitability of human error if work practices are used as the primary means of protection). The safe work practices to be used when work is performed on, near, or with electric circuits and equipment are dependent upon the design of the electrical installation and the standards it must meet.

On the other hand, installations used for power generation, which are not covered by the design requirements of Subpart S, have not been subject to any comparable OSHA standards for equipment or installation design. Equipment grounding, guarding of live parts, and overcurrent protection are not required for power generation equipment under OSHA standards, and the Agency has no assurance that these safety features have been provided. Even if electric utilities "generally" comply with the National Electrical Safety Code (ANSI C2), their generation installations do not necessarily provide the same safety features as the NEC and Subpart S require for utilization equipment. For example, ANSI C2–1984, Section 124.A, requires the guarding of circuit parts operating at more than 150 volts to ground. (This provision has been carried into this final rule as § 1910.269(v)(5)(i).) By contrast, existing OSHA § 1910.303 requires guarding of circuit parts operating at 50 volts or more. In a generating station, electric utilities must currently follow the Subpart S rule for conductors and equipment that are not used for generation, but not for the generation system conductors and equipment. Clearly, safe work practices for the two types of installations would vary, even with similar 120-volt motors, for example, if one has live parts guarded and the other does not. (Of course, if the two types of installations are commingled, the work practices used should be appropriate for whatever poses the greater hazards. Normally, the hazards posed by the electric power generation installation would be greater than those posed by the utilization installation.)

(3) In the electrical safety-related work practices rulemaking, OSHA found that electric utility employees face a significant risk of injury due to hazards posed by installations that are not used for electric power generation. After reviewing all the evidence in the record of that rulemaking, the Agency determined that the risk of electrocution caused by a hazard covered by Subpart S is about the same as or slightly higher in the electric utility industry in comparison to the risk faced by general industry employees as a whole.

(4) OSHA considered whether the hazards to which employees working in electric utility plants are comparable to those faced by employees working in other general industry workplaces covered by subpart S. In general, the hazards faced by electric utility employees working on or near electric utilization installations in generating plants are not unique. With respect to installations in electric power generation plants that are covered by Subpart S, OSHA concluded in the electrical safety-related work practices rulemaking that the hazards from those installations faced by electric utility employees are identical to those faced by other general industry employees. There is nothing special about a lighting installation, for example, in a generating plant that would make the hazards there any different from those in other workplaces.

(5) Electric utilization circuits in generating plants do pose unique hazards if the circuits are commingled with installations of power generation equipment or circuits and if the commingled generation equipment or circuits present greater electrical hazards than those posed by the utilization equipment or circuits alone (such as exposure to higher voltages or lack of overcurrent protection). Under this condition, the work practices to be used would have to conform to § 1910.269 rather than §§ 1910.332 through 1910.335, and the Subpart S work practices standard does not apply. (See the notes to § 1910.331(c)(1).)

No new evidence on this issue was introduced in the present rulemaking. The scope of the Subpart S installation and work practice requirements was the subject of two previous rulemakings (46 FR 4034 and 55 FR 31984).[16] In those rulemakings, EEI and other electric utility representatives raised the issue of whether or not electric utility utilization installations at electric power generation facilities should be covered by Subpart S. OSHA concluded that these installations would be covered under Subpart S. The Agency is not reconsidering this issue in the present rulemaking.

OSHA is deciding in this rulemaking (1) whether compliance with § 1910.269 can be considered as protecting employees to a degree equivalent to compliance with subpart S with respect to work practices and installation covered by subpart S and (2) whether the requirements of subpart S should be incorporated into § 1910.269.

With respect to whether § 1910.269 can be considered as protective as subpart S, OSHA notes that final § 1910.269 contains very few requirements relating to the design of electrical installations. (Whether or not final § 1910.269 should include additional electrical installation requirements is addressed later in this section of the preamble.) The only such requirements are contained in paragraphs (u) and (v) and relate to the guarding of live parts and to access to and workspace around electric equipment. These requirements, although similar in nature to corresponding provisions in subpart S (§ 1910.303 (g) and (h)), are not as protective as their Subpart S counterparts. For example, § 1910.269(u)(5)(i) and (v)(5)(i) require live parts operating at more than 150 volts to be guarded. By contrast, § 1910.303(g)(2)(i) requires guarding of live parts operating at 50 volts or more. Clearly, the Subpart S provision is more protective. Therefore, OSHA will continue to apply the electrical installation safety requirements contained in §§ 1910.302 through 1910.308 for utilization systems in electric generating facilities.

On the other hand, OSHA has concluded that the electrical work practices required by § 1910.269 can protect employees as well as certain provisions contained in the electrical safety-related work practices standard (§§ 1910.332 through 1910.335). Installations not meeting the Subpart S design standard demand, in general, more restrictive safety precautions by employees working on or near them. Most of the requirements contained in final § 1910.269 are more stringent than comparable provisions of §§ 1910.331 through 1910.335. For example, paragraph (l)(9) of final § 1910.269 requires non-current carrying metal parts of equipment to be treated as energized unless the parts have been determined to be grounded. This type of requirement is not contained in subpart S because such metal parts are required to be grounded when they pose a hazard to employees. For this reason, OSHA can consider compliance with these more stringent provisions as compliance with the subpart S work practice requirements. However, subpart S contains work practices that are beyond the scope of § 1910.269 and are thus not covered here. For example, requirements pertaining to unqualified employees working near exposed live parts and to the use of electric utilization equipment are simply not addressed in final § 1910.269. For this reason, OSHA cannot simply accept compliance with § 1910.269 as being compliance with all of §§ 1910.331 through 1910.335 for all employees, whether qualified or unqualified.

OSHA has reviewed the two standards to determine which provisions of subpart S could be considered as being met by an employer complying with final § 1910.269. Based on this review, the Agency has concluded that the hazards addressed by § 1910.333(c) and § 1910.335 (covering work on or near exposed energized parts and safeguards for personnel protection, respectively), with respect to qualified employees only, are adequately covered by final § 1910.269. The other provisions of the subpart S work practices standard either relate extensively to the protection of unqualified employees or relate to equipment generally not covered under § 1910.269. Paragraph (a)(1)(ii)(B) of final § 1910.269 contains a note incorporating these concepts and reading as follows:

Note 2: Work practices performed by qualified persons and conforming to § 1910.269 of this part are considered as complying with § 1910.333(c) and § 1910.335 of this part.

For consistency, OSHA is adding similar language to a new note under § 1910.331(c)(1).

With respect to the issue of whether the requirements of subpart S should be incorporated into § 1910.269, Edison Electric Institute submitted an alternative standard that should be applied, they suggested, to all electrical safety within a generating station in lieu of subpart S (Ex. 3-112, 28, 62-33; DC Tr. 940-979). Representing EEI, Mr. J.

[16] The issue of whether electric utilities are covered by OSHA's electrical installation requirements was also addressed in the rulemaking on the electrical standards for construction (Subpart K of Part 1926, 51 FR 25294).

Frederick Doering explained the rationale behind their suggested paragraph:

EEI reviewed the proposal's lack of coverage addressed to electrical work in power generation. There were only four items in the proposed section (v) covering electrical items.

The EEI proposal had 26 items—the EEI/IBEW proposal.

While nine of the proposed 1910.269 paragraphs (a), (d), (i), (j), (l), (o), (s), (t), and (w) have rules that provide some guidance to power plant electrical work, there's very little on design or electrical work practices in power generation facilities.

* * * * *

We have no dispute that electrical safety in power plants needs to be regulated. In fact, as we say, we think proposed subpart R is inadequate to the extent it would not have addressed these issues. But we want to try to find a way to get all of the regulation of power plant electrical safety in one place—this standard. That's one of the reasons why we have written proposed section (vv).

Another reason, of course, is that subpart S, Parts I and proposed Part II, contain many provisions which are inappropriate for power plants, largely due to the fact that these sections were drawn from the National Electrical Code. We cannot overemphasize that the electrical systems in power plants are engineered in great detail by experienced engineering staffs, making use of a large number of consensus standards and other sources, covering the material, the equipment, system design, and so forth.

* * * * *

We are concerned that one reason OSHA did not include a detailed section on electrical safety in power plants in this proposed standard is that it is considering regulating some portion of power plant work under subpart S. We are also concerned that OSHA believes there are certain hazards in power plants which are properly addressed in subpart S.

We have attempted to make our proposed section (vv) as comprehensive as possible, to address the issues of electrical safety which we know exist in power plants. Therefore, to help the agency understand how our proposal was constructed, and to assure the agency that relevant safety issues are addressed in the standard, we want to show you the sources from which we drew in putting this proposed section (vv) together.

Our hope is that from review, the agency will see that we have covered all of the pertinent electrical safety issues in power plants in our draft, and that it is included in the final standard—and that if it is included in the final standard, there will be no need for OSHA to refer to any other standard to regulate electrical safety in utility plants. [DC Tr. 940–944]

OSHA does not believe that the proposal contained too few provisions related to electrical safety in power plants.[17] All of the general electrical safety requirements in § 1910.269 apply, including paragraphs (d) and (m) on deenergizing electric circuits, paragraph (i) on portable tools, paragraph (l) on work on or near live parts, and paragraph (n) on grounding. Additionally, Subpart S of Part 1910 contains many requirements that are applicable to electrical safety in electric utility power generating stations. OSHA believes that the electrical safety-related work practices contained in final § 1910.269 and in §§ 1910.332 through 1910.335 sufficiently protect employees from electrical hazards caused by poor work practices associated with electric power generation, transmission, and distribution installations. Only in the area of electric power generation, transmission, and distribution installation design is there any deficiency in employee protection.

The Agency has reviewed the new EEI material on electrical safety in generating plants in order to determine if it should be incorporated into the final rule. The Agency compared the submission to requirements in subpart S that are currently being applied to generating plants to ascertain whether or not the EEI provisions would be as protective as the existing OSHA standards.

By their own accounting, EEI indicated that member companies apply less than 50 percent of the electrical installation requirements of Subpart S for utilization systems at their power plants (DC Tr. 946–948). No justification (other than that the provision was not applicable in power plants) was given for the omission of such important requirements as: Illumination of working space (§ 1910.303(g)(1)(v)); guarding of live parts operating between 50 and 150 volts to ground (§ 1910.303(g)(2)); outlet devices (§ 1910.304(b)(2)); grounding connections (§ 1910.304(f)(3)); grounding of hand-held, motor-operated tools, cord- and plug-connected appliances used in damp or wet locations, and portable hand lamps (§ 1910.305(f)(5)(v)(*c*)); grounding of systems and circuits over 1000 volts (§ 1910.305(f)(7)); switches (§ 1910.305(c)); appliances (§ 1910.305(j)(3)); storage batteries (§ 1910.305(j)(7)); and systems over 600 volts (§ 1910.308(a)). OSHA cannot simply ignore these important safety considerations without good cause, especially since these rules currently apply to utilization installations within generating stations. Similar omissions were made in the safety-related work practices section of the new EEI draft.

Additionally, many of the provisions proposed by EEI were not as protective as the existing subpart S counterparts. The rationale for these changes was frequently inadequate for OSHA to justify relaxing its requirements.

The EEI-suggested provisions that were adequately justified could not be incorporated into § 1910.269 alone. OSHA believes that, except for guarding and workspace provisions (which are necessary for the work practices required by § 1910.269), installation design requirements must be proposed and adopted as a complete set. The installation design standards in subpart S (§ 1910.302 through 1910.308) contain an interrelated set of requirements to protect employees from electrical hazards posed by utilization systems. Requirements for overcurrent protection are based on such factors as conductor size and load current ratings of equipment. Equipment grounding considerations are dependent on system grounding design. Standards for the design of an electrical installation must be adopted as a complete set to be protective. The few EEI-suggested provisions that are justified cannot stand alone—they must be integrated into an interdependent collection of requirements to be protective.

Lastly, many applicable requirements of the National Electrical Safety Code were not incorporated. Such rules would have to be a part of any OSHA standard in this area.

The Agency realizes that Subpart S does not apply to electric power generation, transmission, and distribution installations. The EEI proposal would extend protection to generation installations, but it would relax the protection already afforded for other electrical installations within the plant. Additionally, the EEI proposal does not address hazards posed by transmission or distribution installation design. To remedy these problems, OSHA intends to explore this issue more completely in the future and will consider developing a standard that can be proposed at the same time as the proposed revision of Subpart V of part 1926 (discussed earlier in this section of the preamble). OSHA intends to

[17] The only significant area that is addressed only to a minor degree is the design and installation of electric power generation circuits and equipment. Paragraphs (v)(3) and (v)(5) contain rules on access to working space around electric equipment and on guarding of live parts, respectively. These provisions do apply to the design of generation circuits and equipment, but there are no others.

As noted earlier, OSHA relied heavily on the EEI/IBEW draft standard in the development of proposed § 1910.269. Their draft contained few requirements on electrical design, for either the generating station or the transmission and distribution system. Therefore, OSHA also proposed few provisions in this area, even though much of the National Electrical Safety Code relates to electrical design safety.

integrate applicable requirements from Subpart S and from the NESC and to propose a rule that will best protect employees from hazards arising from the design of electric power generation, transmission, and distribution installations.

Paragraph (a)(1)(iii) of final § 1910.269 explains the application of the section with respect to the rest of part 1910. All other General Industry Standards continue to apply to installations covered by this new standard unless an exception is given in § 1910.269. For example, § 1910.269(p)(1)(i) requires the critical components of mechanical elevating and rotating equipment to be inspected before each shift. This provision does not supersede existing § 1910.180(d), which details specific requirements for the inspection of cranes. References in § 1910.269 to other sections of part 1910 are provided only for emphasis.

Paragraph (a)(2) of § 1910.269 addresses training for employees. Since it is widely recognized that electric-utility-type work requires special knowledge and skills, paragraph (a)(2)(i) requires employees to be trained in the safety-related work practices, safety procedures, and other personnel safety requirements in the standard that pertain to their respective job assignments. Employees are also required to be trained in and familiar with any other safety practices necessary for their safety, including applicable emergency procedures.

Mr. George Weedin of the Electrical Division of the Panama Canal Commission suggested that tower, pole, and manhole rescue procedures be specifically mentioned as part of the required training (Ex. 3–43). Some witnesses at the hearing, including NIOSH, the UWUA, and the IBEW, also expressed concern about rescue procedures (DC Tr. 45, 431, 434, 436–437, 640–641). OSHA believes that training in rescue procedures is important. Proposed § 1910.269(a)(2)(i) had a requirement for training in emergency procedures for this very reason. To further explain the importance of this training, the Agency has added pole and manhole rescue as examples of emergency procedures in which employees would have to be trained.

Many comments, including one of the hearing requests, claimed that proposed § 1910.269(a)(2)(i) was overly broad and vague (3–11, 3–20, 3–33, 3–42, 3–44, 3–58, 3–109, 3–112, 3–113, 3–119, 3–123, 3–125, 3–128, 58). Most were concerned about the proposal's requirement, in this paragraph, that employees be trained in "any other safety practices . . . which are not addressed by this section but which are necessary for their safety" (Ex. 3–20, 3–80, 3–109, 3–112, 3–113, 3–119, 3–123, 3–125, 3–128, 58). They suggested replacing the word "other" with "applicable" or "related", claiming that this would clarify the intent of the provision.

In response to these comments, OSHA raised this issue in the notice of public hearing. OSHA representatives at the public hearing explained that the proposed rule would require employees to be trained in work techniques that related to his or her job (DC Tr. 87–88). Additionally, if more than one set of work practices could be used to accomplish a task safely, the employee would need to be trained in only those work methods he or she is to use (DC Tr. 87–88). For example, an insulator on a power line could be replaced through the use of live-line tools, through the use of rubber insulating equipment, or by deenergizing the line. The employee would only have to be trained in the method actually used to replace that insulator. In keeping with these interpretations, the Agency has decided to revise the language of the last sentence of § 1910.269(a)(2)(i) to read as follows:

> Employees shall also be trained in and familiar with any other safety practices, including applicable emergency procedures (such as pole top and manhole rescue), that are not addressed by this section but that are related to their work and are necessary for their safety

The standard cannot specify requirements for every hazard the employee faces in performing electric power generation, transmission, or distribution work. Employers must fill in this gap by training their employees in hazards that are anticipated during the course of jobs they are expected to perform. The revised language of final § 1910.269(a)(2)(i) clearly imparts OSHA's intent that safety training be provided in areas that are not covered by the standard but that are related to the employee's job.

Paragraph (a)(2)(ii) of final § 1910.269 contains additional requirements for the training of qualified employees. Because qualified employees are allowed to work very close to electric power lines and equipment and because they face a high risk of electrocution, it is important that they be specially trained. Towards this end, the proposal would have required that these employees be trained in distinguishing live parts from other parts of electric equipment, in determining nominal voltages of lines and equipment, in the minimum approach distances set forth in the proposal, and in the techniques involved in working on or near live parts.

The Association of Illinois Electric Cooperatives stated that this paragraph, as proposed, would impose a substantial cost burden upon its members (Ex 3–69). They claim that this provision would require very extensive training of workers to become "qualified".

OSHA believes that qualified employees need to be extensively trained in order for them to perform their work safely. The IBEW agreed, stating that their apprenticeship program took between 3 and 5 years (DC Tr. 619–620) However, the Agency also believes that this training is already being provided by the vast majority of utility employers. EEI stated that electric utility workers were highly trained under its membership's current programs (Ex. 3–112). The National Electrical Contractors Association stated that their joint apprenticeship training program is the finest program in the country for journeyman linemen (Ex. 3–60; LA Tr. 191). No one argued that employees who work on electric power generation, transmission, or distribution installations (that is, those who must be "qualified" under § 1910.269) would be able to perform this work safely without the training proposed under paragraph (a)(2)(ii). Therefore, OSHA has retained this paragraph without modification in the final rule.

Under paragraph (a)(2)(v), the final rule permits classroom or on-the-job training or a combination of both. This allows employers to continue the types of training programs that are currently in existence. Additionally, if an employee has already been trained (through previous job assignments, for example), the employer does not have to duplicate previous instruction.

Several commenters suggested adding language permitting an employer to demonstrate that employees have been previously trained (Ex. 3–20, 3–80, 3–112, 3–123). It was claimed that this would eliminate unnecessary and redundant training of existing employees.

Paragraphs (a)(2)(i) and (a)(2)(ii) require employees to be trained. They do not specifically require employers to provide this training themselves or to repeat training already provided. Clearly, the plain language of the standard allows employees to be trained by other parties or to have been trained previously by their own employers. OSHA does not believe it is necessary to modify the language of the standard to recognize this explicitly.

The employer is required, by paragraph (a)(2)(vii), to certify that each employee has been trained. This certification should not necessitate the employer's completing forms or creating new records; existing personnel records would normally suffice, or the employer could simply make out a certification for each employee upon completion of training. Employers relying on training provided by previous employers are expected to take steps to verify that the employee has indeed received it.

Many commenters objected to the requirement for "certification" (Ex. 3–11, 3–22, 3–33, 3–34, 3–39, 3–44, 3–45, 3–58, 3–60, 3–69, 3–71, 3–80, 3–82, 3–83, 3–86, 3–112, 3–113, 3–123). Mr. Robert Felix of the National Arborist Association (NAA) summarized these comments, stating:

> NAA fully supports the training requirement. We, however, oppose the certification requirement as an unworkable administrative nightmare which will serve only to generate OSHA citations but not improve employee safety. [Ex. 3–113]

OSHA representatives at the hearing reiterated the explanation in the preamble to the proposal that employment records would normally be a sufficient means of compliance with the certification requirement. NAA suggested that the final rule clarify this in the standard itself (Ex. 58). Although the Agency did not take the exact approach mentioned by this hearing participant, OSHA has added a note to paragraph (a)(2)(vii) clarifying this point. The new note reads as follows:

> Note: Employment records that indicate that an employee has received the required training are an acceptable means of meeting this requirement.

OSHA believes that this explanation will satisfy most of the commenters with objections to the requirement for certification of training.

The proposal did not include a requirement for follow-up training for employees. However, in the preamble to the proposal, OSHA requested information on the need for such training.

A few expressed opposition to an OSHA requirement for follow-up training (Ex. 3–112, 3–125, 3–128). Edison Electric Institute voiced the concern of those opposed to this type of requirement as follows:

> In response to OSHA's request for comment, EEI believes that it would not be necessary or useful for the standard to specify follow-up training. Electric utility training programs are well established and include follow-up training when needed. The flexibility needed to address perceived training needs when they arise can be lost when subject matter and training cycle are fixed by regulation. Moreover, the difficulty of forecasting when opportunities for on-the-job training will arise would complicate compliance with a follow-up requirement, particularly as to unusual or esoteric skills which are best taught when the need arises to use them on the job. [Ex. 3–112]

Even though EEI argued that it would not be appropriate for the standard to specify follow-up training, they nonetheless admitted that existing programs do include follow-up on an as-needed basis (Ex. 3–112). EEI witnesses also admitted that the initial schooling provided for their employees was being supplemented in various ways (DC Tr. 1096–1099).

Others, including NIOSH, IBEW, and UWUA, supported a new requirement (Ex. 3–21, 3–57, 3–76, 3–82, 3–103, 3–107). They argued that the introduction of new technology in the industry demands retraining employees (Ex. 3–21, 3–76, 3–103, 3–107), that long periods of time may elapse before an employee uses certain procedures (Ex. 3–76; DC Tr. 411–412, 472), and that periodic training reinforces correct work practices (3–21). Mr. Marshall Hicks, National Secretary-Treasurer of the Utility Workers Union of America, stated:

> I would like to expand and explain our position on the training requirements which are proposed in paragraph (a)(2)(ii). We are not confident that the provisions allowing the employers to continue present training practices currently in existence and also the failure of the provision to require follow-up training is sufficient.
>
> Our experience with the current practices and the lack of follow-up training indicates that it is inadequate for maintaining safety and job performance. In many instances, the mere fact that workers may have labored in lower rated classifications and the same promotional ladder is the only job training provided.
>
> And in some cases, an individual worker because of shift assignment, crew assignment or other limited assignment practices may not have experienced more than one or two phases of the work activity as he performs in the lower rated classification.
>
> In recent years, employers have merged classifications to the extent that a number of work disciplines are included in one classification. We have an instance where one employer with workers holding a title of general maintenance journeyman are required to be skilled in two specific trades and semi-skilled in two additional trades.
>
> And the work assignments to those workers are made generally on the basis of where they have been best trained. If an individual is best trained as a welder, most of his assignments are welder, but he may at some time once every two or three months or so be assigned to do electrical repair work without any additional training or experience.
>
> So we find that the on the job training received is not adequate. We suggest that follow-up training be required for those purposes. And we also have the experience circumstances where on shift rotation that an individual who might be working on an off-shift where there is not an awful lot of maintenance work being done may go for a number of months before he is required to perform certain types of work, and he generally forgets what all of the safety practices are between various assignments.
>
> And on the follow-up training, we think that it should be carried out on a routine regular basis for those reasons and for the reasons that the technological changes in the jobs and the work that is required now days is continuing changing and the training is a necessity to keep employees up-to-date on the latest technology. [DC Tr. 410–412]

Mr. Robert Macdonald of the International Brotherhood of Electrical Workers noted that some of the accidents in the IBEW submission were caused by the lack of training (Ex. 12–12; DC Tr. 532–534). They argued that this supported the need for further training and retraining.

OSHA has determined that there is a need for employees to be trained on a continuing basis. Initial instruction in safe techniques for performing specific job tasks is not sufficient to ensure that employees will use safe work practices all the time. With regard to the effect of training on accidents, Dr. Heinz Ahlers of NIOSH stated:

> * * * I think in a majority of those instances, the fatality involved the worker who had been appropriately trained for the exposure that he subsequently came in contact with and just was not following what the training and the company policy had involved. [DC Tr. 47–48]

Continual reinforcement of this initial guidance must be provided to ensure that the employee actually uses the procedures he or she has been taught. This reinforcement can take the form of supervision (DC Tr. 1097), safety meetings (LA Tr. 134–135), pre-job briefings or conferences (DC Tr. 1096), and retraining (DC Tr. 1098–1099). Typically, adequate supervision can detect unsafe work practices with respect to tasks that are routine and are performed on a daily or regular basis. However, if an employee has to use a technique that is applied infrequently or that is based on new technology, some follow-up is needed to ensure that the employee is actually aware of the correct procedure for accomplishing the task (Ex. 3–21; DC Tr. 410–412, 1098–1099). A detailed job briefing, as required under § 1910.269(c)(2), may be adequate if the employee has previously received some instruction, but training would be necessary if the employee has never been schooled in the techniques to be used.

For these reasons, OSHA has supplemented the training requirements proposed in § 1910.269(a)(2) with two new requirements: (1) a requirement for regular supervision and an annual inspection by the employer to determine whether or not each employee is complying with the safety-related work practices required by § 1910.269 and (2) a requirement for additional training whenever an employee must use work practices that he or she does not implement regularly or that involve new technology and whenever an employee is found not in compliance with the work practices required by § 1910.269. The new provisions are contained in paragraphs (a)(2)(iii) and (a)(2)(iv), which read as follows:

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

(iv) An employee shall receive additional training (or retraining) under any of the following conditions:

(A) If the supervision and annual inspections required by paragraph (a)(2)(iii) of this section indicate that the employee is not complying with the safety-related work practices required by this section, or

(B) If new technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices that are different from those which the employee would normally use, or

(C) If he or she must employ safety-related work practices that are not normally used during his or her regular job duties.

Note: OSHA would consider tasks that are performed less often than once per year to necessitate retraining before the performance of the work practices involved.

The note indicates that the Agency considers tasks performed less often than once per year to require retraining before the task is actually performed. OSHA will accept instruction provided in pre-job briefings if it is detailed enough to fully inform the employee of the procedures involved in the job and to ensure that he or she can accomplish them in a safe manner. OSHA believes that this requirement will significantly improve safety for electric power generation, transmission, and distribution workers.

The Utility Workers Union of America was concerned that, if the final training requirements were the same as those in the proposal, the standard would not fully protect electric power generation, transmission, and distribution workers (DC Tr. 410). Several utility employees testified that the training they were given was inadequate and that their employer falsely documented training that was never received (LA Tr. 61, 69, 78, 80, 82–83, 102). They also submitted documentary evidence, including citations issued by California's Division of Occupational Safety and Health, supporting their assertions (Ex. 66). One of the documents submitted was a "QA [Quality Assurance] Surveillance Report" from the Southern California Edison Company (the employer of the employees involved), which stated, "Based on the numerous procedural deficiencies and observations, as documented in this surveillance, it appears that the root cause for these problems stems from the lack of adequate training for Operations personnel in Work Authorizations."

EEI submitted documents detailing the extensive training manuals used to train Southern California Edison employees (Ex. 46). They argued that utility training programs result in a highly qualified work force (Ex. 3–112). As noted previously, other commenters, including NIOSH, stated that training given to utility employees is comprehensive.

While there is substantial evidence in the record that electric utility employees are highly skilled and well trained, OSHA is concerned, based on the evidence submitted by the UWUA, that a few employers may inaccurately "certify" the training of some employees who have not demonstrated proficiency in the work practices required by the standard. An example will help to illustrate the need for the standard to address the overall goals of the training program. At the public hearing, Mr. John Bachofer, testifying on behalf of the Edison Electric Institute, described a complex tagging program and extensive training for that program, which he characterized as typical for the electric utility industry as a whole (LA Tr. 222–226). With respect to training in tagging procedures, Mr. Bachofer stated:

These detailed procedures, together with the safety manual, serve a dual purpose. They establish the specific requirements and provide the explicit direction for protection of employees from hazardous energy and they comprise the text material which is the basis for employee training in protection from hazardous energy. The training process is rigorous, including classroom presentation by qualified instructors, as well as self-study and it does include testing. Employees must demonstrate knowledge and skill in the application of hazardous energy control, consistent with established acceptance criteria, before they are qualified to either request that equipment be removed from service and tagged out, or to execute switching, valving and tagging. [LA Tr. 224]

An employee who has attended a single training class on a procedure that is as complex as the lockout and tagging procedure used in an electric generating plant has generally not been fully trained in that procedure. Unless a training program establishes an employee's proficiency in safe work practices and unless that employee then demonstrates his or her ability to perform those work practices, there will be no assurance that safe work practices will result, and overall employee safety will not benefit nearly as much as it could. To address this problem, the Agency is adding one provision and changing the language of the proposed certification provision. Paragraph (a)(2)(vi) of the final rule, which has no counterpart in proposed § 1910.269, reads as follows:

The training shall establish employee proficiency in the work practices required by this section and shall introduce the procedures necessary for compliance with this section.

Additionally, as noted earlier, the employer is required, under paragraph (a)(2)(vii), to certify that an employee has received the training required by paragraph (a)(2). Under the proposed rule (proposed paragraph (a)(2)(iv)), this certification would have been required "when the employee successfully completes the training". OSHA has changed this phrase to "when the employee demonstrates proficiency in the work practices involved".

The addition of paragraph (a)(2)(vi) and the revised language contained in paragraph (a)(2)(vii) of the final rule will ensure that employers do not try to comply with § 1910.269 by simply handing training manuals to their employees. These provisions will require employers to take steps to assure that employees comprehend what they have been taught and that they are capable of performing the work practices mandated by the standard. OSHA believes that these two paragraphs will maximize the benefits of the training required under the standard.

OSHA believes that the training requirements contained in the final standard are sufficient to protect employees performing electric power generation, transmission, and distribution work. However, in every industry, there will be some employers who are not as faithful in following safety and health standards as others. The Agency intends to vigorously enforce the training requirements of the final rule, because much of the worker's safety depends on knowledge of and skills in proper working procedures. The combination of rigorous training provisions with strict enforcement of these rules will result in increased safety to employees.

Frequently, the conditions present at a jobsite can expose employees to unexpected hazards. For example, the grounding system available at an outdoor site could have been damaged by the weather or by vehicular traffic, or communications cables in the vicinity could reduce the approach distance to an unacceptable level. To protect employees from such adverse situations, the conditions present in the work area should be known so that appropriate action can be taken. Paragraph (a)(3) of § 1910.269 addresses this problem by requiring conditions existing in the work area to be determined before work is started. The language for this paragraph was taken from § 1926.950(b)(1). A similar requirement can be found in ANSI C2–1987 (the NESC), Section 420D (Ex. 2–8).

EEI contended that this paragraph belongs with provisions related to overhead lines (Ex. 3–112). They claimed that the provision was taken from a Subpart V requirement dealing with overhead lines and that making it a general rule distorted its meaning. Mr. Klaus Broscheit of the New England Power Service argued that this provision related to electrical hazards only (Ex. 3–62). He suggested that this be stated in the opening sentence of the requirement.

As noted earlier, § 1910.269(a)(3) was taken from § 1926.950(b)(1), a provision in Subpart V having general applicability. It relates to hazards common to all types of electrical work performed under that standard,[18] not just overhead line work. For example, the condition of the equipment grounding conductor that may be provided on a motor that is part of a generating installation affects the safety of anyone working on that motor. However, OSHA agrees with Mr. Broscheit that the conditions listed in the proposed rule related solely to safety in performing electrical work. Therefore, the Agency is limiting the application of this paragraph in the final rule to work "on or near electric lines or equipment".

Other commenters argued that determinations of switching transients, induced voltages, and integrity of grounds was not necessary for employee safety (Ex. 3–20, 3–23, 3–80, 3–82, 3–101, 3–112). Summarizing their objections, Mr. G. F. Stone of the Tennessee Valley Authority stated:

> Paragraph 3 appears to require an accurate determination be made as to the amount of induced voltage present in a given circuit before work begins. While it is important to recognize and control hazards associated with induced voltages and switching transients, this can be done and is routinely done in the utility industry without ever having to know the amount of induced voltage or switching transients present. The hazards associated with induced voltages are controlled by properly applying protective grounds before work begins. Application of protective grounds is covered in paragraph (n) of this standard. The hazards associated with switching transients are controlled by applying protective grounds, suspending switching operations on adjacent lines, and disabling automatic reclosing schemes.
>
> Unless paragraph (a)(3) is changed to reflect the [commenter's] proposed text, the utility industry will be required to measure for the amount of induced voltage. This step would be costly but would not offer any additional protection for the worker. [Ex. 3–82]

It is not OSHA's intent routinely to require employers to take measurements in order to make the determinations required by § 1910.269(a)(3). Knowledge of the maximum transient voltage level is necessary to perform many routine transmission and distribution line jobs safely; however, no measurement is necessary in the determination of what the maximum level is. It can be determined by an analysis of the electric circuit, or the employer can assume the default maximum transient overvoltages as discussed under § 1910.269(1)(2). Similarly, employers can make determinations of the presence of hazardous induced voltages and of the presence and condition of grounds without taking measurements.[19] To clarify the standard, OSHA has reworded the language of paragraph to read as follows:

> Existing conditions related to the safety of the work to be performed shall be determined before work on or near electric lines or equipment is started. Such conditions include, but are not limited to, the nominal voltages of lines and equipment, the maximum switching transient voltages, the presence of hazardous induced voltages, the presence and condition of protective grounds and equipment grounding conductors, the condition of poles, environmental conditions relative to safety, and the locations of circuits and equipment, including power and communication lines and fire protective signaling circuits.

The conditions found as a result of compliance with this paragraph will affect the application of various requirements contained within § 1910.269. For example, the voltage on equipment will determine the minimum approach distances required under § 1910.269(1)(2). Similarly, the presence or absence of an equipment grounding conductor will affect the work practices required under § 1910.269(1)(9). If conditions to which no specific § 1910.269 provision applies are found, then the employee would be trained, as required by paragraph (a)(2)(i), to use appropriate safe work practices.

Paragraph (b). Paragraph (b) of § 1910.269 sets forth requirements for medical services and first aid. In accordance with § 1910.269(b), the introductory text of paragraph (a)(1)(iii) emphasizes that the requirements of § 1910.151 apply. That existing section includes provisions for available medical personnel, first aid training and supplies, and facilities for drenching or flushing of the eyes and body in the event of exposure to corrosive materials.

Because of the hazard of electric shock when employees are performing work on or with energized lines and equipment, electric power generation, transmission, and distribution workers suffer electrocution on the job. Cardiopulmonary resuscitation (CPR) is necessary in the event of electric shock so that injured employees can be revived. CPR must be started within 4 minutes to be effective in reviving an employee whose heart has gone into fibrillation.

OSHA proposed requiring CPR training for field crews of two or more employees (a minimum of two trained employees) and for fixed worksites (enough trained employees to provide assistance within 4 minutes). The proposal requested comments on whether the requirement was reasonable and, if changes were suggested, on what the costs and benefits of the suggested changes would be.

Many commenters, including NIOSH, IBEW, UWUA, and EEI, supported requiring CPR training for electric power generation, transmission, and distribution workers, though some disagreed with the language contained in the proposed rule (Ex. 3–21, 3–46, 3–76, 3–82, 3–103, 3–107, 3–112). However, the National Arborist Association argued that line-clearance tree trimmers did not face a significant risk of electric shock (Ex. 3–113, 58; LA Tr. 338–340). This objection was also raised by tree trimming companies and

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[18] Although Subpart V applies only to the construction of electric transmission and distribution lines and equipment, the definition of "construction work" as it applies to Subpart V is very broad. In fact, EEI pointed out that much of the work that will be performed under § 1910.269 is nearly the same as work covered under Subpart V (Ex. 3–112).

[19] It may be necessary for measurements to be made if there is doubt as to the condition of a ground or the level of induced or transient voltage and if the employer is relying on one of these conditions to meet other requirements in the standard. For example, an engineering analysis of a particular installation might reveal that voltage induced on a deenergized line is considerable, but should not be dangerous. A measurement of the voltage is warranted if the employer is using this analysis as a basis for claiming that the provisions of § 1910.269(q)(2)(iv) on hazardous induced voltage do not apply. In another case, further investigation would be warranted if an equipment ground is found to be of questionable reliability, unless the equipment is treated as energized under § 1910.269(1)(9).

electric utility companies (Ex. 3–48, 3–63, 3–67, 3–75, 3–90, 3–91, 3–92, 3–98, 3–99, 3–104). Robert Felix, Executive Vice President of the National Arborist Association, claimed that a survey of 55 of their member companies, who perform 90 percent of the line-clearance tree-trimming work in the nation, accounted for 10 fatalities over a 3-year period (Ex. 58). None of the fatalities was caused by contact with an electric power line. He also asserted that OSHA's own fatality data did not demonstrate a risk of electrocution for line-clearance tree trimmers because the data did not distinguish between line-clearance and non-line-clearance tree trimming.[20]

Exhibit 9–6 contains all accident-related inspections for the period April 1984 to September 1989. In this exhibit, there are 19 fatalities for companies in Standard Industrial Code (SIC) 0783 that the data indicate involve line-clearance tree-trimming work. Although SIC 0783 includes companies that do not perform line-clearance tree trimming work as well as those that do, other information in the printout can be used to determine the type of work being performed. The abstract usually indicates that this was the type of work being performed, but sometimes this information can be gleaned from other data in the report, such as the voltage involved (transmission line voltages, 69 kV and higher, are assumed to involve line clearance as such lines are not typically present during residential tree work) or the establishment inspected (that is, an electric utility). Of these 19 fatalities, 12 (63 percent) were due to electric shock.

Exhibit 9–1 contains descriptions of accidents related to trimming trees near overhead power lines. It covers a period from approximately April 1984 to December 1986 and describes 15 accidents involving 14 fatalities and 3 injuries. Five of these accidents (five deaths) appeared to involve line-clearance tree trimming activities—two so state in the abstract; one involved a "trained employee" trimming along a 161-kV right of way (Ex. 9–6, same accident); one involved contact with a 69-kilovolt power line; and one involved an inspection of an electric cooperative (Ex. 9–6, same accident). Only four of the reports (5 deaths) apparently dealt with residential tree trimming. One of the reports concerned a line-clearance tree trimmer who received burns only (no fatality). The other abstracts related to accidents which could have related to either line-clearance or non-line-clearance work. This exhibit alone shows that a minimum of 5 electrocutions involving line-clearance tree-trimming activities occurred during this 2.75-year period, and the true number is likely to be even higher.[21]

It is not clear why the NAA survey failed to include any electrocutions;[22] however, the OSHA data amply demonstrate the risk faced by these tree-trimming employees. An estimated 8 line-clearance tree-trimming employees are electrocuted each year out of a population of approximately 36,000 full-time positions for a fatality rate of 0.00022, or a risk of electrocution of 1 in 100 over a 45-year working lifetime (Ex. 5). OSHA also estimates that about 40 workers among 137,800 electric utility employees at high risk under the proposal were electrocuted each year for a fatality rate of 0.00029, or a risk of electrocution of 1.3 in 100 over a 45-year working lifetime (Ex. 5). On this basis, OSHA has determined that the risk of electrocution for line-clearance employees is about 75 percent of the risk of those who face the highest probability of death from electric shock. Additionally, employees are also exposed to injury from electric shock; and, while the OSHA data do not accurately reflect injury rates, the Agency has found that injuries from electric shock normally occur at a much greater frequency than electrocutions (54 FR 5005–5006; Ex. 5). Therefore, the Agency concludes that employees involved in line-clearance tree-trimming work are exposed to a significant risk of electric shock.

Mr. Robert Felix of the National Arborist Association further argued that CPR was of dubious value with respect to injuries caused by electric shock. In NAA's post-hearing brief, he stated:

a study of the precise issue by medical experts (Cardiologist F. Gravino, M.D., F.A.C.C., et al.) commissioned by NAA and submitted to the Record as part of NAA's post-hearing evidence submission to the Docket, along with other related Record evidence, demonstrates the following medical assessment:

1. * * * There is no demonstrated value of CPR in the electric injury context.

* * * * *

2. * * * CPR is of no value to a person exposed to high voltage shock because of attendant "irreversible damage of either the autonomic nervous system or the cardiac tissue itself." (Gravino, et al., *supra*)

* * * * *

3. * * * Lower voltage contacts from indirect contacts do "not respond to CPR"—see National Safety Council Newsletter of July/August 1990, at p. 1, submitted to the Docket by NAA as part of its post-hearing evidence submission.

Moreover, such lower voltage contacts may induce respiratory block, rather than cardiac block, as to which artificial respiration, which is taught to line clearance tree trimmers as part of first-aid training, provides appropriate assistance, for which CPR would provide no additional benefit—a point conceded by NIOSH (D.C. Tr. 35, 67).

4. * * * Even if otherwise appropriate in an electrical context—a fact not supported by the evidence—CPR is of value only if followed by defibrillation within 8 minutes of the onset of ventricular fibrillation.

The likelihood of getting an 8 minute ambulance response time to a line clearance job site is remote (notwithstanding the isolated anecdotal evidence to the contrary arising in a non line clearance context in Seattle, Washington and West Va.).

* * * the dubious value of CPR further is attenuated by the remote likelihood of obtaining the required defibrillation within 8 minutes. [Ex. 58]

Others asserted that CPR was useful and necessary for the protection of workers exposed to electric shock (Ex. 3–21, 3–76, 3–107). Dr. Richard Niemeier of NIOSH stated that current medical guidelines recommend CPR treatment, as follows:

The revised "Standards and Guidelines for Cardiopulmonary Resuscitation (CPR) and Emergency Cardiac Care (ECC)" recommend the same treatment for cardiopulmonary arrest, whether spontaneous or associated with electrical shock [JAMA 1986]. The guidelines noted that the complications of electric shock that might require CPR include tetany of the muscles used for breathing during contact with the electrical current, prolonged paralysis of breathing muscles for a period following the electric contact, and cardiac arrest. This discussion considers two categories: (1) respiratory arrest (with pulse) and (2) cardiac arrest. [Ex. 15]

NIOSH reviewed studies on the effectiveness of CPR in resuscitating

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[20] NAA also noted that Eastern Research Group, Inc. (ERG), in its "Preparation of an Economic Impact Study for the Proposed OSHA Regulation Covering Electric Power Generation, Transmission, and Distribution" (Ex. 4), estimated a much lower incidence of fatalities to line-clearance tree-trimming crews—between zero and four per year. However, the ERG estimate was based on two sources: IBEW accident reports and the National Arborist Association data. As the IBEW does not represent many line-clearance tree trimmers, it cannot be expected to be in receipt of many reports by its members on line-clearance tree-trimming accidents. The NAA survey included no electrocutions.

[21] For various reasons, the OSHA fatality reports in Exhibits 9–1 and 9–6 did not record all occupational electrocutions occurring in this period. For example, despite reporting requirements, some fatalities are simply never reported to the Agency. Additionally, the OSHA data base does not include reports from all states with their own approved occupational safety and health programs. Further, with respect to Exhibit 9–1, some accident reports submitted for the period covered by this exhibit were not reviewed in time to be entered into the database.

[22] The OSHA data were submitted after the NPRM was published, but before the public hearing. Equivalent data were also submitted by OSHA to the Subpart S work practices rulemaking and were available even before § 1910.269 was proposed.

electric shock victims. Regarding this review of the available evidence, Mr. Niemeier stated:

The question posed by OSHA, at this time, however, is whether sufficient evidence exists to support the recommendation that utility linemen work in pairs and be trained in CPR. Medical ethics and common sense prohibit a prospective study with random allocation of electrical shock or other cardiac arrest victims to "CPR" and "non-CPR" groups. This question must be answered, therefore, by clinical epidemiologic studies that are less than perfect. Cummins and Eisenberg [1985] reviewed the evidence regarding the relationship of early CPR and survival following cardiac arrest. The authors found nine studies that they considered credible (before 1985); all nine studies reported that early CPR had a beneficial effect. Cummins and Eisenberg [1985] concluded that the evidence clearly supported the concept that early CPR (begun on the scene by lay persons) leads to better survival rates than CPR delayed until emergency medical personnel arrive. These studies generally exclude trauma victims from analysis; this fact does not preclude the extrapolation of these results to patients with cardiac rhythm disturbances secondary to contact with electrical energy. [Ex. 15]

The IBEW strongly urged OSHA to require CPR training for those exposed to the hazards of electric shock, stating:

The IBEW urges OSHA to adopt language which would require every employer covered by the standard, where employees can be expected by the nature of the work to be exposed to hazardous electrical contact, to train employees in cardio-pulmonary resuscitation. Line-Clearance tree-trimming personnel must also be trained in CPR. Numerous reports of accidents and life saving incidents submitted by IBEW Local Unions to the IBEW International Office, some of which have been submitted to OSHA during this rulemaking, argue forcibly for this provision in the standard. Therefore, the IBEW fully supports the OSHA proposed Rule 1910.269(b)(1)(i).

During the public hearing(s) testimony was given regarding the effectiveness of administering CPR to electrocution victims where the heart is in a state of fibrillation. The Electric Power Research Institute did a complete study of this issue with regard to methods of pole top rescue. [Ex. 61]

The EPRI study did recognize CPR as part of their recommended treatment for victims of electric shock (Ex. 57).

While the Gravino, et al., report cited in the NAA post-hearing comments did indeed point out several factors limiting the usefulness of CPR in the treatment of electric shock injuries,[23] OSHA is not persuaded that CPR cannot revive some victims of electric shock. In fact, the IBEW testified that their members have used CPR to save lives, and their accident records report the use of cardiopulmonary resuscitation techniques on employees injured by electric shock (Ex 12–12; DC Tr. 559–561, 564–565). The NIOSH testimony clearly indicates that accepted treatment of unconscious electric shock victims includes the application of CPR. As they stated, "The limited data available regarding survival after contact with electrical energy and other relevant data on factors associated with survival after cardiopulmonary arrest support the NIOSH recommendations [DC Tr. 34]."

OSHA has not accepted the argument that lack of fully equipped ambulances and slow response times negate any benefit that CPR training would provide. Though it is true that ACLS is needed to revive the heart after it goes into fibrillation, Mr. Heinz Ahlers of NIOSH stated that defibrillation is not necessary for cases of complete heart stoppage (that is, the heart stops beating completely rather than fibrillates) as occurs in response to some electric shocks (LA Tr. 358–360). Additionally, in cases of fibrillation of the heart muscle, emergency response times are quick enough (within 8 minutes 50 percent of the time in occupational sites in West Virginia—DC Tr. 66–68) and the presence of defibrillating equipment is present in sufficient and increasing quantities (presently in 25 percent of all licensed ambulances—Ex. 58; increasing over time—DC Tr. 67–68) for CPR provided on the scene by crew members to have an impact on employee safety on a country-wide basis.

For the foregoing reasons, OSHA has determined that a requirement for the training of employees in cardiopulmonary resuscitation techniques is necessary and appropriate. Therefore, § 1910.269(b)(1) retains the proposal's requirement that persons with training in first aid, including CPR, be available where employees are exposed to electric shock hazards.

Some commenters did suggest that OSHA clarify the standard to state that CPR was required only for employees exposed to the hazards of electric shock (Ex. 3–34, 3–80, 3–82, 3–88, 3–109, 3–123). Messrs. Nicholas Reynolds, Scott DuBoff, and Allen Flowers, commenting on behalf of several electric utilities, suggested "[i]ncorporation of a voltage level threshold" in the final standard by way of clarification (Ex. 3–109). The American Public Power Association and the Tennessee Valley Authority recommended adding the word "exposed" before "energized" to bring forth the intended meaning of the requirement (Ex. 3–80, 3–82).

OSHA agrees with these comments and has clarified the rule so that it applies to employees "performing work on or associated with exposed lines or equipment energized at 50 volts or more". This will clarify that the rule does not apply to employees working near insulated electric equipment, as the exposure to electric shock hazards is minimal. It also establishes a 50-volt threshold that has previously been recognized in the Agency's electrical standards as a general electric shock hazard limit. (See §§ 1910.303(g)(2)(i), 1910.304(f)(1), and 1910.333(a)(1) for examples.)

Proposed § 1910.269(b)(1)(i)(A) would have required two CPR-trained persons for field work that involved two or more employees. The National Arborist Association argued that requiring a minimum of two trained persons was not feasible for line-clearance tree trimming contractors (Ex. 3–113, 58; LA Tr. 375–377). Others also noted the difficulty of manning crews with two trained employees at all times, due to the extensive use of two-person crews and the 80-percent turnover rate in the industry (Ex. 3–60, 3–63, 3–67, 3–77, 3–87, 3–90, 3–91, 3–98, 3–100, 3–118). NAA made this statement in their post-hearing comment (Ex. 58):

Finally, CPR is not feasible for implementation in the line clearance tree trimming industry because the industry's employee turnover rate is 81% per year! Thus, as currently proposed by OSHA, a line clearance contractor could not field a typical two man line clearance crew until at least one member was trained in CPR, and no sooner than the new employee is trained, statistically, the odds are he will quit! See NAA survey of members' employee turnover for line clearance crews, submitted to the Record as part of NAA's post-hearing evidence submission. This survey shows that fully one third of new hires are gone within 30 days, almost half are gone in 60 days, 59% are gone in 90 days, 70% are gone in 6 months, 78% are gone in 9 months, and 81% are gone in a year. Thus, because having to train all of these imminent quits is an extraordinarily expensive outlay [FOOTNOTE: "$8,260,000—almost four times OSHA's estimate—see our pre-hearing Comment"] of dubious use in any event, we respectfully submit that this proposal exceeds OSHA's proper exercise of its legitimate authority.

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[23] The NAA comments misrepresent the study in one important area. Their comments stated, "CPR is of no value to a person exposed to high voltage shock because of attendant 'irreversible damage of either the autonomic nervous system or the cardiac tissue itself.' ". The actual statement in the study was "Exposure to extremely high voltage (with attendant high amperage) energized electric power lines . . . *might* well lead to irreversible damage of either the autonomic nervous system or the cardiac tissue itself. . . . CPR would be of no value in the resuscitation of a person *so exposed* [emphasis added]." Additional examples are given of circumstances that minimize the usefulness of CPR. However, no statement in the study indicates that CPR is of no value generally in electric shock cases.

NAA did acknowledge, however, that the "logistical infeasibility" of the CPR training requirement could be minimized by allowing employers to phase in training of new employees after they have been hired (Ex. 58; LA Tr. 376–377). In their post-hearing comment, they suggested a phase-in period of 6 months for newly hired employees (Ex. 58).

The Agency has accepted the need for flexibility in applying the rule to employers who experience a high turnover of employees or who, for other reasons, are faced with the problem of manning two-person crews with many new employees. The final rule does require the presence of two persons trained in first aid, including CPR, for field crews consisting of two or more employees. However, an exception is made to allow an employer to provide only one CPR-trained person if all new employees are trained in first aid, including cardiopulmonary resuscitation, within 3 months of their hiring dates. OSHA believes that the 3-month delay in the training of new employees will minimize the economic impact on line-clearance tree-trimming contractors (as well as any other employers who experience a high rate of turnover with new employees). As NAA testified, most of the turnover occurs within the first 3 months of an employee's tenure. Line-clearance tree trimmers that remain beyond 3 months are required to be trained; and, if they then quit and are hired by another firm after that, the training they have already received can be used by their new employer for compliance with paragraph (b)(1). Additionally, the 3-month delay in training new employees provides a built-in exception for students hired during the summer break.

OSHA believes that this rule gives line-clearance tree-trimming contractors and other small employers flexibility by permitting new employees to be trained within 3 months of being hired. It also maximizes safety for exposed employees by requiring all employees to be trained in CPR.

Paragraph (b)(1)(i)(B) of proposed §1910.269 would have required the presence of enough CPR-trained individuals to enable emergency treatment to begin within 4 minutes of an accident. Many commenters objected to the imposition of a time limit on the response to an accident (Ex. 3–20, 3–39, 3–42, 3–80, 3–112, 3–123, 3–131). Most claimed that a stricken employee may not be discovered for a while, making it impossible for employers to meet the standard. Some commenters suggested modifying the rule to apply the 4-minute limit starting with discovery of the accident (Ex. 3–39, 3–73, 3–83). Others recommended more general language, such as "as soon as practical", "as soon as possible", or simply "trained persons shall be available" (Ex. 3–20, 3–80, 3–123, 56).

OSHA intended proposed paragraph (b)(1)(i)(B) to provide guidance in the determination of the number of trained people necessary for prompt application of first aid or CPR in the event of an accident. The 4-minute time given in the proposal was not intended as an absolute time limit on responding to an accident and did not account for delays in discovering an accident. In fact, at the public hearing, Agency representatives stated that the proposal was written in performance language and that the standard would be enforced by determining the time it would take for a CPR-trained individual to get to an injured employee (DC Tr. 201–203). If the provision were worded so that the number of trained employees was based on the total time after discovery of the accident, travel time between the nearest trained person and the exposed employee would not always be counted. OSHA believes that it is important for cardiopulmonary resuscitation to begin within 4 minutes of an electric shock injury. The record indicates that once that time has passed CPR is of limited usefulness. The Agency also believes that it is important for the final rule to incorporate this objective. OSHA has reworded this requirement, however, to state its intent that exposed employees be no more than 4 minutes from a CPR-trained person.

Some commenters were also concerned that remote work stations with limited staffs could not meet the requirement proposed for fixed work locations (Ex. 3–42, 3–102, 3–112). To respond to these comments, OSHA has added the following exception:

> However, where the existing number of employees is insufficient to meet this requirement (at a remote substation, for example), all employees at the work location shall be trained.

Proposed §1910.269(b)(1)(ii) would have required first aid training to be equivalent to the training provided by the American Red Cross. This provision was proposed to define the quality of first aid training required. In the preamble to the proposal, OSHA requested comments on whether there were additional training programs that provide equivalent training and that should also have been listed in the regulation.

Several commenters listed organizations that provide first aid or CPR training equivalent to that given by the American Red Cross (Ex. 3–21, 3–24, 3–42, 3–59, 3–60, 3–69, 3–123). In the past, OSHA recognized many other organizations as having acceptable first aid training programs under §1910.151(b), through the use of interpretations and formal compliance documents (CPL instructions).

While the American Red Cross first aid training program is nationally recognized, OSHA believes that accrediting this organization in the text of the standard would give it greater visibility than others who provide equally protective programs. OSHA also believes that listing all currently recognized first aid courses is not practical, especially since the Agency no longer formally acknowledges such programs. Instead of recognizing individual programs, OSHA has adopted guidelines for the evaluation of first aid training by competent professionals as well as by compliance staff in the context of workplace inspections (OSHA instruction CPL 2–2.53). Because these guidelines are already in place, there is no need to address this issue in §1910.269. Additionally, generic requirements on first aid training belong in §1910.151, where they would apply generally, rather than in §1910.269, where they would apply only to electric power generation, transmission, and distribution work. Therefore, OSHA has decided not to carry proposed paragraph (b)(1)(ii) forward into the final rule. The Agency will continue to use the guidelines in CPL 2–2.53 to determine the adequacy of first aid training courses provided to employees.

In §1910.269(b)(2), OSHA proposed that first aid supplies recommended by a physician be placed in weatherproof containers, unless stored indoors, and that these containers be readily accessible. This was to ensure that proper first aid supplies are available and are in good condition when needed.

Several comments objected to the language "[f]irst aid supplies recommended by a physician" (Ex. 3–21, 3–69, 3–86, 3–102, 3–109, 3–123). They expressed the concern that this term was too ambiguous and would rule out commercially available first aid kits.

This language was taken from existing §1910.151(b). It was the intent of the proposal that the first aid supplies required by this current regulation be stored in weatherproof containers. It was not intended that the existing provision be modified by the new standard to require different types or amounts of first aid supplies. To express this intent more clearly, the final rule replaces "recommended by a physician" with "required by § 1910.151(b)".

Two commenters suggested that the regulation not require first aid supplies stored in vehicles to be kept in a weatherproof container (Ex. 3–20, 3–80). They argued that storing the supplies inside a vehicle would protect them from the weather.

OSHA has decided to require first aid supplies that may be exposed to the weather to be kept in weatherproof containers. This performance-oriented language would thus require the supplies to be protected from the elements only if it is necessary. (It should be noted that § 1926.50(d)(2) requires first aid supplies to be kept in weatherproof containers. Thus, first aid kits used in construction would have to be weatherproof in any event.)

Paragraph (b)(3) of § 1910.269 proposed that first aid kits be maintained ready for use and be inspected at least annually in accordance with an established schedule. OSHA proposed this provision to ensure that first aid kits are maintained with all of the proper equipment.

The Utility Workers Union of America questioned the adequacy of the requirement for annual inspections (Ex. 3–76; DC Tr. 413). Mr. Marshall Hicks of the UWUA stated:

> In dealing with paragraph (b)(3), the requirement for an annual inspection of first-aid kits we also feel is totally inadequate. And again speaking from personal experience, in the system where I was employed, the first-aid kits, ladders and fire extinguishers were inspected on a monthly basis.
>
> And even on a monthly basis, we found that substantial amounts of supplies from the first-aid kits were missing or previously used and had to be restocked. On an annual basis, I am afraid that in less than six months that the first-aid kits would be totally empty if they were not inspected and replenished on a routine basis. We would therefore request or suggest that OSHA reconsider this proposal and require a monthly inspection of first-aid kits.

OSHA is also concerned that supplies might not be adequate if inspections are made on an annual basis. However, there is no evidence that monthly checks are necessary or adequate. Therefore, the final rule carries forward the proposed requirement for an annual inspection and also requires first aid kits to be examined often enough to ensure that expended supplies are replaced on a timely basis.

Paragraph (c). In paragraph (c) of § 1910.269, OSHA requires a job briefing to be conducted before each job. Most of the work performed under the standard requires planning in order to ensure employee safety (as well as to protect equipment and the general public). Typically, electric power transmission and distribution work exposes employees to the hazards of exposed conductors energized at thousands of volts. Power generation work frequently involves electrical hazards, as well as the hazards of air pressures in the range of 15 to 500 pounds per square inch, of water pressures of 35 to 4000 pounds per square inch, of chemical injection systems of 250 to 4000 pounds per square inch, of steam pressures of 15 to 4000 pounds per square inch at temperatures of up to 1000 degrees Fahrenheit, and of hazardous substances (LA Tr. 50). If the work is not thoroughly planned ahead of time, the possibility of human error is increased greatly. To avoid problems, the task sequence is prescribed before work is started. For example, before climbing a pole, the employee must determine if the pole is capable of remaining in place and if minimum approach distances are sufficient, and he or she must determine what tools will be needed and what procedure should be used for performing the job. Without job planning, the worker may ignore the minimum approach distance requirements or may have to reclimb the pole to retrieve a forgotten tool or perform an overlooked task, resulting in increased exposure to the hazards of falling and contact with energized lines.

When more than one employee is involved, the job plan must be communicated to all the affected employees. If the job is planned but the plan is not discussed with the workers, one employee may perform his or her duties out of order or may otherwise not coordinate activities with the rest of the crew, endangering the entire crew. Therefore, OSHA is requiring a job briefing before work is started. The briefing would cover: hazards and work procedures involved, special precautions, energy source controls, and requirements for personal protective equipment.

OSHA received numerous comments about the practicality of enforcing the requirement for job briefings (Ex. 3–9, 3–13, 3–69, 3–71, 3–123, 3–125, 3–128, 62–16, 62–18, 62–22, 62–38). Expressing the concerns of many of these commenters, the Nashville Electric Service stated:

> NES believes job briefing is important, and it has been its experience that such job briefings are already in place. The mandating of such a technical requirement imposes a burden which is very difficult to enforce and would negate the primary object of job briefings; that is, to ensure that crew members are aware of all work-related hazards. [Ex. 62–22]

Additionally, several commenters objected to the additional paperwork burden that would be imposed by the requirement (Ex. 3–20, 3–53, 3–80, 3–109, 3–123).

Others supported OSHA's requirement for job briefings (Ex. 3–9, 3–46, 3–59, 3–107, 3–115; LA Tr. 50–53). Even those who disagreed with the language in proposed § 1910.269(c) accepted the importance of planning the work and discussion of the job plan among employees involved in the work. As the Nashville Electric Service noted, job briefings are already being done.

OSHA has carried the requirement for these briefings forward into the final rule. The concern of those who objected to the paperwork burden is unfounded. The final rule, like the proposal before it, does not contain a provision for making or keeping records of these briefings.

The introductory text in proposed § 1910.269(c)(1) was worded as follows:

> Before starting each job, the employer shall ensure that the employee in charge shall conduct a job briefing with the employees involved. The briefing shall cover such subjects as: hazards associated with the job, work procedures involved, special precautions, energy source controls, and personal protective equipment requirements.

Some comments objected to the phrase "the employer shall ensure that" (Ex. 3–20, 3–44, 3–58, 3–69, 3–71, 3–80, 3–112, 3–123). These commenters offered suggested substitutions, such as "the employer shall require" and "the employee in charge shall conduct". For example, Mr. Carl Behnke of EEI stated:

> while a utility may require that supervisors, foremen and other employees assigned the responsibility for directing work activities perform certain tasks such as conducting a job briefing, the utility cannot "ensure" or "guarantee" that such a briefing will in fact be conducted each and every time it would be necessary and appropriate to do so. This is an effort to impose strict liability which is beyond OSHA's statutory authority, and thus is inappropriate regulatory language. [Footnote omitted.] An employer can be required under OSHA only to establish and communicate a policy requiring that a job briefing be conducted, and implement appropriate disciplinary action against those who are assigned the responsibility but fail to carry it out.
>
> In the EEI/IBEW draft, the responsibility for conducting the job briefing would be delegated by the employer to the "employee in charge." This might include a supervisor or senior employee at the location who is familiar with the work to be performed. The performance-oriented wording contained in the EEI/IBEW submittal represents a more reasonable and rational approach to the issue

of job briefing and should be substituted for OSHA's proposed language. [Ex. 3–112]

OSHA has rejected these arguments. All the suggested alternatives to the proposed language attempt to absolve employers of duties that must be imposed to protect employees to the fullest. As noted by Mr. Behnke, the EEI/IBEW draft language places the responsibility for compliance on the employee in charge. The standard properly places the responsibility on the employer to see that job briefings are conducted. Mr. Behnke also noted that an employer can be required to establish and communicate a policy requiring that job briefings be conducted and to implement appropriate disciplinary action against those who are assigned the task but fail to carry it out (Ex. 3–112). The Agency feels that the EEI/IBEW draft language does not convey the full weight of these duties to employers. Likewise, terms such as "the employer shall require" impose only a small part of the responsibility for compliance on employers.

The current General Industry Standards and Construction Standards contain many examples of the phrase "the employer shall ensure".[24] This language does not make the employer an absolute guarantor of an employee's compliance. In fact, the Agency recognizes unpreventable employee misconduct as an affirmative defense to a citation, and OSHA's policy is not to issue a citation where the employer has fulfilled his or her responsibilities to inform the employee of an adequate work rule and to enforce that rule uniformly.[25]

For these reasons, OSHA has carried forward the language of the proposed provision without substantive change.

Under paragraph , at least one briefing is required to be conducted before the start of each shift. Only one briefing in a shift is needed if all the jobs are similar in nature. Additional planning discussions must take place for work involving significant changes in routine. For example, if the first two jobs of the day involve working on a deenergized line and the third job involves working on energized lines with live-line tools, separate briefings must be conducted for each type of job.

Under paragraph (c)(2), the required briefing would normally consist of a concise discussion outlining the tasks to be performed. However, if the work is particularly hazardous or if the employees may not be able to recognize the hazards involved, then a more thorough discussion must take place. With this provision, OSHA recognizes that employees are familiar with the tasks and hazards involved with routine work. However, it is important to take the time to carefully discuss unusual work situations that may pose additional or different hazards to workers. (See also the preamble discussion of § 1910.269(a)(2)(iv).) OSHA has included a note following this paragraph in the final rule to clarify that, regardless of how short the discussion is, the briefing must still touch on all the topics listed in the introductory text of paragraph (c).

Proposed § 1910.269(c)(3) would have exempted employees working alone from the requirements for job briefings. Though it would still be important for the employee to plan the work, OSHA felt that work procedure discussions would not have relevance for a single worker inasmuch as there would be no one else available for discussion. However, in the preamble to the proposal, OSHA requested comments on the need for and desirability of a requirement for job planning for these workers.

OSHA received several comments supporting the proposed exemption of employees working alone from the requirement for job briefings (Ex. 3–20, 3–42, 3–107, 3–112). The Los Angeles Department of Water and Power argued that it would be superfluous to require job planning for an employee who reports alone at the job location (Ex. 3–20). Union Electric Company was concerned about the practicality of such a requirement (Ex. 3–42).

NIOSH and the National Electrical Manufacturers Association supported a provision requiring job planning for employees working alone (Ex. 3–21, 3–81). NIOSH reported that several of their reports of fatalities among utility workers indicate that a thorough job briefing may have prevented a fatality (Ex. 3–21). They argued that the acknowledged hazards of overhead line work should require prior planning with a supervisor for each day's task and each new location. The UWUA also supported a requirement that applied to employees working alone (DC Tr. 424; LA Tr. 44).

Even in the preamble to the proposal, OSHA recognized the importance of job planning for all employees. The Agency does not believe that an employee who labors alone needs to plan his or her tasks any less than one who is assisting others. Several fatalities in the record involved a lone employee who could have benefitted from better job planning or perhaps a briefing with the supervisor before the job started (Ex. 3–21, 9–2, 12–12). Therefore, OSHA has included a requirement for job planning for these employees. The language in § 1910.269(c)(3) of the final rule reads as follows:

> An employee working alone need not conduct a job briefing. However, the employer shall ensure that the tasks to be performed are planned as if a briefing were required.

OSHA believes that this provision will encourage additional planning of the job.

Paragraph (d). Paragraph (d) of § 1910.269 contains hazardous energy control (lockout/tagout) requirements. The provisions of this paragraph in the proposal were patterned after the national consensus standard of the American National Standards Institute, ANSI Z244.1–1982, "American National Standard for Personal Protection—Lockout/Tagout of Energy Sources—Minimum Safety Requirements" (Ex. 2–21). In addition, the provisions of the proposed paragraph were consistent and compatible with the generic procedures originally contained in OSHA's proposed general industry standard for control of hazardous energy sources (lockout/tagout), which was published on April 29, 1988 (53 FR 15496).

After the electric power generation, transmission, and distribution standard was proposed, a final general industry standard on the control of hazardous energy sources was issued (September 1, 1989, 54 FR 36644). In order to ensure that issues raised in that rulemaking were also considered in this one, OSHA incorporated the entire lockout/tagout record into the record on § 1910.269 (54 FR 4982).[26] The Agency stated in the preamble to proposed § 1910.269 that, if it was determined that final § 1910.269 would contain lockout and tagging provisions, these requirements would be the same as those in the final generic lockout/tagout standard, except as necessary to provide for unique situations in electric power generation work. OSHA used this guideline in developing paragraph (d) of the final electric power generation, transmission, and distribution standard.

OSHA received numerous comments on this issue. Utility representatives

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[24] See, for example, §§ 1910.95, 1910.147, 1910.151, 1910.183, 1910.184, 1910.217, 1910.268, 1910.1001, 1910.1028, 1910.1030, 1910.1047, 1910.1048, 1910.1200, 1910.1450, 1926.24, 1926.50, 1926.58, 1926.59, 1926.403, 1926.431, 1926.605, 1926.800, and 1926.1053. The individual paragraph numbers have been omitted because they are too numerous. Similar language, such as "the employer shall insure" and "the employer shall assure", also occurs throughout the OSHA standards.

[25] Occupational Safety and Health Administration Field Operations Manual, Chapter 5, Section E.

[26] UWUA, Local 246, also requested that OSHA incorporate this evidence into the electric power generation, transmission, and distribution rulemaking (LA Tr. 45).

generally argued that utility tagging systems are unique and provide a high degree of safety to their employees (Ex. 3–20, 3–32, 3–42, 3–82, 3–112, 3–123; LA Tr. 215–239). Others supported the use of the generic standard (at least as proposed) for lockout and tagging of electric power generation systems, which recognized systems using locks or tags (Ex. 3–13, 3–34, 3–39, 3–45, 3–68, 3–73, 3–83, 3–88). NIOSH and the UWUA argued, as they did in the generic standard rulemaking record, that locks should be required and that each employee should be protected by personal locks (Ex. 3–21, 3–76; DC Tr. 30, 414–415; LA Tr. 45–49, 54–59, 68–70).

Mr. John Bachofer, Vice President of Metropolitan Edison Company, representing Edison Electric Institute addressed the issue of control of hazardous energy sources at the public hearing in Los Angeles, CA. He explained the case that tagging systems in use in the utility industry are unique and fully protect employees as follows:

> As OSHA is well aware, one of the most important aspects of this proposal is OSHA's recognition that in the electric utility industry tagging systems provide excellent protection for utility workers when it is necessary to control hazardous energy sources. OSHA specifically recognized this point in the preamble to the generic lockout/tagout standard and we appreciate it. Nonetheless, there are some who are participating in this rulemaking who have asked the agency to reconsider its position on this point.
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> * * * * *
>
> [W]e want to show why this standard should be the only one regulating control of all types of hazardous energy sources in the operation and maintenance of electric utility facilities. There are six basic concepts that we'd like to emphasize. First, the control of energy in several of its various forms; electrical, chemical, thermal, mechanical, internal (such as pressure of liquid or gas) is fundamental to electric utility work. It's a large part of what we do.
>
> Second, because it is central to our operations, control of hazardous energy is absolutely critical to employee safety and all of us in the industry from the CEO to the entry level ground helper, mechanic or operator, take it very, very seriously. Everyone of our employees is trained to recognize that the forms of energy we deal with are very unforgiving. As Mr. Lawson of PEPCO said in the lockout/tagout hearing, "Compliance with tagging procedures in this industry is akin to an orthodox religion."
>
> Third, because we recognize what we are dealing with, the methods we use to control hazardous energy involve a comprehensive and documented process. In the electric utility industry devices that can effect the operation of a system are operated only on specific or standard orders issued from authorized personnel.
>
> Fourth, employees who may be exposed to hazardous energy are trained in the application of hazardous energy control procedures and are required to comply rigorously with those procedures, including the formality and documentation which provides constant audit and reinforcement of the integrity of these procedures. Employees successfully complete training before they're considered qualified to request that tagging procedures be initiated and before they are assigned switching and tagging work as part of their normal job duties. Employees who violate these procedures are subject to serious discipline.
>
> Fifth, the methods for controlling energy, while perhaps varying slightly due to local design differences or practices, are essentially consistent throughout the electric utility industry. We, of course, speak only for the investor-owned portion of the industry, but we think that you'll find that the public power and rural cooperative representatives agree.
>
> Sixth, just as OSHA has concluded, and as IBEW has agreed, this industry's hazardous energy control procedures work and they work very, very well. Not to say that as in any human endeavor there is no chance for human error or for malfeasance. Unfortunately, it happens. Albeit infrequently. Undoubtedly, you have heard in the course of this proceeding of isolated instances in which the system has alleged to have failed, but we wish to point out that there are hundreds of thousands, if not millions, of successful examples. In fact, in the time it takes to make this presentation there will probably be hundreds of successful tagging operations performed in utilities around the country and you won't hear about one of them, which is great because it means that no one will have gotten hurt. [LA Tr. 215–219]

EEI also displayed a videotape of a typical tagging procedure used by one of their member companies (Ex. 12–6). They argued that the tagging system used by electric utilities is characterized by formality and redundant controls (Ex. 56).

OSHA has not accepted the argument that the elements of hazardous energy control in electric utility operations are so unique that they warrant a completely different set of lockout and tagging requirements. EEI's six basic concepts do not demonstrate unique conditions in electric utility workplaces. Rather, they encompass conditions common to many large industrial worksites, as follows:

1. "First, the control of energy in several of its various forms; electrical, chemical, thermal, mechanical, internal (such as pressure of liquid or gas) is fundamental to electric utility work." Not only do many non-utility employers find it necessary to control many different forms of hazardous energy, companies that generate electric power as a by-product of their normal production activities would often have even more sources of energy to control (Ex. 3–39, 3–45, 3–68, 3–83).

2. "Second, because it is central to our operations, control of hazardous energy is absolutely critical to employee safety and all of us in the industry from the CEO to the entry level ground helper, mechanic or operator, take it very, very seriously." Several employers commenting on the generic lockout standard made the same argument (54 FR 36654; Ex. 3–45, 3–68).

3. "Third, because we recognize what we are dealing with, the methods we use to control hazardous energy involve a comprehensive and documented process." In the generic hazardous energy control rulemaking, OSHA found that companies with successful tagging programs "implemented detailed energy control procedures" (54 FR 36655).

4. "Fourth, employees who may be exposed to hazardous energy are trained in the application of hazardous energy control procedures and are required to comply rigorously with those procedures, including the formality and documentation which provides constant audit and reinforcement of the integrity of these procedures." Likewise, OSHA determined that successful tagging programs throughout industry include "extensive training programs", including the reinforcement of this training and discipline for those who violate the tagging procedures (54 FR 36655).

5. "Fifth, the methods for controlling energy, while perhaps varying slightly due to local design differences or practices, are essentially consistent throughout the electric utility industry." While this might be true,[27] OSHA does not believe that consistency alone in energy control across an industry has a great impact on employee safety. For example, if company A and company B have identical lockout procedures, employees might be protected to equal degrees in both companies. However, just the simple fact that both lockout procedures are the same has little impact on employee safety.[28] It is the procedures themselves that directly impact employee safety. In fact, better

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[27] Some evidence in the record indicates that there are differences in the lockout and tagging procedures used by different utilities and even by the same utility in different plants (Ex. 3–31, 3–80; DC Tr. 414; LA Tr. 49). The rulemaking record does demonstrate, however, that the use of tags rather than locks is common practice in the utility industry and that many of the procedures used to ensure the integrity of the "tagout" system are similar.

[28] If both companies share accident information, this might lead to better lockout procedures for both companies. However, it is the lockout procedures, not the consistency between the programs, that lead to better safety for employees.

procedures could lead to even greater safety. Furthermore, different companies with identical procedures could have differing follow-up systems, such as supervision, retraining, and incident investigation. Follow-up techniques themselves can vastly improve lockout procedures. Moreover, new entrants in the utility industry may not choose to apply hazardous energy control procedures in the same manner as existing electric utility companies, and the final electric power generation, transmission, and distribution standard applies to other industries as well. Besides, the generic lockout rule allows for a wide variation in specific procedures. Thus, OSHA has evaluated the lockout and tagging procedures of the electric utility industry, as identified in the electric power generation, transmission, and distribution rulemaking record, to determine whether they protect employees to an acceptable degree. The content of § 1910.269(d) is based on this evaluation.

6. "Sixth, just as OSHA has concluded, and as IBEW has agreed, this industry's hazardous energy control procedures work and they work very, very well." This also does not make the industry's procedures unique. The preamble to the generic lockout standard relates the experience of many companies with successful lockout or tagging programs (54 FR 36654–36655).

Representatives of the Utility Workers Union of America pointed out the weaknesses of some utilities' tagging method of hazardous energy control (LA Tr. 45–49, 54–59, 68–70). Messrs. Carl Wood, Scott Treon, and Willard Kelly testified that tags had come off and had fallen to the floor (LA Tr. 55, 62, 67). Messrs. Bernardo Garcia, Marshall Hicks, and Allen Wilson maintained that work authorizations under these tagging systems had been released under pressure from supervisory personnel or without the knowledge of the employee who held the authorization (LA Tr. 46; DC Tr. 414, 444). UWUA representatives also stated that testing work had been permitted on circuits that were deenergized and tagged (LA Tr. 46, 57, 59–60), that tags had been incorrectly attached (LA Tr. 55), and that some tags were improper (LA Tr. 67–68). They were also concerned that training in the employers' tagging system was inadequate (LA Tr. 46, 61–63, 69). The UWUA supported their allegations with documentary evidence, such as grievances on work authorizations (hazardous energy control) and related training, union safety committee reports of problems with work authorizations, company audit reports and memoranda of such problems, and State and Federal agency notices of deficiencies in the work authorization system (Ex. 66).

In the preamble to the final generic standard on the control of hazardous energy sources, OSHA stated that "various electric utilities * * * report that they have used tagout in lieu of lockout successfully for many years" (54 FR 36655). However, in the preamble to the final electrical safety-related work practices standard, the Agency further found that "as documented in two of the computer printouts in Exhibit 8, the electric utility industry had [at least] 14 fatalities and 17 injuries recorded in OSHA files that were directly caused by a failure of the lockout/tagout procedure in use", during the period of July 1, 1972, to June 30, 1988 (55 FR 32003). It appears from this evidence that, although some electric utility companies have had excellent success with their tagging systems, other companies have had problems.

OSHA found this same dichotomy in the rulemaking record on § 1910.147. The Agency believes that there is no reason to reach a different conclusion here, because the evidence in the electric power generation, transmission, and distribution rulemaking is basically no different from that in the lockout and tagging record. Therefore, OSHA has reached the same final determination and rationale with respect to the issue of whether the Agency should require the use of locks, locks and tags, or tags alone to control potentially hazardous energy, as follows:

> Much of the testimony and comment received in this rulemaking has focused on whether the standard should require lockout as opposed to the proposed approach of allowing lockout or tagout. In a sense, it was unfortunate that attention was focused more on a single aspect of the standard, though it is certainly an important one, than on the standard taken as a whole. The proposed standard was intended to specify that the employer provide a comprehensive set of procedures for addressing the hazards of unexpected reenergization of equipment, and the use of locks and/or tags was intended to be only a single element of the total program. In order to provide adequate protection to employees, the Final Rule requires employers to develop and utilize a comprehensive energy control program consisting of: procedures for shutting down and isolating machines and equipment and locking or tagging out the energy isolating devices; employee training; and periodic inspections of the energy control procedure to maintain its effectiveness. The procedures must consist of steps for deenergization of equipment, isolation of the equipment from energy sources, and verification of deenergization before servicing and maintenance is performed on equipment, and the employees who either perform the servicing or maintenance or are affected by those operations must be properly trained in the energy control procedures which apply to their work.
>
> It should be noted that locks and tags by themselves do not control hazardous energy. It is the isolation of the equipment from the energy source and the following of the established procedures for deenergization and reenergization of the equipment that actually controls the energy. Locks and/or tags are attached to the disconnects and other energy isolating devices after the machine or equipment has, in fact, been isolated, in order to prevent them from being reenergized before the work has been completed. If the equipment has not been properly deenergized, and if proper procedures have not been followed, neither a lock nor a tag will provide protection.
>
> The treatment of lockout vs. tagout presents OSHA with a difficult regulatory dilemma. On the one hand, if the issue were simply whether a lock or a tag will be better able to prevent equipment from being reactivated, there is no question that a lock would be the preferred method. Locks are positive restraints which cannot be removed (except through extraordinary means such as by the use of bolt-cutters) without the use of a key or other unlocking mechanism. By contrast, the limitations of tags used alone are self-evident: They do not serve as positive restraints on energy isolating devices, but are only warnings to employees that the equipment is not to be reenergized. Tags not fastened with a strong material can become detached from the energy isolating device by wind or other environmental conditions, and the legend on some tags can be rendered illegible if the tag becomes wet. Tags may not provide protection if there are affected employees who do not read English or who have not been properly trained in the tagging system and its implementation.
>
> However, the issue in this rulemaking is not merely on the use of lockout vs. tagout, but rather the use of locks and/or tags in a comprehensive program of energy control. As was noted in the preamble of the proposed rule (53 FR 15496, April 29, 1988), OSHA is aware of workplaces in which tagout systems are used with great effectiveness. In particular, various electric utilities and chemical plants report that they have used tagout in lieu of lockout successfully for many years (Tr. pg. H194–214; W2–3 to 2–39). In evaluating these industries, OSHA has determined that there are several factors which have contributed to their successful use of tagout programs: first, these companies have implemented detailed energy control procedures which are quite similar to those set forth in both the proposed and final lockout/tagout standard; second, they have established and utilized extensive training programs to teach their employees about their energy control procedures, including the use of tags and the importance of obeying them; third, these companies reinforce their training periodically. However, it is the fourth common element, discipline, which appears to be the most critical to the success of these programs; the companies with effective tagout programs apply disciplinary action to both supervisors and employees who violate the tagout procedures.

OSHA believes that an effective tagout system needs all four of these elements to be successful. However, it is the fourth element, discipline, which is the most difficult to incorporate into a regulatory approach in the Final Rule. Not surprisingly, it also reflects the most serious limitation of tagout which does not arise with lockout. Because a tagout program does not involve positive restraints on energy control devices, it requires constant vigilance to assure that tags are properly applied; that they remain affixed throughout the servicing and maintenance of equipment; and that no employee violates the tag by reenergizing the equipment, either intentionally or inadvertently, before the tag is removed. By contrast, a lockout device, once applied, cannot inadvertently be removed, and cannot be removed intentionally by an unauthorized person except by the use of force.

In the Final Rule, OSHA has determined that lockout is a surer means of assuring deenergization of equipment than tagout, and that it should be the preferred method used by employees. However, the Agency also recognizes that tagout will nonetheless need to be used instead of lockout where the energy control device cannot accept a locking device. Where an energy control device has been designed to be lockable, the standard requires that lockout be used unless tagout can be shown to provide "full employee protection," that is, protection equivalent to lockout. [54 FR 36655, corrected at 55 FR 38677, 38684]

OSHA has decided to take the same approach in this standard and has taken two steps to realize this objective. First, the final rule includes a note indicating that the Agency will accept compliance with § 1910.147 as compliance with § 1910.269(d). The lockout and tagging provisions of § 1910.269 are based on the requirements in the generic standard; therefore, it is appropriate to recognize this formally in the final rule. This will allay the concerns of the many commenters who were concerned that employers would be faced with having to comply with two different standards for the control of hazardous energy sources.[29] It will also ease the burden of compliance for employers (including electric utilities) who have taken steps to comply with § 1910.147, which has been in effect for over 2 years.

Second, the requirements in paragraph (d) of final § 1910.269 have been patterned after those in final § 1910.147. Issues decided in that rulemaking are being dealt with in the same manner in this one. (References to the preamble discussion of these issues are noted in parentheses, or in brackets if the material is quoted.) The Agency has incorporated different rules in § 1910.269(d) only to the extent that they are warranted based on unique conditions presented by electric power generation installations, as noted in the rulemaking record. Absent such unique conditions, the two standards contain the same requirements, though the language is not always identical.

OSHA believes that this approach will maximize employee safety, while minimizing compliance burdens. This approach also effectively eliminates any safety and cost concerns that might be raised with regard to substantive inconsistencies between the two lockout and tagging standards.

Paragraph (d)(1) of final § 1910.269 limits the application of the provisions of paragraph (d) to the control of energy sources in installations for the purpose of electric power generation, including related equipment for communication or metering. The scope of this paragraph is intended to coincide with the exemption from the generic lockout standard contained in § 1910.147(a)(1)(ii)(B). The provisions of § 1910.269 cover installations exempted by this paragraph in the generic standard. Installations in electric generating plants that are not addressed in § 1910.269(d) are covered under § 1910.147; for such installations, there should be no overlaps or gaps in coverage under the two standards.

EEI also argued that § 1910.269 should be the only standard that applies to the control of hazardous energy within an electric power generation plant and that § 1910.147 should not apply (Ex. 3–112). OSHA decided this issue in the rulemaking on the generic lockout standard as follows:

> If such equipment is either an integral part of, or inextricably commingled with, power generation processes or equipment, OSHA agrees that the power generation standard will apply instead of the generic lockout/tagout standard. [54 FR 36660]

The first note following paragraph (d)(1) has been modified from the proposal to incorporate this concept. As mentioned earlier in this preamble, a second note has been added to the final version of this paragraph explaining OSHA's enforcement policy regarding the interface between § 1910.269 and § 1910.147. Employers who use procedures developed under and conforming to § 1910.147 for the control of hazardous energy sources related to the generation of electric power will be considered as being in compliance with § 1910.269(d).

Procedures for the control of electric energy used for purposes of transmission and distribution are addressed in § 1910.269(m). These systems are installed outdoors and are connected to the ultimate consumer of the electric power. The considerations involved in the control of hazardous energy sources related to transmission and distribution systems are truly unique compared to other industrial energy systems. Transmission and distribution lines are exposed to contact with energized conductors that are part of unrelated circuits; voltage backfeed from unknown power sources can energize "deenergized" lines; and induced voltage from nearby power lines can present hazards to employees working on "deenergized" lines. Therefore, separate requirements apply to the control of hazardous energy involving these systems, as noted in final § 1910.269(d)(1). This separation of energy control procedures was not opposed by any interested party and, in fact, was specifically supported by two commenters (Ex. 3–39, 3–83).

Paragraph (d)(2) lists general requirements. Paragraph (d)(2)(i) of proposed § 1910.269 would have required employers to ensure that all potentially hazardous energy was isolated, locked out or tagged out, and otherwise disabled in accordance with the provisions of paragraph (d), before an employee could perform any activity during which energizing, start-up, or release of stored energy could occur and cause injury.

Several utilities objected to the language contained in this proposed paragraph (Ex. 3–20, 3–23, 3–40, 3–62, 3–80, 3–112, 3–120). Most suggested that OSHA replace the phrase "and otherwise disabled" to "or otherwise disabled".

As an Agency representative explained at the hearing, the proposal was intended to require that equipment be deenergized in accordance with the provisions of the standard (DC Tr. 208–209). The provision was not intended to require employers to take steps to disable equipment in addition to those in the standard. In order to clarify the requirement in the final rule, OSHA has

[29] EEI also noted the possibility of an employer's having to comply with four different general industry standards on lockout and tagging: §§ 1910.147, proposed 1910.269(d) and (m), and 1910.333(b) (Ex. 3–112). However, the OSHA electrical lockout and tagging requirements also recognize compliance with § 1910.147, with two exceptions. Further, § 1910.269(m) has limited application in generating plants (substations and transmission lines only). As discussed later, the differences between paragraphs (d) and (m) are based on differences in hazards posed by the types of installations involved. Therefore, if an employer wanted to follow a single standard on the control of hazardous energy sources for generation and utilization installations within an electric power generating plant, he or she could comply with § 1910.147, with only two additional provisions to follow for work on electric utilization installations.

adopted language taken from § 1910.147(c)(1), which reads as follows:

The employer shall establish a program consisting of energy control procedures, employee training, and periodic inspections to ensure that, before any employee performs any servicing or maintenance on a machine or equipment where the unexpected energizing, start up, or release of stored energy could occur and cause injury, the machine or equipment is isolated from the energy source and rendered inoperative.

As noted previously, OSHA is adopting the generic lockout standard's approach to the issue of whether or not to require locks on disconnects rather than tags alone. Briefly, § 1910.147 requires the use of locks on disconnects that are capable of being locked out, unless the employer demonstrates that the use of a tagging system will provide full employee protection (that is, a level of protection equivalent to that provided by a lockout program).

Paragraph (d)(2)(ii) of final § 1910.269 adopts these requirements, based on § 1910.147(c)(2). These provisions read as follows:

(ii) The employer's energy control program under paragraph (d)(2) of this section shall meet the following requirements:

(A) If an energy isolating device is not capable of being locked out, the employer's program shall use a tagout system.

(B) If an energy isolating device is capable of being locked out, the employer's program shall use lockout, unless the employer can demonstrate that the use of a tagout system will provide full employee protection as follows:

(*1*) When a tagout device is used on an energy isolating device which is capable of being locked out, the tagout device shall be attached at the same location that the lockout device would have been attached, and the employer shall demonstrate that the tagout program will provide a level of safety equivalent to that obtained by the use of a lockout program.

(*2*) In demonstrating that a level of safety is achieved in the tagout program equivalent to the level of safety obtained by the use of a lockout program, the employer shall demonstrate full compliance with all tagout-related provisions of this standard together with such additional elements as are necessary to provide the equivalent safety available from the use of a lockout device. Additional means to be considered as part of the demonstration of full employee protection shall include the implementation of additional safety measures such as the removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device, or the removal of a valve handle to reduce the likelihood of inadvertent energizing.

(C) After [insert date 120 days after publication], whenever replacement or major repair, renovation, or modification of a machine or equipment is performed, and whenever new machines or equipment are installed, energy isolating devices for such machines or equipment shall be designed to accept a lockout device.

OSHA believes that electric utilities generally meet these requirements. Although lockout is rarely used, the industry's tagging systems generally provide protection equivalent to that obtained by the use of a lockout program.[30] The final standard requires this of all affected employers, thus ensuring the safety of all electric power generation, transmission, and distribution workers.

An employer who uses a tagging system must demonstrate that it will provide full employee protection, as explained in paragraph (d)(2)(ii)(B). The employer must obviously demonstrate that the tagging program meets all tagging-related requirements in the standard, such as proper materials and construction of the tagout device, the durability of the tag, and the capability of the attachment means to prevent the unauthorized or accidental removal of the tagout device (see paragraph (d)(3)(ii)). However, as noted earlier, OSHA does not believe that a tagout program that simply meets the requirements of the standard would be as protective as a lockout program, even though the tagging requirements have been strengthened considerably from the proposal. For the employer to demonstrate that a tagging program is as protective as lockout for a lockable piece of equipment, that employer will need to show additional elements that bridge the gap between lockout and tagging. The employer must consider additional measures that will further enhance the safety of the tagging program, such as the removal of isolating circuit elements, the locking of a controlling switch, or the opening of an additional disconnecting device. By requiring that the employer make a showing of the effectiveness of tagging in situations that are otherwise amenable to lockout, the standard that each type of control (lock or tag) will provide an acceptable level of safety for employees who must perform the servicing or maintenance on the machine or equipment. Based upon the range of variations that are possible in different situations, OSHA believes that the comparative effectiveness of any particular energy control program can be made only after examination and evaluation of the factors present at each point of application.

Paragraph (d)(2)(iii) of final § 1910.269 requires a procedure to be developed, documented, and used for the control of potentially hazardous energy. The language of this provision has been modified slightly from proposed § 1910.269(d)(2)(ii) for clarification.

Paragraph (d)(2)(iv) specifies elements to be included in the procedure, including the purpose for the procedure and the rules and techniques to apply. One comment on the corresponding paragraph in the proposal, § 1910.269(d)(2)(iii), was concerned that an entire system would have to be deenergized to allow work to be performed on only a portion of the system (Ex. 3–20). To clarify this in the final rule, OSHA has replaced the word "system" with the term "machine or equipment". This is the language used in § 1910.147.

Paragraphs (d)(2) (iv) through (vi) of proposed § 1910.269, dealing with periodic inspections of the hazardous energy control procedures in use at a workplace, have been combined in the final standard into § 1910.269(d)(2)(v). Paragraph (d)(2)(v) of final § 1910.269 requires periodic inspections to ensure that the provisions of the standard are followed.

In the preamble to the proposal, OSHA requested comments on whether or not a minimum frequency for such inspections should be specified in the standard. Utility representatives responding to this issue generally suggested either that no minimum frequency be specified or that the requirement be deleted entirely (Ex. 3–13, 3–20, 3–42, 3–44, 3–53, 3–58, 3–80, 3–82, 3–112). EEI's comment exemplified these recommendations, as follows:

As proposed, these sections [proposed § 1910.269(d)(2) (iv) and (v)] properly state a performance requirement for periodic inspections. In response to OSHA's request for comment on whether a minimum frequency for periodic inspections should be required, EEI reiterates the testimony of Robert L. Lawson of PEPCO on cross-examination at the hearing on OSHA's proposal for a generic lockout/tagout standard. Mr. Lawson explained to OSHA that:

"We see little value of an annual certification of a tagging system. A tagging system, as we use in our industry, has to be constantly watched by management to ensure that it's working. It's watched, number one, from a discipline standpoint. If you have an isolated employee that ignores it or refuses to comply with something because it's for his convenience, you have to be able to catch those infractions to issue discipline.

"In my company here, PEPCO in Washington, D.C., we're constantly looking at the procedure, to update things. If we have new systems going in, we evaluate that to see whether it is compatible with the existing

[30] The number of fatalities related to failure of electric utilities' tagging systems indicates that some individual systems may not provide safety at this level.

tagging procedures . . . and we're constantly looking at things like that to ensure that the tagging procedure is adequate to protect employees. So that's why we recommend that it's got to be an ongoing, constant survey of that procedure or system." [Footnote omitted.]

Accordingly, because the record shows that evaluation of tagging systems is an ongoing process in the utility industry, EEI submits that there is no record basis for specifying minimum frequency. [Ex. 3–112]

Others suggested a minimum frequency of from once every two hours to once per year (Ex. 3–11, 3–107; DC Tr. 425). For example, the New Hampshire Electric Cooperative stated:

Some minimum should be stated as to what "periodic" is. Once every 100 years is periodic once the inspection has been repeated. We suggest yearly.

The IBEW also supported specifying a minimum frequency, as follows:

The term periodic inspections could lead to misunderstanding regarding the time duration between inspections. The IBEW would propose that the minimum frequency for the periodic inspections be two times per year for each work location.

OSHA has decided to require the inspections to be performed at least once a year. OSHA agrees with the IBEW that the standard needs to specify the frequency of the required inspections; otherwise, enforcement difficulties would be likely. The periodic inspection is intended to assure that the energy control procedures continue to be implemented properly, that the employees involved are familiar with their responsibilities under those procedures, and that employees follow and maintain proficiency in the energy control procedure. The evidence indicates that electric utilities are performing audits of their lockout programs on a constant and routine basis (Ex. 3–112; LA Tr. 217, 264–266, 423–425). An annual inspection, as suggested by the New England Electric Cooperative, is specified in § 1910.147(c)(6)(i), and employers must comply with this requirement for their non-electric power generation installations. The inspections conducted as a result of § 1910.269 can easily be integrated into the ones employers are already conducting under § 1910.147.

Paragraphs (d)(2)(v)(A) through (d)(2)(v)(E) detail requirements that the periodic inspection must meet. These provisions require that the inspections be performed by authorized employees, be designed to correct identified deviations or inadequacies, include reviews between the inspector and authorized and affected employees of the employees' responsibilities, and be certified by the employer. The proposed rule did not contain all the requirements of the final version. The rationale for the inclusion of the new provisions was stated in the preamble discussion of § 1910.147(c)(6), as follows:

Due to the severity of the risks associated with a lapse in the implementation of the energy control procedure, paragraph (c)(6) requires that periodic inspections be performed at least annually in order to verify and to ensure that the energy control procedure is being properly utilized. One method for meeting the performance requirements in this paragraph would be to use random audits and planned visual observations to determine the extent of employee compliance. Another would include modifying and adopting ordinary plant safety tours to suit this purpose.

The periodic inspection is intended to assure that the energy control procedures continue to be implemented properly, and that the employees involved are familiar with their responsibilities under those procedures. A significant change in this requirement from the proposal involves the activities of the person performing the inspections. The inspector, who is required to be an authorized person not involved in the energy control procedure being inspected, must be able to determine three things: first, whether the steps in the energy control procedure are being followed; second, whether the employees involved know their responsibilities under the procedure; and third, whether the procedure is adequate to provide the necessary protection, and what changes, if any, are needed. The inspector will need to observe and talk with the employees in order to make these determinations. The Final Rule provides some additional guidance as to the inspector's duties in performing periodic inspections, to assure that he or she obtains the necessary information about the energy control procedure and its effectiveness. Where lockout is used, the inspector must review each authorized employee's responsibilities under the procedure with that employee. This does not necessarily require separate one-on-one meetings, but can involve the inspector meeting with the whole servicing crew at one time. Indeed, group meetings can be the most effective way of dealing with this situation, because they reinforce the employees' knowledge of the procedures and how they are to be utilized, and to be able to recognize any problems with the energy control program. Where tagout is used, the inspector's review of responsibilities extends to affected employees as well, because of the increased importance of their role in avoiding accidental or inadvertent activation of the equipment or machinery being serviced. OSHA believes that these reviews, which will need to be performed on at least an annual basis during the periodic inspections, will assure that employees follow and maintain proficiency in the energy control procedure, and that the inspector will be better able to determine whether changes are needed.

A related change from the proposal is found in the certification provision in paragraph (c)(6)(ii) of the Final Rule. In addition to the operation, date of inspection, and name of inspector, the Final Rule also requires identification of the employees included in the inspection. This change provides for the inspector to indicate which employees were involved with the servicing operation being inspected, in order to assure that these employees have had the opportunity to review their responsibilities and demonstrate their performance under the procedure.

Inspections must be made by an authorized employee other than one implementing the energy control procedure being inspected. This is done to ensure that the employee performing the inspections knows the procedures and how they are to be utilized, and to be able to recognize any problems with the energy control program. The inspections must be designed and conducted to correct any deviations uncovered. In addition, the employer must certify that they have been performed. These inspections are intended to provide for immediate feedback and action by the employer to correct any inadequacies observed.

These inspections are intended to ensure that the energy control procedure has been properly implemented and to provide an essential check on the continued utilization of the procedure. [54 FR 36672–36673, corrected at 55 FR 38681, 38685]

OSHA believes that this rationale applies equally to the electric power generation, transmission, and distribution standard. As previously noted, the evidence presented by UWUA members demonstrated that not all electric utility tagging systems work as well as those presented by the EEI witnesses. Additionally, the emergence of new types of companies [31] into the electric utility industry and extending the scope of the standard to other industries will expand coverage of § 1910.269 to employers that might not have the tagging systems that provide the level of safety EEI has testified is common among their member companies. To ensure that this does not occur, the Agency has adopted these provisions from § 1910.147.

In paragraphs (d)(2)(vi), (d)(2)(vii) and (d)(2)(viii) of final § 1910.269, OSHA specifies that the employer provide effective initial training, as well as retraining as required by changing

[31] As a result of legislative action and changes in the electric utility industry during the past decade, the number of independent power producers has grown tremendously (Ex. 6–25). (The Federal Energy Regulatory Commission defines an independent power production facility as a generator that is less than 80 megawatts capacity and that uses biomass, waste, renewable resources, geothermal resources, or a combination of these as the primary energy source.) According to ERG, independent power production capacity grew by an estimated 700 percent (Ex. 6–25). Regulated electric utilities purchase electric power at special rates from these independent power producers under the Public Utility Regulatory Policies Act of 1978 (16 U.S.C. 2101 et seq.).

conditions in the workplace, or when an inspection conducted in accordance with paragraph (d)(2)(v) reveals the need for retraining. Additionally, paragraph (d)(2)(ix) requires certification of such training of employees. OSHA considers these requirements to be of critical importance in helping to ensure that the applicable provisions, restrictions, and prohibitions of the energy control program are known, understood, and strictly adhered to by employees.

As is the case with the other provisions of this rule, OSHA believes that the training requirements under this standard need to be performance oriented so as to deal with the wide range of workplaces covered by the standard. However, in order to provide adequate information, any training program under this standard will need to cover at least four areas: The employer's energy control program, the elements of the energy control procedures that are relevant to the employee's duties, the restrictions of the program applicable to each employee, and the requirements of this final rule. The details will necessarily vary from workplace to workplace, and even from employee to employee within a single workplace, depending upon the complexity of the equipment and the procedure, the employees' job duties and their responsibilities under the energy control program, and other factors. Paragraph (d)(2)(vi) of final § 1910.269 establishes the amount of training that is required for the three groups of employees: "Authorized" employees, "affected" employees, and all "other" employees.[32] The relative degree of knowledge required by these three employee groups is in descending order, with the requirements for authorized employees demanding the most effort in training. Because authorized employees must use the energy control procedures, it is important that they receive training in recognizing and understanding all potentially hazardous energy that they might be exposed to during their work assignments. It is also necessary that they be trained in the use of adequate methods and means for the control of such energy. The authorized employees are the ones who must use the energy control procedure to provide for their protection when they are performing the servicing or maintenance of the machines or equipment. Therefore, they need extensive training in aspects of the procedure and its proper use, together with all relevant information about the equipment being serviced.

The training OSHA requires for "affected employees" is less stringent than that for "authorized employees", simply because affected employees do not perform servicing or maintenance operations which are performed under an energy control procedure. Affected employees are important to the overall protection provided in the energy control program, however, because such employees work in areas where the program is being utilized by authorized employees. It is vital to the safety of the authorized employees that the affected employees recognize lockout or tagout devices immediately, that they know about the purpose of those devices, and, most importantly, that they know not to disturb the lockout or tagout devices or the equipment to which the devices are affixed. Therefore, the standard requires that affected employees be instructed in these matters. The instruction needs to be sufficient to enable the employees to determine if a control measure is in use. The instruction also needs to make affected employees aware that disregarding or violating the prohibitions imposed by the energy control program could endanger their own lives or the lives of co-workers.

OSHA requires, in paragraph (d)(2)(vi)(C), that all other employees be instructed about the restrictions imposed upon all employees by the energy control program. This instruction on the employer's energy control program can be conveyed during new employee orientations, by the use of employee handbooks, or through regularly scheduled safety meetings. The training of employees other than authorized and affected employees is considered by OSHA to be essential since other employees working in the plant or facility have been known to have turned on the power to a machine or equipment on which another employee is performing a servicing or maintenance activity. Inadvertent and intentional activation of machines or equipment by employees other than those working on the machine or equipment is not limited to affected employees. The training requirements for these other employees are minimal, essentially requiring only that these employees know what the energy control program does and that they are not to touch any locks, tags, or equipment covered by this program.

The training requirements for the different classes or types of employees as they are defined in this final standard are performance oriented, thereby providing the employer with considerable flexibility in how the training should be conducted. The employer is permitted to use whatever method will best accomplish the objective of the training. Considerable latitude is given to employers in the development and conduct of the required training for authorized, affected, and other employees.

In paragraph (d)(2)(vii), OSHA is establishing a requirement for additional training for all employees in plants or facilities where tagout is the preferred method of energy control. The need for this additional or supplemental training for employees in those facilities is based upon the fact that the use of tagout relies upon the knowledge of the employees and their adherence to the limitations imposed by the use of tags. It is also consistent with current practice. Several commenters who use tagout programs stated in their comments and testimony that tagout is effective in the electric utility industry because, among other things, the program provides for extensive training and reinforcement of the elements of the tagout procedures (Ex. 3–112; DC Tr. 615; LA Tr. 217–218, 224). The requirements of this paragraph have been taken from § 1910.147(c)(7)(ii).

Paragraph (d)(2)(viii) of proposed § 1910.269 would have required annual retraining for all authorized and affected employees, either by regular on-the-job work assignments or by specific training. Several commenters objected to the requirement that this training be provided on an annual basis (Ex. 3–20, 3–80, 3–82, 3–86). They argued that retraining should only be required on a performance basis, that is, when it is needed.

OSHA has accepted these arguments and has incorporated the provisions of § 1910.147(c)(7)(iii) on this subject into § 1910.269(d)(2)(viii) of the final rule. This performance-oriented approach would require formal retraining only when it is necessary for employee safety, such as when the periodic inspection required under paragraph (d)(2)(v) identifies deficiencies or when control procedures that the employee uses change. It should be noted that paragraph (d)(2)(v) requires the periodic inspection of the energy control procedure to be conducted on an annual basis. This inspection includes a review between the inspector and each

[32] The terms "authorized employee" and "affected employee" are defined in proposed § 1910.269(x). An authorized employee is one who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment. An affected employee is one whose job requires him or her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him or her to work in an area in which such servicing or maintenance is being performed. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance covered under this section.

authorized employee, and the inspection must be designed to detect such deficiencies as the need for additional training.

Paragraph (d)(2)(ix) requires the employer to certify that the employee training has been accomplished and has been kept up to date. Many commenters objected to the use of the word "certify" and suggested alternatives, such as "determine" and "verify" (Ex. 3–20, 3–33, 3–39, 3–44, 3–45, 3–58, 3–82, 3–83, 3–86). To clarify this requirement in the final rule, OSHA has included a provision stating that the certification need consist only of the employee's name and the date he or she was trained.

OSHA believes that a written certification serves the same purpose as a written record of the training, while minimizing the paperwork burden on employers. It should be noted that the certification is not intended as a means of evaluating the completeness or efficacy of the training; it only provides an indication that training has been performed. The quality and content of the training are not evaluated through the certification of performance. As noted earlier, the standard sets forth the elements which must be included in the training for employees. In evaluating whether an employee has been adequately trained, OSHA will examine the employee's responsibilities under the energy control program in relation to the elements of the standard.

In paragraph (d)(3) of final § 1910.269, OSHA requires the employer to provide the necessary protective materials and hardware, such as locks, tags, chains, and adapter pins, for attachment to the energy isolating devices. This paragraph in the standard also requires that the devices be unique to the particular use (the only ones authorized for the purpose); that they be durable, standardized, and substantial; and that they identify the user.

The standard utilizes performance language in imposing these requirements. OSHA believes that the obligations imposed by paragraph (d)(3) are not overly restrictive or complicated. To meet the requirement in paragraph (d)(3)(i) to supply protective equipment and hardware, an employer either can issue devices to each employee responsible for implementing energy control measures or can exercise the option of simply having a sufficient quantity of the devices on hand at any given time and assign or distribute them to employees as the need arises. All authorized employees will need to have these devices available to attach to energy isolating devices whenever they perform servicing or maintenance using the energy control procedure.

The proposed standard specified that lockout or tagout devices be singularly identified, be the only devices used for controlling hazardous energy, and be durable, standardized, substantial, and identifiable. These requirements remain substantially unchanged in the final rule (paragraph (d)(3)(ii)). A restriction on the use of these devices (for hazardous energy control only) is being adopted, based on the record on the generic lockout/tagout standard, to ensure that the sight of a distinctive lock or tag will provide a constant message of the use to which the device is being put and the restrictions which this device is intended to convey (54 FR 36671). If lockout or tagout devices are used for other purposes, they can lose their significance in the workplace. For the energy control procedure to be effective, these devices must have a single meaning to employees: Do not energize or attempt to start or operate a machine or equipment when such a device is affixed to an energy isolating device that controls the energy to that machine or equipment.

In § 1910.269(d)(3)(iii), OSHA proposed that lockout or tagout devices be durable. There was concern by some of the witnesses at the hearing that existing tags were of inadequate construction (LA Tr. 121–123). In order to overcome some of these concerns, OSHA is adding in the final rule a requirement that tagout devices be constructed and printed so that exposure to weather or other environmental conditions which exist in the workplace will not cause the tag to become unserviceable or the message on the tag to become illegible (paragraph (d)(3)(ii)A)). For any sign, tag, or other message-bearing item, the message must remain legible for the employees to be able to ascertain the meaning and intent of the message.

In paragraph (d)(3)(ii)(B), OSHA requires lockout and tagout devices to be standardized in one of the following criteria: color, shape, size, print, or format, in order that they be readily identifiable and distinguished from other similar devices found in the workplace. In addition, the final rule clarifies that the use of a standardized print and format is for tagout devices. This is done to ensure that tagout devices, which rely exclusively on employee recognition for their effectiveness, will be so unique as to minimize the chances of their being misidentified or their message misinterpreted.

In paragraph (d)(3)(ii)(C), OSHA requires that lockout devices be substantial enough to prevent their removal without the use of excessive force or unusual techniques. Tagout devices and their means of attachment are similarly required by paragraph (d)(3)(ii)(D) to be constructed so that the potential for inadvertent or accidental removal is minimized. Tag attachment means are further required to be attachable by hand, and to be of strength equivalent to a one-piece non-releasable, self-locking cable tie. These additional requirements are being imposed to ensure that tags do not become disconnected or lost during use, thereby negating their effectiveness. Such provisions were supported at the hearing by some of the witnesses (LA Tr. 121–123).

In paragraph (d)(3)(ii)(E), OSHA requires that lockout or tagout devices identify the employee who applies the device or devices. This requirement is similar to the provision proposed in § 1910.269(d)(3)(v). Identification of the user provides an additional degree of accountability to the overall program. It enables the employer to inspect the application of the energy control procedure and determine which employees are properly implementing its requirements. If locks or tags are not being properly attached by an employee, identification on the locks and tags will enable the employer to locate that employee and correct the problem promptly, including additional training, as necessary. This requirement will enable employers and other employees to determine at a glance which authorized employees are performing a given servicing operation. It puts them on notice that if questions arise about the servicing or the energy control procedure, the persons listed on the lockout and tagout devices are the appropriate persons to ask. The authorized employee has the additional assurance that other employees know of his or her involvement in the servicing operation and that only he or she is allowed to remove the device.

OSHA believes that knowing who applied a lockout device to a machine or equipment can save time and lives. If an employee, upon completing a job, forgets to remove a lockout device, the identity of the employee can be immediately determined and the employee made available to complete the procedure. If that employee cannot be located, it is possible that he or she is still working on the equipment. It would then be possible to check out the area and assure that the employee and others are out of the danger area before the device is removed. Marking a lockout or tagout device is a simple way of identifying the person who applies it and can prevent the inadvertent reenergizing or reactivation of equipment before that employee has been located and has moved clear of the equipment. Thus, marking the identity of the employee who uses a lockout or tagout device is an appropriate safeguard.

Marking of the lockout or tagout devices can also promote a sense of security in employees, in that each device is the individual employee's device, used only for his or her protection. This sense of identity also can be used to encourage willing utilization of the energy control procedure. When an employee can identify with a part of the program he or she controls for his or her own protection, that employee will likely be an active participant in making the program work.

In paragraph (d)(3)(ii)(F), OSHA states that the legend (major message) on tagout devices must warn against hazardous conditions if the equipment is energized. Five examples of major messages are provided in paragraph (c)(5)(iii): Do Not Start, Do Not Open, Do Not Close, Do Not Energize, and Do Not Operate. OSHA recognizes, however, that these messages may not be sufficient to cover all conditions involving hazardous energy control. For that reason, these legends are only examples of what must be stated. Graphics, pictographs, and other symbols that convey the message that the tag represents serve the same purpose as a written message and therefore would be acceptable to OSHA. Additionally, the use of danger tags must meet the requirements of § 1910.145.

OSHA proposed, in § 1910.269(d)(4)(i), that energy isolating devices used for the control of potentially hazardous energy sources, including valves, be marked or labeled to identify the equipment supplied and the energy type and magnitude. If they were positioned and arranged so that these elements were evident, however, the marking requirement would not have applied. Paragraph (d)(4)(ii) proposed that these devices be operated only by authorized employees. OSHA reasoned that employees working with energy control procedures need adequate information about the hazards of the equipment that they are servicing and that they must be certain that the equipment they are working on is the same equipment that was intended to be disabled. They should feel confident that they have secured the correct energy control devices and are protected from the hazards of inadvertently working on energized equipment.

The proposed identification requirement of paragraph (d)(4)(i) would have applied to all energy isolating devices, including devices which control hydraulic, pneumatic, steam, and similar energy sources by the use of valves or similar devices. The proposed generic lockout standard included an identical provision. The comments received in the electric power generation, transmission, and distribution rulemaking record echoed the arguments of those who commented on the generic standard. As there was no new evidence introduced here, OSHA has simply adopted the outcome and rationale relating to final § 1910.147(c)(6), as follows:

> OSHA has determined that the marking or labeling of energy isolating devices is not reasonably necessary for the effectiveness of the energy control program. Authorized employees are required at (c)(7)(i)(A) [§ 1910.269(d)(2)(vi(A)] to receive training in and to know that information relating to hazardous energy. Authorized employees, in order to perform their servicing or maintenance duties under the energy control procedure, are required to know the type and magnitude of the energy sources which must be controlled. The marking or labeling of the sources themselves will not provide the authorized employees with any additional information. Second, as far as affected or other employees are concerned, their role in the energy control program is essentially to understand what the program is designed to accomplish, and to recognize that when they see an energy isolating device with a tag and/or lock on it, they are not to touch the equipment, regardless of what the type and magnitude of the energy might be. OSHA believes that marking the equipment with this information would not enhance the protection of these employees, because their compliance with the energy control procedure does not depend upon knowledge of these details.
>
> Accordingly, OSHA has eliminated the proposed requirement for marking or labeling energy isolating devices. In its place, OSHA is incorporating a specific requirement in paragraph (c)(7)(i)(A) [§ 1910.269(d)(2)(vi(A)] that authorized employees be trained in the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and in the methods and means necessary for energy isolation and control. OSHA further requires in paragraph (d)(1) [§ 1910.269(d)(6)(i)] that authorized employees must know the type and magnitude of the energy, the hazards of the energy to be controlled and the method or means to control the energy even before the machine or equipment is turned off. OSHA believes that employee knowledge of this information is essential to ensure that the correct energy control devices are used on the proper energy isolating devices and in the proper manner. This provision requires the employee to have that specific information prior to deenergizing the equipment, in order to control the energy and render the machine or equipment safe to work on. OSHA does recognize that the physical shutdown of the machine or equipment can be accomplished by either the authorized or affected employee.
>
> The new paragraph (c)(8) [§ 1910.269(d)(4)] requires that lockout or tagout be performed only by the authorized employees who are performing the maintenance or servicing. These are the only employees who are required to be trained to know in detail about the types of energy available in the workplace and how to control the hazards of that energy. Only properly trained and qualified employees can be relied on to deenergize and to properly control lockout or tagout machines or equipment which are being serviced or maintained, in order to ensure that the work will be accomplished safely. [54 FR 36675–36676, corrected at 55 FR 38682, 38685]

In paragraph (d)(5), OSHA requires that whenever servicing or maintenance might affect other employees' work activities, the employer or the authorized employee must tell those employees before applying lockout or tagout devices and after they are removed that servicing or maintenance is going to be done or has been completed on a machine or equipment.

Several commenters were concerned that the standard would require notification of employees who were not at the workplace of the lockout or tagout of machines or equipment (Ex. 3–20, 3–80, 3–42, 3–62, 3–112, 3–120; LA Tr. 226–227). They argued that the equipment was frequently locked out or tagged out over weekends or at night when many employees were away from work. As the Los Angeles Department of Water and Power noted: "The actual intent probably is to ensure that employees currently working with or near equipment be notified prior to application of lockout/tagout controls if such controls would directly affect them." (Ex. 3–20)

Indeed, the Agency does intend, when controls are to be applied to equipment, for employers to inform employees currently working with or near such equipment, not employees at home. An affected employee is one whose job requires him or her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him or her to work in an area in which such servicing or maintenance is being performed. OSHA does not interpret this definition as including a person who is not at the workplace. Employees who are not at the workplace need not be notified of the placement of lockout or tagout controls while they are away from work. However, these employees must be notified of the application of lockout or tagging as soon as they return to work.

OSHA believes that the requirement contained in paragraph (d)(5) is an essential component of the total energy control program. Notification of affected employees when lockout or tagout is going to be applied provides an opportunity for the employer or authorized employee who notifies them of the impending interruption of the normal production operation to remind them and reinforce the importance of the restrictions imposed upon them by the energy control program.

OSHA believes that these measures are important to ensure that employees who operate or use machines or equipment do not unknowingly attempt to reenergize those machines or equipment that have been taken out of service and deenergized for the performance of activities covered by this standard. The lack of information regarding the status of the equipment could endanger both the servicing employees and the employees working near the equipment, who might attempt to reenergize or operate the equipment. Such notification is also needed after servicing is completed to assure that employees know when the control measures have been removed. Without such information, employees might mistakenly believe that a system is still deenergized and that it is safe to continue working on or around it.

Paragraph (d)(6) of final § 1910.269 provides that six separate and distinct steps be followed in stopping, deenergizing, and locking out or tagging machines or equipment and that the actions be taken in the sequence presented. Paragraph (d)(6)(i) requires that in preparation for the shutdown of machinery or equipment, the authorized employee must know about the type and magnitude of the energy, the hazards involved, and the means of controlling them. (As mentioned previously, this provision was incorporated in the final rule in order to address the hazards that would have been covered by proposed paragraph (d)(4)(i) on marking energy isolating devices, which is not included in final § 1910.269.) Paragraph (d)(6)(ii) then requires that the machine or equipment be turned off or shut down according to the procedure normally employed for stopping the machine or equipment. This will be done by the authorized employee or the affected employee (the machine or equipment operator or user). This is the starting point for all subsequent actions necessary to put the machine or equipment in a state that will permit employees to work on it safely.

In many operations, activation of an electrical push-button control or the movement of a simple throw switch (electrical, hydraulic, or pneumatic) to the "stop" or "off" mode is sufficient to meet this provision. In other cases, however, there are many control devices that must be closed, shut down, or stopped in a particular sequence. In these instances, a series of predetermined steps may be necessary to achieve a shutdown of the machine or equipment. Paragraph (d)(6)(ii) of final § 1910.269 requires an orderly shutdown of the equipment to ensure that the necessary steps are taken in the proper sequence.

Following shutdown of the machine or equipment, paragraph (d)(6)(iii), as the next step in the procedure, provides that energy isolation devices be physically located and operated in such a manner as to isolate the machine or equipment from energy sources. For example, once an electrical push-button control has been utilized to stop the movement of machine or equipment parts as the first step of the shutdown procedure, isolation can then be accomplished by ensuring that the push-button circuitry cannot be supplied with additional electrical energy. For such equipment, the isolation requirement can be accomplished by the employee's actions in tracing the path from the control toward the energy source until he or she locates the energy isolating device and by his or her moving the energy isolating device control lever to the "safe", "off", or "open" position. Performing these actions will prevent the reintroduction of energy to the push-button circuitry and will isolate the operating control and the machine or equipment from the energy source.

As the fourth step in the procedure, paragraph (d)(6)(iv) provides that action be taken to secure the energy isolating devices in a "safe" or "off" position. This paragraph requires that lockout or tagout devices be affixed to each energy isolating device by the authorized employee and that they be attached so as to prevent unintended reactivation of the machine or equipment.

Paragraph (d)(6)(iv) of final § 1910.269 requires the hazardous energy control device to be attached in a manner that will minimize the chance that the energy isolating device will be moved into an unsafe position. For energy isolating devices that are capable of being locked out, this provision requires the lock or tag to be attached so as to hold the isolating device in a safe position. Otherwise, a tag would have to be placed as close as safely possible to the isolating device in a position that will be immediately obvious to anyone attempting to operate the device. OSHA believes this will clarify this provision of the standard, as requested by two commenters (Ex. 3–11, 3–42).

Paragraph (d)(6)(v) provides that the next step taken in the energy control procedure is to relieve, disconnect, and restrain all potentially hazardous stored or residual energy in the machine or equipment. Up to this point, the purpose of following all the steps of the procedure has been to enable the employee to isolate and block the source of energy feeding the machine or equipment to be worked on at a point beyond which it cannot be bypassed. However, energy can very easily be trapped in a system downstream from an energy isolating device or can be present in the form of potential energy from gravity or from spring action. Stored or residual energy of this sort cannot be turned on or off; it must be dissipated or controlled (that is, relieved or restrained).

When energy may still be present in a system that has been isolated from the energy source, this paragraph requires such energy to be controlled before an employee attempts to perform any work covered by the scope of the standard. Compliance with this provision might require, for example, the use of blocks or other physical restraints to immobilize the machine, machine components, or equipment for control of the hazard. In the case of electric circuits, grounding might be necessary to discharge hazardous energy. Hydraulic or pneumatic systems might necessitate the use of bleed valves to relieve the pressure.

The final rule addresses the hazards of stored or residual energy in a performance manner. Rather than trying to determine all of the potential manners in which this energy can be stored or retained in machines, equipment, and materials being used in the production process, OSHA requires (in paragraph (d)(6)(i)) that the authorized employee must have knowledge of the energy (including stored or residual energy), its hazards, and how to control it. Paragraph (d)(6)(v) of final § 1910.269 requires the stored or residual energy to be relieved, disconnected, restrained, or otherwise rendered safe as part of the energy control procedure. Under paragraph (d)(6)(vi), verification of isolation must be continued until the servicing or maintenance is completed or until the possibility of reaccumulation of energy no longer exists.

Under paragraph (d)(6)(vii), as the sixth step in the energy control procedure, the authorized employee must ensure that the previous steps of the procedure have been taken to isolate the machine or equipment effectively.

This must be done prior to starting the servicing or maintenance work. The authorized employee needs to verify that the machine or equipment was turned off or shut down properly as required by paragraph (d)(6)(ii) of final § 1910.269; that all energy isolating devices were identified, located, and operated as required by paragraph (d)(6)(iii); that the lockout or tagout devices have been attached to energy isolating devices as required by paragraph (d)(6)(iv); and that stored energy has been rendered safe as required by paragraph (d)(6)(v).

This step of the procedure is intended to assure the employee that the machine or equipment is isolated from the energy, that residual or stored energy has been dissipated or blocked, and that injury could not result from the inadvertent activation of the operating controls. This action may involve a deliberate attempt to start the equipment that has been isolated from the energy. Another means of verifying is testing the machine or equipment with appropriate test instruments. This method would be appropriate, and is in fact required, for use in cases exposing employees to possible electric shock. Verification of isolation could be accomplished for electric circuits by the use of a voltmeter to determine that there is no electrical energy present. Similar test equipment can be utilized to check for the presence of other energy types and sources.

Edison Electric Institute pointed out that the proposal would have required a test only for work involving contact with normally energized parts (Ex. 3-112). They noted that this did not account for the possibility of inadvertent contact with such parts. OSHA agrees with this comment and has modified the language in final § 1910.269(d)(6)(vii) to require testing of energized parts which an employee could contact during the servicing or maintenance.

OSHA also considers the use of visual inspection procedures to be of critical importance throughout the lockout or tagging procedures. Visual inspection can confirm that switches, valves, and breakers have been properly moved to and secured in the "off" or "safe" position. Observing the position of the main electric power disconnect switch can, for example, confirm that the switch is either in the "off" (open) or "on" (closed) position. Visual inspection can also verify whether or not locks and other protective devices have been applied to the control points in a manner that would prevent the unsafe movement of the switches or valves. Finally, a visual inspection can be used to verify that isolation has taken place by determining that all motion has stopped and that all coasting parts, such as flywheels, grinding wheels, and saw blades, have come to rest.

OSHA emphasizes that, in order to verify that hazardous energy has been isolated, the authorized employee may need to use a combination of these methods. The appropriate combination will depend upon the type of machinery or equipment involved, the complexity of the system, and other factors.

Because it was redundant with respect to final § 1910.269(d)(6)(vii), proposed paragraph (d)(6)(viii) has not been carried forward into the final rule. The language from the proposed paragraph, which would have required that the steps taken ensure the effectiveness of the hazardous energy control method, was similar to that in proposed paragraph (d)(6)(vii), which is contained in the final rule.

Paragraph (d)(7) of final § 1910.269 requires certain actions to be taken by authorized employees before lockout or tagout devices are removed from energy isolating devices. These actions are intended to ensure that: (1) the machine or equipment has been returned to a safe operating condition; (2) any employees who might be exposed to injury due to the starting of the machine or equipment know that the machine or equipment is being energized; and (3) employees who applied the energy control devices are available to remove those devices.

Because each servicing employee will have his or her own lockout or tagout device attached to the energy isolating device during the servicing operation, the person in charge of the servicing operation will first determine whether all lockout and tagout devices have been removed by the servicing employees. When a tagging system is used, the employer must have a procedure for ensuring that the tagout device was removed by the employee who placed it. Without such a procedure, the tagging system would not be considered as protective as a lockout system, which by its nature ensures that the employee who applied the lockout device is the one who removed it.

Verifying that all lockout and tagout devices have been removed is an essential step in the procedure, and paragraph (d)(7) requires that a final verification be performed to ensure that it is safe to reenergize the equipment after servicing is completed. Further, a check on the satisfactory completion of the work can also ensure that the machine or equipment will not be damaged by its start up. Although the purpose of the final check is to protect employees, it can also prevent needless downtime of the machine or equipment because the servicing or maintenance was not done correctly or completely the first time.

When servicing or maintenance is done on a large machine or complex system of equipment by a large number of employees as is the case in many electric power generation plants, the machine or equipment would probably be operationally intact before the work begins. When the work is completed, but before the equipment is reenergized, paragraph (d)(7)(i) requires that the employees who did the servicing or maintenance work complete the job by replacing guards and other machinery components and by cleaning up after themselves. Paragraph (d)(7)(ii) then requires a check to ensure that employees are safely positioned and have been notified that the machine or equipment is to be reenergized. A simple procedure to follow to verify that the work area and the machinery is ready to be used for its production function is for a foreman, supervisor, or leadman (whoever is in charge) to ask the workmen if they are done and then to spot check to ensure that all appears ready to resume normal operations.

Paragraph (d)(7)(i) requires that the workplace area around the machine or equipment be inspected to ensure that nonessential items have been removed and that equipment components are operationally intact. This step ensures that tools, machine parts, and materials have been removed and that mechanical restraints, guards, and other machine parts have been replaced before the machine or equipment is returned to its operational mode. Depending on the size or complexity of the machinery and the type and degree of the servicing performed, visual inspection alone might be sufficient to meet this requirement; however, additional measures, such as check lists and other administrative procedures, might have to be used for large, complex machines or equipment.

In paragraph (d)(7)(ii), OSHA requires the work area to be checked to be sure that employees are clear of the machine or equipment before energy is restored to it. This determination usually can be accomplished by a visual inspection. Paragraph (d)(7)(iii) of final § 1910.269 repeats the requirement (in § 1910.269(d)(5)) that affected employees be notified of lockout or tagout device removal and ensures that the notification be made before the machine or equipment is reenergized. Depending on the size or complexity of the equipment and the scope of the operation, the notification may consist of informing affected employees individually, or it may necessitate the use of warning devices, such as horns, bells, or buzzers.

It cannot be overemphasized that employees performing tasks on deenergized equipment may be exposed to hazards involving serious injury or death if the status of the lockout or tagout control can be changed without their knowledge. Lockout or tagout is personal protection. For this reason, OSHA requires (in paragraph (d)(7)(iv)) that lockout or tagout devices be removed by the employees who applied them except in limited situations. In the proposed standard, OSHA considered whether an exception should be provided whenever two conditions exist which would necessitate the removal of a lockout or tagout device by an authorized employee other than the employee who applied the device. Paragraph (d)(7)(iii)(A), as proposed, would have permitted other authorized employees to remove a lockout or tagout device when the employee who applied the lockout or tagout device was not available to remove it. This provision was intended to cover situations such as those that might arise from the sudden sickness or injury of an employee or other emergency conditions. Proposed paragraph (d)(7)(iii)(B) would have permitted use of the exception for unique operating activities involving complex systems, if the employer could demonstrate that it was not feasible to have the device removed by the employee applying it. This was intended to provide flexibility in operations involving the removal of a lockout or tagout device at a remote location.

EEI argued that the person removing a lockout or tagout device need not be the same as the person who placed it (Ex. 3–112; LA Tr. 227–229). They contended that the unique nature of utility tagging programs is such that any qualified employee can participate in it and that when and if tags are removed and equipment returned to service is a matter of operations, not safety.

OSHA does not agree that the removal of a tagout device by a person other than the one who under its protection is not related to safety. In paragraph (d)(7)(iv) of final § 1910.269, OSHA is requiring that, as a general rule, the authorized employee who affixes a lockout or tagout device is the only one allowed to remove it. OSHA believes that each employee must have the assurance that the device is in his or her control, and that it will not be removed by anyone else except in an emergency situation. This will prevent the removal of tagout devices by supervisory personnel without the knowledge of the employee who is performing the work, which the UWUA alleged was occurring under existing industry practices (Ex. 66; LA Tr. 46, 57–58). The entire energy control program in this standard depends upon each employee recognizing and respecting another employee's lockout or tagout device. The servicing employee relies upon the fact that he or she applied the device and assumes that it will remain on the equipment while he or she is exposed to the hazards of the servicing operation. OSHA believes that the only way to ensure that the employee is aware of whether or not the lockout or tagout device is in place is to permit only that employee to remove the device himself or herself.

OSHA can envision very few instances which would justify one employee's removal of another's lockout or tagout device. In a true emergency, and not merely because the employee is not available, the employer may be able to demonstrate a need to remove an employee's lockout or tagout device. An exception to paragraph (d)(7)(iv) of the final rule is being provided to allow for such situations. OSHA emphasizes that removal of a personal lockout or tagout device by another person may not be based on convenience or the simple unavailability of the employee. If a lockout or tagout device is attached, it is assumed that the employee who attached that device is engaged in servicing the equipment for which the device is in use and that that person is exposed to the hazards of reenergizing of energy sources. Therefore, as a general matter, the protection of that employee requires that he or she have complete control over his or her lockout or tagout device. Some modification of the general rule is warranted in the case of transfer of authority between shifts, as discussed under § 1910.269(d)(8)(iii), and to a limited extent in group lockout or tagout, as discussed under § 1910.269(d)(8)(ii), both of which involve coordination of activities between servicing employees. Additionally, under conditions of central control of energy isolating devices, as is the case in many electric utility situations, further modification of the general rule may be warranted, as discussed under § 1910.269(d)(8)(v) later in this preamble.

Under the exception to paragraph (d)(7)(iv), the employer may direct the removal of a lockout or tagout device by another employee only if the energy control program incorporates specific procedures and training for that purpose and only where the employer can demonstrate that the alternative procedure will provide equivalent safety to having the employee remove his or her own device. The procedure must include, at a minimum, the following items: first, verification that the authorized employee is not at the facility; second, making all reasonable efforts to contact that employee to inform him or her that his or her device has been removed; and third, ensuring that employee knows of that device removal before he or she resumes work at the facility. These steps are necessary to ensure that the employee who is protected by the device is not exposed to energy hazards either at the time of its removal or afterwards.

Paragraph (d)(8)(i) requires the employer to develop and use a procedure that establishes a sequence of actions to be taken when energy isolating devices are locked out or tagged out and there is a need for testing or positioning of the machine or equipment or components thereof. These actions are necessary in order to maintain the integrity of any lockout or tagout protection for the servicing employees. It is also necessary in order to provide optimum safety coverage for employees when they have to go from a deenergized condition to an energized one and then return the system to lockout or tagout control. It is during these transition periods that employee exposure to hazards is high and a sequence of steps to accomplish these tasks safely is needed.

Paragraph (d)(8)(i) prescribes a logical sequence of steps to be followed when energy isolating devices are locked out or tagged out and there is a need to test or position the machine, equipment, or components thereof. These steps offer necessary protection to employees when they are involved in this activity. The procedure is clear-cut and should require little or no explanation other than the contents of the standard itself.

It should be noted that OSHA is allowing the removal of the lockout or tagout devices and the reenergizing of the machine or equipment only during the limited time necessary for the testing or positioning of the machine, equipment, or component. This paragraph does not allow the employer or employee to disregard the requirement for locking out or tagging out during the other portions of the servicing or maintenance operation. This exception provides for a temporary measure to be used only to accomplish a particular task for which reenergizing is essential.

One commenter expressed the concern that all lockout or tagout devices would have to be removed from all energy isolating devices (Ex. 3–20). He suggested that the standard permit locks and tags to remain attached to controls that were not to be operated. However, this change is not necessary. The standard does not require all lockout or tagout devices to be removed, only those attached to energy isolating devices that are to be changed from the "safe" or "off" position to the "on" position.

Group lockout involves the performance of servicing or maintenance activities by more than one employee. The group of employees is protected by group lockout or tagout devices, representing the group as a whole, with one authorized employee directly responsible for the performance of the servicing. The proposed requirement for group lockout would have required that the procedure provide the same degree of safety as personal locks or tags. It did not specify the use of individual locks or tags by the individual employees of the group. The proposal would have allowed this system, with the authorized employee being responsible for the safety of all the employees in the group, if that program provided the same degree of safety as personal lockout or tagout.

The issue of group lockout was a concern of the UWUA (Ex. 66; LA Tr. 45–49, 69). As this issue was decided in the generic hazardous energy control standard and no new evidence was submitted under this rulemaking, the Agency has decided to adopt the outcome and rationale with respect to final § 1910.147(f)(3), as follows:

> Based on the record (Ex. 2-27, 2-29, 2-32, 2-44, 2-63, 2-99, 2-106, 51, 56, 60, Tr. pg. W 1-142), OSHA has reexamined the issue of group lockout and has concluded that an additional element is necessary for the safety of the servicing employees: each employee in the group needs to be able to affix his/her personal lockout or tagout system device as part of the group lockout. This is necessary for several reasons: first, the placement of a personal lockout or tagout device enables that employee to control his/her own protection, rather than having to depend upon another person; second, the use of a personal lockout or tagout device will enable each servicing employee to verify that the equipment has been properly deenergized in accordance with the energy control procedure, and to affix his/her device to indicate that verification; third, the presence of an employee's lockout or tagout device will inform all other persons that the employee is working on the equipment; fourth, as long as that device remains attached, all employees know that the job is not completed and that it is not safe to reenergize the equipment; and fifth, the servicing employee will continue to be protected by the presence of his/her device until he/she removes it. The authorized employee in charge of the group lockout or tagout cannot reenergize the equipment until each employee in the group has removed his/her personal device, indicating that he/she is no longer exposed to the hazards from reenergization of the machine or equipment. OSHA is convinced that the use of individual lockout or tagout devices as part of the group lockout provides the greatest assurance of protection for servicing employees.

The proposed rule contained several general elements for group lockout, including provision[s] on primary responsibility and coordination of work forces. These elements are carried forward in the Final Rule. The requirement for the use of personal lockout or tagout devices will only enhance the overall effectiveness of these provisions, because the authorized employee in charge of the group lockout will be better able to evaluate the status of the servicing operation, as well as to determine which, if any, of the servicing employees are working on the equipment at a particular time.

OSHA requires in paragraph (f)(3) [§ 1910.269(d)(8)(ii)] that when a crew, craft, department or other *group* lockout or tagout device is used, it must provide the authorized and affected employees with a degree of protection that is equivalent to the use of *personal* lockout or tagout procedures. As in the case of personal lockout or tagout, the employer who uses group lockout or tagout must develop a procedure which encompasses the elements set forth in paragraph (c)(4) [§ 1910.269(d)(2)(iii) and (d)(2)(iv)].

Paragraph (f)(3) [§ 1910.269(d)(8)(ii)] contains several key provisions which must be included in all group lockout or tagout procedures. If a single lockout device or set of lockout devices (often referred to as "operations locks") are utilized to isolate the machine or equipment from the energy sources, each authorized employee is afforded a means to utilize his/her personal lockout or tagout devices so that no single employee has control of the means to remove the group lockout or tagout devices while employees are still servicing or maintaining the machine or equipment. This can be accomplished by the use of a lockbox or other similar appliance. Once the machine or equipment is locked out, the key is placed into the lockbox and each authorized employee places his/her lockout or tagout device on the box. When each individual completes his/her portion of the work, that person removes his/her lockout or tagout device from the lockbox. Once all personal lockout or tagout devices have been removed, the key for the group lockout devices for the machine or equipment can be used to remove that group lockout device. This method provides individual protection for all employees working under the protection of a particular lockout or tagout device. When more than one group is involved, another authorized person might need to maintain responsibility for coordination of the various lockout control groups in order to ensure continuity of protection and to coordinate workforces.

In addition to designating and assigning responsibility to authorized employees, paragraph (f)(3) [§ 1910.269(d)(8)(ii)] requires the employer to develop and implement procedures for determining the exposure status of individual crew members and for taking appropriate measures to control or limit that exposure. These provisions are seen by OSHA as requiring at least the following steps:

1. Verification of shutdown and isolation of the equipment or process before allowing a crew member to place a personal lockout or tagout device on an energy isolating device, or on a lockout box, board, or cabinet;
2. Ensuring that all employees in the crew have completed their assignments, removed their lockout and/or tagout devices from the energy isolating device, the box lid or other device used, and are in the clear before turning the equipment or process over to the operating personnel or simply turning the machine or equipment on;
3. Providing the necessary coordinating procedures for ensuring the safe transfer of lockout or tagout control devices between other groups and work shifts.

The special coverage of paragraph (f)(3) [§ 1910.269(d)(8)(ii)] recognizes the importance of group lockout and/or tagout devices used under conditions in which the safety of all employees working in the group is dependent on how those devices are used. For that reason, it involves a closer examination of the conditions, methods and procedures needed for effective individual employee protection.

OSHA also believes that by requiring each servicing employee to attach his/her own device in group servicing operations, it becomes possible to extend coverage of group servicing activities under paragraph (f)(3) [§ 1910.269(d)(8)(ii)] beyond lockout, as envisioned by the proposal, to cover tagout, as well. This would primarily involve equipment which has not been designed to accept a lockout device. OSHA believes that when a group lockout or tagout procedure is properly implemented, it adds an additional element of protection to servicing employees: the authorized employee in charge of the group servicing operation applies a group lockout or tagout device to the equipment being serviced, and each servicing employee attaches a personal lockout or tagout device to the group device. These individual devices are removed by the employees who applied them, leaving the group device attached. These employees, by clearing the equipment and removing their own devices, indicate that they are no longer exposed to the hazards of the servicing operation. The authorized employee in charge of the group servicing operation then verifies that all elements of the group servicing have, in fact, been completed, and that it is safe to reenergize the system, before he/she removes the group device. Thus, the additional step provides further assurance that reenergizing the equipment will not endanger employees. Expanding group procedures to encompass tagout as well as lockout will extend the additional protection to operations which would otherwise be permitted under this standard to use tagout devices instead of lockout.

One of the most difficult problems to be dealt with by this standard involves the servicing and maintenance of complex equipment, particularly when the work extends across several workshifts. Under the basic approach taken by this standard, each servicing employee is responsible for the application and removal of his/her own lockout or tagout device. However, the record indicates that the servicing of some complex equipment may take days or weeks, and that in some cases, hundreds of lockout or tagout devices may be necessary. EEI (Ex. 56) noted that in some major maintenance operations, it can take a day or more just to apply lockout/tagout devices to all energy isolating devices. CMA (Ex. 56) explained that in a chemical plant, certain "turn-around" jobs may require the locking or tagging of a hundred or more energy isolation devices and require 25 or more employees to perform the servicing. When complex equipment is being serviced, OSHA recognizes the need to provide employers with the option of utilizing an alternative procedure to each employee locking or tagging out each energy isolating device. When an alternative procedure is used, it must provide equivalent protection for the authorized employees. [54 FR 36681–36682, corrected at 55 FR 38683–38685]

OSHA has adopted language for final § 1910.269 (d)(8)(ii) from § 1910.147(f)(3). The Agency believes that the final standard will best protect employees servicing or maintaining electric power generation equipment.

After the generic lockout/tagout standard was promulgated, OSHA received many questions regarding the necessary elements of a group lockout procedure. The Agency answered many of these questions in the form of an OSHA Instruction, STD 1–7.3, which set guidelines for the enforcement of § 1910.147 when group lockout or tagging was involved. In order to clarify final § 1910.269(d), the Agency is summarizing these guidelines with respect to the manner in which they would apply to § 1910.269(d), as follows:

(1) Group lockout/tagout procedures must be tailored to the specific operation involved. Irrespective of the situation, the requirements of the final rule specify that each employee performing maintenance or servicing activities be in control of hazardous energy during his or her period of exposure.

(2) The procedures must ensure that each authorized employee is protected from the unexpected release of hazardous energy by personal lockout or tagout devices. No employee may affix the personal lockout or tagout device of another employee.

(3) The use of such devices as master locks and tags are permitted and can serve to simplify group lockout/tagout procedures. For example, a single lock may used on each energy isolating device, together with the use of a lockbox for retention of the keys and to which each authorized employee affixes his or her lock or tag. In a tagging system, a master tag may be used, as long as each employee personally signs on and signs off on it and as long as the tag clearly identifies each authorized employee who is being protected by it.

(4) All other provisions of paragraph continue to apply.

Paragraph (d)(8)(iii) of final § 1910.269 requires that specific procedures be used to ensure continuation of lockout or tagout protection for employees during shift or personnel changes in order to provide for an orderly transfer of control measures and in order to be certain that the machine or equipment is continuously maintained in a safe condition. As with group lockout or tagout, the method of accomplishing this task must be part of the procedures that are defined in performance language in § 1910.269 (d)(2)(iii) and (d)(2)(iv). Paragraph (d)(8)(iii) requires specific procedures whenever transfer of control measures is necessary. The underlying rationale for these provisions, whereby hazardous energy control responsibility is transferred, is for the maintenance of uninterrupted protection for the employees involved. It is therefore considered essential that lockout or tagout devices be maintained on energy isolating devices throughout the transition period.

Basically, the transfer of responsibility can be accomplished by the on-coming shift employees accepting control of the system involved prior to the release of control by the off-going employees. Also, the procedures, whether they necessitate the use of simple control measures or the more detailed use of logs and check lists to accomplish an orderly transfer, are to be followed by an assurance that the system is indeed safe for employees to continue working. This assurance may involve action by the authorized supervisory employee responsible for the transfer to verify the continued isolation of the machine or equipment from the energy source.

Perhaps the most critical element of assuring continuity of protection is providing the individual employee with an opportunity to verify that the equipment has been deenergized. Even more than in the case with individual lockout or tagout, the on-coming employee should not have to depend on the actions of another employee or supervisor, particularly one who has left the workplace for the day, for assurance that it is safe to work on the machine or equipment. The group lockout provisions in paragraph (d)(8)(ii) of final § 1910.269 contain what OSHA believes to be the necessary safeguards for these situations. To the extent that the procedures provide for individual verification that the equipment has been properly deenergized and to the extent that the procedures allow for the servicing employee to attest to that verification in accordance with the standard, OSHA believes that such procedures would comply with the final rule. In the case of the type of complex servicing operation described by EEI involving large numbers of energy isolating devices, large numbers of servicing employees, and multiple shifts (Ex. 3–112; LA Tr. 215–239), OSHA acknowledges that the removal and replacement of the lockout or tagout devices each shift could be overly burdensome. When the complexity of the servicing operation necessitates an alternative to such frequent attachment and removal of lockout or tagout devices, the use of the work permit or comparable means, with each employee signing in and out as he or she begins or stops working on the equipment, combined with the servicing employees' verifying that the equipment is deenergized prior to beginning work, would be an acceptable approach to compliance with group lockout or tagout and shift change provisions of the standard.

Because the person applying the lockout or tagout device is generally the one being protected by that device, it is essential that the device not be removed by anyone else except in emergencies. When an employee transfers servicing duties to an employee on the next shift and the equipment is to remain deenergized throughout the shift change, it should not be an undue burden to establish a procedure under paragraph (d)(8)(iii) for the off-going employee to transfer his or her authority to the on-coming employee. In situations in which the off-going employee removes his or her lockout or tagout device before the on-coming employee arrives, the procedure could allow for the off-going employee to apply a tagout device at the time he or she removes his or her device, indicating that the lock had been removed, but that the machine or equipment had not been reenergized. The on-coming employee would verify that the system was still deenergized and would remove the interim tag and substitute his or her lockout device. This would assure that the continuous protection is maintained from one shift to another. When tagout devices are used, it would be possible to use a tag with spaces for the off-going employee to sign off, giving the date and time, and for the on-coming employee to sign on, also giving the date and time. Each employee would verify the deenergizing and energy isolation for his or her own protection before signing onto the tag.

In paragraph (d)(8)(iv), the final standard requires that whenever outside servicing personnel (that is, employees of contractors) are engaged to perform any of the activities covered by this standard, each employer must inform the other employer of their respective lockout or tagout procedures. Each employer shall also ensure that his or her own employees understand and comply with the restrictions and prohibitions of the energy control program in use.

These requirements are necessary when outside personnel work on machines or equipment because their activities have the same or greater potential for exposing employees to servicing hazards as would exist if the employer's own employees were performing the work. These hazards can pose a threat to both the outside service personnel and the employees in the plant or facility.

The outside servicing personnel would certainly be expected to know about the specific equipment being serviced, but they might not be familiar with the energy control procedures being used in the particular workplace. Similarly, the employees at the worksite might be familiar with the procedures being used by their fellow employees, but they might not know what to do if the contractor has a procedure which differs from their own. If such procedures were not coordinated, each group of employees might be endangered by the actions of the other, even if each one followed its own procedures.

This standard is intended to ensure that both the employer and the outside service personnel are aware that their interaction can be a possible source of injury to employees and that the close coordination of their activities is needed in order to reduce the likelihood of such injury. OSHA sees the proper use of these provisions, when they are understood and adhered to, as a way to prevent misunderstandings by either plant employees or outside service personnel regarding: (1) the use of lockout or tagout procedures in general, (2) the use of specific lockout or tagout devices that are selected for a particular application, and (3) the restrictions and prohibitions imposed upon each group of employees by the other employer's energy control program.

OSHA proposed to require outside contractors to use the same procedures as used in the plant or facility where the work is being done, and a similar requirement was considered under the rulemaking on § 1910.147. In the generic standard rulemaking, the Agency determined that it might adversely affect the safety of employees if the standard were to require them to comply in all cases with a procedure which was unfamiliar to them and differed from their usual practices under their own employer's energy control program (54 FR 36680–36681, corrected at 55 FR 38683, 38685). Further, by allowing each employee to use the procedure that he or she is familiar with, § 1910.147(f)(2) provides greater assurance that the employees will willingly use the procedure. OSHA has decided to use the same approach here.

Paragraph (d)(8)(iv) of final § 1910.269 requires that each employer inform the other employer of the procedures used by his or her employees and that each employer's employees understand and comply with the restrictions and prohibitions of the energy control program in use. For example, if there are elements of the contractor's procedures which need to be explained to the facility employees, or if there are other steps needed to assure the safety of the contractor's employees, the facility employer must provide his or her employees with the information to provide the necessary protection.

The requirement for coordination between the contractor and the on-site employer is intended to deal with the potential for either one's employees to create or compound the hazards to which the other's employees are exposed. This is true even if the on-site employer includes as a term of the contract that the contractor follow the on-site employer's lockout or tagging procedures. Regardless of the degree of coordination required by paragraph (d)(8)(iv), each covered employer, whether contractor or on-site employer, has an independent obligation under the OSH Act to provide the protection under the standard for his or her own employees.

The facility owner will need to look at various aspects of the contractor's energy control program to assure that his or her employees are not placed at an increased risk. For example, is the contractor's means of notifying the affected employees of the pending lockout or tagout as thorough as the facility employer's? Is the procedure for identifying the energy isolating devices as exhaustive or complete as the facility employer's? Is the method of lockout or tagout used by the contractor recognized and respected by the facility's employees? Does the contractor's procedure take into account the possibility of reaccumulation of stored energy (if that is a potential problem)? Does the contractor's procedure for removal of lockout or tagout devices and reenergizing and startup of the machine or equipment provide for employee notification and ensuring the equipment is safe before startup? If any of the steps in the contractor's procedures fail to cover significant or essential conditions of the workplace which could adversely affect the safety of the facility employees, action must be taken by the facility employer to minimize the potential for injury to his or her employees.

Edison Electric Institute argued that the tagging systems used by electric utilities across the country are unique and work well to protect their employees (Ex. 3–112; LA Tr. 215–239).[33] They argued that OSHA should adopt provisions from the EEI/IBEW draft relating to lockout and tagging. Because OSHA has already adopted a standard on the control of hazardous energy sources, the Agency believes that the industry must show that unique circumstances, such as the hazards presented or the methods of controlling them, warrant separate and distinct treatment. Mr. John Bachofer, Vice President of Metropolitan Edison Company, representing Edison Electric Institute emphasized six basic concepts of hazardous energy control at electric utilities:

(1) The control of energy is fundamental to electric utility work.

(2) Control of hazardous energy is critical to employee safety in the industry.

(3) The methods used to control hazardous energy involve a comprehensive and documented process.

(4) Employees are trained in and required to comply with the hazardous energy control procedures.

[33] EEI also argued that electric utility employees are not at significant risk of injury under existing industry lockout and tagging procedures (Ex. 62–33). In both the Subpart S work practices rulemaking and the generic hazardous energy control rulemaking, OSHA found existing electric utility lockout and tagging procedures to expose employees to a significant risk of injury (55 FR 32003, 54 FR 36651–36654, 36684). In a review of IBEW fatality reports, Eastern Research Group, Ind., found 4 of 159 fatalities (2.5%) could have been prevented by compliance with proposed § 1910.269(d) (Ex. 6–24). These fatalities occurred among approximately 50,000 electric utility employees at high risk (Ex. 4: Table 3–22 with the population limited to generating plant workers at high risk) at the rate of nearly 2 per year (2.5% of the estimated 70 deaths per year; Ex. 5). The Agency believes that these employees are exposed to a significant risk of injury under existing industry practices. Otherwise, no lockout and tagging standard would have been proposed. OSHA evaluates significant risk based on the hazards that exist under the current state of regulation.

(5) Methods for controlling energy are essentially consistent throughout the electric utility industry.

(6) The electric utility industry's hazardous energy control procedures work very well (LA Tr. 216–218).

As noted earlier, these concepts are in use in other industries as well and do not make the utility industry's tagging system unique. OSHA believes that the only concept employed by electric utilities that is unique to their industry is the use of central control facilities. Mr. Bachofer described the utilities' use of a system operator who initiates and controls switching and tagging procedures, and presented a videotape of a typical tagout procedure in action in a generating plant (Ex. 12–6; LA Tr. 225–232). This evidence indicates that typical utility company tagout procedures are unique. However, as discussed extensively earlier, the evidence presented by the Utility Workers Union of America and the accident data submitted into the record demonstrate that, even under these procedures, employees can be exposed to hazards (Ex. 9–2, 66; DC Tr. 414, 444; LA Tr. 45–49, 54–63, 67–70).[34] Therefore, rather than adopt the EEI/IBEW draft provisions on the control of hazardous energy sources, OSHA is incorporating additional provisions under § 1910.269(d)(8)(v) to allow for the placement and removal of lockout or tagout devices by the system operator. This provides employers with the flexibility to protect employees by central control of energy isolating devices, but provides employees with protection equivalent to that provided by personal lockout or tagout devices. The new paragraph is worded as follows:

(v) If energy isolating devices are installed in a central location under the exclusive control of a system operator, the following requirements apply:

(A) The employer shall use a procedure that affords employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device.

(B) The system operator shall place and remove lockout and tagout devices in place of the authorized employee under paragraphs (d)(4), (d)(6)(iv), and (d)(7)(iv) of this section.

(C) Provisions shall be made to identify the authorized employee who is responsible for (that is, being protected by) the lockout or tagout device, to transfer responsibility for lockout and tagout devices, and to ensure that an authorized employee requesting removal or transfer of a lockout or tagout device is the one responsible for it before the device is removed or transferred.

These requirements recognize lockout and tagout practices that are common in the electric utility industry and that have been successful in protecting employees from hazards associated with the control of hazardous energy sources. Under paragraph (d)(8)(v), the system operator has complete control over hazardous energy sources that endanger employees maintaining or servicing machinery or equipment associated with an electric power generation installation. Other employees do not even have access to the energy control devices and cannot operate them to reenergize machinery or equipment being serviced. This central control of hazardous energy sources, in combination with the lockout and tagging procedures and other safeguards required by paragraph (d), minimizes the accidental reenergizing of machinery and equipment.

Paragraph (d)(8)(v)(A) requires the procedure used to provide protection equal to the use of a personal lockout or tagout device. The procedure used must strictly regulate the operation of energy control devices. For example, it could prohibit the operation of these devices, except under written orders. Additionally, logs of switching orders provide a history of the energy control device operation that can help employers determine the efficacy of their procedures. At a minimum, the procedure must ensure that no lock or tag is removed without the permission of the authorized employee it is protecting and that locked out or tagged out energy control devices are not operated to reenergize hazardous energy sources.

Paragraph (d)(8)(v)(B) requires the system operator to place and remove lockout and tagout devices in place of the authorized employee under paragraphs (d)(4), (d)(6)(iv), and (d)(7)(iv). The system operator is the only person with the authority to operate energy control devices under his or her jurisdiction and to place locks and tags on these devices. An authorized employee will not be able to place or remove his or her own tags; therefore, the system operator is required to perform this function. Allowing other employees to place and remove tags would increase the chances that locks or tags could be removed with the knowledge of the employee they are protecting.

Paragraph (d)(8)(v)(C) requires the employer to make provisions to identify the authorized employee being protected by the lockout or tagout device, to transfer responsibility for lockout and tagout devices, and to ensure that an employee requesting the removal or transfer of a lockout or tagout device is the authorized employee responsible for it. It is important for any lockout or tagging system to protect every employee servicing or maintaining machinery or equipment. To achieve this goal, the lockout or tagging procedures must ensure that no lock or tag protecting an employee is removed without the knowledge and participation of the employee it is protecting. Even though the energy control devices are under the exclusive control of the system operator, the locked out or tagged out devices must not be operated until the employee they are protecting personally authorizes it. When a lockout or tagout device is to be removed or when responsibility for the device is to be transferred to another employee, the lockout or tagout procedures must take steps to identify the employee requesting removal or transfer. Signed orders, for example, could be used, and the signatures on the orders could be checked against the original lockout or tagout request. Password systems, master lock systems, and receipt systems could also be used to identify the authorized employee responsible for the lockout or tagout device. The procedures must also make provision for transferring lockout or tagout from one employee to another, such as may be needed during shift changes. The procedures must also ensure that the system operator does not remove any lockout or tagout device without the specific authorization of the employee it is protecting (except as permitted in paragraph (d)(7)(iv) for emergencies). Paragraph (d)(8)(v)(C) prohibits supervisors (or other employees) from releasing lockout or tagout devices while they are protecting authorized employees, and it recognizes only central control systems that provide protection equivalent to that provided by personal lockout or tagout devices. The use of signed orders, passwords, master locks or tags, or receipts can facilitate compliance with this provision.

Paragraph (e). Paragraph (e) of final § 1910.269 contains requirements for entry into and work in enclosed spaces. An "enclosed space" is defined to be a space that has a limited means of entry or egress, that is designed for periodic entry by employees under normal operating conditions, and that is not expected to contain a hazardous atmosphere, but may contain one under unusual conditions. In this paragraph, OSHA intends to cover only the types of enclosed spaces that are routinely entered by employees engaged in

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[34] OSHA came to the same conclusion in the electrical safety-related work practices rulemaking, 55 FR 32003.

electric power generation, transmission, and distribution work and are unique to underground utility work. Work in these spaces is part of the day-to-day activities performed by employees protected by this standard. Enclosed spaces include manholes and vaults that provide employees access to electric generation, transmission, and distribution equipment. This paragraph does not address other types of confined spaces, such as boilers, tanks, and coal bunkers, that are common to other industries as well. These locations are addressed in OSHA's generic permit-required confined space standard, § 1910.146, which applies to all of general industry, including industries engaged in electric power generation, transmission, and distribution work.

Section 1910.146 contains requirements that address hazards associated with entry into "permit-required confined spaces" (permit spaces). Section 1910.146 defines "confined space" and "permit-required confined space" as follows:

Confined space means a space that:

(1) Is large enough and so configured that an employee can bodily enter and perform assigned work; and

(2) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.); and

(3) Is not designed for continuous employee occupancy.

Permit-required confined space (permit space) means a confined space that has one or more of the following characteristics:

(1) Contains or has a potential to contain a hazardous atmosphere;[35]

(2) Contains a material that has the potential for engulfing an entrant;

(3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or

(4) Contains any other recognized serious safety or health hazard.

The permit-required confined spaces standard requires employers to implement a comprehensive confined space entry program. This standard covers the wide range of permit-required confined spaces encountered throughout general industry. Because the hazards posed by these spaces vary so greatly, § 1910.146 requires employers to implement a permit system for entry into them. The permit system must spell out the steps to be taken to make the space safe for entry and must include provisions for attendants stationed outside the spaces and for rescue of entrants, who could be disabled inside the space. However, an employer need not follow the permit-entry requirements of § 1910.146 for spaces where the hazards have been completely eliminated or for spaces where an alternative set of procedures are observed. The alternative procedures apply only where the space can be made safe for entry through the use of continuous forced air ventilation alone. The procedures, which are set forth in § 1910.146(c)(5)(ii), ensure that conditions within the permit space do not endanger an entrant's life or ability to rescue himself or herself.

Paragraph (e) of 1910.269 applies to "enclosed spaces". By definition, an enclosed space would be a permit-required confined space in the absence of § 1910.269. An enclosed space meets the definition of a confined space—it is large enough for an employee to enter; it has a limited means of access or egress; it is designed for periodic, rather than continuous, employee occupancy[36] under normal operating conditions. An enclosed space also meets the definition of a permit space—although it is not expected to contain a hazardous atmosphere, it has the potential to contain one. The Agency notes that, if hazardous conditions which cannot be controlled through the precautions set out in paragraphs (e) and (t) of final § 1910.269 are present, the enclosed space must be treated as a permit space under § 1910.146.

In the preamble to the permit-required confined spaces standard, OSHA acknowledged that "the practices necessary to make confined spaces that merely have the potential to contain hazardous atmospheres (as opposed to one that contains a hazardous atmosphere under normal operating conditions) safe are widely recognized and used throughout various industries [58 FR 4486]." The Agency recognized the electric power generation, transmission, and distribution industry as one of those industries (58 FR 4489). In fact, proposed § 1910.269(e) was used as the basis of many of the requirements adopted under the alternative procedures adopted in § 1910.146(c)(5)(ii).

OSHA has carried forward proposed paragraph (e) into the final rule, setting requirements for electric power generation, transmission, and distribution work in enclosed spaces. Because these spaces are still permit spaces when work not falling under § 1910.269 is performed, all employers must include these spaces in their permit-space programs and must comply with the general permit-space requirements contained in § 1910.146(c). For example, in accordance with § 1910.146, enclosed spaces must be identified under paragraph (c)(1); employees must be informed of the existence, location, and hazardous nature of enclosed spaces under paragraph (c)(2); the employer must develop a written program covering entry into permit spaces under paragraph (c)(4); the employer must reevaluate permit spaces and reclassify them on the basis of changes in their use or configuration under paragraph (c)(6); and the host employer and contractor must coordinate entry activities under paragraphs (c)(8) and (c)(9).

Edison Electric Institute strongly urged OSHA to include all electric utility confined spaces under the provisions of § 1910.269 (Ex. 3–112, 56; DC Tr. 814–828). Summing up the evidence EEI presented on this issue, Messrs. Carl D. Behnke and Charles Kelly stated:

> Another important issue is whether this standard will regulate all enclosed spaces in electric utility facilities, or only those which OSHA perceives as "unique" to utility operations. As written, the proposal would cover underground systems, such as manholes and vaults. Nothing in the record would support a contrary conclusion. Moreover, as EEI made clear in the rulemaking on OSHA's proposed generic standard on permit-entry enclosed spaces, it makes no sense for the generic standard to regulate work in power plant boilers, or other spaces, such as fuel oil tanks, which are found in electric utility facilities.
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> First, the records in this proceeding and the permit-entry matter show that only in electric power generating plants does one find the type of massive boilers which EEI described and depicted in its comments, testimony, and exhibits. (*See* Lawson presentations). Moreover, under typical procedures applicable in the industry, once

[35] The definition of "hazardous atmosphere" in final § 1910.269(x) is identical to that contained in the final generic permit-required confined spaces standard, § 1910.146(b). OSHA believes that the criteria for determining whether an atmosphere is hazardous is independent of the injury or type of work being performed. For this reason, the definition proposed in § 1910.269 was the same as the one proposed in § 1910.146. The differences between the proposed definition and the one contained in final § 1910.146 were described and explained in the preamble to the generic permit-required confined spaces standard (58 FR 4473–4474).

[36] "One of the characteristics of a confined space is that it is not designed for humans to enter and work for prolonged periods without any additional consideration for safety and health. With respect to manholes and unvented vaults, the Agency notes that atmospheric testing and portable mechanical ventilation are among the recognized procedures that must be undertaken . . . before employees can safely enter these spaces. [Preamble to the generic permit space standard, 58 FR 4478]"

those boilers have been shut down and opened, and slag removed, they present none of the "enclosed space" hazards which the generic standard apparently is intended to regulate.

Second, while equipment such as tanks found in power plants may be similar to those found in other industrial settings, a compelling difference remains. Thus, the employees who will enter power plant spaces regulated under this standard will be the same ones who enter the spaces which OSHA apparently intends to regulate under the generic standard. To the extent the two final standards are as significantly different as the respective proposals, the result will be that power plant workers will be subject to inconsistent standards when performing identical or similar work. This simply makes no sense and for no apparent reason would defeat the value of having a comprehensive standard for power generation in the first place.

Nothing in the record shows that entering spaces in power plants which are like other industrial spaces presents unusual or particular hazards which merit the application of the proposed generic rule. Also, the superior training which investor-owned utilities give their workers would be applicable to all enclosed space entries. [Ex. 56]

OSHA has determined that § 1910.146 is the proper place to regulate permit-required confined spaces other than enclosed spaces. The enclosed space requirements of the final rule are intended to regulate a portion of electric power generation, transmission, and distribution work that is routine and presents limited hazards to the qualified employees covered by § 1910.269 who are performing that work. Electric utility companies have an estimated 14,350 employees engaged in underground transmission and distribution work (where most of the work covered by paragraph (e) occurs).[37] Underground repair crews, in which these employees work, can typically expect to enter a manhole once or twice a day.[38] The enclosed space entry procedure addressed by § 1910.269(e) is a day-to-day part of the routine of these workers. This type of work is unique to underground utilities (such as electric, telephone, and water utilities), and the hazards presented by these spaces are widely recognized by these industries and their workers. Indeed, underground telecommunications work is currently regulated under § 1910.268, which contains procedures basically equivalent to final § 1910.269. In contrast, other permit spaces in electric power generating plants are entered on a far less frequent basis by employees working in the plants, typically, three such entries per week for an entire generating plant.[39] A boiler at a generating plant, for example, is only entered by employees at the plant on a very infrequent basis—the electric generator would have to be shut down for a few days at a minimum, and this is not a routine occurrence.

Additionally, the hazards posed by the enclosed spaces covered in § 1910.269(e) are generally much more limited than the hazards posed by permit spaces addressed in § 1910.146.[40] By definition, "enclosed spaces" are designed for employee occupancy during normal operating conditions. Electrical and other energy systems would not have to be shut down, nor would the space have to be drained of liquids for the employee to enter the space safely. On the other hand, other "permit-required confined spaces" at electric generating plants, such as boilers, fuel tanks, and transformer and circuit breaker cases, are not designed for employee occupancy and require energy sources to be isolated and fluids to be drained from the space before an employee can safely enter.

The hazards posed by enclosed spaces consist of (1) limited access and egress, (2) possible lack of oxygen, (3) possible presence of flammable gases,[41] and (4) possible presence of limited amounts of toxic chemicals. The potential atmospheric hazards are caused by an enclosed space's lack of adequate ventilation and can normally be controlled through the use of continuous forced air ventilation alone. Practices to control these hazards are widely recognized and are currently in use in electric, telecommunications, and other underground utility industries. Such practices include testing for the presence of flammable gases and vapors, testing for oxygen deficiency, ventilation of the enclosed space, controls on the use of open flames, and the use of an attendant outside the space. Existing § 1910.268(o) sets forth regulations addressing these areas in the telecommunications industry, which exposes its employees to the same non-electrical hazards as the electric utility industry. Section 1910.146, itself, recognizes permit spaces that are equivalent to enclosed spaces and sets separate provisions, similar to those contained in § 1910.269(e), for those spaces.

The hazards posed by permit-required confined spaces vary widely between different types of spaces. Some tanks contain flammable liquids, which must be removed before an employee can enter. A boiler must have its fuel system shut down and then must be cooled before an employee can work inside. Each space has its own unique set of entry procedures covering all the hazards associated with it. This is the type of space that § 1910.146 covers. The provisions of that standard are intended to protect employees from all the hazards that may be present in a vast array of different confined spaces.

The EEI/IBEW draft standard recognized the difference between the two types of spaces (Ex. 2–3, 2–4). Paragraph (e)(3) of their draft contained provisions on "enclosed spaces", including requirements related to air contaminants, combustible atmospheres, oxygen deficiency, and access and egress. Paragraph (e)(4) of the EEI/IBEW document contained additional considerations for "permit-entry spaces", which incorporated provisions for the employer to identify the hazards associated with each space, to develop a permit system to control entry into these spaces, and to protect employees from hazards that could be anticipated within the space. These provisions recognize the wide variety of hazards and methods of control associated with permit spaces, as opposed to the basic hazards common to such enclosed spaces as manholes and vaults.

OSHA has also adopted a two-pronged approach to regulating enclosed and permit-required confined space entry. However, rather than develop a new rule on permit-required confined spaces to be placed in § 1910.269, the Agency has determined that permit spaces in electric power generation, transmission, and distribution should be governed by the generic standard, § 1910.146. OSHA has not found such spaces in electric utility work to be sufficiently unique with respect to the hazards they present to warrant separate regulation, except for enclosed spaces that are entered on a routine, daily basis and that are designed to be entered under normal operating conditions. Therefore, consistent with this determination, OSHA has set forth separate requirements in this standard

[37] ERG, "Preparation of an Economic Impact Study for the Proposed OSHA Regulation Covering Electric Power Generation, Transmission, and Distribution", p. 6–8.

[38] *Ibid*, p. 6–21.

[39] *Ibid*, p. 6–25 to 6–26.

[40] Permit spaces covered by the alternative procedures in § 1910.146(c)(5)(ii) pose hazards similar in nature to those found in enclosed spaces. However, the requirements for these spaces are similar to those in paragraph (e) of final § 1910.269.

[41] Airborne combustible dust can also create a hazardous atmosphere. However, if combustible dust is present in sufficient amounts to create a hazardous atmosphere, it will almost surely be present in layers inside the space. The fire hazard associated with layers of combustible dust are not addressed in § 1910.269(e), which deals only with the atmospheric hazards.

(§ 1910.269(e)) for employee entry into enclosed spaces that are unique to the performance of electric power generation, transmission, and distribution work.[42] Other types of permit spaces (such as boilers and tanks) are not addressed in this § 1910.269, but are addressed in the generic confined spaces standard, § 1910.146.

As the non-electrical hazards found in manholes, underground vaults, and similar enclosed spaces are the same in both telecommunications work and electric power generation, transmission, and distribution work, requirements relating to these hazards should be similar. (In joint-use manholes, where both telecommunications and electric distribution equipment are present, telecommunications employees and electric utility employees have to work in the same manholes—though not necessarily at the same time.) Therefore, the provisions contained in § 1910.269(e) are based, in large part, on the requirements of existing § 1910.268(o) relating to telecommunications work on underground installations. In carrying them over to § 1910.269, OSHA has modified and has added to the existing telecommunications regulations as described in the summary and explanation of individual provisions within paragraph (e). The Agency has also drawn from provisions in ANSI C2 and the EEI/IBEW draft that relate to enclosed space hazards.

The introduction to paragraph (e) sets forth the scope of the enclosed space provisions. As previously noted, enclosed spaces are defined as spaces that have limited means of entry or egress, that are designed for periodic entry by employees under normal operating conditions, and that are not expected to contain hazardous atmospheres but may contain them under unusual conditions. These spaces include manholes and unvented vaults. The introduction also notes (1) that paragraph (e) of § 1910.269 applies to routine entry into enclosed spaces in lieu of the permit-space entry requirements of § 1910.146, and (2) that the generic permit-required confined spaces standard, § 1910.146, applies to entries into enclosed spaces where the precautions taken under paragraphs (e) and (t) of § 1910.269 do not protect entrants.

The ventilation in vented vaults prevents a hazardous atmosphere from accumulating, so vented vaults were proposed to be excluded from coverage. However, NIOSH pointed out that the intake or exhaust of a vented vault could be clogged, limiting the flow of air through the vaults (Ex. 3–21; DC Tr. 74). The employee in such cases would be exposed to the same hazards as those presented by non-vented vaults. Additionally, the mechanical ventilation for a vault may fail to operate. To ensure that the employee is protected from the hazards posed by lack of proper ventilation, the final rule exempts vented vaults only if a determination is made that the ventilation is in full operating condition. The determination must ensure that ventilation openings are clear and that any permanently installed mechanical ventilating equipment is in proper working order.

Employers have been required to comply with § 1910.146 for all permit spaces since April 15, 1992. Since that time, entry into enclosed spaces has been covered by that standard. Some employers may want to continue complying with § 1910.146 for entry into enclosed spaces falling under § 1910.269. Because the provisions of § 1910.146 protect employees entering enclosed space to the same degree as § 1910.269(e), OSHA will accept compliance with § 1910.146 as meeting the enclosed space entry requirements of § 1910.269(e). A note to this effect has been included immediately following the introduction to paragraph (e).

Paragraph (e)(1) sets forth the general requirement that employers ensure the use of safe work practices by their employees. These safe work practices must include procedures for complying with the specific regulations contained in paragraphs (e)(4) through (e)(14) and must include safe rescue procedures. The requirement that the safe work practices used provide for rescue of employees was added because of the concern of several interested parties that this issue had been overlooked in the proposal. (See the following discussion of this issue for specific comments.)

NIOSH suggested adding a specific requirement for training employees in the hazards of and procedures for enclosed spaces and in rescue procedures (Ex. 3–21; DC Tr. 45). Dr. Richard Niemeier stated, "Ill-conceived rescue attempts have [led] to multiple fatalities in confined spaces [DC Tr. 45]." EEI and IBEW also endorsed a training requirement for employees working in enclosed spaces, as did the UWUA (Ex. 56, 61; DC Tr. 436).

OSHA has accepted these recommendations. Paragraph (e)(2) of final § 1910.269 requires employees who work in or who are attendants outside of enclosed spaces to be trained in the hazards of and procedures for enclosed space entry and in enclosed space rescue procedures.

The Utility Workers Union of America expressed concern with the lack of adequate coverage of employee rescue and noted the absence of any discussion of the means of rescuing employees from enclosed spaces (DC Tr. 431, 436–437). EEI and IBEW supported a requirement compelling the employer to provide appropriate rescue equipment (Ex. 56, 61; DC Tr. 640–641).

OSHA agrees that there is a need for rescue equipment to be available in the event that an injured employee must be retrieved from the enclosed space. However, there was no agreement on the record as to what constitutes adequate rescue equipment. The EEI and IBEW recommended language referred to "the required rescue equipment" without defining it further. The Agency has decided to adopt a performance approach here and to require, in final § 1910.269(e)(3), the employer to provide equipment that will assure the prompt and safe rescue of injured employees. The equipment must enable a rescuer to remove an injured employee from the enclosed space quickly and without injury to the rescuer or further harm to the fallen employee. A harness, a lifeline, and a self-supporting winch can normally be used in this manner.

Some conditions within an enclosed space, such as high temperature and high pressure, make it hazardous to remove any cover from the space. For example, if high pressure is present within the space, the cover could be blown off in the process of removing it. To protect employees from such hazards, paragraph (e)(4) requires a determination of whether or not it is safe to remove the cover. This determination may take the form of a quick check of the conditions expected to be in the enclosed space. For example, the cover could be checked to see if it is hot and, if it is fastened in place, could be loosened gradually to release any residual pressure. An evaluation must also be made of whether conditions at the site could cause a hazardous atmosphere to

[42] These spaces are also found in other underground utility work as well. For example, the telecommunications industry performs work in some of the same manholes and underground vaults that electric utility workers enter. However, the hazards posed by these enclosed spaces are unique to the extent that they should be covered by a standard separate from the generic confined spaces standard. As noted earlier, entry into enclosed spaces is a routine part of electric power generation, transmission, and distribution work, and the practices necessary for safe entry into these spaces are in widespread use throughout the electric utility industry. Additionally, manhole and vault entry is already covered by § 1926.956 of subpart V for the construction of electric power generation, transmission, and distribution installations and by § 1910.268(o) for telecommunications work.

accumulate in the space. Any conditions making it unsafe for employees to remove the cover are required to be eliminated (that is, reduced to the extent that it is no longer unsafe).

Several persons commented on the language used in this provision in the proposal (proposed § 1910.269(e)(2)). They generally claimed that some existing manhole covers do not accept a test probe and that these covers would have to have holes drilled in them in order to perform the evaluations called for by the proposed language (Ex. 3–38, 3–42, 3–62, 3–112). Mr. Klaus Broscheit of the New England Power Service argued that the standard should allow older manhole covers to be cracked open to test for oxygen and combustibles (Ex. 3–62). Edison Electric Institute suggested requiring the determination to be made before the space is entered rather than before the cover to the space is removed (Ex. 3–112).

OSHA believes that the proposed rule did not require manholes to accommodate a probe. The requirement, as proposed, allowed for covers to be cracked open for any necessary tests. Also, as an Agency representative testified at the public hearing, the provision was simply intended to require a check of whether the cover was hot, a determination of whether there were conditions in the area conducive to the formation of a hazardous atmosphere within the enclosed space, and a check (typically by means of loosening the cover slightly) of whether there was a hazardous pressure differential between the two sides of the cover (DC Tr. 219–221). To make this clear in the final rule, OSHA is revising the language of the requirement to reflect its intent more accurately. Additionally, a note has been added for clarification. This note reads as follows:

Note: The evaluation called for in this paragraph may take the form of a check of the conditions expected to be in the enclosed space. For example, the cover could be checked to see if it is hot and, if it is fastened in place, could be loosened gradually to release any residual pressure. A determination must also be made of whether conditions at the site could cause a hazardous atmosphere, such as an oxygen deficient or flammable atmosphere, to develop within the space.

Paragraph (e)(5) requires that openings to enclosed spaces be guarded to protect employees from falling into the space and to protect employees in the enclosed space from being injured by objects entering the space. The guard could be in the form of a railing, a temporary cover, or any other temporary barrier that provides the required protection. This provision was taken from existing § 1910.268(o)(1)(i), which sets forth the equivalent requirement for underground telecommunications work.

Paragraph (e)(6) prohibits employees from entering enclosed spaces that contain a hazardous atmosphere. Once the hazardous atmosphere is removed (for example, by ventilating the enclosed space), employees would be allowed to enter. If an entry is to be made while a hazardous atmosphere is present, the entry is required to conform to the generic permit-required confined spaces standard, § 1910.146. The use of the term "entry" in this paragraph of § 1910.269 is consistent with the use of that term in § 1910.146, and the definition of "entry" in § 1910.146(b) applies. (A note to this effect is included following paragraph (e)(6) in final § 1910.269.)

The corresponding provision in the proposal, § 1910.269(e)(4), would have permitted an employee to enter an enclosed space containing a hazardous atmosphere if the employee was "protected from the hazards that exist or may develop within the space." As OSHA has noted earlier in this preamble, paragraph (e) is intended to apply only to routine entry into enclosed spaces, where compliance with the procedures set out in paragraphs (e) and (t) adequately protect employees. If a hazardous atmosphere exists in an enclosed space after the testing and ventilation requirements in paragraphs (e)(9) through (e)(13) of final § 1910.269 have been met, additional measures must be taken to protect employees. When this is the case, the generic permit-spaces standard in § 1910.146 contains the relevant requirements necessary to protect entrants. Paragraph (e)(6) of final § 1910.269 makes this clear. (It should be noted that Subpart Z of Part 1910 continues to apply to the exposure of employees to toxic substances.)

Paragraph (e)(7) addresses the use of an attendant outside the enclosed space to provide assistance in an emergency. An attendant is required if there is reason to believe that a hazard[43] exists within the space or if a hazard exists because of traffic patterns near the opening. For example, a manhole containing energized electric equipment that is in danger of failing catastrophically requires an attendant under this paragraph. The purpose of the attendant would be to provide assistance in an emergency; however, he or she would not be precluded from performing other duties outside the enclosed space, as long as those duties do not interfere with the person's function as an attendant. The attendant must have the first aid training required under paragraph (b) of final § 1910.269. The provisions of paragraph (e)(7) are based on existing § 1910.268(o)(1)(ii).

Commenting on the corresponding provision of the proposal (proposed § 1910.269(e)(5)), Mr. Charles Hart of the National Electrical Contractors Association stated that it was not clear whether or not the attendant should be stationed outside the space (Ex. 3–60). Two commenters stated that the provision should explicitly permit the attendant to enter the manhole (Ex. 3–42, 3–112). The Utility Workers Union of America expressed support for the proposed provision requiring the attendant to be outside the space (DC Tr. 426, 436–437). Mr. Eugene Briody, representing UWUA, Local 1–2, stated: "Our local union strongly believes that a second man should be located outside an enclosed space at all times because of the speed with which hazardous conditions can develop in a manhole, and the difficulty an injured employee may have in leaving a manhole (DC Tr. 426)."

The intent of this paragraph is to require the presence of a person with first aid training outside the enclosed space if hazards exist within the space or if a hazard exists due to traffic patterns outside the space. If this person were to enter the enclosed space, he or she might be unable to assist the employee already within the space. For example, if traffic hazards are present in the area of the opening to the enclosed space and if the attendant entered the space, then both the attendant and the workers he or she is intended to protect would be vulnerable upon leaving. No one would be present to minimize or control the traffic hazards. If flooding hazards are present, a person outside the space may be able to assist in a rescue attempt; an attendant inside the space would likely be another victim. Therefore, the final rule explicitly states that the attendant is required to remain outside the enclosed space.

On the other hand, if there is no reason to believe that a hazard exists inside the enclosed space and if no traffic hazards are present, an attendant would still be required under § 1910.269(t)(3) while work is being performed in a manhole containing energized conductors. The major, though not the only, hazard in this case is that of electric shock. Assistance can be provided to a victim of electric shock

[43] The type of hazard to which this paragraph refers is one that threatens the life of an entrant or that interferes with escape from the enclosed space.

by another person in the manhole. Therefore, the provisions of paragraph (t)(3) permit the attendant required under that paragraph to enter the manhole for brief periods of time. However, it should be noted that § 1910.269(e)(7) requires the attendant to be "immediately available outside the space". Thus, an attendant required by paragraph (e)(7) (rather than by paragraph (t)(3)) is required to remain outside the space.

A few commenters suggested prohibiting the attendants from performing "other duties" outside the space, because he or she could be distracted from the primary goal of protecting employees within the enclosed space (Ex. 3–59, 3–82). Michael Kenny of the UWUA stated that the practice of periodic testing of air quality in the enclosed space is among the duties to be performed (Ex. 3–76). OSHA agrees with these comments, in part, and has adopted language that would permit the attendant to perform duties only if they did not distract him or her from monitoring the employees in the enclosed space.

Paragraph (e)(8) requires test instruments used to monitor atmospheres in enclosed spaces to be kept in calibration. This will ensure that test measurements are accurate so that hazardous conditions will be detected when they arise.

In the preamble to the proposal, OSHA requested public comment on whether a specific level of accuracy (for example, plus or minus 10 percent) should be required in this provision. Five commenters suggested referring to the instrument manufacturer's recommendations for guidelines on accuracy (Ex. 3–21, 3–22, 3–59, 3–80, 3–82). James McKnight of the Southwestern Power Administration argued that ±5 percent should be the minimum accuracy, as a 10 percent error in oxygen reading might result in insufficient oxygen for strenuous work (Ex. 3–53). Edison Electric Institute supported a ±10 percent guideline as reflecting conditions that are common in daily operations (Ex. 3–112).

While the Agency expects employers to follow instrument manufacturers' advice for calibrating these devices, OSHA believes that a standard that relies on "manufacturer's specifications" without setting a minimum acceptable standard will be difficult to enforce or could lead to inaccurate readings. The manufacturer's recommendation might not be available during an inspection, and a manufacturer's recommendation to calibrate the instrument to ±30 percent of the full scale reading is possible (though it would be unsafe to rely on an instrument that was so calibrated). Therefore, the final rule adopts a requirement that the instrument be calibrated to within ±10 percent. Because the Agency considers EEI's comment as reflecting common industry practice, OSHA considers ±10 percent to be the minimum accuracy needed. Paragraph (e)(8) does require the test instrument to be kept in calibration, so a higher accuracy is required if specified by the manufacturer.

As noted earlier, because of the lack of adequate ventilation, enclosed spaces can accumulate hazardous concentrations of flammable gases and vapors, or an oxygen deficient atmosphere could develop. It is important to keep concentrations of oxygen and flammable gases and vapors at safe levels; otherwise, an explosion could occur while employees are in the space, or an oxygen deficiency could lead to the suffocation of an employee. Toward these ends, paragraphs (e)(9), (e)(10), (e)(11), (e)(12), (e)(13), and (e)(14) address the testing of the atmosphere in the space and ventilation of the space.

Paragraph (e)(9) requires the atmosphere in an enclosed space to be tested for oxygen. However, continuous forced air ventilation is permitted as an alternative to testing. Such ventilation would ensure that there is sufficient oxygen[44] in the manhole. (See also paragraph (e)(12) for requirements relating to the length of time ventilation must be provided before employees are allowed to enter the manhole.)

Commenting on the corresponding provision of the proposal (proposed § 1910.269(e)(8)), NIOSH argued that oxygen monitoring was appropriate and necessary (Ex. 3–21; DC Tr. 44–45). Testifying at the public hearing, Dr. Richard Niemeier expressed their concerns that oxygen deficiency is a deadly atmospheric condition with no warning properties and that the first symptoms of hypoxia are frequently poor judgment and lack of coordination (DC Tr. 44–45). He also stated that oxygen deficiency may cause erroneous readings on explosivity monitors and that the use of forced-air ventilation in an enclosed space with an atmosphere above the upper explosive limit may result in an explosion (DC Tr. 45).

OSHA is also concerned that the improper use of ventilation may itself cause hazards for employees. However, the proper use of ventilation and testing for flammable gases, along with other precautions, will protect employees from the relevant hazards without the need for an oxygen test. For example, to prevent employees from exposure to oxygen deficiency within the enclosed space, the forced-air ventilation must be properly positioned and run for an adequate length of time before entry to place sufficient oxygen in the working zone. To address the concerns raised by NIOSH, the Agency has adopted language in final § 1910.269 (e)(9) requiring that the procedures used when no oxygen monitoring is performed protect employees from the hazards associated with oxygen deficiency. Furthermore, OSHA has reordered the paragraphs so that the requirement for oxygen testing (or ventilation) appears before the requirement for testing for the presence of flammable gases and vapors. This reordering will stress the importance of ensuring that there is sufficient oxygen to provide an accurate flammability reading. Additionally, a provision has been included in paragraph (e)(10) to require an oxygen concentration in a range that ensures the accuracy of the flammability test.

Paragraph (e)(10) requires the internal atmosphere of the enclosed space to be tested for flammable gases and vapors. The results of the test must indicate that the atmosphere is safe before employees can enter. So that the results are accurate and are relevant to the atmosphere in the space at the time of employee entry, testing is required to be performed with a direct reading meter or similar instrument. Test equipment that samples the atmosphere so that the samples can be forwarded to a laboratory for analysis does not meet the requirements of paragraph (e)(10). The flammability test must be undertaken after the steps taken under paragraph (e)(9) ensure that the enclosed space has sufficient oxygen for accurate results.

One commenter objected to the proposed requirement (proposed § 1910.269(e)(7)) to test for the presence of flammable gases and vapors and suggested that forced ventilation be permitted in place of the testing (Ex. 3–27). OSHA does not agree with this commenter. An employee could not be certain that the atmosphere within an enclosed space was safe without testing, even if ventilation is provided.

If flammable gases or vapors are detected or if an oxygen deficiency is found, paragraph (e)(11) requires the employer to provide forced air ventilation to assure safe levels of

[44] The definition of "hazardous atmosphere" determines what concentrations of oxygen are considered hazardous. (See the discussion of this term under the summary and explanation of paragraph (x) of final § 1910.269 later in this preamble.) Paragraph (e)(6) prohibits entry into an enclosed space while a hazardous atmosphere is present.

oxygen and to prevent a hazardous concentration of flammable gases or vapors from accumulating. As an alternative, an employer could use a continuous monitoring system that ensures that no hazardous atmosphere develops and no increase in flammable gas or vapor concentration occurs. The definition of hazardous atmosphere contains guidelines for the determination of whether or not the concentration of a substance is at a hazardous level. OSHA has included a note to this effect after paragraph (e)(11) of final § 1910.269. An identical note has been included after paragraph (e)(14).

The provisions of paragraphs (e)(9), (e)(10), and (e)(11) have been taken from requirements contained in existing § 1910.268(o)(2) and in ANSI C2–1987, Section 426B, with changes, as noted earlier, based on the rulemaking record.

Paragraph (e)(12) sets forth specific requirements for the ventilation of enclosed spaces. When forced air ventilation is used, it is required to be maintained before entry for a period of time long enough to purge the atmosphere within the space of hazardous amounts of flammable gases and vapors and long enough to supply an adequate concentration of oxygen. After the ventilation has been maintained for this amount of time, employees can then safely enter the space.

In the preamble to the proposal, OSHA requested public comment on whether the Agency should specify what number of air changes of the atmosphere within the enclosed space should be required before employees are allowed to enter. Several commenters opposed specifying an exact number of air changes in the standard (Ex. 3–20, 3–21, 3–32, 3–80, 3–82, 3–112). In general, they argued that no number of air changes can be specified to cover all situations and that a performance approach was appropriate. Many stated that testing should be used to indicate the presence of a safe atmosphere.

Based on these comments, OSHA has decided not to specify a minimum number of air changes before employee entry into the enclosed space. Instead, the Agency will strictly interpret § 1910.269(e)(12) to require either testing to determine the safety of the atmosphere in the space or a thorough evaluation of the air flow required to make the atmosphere safe. As noted by Mr. Eugene Briody of UWUA Local 1–2, the safety of employees working in enclosed spaces should not rely on the "potentially faulty judgment of a supervisor or of an employee" (DC Tr. 427).

Paragraph (e)(12) also requires the air provided by the ventilating equipment to be directed at the area within the enclosed space where employees are at work. The forced air ventilation is required to be maintained the entire time the employees are present within the space. These provisions ensure that a hazardous atmosphere does not reoccur where employees are working.

In order to ensure that the air supplied by the ventilating equipment will provide a safe atmosphere, paragraph (e)(13) requires the air supply to be from a clean source and prohibits it from increasing the hazards in the enclosed space. For example, positioning the air intake for the ventilating equipment near the exhaust from a gasoline or diesel engine would contaminate the atmosphere in the enclosed space. This practice would not be allowed under the standard.

The use of open flames in enclosed spaces is safe only when flammable gases or vapors are not present in hazardous quantities. For this reason, paragraph (e)(14) requires additional testing for flammable gases and vapors if open flames are to be used in enclosed spaces. The tests must be performed immediately before the open flame device is used and at least once per hour while the device is in use. This requirement is based on existing § 1910.268(o)(5)(i).

In the preamble to the proposal, OSHA requested comments on whether the frequency of testing is appropriate or whether the frequency should be increased or decreased. Several utility representatives stated that the periodic testing not be required if continuous ventilation is provided (Ex. 3–27, 3–32, 3–59, 3–112, 3–120). NIOSH, IBEW, and UWUA supported the proposed requirement for periodic testing (Ex. 3–21, 3–107; DC Tr. 427). In fact, NIOSH and UWUA argued that once per hour is not frequent enough.

OSHA believes that the use of open flames in enclosed spaces poses a substantial risk of severe injury should hazardous quantities of flammable gases or vapors accumulate within the space. If the ventilation is not positioned properly, areas within the enclosed space can develop hazardous atmospheres. In such cases, an explosion would likely result from the use of open flames within the space. OSHA agrees with NIOSH and UWUA that hourly testing is not always sufficient. Therefore, the final rule sets a minimum testing frequency of once per hour (as did the proposal), but more frequent testing would be required if conditions indicate the need for it. Examples of such conditions include the presence of volatile flammable liquids in the enclosed space and a history of hazardous quantities of flammable vapors or gases in a given space.

Paragraph (f). Paragraph (f) of final § 1910.269 addresses excavating operations. This paragraph simply references the appropriate existing regulations in the Construction Standards (Part 1926) pertaining to excavations, which are contained in 29 CFR Part 1926, Subpart P. The hazards involved are common to all types of excavating operations, such as trenching. Since excavating work is normally considered a construction operation and since construction regulations dealing with the hazards involved already exist, OSHA considers it appropriate to refer to the construction requirements directly. This ensures that the regulations are the same whether or not the work is "construction work" as defined in § 1910.12. Employers covered by this standard should already be familiar with these requirements because they frequently perform the type of work covered under Subpart V of Part 1926 (which contains a similar reference in § 1926.956(c)(2)).

EEI, IBEW, and UWUA supported OSHA's adoption of the excavation standards for construction (Ex. 3–76, 3–107, 3–112). EEI also recommended that the Agency adopt provisions from the EEI/IBEW draft standard that they claimed were omitted from the OSHA proposal. The hazards addressed by the draft requirements are, however, already covered by rules in Subpart P of Part 1926. Therefore, OSHA has not adopted the EEI recommendation.

It should be noted that OSHA has promulgated, in a separate rulemaking project, a revision of the regulations contained in Subpart P of Part 1926. This revision was published on October 31, 1989 (54 FR 45894). In proposed § 1910.269(f), OSHA referred to the individual sections contained in Subpart P of Part 1926 but noted that operations covered by § 1910.269 would be required to follow whatever is promulgated as a final standard under the Construction Standards rulemaking. Because the revised excavation standard contains different section numbers than those proposed in § 1910.269(f), OSHA has decided to refer to Subpart P as a whole in final § 1910.269. Additionally, the proposal's reference to trenching has been dropped for consistency in terminology between the two standards—trenching is simply one type of excavating work and is covered without being specifically mentioned.

Paragraph (g). Paragraph (g) of final § 1910.269 sets forth requirements for personal protective equipment (PPE), which includes eye and face protection, respiratory protection, head protection, foot protection, protective clothing, electrical protective equipment, and personal fall protection equipment. In accordance with § 1910.269(a)(1)(iii), paragraph (g)(1) emphasizes that the requirements of Subpart I of Part 1910 apply. It should be realized that OSHA considers PPE which meets the requirements of current (as of today) editions of the American National Standards referenced in Subpart I to be in compliance with the current requirements of this subpart.[45] For example, Subpart I of Part 1910 references American National Standard for Industrial Head Protection (Z89.1–1969), although other later editions have been published for head protection (for example, ANSI Z89.1–1986). OSHA considers equipment meeting these newer standards to be acceptable. Subpart I of Part 1910 was proposed for revision on August 16, 1989 (54 FR 33832), and the updating of the PPE requirements with the latest American National Standards will be accomplished when that revision becomes a final rule. The clarifying statement in proposed § 1910.269(g)(1) noting that equipment meeting American National Standard for Industrial Protective Helmets for Electrical Workers (ANSI Z89.2–1971) is acceptable head protection has not been carried forward into the final rule. This ANSI standard is out of date (this equipment is now covered under ANSI Z89.1), and the reference to it will be unnecessary when the revision of Subpart I is published. In the interim, OSHA's existing policy of accepting head protection meeting ANSI Z89.1–1986 will continue.

Paragraph (g)(2) of final § 1910.269 sets forth requirements for personal fall protection systems including fall arrest equipment (body belts and life lines) and work positioning equipment (body belts and safety straps).

In paragraphs (g)(2)(i) and (g)(2)(ii), OSHA is requiring that body belts, lifelines, and lanyards for fall arrest, and body belts and safety straps for work positioning, meet the requirements of Subpart E of Part 1926 and § 1926.959 of this chapter, respectively. Although these regulations are contained in the Construction Standards, OSHA believes that they apply equally as well to personal fall protection systems and to work positioning equipment used in overhead electric line work. Additionally, body belts, lifelines, lanyards, and safety straps used in overhead line work are currently required to comply with pertinent regulations of Part 1926, including §§ 1926.104 and 1926.959, during the construction of transmission and distribution lines and equipment. Since the same personal fall arrest systems and work positioning equipment are used during all phases of overhead electric line work (maintenance work and construction work alike), the standard's reference to existing construction standards is appropriate.

OSHA has proposed, in a separate rulemaking project, Safety Standards for Fall Protection in the Construction Industry (November 25, 1986, 51 FR 42718), to revise and simplify most of the existing fall protection regulations for construction, which are currently scattered throughout 29 CFR Part 1926, and to consolidate them in Subpart M of that Part. Requirements corresponding to § 1926.104 were proposed to be placed in § 1926.502(d). Proposed § 1910.269(g)(2)(i) referred to § 1926.104, which is contained in Subpart E of the Construction Standards, for requirements on body belts, lifelines, and lanyards used for fall arrest. So that this reference can easily be corrected when the final revision of this construction standard is issued, final § 1910.269(g)(2)(i) incorporates by reference the personal fall arrest requirements of Subpart E of Part 1926.

OSHA has also proposed a general industry standard for fall protection, contained in §§ 1910.128 through 1910.131 (April 10, 1990, 55 FR 13423). The Agency has made every effort to make these two proposed standards (for general industry and for construction) compatible. It is the Agency's belief that, once the two standards are published as final rules, fall protection systems meeting the relevant portions of either of them would be acceptable.[46]

Dr. Nigel Ellis urged OSHA to adopt the provisions of Appendix C of § 1910.66 as the standard that fall protection systems for electric power generation, transmission, and distribution work must meet. This appendix contains provisions that the Agency feels are appropriate for fall protection systems in general; and, in fact, proposed §§ 1910.128 through 1910.131 were largely based on the material in § 1910.66. However, because existing construction standards already apply to fall protection equipment in use in the electric utility industry, the Agency is continuing to use them as the basis for § 1910.269 fall protection equipment standards. As noted earlier, the construction standards have been proposed for revision, and the construction and general industry requirements for this equipment will be compatible when the two other proposals are finalized. Therefore, in the future, OSHA may combine the fall protection requirements in § 1910.269(g)(2) with those in §§ 1910.128 through 1910.131 so that there is one consistent set of standards for fall protection systems.

Paragraph (g)(2)(iii) of final § 1910.269 requires body belts, safety straps, lanyards, lifelines, and body harnesses to be inspected before use each day to determine if the equipment is in safe working condition. This provision also prohibits the use of defective equipment. This requirement helps ensure that the protective equipment in use will, in fact, be able to protect employees when called upon to do so.

Paragraph (g)(2)(iv) of final § 1910.269 requires lifelines to be protected against being cut or abraded. Cuts and abrasions significantly reduce the strength of lifelines and could cause them to fail during use.

In § 1910.269(g)(2)(v), OSHA proposed requirements covering the use of fall arrest, work positioning, and travel restricting equipment. The Agency proposed that, unless another type of fall protection was provided, one of these systems be used by employees when they were working at heights more than 4 feet (1.2 m) above the ground on poles, towers, trees, or structures or when they were working from vehicle-mounted elevating and rotating work platforms (aerial lifts). The proposal further stated that the use of fall protection equipment would not have been required when a qualified employee was climbing or changing location on poles, towers, or similar structures which had steps or step bolts. The step bolts or ladders would have had to meet the design requirements proposed in § 1910.269, as well as the applicable requirements in subpart D for fixed ladders. However, OSHA did propose that fall protection equipment (safety straps) be used by employees climbing wood poles not containing step bolts except when they were

[45] OSHA's *de minimis* policy with respect to later editions of consensus standards incorporated by reference in OSHA's standards is described earlier in this preamble under the summary and explanation of final § 1910.137. The Agency has evaluated the current ANSI PPE standards and has found them to be acceptable under that policy.

[46] Whether or not body belts are an acceptable component of a fall arrest system was an issue in the two fall protection rulemakings. The outcome of this issue in these rulemakings will affect whether or not body belts will be acceptable under paragraph , which now references Subpart E of the Construction Standards in Part 1926.

climbing around obstructions, such as crossarms, pins, or braces. This paragraph was proposed to clarify when the use of personal fall protection would be required and when exceptions to its use would have been permitted.

This provision received much attention from the commenters and from the witnesses at the hearing. Most argued that (1) fall protection should not be required when poles are being climbed (Ex. 3–9, 3–11, 3–18, 3–23, 3–32, 3–38, 3–51, 3–53; DC Tr. 367–369, 537–538) or (2) the minimum height such protection should be required is 10 feet (Ex. 3–15, 3–22, 3–26, 3–27, 3–39, 3–42, 3–45, 3–66, 3–82, 3–83, 3–102, 3–109, 3–125, 3–128), or (3) advanced both arguments (Ex. 3–20, 3–62, 3–69, 3–80, 3–101, 3–107, 3–112, 3–123, 56; DC Tr. 845–853). Expressing both arguments, Mr. Larry Hobart, Executive Director of APPA, stated:

> The four foot arrest requirement to protect against unexpected falls which is established by this section is too restrictive, and impractical. (Footnote omitted.) APPA recommends that OSHA establish a fifteen foot requirement. A requirement of this sort is by no means extreme. The State of California, for example, has established a fifteen foot height for fall protection requirements. (Footnote omitted.)
>
> In addition, utilities have for many years used the practice of ascending and descending poles without fall protection, which is referred to as "free climbing." Free climbing is a safe, well established, widely accepted and proven practice. Employees who climb and perform other tasks on poles are qualified employees who have climbing duties as one of their routine work activities.
>
> If fall protection were required (belting-off around the pole), it would equal or exceed the hazards of not wearing fall protection equipment. For example, an employee using a waist belt when ascending or descending a pole would have to reposition the belt every few steps. This would fatigue the employee more than free climbing. Positioning and maneuvering to adjust the belt to the changing diameter of the pole creates additional exposure to fall and injury, as the body must be brought close to the pole and the length adjustment buckle is placed in a position where operation is impractical while maintaining balance.
>
> In addition, large transmission poles are often so large at 4 feet above the ground that a safety belt of ten or twelve feet in length would be required under the rule in order to secure the employee and still permit climbing to occur. As the employee gained height and the pole tapered, the safety belt would have to be shortened (adjusted) frequently and when fully adjusted, would prove too long for safe work at the top of the pole. (Ex. 3–80)

Mr. Gene Trombley, representing EEI, testified at the hearing that using a safety strap while climbing was unnecessary and sometimes even unsafe. He stated:

> Electric utility workers who climb poles and towers for a living are trained to approach each job on the basis of existing conditions, evaluating any hazards that may be faced in ascending and descending poles and towers.
>
> Workers are trained to climb using a variety of techniques and the decision on which technique to use is based on a number of factors including weather, the condition of the pole, and the kind of attachments on the structure like guy wires, telephone cables and cross arms.
>
> Also, where unusual conditions or obstacles do not dictate the kinds of methods to use, line workers have favorite methods of climbing poles with which they are comfortable and therefore the safest.
>
> Any one of these methods is acceptable and has proven safe over the years. I feel very strongly about these statements based upon my own personal experiences. I worked in an area where we shared our poles with another electric utility. We not only had to contend with the usual Bell and Cable TV attachments, we also had to deal with all of the facilities of a fair sized municipal power company.
>
> * * * * *
>
> You need to understand that when a lineman has to climb from ground level to the top of a pole or tower that has numerous attachments, such as telephone cables, Cable TV, guy wires and various other obstructions, your proposal would require him to attach and detach his safety strap each time an obstruction is encountered. This does not protect him; it *increases* the risk of a fall.
>
> Some of the poles I mentioned earlier could require belting as many as 25 or 30 times from the bottom up and down again.
>
> * * * * *
>
> Climbing a pole with a safety strap results in other problems that can create a risk to the worker. For example, the climbing motion can result in a considerable amount of movement at the top of the pole and can cause energized lines to swing together resulting in a fault that could burn the lines down.
>
> For a lineman to eliminate this motion when climbing belted in, he must first develop a rhythm. This is [best] done by learning to climb hand over hand. This develops the proper hand to foot relationship that is necessary to ascend and descend poles smoothly.
>
> * * * * *
>
> We have been successfully using the same climbing methods and equipment for decades and there has *never* been any indication whatsoever that they place the line workers at risk.
>
> Our methods have been developed over the years through actual experience. They are also backed up with training.
>
> Climbing is fundamental to the electric utility line worker. Line workers are given extensive training and possess a great deal of confidence in their ability. To suddenly try to require them to change years and years of training and experience would, I feel, cause a serious reduction in that high level of confidence and ability. (DC Tr. 848–853)

These witnesses and commenters agreed that existing practices in electric utilities were safe and that the OSHA standard should simply adopt these practices (Ex. 3–23, 3–80; DC Tr. 852). They argued that the line worker was in the best position to determine the proper technique to be used in climbing the pole or tower and that the regulation should not interfere with his or her judgment (DC Tr. 581–582, 850–851). Furthermore, witnesses at the hearing, including OSHA's expert witness, Mr. Arthur Lewis, maintained that the use of a pole strap by an employee climbing a pole would be more hazardous under most conditions than climbing without the strap (DC Tr. 367, 849–850).

Others addressed the need for and existing technology of fall protection systems and supported requirements for fall protection for workers climbing poles, towers, and similar structures (Ex. 3–13, 3–16, 3–43, 3–52, 54; DC Tr. 73, 648–659, 686–689). NIOSH supported OSHA's proposed requirement for employees to have fall protection at the work locations on poles, towers, and similar structures and while climbing unstepped wooden poles (DC Tr. 73). Mr. George R. Weedin, Safety Officer for the Electrical Division of the Panama Canal Commission, stated that their employees are tied off at all times while climbing or working on elevated structures and suggested that OSHA adopt a requirement patterned after their practices (Ex. 3–43).

Dr. J. Nigel Ellis of the Research and Trading Corporation and Mr. Andrew Sulowski of Ontario Hydro (representing the U.S. Technical Advisory Group to ANSI on the International Standards Organization's ISO/TC94/SC4, discussed fall protection options available to electric utility workers (DC Tr. 647–659, 683–689). The evidence presented by these witnesses demonstrates that there is a range of options available for protecting electric power generation, transmission, and distribution workers from falls. Dr. Ellis recommended that equipment used for fall protection should meet the requirements of Appendix C of § 1910.66, which was published as a final OSHA standard on July 28, 1989 (54 FR 31408).[47] Mr. Sulowski highlighted the success that Ontario Hydro experienced in totally eliminating their fatalities from falling

[47] Appendix C of § 1910.66 covers fall protection systems used with powered platforms for building maintenance. OSHA's proposed § 1910.128 through 1910.131 noted earlier contain comparable requirements.

to none through the use of a ground-to-ground system of fall protection.

NIOSH stated that risks associated with climbing poles are a major cause of injuries and fatalities in the electric utility industry (DC Tr. 44) and submitted a Canadian study[48] that listed falls as accounting for 21.9 percent of all accidents (Ex. 15). "Climbing up or down a pole, tower, basket, truck" accounted for 14.8 percent of all accidents in this study. The "IBEW Utility Department Survey of Fatal and Serious Occupational Accidents" for the years 1984, 1986, and 1988 report 13 fatalities from slips and falls during the period represented by these surveys[49] (Ex. 12–12).[50] The total number of deaths was 121, and the total non-electrical accidents was 37. In this data base, falls represented about 12 percent of all fatalities and 35 percent of non-electrical deaths. Injuries due to falls from elevations (as coded on the forms) were involved in 10 percent (61 of 637) of the fatality/catastrophe investigations recorded in Exhibits 9–3 and 9–4. These investigations included only electric utilities (SIC 4911).

All of these exhibits demonstrate that electric power generation, transmission, and distribution workers face a significant risk of serious injury due to falls under current industry practices. To determine the extent to which they face hazards addressed by proposed § 1910.269(g)(2)(v), OSHA analyzed fall accidents included in various exhibits contained in the rulemaking record. The results of this analysis are presented in Table 1. As can be seen from the table, employees do fall while climbing poles, towers, or similar structures—26 percent of the falling accidents related to § 1910.269 occurred in this manner. The evidence in the record indicates that climbing a pole, tower, or similar structure is not as safe, under current industry practices, as some of the hearing witnesses testified. Therefore, the Agency has decided that the final standard must provide additional protection beyond that provided by the existing industry practices noted in the record and stated in the EEI/IBEW draft standard.

[48] Kedl E., Laflamme L., et al. (1986). "Typical Accidents Involving Linemen in the Construction Sector". Montreal, Quebec, Canada: Canadian Center for Occupational Health and Safety.

[49] These surveys cover IBEW local unions that represent the employees in investor-owned utilities, rural electric cooperatives, and municipal and governmental utilities.

[50] These IBEW surveys represented reports received by the International Office of the IBEW as follows:

1984—July 15, 1981, to October 1, 1983.

1986—October 1, 1983, to December 31, 1985.

1988—January 1, 1986, to December 31, 1987.

Most of the witnesses agreed that it was not always safe to "free climb" a pole (that is, climb it without the use of a pole strap). Mr. Arthur Lewis, OSHA's expert witness, testified that a pole strap would be needed where the diameter of the pole was too great for an employee to grip it comfortably, if ice was present on the pole, or if there were impediments to the use of climbers (strap-on gaffs) on the pole (DC Tr. 369, 376–377). Mr. Andrew Sulowski of Ontario Hydro noted that some wooden poles were treated with a chemical that made them so hard that they were unsafe to climb without fall protection (DC Tr. 673). Additionally, he mentioned other conditions making it unsafe to climb a pole, tower, or similar structure, such as static electricity on a metal structure, direct contact with energized lines, and falling objects striking an employee from above (DC Tr. 649). Mr. Robert Macdonald of the IBEW and Mr. Gene Trombley representing EEI also stated that some conditions would make it unsafe to climb a pole without the use of a pole strap (DC Tr. 537–538, 1117–1118).

OSHA has accepted the position that it is not always necessary for a qualified employee to use a pole strap when climbing an unstepped wooden pole. On the other hand, the Agency has determined that, under certain circumstances, climbing poles, towers, and similar structures poses a significant risk of serious injury to electric power generation, transmission, and distribution workers. Even EEI recognized that the level of competence of the climber, the condition of the pole, the configuration of attachments on the pole, the weather, and other factors affect the determination of which method of climbing is safe and appropriate to use (Ex. 3–112). Therefore, the final rule adopts a requirement for employees to use a pole strap or other fall protection equipment when they are climbing a pole, tower, or similar structure that is not safe to climb without such protection. The language used in final § 1910.269(g)(2)(v) reads as follows:

The use of fall protection equipment is not required to be used by a qualified employee climbing or changing location on poles, towers, or similar structures, unless conditions, such as, but not limited to, ice, high winds, the design of the structure (for example, no provision for holding on with hands), or the presence of contaminants on the structure, could cause the employee to lose his or her grip or footing.

TABLE 1.—FALLS BY TYPE OF ACCIDENT

Type of fall	Number of accidents[1]
Fall from Pole or Tower	
Climbing or descending	10
Changing location	1
At work location	7
Other (not stated)	3
Fall from tree	6
Failure of structure	12

[1] Each accident involves the death or serious injury of one or more employees.

Source: Ex. 3–21, 9–1, 9–6, 9–7, 12–12, 53. Duplicate entries were not counted. The time period covered by these exhibits varied, but included accidents in the years 1981 to 1989. It does not represent all fall accidents involving death or serious injury during this 9 year period, however. For example, the years 1981 to 1984 are represented only by IBEW data, which includes only accidents that were reported by IBEW local unions during that period.

The term "high winds" is also used in paragraph (q)(4)(iv) of final § 1910.269. OSHA believes that this term is somewhat vague and that further clarification is needed. Therefore, a definition of "high winds" has been incorporated in § 1910.269(x). Winds are considered to be "high" if they are of such velocity (1) that employees would be exposed to being blown from elevated locations, or (2) that an employee or material handling equipment could lose control of material being handled, or (3) that the winds would expose employees to other hazards not controlled by the provisions of the standard involved (for example, winds strong enough to move energized conductors far enough to reduce the minimum approach distance to less than that required under paragraph 1). Additionally, the Agency has included a compliance guideline of 40 miles per hour (30 miles per hour if material handling is involved). Winds beyond this speed are normally considered as being hazardous unless additional precautions are taken to protect employees. At this point, the danger that a worker will be blown off a structure or that workers will lose control of parts of a structure being assembled presents a significant risk to employees. The Agency has used this guideline in enforcing similar standards in the past. (See, for example, 55 FR 13397.) It should be noted that if wind is present in combination with other conditions such as snow or ice, it could be hazardous to climb the pole or structure even if the guideline is not exceeded. The standard requires fall protection to be used in such cases.

It should be noted that the conditions listed in the rule are not the only ones warranting the use of fall protection. Other factors mentioned in the record as affecting the risk of an employee's falling include the level of competence of the employee, the condition of a pole or structure, the configuration of attachments on a pole (Ex. 3–112), and the need to have both hands free for climbing (Ex. 3–18). In fact, OSHA believes that climbing without the use of fall protection is only safe if the employee is using his or her hands to hold onto the structure while he or she is climbing. If the employee is not holding onto the structure (for example, because the employee is carrying tools or equipment in his or her hands), fall protection is required under the final rule. The video tapes entered into the record by EEI (Ex. 12–6), which they claimed represented typical, safe climbing practices in the utility industry, demonstrate employees using their hands to provide extra support and balance. Climbing in this manner will enable an employee to continue to hold onto the structure in case his or her foot slips. If the employee is not using his or her hands for additional support, he or she would be much more likely to fall as a result of a slip.

The note also indicates that fall protection is required for unqualified employees and for employees undergoing training any time they are at heights greater than 4 feet (1.2 m). These employees would not be able to judge for themselves whether or not a safety strap should be used (and, in some cases, may not even be qualified in its use). Additionally, the record indicates that training and experience is one of the reasons a line worker can climb a pole or structure safely without fall protection (Ex. 3–80, 3–112; DC Tr. 848–849, 852–853) and that employees in training are at increased risk of injury due to falling (Ex. 12–12, 54; DC Tr. 689).

Many commenters were also concerned that the standard would apply to ladders, loading docks, and other elevated areas (Ex. 3–26, 3–80, 3–82, 3–86, 3–112, 3–123). Others objected to the use of fall protection for employees climbing trees, although such a requirement was not proposed (Ex. 3–48, 3–63, 3–67, 3–75, 3–77, 3–87, 3–90, 3–91, 3–92, 3–93, 3–98, 3–99, 3–100, 3–113). These commenters requested clarification of the rule in the final standard. OSHA spokespersons testified at the hearing that the standard applied only to structures that were similar to poles and towers used in overhead electric power installations, not to ladders or loading docks (DC Tr. 234). General fall protection requirements for working conditions that are not unique to electric power generation, transmission, and distribution work (such as working on loading docks, ladders, or equipment) are addressed in Subpart D (walking and working surfaces) of OSHA's General Industry Standards. Agency spokespersons also stated that it was not requiring fall protection to be used by employees while they were climbing trees (DC Tr. 100–103).

Because of the widespread confusion of the application of proposed § 1910.269(g)(2)(v), OSHA has modified the language from the proposal. First, the requirement for the use of fall protection for tree trimming work has been moved to § 1910.269(r)(8). A fall protection requirement is included in the ANSI tree trimming standard (ANSI Z133.1 discussed later in this preamble), and the Agency feels that this subject is more appropriately covered with the other tree trimming provisions.

Second, the word "similar" has been added before the word "structures" wherever it appears in paragraph (g)(2)(v) of final § 1910.269. This will reflect the meaning of the rule more accurately. Types of structures covered under this provision include substation structures and other conductor support structures. It does not include loading docks, electric equipment such as transformers or circuit breakers, or fixed or portable ladders used or installed on chimneys, stacks, or buildings. Requirements for these installations, which are not unique to electric power generation, transmission, and distribution work, are addressed in other parts of the OSHA standards, such as Subpart D of the General Industry Standards. A note to this effect also appears in the final rule.

Lastly, the Agency has not included in final § 1910.269 the proposed requirement for the use of fall protection in aerial lifts. Paragraph (c)(2)(v) of existing § 1910.67 requires employees working from an aerial lift to use a body belt with a lanyard attached to the boom or basket. In light of all the injuries and fatalities associated with falls from aerial lifts, however, a reference to § 1910.67 is included in the first note to § 1910.269(g)(2)(v).

These changes clarify the rule so that employees and employers will know that it applies to poles, towers, and similar structures and not to trees, buildings, or aerial lifts.

The current OSHA telecommunications standard, in § 1910.268(g)(1), requires the use of personal fall protection equipment when work is performed at heights more than 4 feet (1.2 m) above the ground. The existing standards in Subpart D of Part 1910 also require fall protection (usually in the form of guard rails) for situations where employees are exposed to falls of more than 4 feet (1.2 m). Additionally, in Subpart V of the Construction Standards, OSHA requires fall protection to be used by "employees working at elevated locations" without specifying the height at which such protection would be necessary (§ 1926.951(b)(1)). The Agency proposed to retain the construction requirement, but clarify it as requiring protection to be initiated at 4 feet (1.2 m) to be consistent with the other OSHA general industry standards dealing with the same hazard.

The EEI/IBEW draft standard applied fall protection requirements beginning at 10 feet (3.05 m). Many commenters objected to the proposed 4-foot (1.2-m) distance and strongly urged OSHA to adopt the EEI/IBEW distance (Ex. 3–15, 3–22, 3–26, 3–39, 3–42, 3–45, 3–62, 3–66, 3–69, 3–80, 3–82, 3–83, 3–101, 3–107, 3–109, 3–112, 3–123, 3–125, 3–128; DC Tr. 846–847). These commenters argued that protection at levels below 10 feet (3.05 m) was inconsistent with industry practice and cited loading docks and ladders as two areas where the proposed requirement would be inappropriate. However, the rule would not apply in these areas.

The other reason cited by these commenters for increasing the distance was that a 6-foot (1.8-m) lanyard would not arrest a fall of less than 6 feet (1.8 m). To address this concern, OSHA is adding a requirement to § 1910.269(g)(2)(vi) for fall arrest systems to be rigged so that the employee can neither fall more than 6 feet (1.8 m) nor contact any lower level. In other words, if the ground is only 5 feet (1.5 m) below the employee, the fall arrest system is required to arrest the fall in less than 5 feet (1.5 m). Fall arrest systems installed in accordance with final § 1910.269(g)(2)(vi) will thus arrest a fall before an employee strikes a lower level. This new provision is consistent with § 1910.129(c)(3) in the previously mentioned general industry fall protection proposal. In fact, the language for this requirement was taken from proposed § 1910.129. (Work positioning systems used for fall protection assist the employee in maintaining a work position, so that no fall is likely. The new provision does not need to apply to this equipment.)

Paragraph (g)(2)(vi) of § 1910.269 proposed that, when stopping or preventing a fall, fall arrest systems not produce an arresting force on an employee of more than ten times the employee's weight or 1800 pounds (8 kN), whichever was lower. Based on section 3.3.5 of ANSI A10.14–1975 (Ex. 2–24), and a National Bureau of Standards report, *A Study of Personal Fall-Safety Equipment*, (NBS IR 76–1146; Ex. 2–25), as well as other literature on fall arrest forces, this proposed requirement was intended to minimize injury to an employee in the event of a fall.

One commenter argued that the portion of the requirement based on the employee's weight was redundant and should be removed (Ex. 3–20). Another (Ex. 3–16) urged OSHA to adopt separate limits for systems using body belts (900 pounds or 4 kN) and for those using body harnesses (1800 pounds or 8 kN). This is the approach taken in Appendix C to existing § 1910.66 and in proposed § 1910.129(b)(1). To be consistent with these other OSHA general industry standards, the Agency has accepted these arguments and has adopted language from proposed § 1910.129(b)(1)(i) and (b)(1)(ii) in final § 1910.269(g)(2)(vi)(A) and (g)(2)(vi)(B). (A full discussion of the rationale of setting separate limits for body belts and body harness is presented in the preambles to final § 1910.66 and proposed § 1910.129(b)(1), 54 FR 31449–31450 and 55 FR 13429, respectively. Briefly, the reason for the difference in separate limits for body belts and body harnesses is because the force distribution on the body when a fall is arrested differ between the two systems, with the body belt being more likely to result in injury at a given arresting force.) Additionally, as noted previously, paragraph (g)(2)(vi)(C) adds a requirement that protects employees from falling too far.

Paragraph (g)(2)(vii) of final § 1910.269 prohibits more than one employee from being attached to any one lifeline when vertical lifelines or droplines are used. This limitation recognizes that it is inherently unsafe to use a single vertical lifeline to tie off two or more employees performing separate tasks. Movement by one employee could cause the lifeline to be pulled to one side. This could, in turn, cause the other employee to lose balance. Therefore, if one employee did fall, movement of the lifeline during the arrest of the fall would very likely cause other employees connected to the lifeline to fall.

In paragraphs (g)(2)(viii) and (g)(2)(ix), OSHA is requiring that snaphooks not be connected to loops in webbing-type lanyards or to each other. These provisions prohibit two methods of attachment that are considered unsafe due to the potential for accidental disengagement of the snaphooks during use.

Paragraph (h). Paragraph (h) of final § 1910.269 addresses ladders, platforms, step bolts, and manhole steps. Paragraph (h)(1) emphasizes that the requirements for ladders in Subpart D of Part 1910 continue to apply.

Paragraph (h)(2) contains requirements for special ladders and platforms used for electrical work. Because of the nature of overhead line work and the limitations of structures available for ladder support, OSHA exempts portable hook ladders and other special ladders used on structures or on overhead lines from the general provisions of §§ 1910.25(d)(2)(i), 1910.25(d)(2)(iii), and 1910.26(c)(3)(iii), which deal with ladder support and placement. To provide employees with protection which approximates that afforded by the "exempted" Subpart D provisions, paragraphs (h)(2)(i) through (h)(2)(iv) apply to these special types of ladders. These same paragraphs also apply to platforms designed for and used in this type of work. The requirements provide that these special ladders and special platforms be secured, specify the acceptable loads and proper strength of this equipment, and provide that they be used only for the particular types of application for which they are designed. (The ratings and design of this equipment are specified by the manufacturer and can usually also be found in standard references.) OSHA has concluded that these alternative criteria provide for the safe use of this special equipment.

The revision of Subpart D mentioned earlier proposed to modify the requirements dealing with ladders so as to make the exceptions listed in § 1910.269(h)(2) unnecessary. The language exempting special ladders will be removed or revised as necessary upon promulgation of the Subpart D revision as a final rule.

Most of the comments received regarding proposed paragraph (h)(2) concerned the requirement in paragraph (h)(2)(iv) that this equipment be capable of supporting without failure at least four times its maximum intended load. Three commenters and two hearing witnesses argued that the four-to-one safety factor was not appropriate for these devices (Ex. 3–51, 3–112, 3–120; DC Tr. 360–362, 722–724). These commenters stated that equipment presently in use can achieve a 2.5-to-1 safety factor with a load rating of 500 pounds. Mr. Joseph Van Name, testifying on behalf of the National Electrical Safety Code Committee, Working Group 8, and the Line Maintenance Group of the Pennsylvania-New Jersey-Maryland Interconnection, said: "Since 1961, continued research on this material indicates that adequate mechanical performance is achieved with a factor of safety of 2 to 2½ for a 'failure' [DC Tr. 723]." Mr. Arthur Lewis, one of OSHA's expert witnesses, stated that ASTM is developing a standard for platforms covered by proposed paragraph (h)(2) and presented the reasoning behind adopting a requirement with a 2.5-to-1 safety factor. He explained as follows:

> I am specifically commenting on the lineman's insulating work platform, a device that is temporarily attached at one end to a pole and which provides a cantilevered work platform for the worker.
>
> The purpose is two-fold in that it insulates the worker from the pole, which normally has to be considered as a ground conductor, while at the same time it provides a work platform for the worker to reach line construction. Such a platform is usually used in locations where an aerial lift vehicle cannot be utilized.
>
> The platform has to be raised from the ground to the work position by hand or by the use of a portable capstan winch. This necessitates that the platform be constructed of lightweight materials. ASTM is currently developing a standard for such platforms. Industry experience with this equipment is extensive and is useful in setting parameters for design standards.
>
> In adopting ratings and safety factor, the committee considered the maximum loading that the platform board could reasonably be expected to carry during use, the need for lightweight construction to prevent injury during installation, the nature of materials of which the platform and supporting members are constructed, and industry experience with platforms presently available in the country.
>
> Material choice today is an aluminum alloy for the metal attachment to the pole and a platform of fiberglass reinforced plastic. Design and manufacture of FRP is at an advanced stage with long term performance of the material being very predictable.
>
> A working load rating of 500 pounds is considered adequate to allow a lineman weighing 250 pounds with tools and materials of an additional 50 pounds to [lift] a heavy conductor or other piece of equipment and not exceed the rating of the platform. Tests on existing platforms on the market and in use throughout industry show that with the 500 pound working load rating a 2.5 to one safety factor is achievable and relatively standard.[51]
>
> Industry experience with platforms in use today has been excellent. [DC Tr. 360–362, corrected at Ex. 6–26]

OSHA agrees that there is a need for these special ladders and platforms to be as light as possible. They are handled by employees working on poles and towers at various heights above the

[51] According to this testimony, a platform rated at 500 pounds will withstand 1250 pounds of force before failure. Using the proposed 4 to 1 safety factor, the working load rating on such a platform would have to be reduced to 312 pounds.

ground. If the ladder or platform is heavier than necessary, injury could result from maneuvering the device in an awkward position or from dropping the device on an employee below. OSHA believes that this risk exceeds the risk that the ladder or platform will fail under load. Additionally, there is no evidence in the record to indicate that existing equipment is posing a significant risk to employees. In fact, OSHA's own expert witness stated that experience with these platforms has been excellent (DC Tr. 362). Therefore, the Agency has accepted the 2.5-to-1 safety factor recommended by the comments and testimony. Paragraph (h)(2)(iv) of final § 1910.269 reflects this lower safety factor.

In § 1910.269(h)(3), OSHA is prohibiting the use of portable metal and other portable conductive ladders near exposed energized lines or equipment. This paragraph addresses the hazard to employees of contacting energized lines and equipment with conductive ladders. However, in specialized high-voltage work, the use of nonconductive ladders could present a greater hazard to employees than the use of conductive ladders. In such situations, the clearances between live parts operating at differing voltages and between the live parts and grounded surfaces are large enough that it is relatively easy to maintain the minimum approach distances required by paragraph (l). Voltage is induced on objects in the vicinity of these high-voltage lines. Using a conductive ladder can minimize the voltage differences between objects[52] within an employee's reach, reducing the hazard to the employee. Therefore, the standard allows a conductive ladder to be used where an employer can demonstrate that the use of a nonconductive ladder would present a greater hazard.

Paragraph (h)(4) of proposed § 1910.269 addressed step bolts and manhole steps. The existing OSHA standards do not specifically address step bolts or manhole steps; rather, they address fixed ladders which are not normally used in manholes or on poles. OSHA proposed that step bolts and manhole steps for general use meet paragraphs (h)(4)(i) through (h)(4)(xiv) and the requirements of § 1910.27 for ladder safety devices. However, as noted previously, after the publication of proposed § 1910.269, OSHA proposed to revise subpart D of part 1910. The latter proposal included provisions on step bolts and manhole steps in § 1910.24 that were almost identical to those proposed in § 1910.269(h)(4). In the subpart D revision, OSHA proposed to remove the step bolt and manhole step provisions in § 1910.268 (telecommunications) as they would no longer be necessary. Such requirements are unnecessary here as well. Therefore, OSHA has not carried the provisions of proposed § 1910.269(h)(4) forward into the final rule. All the comments received in response to this rulemaking dealing with step bolts or manhole step will be considered in the promulgation of § 1910.24.

Similarly, the provisions of proposed paragraph (h)(5) dealt with a subject that was addressed in the subpart D proposal—the exemption of ladders or step bolts on triangulation, telecommunication, electrical power, and similar towers, and ladders on poles and other structures (including stacks and chimneys) from the current requirements in subpart D of this part for ladder safety devices and cages if only qualified employees use these ladders. The generic exemption of ladders and step bolts used by qualified climbers from the general industry requirements for ladder safety devices would eliminate the need to exempt ladders and step bolts under § 1910.269. OSHA has decided against adopting a specific exemption for electric power generation, transmission, and distribution work at this time. If the Agency determines that a "qualified climber" exemption is appropriate for all of general industry, OSHA will take the comments in the § 1910.269 rulemaking record into consideration in the adoption of the revision of subpart D as a final rule. If the Agency decides against the adoption of a general exemption, OSHA will revisit this issue as it relates to electric power generation, transmission, and distribution work in the future and will adopt an appropriate revision of final § 1910.269 based on this rulemaking record.[53]

Paragraph (i). Paragraph (i) of final § 1910.269 addresses hand and portable power tools. Portable and vehicle-mounted generators supplying cord- and plug-connected equipment are also covered by paragraph (i).

Electric tools connected by cord and plug are required to meet paragraph (i)(2). If the equipment is supplied by the wiring of a building or other premises, existing Subpart S of Part 1910 continues to apply as it does now. If premises wiring is not involved (in which case Subpart S does not currently apply), paragraph (i)(2)(ii) requires that the tool frame be grounded or that the tool be double insulated or that the tool be supplied by an isolating transformer with ungrounded secondary. Any of these three methods can protect employees from electric shock, which could directly injure the employee or which could cause an involuntary reaction leading to a secondary injury.

OSHA received several comments suggesting that ground-fault circuit interrupter (GFCI) protection be allowed as an additional alternative (Ex. 3–80, 3–81, 3–112). However, although a GFCI can prevent electrocution, the device cannot by itself prevent an initial electric shock to an employee before it interrupts the circuit. This initial shock could lead to injury from involuntary reaction. This is of particular concern if the employee is in an elevated position, exposing him or her to a fall in the event of electric shock. For this reason, existing electrical standards (for example, § 1910.306(j)(2) and § 1926.404(b)(1)) require GFCI protection in addition to, not in place of, equipment grounding and double insulation. Therefore, in final § 1910.269(i)(2)(ii), OSHA is not allowing the use of a GFCI alone to protect employees using cord- and plug-connected equipment.

Two others suggested that the standard require GFCI protection in addition to that provided by the three alternative protective methods listed in the proposal (Ex. 3–21, 3–76; DC Tr. 415–416, 503). The UWUA was particularly concerned that tools may be dropped and lose whatever protection was afforded by double insulation (DC Tr. 503). OSHA's electrical standards for general industry and for construction recognize double insulation as an appropriate method of protection against electric shock. The Agency has no evidence under these standards that double-insulated tools lose their protective abilities once they are dropped or that electric power generation, transmission, and distribution maintenance work exposes tools and cords to the same degree of mishandling and abuse found on construction sites, where GFCIs are required in addition to double insulation or grounding. Therefore, the final rule adopts the approach presented in paragraph (i)(2) of proposed § 1910.269 (that is, tools must be

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[52] These induced voltages do not normally pose an electrocution hazard. However, the involuntary muscular reactions from contacting objects at different voltages can lead to falls.

[53] At this time, the Agency is not making a determination as to the appropriateness of exempting ladders and step bolts used in electric power generation, transmission, and distribution work from the subpart D requirements for ladder safety devices. OSHA is simply postponing the determination of this issue until the same issue in the subpart D rulemaking, upon which proposed § 1910.269(h)(5) depends, is resolved.

protected by grounding, double insulation, or an isolating transformer).

Paragraph (i)(3) of final § 1910.269 essentially extends the requirements of existing § 1926.404(f)(3) to electric transmission and distribution field operations. The standard basically requires that portable and vehicle-mounted generators provide a means for grounding cord- and plug-connected equipment and allows the frame of the generator to serve as the grounding electrode (reference ground).

Paragraph (i)(4) of final § 1910.269 applies to pneumatic and hydraulic tools. Safe operating pressures are required to be maintained by paragraph (i)(4)(i). This protects employees from the harmful effects of tool failure. Of course, if hazardous defects are present, no operating pressure would be safe, and the tools could not be used. In the absence of defects, the maximum rated operating pressure (as specified by the manufacturer or by standard references) is the maximum safe pressure. A note to this effect has been included in the final rule.

If a pneumatic or hydraulic tool is used where it may contact exposed energized parts, the tool is required to be designed and maintained for such use (paragraph (i)(4)(ii)). Hydraulic systems for tools used near live parts would need to provide protection against the formation of a partial vacuum in the hydraulic line (paragraph (i)(4)(iii)). A pneumatic tool would have to provide protection against the accumulation of moisture in the air supply (paragraph (i)(4)(iv)). These three requirements protect employees from electric shock by restricting current flow through hoses.

Proposed § 1910.269(i)(4)(ii) would have simply required hoses used with hydraulic and pneumatic tools to be nonconductive. The National Electrical Manufacturers Association was concerned that other considerations were also involved in making these tools safe around energized lines (Ex. 3–81). They mentioned the type of oil used, contamination, and the voltage involved as factors that could also affect safety. OSHA agrees with these concerns and has worded paragraph (i)(4)(ii) in the final rule to require that the equipment be designed and maintained for use near energized parts.

Several commenters were concerned about the lack of a requirement in the proposal to prevent the loss of insulating value in hydraulic tools from the creation of a partial vacuum in the hydraulic line (Ex. 3–80, 3–81, 3–107, 3–112; DC Tr. 612–613). If such tools are used so that the highest point on the system is more than about 35 feet (10.7 m) above the oil reservoir, a partial vacuum can form inside the line. This can lead to loss of insulating value in tools used on high voltage lines and to the failure of the system while the employee is working on the power line. The IBEW reported that two accidents resulted from such an occurrence and suggested that OSHA adopt language requiring protection for these systems (DC Tr. 613). The Agency agrees with these comments and has added such a requirement to the final rule in § 1910.269(i)(4)(iii).

OSHA has reworded proposed § 1910.269(i)(4)(iii), which specified the use of accumulators for pneumatic tools used near energized parts in order to accommodate the concerns of EEI that certain pneumatic systems do not need accumulators (Ex. 3–112). The final version of this provision (§ 1910.269)(i)(4)(iv)) states the requirement in performance language—the system must protect against the accumulation of moisture in the air supply—rather than specify the means by which this is accomplished.

Paragraphs (i)(4)(v) and (i)(4)(vi) set forth work-practice requirements to protect employees from the accidental release of pressure and from injection of hydraulic oil into the body. The first of these two provisions requires the release of pressure before connections in the lines are broken, unless the quick-acting, self-closing connectors commonly found on tools are used. The other prohibits employees from attempting to use their bodies in order to locate or stop a hydraulic leak.

Paragraph (j). Paragraph (j) of final § 1910.269 contains requirements for live-line tools, some of which are commonly called "hot sticks." This type of tool is used by qualified employees to handle energized conductors. The tool insulates the employee from the energized line, allowing the employee to safely perform the task at hand. For example, a wire tong, a slender insulated pole with a clamp on one end, is used to hold a conductor at a distance while work is being performed. Common types of live-line tools include wire tongs, wire tong supports, tension links, and tie sticks.

Paragraph (j)(1) requires live-line tools to be designed and constructed to be able to withstand 100,000 V/ft if made of fiberglass, 75,000 V/ft if made of wood, or other equivalent tests. (The voltage per unit length varies with material because the two different insulating materials are capable of withstanding different voltages over equal lengths. A higher design standard for wood would cause most wood to fail to meet the specification. A lower design specification would allow substandard products into service. Paragraph (j)(1), which contains the design criteria for materials used in live-line tools, is based on the capabilities of the materials in question.) Since the withstand voltages are consistent with those in existing § 1926.951(d) and with ASTM F 711–83, *Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live-Line Tools* (Ex. 2–27), tools complying with standards currently in use in the industry continue to be acceptable. A note to this effect and language clarifying that the rule applies to rods and tubes as well as "poles" has been added as suggested by EEI (Ex. 3–112). Together with the minimum approach distances in § 1910.269(l), paragraph (j)(1) protects employees from electric shock during use of these tools.

Paragraph (j)(2)(i) requires the daily visual inspection of live-line tools before they are used. Several commenters suggested that this provision include a requirement for wiping the tool as well, because contamination can frequently be removed at this time (Ex. 3–40, 3–71, 3–112). OSHA has accepted this suggestion.

If any contamination or defect that could lower the insulating value of the live-line tool is present after the tool is wiped, it could be discovered during this inspection, and the tool would have to be removed from service, as required by paragraph (j)(2)(ii). This paragraph protects employees from the failure of live-line tools during use.

EEI and IBEW recommended adding language to this requirement prohibiting defects that could affect the mechanical integrity of the tool as well (Ex. 56, 61). Because mechanical defects can also lead to failure of the tool in use, OSHA has adopted this recommendation. Additionally, to clarify § 1910.269(j)(2)(ii), as requested by several commenters (Ex. 3–40, 3–80, 3–82, 3–102, 3–112), OSHA has added language to indicate that the tool must be removed from service if the defect is present after wiping. Also, the tool must be examined and tested as described under new paragraph (j)(2)(iii) before further use.

The performance criteria given in paragraph (j)(1) are intended to be "design standards" and are to be met at the time of manufacture. The test voltages and length of time that they are applied are not appropriate for periodic retesting of the hot sticks because the live-line tools could sustain damage during the test. In the notice of proposed rulemaking and in the notice of public hearing, OSHA requested information on whether retesting should be required, what values of voltage and time should be used for retests, and what period of time should be allowed between retests.

OSHA received many comments on this issue. Some supported requiring periodic testing of live-line tools (Ex. 3–30, 3–46, 3–57, 3–69, 3–82, 3–123, 61; DC Tr. 362–363). Others opposed mandatory routine testing of these tools (Ex. 3–42, 3–65, 3–94, 3–112, 3–119, 3–120, 56; DC Tr. 762–767, 1152–1153).

Supporters of periodic live-line tool testing expressed concern that the tool needed to be checked periodically in order to verify the tool's ability to protect the worker. In expressing this view, Mr. Arthur Lewis, one of OSHA's expert witnesses, noted that current practices of most firms in the country conform to a 1- to 2-year testing interval (DC Tr. 373–374). Others also endorsed intervals of 2 years or less (Ex. 3–46, 3–57, 61).

Those opposed to a requirement for regular testing argued that inspection of the tool was sufficient to detect defects which could cause failure and that no fatalities have been caused by the failure of a live-line tool. They asserted that testing was necessary only when an inspection found defects in the tool. Several pointed to the Institute of Electrical and Electronics Engineers *Guide for In-Service Maintenance and Electrical Testing of Live-Line Tools*, IEEE Std. 978–1984, which states "Insulating tools should be shop maintained and tested at an interval dependent on their exposure, manner of use, care they receive, individual company policy, and as field inspection dictates (Ex. 60). In response to questions by EEI and OSHA attorneys, Mr. Joseph Van Name made the case for thorough examination of hot sticks as follows:

Mr. Yohay: Are you familiar with the study on live-line tool testing performed by the Georgia Power Company which was mentioned in the hearing last week?

Mr. Van Name: Yes, I am.

Mr. Yohay: Would you please comment on it briefly for the benefit of the OSHA Panel?

Mr. Van Name: * * * The study that they did came out of an incident on their transmission system on [a] 115 kV line. The essential parts of it were published in Electric, Light and Power in August of 1978.

And the reason for this study was that when the workers were performing a job on a 115 kV transmission structure, it started to rain, a very severe storm. And when it started to rain, they had arcing across the sticks on the structure * * *.

[The study stated:] "As the crew prepared to leave the rainy site, they observed arcing over the surface of the sticks. When tak[en] out of service for examination, all the sticks on that structure showed signs of tracking."

Now the reason the study was done then was to evaluate the condition of the surface * * *.

* * * they found out quite early in their review that the dry testing procedures that had been followed would not discriminate as well as a wet test * * * where you actually applied water to the stick in your testing procedures. That enables you in a laboratory environment to evaluate the surface condi[ti]on.

Now what that means is if the sticks are not inspected visually and any stick that is inspected visually, except a hollow one, you can determine this without having to go through an electrical test. A visual inspection is much more important in this case and for this condition than an electrical test. [DC Tr. 748–750]

* * * * *

Mr. Van Name: * * * my personal opinion is that the requirement should be that hot sticks should be periodically inspected visually. And a period of one to two years is very important.

But just automatically testing them for electrical performance is not going to insure a good performing hot stick. In other words, the periodicity should be related to the inspection, not the electrical test.

If you inspect it and you find it is defective in any way or has to be maintained or recoated, as part of that process you do an electrical test before you send it back to the crew.

Ms. Thurber: Are there any flaws that visual inspection would not reveal?

Mr. Van Name: Not that I know of. I was going to make one more comment.

Ms. Thurber: Certainly.

Mr. Van Name: And that is, [that my comment applies to] hot sticks which are not wood * * * and the hot sticks that are not hollow. And there are very few, if any, [wood] sticks in the industry.

* * * * *

So that I would say that hollow sticks require some additional care which could be electrical testing.

Electrical testing also with hollow sticks does not guarantee that there is nothing defective inside a hollow stick—nothing wrong inside a hollow stick. [DC Tr. 763–764]

Although no injuries related to the failure of a hot stick could be found in the record, evidence does indicate that these tools have failed in use (without injury to employees) and that employees do depend on their insulating value in using them to handle energized conductors (Ex. 60, 61; DC Tr. 371, 376, 380–381, 748–749, 765). The fact that live-line tools are not typically used to provide protection for employees in the rain (when work is normally suspended) probably accounts for the lack of injuries in the record. Regardless, live-line tools might be used under wet conditions, in which case it is important to ensure that these tools will retain their insulating qualities when they are wet. Therefore, OSHA has determined that additional regulation of the condition of live-line tools is necessary and appropriate.

Also, although Mr. Van Name's testimony shows that inspection can detect the presence of hazardous defects and contamination, the Agency is concerned about whether the daily inspections required in the OSHA standard will, indeed, detect these problems. In fact, referring to the live-line tools that had failed in use, the Georgia Power Company study that he cited in his testimony stated: "Under visual inspection all the sticks appeared to be relatively clean with no apparent surface irregularities [Ex. 60]." (These tools also passed a "dry" voltage test, but failed a "wet" test.) While the study further noted that the surface luster on the sticks had been reduced, apparently the visual inspection alone was not able to detect such defects as the ones that caused these tools to fail.

To address these concerns, OSHA is adopting additional requirements for the thorough examination, cleaning, repair, and testing of live-line tools on a periodic basis. The tools would undergo this process on a 2-year cycle and any time tools are returned on the basis of the daily inspection required by § 1910.269(j)(2)(ii). The final rule first requires a complete examination of the hot stick (paragraph (j)(2)(iii)(A)). After the examination, the tool must be cleaned and waxed, or it must be repaired and refinished if necessary (paragraph (j)(2)(iii)(B)). According to § 1910.269(j)(2)(iii)(C), a test would also be required: (1) After the tool has been repaired or refinished regardless of its composition; (2) After the examination if the tool is made of wood or hollow FRP; or (3) After the examination if the tool is solid FRP rod or foam-filled FRP tube, unless the employer can demonstrate that the examination has revealed all defects that could cause the tool to fail during use. The test method used must be designed to verify the tool's integrity along its full length and, if made of FRP, its integrity under wet conditions (paragraph (j)(2)(iii)(D)). The test voltages are 75 kV/ft for FRP and 50 kV/ft for wood, and the voltage must be applied for a minimum of 1 minute (paragraph (j)(2)(iii)(E)). Other equivalent tests are permitted. The final rule also includes a note referring to IEEE Std. 978–1984 (Ex. 60), which is an excellent guide to the inspection, care, and testing of live-line tools. This document recommends the practices that are required by the OSHA standard.

Paragraph (k). Paragraph (k) sets forth requirements for material handling and storage. Paragraph (k)(1) simply provides that Subpart N of Part 1910 continues to apply. The phrase "except as modified in this paragraph" from the proposal has not been carried into the final rule because paragraph (k) supplements rather than modifies Subpart N.

Paragraph (k)(2) addresses the handling and storage of materials in the vicinity of energized lines and exposed parts of energized equipment. In general, as is the case through most of the General Industry Standards, material is not allowed to be taken or stored within 10 feet of the lines or exposed parts of equipment. This clearance distance must be increased by 4 inches for every 10 kilovolts over 50 kilovolts. For materials storage, the distance must also be increased to account for the maximum sag and side swing of any conductor and to account for the use of material handling equipment. Maintaining these clearances protects unqualified employees, who are not trained in the recognition and avoidance of the hazards involved, from contacting the energized lines or equipment with materials being handled. However, the work practices these unqualified workers would employ in handling material stored near energized lines are addressed by Subpart S. The general approach taken in new § 1910.269 is to provide safety-related work practices for qualified employees to follow when they are performing electric power generation, transmission, and distribution work. Safe work practices for unqualified employees are not addressed in final § 1910.269, because these practices are already spelled out in Subpart S of OSHA's General Industry Standards (see in particular § 1910.333(c)(3)(i) for work performed by unqualified employees near overhead power lines). In fact, § 1910.269(a)(1)(ii)(B) specifically excludes these practices from coverage under § 1910.269. Therefore, proposed § 1910.269(k)(2) relating to work practices used by unqualified employees has not been carried forward into the final rule.

Paragraph (k)(2)(i) only regulates the storage of materials where exposure is not restricted to qualified employees. If the materials are stored where only qualified workers have access to them, the materials may be safely stored closer to the energized parts than 10 feet, providing these employees have sufficient room to perform their work. To ensure that enough room is available, paragraph (k)(2)(ii) prohibits material from being stored in the working space around energized lines or equipment. (See the discussion of paragraphs (u)(1) and (v)(3) of final § 1910.269 for an explanation of the requirements for access and working space.)

Two commenters suggested specifying the minimum approach distances proposed in paragraph (l) in place of the reference to "working space" (Ex. 3–80, 3–112).

The working space about electric equipment is the clear space to be provided around the equipment to enable qualified employees to work on the equipment. An employee enters this space to service or maintain the electric equipment. The minimum working space specifies the minimum distance an obstruction can be from the equipment. For example, if a switchboard is installed in a cabinet into which an employee will enter, the inside walls of the cabinet must provide a minimum working space to enable the employee to work safely within the cabinet.

The minimum approach distance to be maintained from a live part is the limit of the space about the equipment that a qualified employee is not permitted to enter. The minimum approach distance a qualified employee must maintain from an energized part (covered in final § 1910.269(l)) are smaller than the working space that is required to be provided around the part. The employee must "enter" the working space and still maintain the minimum approach distance. Storing materials in this space would tempt employees to work on energized equipment in cramped quarters if access were necessary in an emergency. Alternatively, if materials stored in the working space had to be moved so that adequate room could be provided, accidents could result from the movement of the material. Therefore, OSHA has not accepted the suggestion to replace "working space" with "clearance distance".

Paragraph (l). Paragraph (l) of final § 1910.269 covers the hazards of working on or near exposed parts of energized lines or equipment.

Paragraph (l)(1) requires employees working on or in areas containing exposed live parts of electric lines or equipment to be qualified. Without proper training in the construction and operation of the lines and equipment and in the electrical hazards involved, workers would likely be electrocuted attempting to perform this type of work and would also expose others to injury as well. In areas containing unguarded live parts energized at more than 50 volts, untrained employees would not be familiar with the practices that are necessary to recognize and avoid contact with these parts.

However, employees in training, under the direct supervision of a qualified employee, are permitted to perform work on live parts and in areas containing unguarded live parts. OSHA believes that the close supervision of trainees will reveal errors "in the act", before they cause accidents. Allowing these workers the experience of performing tasks under actual conditions may also better prepare the employees to work safely.

In the proposal, OSHA included this concept in the text of paragraph (l)(1) itself. In the final rule, the Agency has added a note to the definition of "qualified employee" to indicate that employees who are undergoing on-the-job training are considered to be qualified if they have demonstrated an ability to perform duties safely and if they are under the immediate supervision of qualified employees. Therefore, paragraph (l)(1) of final § 1910.269 no longer refers to employees in training. (See the discussion of the definition of this term under the summary and explanation of § 1910.269(x).) These changes will allay the concerns of those who argued that the language in the proposal would have required fully trained qualified employees to work under the direct supervision of another qualified employee (Ex. 3–20, 3–26, 3–42, 3–80, 3–101, 3–112).

In response to the notice of proposed rulemaking, many employer and employee groups commented on the issue of whether or not a minimum of two employees should be required for work involving energized electric equipment. OSHA did not propose such a rule, but the Agency listed this as an issue in the notice announcing the public hearing. At that time, OSHA stated that it would consider evidence supporting or opposing this type of rule and invited the public to comment on the issue of what conditions necessitate the presence of at least two employees.

NIOSH and the UWUA supported a rule prohibiting a single employee from performing work on energized lines or equipment (Ex. 3–76; DC Tr. 33–34, 42, 412–413). NIOSH maintained that a second employee is needed to provide emergency care to an employee who contacts live parts. (Much of their testimony and evidence relates to the usefulness of CPR training, which was discussed earlier in this preamble.) UWUA witnesses stated their concern that an employee who was injured would not get prompt assistance in case of an accident and testified about two accidents in which employees working alone were involved (DC Tr. 468–470).[54]

Many commenters claimed that certain types of electric power generation, transmission, and distribution work could be performed safely by a single employee (Ex. 3–2, 3–12, 3–17, 3–47, 3–80, 3–112, 3–119, 3–125, 3–128). Witnesses and commenters described the following tasks as not necessitating the presence of a second employee under current industry practices: installing and removing meters; low voltage (generally below 600 volts) work; opening and closing switches, circuit breakers, sectionalizing devices, and other disconnects; and replacing fuses (Ex. 3–2, 3–31, 3–47, 3–80, 3–112, 3–119, 3–125, 3–128, 47; DC Tr. 536, 599–600, 1143, 1157). Additionally, one person noted that high voltage work by a lone employee was only permitted if live-line tools were used (DC Tr. 992–993). In fact, the types of high-voltage work mentioned by the witnesses as safe to perform alone are normally associated with hot stick work.

EEI also argued that the presence of an additional employee is not necessary because most accidents are a result of a worker's disregard for training and well established procedures put in place for his or her protection (Ex. 56). However, if this argument is relevant at all, OSHA believes that it is justification for having an extra employee simply because workers should be able to point out poor work practices to their fellow employees. This alone could prevent many accidents.

In any event, OSHA believes that the most relevant consideration in determining whether or not to require the presence of at least two employees is whether the hazards of the work would be significantly reduced by the presence of an additional worker. Therefore, OSHA believes it is important to determine what types of work frequently result in electric shock, regardless of the number of employees present. Electric shock accidents, in particular, necessitate the immediate availability of a person trained in CPR.

To ascertain this information, the Agency reviewed the accident data in Exhibit 9–2. The results of this analysis are presented in Table 2, which tabulates the number of accidents involving different categories of work. Accidents unrelated to work by qualified employees on energized parts are not included in this table.[55] Data in the other categories demonstrate that working directly on energized lines causes most of the accidents and is presumably the most hazardous job performed by line workers. Even some of the jobs claimed by utilities to be safe for a single employee to perform were involved in a few of the accidents, namely, replacing fuses, opening disconnects with live-line tools, and "low voltage" (600 volts or less) work. In particular, lines operating at 600 volts or less accounted for 13 percent (11 of 86) of the relevant accidents, as shown in Table 3.

As a result of this analysis, OSHA has determined that there is a need for some regulation of what types of work can be performed safely by a solitary employee. For the most part, the types of jobs witnesses and commenters maintained were safe generally involved few injuries or fatalities. Specifically, OSHA has concluded that the following work can be performed with minimal hazard to qualified employees working by themselves:

(1) Substation work not involving direct contact with live parts or climbing on structures, and

(2) Opening disconnects with live-line tools, if the employee is well away from the live parts.

Other types of work, such as line installation and removal, use of mechanical apparatus to lift or position material or persons, and electric station work on energized parts, are much more hazardous. These operations are the types of jobs that the witnesses and commenters generally described as being performed by two or more employees. This was also evident from the accident abstracts. However, the Agency is concerned that some employers may force their employees to do this work alone, whether or not it is common industry practice to provide additional workers. One IBEW witness stated that he heard reports of such an occurrence (DC Tr. 600–601), and EEI also admitted that consideration is being given to reduction of crew size in the future (Ex. 56). Therefore, OSHA is adopting a rule requiring the presence of at least two employees under conditions closely following those in which two or more workers would be present under current industry practices.

TABLE 2.—NUMBER OF ACCIDENTS BY TYPE OF WORK

Type of work	No. of accidents[1]
Moving or repairing lines	18
Line stringing	10
Replacing or repairing equipment	10
Rubber glove (or bare hand) work, other	17
Hot stick work, other	5
Subtotal	60
Mechanical equipment used to lift or position	10
Setting poles	4
Subtotal	14
Station work, work on energized parts	9
Station work, misc	3
Subtotal	12
Total	86

[1] Accidents involving one or more employees injured due to contact with energized parts.
Source: Exhibit 9–2.

TABLE 3.—NUMBER OF ACCIDENTS BY VOLTAGE

Voltage range	No. of accidents
120/240	10
440	1
2.4kV	1
7.2–14.4 kV[1]	53
69kV	1
115kV	2
Unspecified	18
Total	86

[1] The voltage specified was in this range; however, it was not always clear whether the voltage was phase-to-phase or phase-to-ground.
Source: Exhibit 9–2.

EEI was also concerned that a prohibition on working alone would hinder restoration efforts, as follows:

> There are a number of crucial operating functions within the electric utility industry that are performed by one qualified worker, alone, and on energized equipment, at all voltage ranges. A classic example is the expert troubleman who works alone on energized lines in emergencies to restore power, such as during storms. These functions are performed safely literally thousand of times daily. [Ex. 3–112]

OSHA believes that the loss of power can create public safety concerns that outweigh the safety concerns of individual employees. In such cases, action must be taken to restore power so that public safety is assured. To address this concern in the final rule, OSHA is also permitting an employee to work

[54] In their post-hearing comments, EEI argued that one of the accidents actually involved a worker who was not alone (Ex. 56). It is not clear whether or not the two parties were discussing the same accident; however, the Agency is not relying on the UWUA testimony alone in resolving this issue.

[55] Of 117 accidents in Exhibit 9–2, 31 are not relevant to the issue of whether or not qualified employees should be able to work alone near exposed live parts.

alone to effect emergency repairs to the extent necessary to safeguard the general public.

Paragraph (l)(1)(i) of final § 1910.269 applies to the following types of work involving exposed parts energized at more than 600 volts:

(1) Installation, removal, or repair of lines that are energized,

(2) Installation, removal, or repair of deenergized lines if an employee is exposed to contact with other energized parts,

(3) Installation, removal, or repair of equipment, such as transformers, capacitors, and regulators, if an employee is exposed to contact with energized parts,

(4) Work involving the use of mechanical equipment, other than insulated aerial lifts, near energized parts, and

(5) Other work that exposes an employee to electrical hazards greater than or equal to those posed by operations that are specifically listed in the standard.

The first four work operations are those that the record demonstrates expose employees to the greatest risk of electric shock. OSHA has included the fifth category to cover types of work that, while not specifically identified in the record, pose equal or greater hazards.

As the record demonstrates, however, some work can be performed safely by a single employee or must be performed as quickly as possible for reasons of public safety. The standard, in § 1910.269 (l)(1)(ii), recognizes this type of work by granting exceptions for the following operations:

(1) Routine switching of circuits, if the employer cân demonstrate that conditions at the site allow this work to be performed safely,[56]

(2) Work performed with live-line tools if the employee is positioned so that he or she is not exposed to contact with energized parts,[57] and

(3) Emergency repairs to the minimum extent necessary to safeguard the general public.

OSHA has placed restrictions on the use of these exceptions in view of the accidents that occurred even under these limited conditions. Accidents involving hot stick work have typically occurred only when the employee was using a live-line tool but was close enough to energized parts to be injured—sometimes through direct contact, other times by contact through conductors being handled. Employees have been injured during switching operations when unusual conditions, such as poor lighting, bad weather, and hazardous configuration or state of repair of the switching equipment, were present. Because such conditions make the work unsafe, paragraph (l)(1)(ii)(A) would not permit switching operations to be performed by an employee working alone.

The requirement for at least two employees to be present during certain operations does not apply if the voltage of the energized parts involved is 600 volts or less. The record contains conflicting data regarding the safety of performing work at these voltages. Many witnesses and commenters said that it was safe to perform such work, but the data in Table 3 strongly suggests that this is not true.

Unfortunately, the types of work involving voltages of 600 volts or less are not clearly defined in the rulemaking record, at least with respect to the degree of risk they present. For example, electric meter work, which typically involves these lower voltages, is one type of work commonly performed by electric utility workers. However, there are very few accidents involving this type of work. It appears that many of the lower voltage accidents in the record involved qualified employees working on service drops, but there may be conditions making even this type of work safe.

There is insufficient evidence in the record as to whether or not it is safe for qualified employees to work alone on live parts energized at these lower voltages. Therefore, the final rule does not address this situation. OSHA intends to address this issue when Subpart V of Part 1926 is proposed for revision. (The absence of a requirement in the final standard addressing this hazard should not be regarded as a determination that this type of work is always safe under existing industry practices.)

Paragraph (l)(2) of final § 1910.269 requires employees to maintain minimum approach distances from exposed energized parts. The minimum approach distances are specified in Table R–6 through Table R–10.

Paragraph (l)(2) of proposed § 1910.269 set forth the minimum approach distance requirements for work near exposed energized parts. The language of the proposed paragraph was taken from existing § 1926.950(c)(1). Basically, the proposal would have required employees to maintain the minimum approach distances listed in the standard, unless the employee was insulated from the live part or the part was insulated from the employee or the employee was insulated from all other conductive objects.

The proposed rule used the term "clearance" in the heading and in the distance tables to describe the distance an employee must stay away from energized parts. The term clearance was also used in proposed paragraphs (m), (u), and (v). In proposed paragraph (m), "clearance" meant authorization to perform work. In proposed paragraphs (u) and (v), the term meant the clear distance between two objects. OSHA is concerned that this term as used in paragraph (l)(2) might be confused with the same term used in paragraphs (m), (u)(5), and (v)(5) of final § 1910.269. The term "minimum approach distance" has been adopted in the final rule to refer to distances to be maintained from energized parts, and the term "clearance" in the final rule relates only to authorization to perform work or to the clear distance between objects. To make this change clear in final § 1910.269, OSHA has defined the term "*minimum approach distance*" in paragraph (x), *Definitions*. This new definition reads as follows:

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

The Agency has carried forward the proposal's definition of "*clearance (for work)*" into paragraph (x) of final § 1910.269. OSHA has also adopted a definition of "*clearance (between objects)*" in paragraph (x) of final § 1910.269, as follows:

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

This definition has been taken from the 1987 NESC (Ex. 2–8).

The minimum approach distances proposed in Table R–6 were for AC voltages up to 765 kilovolts, nominal. Taken in large part from existing Table V–1 in Part 1926, each of these distances was intended to provide a sufficient gap between the worker and the line so that current could not arc to the employee under the most adverse transient voltage that could be imposed on the line, plus an extra amount for inadvertent movement on the part of the employee. To make it clear that direct contact with live parts was not permitted, OSHA also proposed to add to the distances given in the existing

[56] This provision corresponds to the common types of substation work identified earlier in this preamble as being safe to perform. OSHA has written this provision in performance language to recognize types of work with similar characteristics. It is the hazards associated with the work that is the determining factor rather than the specific task.

[57] This provision corresponds to work involving the use of live-line tools to operate disconnects. Any similar work performed with a hot stick at a safe distance is also safe to perform by a qualified employee working alone. Here, too, OSHA has written this provision in performance language.

standard an "avoid contact" entry under the lowest voltage. Additionally, to make the proposal more consistent with ANSI C2, OSHA proposed to adopt a minimum approach distance of 2 feet for voltages between 1.1 and 15 kilovolts. (Table V–1 gives no minimum approach distances below 2.1 kilovolts.)

Proposed table R–7 applied to DC voltages between 250 and 750 kilovolts, nominal. These distances were taken directly from Table 422–3 of ANSI C2–1984. Since systems of DC voltages other than those listed are rare, no distances were presented for them in the table.

For the highest voltages, the two proposed tables contained notes permitting minimum approach distances smaller than those listed. The smaller minimum approach distance would have been at least the length of the line insulator, and the smaller distance would have had to be necessary to perform the work. In the existing Construction Standards, subpart V uses a similar note, except that the distance may be reduced to the shortest distance between the energized part and a grounded surface. The proposed note differed from the note in subpart V because the subpart V version allowed an employee to be exposed to a risk of arc-over equal to that at the point in the energized system where the probability of arc-over is greatest. The Agency believed that the risk to the employee had to be reduced to a safer level. Taking a different approach, ANSI C2–1984 had separate tables for AC voltages of 345 to 765 kilovolts, nominal, and for all DC voltages of systems with a known transient overvoltage factor. The ANSI C–2 tables used minimum approach distances which increased with increasing surge factors and provided for greater minimum approach distances, in many cases, than the footnotes in OSHA's proposed tables. In the notice of proposed rulemaking, OSHA requested comments on whether it would be more appropriate to use the ANSI C–2 minimum approach distances for the affected voltages and whether the ANSI tables provided better protection for employees than the OSHA proposal.

The comments presented various views on this issue. Two supported the proposal (Ex. 3–13, 3–20), while others suggested that the Agency adopt the ANSI C–2 requirements (Ex. 3–35, 3–57, 3–65, 3–80, 3–82, 3–107). In its pre-hearing comments, Edison Electric Institute also supported the ANSI minimum approach distance tables, but they expressed concern that neither ANSI nor OSHA recognized reductions in minimum approach distances for certain maintenance operations, such as painting and adjusting hardware (Ex. 3–112).

EEI witnesses at the hearing testified about situations that presented problems if they had to meet the proposed minimum approach distances. They were especially concerned about the differences between the footnotes in the proposal and those in subpart V (DC Tr. 856–885). At the hearing, they presented new minimum approach distance tables for use in § 1910.269(l), and one of their witnesses gave testimony providing technical support for the new tables (DC Tr. 872–905). Mr. Nestor Kolcio of the American Electric Power Services Corporation stated that the distances in EEI's tables were based on two formulas (Ex. 31; DC Tr. 899–901):

Equation (1)—*For voltages of 1.1 kV to 72.5 kV:*

$$D=\left(\frac{V_{max}\times pu}{124}\right)^{1.63}$$

Where:

D=Distance in air in feet

V_{max}=Maximum rated line-to-ground rms[58] voltage in kV

pu=Maximum switching surge factor in per unit

Equation (2)—*For voltages of 72.6 kV to 800 kV:*

$$D=\left(C_1+C_2+a\right)S\,kV_{L-G}$$

Where:

D=Insulation distance in feet

C_1=0.01 or 1 percent of line-to-ground kV, based on 60–Hz rod-gap withstand spacing

C_2=1.1, composed of 1.06 for live-line tool-to-air withstand distance ratio plus intangibles

a=saturation factor for system voltages of 345 kV and more

S=Maximum anticipated per unit switching surge

kV=System rms line-to-ground kV, actual

Source: ANSI/IEEE Standard No. 516, 1987.

The distances resulting from these formulas were the basis for calculating the electrical component of the minimum approach distance to energized parts (that is, the distance at which the probability of arc-over or flashover becomes extremely low). Although these formulas were taken from consensus standards, Mr. Kolcio reduced the resultant electrical component of the minimum approach distance by 25 percent at voltages over 72.5 kV, which has the effect of increasing the probability of arc-over at these voltages (Ex. 31; DC Tr. 901). He acknowledged that this reduction was based on "new data" and that no national consensus standard recognized such a reduction as valid (DC Tr. 1134).[59]

Another witness, Mr. Joseph Van Name, representing the National Electrical Safety Code Committee, Working Group 8, and the Line Maintenance Group of the Pennsylvania-New Jersey-Maryland Interconnection, testified about the technical basis upon which minimum approach distances rely (LA Tr. 471–510). He explained that the technical basis for determining the distance needed to protect against sparkover and flashover (types of disruptive discharge[60]) is contained in the *IEEE Guide for Maintenance Methods on Energized Power-Lines*, ANSI/IEEE Std. 516–1987 (Ex. 60; LA Tr. 491). He described the procedure as follows:

The guideline that is fundamental to our work is if the electrical withstand capability of the insulation exceeds not only the operating voltage but any transient or temporary over voltage that might appear during the work process. And I for one, who works on the lines, [feel] that that is kind of important.

Let's go through the process, the major item in this process of determining the safe working clearances. You determine the maximum electrical stress that can appear at the work site from whatever source. The stress then determines the withstand requirement, that's the three sigma requirements. Then, you get a clearance at the work site to preclude flashover, then you assure that if a flashover happens, it will not cause injury.

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[58] Root mean square.
Source: AIEE Standard No. 4, 1943.

[59] The NESC subcommittee working on new minimum approach distance tables (see discussion of their work later in this preamble), which reviewed all the latest technical data, did not accept a similar reduction of the electrical component of the minimum approach distance (Ex. 64, 65).

[60] "Disruptive discharge" means the phenomena associated with the failure of insulation, under electric stress, that include a collapse of voltage and the passage of current; the term applies to electrical breakdown in solid, liquid, and gaseous dielectrics and combinations of these. Terms relating to various types of disruptive discharge include "sparkover", "flashover", and "puncture". "Sparkover" is the term used for a disruptive discharge occurring in a gaseous or liquid dielectric. "Flashover" is the term used for a discharge occurring over the surface of a solid dielectric in a gaseous or liquid medium. "Puncture" is the term used for the discharge occurring through a solid dielectric. (These definitions were taken from Ex. 8–2. These terms were also explained by Mr. Van Name at LA Tr. 486.) The term "sparkover" generally applies to a breakdown that occurs when an employee is using air as an insulating medium; "flashover" usually applies when he or she is using a live-line tool and a breakdown occurs.

I'll go back. If I am at the work site and I effectively am the same electrical gap as the physical gap there, I don't want it to flashover to me. So, to make sure it doesn't come to me, I have to add some more sigmas, not three, but I add the other two to make sure it goes over a known gap, and not to the worker. So, that's what we're trying to do in this whole determination. That's the fundamental thing. [LA Tr. 492–493]

Mr. Van Name also described the factors that influence the length of the safe gap, for the purpose of determining minimum approach distances: temporary overvoltages caused by faults, switching, or lightning; the wave shape of the overvoltage; polarity of the overvoltage; insulating medium; gap geometry; and atmospheric conditions (LA Tr. 493–496). He defined the critical flashover (CFO) voltage as that voltage that would flashover 50 percent of time for a given gap (LA Tr. 496–497). The withstand voltage is three standard deviations (that is, "three sigmas") above that voltage (or 1.15 times the CFO) for a probability of flashover of about 0.1 percent (LA Tr. 496). Mr. Van Name also illustrated the technique of reducing the minimum safe approach distance by installing a gap in the system and specified the technique used for determining the sizes of gaps and minimum approach distances (LA Tr. 508–509).

In concluding his testimony, Mr. Van Name suggested that the standard adopt a "user-friendly" approach consisting of various tables supplying the distances to be maintained from different voltages (LA Tr. 509–510). The numbers in the tables presented at the hearing needed additional refinement, which he promised in the post-hearing comment period. He also suggested that OSHA include the National Electrical Safety Code action on this issue in the record and rely on it as being the best and latest technical information available (LA Tr. 515–516, 534–537, 550–551, 567–569).

From Mr. Kolcio's and Mr. Van Name's presentations, it is clear that OSHA must first determine the size of the air gap that must be present so that an arc does not occur during the most severe overvoltage on a system. This has been referred to as the electrical component of the minimum approach distance. To determine the minimum safe approach distance, OSHA must then add an extra distance to account for ergonomic considerations, or human error.

The electrical component depends on five factors (Ex. 60):

(1) The maximum voltage,

(2) The wave shape of this voltage,

(3) The configuration of the "electrodes" forming the end points of the gap,[61]

(4) The insulating medium in the gap, and

(5) The atmospheric conditions present.

ANSI/IEEE Std. 516–1987 listed values for the electrical component of the minimum approach distance, both for air alone as an insulating medium and for live-line tool sticks in air, that were accepted as being accurate when the standard was adopted (by IEEE) in 1987 (Ex. 60). Using information regarding the wave shape of typical switching surges, Mr. Kolcio argued that these distances could be reduced by 25 percent (DC Tr. 900–901, 1133–1134). On the other hand, OSHA's expert witness, Dr. Robert J. Harrington, testified that the Agency's proposed minimum approach distances were correct. He also noted that OSHA's proposed minimum approach distances were by no means the most conservative in the world (DC Tr. 305–308, 318–319). An IEEE paper presented at the IEEE Power Engineering Society's 1988 Summer Meeting asserted that more conservative distances might be warranted based on gap configurations that more closely reflect actual exposure than the rod-to-rod gap on which IEEE Std. 516–1987 is based and on wave shapes that are close to the critical wave shape[62] (Ex. 60).

The NESC subcommittee having responsibility for the ANSI C–2 minimum approach distance tables completed their review of the latest technical information related to this issue and adopted a change proposal for the 1993 edition of the National Electrical Safety Code (Ex. 64, 65). The basic electrical components of the minimum approach distances in the subcommittee's proposed tables were based on Equation (1) and Equation (2).

OSHA has accepted this approach to establishing the basic electrical component of minimum approach distance. None of the evidence in the record supporting either a smaller or a larger electrical component is substantial enough to outweigh the consensus of expert opinion (that is, ANSI and IEEE) on this matter. However, this distance is only a portion of the minimum approach distance needed for the safety of the employee. Other factors also bear on the total safe distance for employees to maintain from energized parts; the electrical component of the minimum approach distance does not take into account human errors in judging and maintaining the required minimum approach distance.

The NESC subcommittee accepted a set of seven principles to be used in the development of the proposed minimum approach distance tables. These principles were listed as follows:

(1) The following principles shall guide the development of a change proposal for the revision of minimum approach distances under Rule 441.

(2) ANSI/IEEE Standard 516 is to be the electrical basis of the NESC Rules for approach distances: Table 4 (Alternating Current) and Table 5 (Direct Current) for voltages * * * above 72.5 KV. Lower voltages are to be based on ANSI/IEEE Standard 4. The application of ANSI/IEEE Standard 516 shall be inclusive of the formula used by that standard to derive electrical clearance distances.

(3) Altitude correction factors shall be in accordance with ANSI/IEEE Standard 516, Table 1.

(4) The maximum design transient overvoltage data to be used in the development of the basic approach distance tables shall be: 3.0 per unit for voltage[s] 362 KV and less, 2.4 per unit for 500 to 550 KV, 2.0 per unit [for] 765 to 800 KV.

(5) All phase to phase values shall be calculated from the EPRI Transmission Line Reference Book for 115 to 138 KV. ([S]ee EPRI book figure 5.2)

(6) An inadvertent movement factor shall be added to all basic electrical approach distances for all voltage ranges. A distance of one foot shall be added to all voltage ranges. An additional distance of one additional foot shall be added to voltage ranges below 72.6 KV.

(7) The voltage reduction allowance for controlled maximum transient overvoltage shall be such that the minimum allowable approach distance is not less than the given approach distance specified for the highest voltage of the given range. The reason for this is that controlled transient overvoltage factors cannot be applied due to consideration that power frequency dictates the minimum approach distance for the voltage involved.

(8) The transient overvoltage tables will be applied only at voltage ranges

[61] Typical configurations include rod-rod, rod-plane, and conductor-plane. The terminology refers to the configuration of the two electrodes. For example, in a rod-plane configuration, one of the electrodes is a rod perpendicular to an electrode in the shape of a plane.

[62] This refers to the graph of the voltage as a function of time. The "critical wave shape" flashes over at the lowest voltage if all other factors remain constant. If the transient overvoltage on the line presents this critical wave shape it may flash over at a voltage lower than that anticipated by Equation (2).

inclusive of 72.6 KV to 800 KV. All tables shall be established using the higher voltage of each separate voltage range. [Ex. 64, 65]

OSHA has also accepted these principles in forming the minimum approach distance tables in the final rule. Each of the factors listed by the subcommittee is supported by substantial evidence in the record (Ex. 60, 64, 65). The technical aspects of most of these considerations are such that the Agency must rely heavily on the judgment of these experts. Nevertheless, OSHA has reviewed the technical information supporting the subcommittee's action and has found that the data do justify the NESC criteria. Therefore, the Agency has accepted the NESC method of computing the minimum approach distances.[63]

The only other factor to cause any debate was the ergonomic distance to be added to the basic electrical component of minimum approach distance to account for human errors in judging and maintaining the required minimum approach distance. Electric utilities commonly add an ergonomic distance of 1 to 3 feet to the electrical component of minimum approach distance to determine allowable approach distances (Ex. 60). The distances set forth in subpart V Tables V–1 and V–2 provide the ergonomic distances shown in Table 4.

The ergonomic data in the record are limited. Relevant data from the record include a typical arm's reach of about 2 feet and a reaction time to a stimulus of 0.2 to more than 1.0 second (Ex. 8–19). To prevent an employee from breaching the air gap required for the electrical component, the ergonomic distance must be sufficient for the employee to be able to recognize a hazardous approach to an energized line and withdraw to a safe position. Thus, the distance should equal the response time multiplied by the average speed of an employee's movement plus "braking" distance. (This is comparable to the calculation of total braking distance for a motor vehicle. This distance equals the initial speed of the vehicle times the driver's reaction time plus the braking distance for the vehicle itself after the brakes have been applied.) The maximum reach (or range of movement) may place an upper bound on the ergonomic component, however.

For system voltages up to 72.5 kV, phase-to-phase, much of the work is performed using rubber gloves, and the employee is working within arm's reach of energized parts (Ex. 64, 65). The ergonomic component of the minimum approach distance must account for this since the employee may not have time to react and position himself or herself out of danger. A distance of 2 feet appears to meet this criterion and was, in fact, adopted by the NESC subcommittee. OSHA also accepts this value. Therefore, for voltages of 72.5 kV and less, the minimum approach distances set forth in the final rule adopt the electrical component of minimum approach distance given by equation (1) plus an ergonomic component of 2 feet.

TABLE 4.—ERGONOMIC DISTANCES BASED ON SUBPART V, TABLE V–1

Voltage range (kV) phase to phase	Distance (ft)		
	V–1	IEEE 4 IEEE 516[1]	Differ.[2]
2.1 to 15	2.00	0.08	1.92
15.1 to 35	2.33	0.33	2.00
35.1 to 46	2.50	0.50	2.00
46.1 to 72.5	3.00	1.00	2.00
72.6 to 121	3.33	2.08	1.25
138 to 145	3.50	2.58	0.92
161 to 169	3.67	3.00	0.67
230 to 242	5.00	4.17	0.83
345 to 362	7.00	7.42	−0.42
500 to 552	11.00	10.25	0.75
700 to 765	15.00	13.83	1.17

[1] This column represents the electrical component of the minimum approach distance as given in the following standards:

2.1 to 7.5 kV: AIEE Standard 4–1943, *High Voltage Testing Techniques.*

7.6 kV and above: ANSI/IEEE Standard 516–1987, *IEEE Guide for Maintenance Methods on Energized Power Lines.*

[2] This equals the ergonomic component of the minimum approach distance based on Subpart V, Table V–1.

For operations involving lines energized at voltages over 72.5 kV, the applicable work practices change. Generally, live-line tools are employed to perform the work while equipment is energized (Ex. 64, 65). When hot sticks are not used, employees use work methods that more tightly control their movements than when they perform rubber glove work. Additionally, exposure to conductors at a potential different from the one on which work is being performed is limited or nonexistent. Therefore, a smaller ergonomic component is appropriate for the higher voltages.[64] The NESC subcommittee has accepted a value of 1 foot for this component. OSHA has adopted this distance as well. Therefore, for voltages over 72.5 kV, the minimum approach distances set forth in the final rule adopt the electrical component of the minimum approach distance given by Equation (2) plus an ergonomic component of 1 foot.

It should be noted that the ergonomic component of the minimum approach distance is only considered a safety factor that protects employees in case of errors in judging and maintaining the full minimum approach distance. The actual working position selected must account for the range of movements that could normally be anticipated while an employee is working. Otherwise, the employee would violate the minimum approach distance while he or she is working.

As noted earlier, the proposal permitted work to be performed at distances less than those given in proposed Tables R–6 and R–7 at voltages of 345 kV or more if the work was performed at a distance that was at least as long as the insulator string. Several commenters and witnesses urged OSHA to recognize methods of working on or near energized parts that would permit an employee to approach the parts closer than permitted by proposed § 1910.269(1)(2) and Tables R–6 and R–7 (Ex. 3–35, 3–65, 3–72, 3–80, 3–82, 3–112, 56; DC Tr. 856–868; LA Tr. 280–281, 471–511). They noted that Subpart V allows approach as close as the shortest distance between an energized part and a grounded surface. EEI suggested that § 1910.269 contain a similar footnote and that the note be extended to lower voltages as well (Ex. 3–112; DC Tr. 856–858).

[63] The minimum approach distance tables in the original NESC change proposal contained several errors in calculation. OSHA, while accepting the NESC method of computing the distances, has calculated the actual distances and has carried the correct distances into final § 1910.269.

[64] It can also be argued that a large part of the electrical component of the minimum approach distance at the higher voltages results from the unlikely, though possible, imposition of a surge on the energized equipment. This line of reasoning implies that it is safe to approach an energized part closer than the electrical component, as long as such approach takes a minimal amount of time. OSHA does not, however, believe that it is safe to enter this zone at any time. At the electrical component distance the probability of flashover is 1 in 1000 if it occurs at the same moment as the maximum transient overvoltage. The record has little information regarding what the probability is that a given overvoltage would be at a maximum. However, it is clear that, given sufficient exposure, a sparkover will eventually occur at distances less than the electrical component of the minimum approach distance. Because OSHA's standard allows for the reduction of minimum approach distances for systems with known transient overvoltages, it is logical to assume that the maximum possible transient overvoltage is reasonably likely to occur. This would place an employee at significant risk of serious injury due to sparkover if the electrical component of the minimum approach distance is violated. It should be noted that one of the sources of temporary overvoltage is faults, which could be caused by the work operation being performed. (For example, a conductor being handled could drop onto a tower. The resultant ground fault could cause a temporary overvoltage on the unfaulted phase conductors.)

As OSHA explained at the hearing, the language in subpart V permits employees to work at a distance from energized parts that may expose them to a flashover (DC Tr. 254–255). Under questioning, Mr. Joseph Van Name agreed that it was not proper to use this distance as the minimum approach distance:

Mr. Wallis: * * * you really shouldn't take the shortest distance anywhere on the system, no matter how far away it is?

Mr. Van Name: As a general term, the answer is positively no. I think I tried to make that rather clear. [LA Tr. 542]

The language in subpart V exposes employees to a probability of flashover that is equal to the worst case probability anywhere on the system. No leeway for inadvertent movement is included in this distance. Additionally, it is possible (though perhaps not likely) that the shortest distance between a live part and a grounded surface is less than the withstand distance for the voltage involved. Clearly, this is neither safe nor acceptable.

Some commenters and witnesses proposed that the standard recognize limiting surge factors[65] as one method of reducing the minimum approach distance (Ex. 3–35, 3–65, 3–72, 3–80, 3–82; DC Tr. 881–882; LA Tr. 280–281, 471–511). They argued that, if the maximum transient overvoltage that could occur on a line was lower than the worst case estimates used to compile proposed Tables R–6 and R–7, the minimum approach distance between an employee and an energized part could be safely reduced. These commenters and witnesses listed various methods of controlling the maximum surge factor on a line including:

(1) Modifying the operation of a circuit breaker or other switching device, including blocking the reclosing feature of a circuit,

(2) Installing surge arresters or temporary protective gaps, and

(3) Changing the operation of the system to restrict the effect of switching operations (Ex. 64, 65).

Mr. Van Name explained the method of using protective gaps to reduce the surge factor in great detail (LA Tr. 478–482, 509). He also explained the technical considerations involved in protecting the employee when such a gap is used. He indicated that the minimum approach distances that would be supplied in the post-hearing comment period would incorporate this concept (LA Tr. 534–537, 550–551, 567–569). In fact, the NESC subcommittee, as mentioned previously, did incorporate this concept into their proposed change for the 1993 National Electrical Safety Code (Ex. 64, 65).

The Agency has adopted the approach of the NESC subcommittee in the final rule. Final § 1910.269 recognizes the use of gaps and other means of decreasing the surge factor on energized lines as acceptable methods of reducing the required minimum approach distance. Table R–6 through Table R–10 list minimum approach distances for various surge factors and phase-to-phase voltages.

In response to questions by EEI, Mr. Van Name acknowledged that explanatory material would be necessary to enable employers and employees to use a standard adopting this approach (LA Tr. 516–517). OSHA has accepted this suggestion as well. The final rule incorporates an appendix (Appendix B) presenting information necessary to the proper use of § 1910.269(l)(2). Much of this information is based on material provided by the NESC subcommittee on work rules (Ex. 64, 65).

There is one difference between the OSHA tables of minimum approach distances and the proposed ANSI tables. The lowest voltage given in the ANSI subcommittee's tables is 300 volts, for which the appropriate minimum approach distance is "avoid contact." The final rule extends this "minimum approach distance" down to 50 volts.

OSHA proposed that employees "avoid contact" with all voltages at 1000 volts or less. In response to the proposal, EEI argued that electrical protective equipment was unnecessary below 300 volts (Ex. 56). They claimed that "the record evidence does not show that linemen have been placed at significant risk * * *"

The Agency strongly disagrees with EEI on this point. As Table 3 shows, 15 percent of the accidents to qualified employees working on or near live parts were at voltages below 300 volts (Ex. 9–2).[66] OSHA believes that there is a hazard for employees exposed to any voltage higher than 50 volts. Requirements in Subpart S for guarding of live parts start at 50 volts (see, for example, § 1910.303(g)(2)), and even qualified electric utility workers have been electrocuted at voltages as low as 120 volts to ground (Ex. 9–2). Therefore, a level of 50 volts rather than 300 volts has been adopted in the final rule as the low voltage cutoff for taking measures to prevent employee contact.

One last method of reducing minimum approach distances was addressed at the hearing. Three witnesses discussed limiting the reach of employees by means such as barriers as a method of reducing the ergonomic component of the minimum approach distance (DC Tr. 873–885, 903–905; LA Tr. 509–510). They argued that, if the employee's movements were restricted, a smaller ergonomic component would be warranted. This concept was also suggested to the NESC subcommittee on work rules for inclusion in the change proposal for the 1993 National Electrical Safety Code (Ex. L62–44, 64, 65). At the hearing, EEI suggested an ergonomic component of the minimum approach distance of 1 foot for employees protected by means of position or warning barriers (DC Tr. 878). A similar suggestion to the NESC subcommittee included an ergonomic distance of 0.5 feet (Ex. L62–44). This concept was not accepted by the NESC subcommittee, however (Ex. 64, 65).

OSHA has not accepted a reduction in the ergonomic component of the minimum approach distance by means of warning barriers or employee positioning for a number of reasons. First, no amount of reduction in the ergonomic distance is supported by any evidence in the record. EEI's original suggestion of a 1-foot distance for this component under limited conditions has been incorporated into the final minimum approach distances without restriction for voltages above 72.5 kV. The later recommendation for a 0.5-foot add-on appears to be justified solely on the basis of what the absolute minimum approach distance is on an industry-wide basis under current practices rather than on the basis of what is technologically justified and safe for employees.

Second, for voltages over 72.5 kV, the ergonomic component of the minimum approach distance is only 1 foot. This relatively short distance gives the employee very little room to err in judging and maintaining the minimum approach distance involved. While a warning barrier may aid the employee in judging the distance, the 0.5-foot ergonomic component of the minimum approach distance is simply too small to protect the employee if he or she inadvertently moves too close to the energized part.

For voltages of 72.5 kV and less, the minimum approach distance is between 2 and 3 feet. The minimum approach distance recommended by the rejected change proposal for these voltages would be only 0.5 to 1.5 feet. Clearly,

[65] Surge factor is the ratio of the maximum overvoltage due to switching or faults to the normal system voltage. This value is expressed in "per unit"; the maximum transient overvoltage is typically expressed in kilovolts.

[66] The percentage does not include accidents in which the voltage level was not given.

any tools or equipment being held by an employee would expose him or her to inadvertent contact with the lines, regardless of the electrical component of the minimum approach distance. The accidents in the record amply demonstrate that this is a common occurrence.

If anything, the accidents in the record indicate that the ergonomic component should be increased, not decreased. The ergonomic component of the minimum approach distance is a cushion against an employee's coming too close to an energized part. Unfortunately, it cannot be reasonably sized to ensure that no employee will ever get close enough to be injured or killed. The Agency must choose a distance that will be sufficient under typical working conditions to provide adequate safety to electrical line workers. Given existing industry practices and the other provisions included in this final rule, OSHA believes that the 1- and 2-foot ergonomic components of the minimum approach distance provided in Table R–6 through Table R–8 will afford this protection.

As noted earlier, EEI argued that minimum approach distances smaller than those required by Subpart V were sometimes necessary to perform work on energized systems. Although the minimum approach distances set forth in final § 1910.269(1)(2) are basically no less than those in the construction standard, the rule does recognize procedures that permit closer approaches.

The standard provides smaller minimum approach distances for systems with surge factors that are limited by means such as system design, switching controls, and temporary protective gaps. Frequently, built-in or temporary limits on the surge factor on a system can result in a minimum approach distance that is small enough to permit work to be performed without additional protective measures. Because the line worker cannot determine surge factors at the jobsite, surge factor reduction is permitted only when the employer can demonstrate, through engineering analysis, that the possible surges on the line will be held to values no more than permitted under Table R–7 and Table R–8. Methods of controlling and determining the surge factor for a system are given in appendix B.

Other means of allowing closer approach are also permitted. Proposed § 1910.269(l)(2) provided three exceptions to the use of the minimum approach distances in Tables R–6 and R–7. The first exception was that the employee be insulated from the energized part. The second exception was for the live part to be insulated from the employee. The last exception was for the employee to be insulated from energized parts at a voltage different from that on which work was being performed. Similar exceptions are provided in the final rule as well.

Existing § 1926.950(c)(1)(i), from which proposed § 1910.269(l)(2)(i) was taken, also specifically permits the employee to be guarded or isolated from the live parts. This language was omitted from the proposal. EEI strongly objected to the omission and urged that the final rule adopt the language of the requirement in the Construction Standards (Ex. 3–112; DC Tr. 868–870). However, it should be noted that the introductory language in final § 1910.269(l)(2) requires minimum approach distances to be maintained from "exposed" energized parts. Guarded live parts, whether they are guarded by enclosures or barriers or are guarded by position (isolated), are not addressed by this rule.[67] Including language exempting live parts that are "guarded" or "isolated" would be redundant and could lead to misinterpretation of the rule. Therefore, EEI's suggestion has not been adopted. Additionally, similar redundancies in paragraphs (c)(1)(ii) and (iii) of § 1926.950 have not been carried forward into paragraphs (l)(2)(ii) and (l)(2)(iii) of final § 1910.269. To clarify the rule, however, a note has been included following paragraph (l)(2) to indicate that parts of electric circuits meeting paragraphs (u)(5)(i) and (v)(5)(i) are not considered as "exposed" unless a guard is removed or an employee enters the space intended to provide isolation from the live parts.

Final § 1910.269(l)(2)(i) contains the first exception—insulating the employee from the energized part. This insulation can take the form of rubber insulating gloves and rubber insulating sleeves. This equipment protects the employee from electric shock as he or she works on the line or equipment. Even though uninsulated parts of the employee's body may come closer to the live part than would otherwise be permitted by Table R–6 through Table R–10, the employee's hand and arm would be insulated from the live part, and the working distances involved would be sufficient protection against arc-over. As noted earlier the tables include a component for inadvertent movement, which is unnecessary for employees using rubber insulating equipment. In the worst case situation, an employee would be working on a line requiring a 3-foot minimum approach distance.[68] The electrical component of this minimum approach distance is 1 foot. Because the distance from the hand to the elbow is about 1 foot and because it would be uncomfortable to work closer than this distance to a line being held in the hand, the worst case minimum approach distance would exceed the electrical component of the minimum approach distance, and the employee would be protected from sparkover. In any event, the accident data in the record show that the overriding hazard to employees is posed by other energized conductors in the work area, to which the minimum approach distances still apply. The rubber gloves, of course, provide protection only for the line on which work is being performed.

Of course, the insulation used would have to be designed for the voltage. (The revision of § 1910.137 gives use voltages for electrical protective equipment.) As a clarification, paragraph (l)(2)(i) notes that the insulation is considered as protection only against parts upon which work is being performed; the required minimum approach distances would have to be maintained from other exposed energized parts.

As a second option to maintaining the minimum approach distances, paragraph (l)(2)(ii) of final § 1910.269 allows the energized part to be insulated from the employee. Such insulation could be in the form of insulating blankets or line hose or other suitable insulating equipment. Again, the insulation would have to be adequate for the voltage.

Paragraphs (l)(2)(i) and (l)(2)(ii) recognize the protection afforded to the employee by an insulating barrier between the employee and the energized part. As long as the insulation is appropriate and is in good condition, current will not flow through the worker, and he or she is protected.

The third option (paragraph (l)(2)(iii)) to the maintenance of the minimum approach distances is to insulate the employee from exposed conductive objects other than the live part upon which work is to be performed. Much of the work performed under this option is called "live-line bare-hand" work. (For specific practices for this type of work, see the discussion of final § 1910.269

[67] Paragraphs (u)(5)(i) and (v)(5)(i) contain requirements for the guarding of live parts. Parts of electric circuits that meet these two provisions are not considered as "exposed" unless a guard is removed or an employee enters the space intended to provide isolation from the live parts.

[68] The maximum use voltage for Class IV rubber gloves is 36 kilovolts. If only single-phase exposure is involved, the maximum phase-to-phase voltage would be in the 46.1 to 72.5 kilovolt range Table R–6.

(q)(3).) In this type of work, the employee is in contact with the energized line, like a bird on a wire, but is not contacting another conductive object at a different potential. Because there is no complete circuit, current cannot flow through the worker, and he or she is protected.

In the preamble to the proposal, OSHA requested public comment on whether rubber insulating sleeves should be required when gloves are used on lines or equipment. The Agency received a significant amount of comment on this issue.

Several commenters supported a requirement for employees to wear rubber insulating sleeves when working on or near exposed energized parts (Ex. 3–13, 3–46, 3–57, 3–107, 64; DC Tr. 558–561, 610–612). They stressed the extra safety that sleeves would provide. Mr. James Ozzello of the International Brotherhood of Electrical Workers summarized the IBEW accident data relating to the lack of rubber insulating sleeves by electric line workers, as follows:

> **Mr. Ozzello:** Regarding the rubber sleeves, I only included those accidents where the electric contact was in the area that would be covered by the rubber sleeves. I did not include those accidents where the electric contact was in the area of rubber sleeves and the victim was not wearing rubber gloves or where the victim was using a live line tool, a hot stick.
>
> If the employee was not wearing rubber gloves, chances are he would not be wearing the rubber sleeves. Also, many companies do not require the use of rubber protective equipment when live line tools are used.
>
> * * * * *
>
> To summarize the three surveys on fatal and serious accidents, there were a total of 171 fatal accidents and 271 serious accidents.
>
> * * * * *
>
> Rubber sleeves might have prevented nine of the fatalities and [sixteen] of the serious accidents. [DC Tr. 558–561]

Others opposed a requirement for employees to wear sleeves as well as gloves (Ex. 3–23, 3–32, 3–42, 3–60, 3–82, 3–112, 46, 47, 56, L62–33, L62–43, L62–44; DC Tr. 925–926). EEI pointed to the experience of four electric utilities that have had no electrical contact accidents that the use of rubber insulating sleeves would have prevented (Ex. 46). The experience of these companies was summarized by Mr. Tony E. Brannan of Georgia Power Company, representing EEI, who stated:

> **Mr. Brannan:** I would like to make, if I may, just one comment, one side comment here.
>
> Please note that rubber glove. Now our fine faithful colleague friends from up north have been showing you some slides where employees use sleeves. That is those things that go around the shoulder and come down the arm.
>
> Well, that is all well and good and I am not trying to criticize their work practices. But I am trying to show you here that there are other ways of protecting employees other than using sleeves.
>
> (Viewgraph displayed)
>
> **Mr. Brannan:** Now look at this glove. That glove goes up over the elbow of that individual. That gloves [sic] has what is called an 18-inch cuff, which means that it goes up, way up onto the forearm.
>
> Now what I am suggesting and requesting, respectfully requesting, is that if you in this case follow the language in Subpart V where gloves "or" sleeves and gloves shall be used. In other words, please continue and let the use of rubber sleeves be optional.
>
> Some companies use them and some companies don't. In our company we have a tremendous cover-up program and we cover-up even the paths to ground up on the pole.
>
> So therefore we do not use sleeves. They are hot in the south in the summertime. They don't breathe. And we look at them as a nuisance. I can tell you that we in our company have never had an accident that rubber sleeves would have prevented. [DC Tr. 925–926]

EEI also pointed to the cost and inadequate supply of rubber insulating sleeves as factors the Agency should consider as factors supporting their view (Ex. 56). They submitted many petitions urging OSHA not to adopt a requirement for the use of sleeves (Ex. 46) and stated that "[t]his spontaneous expression of concern by employers and employees alike surely cannot be ignored by the Agency" (Ex. 56).

OSHA's primary concern is for the safety of employees. The injuries and fatalities to which Mr. Ozzello referred constitute 5.9 and 5.3 percent of the totals, respectively. This is a significant portion of the total number of serious accidents occurring among electric line workers. The Agency believes that these injuries and fatalities are clearly preventable.

The use of rubber insulating sleeves would certainly have prevented most of these accidents. However, as demonstrated by the commendable safety record of the companies cited by EEI, the extensive use of insulating equipment to cover energized parts in the employee's work area would also appear to prevent employees' upper arms and shoulders from contacting live parts. In fact, if every energized part within reach of an employee were insulated, electrical contacts involving other parts of the body, such as an employee's head or back, would be averted as well. The NESC subcommittee on work rules also recognized this method as providing protection to employees (Ex. 64, 65).

The proposal and existing subpart V do not require any protection for employees working on or near exposed live parts beyond the use of rubber insulating gloves, and it appears from the descriptions of the accidents cited by the IBEW that some companies do not go beyond the existing OSHA regulations. To prevent such accidents from occurring in the future, the Agency has decided to require protection in addition to that required by subpart V.

The final rule adopts a provision, § 1910.269(l)(3), requiring the use of rubber insulating sleeves (in addition to rubber insulating gloves), unless live parts that are exposed to contact with an employee's upper arm or shoulder are insulated. Employees can work without sleeves by installing rubber line hose, rubber blankets, and plastic guard equipment on energized equipment. However, an employee installing such protective equipment on energized lines must wear rubber sleeves unless his or her upper arms and shoulders are not exposed to contact with other live parts during this operation.

OSHA believes that paragraph (l)(3) incorporates the most effective approach to preventing accidents involving work on or near exposed live parts. Companies that rely on extensive insulation of live parts in the work area can generally continue to use this method to protect employees. Companies that use gloves alone to protect their employees may have to purchase additional supplies of rubber insulating equipment.

Evidence in the record indicates that supplies of rubber insulating sleeves at the time the rulemaking record closed were not sufficient to enable employers to acquire them in quantities adequate to ensure compliance with the standard (Ex. 46, 56). In its post-hearing brief (Ex. 56), EEI stated: "Any requirement for additional rubber protective sleeves could only be phased in over a period of three years at a minimum." That statement was made in August of 1990, over 3 years ago. As EEI noted in their brief, demand for additional supplies of rubber insulating sleeves was anticipated by the manufacturers as early as 1990. Furthermore, the NESC requirement on the use of sleeves was adopted in July of 1992, well over 1 year ago. Thus, employers and manufacturers have had over 1 year's lead time based on compliance with the NESC. Lastly, the standard recognizes alternative approaches for protecting employees. Because of this, some employers may not need to purchase rubber sleeves to comply with the final rule. Taking this information into consideration, OSHA has determined that no additional delay in effective date, beyond the 120 days given for the final rule as a whole, is needed to enable employers to obtain sufficient supplies of rubber insulating equipment.

Paragraph (l)(3) of proposed § 1910.269 would have required employees to position themselves so that a shock or slip would not cause the worker's body to move towards exposed parts at a potential different from that of the employee. Since slips, and even electric shocks, are not entirely preventable, it is important for the employee to take a working position so that such an event will not increase the severity of any incurred injury. This proposed requirement was taken from ANSI C2–1984, Section 422F.

Several commenters objected to this provision (Ex. 3–20, 3–22, 3–42, 3–60, 3–80, 3–82, 3–101, 3–112). They noted that the ANSI requirement was not written in mandatory language and that it was not always possible to work from below an energized part. Most suggested alternative language, such as replacing "employees may not work" to "employees shall avoid, where practical" (Ex. 3–20) and replacing "may" with "should" (Ex. 3–42). Some gave examples demonstrating the impracticality of such a rule (Ex. 3–20, 3–42, 3–101; DC Tr. 991–992).

OSHA agrees that it is not always possible to comply with the rule as proposed. However, the Agency believes that it is important for an employee to work from a position where a slip or a shock will not bring him or her into contact with an energized part unless other conditions, such as the configuration of the lines involved or fatigue of the employee, would make another working position safer. The position taken must be the safest available to accomplish the task, but may not be the most efficient one. Even electric utility representatives stated that it is common practice to teach employees to work from below energized parts, where a slip would take the employee away from the parts (Ex. 3–82, 3–112; DC Tr. 989–991). Unfortunately, most of the suggested alternatives would render the provision largely unenforceable. To provide employees with the safest work position feasible, OSHA has adopted the following language in paragraph (l)(4) of final § 1910.269:

> The employer shall ensure that each employee, to the extent that other safety-related conditions at the worksite permit, works in a position from which a slip or shock will not bring the employee's body into contact with exposed, uninsulated parts energized at a potential different from the employee.

The revised language recognizes situations that preclude working from a position from which a slip would bring the employee into contact with a live part but remains enforceable in the Agency's view. The language contained in this provision also allows such options as guarding or insulating the live part as alternative means of compliance.

Paragraph (l)(5) addresses the practices of connecting and disconnecting lines and equipment. Common industry practice, as reflected in ANSI C2–1984, Section 422G, is to make a connection so that the source is connected as the last item in sequence and to break a connection so that the source is removed as the first item in sequence. In this way, conducting wires and devices used to make and break the connection are deenergized during almost the entire procedure. Since these wires and devices must be handled during the procedure, the requirement reduces the chance for an electrical accident. Also, to prevent the disconnected conductors from being energized, loose conductors must be kept away from live parts. These requirements have been broken into separate paragraphs in the final rule.

Taken from ANSI C2–1984, Section 420I2, § 1910.269(l)(6)(i) prohibits the wearing of conductive articles by employees working within reach of exposed live parts of equipment if these articles would increase the hazards associated with accidental contact with the live parts. If an employee wants to wear metal jewelry, he or she can cover the jewelry so as to eliminate the contact hazard. This requirement is not intended to preclude workers from wearing metal rings or watch bands if the work being performed already exposes them to electric shock hazards and if the wearing of metal would not increase the hazards. (For example, for work performed on an overhead line, the wearing of a ring does not increase the likelihood that an employee would contact the line, nor would it increase the severity of the injury should contact occur.) However, this requirement would protect employees working on energized circuits with small clearances and high current capacities (such as some battery-supplied circuits) from severe burn hazards to which they would otherwise be exposed. The rule also protects workers who are only minimally exposed to shock hazards from being injured as a result of a dangling chain's making contact with an energized part. OSHA has accepted the suggestion of two commenters that the proposed term "in the vicinity of" be replaced with "within reaching distance" to help clarify the requirement (Ex. 3–20, 3–80).

OSHA mentioned in the preamble to the proposal that certain clothing fabrics were easily ignited and could pose severe burn hazards. The Agency noted that, since qualified employees are commonly exposed to electric arcs, it had been suggested that clothing made of these materials be prohibited for exposed employees. The preamble also stated that American Society for Testing and Materials Committee F–18 on Electrical Protective Equipment for Workers was exploring possible standards for application to clothing. However, since no standards existed, OSHA requested public comment on the desirability of adopting requirements in this area and on the costs and benefits of any suggested provisions. The notice of public hearing informed interested parties that the Agency was considering a prohibition of any clothing that would substantially increase the severity of any injury received from arcing electric equipment.

OSHA received many comments on this issue. In its original submission, EEI maintained that electric utility employees are rarely exposed to electric arcs because of the quality of their training and the extent of the safeguards provided (Ex. 3–112). If this were true, the Agency would not need to regulate the type of clothing these workers wear. However, this statement was strongly rebutted by the testimony of Mr. James Ozzello of the IBEW, who stated:

> When examining the accident reports for these accidents where burns might have been the cause of a death or contributing factor to the death of a victim, or a factor in the seriousness of the accident, I did not include flash burns or burns that could have been solely electrical burns.
>
> I only included the type of burns that the wearing of either flame resistant clothing or a natural fiber clothing might have prevented or lessened the degree of injury.
>
> I also did not include burns that were caused by either escaping steam or hot water.
>
> * * * * *
>
> To summarize the three surveys on fatal and serious accidents, there were a total of 171 fatal accidents and 271 serious accidents [overall].
>
> * * * * *
>
> If 65 of the employees who were involved in serious accidents had been wearing natural fiber clothing or flame retardant clothing, their accidents might not have been classified as serious accidents. [DC Tr 559–562]

OSHA has determined, therefore, that electric power generation, transmission, and distribution workers do face a significant risk of injury from burns due to electric arcs.

The evidence was nearly universal that certain fabrics increase the extent of injuries to employees caught in an electric arc or otherwise exposed to flames (Ex. 3–9, 3–10, 3–13, 3–20, 3–22, 3–51, 3–57, 3–80, 3–82, 3–88, 3–95, 3–107, 12–12, 47, 56; DC Tr. 363–364). Nonetheless, the commenters disagreed on the approach that OSHA should take in regulating the type of clothing worn by employees. Several claimed that requirements dealing with this subject would be difficult to enforce and suggested that OSHA adopt either no regulation or a simple provision requiring workers to be trained in the relevant hazards (Ex. 3–10, 3–42, 3–69, 3–123, 56). Most, however, took a position similar to that of OSHA's expert witness Mr. Arthur Lewis, who recommended adopting a rule that would prohibit employees from wearing clothing made of fabrics that could increase the extent of their injuries in the event of exposure to electric arc (Ex. 3–9, 3–13, 3–20, 3–57, 3–82, 3–107, 47; DC Tr. 363–364).[69]

Several interested parties submitted evidence regarding the flammability of various materials and the degree of injuries that would occur under certain conditions. The IBEW introduced a videotape, produced by the Duke Power Company, demonstrating the effects of different types of clothing upon exposure to electric arcs (Ex. 12–12). This tape provides clear evidence of the hazards of wearing clothing made from certain untreated synthetic fabrics, such as polyester, acetate, nylon, and rayon. Representatives from E. I. du Pont de Nemours and Company and from Hoechst Celanese Corporation submitted test data on various fabrics (Ex. 44, 3–95). The du Pont data, contrary to other evidence in the record, indicated that untreated cotton resulted in a higher predicted percentage of second and third degree burns than an untreated polyester/cotton blend. However, these results were obtained with a 4-second gas heat flux of 2 calories/cm^2-sec—not a normal electric arc exposure, which is of high energy density but short duration.

OSHA believes the data from the Duke Power Company study are more directly related to electric power generation, transmission, and distribution work, at least at present. In the future, the results of the ASTM Committee work should improve the data available to the Agency and should provide a basis upon which a detailed standard could be based. In the meantime, OSHA has decided that a performance-oriented approach to the problem is warranted. The risk to employees is too great for the Agency simply to ignore the problem, and the quickest immediate solution is for employees to avoid wearing fabrics that might worsen any injuries they experience from an electric arc. Therefore, for exposed employees, paragraph of final § 1910.269 adopts a requirement that these employees be trained in the hazards related to the clothing that they wear, and paragraph sets forth a prohibition of apparel that could increase the extent of injuries received by a worker who is exposed to an electric arc. OSHA has also included a note following paragraph to indicate the types of clothing fabrics that the record demonstrates are hazardous to wear by employees exposed to electric arcs.

The requirement is intended to prohibit the types of fabrics shown in the Duke Power Company videotape to be expected to cause more severe injuries than would otherwise be anticipated. These include such untreated materials as polyester and rayon, unless the employee is otherwise protected from the effects of their burning. Natural fabrics, such as 100 percent cotton or wool, and synthetic materials that are flame resistant or flame retardant are acceptable under the final rule. (If and when a national consensus standard on clothing for electrical workers becomes available, OSHA will examine whether or not to revise the rule to require materials conforming to such a standard.) The Agency realizes that employers may have difficulties enforcing company rules on the types of clothing that their employees may wear. OSHA will adopt flexible enforcement policies in this area for employers making good faith efforts to comply with the standard. Additionally, the Agency intends to support such outreach activities as training, speeches, and informational pamphlets to educate employers and employees about the hazards associated with flammable clothing.

To protect employees from contacting energized parts, paragraph (l)(6) of proposed § 1910.269 would have required fuses for circuits over 300 volts to be installed and removed using insulated tools or gloves. Additionally, employees installing expulsion-type fuses would have been required to wear eye protection and would have had to stand clear of the fuse's exhaust path. This requirement was taken from ANSI C2–1984, Section 420O.

Two commenters argued that, at higher voltages, the proposal was not adequate to protect employees (Ex. 3–69, 3–123). They also suggested that some protection be required for voltages below 300 volts.

OSHA agrees that there is a hazard for employees exposed to any voltage higher than 50 volts. Requirements in Subpart S for guarding of live parts start at 50 volts (see, for example, § 1910.303(g)(2)), and even qualified electric utility employees have been electrocuted at voltages as low as 120 volts to ground (Ex. 9–2). Therefore, the final standard also requires protection for the installation or removal of fuses with exposed parts energized at more than 50 volts.

The installation and removal of fuses on circuits energized at voltages much higher than 300 volts can also lead to hazards not completely addressed by proposed § 1910.269(l)(6) if expulsion-type fuses are involved. When an expulsion fuse operates on a fault or overload, the arc from the fault current erodes the tube of the fuse holder (Ex. 8–5). This produces a gas that blasts the arc out through the fuse tube vent or vents, and with it any loose material in the way. Employees could be injured by the arc blast or by particles blown, by the blast, in their eyes. (For this reason, OSHA has not accepted the argument of three commenters, Ex. 3–38, 3–125, 3–128, that no protection is needed by employees handling the fuses with 30-foot hot sticks.) Employees should never install or remove such fuses using gloves alone. Therefore, in final § 1910.269(l)(7), the Agency is requiring them to use eye protection and tools rated for the voltage.

Paragraph (l)(8) explains that covered conductors are treated under the standard as uninsulated. (See the definition of "covered conductor" in § 1910.269(x).) The covering on this type of wire protects the conductor from the weather but does not provide adequate insulating value.

Since ungrounded metal frames of equipment can become energized, paragraph (l)(8) of proposed § 1910.269 would have required the testing of these metal parts for voltage before they could be treated as deenergized. Two commenters questioned the wisdom of this provision (Ex. 3–69, 3–123). They noted that a test is only good at the specific time the test is done.

OSHA has accepted this recommendation. Paragraph (l)(9) in the final rule restates the requirement so that noncurrent-carrying metal parts of equipment or devices must be treated as energized unless the installation is inspected and these parts are

[69] Some of these supported a requirement for natural fibers, such as cotton; others supported a prohibition against synthetic materials, such as polyester.

determined to be grounded. Grounding these parts, whether by permanent grounds or by the installation of temporary grounds, would provide protection the entire time work is being performed.

Paragraph (l)(10) requires devices used to open circuits under load conditions to be designed to interrupt the current involved.

This provision was not included in proposed § 1910.269. The National Electrical Manufacturers Association (NEMA) urged OSHA to add a requirement for opening circuits under load only with devices intended to interrupt current (Ex. 3–81). Edison Electric Institute recommended adoption of a similar requirement (Ex. 28). The Agency agrees with EEI and NEMA that it is hazardous to open a circuit with a device that is not designed to interrupt current if that circuit is carrying current. Non-load-break switches used to open a circuit while it is carrying load current could fail catastrophically, severely injuring or killing any nearby employee. Therefore, OSHA has adopted a requirement that devices used to open circuits under load conditions be designed to interrupt the current involved as paragraph (l)(10) of final § 1910.269.

Paragraph (m). Paragraph (m) of final § 1910.269 addresses the deenergizing of electric transmission and distribution lines and equipment for the protection of employees. Transmission and distribution systems are different from other energy systems found in general industry or even in the electric utility industry itself. The hazardous energy control methods for these systems are necessarily different from those covered under § 1910.269(d). Transmission and distribution lines and equipment are installed outdoors and are subject to being reenergized by means other than the normal energy sources. For example, lightning can strike a line and energize an otherwise deenergized conductor, or a line could be energized by unknown cogeneration sources not under the control of the employer. Additionally, some deenergized transmission and distribution lines are subject to being reenergized by induced voltage from nearby energized conductors or by contact with other energized sources of electrical energy. Another difference is that energy control devices are often very remote from the worksite and are frequently under the centralized control of a system operator.

For these reasons, OSHA proposed to cover the control of hazardous energy sources related to transmission and distribution systems separately. Because paragraph (m) covers this area, the general requirements for hazardous energy control in paragraph (d) of final § 1910.269 do not apply to the disconnection of transmission and distribution lines and equipment from sources of electrical energy. There was no significant objection to this approach in the record, and OSHA has carried it forward into the final rule.

In addition to setting forth the application of § 1910.269(m), paragraph (m)(1) explains that conductors and equipment that have not been deenergized under the procedures of either paragraph (d) or (m) of § 1910.269 have to be treated as energized. Therefore, there are no gaps in the coverage of these two paragraphs.

Several commenters objected to the application of the requirements of proposed § 1910.269(m) to distribution lines of 600 volts or less (Ex. 3–20, 3–42, 3–80, 3–112). These commenters stated that their procedures for the lower voltages did not conform to OSHA's proposal and that they had experienced no accidents as a result of using them. EEI specified how utilities' approach differs for lines and equipment operating at 600 volts or less. They stated:

> OSHA has not proposed to use the triggering level of 600 volts contained in subpart V, [§]1926.950(d) and proposed by EEI/IBEW as the threshold for application of these requirements. Accordingly, formal clearance[70] procedures would be used to work voltages lower than 600 volts without personal protective equipment. To initiate these procedures for voltages less than 600 volts would result in substantial work delays that are completely unnecessary. Once again, we do not understand why OSHA proposes to depart from subpart V for a hazard which is truly identical whether performing maintenance or construction. Stated simply, 600 volts is 600 volts.
>
> OSHA has also omitted the phrase "visibly open" contained in the EEI/IBEW draft. This could mean that formal clearance procedures would be required even on small jobs where the crew working on the facility can clearly see that the disconnect switches are open or locked out or tagged out. Subpart V, section 1926.950(d)(1) provides that its requirements do not apply if the disconnecting means is "visibly open or visibly locked out." Again, the reason for departing from subpart V for identical hazards is not explained or justified.
>
> The "visibly open" provision is utilized on some high voltage work, involving one or two spans of conductor, removing transformers from the line, and some substation work. The "visibly open" provision and the "600 volt" threshold are also used on most secondary and service work. Consistent with OSHA's existing standards, most utilities presently allow personnel to work on deenergized equipment normally energized below 600 volts without rubber protective equipment if the means of disconnecting is visibly open or visibly tagged or locked open. There are other precautions, such as testing for voltage, removal of customer meters, disconnecting service taps or shunting the transformer secondary leads, that are used to protect workers. Most utilities do not require personal protective grounds below 600 volts.
>
> With no voltage threshold for application of this [paragraph], prohibitive costs will be incurred for utilities that presently comply with subpart V and use the 600 volt threshold for both construction and maintenance work. These added costs will flow from instituting centralized control for these low voltage operations, purchasing additional grounds and implementing procedures on a daily basis. [Ex. 3–112]

OSHA firmly believes that certain procedures must be followed for deenergizing live parts at any voltage over 50 volts[71] if employees will be in contact with the parts during the course of work. Contact with electric circuit parts energized at 600 volts or less can be as fatal as contact with higher voltages. The basic steps necessary for deenergizing electric circuits are the same regardless of voltage—first, the disconnecting means for the circuit must be opened; second, a method of securing the disconnecting means from accidental closure must be used; third, the circuit must be tested to ensure that it is in fact deenergized; and, fourth, measures (such as grounding) must be used to ensure that no hazardous voltage can be impressed on the circuit while employees are working. These are the steps that were proposed in § 1910.269(m) and that have been carried into the final rule. These are the same steps that are set forth, without a voltage limitation, in 1987 NESC Section 423, on which the proposal was based (Ex. 2–8).

In response to the comments, OSHA has modified the details of the individual steps (that is, paragraphs in the final rule), as explained later in this section of the preamble (see, for example, the summary and explanation of paragraphs (m)(2)(ii) and (m)(3)(i)). These modifications have been based, not on voltage, but on the circumstances involved with different types of installations. For example, one of these circumstances is whether or not central control of the electric circuit is exerted. Central control of transmission and distribution circuits is not required by the standard (as implied by EEI) but, if present, necessitates modifications of

[70] The word "clearance", as used in the discussion of this paragraph, means the procedure used to deenergize lines and equipment (and hold them "clear") for the protection of employees.

[71] This is also the voltage limit for the application of the requirement for deenergizing live parts in OSHA's electrical safety-related work practices standard, § 1910.333(a)(1).

the details of the basic steps to be taken. This is true regardless of the voltage involved.

For these reasons, OSHA has not limited the application of paragraph (m) of final § 1910.269 to circuit parts operating at more than 600 volts.

Proposed § 1910.269(m)(2) outlined how the individual provisions in paragraph (m)(3) would have applied under various conditions. The entire paragraph (m)(3) would have applied to situations in which the employee depended on others for deenergizing the circuits or in which the employee obtained authorization to perform the task himself or herself. All of paragraph (m)(3) would also have applied if a single employee, other than the system operator, was in complete control of the lines or equipment and of their means of disconnection. In this case, the employee in charge would have been required to take the place of the system operator, as necessary, to open and tag switches and other devices controlling electrical energy to the lines or equipment involved. (The system operator is a qualified person, commonly located in a control room, who operates the system or its parts.)

If an employee was working alone and if the means of disconnection were visible to the employee, the only requirements of paragraph (m)(3) which would have applied were those directly pertaining to the deenergizing and reenergizing of lines and equipment. Provisions for tagging and for communication with others would not have applied.

EEI suggested that this last condition be extended to apply to a crew of employees, as well as employees working alone (Ex. 3–112; LA Tr. 240–241). They argued that tags were not necessary if a single group of employees was working on a deenergized circuit and if the disconnecting means for that circuit was visibly open.

OSHA has accepted this recommendation. The Agency agrees that, under certain conditions, tagging a disconnecting means that is open and visible to a crew as they are performing their work would not increase the safety of the employees. As noted by the commenters, some systems are under the direction of a central system operator who controls all switching operations. Other systems (mostly distribution installations) are not under any centralized control. These systems are energized and deenergized in the field without the direct intervention of a system operator. To incorporate EEI's suggestion into the final rule and to reflect more clearly this bifurcated approach to deenergizing transmission and distribution lines and equipment, OSHA has reorganized and revised paragraph (m)(2).

Paragraph (m)(2)(i) of proposed § 1910.269 has been carried forward into the final rule. The language of this provision, however, has been modified to make it clear that all of the requirements of paragraph (m)(3) apply only if a system operator is in charge of the lines and equipment and of their means of disconnection.

Paragraph (m)(2)(ii) defines the general application of the rule to crews working on lines that are not under the control of a system operator. In the usual case, one employee is designated to be in charge of the clearance. All the requirements in paragraph (m)(3) apply, with the employee in charge of the clearance taking the place of the system operator. In this manner, the final rule provides protection against the unintended energizing of transmission and distribution lines without requiring all lines to be under the control of one employee. One employee in a crew will be in charge of the clearance for the crew; procedures will be followed to ensure that the lines are truly deenergized; tags will be placed on the lines; and procedures will be followed to remove the tags and reenergize the lines.

However, in some cases, certain requirements contained in paragraph (m)(3) are not necessary for the safety of employees. If only one crew will be working on transmission or distribution lines and if the means of deenergizing the lines is accessible and visible to and under the sole control of the employee in charge of the clearance, the provisions requiring tags on the disconnecting means are unnecessary. The proposed rule would have applied the appropriate provisions for this situation, but only for employees working alone. As EEI noted in their comments, the hazards are basically the same whether an employee is working alone or as part of a crew, as long as the disconnecting means are accessible and visible to the employees and are under the sole control of a single employee.

Therefore, paragraph (m)(2)(iii) exempts a portion of the requirements of paragraph (m)(3) from applying to work that is performed by a single crew of employees,[72] if the means of disconnection of the lines and equipment are accessible and visible to and under the sole control of the employee in charge of the clearance. The provisions of paragraph (m)(3) that would not apply are those relating to (1) requesting the system operator to deenergize the lines, (2) automatic and remote control of the lines, (3) the wording on tags, (4) two crews working on the same line, and (5) tag removal. It is not necessary to request the system operator to deenergize the lines because he or she would not be in control of the disconnecting means for the lines. Only one person would be in charge of the clearance for the crew, and the means of disconnection for the lines would be accessible and visible to and under the control of that person.[73] Thus, tags would not be needed for the protection of the crew, and remote and automatic switching of the lines would not be recognized under paragraph (m)(2)(iii). Additionally, this paragraph does not apply to work performed by two crews working on lines or equipment controlled by the same disconnecting means. (A group of employees made up of several "crews" of employees who are under the direction of a single employee and who are working in a coordinated manner to accomplish a task on the same lines or equipment are considered to be a single crew, rather than as multiple independent crews, for the purposes of paragraph (m)(2)(iii).) If the crews are independent, each crew would need an employee-in-charge of its clearance. Therefore, no one could be considered as having sole control over the disconnecting means protecting the crews, and the exceptions listed in paragraph (m)(2)(iii) would not apply.

Under any of the preceding scenarios, disconnecting means that are accessible to people not under the employer's control must be rendered inoperable. For example, a switch handle mounted at the bottom of a utility pole that is not on the employer's premises must be locked in the open position while the overhead line is deenergized. This requirement, which is contained in paragraph (m)(2)(iv) prevents a member of the general public or an employee (of a contractor, for example) who is not under the employer's control from closing the switch and energizing the line.

Paragraph (m)(3) of final § 1910.269 sets forth the exact procedure for deenergizing transmission and distribution lines and equipment. The procedure must be followed in the order presented in the rule. Except as noted, the rules are consistent with existing § 1926.950(d)(1), although the language originally contained in the proposal was taken in large part from ANSI C2–1987,

[72] An employee working alone is considered to be a "crew" of one.

[73] The means of disconnection is under the sole control of the employee in charge of the clearance, and it need only be accessible and visible to that employee. Other employees in the crew have no control whatsoever over the disconnecting means.

section 423. The Agency has attempted to simplify the language of the consensus standard and to write the requirements in performance-oriented terms whenever possible. In the final rule, OSHA has incorporated changes that are justified on the basis of the record considered as a whole, as noted in the following discussion of the individual paragraphs.

Paragraph (m)(3)(i) requires an employee to request the system operator to deenergize a particular section of line or equipment. So that control is vested in one authority, a single designated employee would be assigned this task. This designated employee thus becomes the employee in charge of and responsible for the clearance for work.

One commenter was concerned that this provision would require the presence of a foreman on the worksite (Ex. 3–2). Others thought that the provision would prohibit prearranged switching requests performed by someone who would not be performing the actual work (Ex. 3–20, 112; LA Tr. 241–242).

These concerns are unfounded. The designated employee who requests the clearance need not be in charge of other aspects of the work; the regulation intends for this designated employee to be in charge of the clearance. He or she is responsible for requesting the clearance, for informing the system operator of changes in the clearance (such as transfer of responsibility), and for insuring that it is safe for the circuit to be reenergized before the clearance is released. If someone other than an employee at the worksite requests the clearance and if that clearance is in place before the employee arrives at the site, then clearance must be transferred under § 1910.269(m)(3)(ix). The Agency believes that the person requesting the clearance, once the lines are indeed deenergized, must be the one to contact in case alterations in the clearance are necessary. The employees who will be performing the actual work at some time in the future would not necessarily be aware that a clearance has been requested and would not be in position to answer questions about the clearance.

OSHA believes that this intent is clear from the wording of the last sentence of paragraph (m)(3)(i), which reads as follows: "The designated employee becomes the employee in charge (as this term is used in paragraph of this section) and *is responsible for the clearance* [emphasis added]." Therefore, no changes have been made to the language of this provision.

The second step (paragraph (m)(3)(ii)) is to open all switches through which electrical energy could flow to the section of line or equipment. The disconnecting means must then be made inoperable if the design of the device permits. For example, the removable handle of a switch could be detached. Also, the switches must be tagged to indicate that employees are at work. This paragraph ensures that the lines are disconnected from their sources of supply and protects against the accidental reclosing of the switches.

Several commenters noticed that the phrase "lines and equipment to be energized" in this paragraph in the proposal referred to lines and equipment that actually were to be deenergized (Ex. 3–32, 3–40, 3–42, 3–82, 3–107, 3–112). This was an inadvertent error in the proposal, and it has been corrected in the final rule.

Some commenters also expressed the concern that this provision would require the disconnection of hundreds of transformers, in certain cases, in order to eliminate possible unexpected sources of electric energy (Ex. 3–101, 3–123). This rule is intended to require the disconnection of known sources of electric energy, and the language in the final rule makes this clear. Hazards related to the presence of unexpected energy sources are controlled by testing for voltage and by grounding the circuit, as required by paragraphs (m)(3)(v) and (m)(3)(vi), respectively.

Paragraph (m)(3)(iii) requires the tagging of automatically and remotely controlled switches. An automatically or remotely controlled switch must also be rendered inoperable if the design of the switch allows for it to be made inoperable. This provision would also protect employees from being injured as a result of the automatic operation of such switches.

In the preamble to the proposal, OSHA requested public comment on whether it is appropriate to require all new and replacement switches that are to be automatically or remotely controlled to be designed so that they could be rendered inoperable and on whether it is feasible for such switches to be so designed.

Some commenters supported such a requirement (Ex. 3–76, 3–107; DC Tr. 416–417). The UWUA argued that all disconnecting means should be locked out and under the control of the employee performing the work (DC Tr. 416–417). Mr. G. F. Stone of the Tennessee Valley Authority claimed that it would be feasible to require new switches to be designed so that they could be rendered inoperable only if the rule applied to automatically or remotely controlled switches (Ex. 3–82).

Three commenters opposed such a requirement (Ex. 3–59, 3–81, 3–112). Mr. James W. Broome of the Arizona Electric Power Cooperative, Inc., expressed the view that the procedures already in place adequately protect employees and that any requirement for changes in the design of automatic and remotely controlled switches would increase the cost of these devices (Ex. 3–59). EEI believed that there were too many different types of switches in use and that most of them currently have the capability of disabling the automatic or remote control feature (Ex. 3–112). Agreeing with EEI, the National Electrical Manufacturers Association, which represents manufacturers of such devices, also opposed regulations requiring a change in the design of these devices (Ex. 3–81).

There is insufficient evidence on the record to determine whether or not it is feasible to require automatically and remotely controlled switches to be capable of having the automatic or remote control feature disabled. In any event, the procedures required by the standard will protect employees from the hazards involved. Paragraph (m)(3)(iii) requires automatically and remotely controlled switches to be tagged at the point of control. This alerts the person who would initiate action to reenergize the circuit that the line or equipment is deenergized for the protection of employees. The only way the line or equipment could be reenergized is for someone to override the tag, and the requirements of paragraph (m) are intended to prevent that. Therefore, the Agency is not adopting a requirement that new automatically and remotely controlled switches be designed so that they could be rendered inoperable.

Paragraph (m)(3)(iv) requires tags to prohibit operation of the switches to which they are attached. They are also required to state that employees are at work.

After the previous four requirements have been met and after the employee in charge of the work has been given a clearance by the system operator, paragraph (m)(3)(v) requires the lines or equipment to be tested. This test ensures that the lines have in fact been deenergized and is intended to prevent accidents resulting from someone's opening the wrong disconnect. It also protects employees from hazards associated with unknown sources of electric energy.

The proposal would have required the testing to be performed by the employee in charge. Mr. Carl D. Behnke of EEI and Mr. G. F. Stone of the Tennessee Valley Authority suggested allowing other employees to perform the testing (Ex. 3–82).

OSHA believes that it is not necessary for the employee in charge to perform the actual testing. Therefore, Mr. Behnke's and Mr. Stone's suggestions have been accepted, and the final rule does not specify who is to execute the tests.

Edison Electric Institute and Oglethorpe Power Company recommended allowing visual determination of whether a line was deenergized (Ex. 3–102, 3–112).

Existing § 1926.950(d)(1)(iii) permits visual inspection in lieu of tests. However, especially because of the increasing amount of cogeneration (electric generation of power by customers of the utility), which can unknowingly supply lines with electricity, a visual determination of the state of energization is not always accurate. The IBEW supported this view, stating:

> The IBEW supports OSHA in the requirement that a test of the lines or equipment be made after clearance has been given by the system operator. A visual inspection cannot reliably determine if a line is deenergized. The IBEW has had reports from its local unions where the failure to test lines or equipment for the absence of voltage was a critical factor in an accident. [Ex. 3–107]

OSHA has concluded that it is important that lines and equipment on which work is to be performed always be tested for an energized condition, so that employees will not falsely believe that the line or equipment is deenergized. As the IBEW comment indicates and as the accident descriptions in the record demonstrate (Ex. 9–2, 12–12), the failure to test for voltage has been a cause of accidents. Therefore, the final rule does not allow visual inspection in lieu of testing the lines or equipment.

Paragraph (m)(3)(vi) requires the installation of any protective grounds required by § 1910.269(n) at this point in the sequence of events. Since the lines or equipment have been deenergized and tested in accordance with the previous provisions, it is now safe to install a protective ground.

After the six previous rules have been followed, paragraph (m)(3)(vii) permits the lines or equipment to be treated as deenergized.

Paragraph (m)(3)(viii) requires each independent crew to follow the steps outlined in § 1910.269(m)(3) separately, to ensure that a group of workers does not make faulty assumptions about what steps have been or will be taken by another group to deenergize lines or equipment.

Three commenters stated that some utilities use one tag for all crews involved, maintaining a log to identify each crew separately (Ex. 3–20, 3–27, 3–112). They recommended that the standard allow this practice to continue.

Paragraph (m)(3) of final § 1910.269 does not require a separate tag for each crew (nor did paragraph (m)(3) in the proposal); it does require, however, separate clearances for each crew. There must be one employee in charge of the clearance for each crew, and the clearance for a crew is held by this employee. In complying with paragraph (m)(3)(viii), the employer must ensure that no tag is removed unless its associated clearances are released (paragraph (m)(3)(xii)) and that no action is taken at a given point of disconnection until all protective grounds have been removed, until all crews have released their clearances, until all employees are clear of the lines or equipment, and until all tags have been removed at that point of disconnection (paragraph (m)(3)(xiii)).

In some cases, as when an employee in charge has to leave the job because of illness, it may be necessary to transfer a clearance. Under such conditions, paragraph (m)(3)(ix) requires that the employee in charge inform the system operator and that the employees in the crew be informed of the transfer. If the employee holding the clearance is forced to leave the worksite due to illness or other emergency, the employee's supervisor could inform the system operator of the transfer in clearance. (The proposed rule used the term "forced absence". As a clarification, the final rule replaces this term with language stating specifically that the absence is "forced" due to illness or other emergency.)

After the clearance is transferred, the new employee in charge is then responsible for the clearance. It is important that only one employee at a time be responsible for any clearance; otherwise, independent action by any worker could endanger the entire crew.

Once work is completed, the clearance will have to be released so that the lines or equipment can be reenergized. Paragraph (m)(3)(x) covers this procedure. To ensure that it is safe to release the clearance, the employee in charge must: (1) Notify workers in the crew of the release, (2) determine that they are clear of the lines and equipment, (3) determine that grounds have been removed, and (4) notify the system operator that the clearance is to be released.

Paragraph (m)(3)(xii) in the proposal would have required that the employee requesting tag removal be the one who requested its placement. The intent of this proposed rule was to ensure that any one clearance is always under the control of a single employee.

Several commenters pointed out that the description of this provision in the preamble depicted the actual procedure for releasing a clearance but the rule itself did not (Ex. 3–20, 3–27, 3–112; LA Tr. 243–244). The preamble text stated: "Paragraph (m)(3)(xii) proposes that the employee releasing the clearance be the one who was responsible for requesting it." Mr. Howard D. Wilcox of Consumers Power Company, representing EEI, pointed out that the person normally requesting tag placement is literally the system operator (LA Tr. 243–244). He stated that when a request is actually made to remove the tag the person requesting its removal could quite possibly be someone else acting in that capacity. All these commenters agreed that the person releasing the clearance would be the same one who requested it.

OSHA has accepted these suggestions. The language of this provision in the final rule, which has been moved to paragraph (m)(3)(xi) to reflect its true position in the procedure, now conforms to the description of the proposed rule. The person who is releasing the clearance must be the one who requested it, unless responsibility has been transferred. However, because the persons who place and remove the tags may not be the same, it is important for the regulation to prohibit removing a tag without the release of the clearance by the employee who is responsible for it. Therefore, OSHA has added a requirement adopting this prohibition as paragraph (m)(3)(xii) of final § 1910.269. It should be noted that the person requesting a clearance is the employee in charge of the clearance under paragraph (m)(3)(i). If the supervisor or the system operator is the person who originally requested the clearance, the clearance must be transferred to another employee under paragraph (m)(3)(ix) before that employee can become responsible for the clearance.

According to paragraph (m)(3)(xiii), action may be taken to reenergize the lines or equipment only after grounds and tags have been removed, after all clearances have been released, and after all employees are in the clear. This protects employees from the possibility that the line or equipment could be reenergized while employees are still at work.

Several commenters objected to the language of this provision as proposed in paragraph (m)(3)(xi) (Ex. 3–20, 3–42, 3–62, 3–112; LA Tr. 229–230, 242–243). They were concerned that this requirement would force employees to remove all tags from all disconnecting means, then retrace their steps to reclose the switches, even if they were miles apart. For example, a 5-mile section of line could be deenergized by opening and tagging switches at each end of the line. These commenters were concerned that the standard would require them to remove the tags from one end, and then travel 5 miles to the other end to remove the tags there before any switch could be closed.

The Agency did not intend for this provision to require the removal of all tags from all disconnecting means before any of them could be reclosed. It was intended to require that all tags for any particular switch be removed before that switch was closed. It is very important in a tagging system that no energy isolating device be returned to a position allowing energy flow if there are any tags on it that are protecting employees. OSHA has reworded the language of proposed § 1910.269(m)(3)(xi) to reflect its meaning more accurately. In the case of the 5-mile section of line used in the earlier example, after all the tags were removed from any one switch that one switch could then be closed. The Agency believes that paragraph (m)(3)(xiii) of final § 1910.269 will eliminate the objections raised by the commenters.

Paragraph (n). Sometimes, normally energized lines and equipment which have been deenergized to permit employees to work become accidentally energized. This can happen in several ways, for example, by contact with another energized circuit, by voltage backfeed from a customer's cogeneration installation, by lightning contact, or by failure of the clearance system outlined in § 1910.269(m).

Transmission and distribution lines and equipment are normally installed outdoors where they are exposed to damage from the weather and from actions taken by members of the general public. Many utility poles are installed alongside roadways where they may be struck by motor vehicles. Distribution lines have been damaged by falling trees, and transmission line insulators have been used for target practice. Additionally, customers fed by a utility company's distribution line may have cogeneration or backup generation capability, sometimes without the utility company's knowledge. All these factors can reenergize a deenergized transmission or distribution line or equipment. Energized lines can be knocked down onto deenergized lines. A backup generator or a cogenerator can cause voltage backfeed on the deenergized power line. Lastly, lightning, even miles from the worksite, can reenergize a line. All of these problems pose hazards to employees working on deenergized transmission and distribution lines and equipment. In fact, these problems have been a factor in 14 of the accidents in Exhibit 9–2.

Grounding the lines and equipment is used to protect employees from injury should such reenergizing occur. Grounding also provides protection against induced voltages and static charges on a line. (These induced and static voltages can be high enough to endanger employees, either directly from electric shock or indirectly from involuntary reaction.)

Grounding, as a temporary protective measure, involves connecting the deenergized lines and equipment to earth through conductors. As long as the conductors remain deenergized, this maintains the lines and equipment at the same potential as the earth. However, if voltage is impressed on a line, the voltage on the grounded line rises to a value dependent upon the impressed voltage, the impedance between its source and the grounding point, and the impedance of the grounding conductor.

Various techniques are used to limit the voltage to which an employee working on a grounded line would be exposed. Bonding is one of these techniques. Conductive objects within the reach of the employee are bonded together to create an equipotential work area for the employee. Within this area of equal potentials, voltage differences are limited to a safe value.

Paragraph (n) of final § 1910.269 addresses protective grounding and bonding.[74] As noted in paragraph (n)(1), entire paragraph (n) applies to the grounding of deenergized transmission and distribution lines and equipment for the purpose of protecting employees. Additionally, paragraph (n)(1) indicates that paragraph (n)(4) applies to the protective grounding of nonelectrical equipment, such as aerial lift trucks, as well. Under normal conditions, such equipment would not be connected to a source of electric energy. However, to protect employees in case of accidental contact of the equipment with live parts, protective grounding is required elsewhere in the standard (in § 1910.269(q)(3)(xi), for example); and, to ensure the adequacy of this grounding, the provisions of paragraph (n)(4) must be followed.

Three commenters objected to the inclusion of systems of 600 volts and less within the scope of paragraph (n) of proposed § 1910.269 (Ex. 3–20, 3–80, 3–120). They argued that the cramped spaces involved made working with grounds more hazardous than working without them.

OSHA has not accepted these changes. Neither existing § 1926.954 nor the NESC limit the application of grounding requirements to voltages over 600 volts. In fact, even the EEI/IBEW draft standard contained no such limitation. Additionally, the commenters did not provide any information indicating that work on ungrounded deenergized equipment normally operating at 600 volts or less is safe. The Agency is particularly concerned that undetected voltage from a customer's generating system may backfeed the low voltage circuit and energize the line while the employee is working. Several of the accidents in the record occurred in this manner (Ex. 9–2). Although the employee usually happened to be working on the high voltage side of a transformer in these cases, a similar result would have occurred had the worker been contacting the low voltage side. For these reasons, no voltage limitation has been included in paragraph (n)(1) of final § 1910.269.

The general requirement contained in paragraph (n)(2) states the conditions under which lines and equipment must be grounded. Basically, in order for lines or equipment to be treated as deenergized, they must be deenergized under paragraph (m) of final § 1910.269 and grounded. Grounding may be omitted only if the installation of a ground is impracticable (such as during the initial stages of work on underground cables, when the conductor is not exposed for grounding) or if the conditions resulting from the installation of a ground would introduce more serious hazards than work without grounds. It is expected that conditions warranting the absence of protective grounds will be relatively rare.

In the preamble to the notice of proposed rulemaking, OSHA invited public comment on what conditions were appropriate for this exception and on whether the standard should list the specific types of conditions for which grounding would not be required. Several commenters provided examples of situations where grounding would not be required under the proposed requirement (Ex. 3–13, 3–20, 3–42, 3–45, 3–112). However, no definitive guidelines were presented. Therefore,

[74] As used throughout the rest of this discussion and within paragraph (n) of final § 1910.269, the term "grounding" includes bonding. Technically, grounding refers to the connection of a conductive part to ground, whereas bonding refers to connecting conductive parts to each other. However, for convenience, OSHA is using the term "grounding" to refer to both techniques of minimizing voltages to which an employee will be exposed.

the language of paragraph (n)(2) of final § 1910.269 has not been changed from that in the proposal.

If grounds are not installed and the lines and equipment are to be treated as deenergized, however, precautions have to be observed, and certain conditions must be met. Obviously, the lines and equipment still must be deenergized by the procedures of § 1910.269(m). Also, there may be no possibility of contact with another source of voltage, and the hazard of induced voltage may not be present. Since these precautions and conditions do not protect against the possible reenergizing of the lines or equipment under all conditions, the omission of grounding is permitted only in very limited circumstances.

Paragraph (n)(3) of proposed § 1910.269 would have required protective grounds to be installed at the work location. However, if it was not feasible to provide a ground where the employee is working, grounds would have been required on both sides of the work location. This was to provide for situations such as those that could arise when an employee worked from an aerial lift between two structures supporting a transmission or distribution line.

Several commenters objected to the language in the proposal and suggested that OSHA use the wording similar to that contained in the EEI/IBEW draft standard or in § 1926.954(f) (Ex. 3–2, 3–42, 3–112, 3–123, 56; DC Tr. 929–931). They argued that grounding on both sides of the work location is a common and accepted method of protecting employees from the hazards associated with deenergized lines. Two other commenters stated that placement of grounds on each side of the work location does not necessarily protect the employee (Ex. 3–44, 3–58). They argued that such grounds are intended to operate the protective equipment for the circuit.

EEI pointed to the IEEE proposed *Guide for Protective Grounding of Power Lines*, IEEE P1048–1989, as evidence supporting their position that employers should be given the choice as to what method of grounding should be used (Ex. 3–112). On behalf of EEI, Mr. Carl D. Behnke stated:

> The specification of the placement of protective grounds cannot be treated with a simple, one paragraph regulation. For example, on page 8 of IEEE's recently published "Guide for Protective Grounding on Power Lines", prepared by Work Group 15.07.06, Safety and Regulations, Engineering in the Safety, Maintenance, and Operation of Line[s] Subcommittee, Transmission and Distribution Committee (ESMOL), IEEE Power Engineering Society, the Work Group states:
>
> The decision to use work site grounds (single point) or bracketed (adjacent structure grounds) involves evaluation of the electrical risk to all members of the crew and requires analysis of line design and permanent structure grounding practices of the industry.
>
> * * * * *
>
> The IEEE guide referred to above illustrates on pages 11–12 the varying practices of selected companies, and the varying practices used in transmission as opposed to distribution work. Since some companies use single point grounding, OSHA might conclude that single point is "feasible," in that "it is capable of being done." But this does not mean it can be required for all utilities under section 3(8) in a safety standard. The IEEE guide demonstrates that various grounding methods provide safety, and that one method is not necessarily superior to the other.
>
> * * * * *
>
> The question of grounding for the protection of employees has long been, and still remains, a subject for debate among those knowledgeable and experienced in the electric utility industry and engineering fields. OSHA's concern should be *whether* grounds are provided in such a manner so as to provide protection for workers, and *not* the specific location of the grounds.
>
> In developing safe work practices and procedures for the construction and maintenance of overhead power lines, many factors must be considered. Grounding strategies which will afford maximum protection for workers can be accomplished in a variety of ways which do not necessarily include placing grounds at the very location where workers are positioned.

Others supported OSHA's preference for single point grounds wherever possible (Ex. 3–29, 3–53, 3–55, 3–107). At the hearing and in the post-hearing comment period, the IBEW went further to suggest that the standard provide an equipotential work area for the exposed employees (Ex. 64; DC Tr. 543–545). Mr. James L. Dushaw, Director of the International Brotherhood of Electrical Workers' Safety and Health Department testified in support of this position as follows:

> Reasonable and technically sound provisions for protective grounding of lines and equipment is fundamental to the safety of line workers. It is remarkable that the well-recognized concept of creating [an] equipotential work zone is not better accepted and established.
>
> * * * * *
>
> The fundamental purpose of the equipotential work zone is to minimize electric current flow across the worker's body. It is very simple and should be easily understood.
>
> The proposed rule requires temporary protective grounds as required be placed at the work location or, in the alternative, on each side of the work location as close to it as possible.
>
> Given the stated knowledge about performance of protective grounds for line workers working from or close to poles or other supporting structures that are at ground potential or a percentage of ground potential, the OSHA proposal does not provide adequate protection for workers where conductors may become energized as discussed in OSHA's summary and explanation of the proposed standard.
>
> It has become clear that, standing alone, grounds installed on either side of the work location or bracketed grounds do not prevent potentially lethal current from reaching and flowing through the worker.
>
> I think there is a conception here that with electrical power that in bracketed grounds somehow those bracketed grounds are going to stop the electric current from flowing through the worker and it simply doesn't happen. The current takes every path.
>
> * * * * *
>
> Similarly, grounds installed at the work location without bonding or connection directly to the pole or structure at a point close or-below the work area does not diminish the current flow through the worker who is in contact with the line and the structure simultaneously.
>
> * * * * *
>
> Our Union recommends that OSHA revise 1910.269 paragraph ((n)(3)) to performance based language as follows. * * * temporary protective grounds shall be placed at locations in such a manner as to prevent worker exposure to hazardous differences in electrical potentials. (DC Tr. 543–545)

A similar performance-oriented approach was also supported by the American Public Power Association and by the Tennessee Valley Authority (Ex. 3–80, 3–82). At the public hearing, EEI also lent limited support to the IBEW approach, as follows:

> The proposed language that you have seen (that was contained in the EEI/IBEW draft) is a reflection of our industry safety rules and safe work practices that are in place because they work and we urge you to allow these safe practices to continue.
>
> In the alternative, the performance-oriented language that was submitted the other day by the IBEW through Mr. Dushaw's testimony appears to be an acceptable option that would provide the level of flexibility that we need. (DC Tr. 930)

OSHA reviewed the accidents in Ex. 9–2 and Ex. 9–2A for those involving improper protective grounding. There were nine accidents in these two exhibits related to protective grounding. In three cases, inadequate grounds were present. Based on the fact that grounding is a backup measure, intended to provide protection only when all other safety-related work practices fail, OSHA believes that this is a significant incidence of faulty grounding. Grounding practices that do not provide an equipotential zone in which an employee is safeguarded from voltage differences do not provide complete protection. In case the line is accidentally reenergized, voltages to which an employee would be exposed due to inadequate grounding would be lethal, as can be seen by some of the exhibits in the record (Ex. 6–27, 57). The employee would be protected only if he or she is not in contact with the line until the energy source is cleared by circuit protective devices.[75]

For these reasons, OSHA has accepted the IBEW approach to the problem. Final § 1910.269 (n)(3) requires protective grounds to be so located and arranged that employees are not exposed to hazardous differences in potential. The final rule thus allows employers and employees to use whatever grounding method they prefer as long as employees are protected. For employees working at elevated positions on poles and towers, single point grounding may be necessary, together with grounding straps to provide an equipotential zone for the worker. Employees in insulated aerial lifts working at midspan between two conductor supporting structures may be protected by grounding at convenient points on both sides of the work area. Bonding the aerial lift to the grounded conductor will ensure that the employee remains at the potential of the conductor in case of a fault. Other methods may be necessary to protect workers on the ground, including grounding mats and insulating platforms. The Agency believes that this performance-oriented approach will provide the flexibility needed by employers, but will afford the best protection to employees.

Paragraph (n)(4) contains requirements that grounding equipment must meet. So that the protective grounding equipment does not fail, it is required to have an ampacity high enough so that the fault current would be carried for the amount of time necessary to allow protective devices to interrupt the circuit. This provision is contained in paragraph (n)(4)(i) of final § 1910.269. One commenter noted that the fault current is not always single-phase to ground as implied by the proposal, but can also be phase to phase or three-phase to ground (Ex. 3–45). The language in the final rule requires the protective grounding equipment to be able to carry the maximum fault current, regardless of the type of fault. Also, as suggested by another commenter (Ex. 3–120), OSHA has added a note referencing the ASTM standard on protective grounding equipment (ASTM F855–83).

Under paragraph (n)(4)(ii), the impedance of the grounding equipment is required to be low enough to ensure the quick operation of the protective devices. As recommended by a commenter (Ex. 3–40), the phrase "impedance to ground" contained in the proposal has been changed to "impedance" in the final rule. This change recognizes that the relevant impedance is sometimes between phases rather than between phase and ground, and the revision is consistent with the modification of the preceding paragraph.

Paragraphs (n)(4)(i) and (n)(4)(ii) help ensure the prompt clearing of the circuit supplying voltage to the point where the employee is working. Thus, the grounding equipment limits the duration and reduce the severity of any electric shock, though it does not itself prevent shock from occurring.

Paragraph (n)(5) of § 1910.269 requires lines and equipment that are to be grounded to be tested for voltage before a ground is installed. If a previously installed ground is evident, no test need be conducted. This requirement prevents energized equipment from being grounded, which could result in injury to the employee installing the ground.

The proposed version of this paragraph would have required the test to determine that the line or equipment was "absent of voltage". Many commenters suggested that the standard require only that the line or equipment be free of nominal voltage (Ex. 3–20, 3–33, 3–42, 3–44, 3–58, 3–69, 3–80, 3–82, 3–102, 3–112, 3–123; DC Tr. 719). They argued that lines which are deenergized frequently have voltage induced on them from other nearby energized lines and that it was safe to install grounds as long as the nominal line voltage was absent. OSHA has accepted this argument. Final § 1910.269(n)(5) requires that the line or equipment be free of nominal voltage.[76]

Paragraphs (n)(6) and (n)(7) set forth the procedure for installing and removing grounds. To protect employees in the event that the "deenergized" equipment to be grounded is or becomes energized, the standard requires the "equipment end" of the grounding device to be applied last and removed first and that a live-line tool be used for both procedures in order to protect workers.

The proposal would have required the use of a live-line tool or "other insulated device". Several commenters were concerned that this language implied that rubber insulating gloves could be used to install and remove grounds (Ex. 3–11, 3–44, 3–58, 3–69, 3–71, 3–123). They noted that it was unsafe for an employee to be too close when connecting or disconnecting a ground and urged OSHA to eliminate the phrase "or other insulated device" from the rule.

The Agency agrees with these commenters and has adopted their suggestion in the final rule. OSHA will consider any device that is insulated for the voltage and that allows an employee to apply or remove the ground from a safe position to be a live-line tool for the purposes of § 1910.269 (n)(6) and (n)(7). It should be noted that, during the periods before the ground is installed and after it is removed, the line or equipment involved must be considered as energized (under paragraph (l)(1)). As a result, the minimum approach distances specified in paragraph (l)(2) apply when grounds are installed or removed.

With certain underground cable installations, a fault at one location along the cable can create a substantial potential difference between the earth at that location and the earth at other locations. Under normal conditions, this is not a hazard. However, if an employee is in contact with a remote ground (by being in contact with a conductor that is grounded at a remote station), he or she can be exposed to the difference in potential (because he or she is also in contact with the local ground). To protect employees in such situations, paragraph (n)(8) prohibits grounding cables at remote locations if a hazardous potential transfer could occur under fault conditions.

Paragraph (n)(9) addresses the removal of grounds for test purposes. Under the proposal, the previously grounded lines and equipment would have had to be treated as energized while they remain ungrounded.

Several commenters objected to this proposed provision (Ex. 3–20, 3–42, 3–80, 3–101, 3–112). They were concerned that the tests could not be performed if the equipment was considered energized. To correct this problem, some of these commenters suggested the following language from the EEI/IBEW draft standard:

> Grounds may be temporarily removed only when necessary for test purposes and caution shall be exercised during the test procedures. (Ex. 2–3)

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[75] Facilitating the opening of circuit protective devices is another function of protective grounding. However, on the basis of the record, OSHA believes this is secondary to providing a safe area in which employees can work.

[76] "Nominal voltage" is discussed in the definition of "voltage" as follows:

The nominal voltage of a system or circuit is the value assigned to a system or circuit of a given voltage class for the purpose of convenient designation. The operating voltage of the system may vary above or below this value.

OSHA acknowledges the problems that the proposed rule would have caused. However, the Agency does not believe that the language proposed in the EEI/IBEW draft contains any safeguards for employees. Certainly, such a requirement would be difficult to enforce. To resolve this issue, OSHA has adopted the following language in final § 1910.269(n)(9):

Grounds may be removed temporarily during tests. During the test procedure, the employer shall ensure that each employee uses insulating equipment and is isolated from any hazards involved, and the employer shall institute any additional measures as may be necessary to protect each exposed employee in case the previously grounded lines and equipment become energized.

The examples of precautions that should be taken are based on suggestions of New Hampshire Electric Cooperative, Inc., Federated Rural Electric Insurance Company, National Utility Training and Safety Education Association, and Oglethorpe Power Company (Ex. 3–11, 3–44, 3–58, 3–102). OSHA believes that this approach will address the concerns of the commenters objecting to the proposal but will still protect employees.

Paragraph (o). Paragraph (o) of final § 1910.269 sets forth safety work practices covering electrical hazards arising out of the special testing of lines and equipment (namely, in-service and out-of-service, as well as new, lines and equipment) to determine maintenance needs and fitness for service. Generally, the need to conduct tests on new and idle lines and equipment as part of normal checkout procedures, in addition to maintenance evaluation, is specified in the National Electrical Safety Code (ANSI C2). Basically, as stated in paragraph (o)(1), the rules apply only to testing involving interim measurements utilizing high voltage, high power, or combinations of both, as opposed to testing involving continuous measurements as in routine metering, relaying and normal line work.

For the purposes of these requirements, high-voltage testing is assumed to involve voltage sources having sufficient energy to cause injury and having magnitudes generally in excess of 1000 volts, nominal. High-power testing involves sources where fault currents, load currents, magnetizing currents, or line dropping currents are used for testing, either at the rated voltage of the equipment under test or at lower voltages. Paragraph (o) covers such testing in laboratories, in shops and substations, and in the field and on transmission and distribution lines.

Examples of typical special tests in which either high-voltage sources or high-power sources are used as part of operation and maintenance of electric power generation, transmission, and distribution systems include cable-fault locating, large capacitive load tests, high current fault-closure tests, insulation resistance and leakage tests, direct-current proof tests, and other tests requiring direct connection to power lines.

Excluded from the scope of paragraph (o) are routine inspection and maintenance measurements made by qualified employees in accordance with established work practice rules where the hazards associated with the use of intrinsic high-voltage or high-power sources require only those normal precautions peculiar to such periodic work. Obviously, the work practices for these routine tests must comply with the rest of final § 1910.269. Because this type of testing poses hazards that are identical to other types of routine electric power generation, transmission, and distribution work, OSHA has determined that the requirements of § 1910.269 excluding paragraph (o) adequately protect employees performing these tests. Two typical examples of such excluded test work procedures would be "phasing-out" testing and testing for a "no voltage" condition. To clarify the scope of this paragraph in the final rule, as suggested by two commenters (Ex. 3–20, 3–80), a note to this effect has been added after paragraph (o)(1). Additionally, because the scope of final § 1910.269 has been extended to cover non-utilities, proposed language limiting the application of paragraph (o) to electric utilities has been removed. (See the discussion of final § 1910.269(a)(1)(i).)

Paragraph (o)(2)(i) of final § 1910.269 requires employers to establish work practices governing employees engaged in certain testing activities. These work practices are intended to delineate precautions that employees must observe for protection from the hazards of high-voltage or high-power testing. For example, if high-voltage sources are used in the testing, employees are required to follow the safety practices established under paragraph (o)(2)(i) to protect against such typical hazards as inadvertent arcing or voltage overstress destruction, as well as accidental contact with objects which have become residually charged by induced voltage from electric field exposure. If high-power sources are used in the testing, employees are required to follow established safety practices to protect against such typical hazards as ground voltage rise as well as exposure to excessive electromagnetically-caused physical forces associated with the passage of heavy current.

These practices apply to work performed at both permanent and temporary test areas (that is, areas permanently located in the controlled environment of a laboratory or shop and in areas temporarily located in a non-controlled field environment). At a minimum, the safety work practices are required to cover the following types of test-associated activities:

(1) Guarding the test area to prevent inadvertent contact with energized parts,

(2) Safe grounding practices to be observed,

(3) Precautions to be taken in the use of control and measuring circuits, and

(4) Periodic checks of field test areas.

Paragraph (o)(2)(ii) complements the general rule on the use of safe work practices in test areas with a requirement that all employees involved in this type of work be trained in these safety test practices. This paragraph further requires a periodic review of these practices to be conducted from time to time as a means of providing reemphasis and updating.

Although specific work practices used in test areas are generally unique to the particular test being conducted, three basic elements affecting safety are commonly found to some degree at all test sites: Guarding, grounding, and the safe utilization of control and measuring circuits. By considering safe work practices in these three categories, OSHA has attempted to achieve a performance-oriented standard applicable to high-voltage and high-power testing and test facilities.

OSHA believes that guarding can best be achieved when it is provided both around and within test areas. By controlling access to all parts that are likely to become energized by either direct or inductive coupling, the standard will prevent accidental contact by employees. Paragraph (o)(3)(i) requires permanent test areas to be guarded by having them completely enclosed by walls or some other type of physical barrier. In the case of field testing, paragraph (o)(3)(ii) attempts to achieve a level of safety for temporary test sites comparable to that achieved in laboratory test areas. For these areas, a barricade of tapes and cones or observation by an attendant are acceptable methods of guarding.

Three commenters objected to the specification of safety tape with signs as the only acceptable type of barricade or barrier (Ex. 3–69, 3–82, 3–112). They suggested a performance-oriented approach that would accept other types of barriers or barricades. OSHA has accepted this suggestion. Final § 1910.269(o)(3)(ii)(B) accepts any barrier or barricade that provides a means of limiting access to the test area physically and visually equivalent to safety tape with signs.

Since the effectiveness of the temporary guarding means can be severely compromised by failing to remove it when it is not required, frequent safety checks must be made to monitor its use. For example, leaving barriers in place for a week at a time when testing is performed only an hour or two per day is likely to result in disregard for the barriers. For this reason, paragraph (o)(3)(iii) requires the temporary barriers to be removed when they are no longer needed.

Within test areas, whether temporary or permanent, additional safety can be achieved by observing the guarding practices that control access to test areas. Paragraph (o)(3)(iv) therefore requires that such guarding be provided if the test equipment or apparatus under test may become energized as part of the testing by either direct or inductive coupling. A combination of guards and barriers, preferably interlocked, is intended to provide protection to all employees in the vicinity.

Suitable grounding is another important work practice that can be employed for the protection of personnel from the hazards of high-voltage or high-power testing. If high currents are intentionally employed in the testing, an isolated ground-return conductor, adequate for the service, is required so that no intentional passage of heavy current, with its attendant voltage rise, will occur in the ground grid or in the earth. Another safety consideration involving grounding is that all conductive parts accessible to the test operator during the time that the equipment is operating at high voltage be maintained at ground potential, except portions of the equipment that are isolated from the test operator by suitable guarding. Paragraph (o)(4) of final § 1910.269 contains requirements for proper grounding at test sites.

Paragraph (o)(4)(i) requires that grounding practices be established and implemented for test facilities and that the basic grounding practice be to treat as energized all ungrounded terminals of test equipment or apparatus under test until reliably determined otherwise. Paragraph (o)(4)(ii) requires visible grounds to be properly applied before work is performed on the circuit or item or apparatus under test.

Paragraph (o)(4)(iii) addresses hazards resulting from the use of inadequate ground-returns in which a voltage rise in the ground grid or in the earth can result whenever high currents are employed in the testing. Test personnel who may be exposed to such potentials are required to be protected from the hazards involved.

Proposed § 1910.269(o)(4)(iii) would have required the employer to establish an essentially equipotential safe area through the use of an isolated ground-return system. Three commenters objected to this requirement (Ex. 3–20, 3–35, 3–80). Exemplifying their objections, Mr. Eldon A. Cotton of the Department of Water and Power of the City of Los Angeles submitted the following comment:

> To insure the validity of test results, occasionally power systems must be tested under actual operating conditions. These tests can require high ground currents (e.g., system fault tests). To fully test control and protective relay system response or power system recovery characteristics during a major disturbance, testing must be as realistic as possible. This is not accomplished by requiring an isolated ground current return system from a fault staged miles from the power system facility.
>
> Before performing such operational tests, qualified electrical engineers study system conditions and develop appropriate test plans. The primary responsibility of individuals writing these test plans is to assure the safety of personnel and equipment under expected and unexpected conditions. Utilities have a long history of safety when staging tests requiring large ground currents. [Ex. 3–20]

OSHA agrees that, under such conditions, it is not reasonable to require an isolated ground-return conductor system. Therefore, paragraph (o)(4)(iii) of final § 1910.269 provides an exception to the requirement for such a system. The exception applies if the isolated ground-return cannot be provided because of the distance involved and if employees are protected from hazardous step and touch potentials that may develop. Consideration must always be given to the possibility of voltage gradients developing in the earth during impulse, short-circuit, inrush, or oscillatory conditions. Such voltages may appear between the feet of an observer, or between his or her body and a grounded object, and are usually referred to as "step" and "touch" potentials. Examples of acceptable protection from step and touch potentials include suitable electrical protective equipment and the removal of employees from areas that may expose them to hazardous potentials.

Another grounding situation is recognized by paragraph (o)(4)(iv) in which grounding through the power cord of test equipment may be inadequate and actually increase the hazard to test operators. Normally, an equipment grounding conductor is required in the power cord of test equipment to connect it to a grounding connection in the power receptacle. However, in some circumstances, this practice can prevent satisfactory measurements, or current induced in the grounding conductor can cause a hazard to personnel. If these conditions exist, the use of the equipment grounding conductor within the cord is not mandatory, and paragraph (o)(4)(iv) requires that an equivalent safety ground be provided.

Paragraph (o)(4)(v) further requires that a ground be placed on the high-voltage terminal and any other exposed terminals when the test area is entered after equipment is deenergized. In the case of high capacitance equipment or apparatus, before a direct ground can be applied, the initial grounding discharge must be accomplished through a resistor having an adequate energy rating.

Paragraph (o)(4)(vi) recognizes the hazards associated with field testing in which test trailers or test vehicles are used. In addition to requiring the chassis of such vehicles to be grounded, paragraph (o)(4)(vi) provides for a performance-oriented approach by requiring that protection be provided against hazardous touch potentials by bonding, by insulation, or by isolation. The protection provided by each of these methods is described in the following examples:

(1) Protection by bonding can be effected by providing, around the vehicle, an area covered by a metallic mat or mesh of substantial cross-section and low impedance which is bonded to the vehicle at several points and is also bonded to an adequate number of driven ground rods or, where available, to an adequate number of accessible points on the station ground grid. All bonding conductors must be of sufficient electrical size to keep the voltage developed during maximum anticipated current tests at a safe value. The mat must be of a size which precludes simultaneous contact with the vehicle and with the earth or with metallic structures not adequately bonded to the mat.

(2) Protection by insulation can be accomplished, for example, by providing around the vehicle an area of dry wooden planks covered with rubber insulating blankets. The physical extent of the insulated area must be sufficient to prevent simultaneous contact with the vehicle, or the ground lead of the vehicle, and with the earth or with metallic structures in the vicinity.

(3) Protection by isolation can be implemented by providing an effective means to exclude personnel from any area where simultaneous contact could be made with the vehicle (or conductive parts electrically connected to the vehicle) and with other conductive materials. A combination of barriers together with effective, interlocked restraints may be employed to prevent the inadvertent exit from the vehicle during the testing.

Finally, a third category of safe work practices applicable to employees performing testing work, which complements the first two safety work practices of guarding and grounding, involves work practices associated with the installation of control and measurement circuits utilized at test facilities. Practices necessary for the protection of personnel and equipment from the hazards of high-voltage or high-power testing must be observed for every test where special signal-gathering equipment is used (that is, meters, oscilloscopes, and other special instruments). In addition, special settings of protective relays and the re-examination of backup schemes may be necessary to ensure an adequate level of safety during the tests or to minimize the effects of the testing on other parts of the system under test. As a consequence, paragraphs (o)(5)(i) through (o)(5)(iii) address the principal safe work practices involving control and measuring circuit utilization within the test area.

Generally control and measuring circuit wiring should remain within the test area. If this is not possible, however, paragraph (o)(5)(i) covers requirements to minimize hazards should it become necessary to have the test wiring routed outside the test area. Cables and other wiring must be contained within a grounded metallic sheath and terminated in a grounded metal enclosure, or other precautions must be taken to provide equivalent safety.

Paragraph (o)(5)(ii) covers the avoidance of possible hazards arising from inadvertent contact with energized accessible terminals or parts of meters and other test instruments. Meters with such terminals or parts must be isolated from test personnel.

Work practices involving the proper routing and connection of temporary wiring to protect against damage are covered in paragraph (o)(5)(iii). This paragraph also requires the various functional wiring used for the test set-up to be kept separate, to the maximum extent possible, in order to minimize the coupling of hazardous voltages into the control and measuring circuits.

A final safety work practice requirement related to control circuits is addressed by paragraph (o)(5)(iv). This paragraph requires, if employees are present within the guarded test area during the test, a test observer who can, in cases of emergency, immediately deenergize all test circuits for safety purposes.

Since the environment in which field tests are conducted differs in important respects from that of laboratory tests, extra care must be taken to ensure appropriate levels of safety. Permanent fences and gates for isolating the field test area are not usually provided, nor is there a permanent conduit for the instrumentation and control wiring. As a further hazard, there may be other sources of high-voltage electric energy in the vicinity in addition to the source of test voltage.

It is not always possible in the field to prevent ingress of persons into a test area physically, as is accomplished by the fences and interlocked gates of the laboratory environment. Consequently, readily recognizable means are required to discourage such ingress; and, before test potential or current is applied to a test area, the test operator in charge must ensure that all necessary barriers are in place.

As a consequence of these safety considerations, paragraph (o)(6)(i) calls for a safety check to be made at temporary or field test areas at the beginning of each group of continuous tests (that is, a series of tests conducted one immediately after another). Paragraph (o)(6)(ii) requires that, as a minimum for the safety check, the person responsible for the testing verify, before the initiation of a continuous period of testing, the status of a general group of safety conditions. These conditions include the state of guards and status signals, the marking of disconnects, the provision of ground connections and personal protective equipment, and the separation of circuits.

Paragraph (p). Requirements for mechanical equipment are contained in § 1910.269. (Subpart N of Part 1910 contains additional requirements related to specific types of lifting equipment.)

Paragraph (p)(1) sets forth general requirements for mechanical equipment used in the generation, transmission, or distribution of electric power. Paragraph (p)(1)(i) requires the critical safety components[77] of mechanical elevating and rotating equipment to be inspected before use on each shift. Some commenters were concerned that this provision, as proposed, would require the disassembly of components of mechanical equipment each time it was used (Ex. 3–20, 3–22, 3–62). This was not the intent of this paragraph. OSHA has worded the provision in the final rule to make it clear that a thorough visual inspection is required. It is not necessary to disassemble equipment to perform a visual inspection.

Paragraph (p)(1)(ii) requires a reverse signal alarm or a designated employee[78] to signal when it is safe to back up the vehicle for vehicles operated under certain conditions exposing an employee to hazards. (It is not intended for this provision to require the presence of a second employee. If the driver of the equipment is the only employee present and if no employees would be exposed to the hazards of vehicle backup, the standard would not apply.) This provision is based on existing §§ 1926.601(b)(4) and 1926.602(a)(9)(ii), which apply to construction. Because the same equipment is used for electric power generation, transmission, and distribution work during maintenance, as well as construction, and because the type of work being performed is similar in both situations, OSHA believes it is appropriate to make the requirements applying to this equipment the same whether maintenance or construction work is being performed.

Paragraph (p)(1)(iii) prohibits the operator of an electric line truck from leaving his or her position at the controls while a load is suspended, unless the employer can demonstrate that no employee, including the operator, might be endangered. This ensures that the operator will be at the controls if an emergency arises that necessitates moving the suspended load For example, due to wind or unstable soil, the equipment might start to tip over. Having the operator at the controls ensures that corrective action can be taken quickly enough to prevent an accident. Equivalent requirements for truck cranes and derricks are contained in §§ 1910.180(h)(4)(i) and 1910.181(i)(4)(i), respectively, which also apply to those types of equipment.

Paragraph (p)(1)(iv) requires roll-over protective structures to be provided on

[77] The critical safety components of aerial lifts are identified in § 1910.67(c)(4) as being components whose failure would result in a free fall or free rotation of the boom. A note has been included following paragraph (p)(1)(i) of final § 1910.269 similarly defining these components in the electric power generation, transmission, and distribution standard.

[78] A designated employee is someone who is designated by the employer to perform specific duties under the terms of the standard and who is knowledgeable in the construction and operation of the equipment and the hazards involved. (See § 1910.269(x), *Definitions.*)

certain types of mechanical equipment. The equipment listed in this paragraph is frequently used for electric power generation, transmission, and distribution work during construction, and Subpart W of Part 1926, which contains the same list, already requires this equipment to have such protection. The final rule extends the protection afforded by the construction standards to operations that do not involve construction work. The roll-over protective structures must conform to subpart W of part 1926.

Paragraph (p)(2) sets forth requirements for outriggers. Paragraph (p)(2)(i) requires vehicular equipment provided with outriggers to be operated with the outriggers extended and firmly set as necessary for the stability of the equipment in the particular configuration involved. The stability of the equipment in various configurations is normally provided by the manufacturer, but it can also be derived through engineering analysis. This paragraph also prohibits the outriggers from being extended or retracted outside the clear view of the operator unless all employees are outside the range of possible equipment motion. Paragraph (p)(2)(ii) applies where the work area or terrain precludes the use of outriggers and limits the operation of the equipment only within the maximum load ratings as specified by the manufacturer for the particular configuration without outriggers. These two paragraphs help ensure the stability of the equipment while loads are being handled and prevent injuries caused by extending outriggers into employees. (Additional requirements for the use of outriggers on truck cranes are contained in § 1910.180(h)(3)(ix).)

A few of the accident descriptions submitted into the record by OSHA indicated that fatalities are occurring because of the use of aerial lift buckets to move overhead power lines (Ex. 9–1, 9–2). The employees in the aerial lift were killed when the unrestrained line slid up the bucket and contacted the employee (in two cases) or when current passed through a leakage hole in the bottom of the bucket (in the other case). In order to prevent such accidents, the Agency requested public comment on a possible prohibition against moving or contacting overhead power lines with the bucket of an aerial lift (54 FR 30404).

The following discussion with the IBEW witnesses represents the most detailed and useful information in the record on this issue:

Ms. Thurber: I would like to ask your comments on [this issue].

Mr. Dushaw: Given the proper equipment, I see no reason to prohibit moving of aerial conductors with aerial lift equipment and bucket trucks. Pieces of equipment are designed to do just exactly that.

And it certainly in many cases puts a man in a safer configuration than [if] he [were] to do it by some other means.

The cases talked about there, with the hole in the bottom of the bucket truck, I don't know what you can do to prevent that. If somebody doesn't like the water in the bottom of the bucket truck and decides to take a drill and drill a hole to let the water out, he has bridged the insulating quality of the bucket truck and put himself in a bad position, which should be prevented under any circumstances.

Ms. Thurber: What about those instances where the cable will knock a person out, slide over and knock a person out of a bucket? Is there a way to prevent that?

Mr. Dushaw: Well, I don't know. That can happen.

Ms. Thurber: Electrocute him and knock him out.

Mr. Dushaw: If you have lost control of the job site to that extent, this could happen whether a person is in a bucket truck, on a pole or flying. It doesn't make any difference.

Obviously he has lost control of something there that is not the fault of the equipment itself but the planning of the job.

Ms. Thurber: Can you tell me if bucket trucks are designed to move cables? We are talking about when a bucket truck is designed to move a cable, not when one is standing on a bucket working on a cable or something.

Mr. MacDonald: Yes, they are. It depends on their load-lifting capacity.

Mr. Ozzello: They make a [device] that is attached to the aerial unit and on that [device] you can attach the electric wires. Then you can lift those wires up off the cross-arm. You can replace the cross-arm or lower that [device] down and reattach those wires to the cross-arm. That is a normal procedure. The [device] is made out of fiberglas[s] and is theoretically tested on a periodic basis.

Ms. Thurber: Let me let David follow up on that just briefly.

Mr. Wallis: The two cases in the record were not using the equipment you mentioned. The bucket itself was used to push the conductors out of the way.

Mr. Ozzello: That was a misuse of the equipment.

Mr. Wallis: So should that practice be prohibited?

Mr. Ozzello: Yes it should be. That is misuse of the equipment. The equipment was not designed to be used in that manner.

Mr. Wallis: Okay. Thank you.

Mr. Dushaw: I would say that with that a consideration here is what the load is you are lifting.

Mr. Ozzello: There are devices that will measure that load to keep you from exceeding the load limit of the vehicle. [DC Tr. 604–606]

Proposed § 1910.269(p)(3) addressed loads applied to lifting equipment. As proposed, this provision would have limited the maximum load to be lifted. Based on the testimony of the IBEW witnesses and on the accident descriptions in the record, OSHA believes that this provision should be broadened to extend to all types of loads applied to mechanical equipment. It is important for mechanical equipment to be used within its design limitations so that the lifting equipment does not fail during use and so that employees are not otherwise endangered. Therefore, OSHA has adopted the following language in paragraph (p)(3) of final § 1910.269:

Mechanical equipment used to lift or move lines or other material shall be used within its maximum load rating and other design limitations for the conditions under which the work is being performed.

This provision will better protect employees than the comparable provision in the proposal.

Even in electric-utility operations, contact with live parts through mechanical equipment causes many fatalities each year. A sample of typical accidents involving the operation of mechanical equipment near overhead lines is given in Table 5. Industry practice and existing rules in subpart V of the Construction Standards require aerial lifts and truck-mounted booms to be kept away from exposed energized lines and equipment at distances greater than or approximately equal to those set forth in Table R–6. However, some contact with the energized parts does occur during the hundreds of thousands of operations carried out near overhead power lines each year. If the equipment operator is distracted briefly or if the distances involved or the speed of the equipment towards the line is misjudged, contact with the lines is the expected result, rather than simple coincidence, especially when the minimum approach distances are relatively small. Mr. James L. Dushaw of the IBEW agreed stating, "It is impractical and dangerous to believe that electrical contact with uninsulated vehicular equipment or suspended loads such as occurs in [pole-]setting or any other operations can simply be avoided [DC Tr. 547]." Because these types of contacts cannot be totally avoided, OSHA believes that additional requirements are necessary for operating mechanical devices near exposed energized lines. Paragraph (p)(4) of final § 1910.269 addresses this problem.

Proposed paragraph (p)(4)(i) would have required the minimum approach distances in Table R–6 to be maintained between the equipment and the live parts while equipment was being operated near exposed energized lines or equipment, without exception. Edison Electric Institute and Tennessee Valley Authority suggested that this provision provide an exception for insulated equipment (Ex. 3–82, 3–112; DC Tr. 906–912). They argued that it was safe for this equipment to be brought close to energized lines. Mr. Gene Trombley, representing EEI, stated that not only was it safe to operate this equipment very close to the lines, it would be unsafe to operate it farther away (DC Tr. 906–912). He stated that employees would be forced to lean out of the bucket to reach the conductors to perform work on them, possibly causing back injuries and other muscle strains. He said, "These trucks are designed to put you in the work area, not to be on the outside looking in [DC Tr. 907]."

TABLE 5.—ACCIDENTS INVOLVING THE OPERATION OF MECHANICAL EQUIPMENT NEAR OVERHEAD LINES

Type of equipment	Number of fatalities				Type of accident
	Total	Grounded			
		Yes	No	?	
Boom Truck/Derrick Truck	7	1		6	Boom contact with energized line.
	2	1		1	Pole contact with energized line.
Aerial lift	1			1	Boom contact with energized line.
	3		1	2	Lower boom contact with energized line.
	3			3	Employee working on deenergized line when upper boom contacted energized line.
	1			1	Winch on lift used on energized line arced to nearby ground.
Vehicle	1		1		Line fell on vehicle.
	1			1	Unknown type of vehicle and type of accident.
Total	19	2	2	15	

Source: Exhibits 9–2 and 9–2A.

OSHA has accepted this recommendation. Aerial lifts are designed to enable an employee to position himself or herself at elevated locations with a high degree of accuracy. The aerial lift operator is in the bucket next to the energized lines and can easily judge the approach distance. This minimizes the chance that the equipment will contact an energized line and that the energized line will be struck down should contact actually occur. The employee operating the lift in the bucket is protected from the hazards of contacting the live parts under the provisions of paragraph (l). As the device is insulated, employees on the ground are protected from electric shock in the case of contact with the lines. Lastly, paragraph (p)(3) prevents the aerial lift from striking down the power line. Therefore, final § 1910.269 (p)(4)(i) provides an exception to the requirement to maintain specific minimum approach distances for the insulated portion of an aerial lift operated by an employee in the lift. (It should be noted that this exception relates only to the conductor on which the employee is working. Paragraph (l)(2) still requires the employee to maintain the required distance from conductors at potentials different from that on which he or she is working.)

Determining the distance between objects that are themselves relatively far away from the observer can sometimes be difficult. For example, different perspectives can lead to different estimates of the distance, and lack of a suitable reference can result in errors (Ex. 8–19). If the minimum approach distance cannot be accurately determined by the operator, an extra person is required, by paragraph (p)(4)(ii), to observe the operation and give warnings when the specified minimum approach distance is approached.

EEI recommended that the phrase "[i]f it is difficult for the operator to determine the distance between the equipment and the energized parts" to "where it is difficult for the operator to maintain the desired clearance by visual means" (Ex. 3–112). They claimed that whether the minimum approach distance was sufficient was the determining factor, not whether the distance itself could be judged.

The purpose of proposed § 1910.269(p)(4)(ii) was to ensure that an observer was used if the approach distance between the equipment and a live part could not be maintained due to difficulty in judging the minimum approach distance by the operator. OSHA agrees with EEI that the determining factor is whether the minimum approach distance can be maintained. The Agency also realizes that the proposed rule may not have made this clear and has modified the language of this provision in the final rule to read as follows:

A designated employee other than the equipment operator shall observe the approach distance to exposed lines and equipment and give timely warnings before the minimum approach distance required by paragraph (p)(4)(i) is reached, unless the employer can demonstrate that the operator can accurately determine that the minimum approach distance is being maintained.

This language clarifies that an observer is needed unless the employer can demonstrate that the operator can accurately determine that the minimum approach distance can be maintained.

Proposed paragraph (p)(4)(iii) would have required one of two alternative protective measures to be taken if it was possible during operation for the equipment to come closer to the live parts than the required minimum approach distance. The first alternative was for the mechanical equipment and any attached load to be treated as live parts. The second alternative was for the equipment to be insulated for the voltage involved. Under this alternative, the mechanical equipment would have had to be positioned so that uninsulated portions of the equipment could not have come within the specified minimum approach distance of the line. The proposal was intended to protect employees from electric shock in case contact was made.

In the development of proposed paragraph (p)(4), OSHA considered other methods of protecting employees from accidental contact with exposed energized lines. For example, OSHA considered allowing the mechanical equipment to be grounded as an additional option to the two alternatives proposed in paragraph (p)(4)(iii). However, grounding alone does not provide sufficient protection for employees, because if contact is made with a line of common distribution voltage, the equipment will still rise to a hazardous voltage with respect to earth only a few feet from the grounding point. OSHA requested comments and suggestions on the proposed rule and solicited information on additional methods of protecting employees.

Many commenters provided their views on protecting workers from the hazards of contacting overhead power lines through mechanical equipment. Most of the individual comments on this paragraph related to its application to line-clearance tree-trimming work (Ex. 3–48, 3–63, 3–67, 3–75, 3–77, 3–78, 3–89, 3–90, 3–92, 3–98, 3–99, 3–100, 3–104, 3–113, 3–118). Except for a few who supported the proposal (Ex. 3–92, 3–98, 3–118), the commenters argued that the proposed rule would prohibit tree workers on the ground from contacting a chipper hooked to an aerial lift that was used to position an employees trimming trees near power lines. Because the aerial lifts are insulated, they contended, employees on the ground could safely feed the chipper. A description of the method of performing this work was summarized by Mr. Robert Felix, Executive Vice President of the National Arborist Association, as follows:

> The normal equipment configuration of many line clearance tree trimming crews is a fully insulated aerial lift truck with a chipper in tow. While one employee is in an elevated insulated bucket, typically another is on the ground feeding the cut brush into the chipper. In that fashion, the brush is effectively cut, and removed, in integrated fashion. This time-proven method is safe. NAA's 1989 survey of its members performing line clearance work using properly fully insulated aerial lift trucks with attached chipper indicates that in the past 3 years, covering approximately 192 million man/hours [sic] of work, no personnel were injured by electric shock incident to operating a chipper while a fully insulated aerial lift device was elevated. [Ex. 3–113]

The OSHA proposal clearly presented two alternatives if equipment could come too close to exposed energized power lines: (1) The equipment and attached load could be treated as energized or (2) the equipment could be insulated for the voltage. Equipment operated under the second alternative would have had to be positioned so that uninsulated portions could not violate the minimum approach distance requirements. The Agency believes that the language contained in the proposal clearly recognized the safe use of insulated aerial lifts outlined by Mr. Felix.

Under the proposal, the only time an employee feeding a chipper would have had to consider the equipment energized was when the aerial lift was positioned so that the uninsulated portion (normally, the lower part of the boom) could have come too close to a power line. If the uninsulated portion contacted the line, any employee in contact with the chipper would probably have been electrocuted. In fact, this happened to tree-trimming crews in the past. Two of the accidents, resulting in two deaths and one hospitalized injury, described in Exhibit 9–6 involved employees contacting chippers energized when the boom of an aerial lift struck a power line. Three additional accidents, resulting in three fatalities, occurred to employees in contact with the aerial lift truck itself. One of the commenters supporting the proposed rule included a memorandum describing one of these accidents as a reason why the proposal was correct (Ex. 3–92).

OSHA has therefore carried forward the option of using equipment insulated for the voltage, without change, as § 1910.269(p)(4)(iii)(B).

Many of the commenters suggested allowing additional options to the two presented for operations of mechanical equipment near exposed energized power lines (Ex. 3–13, 3–23, 3–40, 3–60, 3–62, 3–112). Two of them urged OSHA to include the installation of insulating protective equipment on the lines as an acceptable option (Ex. 3–23, 3–62). They argued that this would also protect employees.

The proposal limited its application to "exposed energized lines or equipment". Insulating barriers used on the lines would render them unexposed. Thus, under the proposed rule, insulating barriers were an acceptable alternative. Rubber insulation is not, however, normally considered to be a "barrier"[79] and would not have been an acceptable option under most conditions. For certain types of operations, rubber insulating line hose and blankets would not provide sufficient protection. For example, using a crane to lift and position metal tower sections exposes the insulation to damage upon inadvertent contact. Other operations, such as the use of an aerial lift operated by an employee in the lift, would be much less likely to damage the insulation. Therefore, OSHA has decided to accept insulating the energized lines or equipment as an option if the insulating material used will withstand the type of contact likely to result during operation. Paragraph (p)(4)(iii)(A) of final § 1910.269 sets forth this option.

Another method supported by these commenters was grounding the mechanical equipment (Ex. 3–13, 3–23, 3–40, 3–60, 3–62, 3–112, 56; DC Tr. 918–920; LA Tr. 195–196). Most argued that, although grounding does not provide complete protection, it facilitates rapid opening of the circuit protective devices, which deenergizes the lines. They stressed that it is important for the line to be deenergized quickly. In its prehearing comment, EEI made the strongest argument for accepting vehicle grounding, as follows:

> Similarly, in 1926.950(c) and 1926.952(c)(2)(ii), OSHA recognizes grounding as a satisfactory means of protecting employees. In the preamble, however, OSHA asserts that "grounding does not provide sufficient protection for employees." 54 Fed. Reg. 4994. No accident or engineering data is cited, however, to support this assertion.
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> A decision not to permit equipment grounding as a method of providing protection and compliance would be a mistake. As OSHA knows, it is a common industry practice to use grounding as a method of providing protection to employees working on the ground. The industry is well aware of the possibilities of hazardous touch and step potentials. However, after considering all safety elements involved in various work practices requiring the use of mechanical equipment, grounding continues to be one of the viable methods of protecting employees.
>
> Grounding may not prevent injury if the employee happens to be in contact with the truck when it becomes energized, but the seriousness of the accident is generally limited. Similarly, it becomes obvious that when barricading rules are broken (and they are hard to enforce), and the truck becomes energized, a serious accident may occur. However, the option of using grounding should not be eliminated, particularly when it can be used in combination with other methods to enhance worker protection.
>
> The requirements of the proposed standard appear to be driven by a concern for step potentials. However, the phenomena associated with both touch and step potentials have been well known for years. For example, we submit as Attachment J the Harrington and Martin AIEE article in the August 1954 *Transactions* which describes the concept of step potentials.
>
> Considering that this phenomenon has been known for years, it is worth asking why,

[79] "Exposed" means not isolated or guarded. "Guarded" means covered, fenced, enclosed, or otherwise protected, by means of suitable covers or casings, barrier rails or screens, mats, or platforms, designed to minimize the possibility, under normal conditions, of dangerous approach or accidental contact by persons or objects. A note under the definition of "guarded" states that wires that are insulated, but not otherwise protected, are not considered as guarded. Examples of barriers that are acceptable included electrically insulating plastic guard equipment (see ASTM F968–90) and "goalpost-type" guards installed to limit the movement of mechanical equipment. Whatever barrier is used must be capable of withstanding any impact that is likely to be imposed and must be installed so as to prevent the mechanical equipment from approaching too close to the energized lines or equipment.

over the years, both OSHA and national consensus standards have permitted grounding as a means of protecting employees on the ground. Among the consensus standards which permit grounding for this purpose are the 1987 National Electrical Safety Code, for lifting equipment, and IEEE Standard 516, 6.6 for lifting equipment and aerial lifts. (See attachments K and L).

An advantage of having a vehicle grounded is that if contact is made, protective fusing or relaying is instantaneously activated to deenergize a faulted line. Because grounding is intended to trigger rapid deenergizing of the overhead line, it substantially decreases the likelihood that the person will sustain a severe electrical shock.

An ungrounded vehicle could become a booby trap should the vehicle or equipment remain in contact with the energized conductor and not be noticed. In this instance, a path to ground could be completed if a worker gets on or off the truck or reaches into a tool bin. This situation is more likely at 4,160 volts or below. But if the vehicle is grounded, this risk to the unsuspecting worker would not be present. Also, when equipment is located under transmission lines, induced voltage, if present, will be shorted out, eliminating this startling but generally not harmful current flow.

Also, at phase-to-neutral voltage of 7,200 volts and above, the ungrounded vehicle in contact with an energized conductor presents another potential hazard—fire. The voltage stresses across the surface of the outrigger and resultant creepage will cause tires to burn or possibly start grass fires, a very serious threat to the workers in the vehicle or up in the air. [Ex. 3–112]

OSHA does not dispute the fact that grounding can facilitate the deenergizing of energized conductors. The proposal did not prohibit the use of vehicle grounding; it simply did not recognize it alone as being capable of completely protecting employees working around the vehicles. While vehicle grounding can also limit the voltage impressed on a vehicle in contact with an energized line, however, it does not normally reduce the voltage to a safe level. Evidence in the record, including descriptions of two fatal accidents, supports this assertion (Ex. 3–57, 6–10, 6–27, 9–2; DC Tr. 309–310, 349–350, 548). Dr. Robert J. Harrington, one of OSHA's expert witnesses, explained why this occurs:

Dr. Harrington: While at first sight it would appear that grounding of the equipment is advisable, there are implications with respect to any equipotentials appearing on the surface of the ground close to the actual grounding point. Even if the grounding is solid, the current penetration will probably be insufficient to prevent the presence of equipotentials due to fault current. [DC Tr. 309–310]

* * * * *

Ms. Thurber: Does voltage appear on grounded mechanical equipment when that equipment contacts an energized line?

Dr. Harrington: Oh, yes, certainly.

Ms. Thurber: Can you explain for those of us who do not understand this very well how that happens?

Dr. Harrington: Well, even if you have got solid ground up there for the vehicle itself, what essentially happens once we get connection to the energized part * * * the vehicle itself is probably fairly close to it as a zero potential, but along the ground there is a pattern of equal potentials which may be quite considerable in terms of voltage. If I had a diagram or something, I could explain it more precisely.

But essentially the grounding point at which the vehicle is supposed to be grounded and the actual ground of the system may be considerably far apart, and it probably will be. And in between that point of the so-called ground of the vehicle and the actual grounding of the system there will be these equal potentials appearing on the surface of the earth, the surface of the ground.

Now that is partly due to the fact that the current penetration around the actual grounding point is not perfect * * * So essentially therefore one gets on the surface of the earth fairly close to the vehicle quite considerable voltage equal potentials.

And therefore there is a considerable risk and hazard to those in the region of the vehicle at this time. [DC Tr. 349–350]

The IBEW was also concerned about equipotentials, but was even more concerned that the OSHA standard might encourage employers not to ground mechanical equipment when operated near overhead lines (Ex. 64; DC Tr. 545–550). On their behalf, Mr. James Dushaw cited the continued presence of step potentials and fires as hazards that would be caused by the lack of grounding (DC Tr. 547–548).

On the basis of the record considered as a whole, OSHA believes that vehicle grounding alone cannot always be depended upon to provide sufficient protection against the hazards of mechanical equipment contact with energized power lines. On the other hand, the Agency recognizes the usefulness of grounding as a protective measure that can be used in combination with other techniques to protect employees from electric shock. Such supplemental techniques include:

(1) Using the best available ground to minimize the time the lines remain energized,

(2) Bonding equipment together to minimize potential differences,

(3) Providing ground mats to extend areas of equipotential, and

(4) Using insulating protective equipment or barricades to guard against any remaining hazardous potential differences.

The final rule recognizes all these techniques. Paragraph (p)(4)(iii)(C) of final § 1910.269 sets forth the performance-oriented requirement that assures that employees on the ground will be protected from the hazards that could arise if the equipment contacts the energized parts. The protective measures used must ensure that employees are not exposed to hazardous differences in potential. Information in appendix C to the standard provides guidelines for employers and employees that explain the various measures and how they can be used. A note referencing this appendix has been included in the final rule.

The last issue related to paragraph (p)(4)(iii) of proposed § 1910.269 concerned when the rule should apply. The proposed paragraph used the phrase "[i]f it is possible for the mechanical equipment or any attached load to be taken closer to exposed energized lines or equipment than the clearance specified". This language was chosen because of the difficulty OSHA experienced in enforcing comparable provisions in subpart V of the Construction Standards.[80]

EEI noted that the wording of these provisions had caused enforcement-related problems (Ex. 3–112, 56). They pointed to two federal Court of Appeals decisions which reached the conclusion that these requirements are unclear and need substantial revision (*Pennsylvania Power & Light Co. v. OSHRC*, 737 F.2d 350; and *Wisconsin Electric Power Co. v. OSHRC*, 567 F.2d 735, 738).

Many commenters objected to this approach (Ex. 3–26, 3–63, 3–89, 3–112, 3–113, 3–120, 56, 58; DC Tr. 914–928; LA Tr. 343). They were concerned that the provision would apply whenever there was a possibility of close approach even if the chance of the equipment's getting too close to the power line was remote. EEI argued that "the pointless cost and loss of productivity resulting from such a requirement would be enormous, especially if one considers how many times per day electric utilities around the country operate mechanical equipment in locations where extension of a boom to reach an overhead power line is at least physically possible [Ex. 3–112]." Mr.

[80] The relevant subpart V regulations are:

§ 1926.952(c)(2) "mechanical equipment shall not be operated *closer* to any energized line or equipment *than the clearances* set forth in § 1926.950(c) unless . . . [emphasis added]"

§ 1926.955(a)(6)(i) "equipment or machinery working *adjacent to* energized lines or equipment. [emphasis added]"

§ 1926.955(a)(6)(ii) "Lifting equipment shall be . . . when utilized *near* energized equipment or lines. [emphasis added]"

Tony E. Brannan of Georgia Power Co., representing EEI, described several example situations that would unnecessarily require precautions to be taken under the proposal, as follows:

(1) Work on one side of a street where energized power lines are on the opposite side and where the boom of a line truck could reach the energized lines,

(2) Work, such as lifting material, that is unrelated to energized lines but that is close enough to power lines to present the possibility of contact,

(3) Work performed with the boom lowered, such as entry into and exit from the truck upon arrival or departure, and

(4) Work on the vehicle while it is parked near energized lines (DC Tr. 920–928).

Several commenters suggested that OSHA use the phrase "when it is intended" or "where it can be reasonably anticipated" in the final rule in place of the proposed phrase "if it is possible" (Ex. 3–26, 3–112, 56, 64). EEI urged OSHA to use a reasonable triggering point and to rely on job planning to determine when the triggering point was reached (Ex. 56). The National Arborist Association simply suggested removing the offensive phrase from the requirement (Ex. 3–113, 56).

OSHA believes that these commenters have a valid point. While some of the examples presented by Mr. Brannan would not be covered under § 1910.269 (for example, vehicle servicing) or would still pose a substantial risk to employees (for example, work unrelated to energized lines), others demonstrated that the risk of contact with an energized line may not be significant even though there is a possibility of contact. In particular, the Agency can envision a line crew working on deenergized equipment across the street from an energized line. If the mechanical equipment is positioned so that it is barely possible to contact the energized lines and if the crew performs all the work on the deenergized side of the street the likelihood of contact is remote. However, many situations covered under the standard do require the employees to be exposed to a substantial risk of having the mechanical equipment contact an energized line. The nature of electric power generation, transmission, and distribution work naturally brings employees and the equipment they use near energized lines.

The question then becomes what language can be used to describe the triggering point. Eliminating the phrase "if it is possible" as NAA suggests would require precautions to be taken only when the minimum approach distance is violated, an act prohibited by paragraph of final § 1910.269.

EEI's and IBEW's suggested phrase, "when it is intended", is better. However, it cannot always be foreseen before work starts whether the mechanical equipment will be taken too close to energized lines. Some of the accident descriptions contained in the record depict situations involving changes in approach directions not envisioned in the job plan (Ex. 9–2). For example, a different approach than originally planned may be necessary for an articulating device to be able to reach a desired position. In such cases, the employee operating the equipment has his or her mind on the task of positioning the device, and whether or not it was originally intended to get too close to the lines is irrelevant. In one of the cases cited by EEI, an accident occurred when the job plan was allegedly violated by the operator himself (*Pennsylvania Power & Light Co. v. OSHRC*, 737 F.2d 350; Ex. 46).

Additionally, OSHA believes it is important to initiate protective measures before the boom (or an equivalent part) of the equipment is moved. Once the boom has been started in motion to perform work near the power lines, the employee will be concentrating on maneuvering it into position and may not remember to or be convinced of the need to stop to take these measures.

For these reasons, the Agency is taking a different, more performance-oriented approach than anything suggested by the commenters. OSHA has decided to require that the necessary protective steps be taken if the employer knows or reasonably could have known that the hazard of the mechanical equipment's becoming energized exists during operation. Such a hazard could exist because of the likelihood of direct contact with the line, of current arcing to the equipment, or of hazardous induced voltage. This concept is set forth in the introductory text of § 1910.269, which reads as follows:

> If, during operation of the mechanical equipment, the equipment could become energized, the operation shall also comply with at least one of paragraphs (p)(4)(iii)(A) through (p)(4)(iii)(C) of this section.

The Agency believes that the final rule addresses the problem directly, by applying only to hazardous operations, rather than indirectly as the proposal did. Under paragraph (p)(4)(iii) of final § 1910.269, only operations exposing employees to the hazard of dangerous voltage being impressed or induced on mechanical equipment require measures to be taken to minimize the risk of injury from electric shock.

Paragraph (q). Paragraph (q) of final § 1910.269 applies to work involving overhead lines or equipment. The types of work performed on overhead lines and addressed by this paragraph include the installation and removal of overhead lines, live-line bare-hand work, and work on towers and structures. While performing this type of work, employees are typically exposed to the hazards of falls and electric shock.

Paragraph (q)(1)(i) requires the employer to determine that elevated structures such as poles and towers are of adequate strength to withstand the stresses which will be imposed by the work to be performed. For example, if the work involves removing and reinstalling an existing line on a utility pole, the pole will be subjected to the weight of the employee (a vertical force) and to the release and replacement of the force imposed by the overhead line (a vertical and possibly a horizontal force). The additional stress involved may cause the pole to break, particularly if the pole has rotted at its base. If the pole or structure cannot withstand the loads to be imposed, it must be reinforced so that failure does not occur. This rule protects employees from falling to the ground upon failure of the pole or other elevated structure.

As the last step in ascertaining whether a wood pole is safe to climb, as required under paragraph (q)(1)(i), checking the actual condition of the pole is important because of the possibility of decay and other conditions adversely affecting the strength of the pole. Appendix D of final § 1910.269 contains methods of inspecting and testing the condition of wood structures before they are climbed. These methods, which can be used in ascertaining whether a wood pole is capable of sustaining the forces imposed by an employee climbing it, have been taken from § 1910.268, the telecommunications standard. It should be noted that the employer must also ascertain whether the pole is capable of sustaining any additional forces that will be imposed during the work.

Several commenters argued that the standard should be changed to require this determination to be performed by a qualified employee (Ex. 3–22, 3–32, 3–40, 3–42, 3–69, 3–112, 3–116, 3–123, 3–125, 3–128). They argued that employees climbing the poles and structures are qualified to inspect poles and structures and determine whether they are safe to climb. In their view, it is the worker, not the employer, who is the most appropriate one to perform this function.

OSHA realizes that the employee at the worksite will be the one to inspect the structure for deterioration and will also determine whether it is safe to climb. However, under the OSH Act, it is the employer's responsibility to ensure that this is accomplished, regardless of who performs the work. (See the discussion of this issue under the summary and explanation of the introductory text of paragraph (c), earlier in the preamble.) Additionally, some work involves changing the loading on the structure. For example, replacement transformers may be heavier, and the equipment needed to perform the work will impose extra stress on the pole. The employee in the field is not necessarily skilled in structural engineering, and a determination as to whether or not the pole could withstand the stresses involved would need to be performed by the employer's engineering staff. (Typically, this task is performed in the initial design of the system or when changes are made.) For this reason, OSHA believes it is necessary to specify in the standard the employer's responsibility in this regard. Therefore, the wording of this provision has not been changed in the final rule. However, the Agency expects the determination of the condition of the pole or structure to be made at the worksite by an employee who is capable of making this determination. The employer fulfills the obligation imposed by the standard by training his or her employees and by enforcing company rules that adhere to the standard.

When poles are handled near overhead lines, it is necessary to protect the pole from contact with the lines. Paragraph (q)(1)(ii) prohibits letting the pole come into direct contact with the overhead lines. Measures commonly used to prevent such contact include installation of insulating guards on the pole and pulling conductors away from the area where the pole will go.

Paragraph (q)(1)(iii) of final § 1910.269 requires employees handling the poles to be insulated from the pole. This provision was proposed as part of § 1910.269(q)(1)(ii). However, for clarity, the two requirements contained in the proposed paragraph have been separated into two distinct paragraphs ((q)(1)(ii) and (q)(1)(iii)) in the final rule. These requirements protect employees from hazards caused by falling power lines and by contact of the pole with the line. They are in addition to the requirements in paragraph (p)(4) for operations involving mechanical equipment.

Several commenters suggested limiting the application of these two provisions to lines of more than 600 volts (Ex. 3–20, 3–42, 3–80, 3–112). They noted that the EEI/IBEW draft contained such a limitation. Additionally, EEI claimed that providing protection at the lower voltage levels would be impractical and would add nothing to the safety of employees handling poles (Ex. 3–112).

Two existing OSHA requirements apply to setting, moving, and removing poles near overhead lines: § 1910.268(n)(11), in the telecommunications standard, and § 1926.955(a), in Subpart V. Both contain requirements comparable to proposed § 1910.269(q)(1)(ii), and neither contains a lower voltage limitation. Furthermore, poles are often conductive. They can be made of metal or concrete, which OSHA considers to be conductive, as well as wood. Even wood poles pose an electric shock hazard when being moved near electric power lines. Wet poles and poles with ground wires running along their length are both highly conductive. Some of the accidents described in the record involve wood poles with installed ground wires being placed between energized conductors (Ex. 9–2). Even though the voltage was greater than 600 volts or was unspecified, these accidents show the dangers, regardless of the voltage involved. (Any voltage greater than 50 volts is normally considered lethal.) Therefore, OSHA has not accepted the suggested 600-volt limitation.

To protect employees from falling into holes into which poles are to be placed, paragraph (q)(1)(iv) requires the holes to be guarded by barriers or attended by employees. For clarification, the language in this provision has been changed slightly from the wording in the proposal. The final version is similar to that suggested by the American Public Power Association (Ex. 3–80).

Paragraph (q)(2) of final § 1910.269 addresses the installation and removal of overhead lines. The provisions contained in final § 1910.269 (q)(2) have been taken, in large part, from existing § 1926.955(c), on stringing and removing lines, and § 1926.955(d), on stringing adjacent to energized lines. However, the final rule combines these provisions into a single paragraph (q)(2).

EEI objected to the merging of these two paragraphs into one (Ex. 3–112, 56). They noted that the EEI/IBEW draft followed the Subpart V format and that it was widely understood in the industry.

OSHA believes that paragraphs (c) and (d) of § 1926.955 are confusing. Paragraph (c) in the construction standard is entitled *"Stringing or removing deenergized conductors"*, while paragraph (d) is *"Stringing adjacent to energized lines"*. However, whereas both of these paragraphs relate to the installation of deenergized conductors, paragraph (c) also contains provisions related to stringing lines adjacent to live conductors. Additionally, some of the requirements are redundant [81] or inconsistent,[82] even though paragraph (d) incorporates the requirement of paragraph (c) by reference. Therefore, OSHA has retained the proposed approach of combining these two paragraphs from the Construction Standards.

Paragraph (q)(2)(i) requires precautions to be taken to prevent the line being installed or removed from contacting existing energized power lines. Common methods of accomplishing this include the use of the following techniques: Stringing conductors by means of the tension stringing method (which keeps the conductors off the ground and clear of energized circuits) and the use of rope nets and guards (which physically prevent one line from contacting another). These precautions, or equivalent measures, are necessary to protect employees against electric shock and against the effects of equipment damage resulting from accidental contact of the line being installed with energized parts.

Even though the precautions taken under paragraph (q)(2)(i) minimize the possibility of accidental contact, there is still a significant risk that the line being installed or removed could make contact with energized lines. Paragraph (q)(2)(i)(A) of proposed § 1910.269 would have required the line being installed, plus any connected equipment, to be treated as energized if any of several listed accident situations could energize the line. This was intended to ensure that, in the event of contact with other energized lines, these workers would be handling the equipment (which would now be energized as a result) only through insulating devices.

Several commenters argued that OSHA should recognize the widely used practice of grounding the installed cable to protect employees (Ex. 3–62, 3–112, 3–120, 3–123). They offered reasons

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[81] For example, both § 1926.955(c)(5) and (d)(2) require the use of the tension stringing method or other means of preventing the line being installed from contacting an energized conductor.

[82] For example, § 1926.955(c)(10), (d)(5), and (d)(8)(iii) relate to the removal of grounds and imply that it is permissible to remove them at different times during the operation.

similar to those used on the issue of whether to recognize vehicle grounding for mechanical equipment used near exposed electric power lines. (See the previous discussion of this issue.)

OSHA believes that this issue is equivalent to the one on vehicle grounding. In fact, the hazards are identical: employees are exposed to hazardous differences in potential if the conductor being installed or equipment being used makes contact with an energized line. The methods of protection that can be applied are also the same in both cases. Therefore, the Agency has determined that the approach used for the hazard of contact between mechanical equipment and overhead lines should also be used for the hazard of contact between a line being installed or removed and an existing energized conductor. To accomplish this, paragraph (q)(2)(ii) of final § 1910.269 simply adopts the requirements of paragraph (p)(4)(iii) by reference. Basically, the employer is required to institute measures to protect employees from hazardous differences in potential at the work location. (See the discussion of final § 1910.269(p)(4)(iii) and Appendix C to § 1910.269 for acceptable methods of compliance.)

Paragraph (q)(2)(i)(B) of proposed § 1910.269 would have allowed employees working aloft to be protected by grounding the line being installed. Because paragraph (q)(2)(ii) of final § 1910.269 takes a performance-oriented approach to the protection of employees from hazardous differences in potential, this proposed paragraph is no longer necessary and is not being carried forward into the final rule.

Paragraph (q)(2)(iii) of final § 1910.269 requires the disabling of the automatic-reclosing feature of the devices protecting any circuit that operates at more than 600 volts and that passes under conductors being installed. If it is not made inoperative, this feature would cause the circuit protective devices to reenergize the circuit after they had tripped, exposing the employees to additional or more severe injury.

Many commenters argued that, because older circuit reclosing devices did not permit the disabling of the automatic circuit reclosing feature, the rule should permit alternative protective measures, such as guarding the energized lines and grounding the lines being installed (Ex. 3-2, 3-42, 3-44, 3-58, 3-62, 3-69, 3-71, 3-80, 3-112).

Paragraph (q)(2)(i) of final § 1910.269 requires the use of techniques that minimize the possibility of contact between the existing and new conductors. Paragraph (q)(2)(ii) of final § 1910.269 requires the use of measures that protect employees from hazardous differences in potential. These two paragraphs encompass all the suggested alternatives and provide the primary protection to employees installing conductors. Paragraph (q)(2)(iii) is secondary protection; it provides an additional measure of safety in case the first two provisions are violated. Therefore, in the final rule, OSHA is applying this paragraph only to circuit reclosing devices that are designed to permit the disabling of the automatic reclosing feature. (The issue of whether or not OSHA should require new automatic switching devices to be made so as to allow disabling of the automatic switching feature was discussed under the summary and explanation of paragraph (m)(3)(iii), earlier in this preamble.) The Agency believes that the combination of these three paragraphs in final § 1910.269 will provide better protection than the comparable provisions in the proposal.

Paragraph (q)(2)(iv) sets forth rules protecting workers from the hazard of voltage induced on lines being installed near (and usually parallel to) other energized lines. These rules, which provide supplemental provisions on grounding, would be in addition to those elsewhere in the standard. In general, when employees may be exposed to the hazard of induced voltage on overhead lines, the lines being installed must be grounded to minimize the voltage and to protect employees handling the lines from electric shock.

Several commenters (Ex. 3-13, 3-20, 3-40, 3-62, 3-80, 3-82, 3-112) objected to the limited options available under this provision in the proposal (proposed § 1910.269(q)(2)(iii)). Some argued that it was not always possible to determine the exact voltage that would be induced on a line (Ex. 3-13, 3-20, 3-82, 3-101, 3-107, 3-112). Others suggested that a determination of voltage was unnecessary if the line was assumed to carry a hazardous voltage (Ex. 3-20, 3-40, 3-82, 3-101, 3-107, 3-112). Still others suggested allowing work to be performed as if the conductors were energized (Ex. 3-20, 3-40, 3-62, 3-80, 3-112).

OSHA has accepted all of these recommendations. Paragraph (q)(2)(iv) of final § 1910.269 requires a determination of the "approximate" voltage, unless the line being installed is assumed to carry a hazardous induced voltage. Additionally, workers may treat the line as energized rather than comply with the additional grounding requirements contained in this paragraph.

The standard does not provide guidelines for determining whether or not a hazard exists due to induced voltage. The hazard depends not only on the voltage of the existing line, but also on the length of the line being installed and the distance between the existing line and the new one. Electric shock from induced voltage poses two different hazards. First, the electric shock could cause an involuntary reaction, which could cause a fall or other injury. Second, the electric shock itself could cause respiratory or cardiac arrest. 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 resistor. (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). It is up to the employer to ensure that employees are protected against serious injury from any voltages induced on lines being installed and to determine whether the voltages are high enough to warrant the adoption of the additional provisions on grounding spelled out in paragraphs (q)(2)(iv)(A) through (q)(2)(iv)(E) of final § 1910.269. These rules set forth the following requirements:

(1) Grounds must be installed in increments of no more than 2 miles (paragraph (q)(2)(iv)(A));

(2) Grounds must remain in place until the installation is completed between dead ends (paragraph (q)(2)(iv)(B));

(3) Grounds must be removed as the last phase of aerial cleanup (paragraph (q)(2)(iv)(C));

(4) Grounds must be installed at each work location and at all open dead-end or catch-off points or the next adjacent structure (paragraph (q)(2)(iv)(D)); and

(5) Bare conductors being spliced must be bonded and grounded (paragraph (q)(2)(iv)(E)).

Proposed paragraphs (q)(2)(iii)(F) and (q)(2)(iii)(G), which related to the connection and removal of grounds, respectively, have not been carried forward into the final rule. As noted by EEI (Ex. 3-112), these two paragraphs simply repeated the provisions of § 1910.269 (n)(6) and (n)(7) and were therefore unnecessary.

Paragraph (q)(2)(v) requires reel handling equipment to be in safe operating condition and to be leveled and aligned. Proper alignment of the stringing machines will help prevent failure of the equipment, conductors, and supporting structures, which could result in injury to workers.

Prevention of the failure of the line pulling equipment and accessories is also the purpose of paragraphs (q)(2)(vi), (q)(2)(vii), and (q)(2)(viii). These provisions respectively require the operation to be performed within the load limits of the equipment, require the repair or replacement of defective apparatus, and prohibit the use of conductor grips not specifically designed for use in pulling operations. Equipment that has been damaged beyond manufacturing specifications or that has been damaged to the extent that its load ratings would be reduced are considered to be defective. Load limits and design specifications are normally provided by the manufacturer, but they can also be found in engineering and materials handbooks (see, for example, *The Lineman's and Cableman's Handbook*, Ex. 8–5).

When the tension stringing method is used, the pulling rig (which takes up the pulling rope and thereby pulls the conductors into place) is separated from the reel stands and tensioner (which pay out the conductors and apply tension to them) by one or more spans (the distance between the structures supporting the conductors). In an emergency, the pulling equipment operator may have to shut down the operation. Paragraph (q)(2)(ix) of final § 1910.269 requires communication to be maintained between the reel tender and the pulling rig operator, so that in case of emergency at the conductor supply end, the pulling rig operator can shut the equipment down before injury-causing damage occurs. The proposed version of this rule, paragraph (q)(2)(viii), would have required simply that "reliable communications" be maintained. The language contained in paragraph (q)(2)(ix) of final § 1910.269 clarifies that two-way radios or other equivalent means constitute "reliable communication".

Paragraph (q)(2)(x) prohibits the operation of the pulling rig under unsafe conditions. This provision was proposed as part of § 1910.269(q)(2)(viii). It has been designated as a separate paragraph in the final rule. OSHA has included a note following paragraph (q)(2)(x) of the final rule. The explanatory note, which was not contained in the proposal, provides examples of unsafe conditions.

Paragraph (q)(2)(xi) prohibits employees from unnecessarily working directly beneath overhead operations or on the cross arm. This provision minimizes exposure of employees to injury resulting from the failure of equipment, conductors, or supporting structures during pulling operations.

Under certain conditions, work must be performed on transmission and distribution lines while they remain energized. Sometimes, this work is accomplished using rubber insulating equipment or live-line tools. However, this equipment has voltage and other limitations which make it impossible to insulate the employee performing work on live lines under all conditions. In such cases, usually on medium- and high-voltage transmission lines, the work is performed using the live-line bare-hand technique. If work is to be performed "bare handed", the employee works from an insulated aerial platform and is electrically bonded to the energized line. Since there is essentially no potential difference across the worker's body, he or she is protected from electric shock. Paragraph (q)(3) of final § 1910.269 addresses the live-line bare-hand technique.

Paragraph (q)(3)(i) requires employees using or supervising the use of the live-line bare-hand method on energized lines to be trained in the use of the technique. Periodic retraining must be provided as required under paragraph (a)(2) of final § 1910.269. Without this training, employees would not be able to perform the highly specialized work safely.

Before work can be started, the voltage of the lines on which work is to be performed must be known. This voltage determines the minimum approach distances and the types of equipment which can be used. If the voltage is higher than expected, the minimum approach distance will be too small and the equipment may not be safe for use. Therefore, paragraph (q)(3)(ii) requires a determination to be made of the voltage of the circuit, of the minimum approach distances involved, and of the voltage limitations of equipment to be used.

Paragraph (q)(3)(iii) requires insulated tools and equipment to be designed, tested, and intended for live-line bare-hand work and that they be kept clean and dry. This requirement is important to ensure that equipment does not fail under constant contact with high voltage sources. The final version of this rule explains that it applies to insulated tools, insulated equipment, and aerial devices and platforms used in live-line work. This clarification was made in response to the request of three commenters (Ex. 3–65, 3–81, 3–112). The Agency considers insulated equipment that is rated for the voltage on which it is used (such as a live-line tool) to meet this requirement.

Paragraph (q)(3)(iv) requires the automatic-reclosing feature of circuit protective devices to be made inoperative. In case of a fault at the worksite, it is important for the circuit to be deenergized as quickly as possible and for it to remain deenergized once the protective devices have opened the circuit. This prevents any possible injuries from becoming more severe. Additionally, this measure helps limit the possible switching surge voltage, which provides an extra measure of safety. (The issue of whether or not OSHA should require new automatic switching devices to be made so as to allow disabling of the automatic switching feature was discussed under the summary and explanation of paragraph (m)(3)(iii), earlier in this preamble.)

Sometimes the weather makes live-line bare-hand work unsafe. For example, lightning strikes on lines being worked can create severe transient voltages, against which the minimum approach distances required by final § 1910.269 may not provide complete protection. Additionally, the wind can reduce the minimum approach distance below acceptable values. To provide protection against environmental conditions which can increase the hazards by an unacceptable degree, paragraph (q)(3)(v) prohibits live-line bare-hand work in the midst of a thunderstorm or under any other conditions that make the work unusually hazardous (that is, hazardous in spite of the precautions taken under the final rule). Also, work may not be performed under any conditions that reduce the minimum approach distances below required values. If insulating guards are provided to prevent hazardous approach to other energized parts and to ground, then work may be performed under conditions reducing the minimum approach distances.

Paragraph (q)(3)(vi) requires the use of a conductive device, usually in the form of a conductive bucket liner, which creates an area of equipotential in which the employee can work safely. The employee must be bonded to this device by means of conductive shoes or leg clips or by another effective method. Additionally, if necessary to protect employees further, electrostatic shielding would be required.

To avoid receiving a shock caused by charging current, the employee must bond the conductive bucket liner (or other conductive device) to the energized conductor before he or she touches the conductor. Typically, a hot stick is used to bring a bonding jumper (already connected to the conductive bucket liner) into contact with the live line. This connection brings the equipotential area surrounding the employee to the same voltage as that of the line. Paragraph (q)(3)(vii) requires the conductive device to be bonded to the energized conductor before any employee contacts the energized conductor and requires this connection to be maintained until work is completed.

Paragraph (q)(3)(viii) requires aerial lifts used for live-line bare-hand work to be equipped with upper controls that are within reach of any employee in the bucket and with lower controls that permit override operation at base of the boom. Upper controls are necessary so that employees in the bucket can precisely control the lift's direction and speed of approach to the live line. Control by workers on the ground responding to directions from those in the bucket could lead to contact by an employee in the lift with the energized conductor before the bonding jumper is in place. Controls are needed at ground level, however, so that employees in the lift who might be disabled as a result of an accident or illness could be promptly lowered and assisted. For this reason, paragraph (q)(3)(ix) prohibits operation of the ground level controls except in case of emergency.

In the preamble to the proposal, OSHA requested comments on whether there were operations involving live-line bare-hand work that require the use of the lower controls in lieu of the ones in the lift. In response to this request, the IBEW supported the proposed language (Ex. 3–107). EEI suggested that the standard allow the lower controls to be operated with the permission of the employee in the lift because in some situations it would be necessary or safer (Ex. 3–112). However, EEI did not specify what type of procedure would necessitate such operation or explain how this could be done safely. Because OSHA does not believe it would be either safer or necessary for an employee on the ground to operate the lift in other than emergency conditions, the final rule adopts the provision as proposed.

Paragraph (q)(3)(x) requires aerial lift controls to be checked to ensure that they are in proper working order before any employee is lifted into the working position.

To protect employees on the ground from the electric shock that would be received upon touching the truck supporting the aerial lift, paragraph (q)(3)(xi) requires the truck to be grounded or treated as energized. In this case the insulation of the lift limits the voltage on the body of the truck to a safe level if the truck itself is grounded.

Aerial lifts that are used in live-line bare-hand work are exposed to the full line-to-ground voltage of the circuit for the duration of the job. To ensure that the insulating value of the lift being used is high enough to protect employees, paragraph (q)(3)(xii) requires a boom-current test to be made before work is started each day. The test is also required when a higher voltage is encountered and when conditions change to a degree that warrants retesting the equipment.

Under the standard, the test consists of placing the bucket in contact with a source of voltage equal to that being encountered during the job and keeping it there for at least 3 minutes. This is normally accomplished at the worksite by placing the bucket in contact with the energized line on which work is to be performed (without anyone in it, of course).

Several smaller electric utility companies and one oil company objected to the requirement to test aerial lifts on a day-to-day basis (Ex. 3–2, 3–12, 3–17, 3–26, 3–124). These commenters argued that the insulating value of this type of equipment does not change significantly from day to day and that this type of test was very expensive.

OSHA believes that, if live-line bare-hand work is to be performed, a test must be conducted before work starts each day. The aerial lift is deliberately placed into contact with the energized line, and any damage to the insulation could quickly lead to the death of an employee. The insulation on these devices must be constantly monitored for adequacy.

The test proposed in § 1910.269(q)(3)(xii) is already required under § 1926.955(e)(11) for similar work performed under the Construction Standards. Additionally, all aerial lifts insulated for voltages over 69 kV are required by § 1910.67[83] (through ANSI A92.2–1969) to be equipped with electrodes for conducting these tests. Final § 1910.269 does not require these devices to be sent to a test facility for testing (in fact, this would be counterproductive), nor does it require these tests to be performed on all aerial lifts used in electric power generation, transmission, and distribution work. This provision applies only to lifts used in live-line bare-hand work and only when they are so used. For these reasons, OSHA has carried this requirement forward into the final rule.

To provide employees with a level of protection equivalent to that provided by American National Standard for Vehicle-Mounted Elevating and Rotating Aerial Devices (ANSI A92.2–1979; Ex. 2–28), § 1910.269(q)(3)(xii) proposed to permit a leakage current of up to 1 microampere per kilovolt of nominal phase-to-*ground* voltage. In contrast, the corresponding provisions in Subpart V of Part 1926 (§ 1926.955(e)(11)) and in the EEI/IBEW draft allow up to 1 microampere of current for every kilovolt of phase-to-*phase* voltage. (For a three-phase, Y-connected system, the phase-to-phase voltage equals 1.73 times the phase-to-ground voltage.) Because of the inconsistency between the proposal and OSHA's existing standard, the Agency requested comments on the appropriateness of the leakage current level permitted by the proposal.

Four commenters responded to this request (Ex. 3–41, 3–82, 3–107, 3–112). EEI and the Tennessee Valley Authority (TVA) supported the Subpart V level of 1 microampere per kilovolt of phase-to-phase voltage (Ex. 3–82, 3–112). They argued that this level was more appropriate for field testing and was consistent with the existing OSHA standard.

IBEW and the Manufacturers of Aerial Devices & Digger Derricks Council supported the lower level proposed in § 1910.269(q)(3)(xii) (Ex. 3–41, 3–107). They noted that this is the level adopted in the consensus standard. Also, the latest version of the ANSI standard includes a provision for field testing of insulated aerial devices at a level of 1 microampere per kilovolt of phase-to-ground voltage (Ex. 2–28, 60).

The manufacturers of insulated aerial lifts and the national consensus standard support the leakage level contained in the proposal. Neither EEI nor TVA explained how a higher leakage current level would better protect employees than the level set in the national consensus standard. Therefore, OSHA is adopting the maximum leakage current of 1 microampere per kilovolt of phase-to-ground voltage from ANSI A92.2–1979.

Paragraph (q)(3)(xii) requires the suspension of related work activity any time (not only during tests) a

[83] Paragraph (b)(1) of § 1910.67 requires all vehicle-mounted elevating and rotating work platforms (aerial lifts) to conform to the provisions of ANSI A92.2–1969, *Vehicle Mounted Elevating and Rotating Work Platforms*. Section 4.11 of that standard contains the requirement for platforms insulated for more than 69 kV to be equipped with test electrodes. These electrodes can be used for field testing as noted in the Appendix to that standard and in Section 6.3.1.3 of the 1979 version of that standard (ANSI A92.2–1979).

malfunction of the equipment is evident. This requirement is intended to prevent the failure of insulated aerial devices during use. As requested by a commenter (Ex. 3–62), this provision in the final rule has been clarified so that only work from the aerial lift is affected. Work not involving the aerial lift could be continued. Halting work from the lift will protect employees in the lift, as well as those on the ground, from the electrical hazards involved.

Paragraphs (q)(3)(xiii), (q)(3)(xiv), and (q)(3)(xv) of final § 1910.269 require the minimum approach distances specified in Table R–6 through Table R–10 to be maintained from grounded objects and from objects at a potential different from that at which the bucket is energized. (The proposal contained a separate table for live-line bare-hand work. The final rule has consolidated all the minimum approach distance tables in one place, under § 1910.269(l).) Paragraph (q)(3)(xiii) applies to minimum approach distances in general; paragraph (q)(3)(xiv) covers minimum approach distances to be used as the employee approaches or leaves the energized conductor; and paragraph (q)(3)(xv) relates to the distance between the bucket and the end of a bushing or insulator string. The phrase "or any other grounded surface" has been added after "insulator string" to indicate that the bucket must maintain this minimum approach distance from any grounded surface, as recommended by Mr. Joseph Van Name (DC Tr. 732).

The tables referenced in paragraphs (q)(3)(xiii), (q)(3)(xiv), and (q)(3)(xv) are those set forth in paragraph (l)(2) of final § 1910.269. The rationale behind the adoption of those tables and the discussion of issues related to minimum approach distances is presented under the preamble summary of that paragraph. The principles behind the two sets of tables are the same. (In fact, EEI proposed placing all these requirements under paragraph (l). OSHA has not adopted this approach at this time because of concerns of sufficient notice to interested parties. However, consolidation of the live-line bare-hand requirements and the other regulations relating to work on energized lines will be considered in future rulemaking efforts.)

Paragraph (q)(3)(xvi) prohibits the use of hand lines between the bucket and boom and between the bucket and ground. Such use of lines could set up a potential difference between the employee in the bucket and the power line when the employee contacts the hand line. If the hand line is supported by the energized conductor, as permitted by the paragraph, no potential difference is generated at the bucket. Unless the rope is insulated for the voltage, employees on the ground must treat it as energized.

For similar reasons, paragraph (q)(3)(xvii) prohibits passing uninsulated equipment or materials to an employee bonded to an energized part.

Paragraph (q)(3)(xviii) requires a durable chart reflecting the minimum approach distances prescribed by Table R–6 through Table R–10 to be mounted so that it is visible to the operator of the boom. Of course, a table prescribing minimum approach distances greater than those required would also be acceptable. Paragraph (q)(3)(xix) requires a non-conductive measuring device to be available to the employee in the lift. Compliance with these two provisions in the final standard will assist the employee in determining the minimum approach distances required by the standard.

Paragraph (q)(4) of final § 1910.269 addresses hazards associated with towers and other structures supporting overhead lines.

To protect employees on the ground from hazards presented by falling objects, paragraph (q)(4)(i) prohibits workers from standing under a tower or other structure, unless their presence is necessary to assist employees working above.

Paragraph (q)(4)(ii) relates to operations which involve lifting and positioning tower sections. This provision normally requires tag lines or other similar devices to be used to control tower sections being positioned. The use of tag lines protects employees from being struck by tower sections that are in motion.

Paragraph (q)(4)(iii) requires loadlines to remain in place until the load is secured so that it cannot topple and injure an employee.

Some weather conditions can make work from towers and other overhead structures more hazardous than usual. For example, icy conditions may make slips and falls much more likely, in fact even unavoidable. Under such conditions, work from towers and other structures would generally be prohibited by § 1910.269(q)(4)(iv). However, when emergency restoration work is involved, the additional risk may be necessary for public safety, and the standard permits such work to be performed even in bad weather.

The final rule allows work to continue under any type of emergency restoration,[84] whether or not power is available. This change was requested by two commenters that noted that emergency conditions sometimes develop with actual loss of power and that it would be better to allow restoration work to avoid this situation (Ex. 3–69, 3–123).

Paragraph (r). Paragraph (r) of final § 1910.269 addresses safety considerations related to line-clearance tree trimming. As can be seen from the definition in § 1910.269(x), line-clearance tree trimming is the trimming of any tree or brush that is within 10 feet (305 cm) of an electric power line. Since § 1910.269 addresses hazards unique to electric power generation, transmission, and distribution work, general tree trimming is not covered by this paragraph. For example, tree trimming contractors performing work at a residence where there are no overhead power lines within 10 feet of any trees or brush are not required to follow § 1910.269(r).

The requirements for this paragraph have been taken, in large part, from ANSI Z133.1–1982, *American National Standard Safety Requirements for Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and for Cutting Brush* (Ex. 2–29).

Paragraph (r)(1) covers the electrical hazards associated with line-clearance tree trimming. This paragraph does not apply to qualified employees. These employees are highly trained and are adequately protected by other provisions in the standard, including the requirements for personal protective equipment in paragraph (g) and for working on or near exposed energized parts in paragraph (l). Line-clearance tree trimmers, on the other hand, do not have such extensive training, and more stringent requirements dealing with electrical hazards are necessary and appropriate for their protection. Paragraph (r)(1) of final § 1910.269 sets forth such requirements.

The distinction between the "qualified employee" and "line-clearance tree trimmer" is discussed in summary and explanation of final § 1910.269(a)(1)(i)(E), earlier in this preamble, and final § 1910.269(x), later in this preamble. As noted in those discussions, a "qualified employee" under § 1910.269 is an employee who has been trained to work on energized electric power generation, transmission, and distribution installations. Line-clearance tree trimmers are not considered to be "qualified employees" under § 1910.269. As explained earlier,

[84] Emergency restoration work is considered to be that work necessary to restore an electric power generation, transmission, or distribution installation to an operating condition to the extent necessary to safeguard the general public.

they do not have the necessary training to use the protective equipment that would be necessary to work on energized electric power generation, transmission, and distribution installations. They do, however, have the training necessary to perform tree-trimming work very close to energized transmission and distribution lines, and the work they perform is directly associated with electric power transmission and distribution installations. Therefore, work practices necessary for their safety are included in § 1910.269.

Subpart S of the General Industry Standards also contains safety-related work practice requirements for work, such as tree trimming, that is performed near overhead power transmission and distribution lines. However, the Subpart S safety-related work practices do not apply to work performed by "qualified persons on or directly associated with" electric power generation, transmission, and distribution installations. Because line-clearance tree trimmers do have training necessary to enable them to work very close to energized electric power transmission and distribution lines and because the work practices necessary for their safety have been included in § 1910.269, they are considered to be "qualified persons" for the purpose of § 1910.331(c)(1).[85]

Other tree workers do not have the training necessary for them to be either "qualified employees" or "line-clearance tree trimmers",[86] as defined under § 1910.269(x). These employees are not covered under § 1910.269 at all. The work practices these employees must use are contained in Subpart S of Part 1910. Under Subpart S, tree workers must maintain a 10-foot minimum approach distance from overhead lines. (In fact, trimming any branch that is within 10 feet of an overhead power line is prohibited by Subpart S.)

Proposed § 1910.269(r)(1)(i) would have required an inspection to be made of the tree on which work is to be performed to see if an electric conductor passes within 10 feet of the tree. This inspection was intended to give an indication of whether an electrical hazard exists.

The preamble discussion of final § 1910.269(a)(1)(i)(E) noted that OSHA had decided to move the requirement for the determination of voltage levels, as it relates to line-clearance tree trimming, to paragraph (r)(1)(i). Under this paragraph, the employer must make a determination of the voltages to which employees are exposed, so that employees would be able to maintain the proper minimum approach distances. However, if employees treat all conductors as energized at the maximum voltage to be encountered, only the maximum voltage need be determined. Because § 1910.269 applies only to line-clearance tree trimming activities, the proposed general requirement for an inspection of the tree for the presence of electric power lines, which must be present for the standard to apply, has been eliminated.

Paragraphs (r)(1)(ii) and (r)(1)(iii) of the proposal would have required a 10-foot (305-cm) minimum approach distance for non-line-clearance tree trimmers and would have prohibited these tree trimmers from trimming trees that were within 10 feet of an electric power line. The National Arborist Association noted that the Electrical Safety-Related Work Practices Standard[87] (which was also a proposal at the time of their comments) covered work performed by unqualified employees near overhead power lines (Ex. 3–113, 58; LA Tr. 347–350). They were concerned that the two standards contained conflicting provisions aimed at protecting non-line-clearance tree workers. These concerns were expressed by Mr. Richard Proudfoot of Pruett Tree Service as follows:

> I'm Dick Proudfoot. I'm General Manager of Pruett Tree Service in Lake Oswego, Oregon. We do not perform line clearance tree trimming work. For that reason alone, I should not be here today in behalf of residential and commercial tree trimmers because this proposed standard supposedly is directed only to line clearance tree trimming work.
>
> The rub is twofold. First, this proposed standard actually regulates us even though it pretends not to, and second, OSHA already has dealt with residential and commercial tree trimmers in the pending OSHA section 1910.331, electrical related safe work practice standard, but contradicts that regulation in today's standard.
>
> Specifically, the pending .331, electric related safe work practice standard, covers tree care workers, such as those employed by my company, who do not perform line clearance work and excludes line clearance workers with the intention they be covered by today's line clearance standard. Thus, the pending electrical related work practice standard requires residential/commercial trimmers who work in a non-line clearance context to maintain ten feet between the tree trimmer and the overhead conductor. That approach is entirely correct.
>
> However, OSHA contradicts in today's standard the correct approach it has taken in the pending .331 standard, because in today's line clearance standard OSHA says that a non-line clearance tree trimmer may not trim a tree if any part of the tree is within ten feet of a conductor, even though under the pending .331 standard we could trim the tree, so long as we stayed ten feet away from the wire. Thus, the standard that is intended to apply to us properly measures the distance of the employee to the wire, while this standard would measure for the same employee the distance of the tree to the wire.
>
> To begin with, if we are subject to the .331 standard, as OSHA tells us we are, the agency has no business to regulate the same conduct of non-line clearance trimmers in this standard. Safety compliance requires non-contradictory standards. Contradictory signals from OSHA breeds non-compliance and unsafe conditions.
>
> OSHA should, therefore, delete from today's standards its attempt in section (r)(1)(iii) to regulate non-line clearance trimmers and leave that to OSHA's sound resolution of that issue in the pending .331 standard. Section (r)(1)(iii) should, therefore, be deleted from today's line clearance standard altogether. [LA Tr. 347–349]

Proposed § 1910.269 did, in fact, overlap the provisions of the Electrical Safety-Related Work Practices Standard in Subpart S. The Subpart S requirements currently apply to tree workers who are not line-clearance tree trimmers regardless of the type of work being performed—commercial, residential, or line-clearance tree trimming. The presence of proposed paragraphs (r)(1)(ii) and (r)(1)(iii) in final § 1910.269 would only confuse employers. In fact, under § 1910.269(a)(1)(ii)(B), work practices covered by Subpart S (that is, work by unqualified employees near electric power generation, transmission, and distribution installations) are not regulated under the electric power generation, transmission, and distribution standard. Therefore, Proposed paragraphs (r)(1)(ii) and (r)(1)(iii) are beyond the scope of § 1910.269, and the Agency has not carried them forward into the final rule.

Paragraph (r)(1)(ii) of final § 1910.269 lists the conditions under which a second qualified line-clearance tree trimmer is required to be present. The listed conditions are: (1) if the employee is to come closer than 10 feet (305 cm)

[85] This paragraph reads as follows:

(c) *Excluded work by qualified persons.* The provisions of §§ 1910.331 through 1910.333 do not apply to work performed by qualified persons on or directly associated with the following installations:

(1) *Generation, transmission, and distribution installations.* Installations for the generation, control, transformation, transmission, and distribution of electric energy (including communication and metering) located in buildings used for such purposes or located outdoors.

[86] For the purposes of paragraph (r), trainees working under the supervision of a qualified line-clearance tree trimmer are considered to be qualified line-clearance tree trimmers.

[87] This standard is set forth in §§ 1910.331 through 1910.335 of Subpart S, which was promulgated as a final rule on August 6, 1990 (55 FR 31984).

to electric circuit parts energized at more than 750 volts; (2) if a branch or limb is closer to such parts than the distances listed in Table R–6, Table R–9, and Table R–10; or (3) if roping must be used to remove branches or limbs from such parts. Under these conditions, a line-clearance tree trimmer is placed in a more hazardous environment than is usual, and errors are more likely to lead to an electrical accident. The second employee would be able to assist an employee in trouble or would be able to summon help readily.

Some electric utility representatives argued that this requirement (proposed as paragraph (r)(1)(iv)) would be burdensome (Ex. 3–69, 3–112, 3–120, 3–123). They claimed that it would unnecessarily restrict crews clearing lines and restoring service.

The hazards posed by working close to electric power lines are widely recognized. The need for a second employee is acknowledged in section 4.2.3 of the ANSI Z133.1 standard and is amply demonstrated by the accident descriptions of tree trimmers electrocuted while trimming trees (Ex. 9–5 and 9–6). Therefore, OSHA has retained this provision as proposed. However, it should be noted that, if qualified employees are involved, § 1910.269(l)(1)(i), and not paragraph (r)(1)(ii), addresses the need for the presence of a second employee.

In general, line-clearance tree trimmers do not have the experience or training for work on overhead electric power lines. However, they do have the training and skills necessary to be able to perform work safely near these lines. By using special techniques and equipment, these workers trim trees that are close to the overhead lines without bringing their bodies or other conductive objects within the danger zone. Therefore, paragraph (r)(1)(iii) requires the same minimum approach distances (listed in Table R–6, Table R–9, and Table R–10) for line-clearance work as those for regular line work, but the standard does not permit line-clearance tree trimmers to come closer than the minimum approach distances in the tables even when using protective equipment.

Employees could receive an electric shock through the branches of the trees they are trimming if the branch, once it is cut or breaks free, contacts an energized conductor. To prevent electric shock to an employee if this should occur, paragraph (r)(1)(iv) requires branches that are closer to the lines than permitted under Table R–6, Table R–9, and Table R–10 to be removed by the use of insulating equipment. This can be accomplished through the use of pruners with insulating handles.

The proposal's preamble discussion of this paragraph (proposed § 1910.269(r)(1)(vi)) implied that the insulating equipment would also have to be in strict conformance to proposed § 1910.269(j) on live-line tools. Some commenters objected to this (Ex. 3–112, 3–113, 58; LA Tr. 343–345). They stated that the testing requirements in paragraph (j) were unnecessary for the type of equipment tree trimmers use and that no injuries have resulted from the use of a wood-handled tree pruner.

As OSHA representatives noted at the hearing, the reference to the provisions on live-line tools was meant to clarify what type of equipment would be considered as "insulating" under the proposed tree-trimming rule and that individual tool poles would not have to be tested (DC Tr. 115–119). The Agency believes that some guidance is necessary with respect to what types of tools will meet the requirement that "insulating equipment" be used. Wood pruner poles that meet the test criteria given in final § 1910.269(j)(1), which gives design criteria for live-line tools, and that are not wet [88] or contaminated meet § 1910.269(r)(1)(iv). Individual tool poles need not be tested. The Agency will accept evidence indicating that tools of a given construction generically meet the test criteria. A note to this effect has been included following paragraph (r)(1)(iv) of final § 1910.269.

Paragraph (r)(1)(v) prohibits ladders, platforms, and aerial devices from coming closer to energized lines than the distances listed in Table R–6, Table R–9, and Table R–10. This provision is intended to prevent electric shock to line-clearance tree trimmers, who are not familiar with the practices necessary to contact the lines safely.

Proposed paragraph (r)(1)(viii) would have prohibited line-clearance tree-trimming operations during storms and under emergency conditions. This provision received most of the objections raised to the proposal. Electric utilities, unions, and tree trimming contractors alike overwhelmingly opposed this provision (Ex. 3–9, 3–11, 3–20, 3–23, 3–27, 3–29, 3–32, 3–38, 3–40, 3–42, 3–48, 3–55, 3–62, 3–63, 3–66, 3–67, 3–69, 3–75, 3–77, 3–78, 3–82, 3–87, 3–89, 3–90, 3–91, 3–92, 3–93, 3–94, 3–97, 3–98, 3–99, 3–100, 3–104, 3–107, 3–112, 3–113, 3–118, 3–119, 3–120, 3–123, 3–125, 3–128, 47, 58; DC Tr. 931–934, 1141–1142; LA Tr. 345–346). They all argued that tree-trimming contractors have assisted electric utilities in restoring power after storms and during other emergencies. They claimed that the work was performed safely and with few accidents. The testimony of Mr. Robert Felix, Executive Vice President of the National Arborist Association, represented these objections as follows:

> The section (r)(1)(viii), storm work prohibition, is utterly unacceptable to us. It's unacceptable to the utilities and to the IBEW, as well. It must be discarded in its entirety. Obviously, line clearance work is never done during a storm. After a storm is over, however, line clearance crews' work are vital to the effort to clear debris so that the utilities can have their linemen efficiently restore power. To require, as is proposed, linemen to perform the debris clearance work would be doubly dysfunctional. One, linemen are not trained in tree and branch removal proximate to energized conductors. Two, if linemen had to do such work to the exclusion of line clearance tree trimmers, the task of restoring power to hospitals, homes, offices and school would be indefinitely delayed. This provision is ill conceived, it's intolerable and it must go.
>
> We would support instead the ANSI Z133 requirement, or a similar proposal, that requires storm emergency work to be performed only by qualified line clearance tree trimmers and qualified line clearance tree trimmer trainees, who are trained in recognition of the hazards involved and work practices appropriate to those hazards. [LA Tr. 345–346]

The commenters gave many examples of successful tree trimming operations performed in the aftermath of severe storms. The testimony of Mr. William R. Powell, representing the American Public Power Association, gave a typical example:

> Consider for example the proposed rules, limitations on line clearance tree trimming. The proposed rule would prohibit line clearance tree trimming operations conducted by other than qualified employees during quote, "storms or under emergency conditions," close quote.
>
> The impact of Hurricane Hugo, one of the major natural disasters to recently hit our country provides ample illustration that the proposed prohibition is unworkable for large and small utilities alike.
>
> The South Carolina Public Service Authority, [SCPSA], which employs over 1600 people reports that it could have taken several months rather than several weeks to restore power to its customers if it had not been able to use the service of line clearance tree trimmers in the aftermath of Hurricane Hugo.
>
> As it was, it took [SCPSA] almost two solid weeks of 16- to 18-hour days working over 13, or over 300 independent line clearance tree trimmers in addition to a substantial complement [of] qualified linemen to restore power to its service community

[88] It should be noted that untreated wood absorbs moisture, even if it is not exposed to rain. It is important to keep wood poles dry and to maintain their finish so that they do not become conductive.

None of the participating line clearance tree trimmers suffered significant injuries during this restoration effort.

If in the emergency situation, the utility the size of [SCPSA] which has access to substantial internal * * * manpower resources, could not have restored electric service to its community in a timely fashion without the help of line clearance tree trimmers, a smaller utility having as few as four employees would even be more hard pressed to restore service to its customers without outside assistance.

For this reason, the Agency's [proposed] rule needs to be modified to allow the use of line clearance tree trimmers during emergencies or other similar situations.

In this regard, the APPA strongly supports the Agency's suggestion that the proposed restriction be * * * replaced by performance-oriented language designed to insure that those clearing lines are aware of the dangers involved at all times and under all circumstances. [DC Tr. 1141–1142]

Mr. Felix noted, however, that restoration work is limited to work performed in the aftermath of a storm, testifying as follows:

Obviously, line clearance work is never done during a storm. After a storm is over, however, line clearance crews' work [is] vital to the effort to clear debris so that the utilities can have their linemen efficiently restore power. [LA Tr. 345]

OSHA recognizes the need for power to be restored quickly after storms. Public safety considerations demand that electric service not be interrupted any longer than necessary.

The Agency's concern in proposing the prohibition on storm and emergency work by line-clearance tree trimmers was that these employees were not trained sufficiently for this type of work. In fact, several accident descriptions submitted to the record tend to support this concern (Ex. 9–6, 53). The widespread objection to this prohibition, however, seems to indicate that line-clearance tree trimmers are trained in emergency restoration work (at least insofar as it involves clearing trees from electric power lines). This training is limited, however, to emergency restoration work performed after, rather than during, a storm.

OSHA is acquiescing to the nearly unanimous opposition to proposed § 1910.269(r)(1)(viii), and the final rule does not include a prohibition of line-clearance work for the restoration of power in the aftermath of a storm. However, the final rule does prohibit line-clearance tree trimming when adverse weather conditions make the work hazardous in spite of the work practices required by § 1910.269 and includes a note explaining what these weather conditions are. Additionally, to ensure that employees who perform line-clearance work in the aftermath of storms or who work under other emergency conditions are properly trained, the Agency is adopting a requirement for specific training in the hazards posed by this type of work. This requirement is contained in final § 1910.269(r)(1)(vi).

In § 1910.269(r)(2), OSHA is adopting requirements for brush chippers. These requirements specify that chippers be equipped with a locking ignition system, that access panels be in place during operation, that the inlet feed hopper be of sufficient length to prevent workers from contacting the blades during operation, that trailer chippers be chocked or secured when not attached to a vehicle, and that employees wear proper protective equipment in the area of operation. (It should be noted that the existing general machine guarding requirements of § 1910.212 continue to apply to brush chippers.) These requirements are derived from Section 5.3 of ANSI Z133.1–1982 and are intended to prevent injury to employees operating or maintaining brush chippers.

The only provision in this proposed paragraph that received comment was the requirement in § 1910.269(r)(2) that brush chipper operators wear eye and face protection. A similar requirement was also proposed for stump cutter operators under paragraph (r)(4)(ii). Many commenters argued that operators of brush chippers and stump cutters did not need full face protection (Ex. 3–38, 3–48, 3–63, 3–69, 3–112, 3–113, 3–118, 3–123, 3–125, 3–128, 58; LA Tr. 346). In fact, Mr. Robert Felix argued that face protection was actually harmful because "those masks fog up, obscure vision and hinder employee communication" (LA Tr. 346).

OSHA is concerned that employees using eye protection alone will not be fully protected from the hazards of flying debris from brush chippers and stump cutters. However, there is insufficient evidence in the record for the final rule to require full face protection on an industry-wide basis. Therefore, the Agency has modified the language of paragraphs (r)(2)(v) and (r)(4)(ii) in final § 1910.269 so that employees must wear personal protective equipment as required by Subpart I. Using such information as the chipper manufacturer's recommendations and the hazards noted during the inspection, OSHA will determine on a case-by-case basis whether or not the hazards at the jobsite warrant full face protection. This is the policy currently in use for tree-trimming operations.

In § 1910.269(r)(3), OSHA is adopting requirements for sprayers and associated equipment. These provisions require walking and working surfaces to be slip-resistant. If the slippery conditions cannot be removed, slip-resistant footwear or handrails meeting the requirements of Subpart D of Part 1910 are required to be used to prevent employees from slipping. In addition, if the spraying operation takes place with the vehicle in motion, the area from which the operator works must be provided with guardrails to protect him or her from falling from the vehicle. These requirements are based on Section 5.4 of ANSI Z133.1–1982.

Paragraph (r)(4) contains requirements for stump cutters. These provisions specify that cutters be equipped with enclosures or guards to protect employees from the blades and debris and that employees wear personal protective equipment in the immediate area of stump grinding operations. These requirements are essentially the same as those contained in Section 5.5 of ANSI Z133.1–1982. Paragraph (r)(4)(ii) of final § 1910.269 has been changed from the proposal as noted earlier.

Paragraph (r)(5) sets forth requirements intended to protect employees from the hazards presented by power saws. Paragraph (r)(5) adopts the requirements of § 1910.266(c)(5)[89] (dealing with instructions for power saw operations). In addition, paragraph (r)(5) of final § 1910.269 contains requirements for starting saws, saw design relative to chain movement and idling speed, saw operation, refueling, cleaning, and other saw maintenance. These requirements are based on Section 6.2 of ANSI Z133.1–1982 and on requirements contained in the draft standard recommended by EEI and IBEW.

Several commenters suggested revising the wording of proposed paragraph (r)(5)(iv) (Ex. 3–11, 3–44, 3–58, 3–69, 3–102). The proposal would have required employees to have "secure footing" when starting a saw. They noted that an employee working in a tree would not have "secure footing" and recommended that the standard require the employee to be in a secure working position instead. OSHA has revised the language of this provision in the final rule to accommodate this concern. The language contained in

[89] OSHA has proposed to revise the logging standard, § 1910.266. The reference in final § 1910.269(r)(5) to the relevant power saw requirements in the logging standard, which were contained in § 1910.266(e)(5) of that proposal, will be revised when the logging standard is promulgated as a final rule.

final paragraph (r)(5)(iv) agrees with the comparable provision proposed in the logging standard, § 1910.266(e)(5)(v), which makes it clear that it is the saw that is to be firmly supported when it is started. (It should be noted that paragraph (r)(5)(vi) prohibits employees from carrying a running saw into a tree.)

In § 1910.269(r)(6), OSHA is adopting requirements for backpack power units. To protect employees operating or maintaining this equipment and other employees in the area, the requirements of the final rule specify that no one other than the operator be within 10 feet (305 cm) of the cutting head of the brush saw, that the unit be equipped with a quick shutoff switch, and that power unit engines be stopped for all cleaning, refueling, adjustments, and repairs. These requirements are based on Section 6.3 of ANSI Z133.1–1982.

Paragraph (r)(7) contains requirements for climbing rope. To protect employees from hazards posed by rope breakage, these provisions require that ropes have a specified minimum strength (taken from section 7.9 of the ANSI standard), that defective or damaged rope not be used, that rope contact with chemicals be avoided, that climbing rope not be spliced to effect repair, that rope ends be secured to prevent unraveling, and that ropes be stored properly. In accordance with the recommendations of NIOSH, OSHA has added, to paragraph (r)(7)(ii), a requirement for inspection of rope before use. The inspection will enable an employee to detect damage and defects.

Proposed § 1910.269(r)(7)(vii) would have required that ropes that could be taken closer to exposed energized lines than the specified minimum approach distances be treated as energized by employees on the ground or in contact with ground unless electrical protective equipment was used.

Several commenters objected to this provision (Ex. 3–20, 3–48, 3–63, 3–80, 3–112, 3–113, 58; LA Tr. 346–347). They argued that it would render the ropes unusable in many situations, including rescue of an injured employee. The NAA offered this explanation, along with an alternative:

> We complained in our pre-hearing Comment that OSHA's proposed § (r)(7)(vii) requirement that all rope brought within the Table R–6 and R–7 minimum separation distances be treated as energized, was unacceptable because it (1) would defeat the long standing safe work practice of line clearance tree trimmers to pull branches back from conductors to permit safe cutting of those branches; (2) would prohibit the use of ropes in effecting tree rescues of employees; and (3) would conflict with the proposed § (r)(1)(iv)(C) practice permitting the roping of branches in line clearance work.
>
> While the proposed requirement to treat as energized all rope brought within the separation distances is so over broad as to wipe out all of the proper uses of rope proximate to overhead conductors, *OSHA indicated at the public hearing that its concern was of a far more limited order:* namely, to prevent the use of "wet or contaminated" ropes proximate to wires (D.C. Tr. 127–130). OSHA asked us to submit an alternative more closely tailored to OSHA's legitimate concerns (id). We therefore propose the following substitute language to replace proposed (r)(7)(vii) [footnote omitted]:
>
> "(vii) Ropes which are (A) wet, or (B) so contaminated so as reasonably to impair their dielectric capacity, or (C) are not considered to be dielectric for the voltage of the wires they are used proximate to, may not be taken closer to exposed energized lines than the clearance distance specified in Table R–6 or R–7." [Ex. 58]

OSHA has accepted the NAA approach. Paragraph (r)(7)(vii) of final § 1910.269 prohibits rope that is wet, contaminated, or otherwise not insulated for the voltage from being used near overhead power lines.

A paragraph providing for fall protection for line-clearance tree-trimming work has been added as § 1910.269(r)(8). This requirement was originally proposed under paragraph (g)(2)(v). A detailed explanation of this provision and of why it was moved is presented in the preamble discussion of final § 1910.269(g)(2)(v).

Paragraph (s). Final § 1910.269(s) addresses communication facilities associated with electric power generation, transmission, and distribution systems. Typical communications installations include those for microwave signaling and power line carriers.

Microwave signaling systems are addressed by paragraph (s)(1). To protect employees' eyes from being injured by microwave radiation, paragraph (s)(1)(i) prohibits employees from looking into an open waveguide or antenna which is connected to an energized source of microwave radiation.

Existing § 1910.97, which covers non-ionizing radiation, prescribes a warning sign with a special symbol indicating non-ionizing radiation hazards. Paragraph (s)(1)(ii) of final § 1910.269 requires areas which contain radiation in excess of the radiation protection guide set forth in § 1910.97 to be posted with the warning sign. Also, the standard requires the lower half of that sign to be labeled as follows:

> Radiation in this area may exceed hazard limitations and special precautions are required. Obtain specific instruction before entering.

The sign is intended to warn employees about the hazards present in the area and to inform them that special instructions are necessary to enter the area.

In § 1910.97, the radiation protection guide is advisory only. Paragraph (s)(1)(iii) of final § 1910.269 makes the guide mandatory for electric utilities by requiring the employer to institute measures that prevent any employee's exposure from being greater than that set forth in the guide. These measures may be of an administrative nature (such as limitations on the duration of exposure) or of an engineering nature (such as a design of the system that limits the emitted radiation to that permitted by the guide) or may involve the use of personal protective equipment.

Power line carrier systems use the power line itself to carry signals between equipment at different points on the line. Because of this, OSHA is requiring, in paragraph (s)(2), that work associated with power line carrier installations be performed according to the requirements for work on energized lines.

Paragraph (t). In many electric distribution systems, electric equipment is installed in enclosures, such as manholes and vaults, set beneath the earth. Paragraph (t) of final § 1910.269 addresses safety for these underground electrical installations. The requirements set forth in this paragraph are in addition to requirements contained elsewhere in the standard (and elsewhere in Part 1910) because paragraph (t) only contains considerations unique to underground facilities. For example, paragraph (e), relating to enclosed spaces, also applies to underground operations involving entry into an enclosed space.

Paragraph (t)(1) requires the use of ladders or other climbing devices for entrance into and exit from manholes and subsurface vaults that are more than 4 feet (122 cm) deep. Because employees can easily be injured in the course of jumping into subsurface enclosures or in climbing on the cables and hangers which have been installed in these enclosures, the standard requires the use of appropriate devices for employees entering and exiting manholes and vaults. The practice of climbing on equipment such as cables and cable hangers is specifically prohibited by paragraph (t)(1).

In the preamble to the proposal, OSHA requested public comment on the appropriateness of requiring ladders or other climbing devices for subsurface enclosures more than 4 feet (122 cm) deep, as opposed to requiring them for shallower enclosures or for deeper enclosures. Three commenters addressed this issue. Rensselaer Polytechnic Institute and EEI supported the 4-foot (122-cm) depth as being appropriate (Ex. 3–22, 3–112). Only Tennessee Valley Authority suggested a different depth, 6 feet (183 cm), but did not provide a reason (Ex. 3–82).

Because the 4-foot (122-cm) depth is consistent with requirements in § 1910.23 (contained in Subpart D of Part 1910) and in paragraph (g)(2)(v) of final § 1910.269 to provide fall protection starting at this height (and in light of the lack of significant opposition), OSHA has carried the proposed provision forward into the final rule without change.

Paragraph (t)(2) requires equipment used to lower materials and tools into manholes or vaults to be capable of supporting the weight and requires this equipment to be checked for defects before use. Paragraph (t)(2) also requires employees to be in the clear when tools or materials are lowered into the enclosure. This provision protects employees against being injured by falling tools and material.

The proposed rule would not have required employees to be clear of tools or material other than hot compounds being lowered into the manhole. Two commenters noted the possibility of injury due to falling objects and suggested that OSHA extend application of this requirement to any tools or material being lowered (Ex. 3–46, 3–107).

The probability that an object will fall while being lowered is not related to whether or not it is a hot compound. Additionally, the likelihood and degree of injury is relatively constant whether or not a hot compound is involved. Therefore, OSHA has decided to extend the application of this provision as suggested. It should be noted that, because work addressed by paragraph (t) of final § 1910.269 exposes employees to the danger of head injury, § 1910.132(a) requires employees to wear head protection when they are working in underground electrical installations.

Paragraph (t)(3) of proposed § 1910.269 would have required attendants for manholes. During the time work was being performed in a manhole which contained energized electric equipment, an employee would have been required to be available in the immediate vicinity (but not normally in the manhole) to render emergency assistance. However, the attendant would have been allowed to enter the manhole, for brief periods, to provide other than emergency assistance to those inside. Also, an employee working alone would have been permitted to enter a manhole briefly for the purpose of inspection, housekeeping, taking readings, or other similar work, if this work could be performed safely.

The provisions in paragraph (t)(3) were proposed so that emergency assistance could be provided to employees working in manholes, where the employees work unobserved and where undetected injury could occur. Taken from existing § 1926.956(b)(1), these proposed requirements were intended to protect employees within the manhole without exposing the attendants outside to a risk of injury greater than that faced by those inside. The existing and proposed standard applied to manholes containing equipment energized at any voltage. However, the EEI/IBEW draft standard suggested that OSHA require attendants only if the voltage exceeded 250 volts. Although it might seem safe to allow employees to work alone in manholes containing equipment energized at 250 volts or less, employees could be seriously injured at these lower voltages under certain conditions. In the preamble to the proposal, OSHA requested public comment on whether an attendant was necessary for entry into manholes or vaults containing electric equipment energized at 250 volts or less. OSHA also requested comments on whether employees should ever be allowed to enter manholes alone and, if so, under what conditions and for what length of time.

Several commenters urged OSHA to require an attendant for all underground operations, regardless of the voltage of electric equipment (Ex. 3–21, 3–46, 3–76). The UWUA noted that there have been fatalities encountered at voltages much less than 250 volts (Ex. 3–76). EEI argued that an attendant was not necessary unless the voltage level presented a hazard (Ex. 3–112). They went on to suggest 250 volts as an appropriate limit.

OSHA believes that the current subpart V regulation is correct in not providing a lower limit on the voltage of energized equipment requiring the presence of an attendant. The National Electrical Safety Code (ANSI C2–1987, Section 426C) also requires an attendant regardless of the voltage of energized equipment (Ex. 2–8). Additionally, at least one of the accidents described in the record involves an employee electrocuted by a voltage lower than 250 volts (Ex. 53). Therefore, the final rule requires an attendant for work involving energized electric equipment regardless of voltage.

Most of the comments received on paragraph (t)(3) supported allowing an employee to work alone, as proposed, when he or she is performing inspections, housekeeping, or similar work (Ex. 3–22, 3–32, 3–103, 3–107, 3–112). They contended that this work could be performed alone safely. Additionally, EEI noted that the NESC permits this type of work to be performed by employees working alone (Ex. 3–112). The UWUA supported allowing this only if it has been clearly established that no work hazards exist, if the manhole is continually ventilated, if there is sufficient clearance from live parts, and if the work does not require contact with or close approach to the live parts (Ex. 3–76; DC Tr. 417). Opposing these views, NIOSH and IBEW Local 17 supported requiring an attendant under all conditions because of the presence of other hazards in enclosed spaces (Ex. 3–21, 3–66).

OSHA has retained the language of proposed paragraphs (t)(3)(ii) and (t)(3)(iii) in the final rule. On balance, the record supports the proposed conditions for permitting work by an employee in a manhole without an attendant. If other hazards in the space warrant the presence of an additional employee, final § 1910.269(e)(7) already requires it. The electrical hazards addressed by the UWUA are covered in final § 1910.269(l). Because the hazards addressed by paragraph (t)(3) are primarily related to electric shock, allowing the attendant to enter the manhole briefly [90] has no significant effect on the safety of the employee he or she is protecting. In case of electric shock, the attendant would still be able to provide assistance. The final rule requires the attendant to be trained in first aid and in CPR as required by final § 1910.269(b)(1) to ensure that CPR and other first aid treatment will be available if needed.

However, if other hazards are believed to endanger the employee in the manhole, paragraph (e)(7) of final § 1910.269 also applies.[91] Paragraph (e)(7) requires attendants for work in an

[90] The attendant is permitted to remain within the manhole only for the short period of time necessary to assist the employee inside the manhole with a task that one employee cannot perform alone. For example, if a second employee is needed to help lift a piece of equipment into place, the attendant could enter only for the amount of time that is needed to accomplish this task. However, if significant portions of the job require the assistance of a second worker in the manhole, the attendant would not be permitted to remain in the manhole for the length of time that would be necessary, and a third employee would be required.

[91] Additionally, as noted in the discussion of paragraph (e), earlier in this preamble, the entry would have to be conducted in accordance with § 1910.146, the generic permit-required confined spaces standard, if paragraphs (e) and (t) of final § 1910.269 do not adequately protect the entrants.

enclosed space (for example, a manhole) if there is reason to believe that a hazard may exist within the space or if a hazard exists because of traffic patterns in the area of the opening to the enclosed space. For example, if the ventilation of the manhole required by paragraph (e)(11) reduces the concentration of flammable vapors to an acceptable level and if failure of the ventilation system could allow the concentration flammable vapors to become hazardous again, an attendant would be required. An attendant is also required when traffic patterns in the area around the manhole opening endanger an entrant exiting the manhole. In such situations, the employee on the surface would be exposed to the same hazards against which he or she is trying to protect the original entrant. Therefore, the final rule does not permit attendants required under paragraph (e)(7) to enter the manhole. To clarify the application of the two different attendant requirements, a note has been added to paragraph (t)(3)(ii) in the final rule. The note indicates that if an attendant is also required under paragraph (e)(7), one person may serve to satisfy both requirements, but is not permitted to enter the manhole.

OSHA has included a second note following paragraph (t)(3)(ii) in the final rule. The note serves as a reminder that paragraph (l)(1) prohibits unqualified employees from working in areas containing unguarded, uninsulated energized lines or parts of equipment.

Under paragraph (t)(3)(iv) reliable communications are required to be maintained among all employees involved in the job, including any attendants, the employees in the manhole, and employees in separate manholes working on the same job. The language of this provision has been modified slightly from that in the proposal for consistency with final § 1910.269(q)(2)(ix), which contains a similar requirement.

Several hearing participants addressed the issue of manhole rescue. The UWUA and Mr. J. Nigel Ellis, President of the Research and Trading Corporation, suggested that OSHA adopt provisions relating to the availability of manhole rescue equipment (Ex. 54; DC Tr. 434, 436–437, 483–488). EEI and IBEW recommended language also addressing this concern (Ex. 56, 64).

OSHA has decided to address rescue under the requirements pertaining to enclosed spaces. The hazards related to rescuing employees working in spaces with restricted means of access are common to all enclosed spaces and are more appropriately covered under provisions dealing with such spaces. The discussion and resolution of this issue can be found in the summary and explanation of final § 1910.269(e)(3).

To install cables into the underground ducts, or conduits, that will contain them, employees use a series of short jointed rods or a long flexible rod inserted into the ducts. The insertion of these rods into the ducts is known as "rodding." The rods are used to thread the cable-pulling rope through the conduit. After the rods have been withdrawn and the cable-pulling ropes have been inserted, the cables can then be pulled through by mechanical means.

Paragraph (t)(4) of § 1910.269 requires the duct rods to be inserted in the direction presenting the least hazard to employees. To make sure that the rod does not contact live parts in the far manhole or vault, the final rule also requires an employee to be stationed at the remote end of the rodding operation.

To prevent accidents resulting from working on the wrong cable, one that may be energized, paragraph (t)(5) requires the identification of the proper cable when multiple cables are present in a work area. The identification must be made by electrical means, unless the proper cable is obvious because of appearance, location, or other means of readily identifying the proper cable.

This provision in the proposal would have allowed distinctive appearance or location to be the only alternative means of identifying the proper cable. Several commenters requested a more performance-oriented approach that would allow for other means of identifying the cable, such as cable tags (Ex. 3–42, 3–62, 3–120, 3–125, 3–128). OSHA has added language in the final rule recognizing any means of readily identifying the correct cable. Additionally, this paragraph was originally proposed as § 1910.269(t)(6), but was switched with proposed paragraph (t)(5) in the final rule.

If any energized cables are to be moved during underground operations, paragraph (t)(6) requires them to be inspected for possible defects that could lead to a fault. (If a defect is found, paragraph (t)(7) applies.) These provisions protect employees against possibly defective cables, which could fault upon being moved, leading to serious injury.

This paragraph, which was proposed as § 1910.269(t)(5), also would have required the cable to be moved under the direct supervision of a qualified employee. Because final § 1910.269(l)(1) already requires such work to be performed by a qualified employee, this additional portion of proposed paragraph (t)(5) is unnecessary. Additionally, at least one commenter misinterpreted the proposal to forbid the employee supervising the work from actually performing it (Ex. 3–62). Therefore, this language has not been carried forward into the final rule.

Since defective energized cables may fail with an enormous release of energy, precautions must be taken to minimize the possibility of such an occurrence while an employee is working in a manhole. Therefore, paragraph (t)(7) proposed to prohibit employees from working in a manhole which contains an energized cable with a defect that could lead to a fault. The proposal listed typical abnormalities that could expose employees to injury as: oil or compound leaking from a cable or joint (splice), a broken cable sheath or joint sleeve, hot localized surface temperatures on a cable or joint, or a joint that is swollen so much that its circumference exceeds 3.5 times the standard sleeve diameter. OSHA invited comments on whether there were additional defects that should be listed. OSHA also invited data on whether any of the listed defects could not possibly lead to a fault in the cable system.

Three commenters contended that it is not unusual to have small amounts of oil or compound leaking from a cable or joint (Ex. 3–20, 3–42, 3–80). They claimed that this would not indicate the presence of an impending fault but would suggest the need for closer inspection and evaluation.

On the other hand, Edison Electric Institute agreed that all the conditions listed in the proposal could be indicators of impending faults, except for the presence of swelling in a joint (Ex. 3–112). They cited surveys of two electric utilities that had disassembled over 100 joints apiece. In both cases, they noted, no evidence was found that a swollen or collapsed lead casing on a cable joint was more susceptible of failure than a joint with no change to its exterior geometry. They argued that there is no basis for OSHA to select a particular circumference formula or measurement as an indication in all instances that a fault is impending.[92]

By contrast, the UWUA testified that joints swollen to any degree posed a threat of failure (Ex. 3–76; DC Tr. 417–418, 427–429, 515–521). Mr. George

[92] EEI also cited an Occupational Safety and Health Review Commission decision that they felt supported their claim (Ex. 56). In fact, the Administrative Law Judge cited proposed § 1910.269(t)(7) in his decision as validating the respondent's measures to protect employees, which he found did not expose employees to unreasonable hazards and conformed to the OSHA proposal (Secretary of Labor v. Consolidated Edison Company of New York, Inc., OSHRC Docket Nos. 88–004, 88–461).

Hollman, on behalf of the UWUA, stated their position as follows:

It has been my experience as a troubleshooter in the emergency department that most of the cable failures that I see have been in fact swollen joints. That we have seen a great number of them that have already exploded and nobody realizes whether in fact it was a swollen joint.

We had on our ["D" fault] procedure which is a procedure utilized by the Edison Company they have the chart for what the circumference of a sleeve should be. The integrity of that joint is compromised considerably when you get the joint swollen beyond the engineering specification.

So our position would be if that if it is a 5.5 inch sleeve, that that is the engineering specification for the sleeve. For them to go beyond that to say that it is okay, the integrity is severely compromised. So we have seen in many instances that upon opening it that water came right out of the bottom, and water and oil do not mix.

So that would tell you immediately that any cable joint that has water in it other than a sleeve which might be from a polyethylene type cable or EPR cable would be in danger of failures. Any type of immersible cable that has water in it is in danger of failure. I think that both sides agree on that.

And it has been my experience that many times when we open up a swollen joint that we find water in it. So we feel that it is definitely assumed to fail, at what point where the sleeve ruptures and starts emitting fluid out of it. I think that when you take a chart and you say well at this point in the chart it is not going to kill you and go one-eighth of an inch more and now it will, I think is ludicrous.

So that has been the argument all along, of where you got the chart from, where did you get the numbers, and where did you say that that is the stress point. What type lead sleeve from one lead sleeve to another manufacturer, which is stronger, how many manufacturers are you utilizing, and who came up with it. And usually we do not get any answers. Somebody just hands you a piece of paper with that sleeve.

And I think that when you take the OSHA standard that you put forward of 3.5, 3.5 of a circumference or a diameter, right away they are going to get bulldozed on that job, and they are going to be confused on what 3.5 is. Because I think that I was a little bit confused on it myself until I really got into it. [DC Tr. 519–521]

Mr. David J. Mahoney of the Los Angeles Department of Water and Power testified that joints on their system were corrected before swelling to the extent cited in the proposal (LA Tr. 457–458).

OSHA considers the conditions listed in the proposal as indications that a cable or joint is not normal and may be in danger of failing. If a cable is leaking, it is certainly capable of allowing the entrance of moisture (which is an undisputed cause of faults). In certain cases, an employer may be able to demonstrate that a particular condition is not related to a possible fault-producing state. There is some evidence in the record, for example, that a joint that is swollen is not in danger of failing unless other conditions, such as the presence of higher than normal temperatures or leaks, also exist (Ex. 46). Unfortunately, the record does not contain good evidence of what symptoms a joint or cable displays before failing. (Since the fault destroys most of the available evidence, this is not surprising.) However, the record does demonstrate what the likely consequences of employee exposure to a fault on an underground power line—severe burns, possibly resulting in death (Ex. 6–16). Additionally, the conditions listed in the proposal are considered abnormal, requiring the use of protective measures.

OSHA has concluded that employees may work in a manhole that contains a cable with abnormalities only when service load conditions and feasible alternatives prevent deenergizing the cable and only when the employees are protected from a failure. Rather than specify the precise conditions requiring protective measures, paragraph (t)(7) of final § 1910.269 presumes that certain conditions are indicative of a problem, as follows:

Where a cable in a manhole has one or more abnormalities that could lead to or be an indication of an impending fault, the defective cable shall be deenergized before any employee may work in the manhole, except when service load conditions and a lack of feasible alternatives require that the cable remain energized. In that case, employees may enter the manhole provided they are protected from the possible effects of a failure by shields or other devices that are capable of containing the adverse effects of a fault in the joint.

Note: Abnormalities such as oil or compound leaking from cable or joints, broken cable sheaths or joint sleeves, hot localized surface temperatures of cables or joints, or joints that are swollen beyond normal tolerance are presumed to lead to or be an indication of an impending fault.

The abnormalities listed in proposed paragraph (t)(7) have been moved to a note following this provision in the final rule. The criterion for determining the amount of acceptable swelling has also been revised to indicate that joints "that are swollen beyond normal tolerance" are presumed to be an abnormality. The note states that the listed conditions are presumed to lead to or be an indication of a possible impending fault. An employer could demonstrate that any one of these conditions, in a particular case, is not indicative of an impending fault, in which case § 1910.269(t)(7) would not require protective measures to be taken.

Under some service load conditions, it may not be feasible for the electric utility to deenergize the cable with the defect at the same time that another line is deenergized for maintenance work. In such cases, paragraph (t)(7) of final § 1910.269 allows the defective cable or splice to remain energized as long as the employees in the manhole are protected against the possible effects of a failure. For example, a ballistic blanket wrapped around a defective splice can protect against injury from the effects of a fault in the splice.

Some commenters noted that handling a conductor to wrap a protective blanket around it may itself induce the impending fault to occur (Ex. 3–20, 3–80). The UWUA was concerned that a ballistic blanket might not provide complete protection (Ex. 3–76; DC Tr. 519).

Paragraph (t)(7) requires employees to be protected by shields capable of containing the adverse effects of a failure. The energy that could be released in case of a fault is known, and the energy absorbing capability of a shield can be obtained from the manufacturer or can be calculated. As long as the energy absorbing capability of the shield exceeds the available fault energy, the shield will protect employees. Employees are required to be protected, regardless of the type of shielding device used and of how it is applied. Additionally, the standard permits this option to be used only "if the defective cable or splice cannot be deenergized due to service load conditions". Employers are required to use alternatives such as those mentioned by Mr. Eugene Briody (for example, the use of shunts or other means of supplying areas with power [DC Tr. 518–519]) whenever feasible before allowing access.

Paragraph (t)(8) requires metallic sheath continuity to be maintained while work is performed on underground cables. Bonding across an opening in a cable's sheath protects employees against shock from a difference in potential between the two sides of the opening.

Several commenters objected to this requirement (Ex. 3–32, 3–42, 3–45, 3–62, 3–112, 3–123). They generally argued that it was not always possible to provide a bonding jumper across the opening in the sheath. Some cited the problems of jacketed cables (Ex. 3–32, 3–112), one cited corrosion problems (Ex. 3–123), and others simply suggested allowing alternatives (Ex. 3–42, 3–45, 3–62).

The Lineman's and Cableman's Handbook describes the purpose behind bonding cable sheaths as follows:

Cable Bonding and Grounding. The purpose of bonding and grounding the cable sheaths is to maintain them at or near ground potential. A No. 2 AWG copper wire is generally used. It must be attached to the sheaths with a special bond clip which is soldered to the wire and sheath and connected to a low-resistance ground.

Bonding and grounding reduce the likelihood of arcing between the sheath of a faulted cable and other nearby sheaths. It thus reduces the danger to cablemen who may be in a manhole when a cable fault occurs. It also minimizes the harmful effects of corrosive action due to stray currents.[93] [Ex. 8–5]

While this description relates to the permanent installation of grounds and bonding jumpers on cable installations, it nonetheless holds true for temporary bonding across the opening in a sheath. Under fault conditions, the voltage difference between the two sides of the opening can reach lethal levels if proper bonding is not in place. This hazard is currently recognized in § 1926.956(c)(7), which contains a requirement equivalent to the one being adopted in final § 1910.269(t)(8). The final rule is performance oriented, accepting any method of ensuring continuity that limits potential differences to safe levels (per § 1910.269(n)(3)). However, as noted by Union Carbide Corporation, there are certain periods, such as during the cable stripping process, when cable sheath continuity cannot be maintained (Ex. 3–45). They recommended that the standard allow the use of electrical protective equipment during these periods. OSHA agrees with Union Carbide, and paragraph (t)(8) of final § 1910.269 allows the cable sheath to be treated as energized in lieu of bonding. (The voltage to which the sheath is to be considered energized is equal to the maximum voltage that could be seen across the sheath under fault conditions.) This is consistent with other parts of the final rule, such as paragraph (l)(9), which recognize treating objects as energized as an alternative to grounding.

Paragraph (u). Paragraph (u) of final § 1910.269 addresses work performed in substations. As is the case elsewhere in the standard, the provisions of this paragraph are intended to supplement (rather than modify) the more general requirements contained in other portions of § 1910.269, such as paragraph (l) on minimum approach distances.

Paragraph (u)(1) requires enough space to be provided around electric equipment to allow ready and safe access to and operation and maintenance of the equipment. This rule prevents employees from contacting exposed live parts as a result of insufficient maneuvering room. A note has been included to recognize, as constituting compliance, the provisions of ANSI C2–1987 for the design of workspace for electric equipment.

Some commenters objected to the application of this provision to installations made before the standard's effective date (Ex. 3–20, 3–22, 3–80, 3–82, 3–101, 3–112; DC Tr. 833–836). Arguing that this pointed out the need for an omnibus grandfather clause, they claimed that older substations do not meet the access and working distances specified in the latest ANSI standards. They noted that these facilities were built under standards in effect at the time of installation. Mr. Howard D. Wilcox, representing EEI, testified on this subject as follows:

> One of the best examples of the need for a grandfather clause is electric substations. A substation is a facility that transforms electricity from one voltage to another.
>
> In certain types of substations, there are buildings that house control switches, relays and associated circuitry. The purpose of this equipment is to control circuit breakers that are located in the substation yard. Photo No. 1 shows the front of one of these panels. You can see that it has been around for a while.
>
> The reverse side of these panels must be periodically accessed by relay technicians, substation mechanics and other qualified personnel to perform inspections and tests.
>
> As you can see in Photo NO. 2, the clearances between panels in these older stations is less than 30 inches and in this station is about 23 inches from the back of both of those panels.
>
> Paragraph (u) of the proposal as written calls for sufficient access and working space to be provided in accordance with the National Electric [sic] Safety Code, ANSI C2–1987, which would require a 30-inch clearance between the panels.
>
> A significant number of older indoor substations do not comply with ANSI C2–1987 because they were built prior to the 30-inch requirement. However, ANSI C2 contains a grandfather provision which exempts existing facilities from its design requirements.
>
> The preamble to this proposed rule recognizes that "older installations may not meet the exact dimensions set forth in the latest version" of the National Electric Safety Code, and notes that the agency believes the language of the standard to be sufficiently performance-oriented to exempt these older installations.
>
> The actual language of the proposed standard, however, merely requires sufficient access and working space and references the 1987 version of the National Electric Safety Code.
>
> We are concerned, therefore, that the standard could be interpreted as requiring strict compliance with the National Electric Safety Code clearance requirements even though the NESC itself "grandfathers" the existing equipment.
>
> If so, compliance with the standard would require massive retrofitting of numerous older substations, which, although they provide adequate access and working space, do not provide the full clearances required by ANSI C2–1987.
>
> In order to perform the retrofit, the substation control houses would have to be completely rebuilt. Present cost for a complete 138 kV/46 kV substation control house is in the order of $350,000 for material, labor, engineering and overheads on the Consumers Power Company system.
>
> Rebuild of the substation control house shown in Photos Nos. 1 and 2, which has a significantly larger number of outgoing circuits, would be in the $900,000 range on the Consumers Power Company system.
>
> I cannot begin to estimate what the capital cost to the entire industry would be, and what the impact on the nation's electric system and customers would be, if we had to systematically shut down older substations and completely rebuild their control houses to provide for this extra clearance.
>
> The number of accidents experienced in this environment on the Consumers Power Company System in the time I have been with the company is zero.
>
> We, as all other utilities, provide safe work practices and equipment to allow working in this environment, such as insulated tools, rubber gloves, and protective cover-up. (DC Tr. 833–836)

As noted in the preamble to the proposal, OSHA realizes that older installations may not meet the dimensions set forth in the latest version of the national consensus standard. The Agency continues to believe that the language of proposed § 1910.269(u)(1) is sufficiently performance oriented that older installations built to specifications in the standards that were in effect at the time they were constructed would meet the requirement for sufficient workspace provided that the installation and work practices used enable employees to perform work safely within the space and to maintain the minimum approach distances specified in paragraph (l)(2). The note for this provision clearly states that the NESC specifications are *guidelines*. The ANSI standard is specifically not being incorporated by reference here. To clarify the guidelines in the final rule, OSHA has included the following language in the note to paragraph (u)(1):

> **Note:** Guidelines for the dimensions of access and workspace about electric equipment in substations are contained in American National Standard-National Electrical Safety Code, ANSI C2–1987. Installations meeting the ANSI provisions comply with paragraph (u)(1) of this section. An installation that does not conform to this ANSI standard will, nonetheless, be considered as complying with paragraph

[93] Kurtz, Edwin B., and Shoemaker, Thomas M., *The Lineman's and Cableman's Handbook*, Sixth Edition, 1981, McGraw-Hill Book Co., p. 33–13.

(u)(1) of this section if the employer can demonstrate that the installation provides ready and safe access based on the following evidence:

(1) That the installation conforms to the edition of ANSI C2 that was in effect at the time the installation was made,

(2) That the configuration of the installation enables employees to maintain the minimum approach distances required by paragraph (l)(2) of this section while they working on exposed, energized parts, and

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

This language accomplishes three goals. First, it explains that an installation need not be in conformance with ANSI C2-1987 in order to be considered as complying with final § 1910.269(u)(1). Second, it informs employers whose installations do not conform to the latest ANSI standard of how they can demonstrate compliance with the OSHA standard. Third, it ensures that, however old an installation is, it provides sufficient space to enable employees to work within the space without significant risk of injury.

The Agency has not adopted Mr. Wilcox's suggested complete exemption of older installations from final paragraph (u)(1). The basic rule is for the equipment to provide adequate access and working space. Even Mr. Wilcox believes that his company's older installations meet this. If a facility does not provide sufficient space, it poses a hazard to employees and should be modified. Based on the record, however, OSHA believes that the vast majority of installations were made in accordance with standards in effect at the time they were built. In such cases, the working and access space involved should normally be sufficient, and the note in the final rule ensures that it is.

Paragraph (u)(2) requires draw-out-type circuit breakers to be inserted and removed while the breaker is in the open position. (A draw-out-type circuit breaker is one in which the removable portion may be withdrawn from the stationary portion without the necessity of unbolting connections or mounting supports.) Additionally, if the design of the control devices permits, the control circuit for the circuit breaker would have to be rendered inoperative. (Some circuit breaker and control device designs do not incorporate a feature allowing the control circuit for the breaker to be rendered inoperative.) These provisions are intended to prevent arcing which could injure employees.

Because voltages can be impressed or induced on large metal objects near substation equipment, paragraph (u)(3) requires conductive fences around substations to be grounded. Continuity across openings is also required in order to eliminate voltage differences between adjacent parts of the fence.

Paragraph (u)(3)(ii) proposed the locking of unattended substations. Two commenters suggested limiting the application of this rule to substations containing exposed live parts (Ex. 3-34, 3-45). One of them made a similar comment regarding proposed paragraph (u)(4)(i), which contains the same requirement (Ex. 3-34).

OSHA has decided to omit proposed paragraph (u)(3)(ii) from the final rule. The hazard it addressed is covered in the same manner in final § 1910.269(u)(4), discussed next.

Paragraph (u)(4) addresses the guarding of energized parts. In the proposal, all rooms and spaces containing electric supply lines or equipment would have been required to be enclosed within fences, screens, partitions, or walls to prevent unqualified persons from entering. The entrances to such rooms and spaces would have been required to be locked or attended, and warning signs would have been required. These provisions, which were proposed in paragraph (u)(4)(i), were intended to prevent unqualified persons from gaining access to high voltage equipment and from contacting exposed live parts.

Several other commenters suggested changing the phrase "unqualified persons" to "unauthorized employees" (Ex. 3-11, 3-44, 3-58, 3-69, 3-102, 3-112, 3-123). Two of them maintained that the rule would preclude apprentices from entering the area containing energized electric supply equipment (Ex. 3-44, 3-58, 3-102). Others argued that the word "qualified" was too restrictive and that it would prevent activities such as meter reading, inspection, and engineering from these areas (Ex. 3-11, 3-69, 3-112, 3-123). Two additional commenters urged OSHA to limit the application of the rule to areas accessible to the public (Ex. 3-20, 3-80).

OSHA does not agree that the requirement is too restrictive with respect to which persons are denied access to hazardous areas. The term "authorized employee" is not appropriate for use in this rule. The definition of this term restricts its use to requirements dealing with the control of hazardous energy sources.[94] Even assuming that the commenters intended the EEI/IBEW draft definition of "authorized employee" to apply, the Agency believes that the definition in their draft standard would result in a requirement that is no less restrictive than the OSHA rule. Their definition reads as follows:

A qualified employee to whom the authority and responsibility *to perform a specific assignment* has been given by the employer. (Ex. 2-3, emphasis supplied in the original document)

Thus, under the EEI/IBEW draft standard, a person would still have to be "qualified" to be an "authorized employee". (The issue of whether OSHA's definition of "qualified employee" is too restrictive is discussed under the summary and explanation of § 1910.269(x).)

OSHA believes that it is important to prohibit unqualified persons from areas containing energized electric supply equipment regardless of the work they would be performing. Employees working in these areas must be trained in the hazards involved and in the appropriate work practices, as required by paragraph (a)(2)(ii). Otherwise, they would not be able to distinguish hazardous circuit parts from non-hazardous equipment and would not be familiar with the appropriate work practices, regardless of the jobs they are performing. There are accidents described in the record that involve contact of unqualified persons with energized parts in such areas. Accidents of this type responsible for the deaths of three employees were described in Exhibit 9-2.

For these reasons, the Agency has retained the term "unqualified persons" in final § 1910.269(u)(4).

As noted earlier, two commenters suggested revising the restrictions on access by unqualified persons to apply only to areas containing exposed live parts, at least with respect to industrial installations (Ex. 3-34, 3-45).

OSHA agrees with these commenters, at least in part. Section 1910.269 is intended to apply to electrical installations that are largely unregulated. The Subpart S installation standards typically do not apply, and the electric equipment may pose hazards in addition to those of exposed live parts. For example, equipment enclosures may be ungrounded. If the requirements of Subpart S are not being met, then it is important to prevent unqualified persons from gaining access

[94] *Authorized employee*—"An employee who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance covered under this section."

to areas containing electric supply equipment.

If, on the other hand, the installation conforms to Subpart S, at least with respect to the guarding of live parts and to the grounding of enclosures for these parts, the provisions of proposed paragraph (u)(4)(i) are unnecessary. In Subpart S, suitable protection is provided in a similar, though not identical, requirement contained in § 1910.303(h)(2). This requirement in Subpart S, along with §§ 1910.303(g)(2) and 1910.304(f)(5), provides safety to employees equivalent to that provided by proposed § 1910.269(u)(4)(i). These provisions prohibit unqualified persons from accessing areas containing exposed live parts operating at 50 volts through 600 volts and located less than 8 feet above the floor or other working surface. Unqualified persons are also prohibited from areas containing live parts operating at more than 600 volts, unless the live parts are completely enclosed in metal enclosures or are installed at an elevation of at least 8 feet, 6 inches. The metal enclosures must be grounded, and the minimum height increases with increasing voltage.

In the final rule, OSHA is adopting requirements that follow the Subpart S approach to excluding unqualified persons from access to unsafe areas. Final § 1910.269(u)(4) sets forth criteria for access by unqualified persons to spaces containing electric supply lines or equipment that are equivalent to those contained in Subpart S, with one exception. Paragraph (u)(5)(i) of final § 1910.269 does not permit the installation of unguarded live parts operating at more than 150 volts, although it does recognize "guarding by location". Following these guidelines, paragraph (u)(4)(i) divides areas containing electric supply equipment into three categories, rather than two, as follows:

(1) areas where exposed live parts operating at 50 to 150 volts to ground are located within 8 feet of the ground or other working surface,

(2) areas where live parts operating at between 150 and 601 volts and located within 8 feet of the ground or other working surface are guarded only by location, as permitted under paragraph (u)(5)(i), and

(3) areas where live parts operating at more than 600 volts are located, unless:

(a) the live parts are enclosed within grounded, metal-enclosed equipment whose only openings are designed so that foreign objects inserted in these openings will be deflected from energized parts, or

(b) the live parts are installed at a height above ground and any other working surface that provides protection at least equivalent to an 8-foot height at 50 volts.

Paragraphs (u)(4)(ii) through (u)(4)(v) contain the requirements that apply to these areas. The areas have to be so enclosed as to minimize the possibility that unqualified persons will enter; warning signs have to be displayed; and entrances not under the observation of an attendant have to be kept locked. Additionally, unqualified persons are not permitted to enter these areas while the electric supply lines or equipment are energized.

With these changes, OSHA has codified the provisions in the final rule that are equivalent to proposed paragraph (u)(4)(i) as entire paragraph (u)(4). The remaining requirements of proposed paragraph (u)(4) (proposed as § 1910.269(u)(4)(ii) through (u)(4)(iv)) have been placed under paragraph (u)(5) in final § 1910.269.

Paragraph (u)(5)(i) requires live parts operating at more than 150 volts to be guarded (by physical guards or by location) or insulated. This provision protects qualified employees from accidentally contacting energized parts. Guidance for clearance distances appropriate for guarding by location can be found in ANSI C2. Installations meeting ANSI C2–1987 are considered to meet paragraph (u)(5)(i), which is based on Section 124A.1 of that standard.

Several interested parties made comments to this paragraph (proposed § 1910.269(u)(4)(ii)) that were similar to the comments on paragraph (u)(1), discussed earlier (Ex. 3–62, 3–65, 3–80, 3–82, 3–112). Namely, they claimed that older installations did not meet current ANSI standards. OSHA has used the same approach in the final version of this provision as the Agency used under the earlier requirement. In this case, OSHA will consider installations that do not meet ANSI C2–1987 as meeting paragraph (u)(5)(i) provided the employer can demonstrate that the installation provides sufficient clearance based on the following evidence:

(1) That the installation meets the requirements of the edition of ANSI C2 that was in effect at the time the installation was made,

(2) That each employee is isolated from live parts at the point of closest approach, and [95]

(3) That the precautions taken protect employees to the same degree as the clearances specified in ANSI C2–1987.

This approach affords employers flexibility in complying with the standard and affords employees protection from injury due to sparkover from live circuit parts.

Paragraph (u)(5)(ii) provides that the guarding of live parts within a compartment be maintained during operation and maintenance functions. This guarding is intended to prevent accidental contact with energized parts and to prevent objects from being dropped on energized parts. However, since access must be gained to energized equipment by qualified employees, an exception to this proposed requirement allows the removal of guards for this purpose. In such cases, paragraph (u)(5)(iii) protects other employees working nearby by requiring the installation of protective barriers around the work area.

So that employees can receive pertinent information on conditions that affect safety at the substation, paragraph (u)(6)(i) requires employees who do not regularly work at the station to report their presence to the employee in charge. Typical conditions affecting safety in substations include the location of energized equipment in the area and the limits of any deenergized work area. Paragraph (u)(6)(ii) requires this specific information to be communicated to employees during the job briefing required by paragraph (c) of final § 1910.269.

Paragraph (v). Paragraph (v) of final § 1910.269 contains requirements pertaining to electric power generating plants and to work practices used in these plants. As is the case elsewhere in the standard, the provisions of paragraph (v) are intended to supplement (rather than modify) the other more general requirements of § 1910.269.

Paragraph (v)(1)(i) requires the employer to maintain interlocks and other safety devices (such as relief valves) in a safe and operable condition. This requirement ensures that these devices perform their intended function of protecting workers when called upon to do so. To ensure further that these devices remain operable, paragraph (v)(1)(ii) prohibits them from being modified to defeat their function, except as necessary for the test, repair, or adjustment of the device.

Three commenters suggested allowing safety devices to be modified when necessary to permit operations to continue (Ex. 3–20, 3–80, 3–112).

No evidence was presented to demonstrate why defeating a safety

[95] An employee is isolated from an energized part if the installation prevents the employee from coming within the withstand distance for the voltage involved. Appendix ——— contains information on determining withstand distances.

device would be necessary nor was any evidence given as to how this could be accomplished without endangering employees. These devices are required by safety codes (such as the NESC) and are installed to protect persons from hazards posed by different types of equipment. For example, pressure vessels are commonly equipped with safety relief valves so that the safe operating pressure of the vessel is not exceeded. Defeating this valve would expose employees to possible explosion, a widely recognized hazard. OSHA does not believe that these devices could be defeated without exposing employees to hazards, so paragraph (v)(1)(ii) has been adopted as proposed.

Sometimes the brushes on a generator or exciter must be replaced while the machine is in operation. This work is unusually hazardous, and extreme caution must be observed by employees performing the job. To protect these workers, paragraph (v)(2) contains requirements for replacing brushes while the generator is in service. Since field windings and exciters are operated in an ungrounded condition, there is no voltage with respect to ground on the brushes as long as there is no ground fault in the circuit. So that no voltage to ground is present while employees are changing the brushes, paragraph (v)(2) requires the exciter-field circuit to be checked to ensure that a ground condition does not exist.

Paragraph (v)(2) in the proposal also contained the following requirement:

> If the equipment has ground protecting devices, the protective devices shall be disconnected and tagged before brushes are changed.

Several commenters objected to this requirement (Ex. 3–42, 3–61, 3–82, 3–112, 3–123). They maintained that this provision was unnecessary. EEI stated that "[c]ontinuation in service of ground detection/protection devices is advantageous to reliability of service" (Ex. 3–112). They recommended substitution of the following EEI/IBEW provision (from which the OSHA proposal was taken):

> Where such equipment has ground protecting devices, such devices shall be disconnected and tagged before changing brushes.

The proposed OSHA paragraph simply corrected grammatical errors in the EEI/IBEW version. Accepting EEI's suggested language would not overcome the objections to this provision.

Mr. G.F. Stone of the Tennessee Valley Authority (TVA) aptly described the purpose of disconnecting ground protecting devices and the reasons for their opposition to this requirement as follows:

> The ground protecting devices are disconnected before the brushes are changed for operational reasons and not for employee protection.
>
> The ground protecting device serves to trip the generator when a ground condition is detected on the generator field, but only for equipment protection. The ground protecting devices are disconnected only to ensure the generator does not trip off line while the brushes are being changed and not for protecting employees from electrical hazards. While employees are changing brushes they are exposed to a maximum of 375 volts dc from the positive brush to the negative brush regardless of whether or not the ground protecting devices are disconnected.
>
> Employee protection is provided by an insulative barrier of fiber board between the positive and negative brushes, following safe operating and maintenance procedures, and training employees in safe methods to change brushes. However, disconnecting the ground protecting devices does not provide employee protection.
>
> This requirement would require unnecessary costs due to tagging equipment without increasing the level of protection provided the employee. [Ex. 3–82]

The Agency has accepted TVA's recommendation and has not carried the proposed requirement forward into final § 1910.269(v)(2).

Paragraph (v)(3) requires enough space to be provided around electric equipment to allow ready and safe access to and operation and maintenance of the equipment. This rule prevents employees from contacting exposed live parts as a result of insufficient maneuvering room. A note has been included to recognize, as constituting compliance, the provisions of ANSI C2–1987 for the design of workspace for electric equipment.

Several interested parties made comments to this paragraph that were similar to the comments on paragraph (u)(1), discussed earlier (Ex. 3–20, 3–22, 3–80, 3–82, 3–102). Namely, they claimed that older installations did not meet current ANSI standards. OSHA has used the same approach in the final version of this provision as the Agency used under the earlier requirement. The language in the note following paragraph (v)(3) includes a statement regarding older installations. This language is identical to that contained in the note following paragraph (u)(1), except that the paragraph references are different. (See the summary and explanation of paragraph (u)(1), earlier in this preamble for a discussion of this language.)

Paragraphs (v)(4) and (v)(5) contain requirements on the guarding of energized parts. Comments on these provisions were similar to the ones on proposed § 1910.269(u)(4), which has been split in the final rule into paragraphs (u)(4) and (u)(5). These two sets of provisions contain equivalent requirements for guarding live parts, with paragraphs (u)(4) and (u)(5) of final § 1910.269 applying to substations and paragraphs (v)(4) and (v)(5) applying to generating plants. OSHA has adopted the same changes, based on the record, in both places in the final rule. For discussion of the rationale behind these changes and the comments upon which they were based (as well as suggestions that were not accepted), see the summary and explanation of paragraphs (u)(4) and (u)(5) earlier in this preamble.

Paragraph (v)(4)(i) divides areas containing electric supply equipment into three categories, rather than two, as follows:

(1) areas where exposed live parts operating at 50 to 150 volts to ground are located within 8 feet of the ground or other working surface,

(2) areas where live parts operating at between 150 and 601 volts and located within 8 feet of the ground or other working surface are guarded only by location, as permitted under paragraph (v)(5)(i), and

(3) areas where live parts operating at more than 600 volts are located, unless:

(a) the live parts are enclosed within grounded, metal-enclosed equipment whose only openings are designed so that foreign objects inserted in these openings will be deflected from energized parts, or

(b) the live parts are installed at a height above ground and any other working surface that provides protection at least equivalent to an 8-foot height at 50 volts.

Paragraphs (v)(4)(ii) through (v)(4)(v) contain the requirements that apply to these areas. The areas have to be so enclosed to minimize the possibility that unqualified persons will enter; warning signs have to be displayed; and entrances not under the observation of an attendant have to be kept locked. Additionally, unqualified persons are not permitted to enter these locations while the electric supply lines or equipment are energized.

Paragraph (v)(5)(i) requires live parts operating at more than 150 volts to be guarded (by physical guards or by location) or insulated. This provision protects qualified employees from accidentally contacting energized parts. Guidance for clearance distances appropriate for guarding by location can be found in ANSI C2. Installations meeting the ANSI provisions comply with paragraph (v)(5)(i). Installations meeting ANSI C2–1987 are considered to meet paragraph (v)(5)(i), which is based on Section 124A.1 of that standard.

Several interested parties made comments to this paragraph that were similar to the comments on paragraph (u)(5)(i), discussed earlier (Ex. 3–80, 3–82, 3–112, 3–120). Namely, they claimed that older installations did not meet current ANSI standards. OSHA has used the same approach in the final version of this provision as the Agency used under the earlier requirement. The language in the note following paragraph (v)(3) includes a statement regarding older installations. This language is identical to that contained in the note following paragraph (u)(5)(i), except that the paragraph references are different. (See the summary and explanation of paragraph (u)(5)(i), earlier in this preamble for a discussion of this language.)

Paragraph (v)(5)(ii) provides that the guarding of live parts within a compartment be maintained during operation and maintenance functions. This guarding is intended to prevent accidental contact with energized parts and to prevent objects from being dropped on energized parts. However, since access must be gained to energized equipment by qualified employees, an exception to this proposed requirement allows the removal of guards for this purpose. In such cases, paragraph (v)(5)(iii) protects other employees working nearby by requiring the installation of protective barriers around the work area.

Paragraph (v)(5) of proposed § 1910.269 addressed the breaking of pressure connections. Paragraph (v)(5)(i) would have required lines which exposed employees to hazardous pressures or temperatures to be isolated, drained, and locked out or tagged in accordance with proposed § 1910.269(d) before a valve bonnet or stuffing box gland was moved or removed and before a flanged joint or other pressure connection was broken. Paragraph (v)(5)(ii) would have required that the bolts, nuts, or other fasteners be loosened after locking out or tagging the line.

Several commenters were concerned that proposed paragraph (v)(5) would not permit adjusting or repacking valves while they were in service (Ex. 3–42, 3–112, 3–120, 56; DC Tr. 828–829). EEI argued that this provision would require locking or tagging out of equipment that could be safely worked while it was in service. They illustrated their problem with examples, as follows:

Examples are re-packing valves which are backseated, adjusting pump packing glands, retorquing pressure boundary bolts per manufacturers' instructions (such as feedwater heater heads, boiler feed pump casings, turbine shell bolts) after heating, effecting temporary leak repairs by applying clamp-on covers, connecting/disconnecting instrumentation, etc. [Ex. 3–112]

These rulemaking participants urged OSHA to adopt provisions specifically permitting this type of work under procedures established by the employer and performed by employees trained in this operation. Additionally, Mr. Stephen R. Marsh of Rensselaer Polytechnic Institute urged OSHA to provide an alternative to loosening bolts, nuts, and other fasteners to recognize the fact that these devices sometimes freeze in place and have to be broken off (Ex. 3–22).

OSHA does not believe the incorporation of these suggestions is necessary. The proposed paragraph was intended to provide requirements that would supplement the lockout and tagging requirements of paragraph (d). The proposed requirements provided specific procedures on how lines were to be relieved of hazardous temperatures and pressures. It was not intended to require the deenergizing of equipment that would not otherwise be required to be locked out or tagged out under paragraph (d). However, the comments received on proposed paragraph (v)(5) indicate that this was not clear. OSHA believes that employees are fully protected from the hazards associated with the control of hazardous energy sources under final § 1910.269(d) and that the provisions proposed in paragraph (v)(5) are unnecessary. The employer's lockout and tagging procedures required under paragraph (d) will state exactly how employees are to be protected from the hazards related to the control of hazardous temperatures and pressures in lines.

Boilers are an essential part of steam-driven electric generating plants. Water is heated and converted to steam, which in turn drives the steam turbine generating equipment. Boilers, whether of the water tube or fire tube type, contain water and steam spaces that must be entered periodically for maintenance. Paragraph (v)(6) of final § 1910.269 contains two provisions relating to some of the hazards involved. (An introductory sentence has been added to this paragraph in the final rule to clarify that it applies to work in water and steam spaces associated with boilers.)

Paragraph (v)(6)(i) requires an inspection to be undertaken by a designated person to ensure that work can be initiated safely. To protect employees who may have to reenter the work area from hazards arising from incomplete work or other problems that may have occurred during the course of work, this paragraph also requires a similar inspection to be performed after work is completed. As a further precaution, this paragraph requires employees to wear eye or face protection during cleaning operations.

Proposed paragraph (v)(6) only specified eye protection. However, as noted previously, the provisions of § 1910.269 are intended to supplement the other requirements of OSHA's General Industry Standards in Part 1910. Section 1910.132(a) already requires employees to wear full face protection any time it is necessary for their protection. So that it is clear that final § 1910.269 does not reduce the protection afforded by § 1910.132, paragraph (v)(6)(i) of final § 1910.269 requires full face protection if it is necessary.

Paragraph (v)(6)(ii) requires provisions to be made to shield employees working near the end of water or steam tubes during cleaning operations.

In § 1910.269(v)(7), OSHA is promulgating requirements for the chemical cleaning of boilers and pressure vessels. These requirements specify that areas be cordoned off to restrict access during cleaning and that the number of workers in the area be limited to those needed to do the operation. Because of the flammability of chemicals used in cleaning and the possibility of flammable gases in the boiler or pressure vessel, the standard prohibits smoking, welding, and other ignition sources during cleaning operations. In addition, requirements are set forth for the use of protective clothing, goggles, boots, and gloves and for the availability of water or showers in the general area of work. (A note has been included after paragraph (v)(7)(iii) in final § 1910.269 to indicate that § 1910.141 contains requirements related to water supply and to washing facilities.) These provisions recognize the safety hazards of chemical cleaning and are intended to minimize risks to employees during these operations.

Mr. Robert L. Barham of the Carolina Power and Light Company suggested restricting the application of provisions addressing the hazards of flammable materials to cleaning operations that used such materials (Ex. 3–23). OSHA has accepted his recommendation and has revised the final rule accordingly.

Paragraph (v)(8) of final § 1910.269 contains requirements for chlorine system safety. (These requirements, of course, are in addition to other provisions in Part 1910 addressing the hazards of exposure to chlorine, such as those in Subparts I and Z. These subparts also have application to some of the other hazards addressed by paragraph (v), such as paragraph (v)(8) on chlorine systems.) OSHA is requiring gaseous chlorine system enclosures to be posted with signs restricting entry and warning of the hazards. Entry into the restricted area is permitted only for designated employees equipped with personal protective equipment and is limited to the number required to perform the task. In addition, OSHA requires repair kits (for the emergency repair of chlorine leaks) to be available. Chlorine tanks, pipes, and equipment must also be purged and isolated from other sources of chlorine before repair operations begin. Lastly, OSHA requires the employer to take precautions to prevent the accidental mixing of chlorine with reactive materials that could produce a hazardous situation.

Paragraph (v)(9) of final § 1910.269 contains requirements for boiler repair work. These requirements specify that boiler furnaces and ash hoppers be inspected for possible falling objects, such as failed liners, before repair work is begun. If this hazard exists, overhead protection is required to be provided. An employer could instead choose to remove objects that could fall and injure employees. Obviously, after the hazard is removed, no overhead protection would be required. Additionally, OSHA requires employees to stand clear of the opening of an operating boiler when opening the door to prevent injury which may be caused by hot gases escaping from the open door.

Paragraph (v)(10) of final § 1910.269 contains requirements for turbine-generator systems. Turbine generators are typically cooled by air or hydrogen circulated by fans mounted on the generator rotor. The requirements of paragraph (v)(10) address the fire and explosion hazards of hydrogen in turbine generators and are based on requirements in the draft standard recommended by EEI and IBEW. These requirements prohibit smoking or other ignition sources near hydrogen or hydrogen sealing systems and require the posting of signs warning of the explosion hazard (paragraph (v)(10)(i)). In addition, conditions of excessive hydrogen makeup or abnormal pressure loss are considered to be an emergency situation requiring correction (paragraph (v)(10)(ii)), and a quantity of inert gas suitable for purging hydrogen from generators is required to be available (paragraph (v)(10)(iii)).

Two commenters recommended that paragraph (v)(10)(ii) in the proposal be amended to require an inspection upon evidence of excessive hydrogen makeup or abnormal pressure loss (Ex. 3–20, 3–80). They maintained that these conditions do not always constitute an emergency.

OSHA has not adopted this suggestion. Excessive hydrogen makeup and abnormal loss of pressure are indications that hydrogen may be leaking from the system, and the escaping hydrogen poses serous explosion hazards. Even if these symptoms are not caused by leaks, it would be much more difficult to detect a leak that occurred while the symptoms were being ignored. Thus, it is important to correct the problems causing the excessive hydrogen makeup or abnormal loss of pressure as soon as possible.

Paragraph (v)(11) contains requirements for the handling of coal and ash and includes provisions on the use of railroad equipment and conveyors for this purpose. Several provisions within this paragraph relate to the hazards of coal or coal handling. It should be noted that MSHA has jurisdiction over the handling of coal until it is fully processed. (For a complete discussion of the extent of OSHA's authority over coal-related hazards, see the summary and explanation of § 1910.269(a)(1)(i)(B), earlier in this preamble.)

Paragraph (v)(11)(i) permits only designated persons to operate railroad equipment. Designated persons are persons who are knowledgeable of the construction and operation of the equipment (in this instance, railroad equipment) and hazards involved and who are assigned by the employer to perform this task.

Restricting the running of railroad equipment to persons who are knowledgeable of the way to operate the equipment and of the accepted rules, such as right-of-way and signalling, will prevent accidents by assuring that the equipment operator is competent.

Paragraph (v)(11)(ii) requires a warning to be given before a locomotive or locomotive crane is moved. This warning will allow employees the opportunity to stand clear of the train and track before the equipment moves.

The standard requires, in paragraphs (v)(11)(iii) and (v)(11)(iv), that drawheads not be aligned by employees kicking the drawheads (to prevent injury to or loss of the employees' feet) and that drawheads and knuckles not be shifted while railroad equipment is in motion (to prevent runaway rail cars). (A drawhead is the body of the automatic coupler, and the knuckle is the movable arm which connects with the drawhead to form the coupling on cars and locomotives.)

Paragraph (v)(11)(v) proposed that railroad cars, when stopped for unloading, be blocked to prevent the cars from moving. Several commenters objected to this provision (Ex. 3–20, 3–23, 3–26, 3–42, 3–59, 3–80, 3–82, 3–112). They argued that other means were available to secure railroad cars from movement during unloading operations. For example, the unloading equipment itself may serve to hold the car in place.

The Agency agrees with these comments. Therefore, the final rule states the provision in terms of the performance desired, that is, that railroad cars be secured from displacement so that they cannot move during the unloading operation.

In paragraph (v)(11)(vi), the standard requires an emergency means of stopping railcar dumping during this operation. In the event an incident occurs, this safeguard will allow interruption of the dumping operation to prevent or minimize injury to employees.

Paragraph (v)(11)(vii) requires employees to be trained and knowledgeable in coal- and ash-handling conveyors operations if they work in conveyor areas. For example, their training and knowledge should be thorough in the subjects of: (1) operation of the conveyor system, (2) hazards associated with conveyors, (3) how to minimize these hazards, and (4) requirements of this standard that pertain to conveyor operation.

The standard prohibits, in paragraph (v)(11)(viii), employees from riding on coal- or ash-handling conveyors. Belt conveyors are not designed to carry persons and riding the conveying medium can be very hazardous. This paragraph further provides that employees be allowed to cross over a belt conveyor only at walkways, unless the conveyor is locked out or tagged in accordance with § 1910.269(d).

Paragraph (v)(11)(ix) addresses the hazard of unexpected startup of conveyors. If a conveyor could cause injury when it is started, paragraph (v)(11)(ix) requires personnel in the area to be alerted by a signal or by a designated employee that the conveyor is about to start. For automatically and remotely controlled conveyors, an audible warning device that could be heard and recognized by employees at all points along the conveyor where personnel could be present is required. However, a visual warning is permitted if it would be more effective in alerting employees. The requirements for warning devices are contained in paragraph (v)(11)(x).

Exceptions to the requirement for warning devices are given in paragraph (v)(11)(x) for systems whose function would be seriously hindered by the required time delay. In such cases, warning signs are required to be provided at locations along the conveyor where it is not guarded by position or location. These exceptions protect employees at conveyor installations that cannot have warning devices installed for design reasons.

The provisions of paragraph (v)(11)(ix) are intended to protect employees from getting caught in and injured by a conveyor that is started unexpectedly. This paragraph is based on provisions in the *Safety Standard for Conveyors and Related Equipment,* ASME/ANSI B20.1–1987 (Ex. 2–30).

Three commenters maintained that the cost of this requirement was not justified by the benefits (Ex. 3–23, 3–26, 3–112). They argued that precautions, such as covering the conveyors, installing emergency stop devices, and avoiding unsafe positions unless the equipment was locked or tagged out, are effective measures to prevent injury. They submitted cost estimates ranging from $9,000 to $50,000 per station for retrofitting existing systems.

Mr. James W. Broome of the Arizona Electric Power Cooperative, Inc. believed that all conveyors should be provided with alarms and warning signs to alert employees of automatic starting (Ex. 3–59).

OSHA's final rule does recognize guarding as an alternative to warning systems. Conveyor systems that do not expose employees to hazards do not require warning alarms. Of course, if the guards are removed, the conveyor system would have to be locked out or tagged in accordance with § 1910.147.

For conveyor systems that are not completed guarded, OSHA has decided to provide an exception to the requirement for warning devices for conveyor systems installed before [insert date 1 year after date of publication] until their control systems are rebuilt. Conveyors that are currently in place and those that are in the final stages of installation would require substantial costs to retrofit warning devices. OSHA does believe that warning signs and training can provide adequate protection for older conveyors, although warning devices are considered more effective for the long run.[96] Therefore, paragraph (v)(11)(x) of final § 1910.269 exempts existing conveyor installations from the requirement for warning alarms until their control systems are rebuilt. Incorporating warning devices into a conveyor in its initial design stage or when its controls system is rebuilt is a much more cost-effective approach, one that OSHA has taken in the final rule. Before the conveyor system is installed it is a relatively simple matter to incorporate warning devices as a part of the control system. Similarly, when the control system is rebuilt (rewired), installing a warning system and connecting it to the control system can be a cost-effective technique of preventing injuries associated with unexpected conveyor movement.

In adopting final paragraph (v)(11)(x), OSHA has also clarified the language from the corresponding provision of the proposed rule (paragraph (v)(12)(ix)(A)) to indicate that the alarm must be recognized by employees as a warning that the conveyor will be started. Obviously, an alarm that could not be identified by employees would not be an effective warning, and the final rule requires employers to ensure (through such means as training and the design of the alarm system) that the alarm is recognized. Additionally, because the alarm will be understood by employees, OSHA has not carried forward the provision in the proposal exempting conveyor systems from the alarm requirements if the intent of the alarm could be misinterpreted.

Paragraph (v)(11)(xi) addresses hazards associated with emergency situations involving automatically and remotely controlled conveyors. These conveyors are required to have emergency stop devices so that the equipment could be deenergized in case an employee becomes endangered by its operation. However, if the design, function, and operation of a conveyor is not hazardous to personnel, an emergency stop is not required. For example, a conveyor system that operates at low speed and that does not contain exposed nip or pinch points is considered as not posing a hazard to employees.

The emergency stop devices have to be easily identifiable and have to be placed anywhere the conveyor is not guarded. They are also required to act directly on the control of the conveyor (not dependent on the stopping of other intermediate equipment) and to be installed so that they cannot be overridden.

The requirements contained in paragraph (v)(11)(xi) are also based on ASME/ANSI B20.1–1987.

Paragraph (v)(11)(xii) of final § 1910.269 requires that, where a combustible atmosphere may be produced in coal-handling operations, sources of ignition be eliminated or controlled to prevent the ignition of combustible gases. This requirement mitigates the hazard of fire and explosion in coal-handling operations. It also indicates that a combustible atmosphere may occur in these operations. An area in which this may occur must be considered a Class II location as far as ignition sources are concerned, and a note to this effect is included in the final rule. (See subpart S of part 1910 for requirements pertaining to the control of electrical ignition sources in Class II locations—locations that are hazardous because of the presence of combustible dust, such as coal dust.)

In paragraph (v)(11)(xiii), OSHA is prohibiting employees from working on or beneath overhanging coal. Based on requirements contained in the draft standard recommended by EEI and IBEW, this requirement addresses the hazards of an employee's being struck or crushed by falling coal or suffocating by being buried in coal.

Mr. Charles T. Autry of the Oglethorpe Power Company urged OSHA to allow utilities to provide protection so that employees could work, if necessary, in areas with overhanging coal (Ex. 3–102).

OSHA has accepted his recommendation. Paragraph (v)(11)(xiii) permits employees to work in these areas if they are protected from all hazards associated with shifting coal. For example, support structures could be provided to protect employees from the falling coal or to prevent the coal from falling.

Paragraph (v)(11)(xiv) requires employees entering a bunker or silo to wear a safety harness with lifeline attached to a fixed support outside the bunker attended at all times by a standby employee. Also based on requirements contained in the draft standard recommended by EEI and IBEW, this requirement further addresses the hazard of an employee's suffocating by being buried in coal or ash.

Proposed § 1910.269(v)(12) contained requirements for walking and working surfaces. Proposed paragraph (v)(12)(i) emphasized that the requirements of Subpart D of Part 1910 would continue to apply. Paragraph (v)(12)(ii) would have provided an exception to the Subpart D requirements whereby a floor hole, through which passes machinery, piping, or other equipment that may expand or contract in the hole, would have been permitted to be guarded by a toeboard if the opening around the machinery or pipe was 12 inches (30.5

[96] There is at least one accident described in the record that could have been prevented by warning devices (Ex. 6–23, 6–24).

cm) or less. This provision recognized the need to provide for expansion and contraction of equipment. OSHA believed that a toeboard would normally prevent an employee's foot from entering the opening as well as prevent tools from falling through the hole.

Ms. Nancy Weinberg of the American Textile Manufacturers Institute was concerned about consistency of proposed paragraph (v)(12) with Subpart D (Ex. 3–54).

OSHA proposed equivalent provisions in its revision of Subpart D (paragraphs (b)(1) and (b)(4) of proposed § 1910.27, 55 FR 13401). In order to ensure consistency with Subpart D, as requested by Ms. Weinberg, and because the proposed provision addressed a condition common to many industries, the Agency is not carrying proposed § 1910.269(v)(12) forward into this final rule. The subject will be addressed in the forthcoming revision of Subpart D.

Paragraph (v)(12) of final § 1910.269 requires employees working near gates, valves, intakes, or flumes of a hydroplant to be warned before changes are made in water flow rates, if such a change would pose a hazard to employees. As a clarification of the intent of this paragraph, the Agency has added the phrase "and shall vacate dangerous areas" to the wording contained in the proposal. Thus, the final provision reads as follows:

> Employees working on or close to water gates, valves, intakes, forebays, flumes, or other locations where increased or decreased water flow or levels may pose a significant hazard shall be warned and *shall vacate such dangerous areas* before water flow changes are made. [Emphasis added.]

OSHA believes that this will point out the purpose of the rule and will ensure that employees are not injured as a result of water flow changes.

Paragraph (w). Paragraph contains requirements for special conditions that are encountered during electric power generation, transmission, and distribution work.

Since capacitors store electric charge and can release electrical energy even when disconnected from their sources of supply, some precautions may be necessary, in addition to those contained in § 1910.269(m) (deenergizing lines and equipment) and § 1910.269(n) (grounding), when work is performed on capacitors or on lines which are connected to capacitors. Paragraph (w)(1) sets forth precautions which will enable this equipment to be considered as deenergized. Under paragraph (w)(1)(i), capacitors on which work is to be performed must be disconnected from their sources of supply and short-circuited. This not only removes the sources of electric current but relieves the capacitors of their charge as well.

Two commenters suggested adding a requirement for a 5-minute wait, after disconnection, before the short circuit is applied (Ex. 3–80, 3–82). They pointed out that ANSI/IEEE Standard No. 18 requires all capacitors to have an internal resistor across its terminals to reduce the voltage to 50 volts or less within 5 minutes after the capacitor is disconnected from an energized source. OSHA is not applying this requirement to lines to which capacitors are connected. The employees who would be short-circuiting and grounding these lines would frequently not be the same as the employees who would be deenergizing them. Thus, the time between deenergizing the lines and short-circuiting them cannot be controlled in such cases. In any event, lines are normally deenergized at a different point from where they are short-circuited and grounded, and a delay of more than 5 minutes is effectively built into this process.

OSHA has accepted the suggested delay before short circuiting is applied. Paragraph (w)(1)(i) of final § 1910.269 requires capacitors to be deenergized and, after a 5-minute wait, short circuited.

For work on individual capacitors in a series-parallel capacitor bank, each unit must be short-circuited between its terminals and the capacitor tank or rack; otherwise, individual capacitors could retain a charge. This consideration is set forth in paragraph (w)(1)(ii). Lastly, paragraph (w)(1)(iii) also requires lines to which capacitors are connected to be short-circuited before the lines can be considered deenergized.

Several commenters suggested adding requirements for capacitor circuits to be grounded, as well, before they could be considered deenergized (Ex. 3–44, 3–58, 3–66, 3–80, 3–82, 3–102, 3–112).

Rather than add a specific requirement for grounding, the Agency has decided to add a note referring to the requirements for deenergizing electric transmission and distribution lines and equipment, paragraph (m), and for grounding, paragraph (n). OSHA believes that this will alert readers to the appropriate requirements for deenergizing and grounding without adding redundant, and perhaps inconsistent, provisions.

Although the magnetic flux density in the core of a current transformer is usually very low, resulting in a low secondary voltage, it will rise to saturation if the secondary circuit is opened while the transformer primary is energized. If this occurs, the magnetic flux will induce a voltage in the secondary winding high enough to be hazardous to the insulation in the secondary circuit and to personnel. Because of this hazard to workers, paragraph (w)(2) prohibits the opening of the secondary circuit of a current transformer while the primary is energized. If the primary cannot be deenergized for work to be performed on the secondary, then the secondary circuit must be bridged so that an open-circuit condition does not result.

In a series streetlighting circuit, the lamps are connected in series, and the same current flows in each lamp. This current is supplied by a constant-current transformer, which provides a constant current at a variable voltage from a source of constant voltage and variable current. Like the current transformer, the constant current source attempts to supply current even when the secondary circuit is open. The resultant open-circuit voltage can be very high and hazardous to employees. For this reason, paragraph (w)(3) sets forth a requirement, similar to that in paragraph (w)(2), that either the streetlighting transformer be deenergized or the circuit be bridged to avoid an open-circuit condition.

Frequently, electric power generation, transmission, and distribution employees must work at night or in enclosed places, such as manholes, that are not illuminated by the sun. Since inadvertent contact with live parts can be fatal, good lighting is important to the safety of these workers. Therefore, paragraph (w)(4) requires sufficient illumination to be provided so that work can be performed safely.

The proposal did not provide specific guidance with respect to levels of illumination that are necessary for safety under various conditions. In the notice of proposed rulemaking, OSHA requested comments and supporting data on this issue. Unfortunately, the comments on this paragraph did not include any recommended specifications. Therefore, the final rule sets forth the requirement as proposed. In enforcing this provision, the Agency will use, as guidelines, other OSHA and national consensus standards that apply to this subject (for example, § 1926.56, which applies to work performed during the construction of electric power transmission and distribution installations).

To protect employees working in areas that expose them to the hazards of drowning, paragraph (w)(5) requires the provision and use of personal flotation devices. Additionally, to ensure that these devices will provide the necessary protection upon demand, they must be approved by the U.S. Coast Guard, be maintained in safe condition, and be regularly inspected for defects that render them unsuitable for use. Lastly, employees would not be permitted to cross streams unless a safe means of passage is provided.

Three commenters were concerned that the language in proposed § 1910.269(w)(5)(i) could be interpreted to require floatation devices where the danger of drowning is minimal, such as near decorative fountains and swimming pools (Ex. 3–20, 3–80, 3–112).

OSHA does not believe the language proposed in this paragraph and carried forward into the final rule normally requires personal floatation devices when work is performed over a fountain or swimming pool. However, there may be times when the size and depth of a fountain or pool and the type of work being performed would expose the employee to the hazard of drowning. In enforcing paragraph (w)(5)(i) of final § 1910.269, the Agency will consider the extent of the hazard faced by the worker.

Employees working in areas with pedestrian or vehicular traffic are exposed to additional hazards compared to employees working on an employer's premises, where public access is restricted. One serious additional hazard faced by workers exposed to the public is that of being struck by a vehicle (or even by a person). To protect employees against being injured as a result of traffic mishaps, paragraph (w)(6) requires the placement of warning signs or flags or other warning devices to channel approaching traffic away from the work area if the conditions in the area pose a hazard to employees. If warning signs are not sufficient protection or if employees are working in an area in which there are excavations, barricades must be erected. Additionally, warning lights are required for night work.

Edison Electric Institute suggested incorporating the requirements of § 1926.200(g)(2), which covers traffic control devices (Ex. 3–112). This provision in OSHA's Construction Standards incorporates ANSI D6.1–1971, *Manual on Uniform Traffic Control Devices for Streets and Highways*, by reference. OSHA has accepted this recommendation and has added the reference to the construction standard in paragraph (w)(6)(i).

Paragraph (w)(7) addresses the hazards of voltage backfeed due to sources of cogeneration or due to the configuration of the circuit involved. Under conditions of voltage backfeed, the lines upon which work is to be performed remain energized after the main source of power has been disconnected. As noted by this provision, the lines have to be worked as energized, under § 1910.269(l), or could be worked as deenergized, following paragraphs (m) and (n) of final § 1910.269. The referenced paragraphs contain the appropriate controls and work practices to be taken in case of voltage backfeed.

Sometimes, electric power generation, transmission, and distribution work involves the use of lasers. Appropriate requirements for the installation, operation, and adjustment of lasers are contained in existing § 1926.54 of the Construction Standards. Rather than develop different requirements for electric power generation, transmission, and distribution work, OSHA has adopted the construction regulation by reference in paragraph (w)(8) of final § 1910.269.

To ensure that hydraulic equipment retains its insulating value, paragraph (w)(9) requires the hydraulic fluid used in insulated sections of such equipment to be of the insulating type.

Paragraph (x). Final § 1910.269(x) contains definitions of terms used in the standard.[97] Since these definitions have been taken, in large part, from consensus standards and existing OSHA regulations and since the definitions included are generally self-explanatory, OSHA expects these terms to be well understood, and no explanation is given here beyond that needed to discuss issues raised during the rulemaking period. However, for terms whose meaning may not be readily apparent, the Agency has provided an explanation in the discussion of the provision in which the term first appears.

OSHA received several comments relating to the definitions of authorized, designated, and qualified employees (Ex. 3–20, 3–31, 3–40, 3–42, 3–44, 3–66, 3–69, 3–73, 3–80, 3–82, 3–102, 3–112, 3–123). The definitions in the proposal were based on the relevant national consensus standards (for example, American National Standard C2, the *National Electrical Safety Code*). However, the commenters believed that the proposed language was inappropriate.

[97] Paragraph (x) only defines terms that are used in § 1910.269. However, many of the documents listed in Appendix contain definitions of terms generally associated with electric power generation, transmission, and distribution work. In particular, *IEEE Standard Dictionary of Electrical and Electronic Terms* (IEEE Std. 100–1988), *IEEE Guide to the Installation of Overhead Transmission Line Conductors* (IEEE Std. 524–1992), and *IEEE Guide on Terminology for Tools and Equipment to Be Used in Live Line Working* (IEEE Std. 935–1989) set out definitions of commonly used terms.

Most of the commenters objected to the definition of "qualified employee" (Ex. 3–20, 3–40, 3–42, 3–44, 3–58, 3–69, 3–80, 3–82, 3–102, 3–112, 3–123). They were concerned that the wording in the proposal was too broad and that it would require an employee to be trained in all aspects of electric power generation, transmission, and distribution equipment. The comments of Ms. Meredith McCoy on behalf of the National Rural Electric Cooperative Association were typical:

> The proposed standards require that only a "qualified employee" or "qualified person" perform certain functions, and define these terms to mean "[o]ne knowledgeable in the construction and operation of electric power generation, transmission and distribution equipment and the hazards involved." * * *
>
> Thus, the proposed standards appear to require that workers know all aspects of both the construction and operation of electric power generation, transmission, and distribution, even though many of these aspects have no relevance to their jobs or job safety. For example, the safety of employees at distribution co-ops does not require that they be trained in problems related to generation. As another example, the proposed standards could be interpreted to require that line clearance tree trimmers be knowledgeable in power plant ash handling. NRECA does not believe that OSHA intended such a requirement, which would be impracticable in terms of the cost and time of the training which would be necessary, and which would bear little, if any, relationship to worker safety. Consequently, the proposed standards should be clarified to provide that employees need only be "qualified" in regard to those aspects of the construction and operation of electric power generation, transmission, and distribution which directly relate to their job safety. [Ex. 3–123]

Ms. McCoy is correct. OSHA did not intend to require employees to be knowledgeable in all aspects of electric power generation, transmission, and distribution equipment in order to be considered as "qualified". The proposed definition of "qualified employee" read as follows:

> *Qualified employee (qualified person).* One knowledgeable in the construction and operation of electric power generation, transmission, and distribution equipment and the hazards *involved.* [Emphasis added.]

The Agency intended the word "involved" to modify "equipment", as well as "hazards". From the comments on this definition, OSHA can see that this interpretation is not apparent from the proposed language. Therefore, the Agency has revised the wording slightly in the final rule. The definition of "qualified employee" in the final rule reads as follows:

> *Qualified employee (qualified person).* One knowledgeable in the construction and

operation of electric power generation, transmission, and distribution equipment involved, along with the associated hazards.

OSHA believes that this language will convey the Agency's true intent and will allay the concerns of the commenters. It should be noted that the final rule uses the term "qualified employee" to refer only to employees who have the training to work on energized electric power generation, transmission, and distribution installations. Paragraph (a)(2)(ii) of final § 1910.269 sets out the training an employee must have to be considered a qualified employee. A note to this effect has been included following the definition of this term.

EEI also commented on the related definitions of "authorized employee" and "designated employee" (Ex. 3–112). They argued that no employee should be authorized or designated without first being qualified.

OSHA notes that the term "authorized employee" is used in the standard only in § 1910.269(d) with regard to the control of hazardous energy sources. Therefore, the definition of that term is necessarily restricted to applications involving lockout and tagging. Since the Agency relied heavily on the language of final § 1910.147 in promulgating paragraph (d) of final § 1910.269, OSHA has decided to use the definition from the generic standard on hazardous energy control in that context. Similarly, the definition of "affected employee" in this final rule has also been taken from § 1910.147.

The term "qualified employee", as used in final § 1910.269, relates only to employees who perform work on energized electric equipment. The term "designated employee" is used in a more general way to refer to employees who are competent to perform a task and who are assigned that task by their employers, and it was defined in this manner in the proposal. For example, § 1910.269(v)(11)(i) requires railroad equipment to be operated by designated employees. These employees are not necessarily "qualified" electrical workers. Therefore, OSHA has retained the proposed definition of "designated employee" in the final rule.

Other commenters were concerned that the proposal did not refer to line-clearance tree trimmers as "qualified" (Ex. 3–20, 3–80, 3–113, 58; DC Tr. 85–87). Mr. Robert Felix, Executive Vice President of the National Arborist Association, stated these concerns as follows:

> * * * NAA fully supports the wisdom of the Agency's decision to treat differently persons who work *on* conductors from those, such as line clearance tree trimmers, who are trained to work proximate to, but not on, conductors. This appropriate distinction is based on the Agency's proper recognition that the very foundation of safety in the line clearance tree trimming industry is training in using special techniques to work safely proximate to energized conductors but never to touch conductors. These special techniques serve the public interest by enabling trees growing in the vicinity of power lines to be trimmed without de-energizing lines, consistent with maintaining employee safety by forbidding them to ever touch conductors. Thus, the proposed standard is entirely correct in recognizing the fundamentally different regulatory concerns in dealing with those who work on conductors, as compared to those trained to work near, but not on, conductors.
>
> Our problem is purely semantic and not substantive: because line clearance tree trimmers are uniquely *qualified* to trim trees proximate to conductors, it is misleading and utterly confusing to term them "not qualified" for the purpose of applying only portions of the subject proposed standard to them; for line clearance tree trimmers are, indeed, *uniquely qualified* to perform this highly specialized service.
>
> In fact, this confusion is compounded when the subject standard is viewed, as it must, in conjunction with ANSI Z-133 and the pending proposed § 1910.331 electric safe work practice standard for general industry. OSHA's intent under *that* standard, it will be recalled, is to exempt "*qualified* line clearance tree trimmers"—*the very same personnel who would be covered under this standard as "not qualified"!* This anomalous terminology is untenable.

To disarm this needless incongruity, we suggest that in order to achieve consistency between 1910.331 and .269, the same terminology used in 1910.331 be employed by OSHA in the subject standard—that the term "qualified line clearance tree trimmer" [footnote omitted] be used in both standards to indicate their exemption from 1910.331 and their partial coverage under the subject standard, because of their qualification to work *proximate* to conductors. To distinguish these employees who are partially covered by the subject standard, from utility employees who work *on* conductors and therefore are subject to the entire standard, we suggest that the latter be referred to as "qualified utility employees". [Ex. 3–113]

The Agency understands the tree trimming contractors' concerns. Under § 1910.331(c)(1), line-clearance tree trimming is exempt from the Subpart S work practices standard only if performed by "qualified employees" as defined in § 1910.399. This definition is quite similar to that contained in § 1910.269(x). Thus, Subpart S could be misinterpreted as applying to line-clearance tree trimmers, even though that is not the Agency's intent. OSHA has decided to provide a note under the definition of "line-clearance tree trimmer" to indicate that these employees, though not considered to be "qualified employees" under § 1910.269, are still considered to be "qualified employees" under § 1910.331. The Agency believes that this note will clarify the rule and will prevent enforcement difficulties.

However, OSHA has not adopted the National Arborist Association's suggestion. As noted previously, the only employees considered "qualified" under final § 1910.269 are those trained to work on energized conductors. Additionally, paragraph (a)(2)(ii) imposes training requirements for qualified employees that line-clearance tree trimmers do not normally, by NAA's own admission, meet. Therefore, to state that line-clearance tree trimmers are also considered as "qualified employees" under § 1910.269 would lead to confusion and possible misinterpretation of the standard.

Appendices. OSHA is including five appendices to final § 1910.269.

Appendix A (A–1 through A–5) contains flow charts depicting the interface between § 1910.269 and the following standards: § 1910.146, *Permit-required confined spaces*; § 1910.147, *The control of hazardous energy (lockout/tagout)*; and Part 1910, Subpart S, *Electrical*. This appendix will assist employers in determining which of these standards applies in different situations.

Appendix B provides information relating to the determination of appropriate minimum approach distances as required by § 1910.269(l)(2) and (q)(3).

Appendix C provides information relating to the protection of employees from hazardous step and touch potentials as addressed in § 1910.269(o)(4)(iii), (p)(4)(iii)(C), and (q)(2)(ii).

Appendix D contains information on the inspection and testing of wood poles addressed in § 1910.269(q)(1)(i).

Appendix E contains references to additional sources of information that may be used to supplement the requirements of final § 1910.269. The national consensus standards referenced in this appendix contain detailed specifications that employers may follow in complying with the more performance-oriented requirements of OSHA's final rule. Except as specifically noted in § 1910.269, however, compliance with the national consensus standards is not a substitute for compliance with the provisions of the OSHA standard.

C. Subpart S

The notice of proposed rulemaking did not contain any changes to Subpart S of Part 1910. The provisions of Subpart S most directly affected by new § 1910.269 are contained in Part II of that subpart, electrical safety-related work practices. These provisions are contained in §§ 1910.331 through 1910.335 of this chapter and, at the time § 1910.269 was proposed, were only in the proposed rule stage themselves.

Because the two standards are related, however, the Agency believes that it will be helpful to revise two of the existing notes to requirements in Subpart S and, as mentioned previously, to add one additional note. This will clarify the interface between the two standards. Only the informational notes are being amended; the requirements of Subpart S are not affected by these changes.

As discussed under the explanation of final § 1910.269(a)(1)(ii)(B), OSHA is adding the following new note after § 1910.331(c)(1):

For work on or directly associated with utilization installations, an employer who complies with the work practices of § 1910.269 (electric power generation, transmission, and distribution) will be deemed to be in compliance with § 1910.333(c) and § 1910.335. However, the requirements of § 1910.332, § 1910.333(a), § 1910.333(b), and § 1910.334 apply to *all* work on or directly associated with utilization installations, regardless of whether the work is performed by qualified or unqualified persons.

The first note following this paragraph in Subpart S describes the types of installations covered by the electrical safety-related work practices standard. The new note should give employers and employees guidance as to what standard to follow when both standards address the same hazards.

OSHA is adding the following paragraph at the end of the second note after § 1910.331(c)(1):

Such [electric power generation, transmission, and distribution] work is covered by § 1910.269 of this part.

Additionally, the Agency is revising the first sentence in the note after the introductory text in § 1910.333(c)(3):

The work practices used by qualified persons installing insulating devices on overhead power transmission or distribution lines are covered by § 1910.269 of this part, not by §§ 1910.332 through 1910.335 of this part.

These two amendments will refer interested parties to § 1910.269 for requirements that apply to electric power generation, transmission, and distribution work.

IV. Statutory Considerations

A. Introduction.

OSHA has described the hazards in the generation, transmission, and distribution of electric power and the measures required to protect affected employees from those hazards in section I, *Background*, and in section III, *Summary and Explanation of the Final Rule*, earlier in this preamble. The Agency is providing the following discussion of the statutory mandate for OSHA rulemaking activity to explain the legal basis for its determination that the Electric Power Generation, Transmission, and Distribution standard and the revised Electrical Protective Equipment standard, as promulgated, are reasonably necessary to protect affected employees from significant risks of injury and death.

Section 2(b)(3) of the Occupational Safety and Health Act authorizes "the Secretary of Labor to set mandatory *occupational safety and health standards* applicable to businesses affecting interstate commerce", and section 5(a)(2) provides that "[e]ach employer shall comply with *occupational safety and health standards* promulgated under this Act" (emphasis added). Section 3(8) of the OSH Act (29 U.S.C. § 652(8)) provides that "the term 'occupational safety and health standard' means a standard which requires conditions, or the adoption or use of one or more practices, means, methods, operations, or processes, reasonably necessary or appropriate to provide safe or healthful employment and places of employment."

In two recent cases, reviewing courts have expressed concern that OSHA's interpretation of these provisions of the OSH Act, particularly of section 3(8) as it pertains to safety rulemaking, could lead to overly costly or under-protective safety standards. In *International Union, UAW* v. *OSHA*, 938 F.2d 1310 (D.C. Cir. 1991), the District of Columbia Circuit rejected substantive challenges to OSHA's lockout/tagout standard and denied a request that enforcement of that standard be stayed, but it also expressed concern that OSHA's interpretation of the OSH Act could lead to safety standards that are very costly and only minimally protective. In *National Grain & Feed Ass'n* v. *OSHA*, 866 F.2d 717 (5th Cir. 1989), the Fifth Circuit concluded that Congress gave OSHA considerable discretion in structuring the costs and benefits of safety standards but, concerned that the grain dust standard might be under-protective, directed OSHA to consider adding a provision that might further reduce significant risk of fire and explosion.

OSHA rulemakings involve a significant degree of agency expertise and policy-making discretion to which reviewing courts must defer. (See for example, *Building & Constr. Trades Dep't, AFL–CIO* v. *Brock*, 838 F.2d 1258, 1266 (D.C. Cir. 1988); *Industrial Union Dep't, AFL–CIO* v. *American Petroleum Inst.*, 448 U.S. 607, 655 n. 62 (1980).) At the same time, the agency's technical expertise and policy-making authority must be exercised within discernable parameters. The lockout/tagout and grain handling standard decisions sought clarification of the agency's view of the scope of its expertise and authority. In light of those decisions, the preamble to this safety standard states OSHA's views regarding the limits of its safety rulemaking authority and explains why the Agency is confident that its interpretive views have in the past avoided regulatory extremes and continue to do so in this rule.

Stated briefly, the OSH Act requires that, before promulgating any occupational safety standard, OSHA demonstrate based on substantial evidence in the record as a whole that: (1) the proposed standard will substantially reduce a significant risk of material harm; (2) compliance is technologically feasible in the sense that the protective measures being required already exist, can be brought into existence with available technology, or can be created with technology that can reasonably be developed; (3) compliance is economically feasible in the sense that industry can absorb or pass on the costs without major dislocation or threat of instability; and (4) the standard is cost effective in that it employs the least expensive protective measures capable of reducing or eliminating significant risk. Additionally, proposed safety standards must be compatible with prior agency action, must be responsive to significant comment in the record, and, to the extent allowed by statute, must be consistent with applicable Executive Orders. These elements limit OSHA's regulatory discretion for safety rulemaking and provide a decision-making framework for developing a rule.

B. Congress Concluded That OSHA Regulations are Necessary to Protect Workers From Occupational Hazards and That Employers Should be Required to Reduce or Eliminate Significant Workplace Health and Safety Threats

At section 2(a) of the OSH Act (29 U.S.C. § 651(a)), Congress announced its determination that occupational injury and illness should be eliminated as much as possible: "The Congress finds that occupational injury and illness arising out of work situations impose a substantial burden upon, and are a hindrance to, interstate commerce in terms of lost production, wage loss, medical expenses, and disability compensation payments." Congress therefore declared "it to be its purpose and policy * * * to assure so far as possible every working man and woman in the Nation safe * * * working conditions [29 U.S.C. § 651(b)]."

To that end, Congress instructed the Secretary of Labor to adopt existing federal and consensus standards during the first two years after the OSH Act became effective and, in the event of conflict among any such standards, to "promulgate the standard which assures the greatest protection of the safety or health of the affected employees [29 U.S.C. § 655(a)]." Congress also directed the Secretary to set mandatory occupational safety standards (29 U.S.C. § 651(b)(3)), based on a rulemaking record and substantial evidence (29 U.S.C. § 655(b)(2)), that are "reasonably necessary or appropriate to provide safe * * * employment and places of employment." When promulgating permanent safety or health standards that differ from existing national consensus standards, the Secretary must explain "why the rule as adopted will better effectuate the purposes of this Act than the national consensus standard [29 U.S.C. § 655(b)(8)]." Correspondingly, every employer must comply with OSHA standards and, in addition, "furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees [29 U.S.C. § 654(a)]."

"Congress understood that the Act would create substantial costs for employers, yet intended to impose such costs when necessary to create a safe and healthful working environment. Congress viewed the costs of health and safety as a cost of doing business * * * Indeed, Congress thought that the *financial costs* of health and safety problems in the workplace were as large as or larger than the *financial costs* of eliminating these problems [*American Textile Mfrs. Inst. Inc.* v. *Donovan*, 452 U.S. 490, 519–522 (1981) (*ATMI*); emphasis was supplied in original]." "[T]he fundamental objective of the Act [is] to prevent occupational deaths and serious injuries [*Whirlpool Corp.* v. *Marshall*, 445 U.S. 1, 11 (1980)]." "We know the costs would be put into consumer goods but that is the price we should pay for the 80 million workers in America [S. Rep. No. 91–1282, 91st Cong., 2d Sess. (1970); H.R. Rep. No. 91–1291, 91st Cong., 2d Sess. (1970), *reprinted in* Senate Committee on Labor and Public Welfare, *Legislative History of the Occupational Safety and Health Act of 1970*, (Committee Print 1971) ("Leg. Hist.") at 444 (Senator Yarborough)]." "Of course, it will cost a little more per item to produce a washing machine. Those of us who use washing machines will pay for the increased cost, but it is worth it, to stop the terrible death and injury rate in this country [*Id.* at 324; see also 510–511, 517]."

> [T]he vitality of the Nation's economy will be enhanced by the greater productivity realized through saved lives and useful years of labor.
>
> When one man is injured or disabled by an industrial accident or disease, it is he and his family who suffer the most immediate and personal loss. However, that tragic loss also affects each of us. As a result of occupational accidents and disease, over $1.5 billion in wages is lost each year [1970 dollars], and the annual loss to the gross national product is estimated to be over $8 billion. Vast resources that could be available for productive use are siphoned off to pay workmen's compensation and medical expenses * * *
>
> Only through a comprehensive approach can we hope to effect a significant reduction in these job death and casualty figures. [*Id.* at 518–19 (Senator Cranston)]

Congress considered uniform enforcement crucial because it would reduce or eliminate the disadvantage that a conscientious employer might experience where inter-industry or intra-industry competition is present. Moreover, "many employers—particularly smaller ones—simply cannot make the necessary investment in health and safety, and survive competitively, unless all are compelled to do so [Leg. Hist. at 144, 854, 1188, 1201]."

Thus, the statutory text and legislative history make clear that Congress conclusively determined that OSHA regulation is necessary to protect workers from occupational hazards and that employers should be required to reduce or eliminate significant workplace health and safety threats.

As Construed by the Courts and by OSHA, the OSH Act Sets Clear and Reasonable Limits for Agency Rulemaking Action

OSHA has long followed the teaching that section 3(8) of the OSH Act requires that, before it promulgates "any permanent health or safety standard, [it must] make a threshold finding that a place of employment is unsafe—in the sense that significant risks are present and can be eliminated or lessened by a change in practices [*Industrial Union Dep't, AFL-CIO* v. *American Petroleum Inst.*, 448 U.S. 607, 642 (1980) (plurality) (*Benzene*); emphasis was supplied in original]." Thus, the national consensus and existing federal standards that Congress instructed OSHA to adopt summarily within two years of the OSH Act's inception provide reference points concerning the least an OSHA standard should achieve (29 U.S.C. §§ 655(a)). As a result, OSHA is precluded from regulating insignificant safety risks or from issuing safety standards that do not at least lessen risk in a significant way.

The OSH Act also limits OSHA's discretion to issue overly burdensome rules, as the agency also has long recognized that "any standard that was not economically or technologically feasible would *a fortiori* not be 'reasonably necessary or appropriate' under the Act. See *Industrial Union Dep't* v. *Hodgson*, [499 F.2d 467, 478 (D.C. Cir. 1974)] ('Congress does not appear to have intended to protect employees by putting their employers out of business.') [*American Textile Mfrs. Inst. Inc.*, 452 U.S. at 513 n. 31 (a standard is economically feasible even if it portends 'disaster for some marginal firms,' but it is economically infeasible if it 'threaten[s] massive dislocation to, or imperil[s] the existence of,' the industry)]."

By stating the test in terms of "threat" and "peril," the Supreme Court made clear in *ATMI* that economic infeasibility begins short of industry-wide bankruptcy. OSHA itself has placed the line considerably below this level. (See for example, *ATMI*, 452 U.S. at 527 n. 50; 43 FR 27360 (June 23, 1978). Proposed 200 μg/m3 PEL for cotton dust did not raise serious possibility of industry-wide bankruptcy, but impact on weaving sector would be severe, possibly requiring reconstruction of 90 percent of all weave rooms. OSHA concluded that the 200 μg/m3 level was not feasible for weaving and that 750 μg/m3 was all that could reasonably be required. See also 54 FR 29245–29246 (July 11, 1989); *American Iron & Steel Institute*, 939 F.2d at 1003. OSHA raised engineering control level for lead in small nonferrous foundries to avoid the possibility of bankruptcy for about half of small foundries even though the industry as a whole could have survived the loss of small firms.)

All OSHA standards must also be cost-effective in the sense that the protective measures being required must be the least expensive measures capable of achieving the desired end (*ATMI*, at 514 n. 32; *Building and Constr. Trades Dep't AFL-CIO* v. *Brock*, 838 F.2d 1258, 1269 (D.C. Cir. 1988)). OSHA gives additional consideration to financial impact in setting the period of time that should be allowed for compliance, allowing as much as 10 years for compliance phase-in. (See *United Steelworkers of Am.* v. *Marshall*, 647 F.2d 1189, 1278 (D.C. Cir. 1980), *cert. denied*, 453 U.S. 913 (1981).) Additionally, OSHA's enforcement policy takes account of financial hardship on an individualized basis. OSHA's Field Operations Manual provides that, based on an employer's economic situation, OSHA may extend the period within which a violation must be corrected after issuance of a citation (CPL 2.45B, chapter III, paragraph E6d(3)(a), Dec. 31, 1990).

To reach the necessary findings and conclusions, OSHA conducts rulemaking in accordance with the requirements of section 6 of the OSH Act. The rulemaking process enables the Agency to determine the qualitative and, if possible, the quantitative nature of the risk with (and without) regulation, the technological feasibility of compliance, the availability of capital to the industry and the extent to which that capital is required for other purposes, the industry's profit history, the industry's ability to absorb costs or pass them on to the consumer, the impact of higher costs on demand, and the impact on competition with substitutes and imports. (See *ATMI* at 2501–2503; *American Iron & Steel Institute* generally.) Section 6(f) of the OSH Act further provides that, if the validity of a standard is challenged, OSHA must support its conclusions with "substantial evidence in the record considered as a whole," a standard that courts have determined requires fairly close scrutiny of agency action and the explanation of that action. (See *Steelworkers*, 647 F.2d at 1206–1207.)

OSHA's powers are further circumscribed by the independent Occupational Safety and Health Review Commission, which provides a neutral forum for employer contests of citations issued by OSHA for noncompliance with health and safety standards (29 U.S.C. §§ 659–661; noted as an additional constraint in *Benzene* at 652 n. 59). OSHA must also respond rationally to similarities and differences among industries or industry sectors. (See *Building and Constr. Trades Dep't, AFL–CIO* v. *Brock*, 838 F.2d 1258, 1272–73 (D.C. Cir. 1988).)

OSHA rulemaking is thus constrained first by the need to demonstrate that the standard will substantially reduce a significant risk of material harm, and then by the requirement that compliance is technologically capable of being done and not so expensive as to threaten economic instability or dislocation for the industry. Within these bounds, further constraints such as the need to find cost-effective measures and to respond rationally to all meaningful comment militate against regulatory extremes.

D. The Electric Power Generation, Transmission, and Distribution Standard and the Electrical Protective Equipment Standard Comply With the Statutory Criteria Described Above and Are Not Subject to the Additional Constraints Applicable to Section 6(b)(5) Standards

Standards which regulate hazards that are frequently undetectable because they are subtle or develop slowly or after long latency periods, are frequently referred to as "health" standards. Standards that regulate hazards, like explosions or electrocution, that cause immediately noticeable physical harm, are called "safety" standards. (See *National Grain & Feed Ass'n* v. *OSHA (NGFA II)*, 866 F.2d 717, 731, 733 (5th Cir. 1989). As noted above, section 3(8) provides that *all* OSHA standards must be "reasonably necessary or appropriate." In addition, section 6(b)(5) requires that OSHA set health standards which limit significant risk "to the extent feasible." OSHA has determined that the Electric Power Generation, Transmission, and Distribution standard and the revised Electrical Protective Equipment standard are safety standards, because these two standards address hazards, such as high voltage electricity and falls from elevations, that are immediately dangerous to life or health, not the longer term, less obvious hazards subject to section 6(b)(5).

The OSH Act and its legislative history clearly indicate that Congress intended for OSHA to distinguish between safety standards and health standards. For example in section 2(b)(6) of the OSH Act, Congress declared that the goal of assuring safe and healthful working conditions and preserving human resources would be achieved, in part:

> * * * by exploring ways to discover latent diseases, establishing causal connections between diseases and work in environmental conditions, and conducting other research relating to health problems, in recognition of the fact that occupational health standards present problems often different from those involved in occupational safety.

The legislative history makes this distinction even clearer:

> [The Secretary] should take into account that anyone working in toxic agents and physical agents which might be harmful may be subjected to such conditions for the rest of his working life, so that we can get at something which might not be toxic now, if he works in it a short time, but if he works in it the rest of his life might be very dangerous; and we want to make sure that such things are taken into consideration in establishing standards. [*Leg. Hist.* at 502–503 (Sen. Dominick), quoted in *Benzene* at 648–49]

Additionally, Representative Daniels distinguished between "insidious 'silent killers' such as toxic fumes, bases, acids, and chemicals" and "violent physical injury causing immediate visible physical harm" (*Leg. Hist.* at 1003), and Representative Udall contrasted insidious hazards like carcinogens with "the more visible and well-known question of industrial accidents and on-the-job injury" (*Leg. Hist.* at 1004). (See also, for example, S. Rep. No. 1282, 91st Cong., 2d Sess 2–3 (1970), U.S. Code Cong. & Admin. News 1970, pp. 5177, 5179, reprinted in Leg. Hist. at 142–143, discussing 1967 Surgeon General study that found that 65 percent of employees in industrial plants "were potentially exposed to harmful physical agents, *such as severe noise or vibration*, or to toxic materials"; Leg.Hist at 412; *id.* at 446; *id.* at 516; id. at 845; *International Union, UAW* at 1315.)

In reviewing OSHA rulemaking activity, the Supreme Court has held that section 6(b)(5) requires OSHA to set "the most protective standard consistent with feasibility" (*Benzene* at 643 n. 48). As Justice Stevens observed:

> The reason that Congress drafted a special section for these substances * * * was because Congress recognized that there were special problems in regulating health risks as opposed to safety risks. In the latter case, the risks are generally immediate and obvious, while in the former, the risks may not be evident until a worker has been exposed for long periods of time to particular substances. [*Benzene*, at 649 n. 54.]

Challenges to the grain dust and lockout/tagout standards included assertions that grain dust in explosive quantities and uncontrolled energy releases that could expose employees to crushing, cutting, burning or explosion hazards were harmful physical agents so that OSHA was required to apply the criteria of section 6(b)(5) when determining how to protect employees from those hazards. Reviewing courts have uniformly rejected such assertions. For example, the Court in *International Union, UAW* v. *OSHA*, 938 F.2d 1310 (D.C. Cir. 1991) rejected the view that section 6(b)(5) provided the statutory criteria for regulation of uncontrolled energy, holding that such a "reading would obliterate a distinction that Congress drew between 'health' and 'safety' risks." The Court also noted that the language of the OSH Act and the legislative history supported the OSHA position (*International Union, UAW* at 1314). Additionally, the Court stated: "We accord considerable weight to an agency's construction of a statutory scheme it is entrusted to administer, rejecting it only if unreasonable" (*International Union, UAW* at 1313, citing *Chevron U.S.A., Inc.* v. *NRDC*, 467 U.S. 837, 843 (1984)).

The Court reviewing the grain dust standard also deferred to OSHA's reasonable view that the Agency was not subject to the feasibility mandate of section 6(b)(5) in regulating explosive quantities of grain dust (*National Grain & Feed Association* v. *OSHA (NGFA II)*, 866 F.2d 717, 733 (5th Cir. 1989)). It therefore applied the criteria of section 3(8), requiring the Agency to establish that the standard is "reasonably necessary or appropriate" to protect employees.

As explained in section I, *Background*, and section III, *Summary and Explanation of the Final Rule*, earlier in this preamble, and in section V, *Regulatory Impact Assessment*, later in this preamble, OSHA has determined that the generation, transmission, and distribution of electric power and the non-use or misuse of appropriate electrical protective equipment poses significant risks to employees (86 fatalities and 12,977 injuries annually) and that the provisions of the final rule are reasonably necessary to protect affected employees from those risks. The Agency estimates that compliance with the Electric Power Generation, Transmission, and Distribution standard and the revised Electrical Protective Equipment standard will cost $40.9 million in the first year and $21.7 million annually thereafter and will reduce the risk of the identified hazards (preventing 61 fatalities and 1634 injuries annually). This constitutes a substantial reduction of significant risk of material harm for the exposed population of approximately 382,073 employees in electric utilities and in general industries. The Agency believes that compliance is technologically feasible because the rulemaking record indicates that the engineering controls, work practices, and personal protective equipment required by the standard are already in general use throughout the industries covered by the standard. Additionally, OSHA believes that compliance is economically feasible, because, as documented in the Regulatory Impact Analysis, all regulated sectors can readily absorb or pass on compliance costs.

As detailed in section V, *Regulatory Impact Assessment*, later in this preamble, and in Table 6, the standard's costs, benefits, and compliance requirements are consistent with those of other OSHA safety standards, such as the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard.

OSHA assessed employee risk by evaluating exposure to the hazards associated with electric power generation, transmission, and distribution work in a large range of industries. Section V, *Regulatory Impact Assessment*, later in this preamble, presents OSHA's estimate of the costs and benefits of the Electric Power Generation, Transmission, and Distribution standard and the revised Electrical Protective Equipment standard in terms of the Standard Industrial Classification (SIC) codes for the industries regulated.

The Agency acknowledges that some industries covered by the Electric Power Generation, Transmission, and Distribution standard and by the revised Electrical Protective Equipment standard have more documented injuries or fatalities associated with electric power generation, transmission, and distribution work than do others. OSHA does not believe that the risk associated with exposure to electric power generation, transmission, and distribution hazards varies according to the number of incidents documented for a particular SIC code. OSHA has set the scope of the Electric Power Generation, Transmission, and Distribution standard and the revised Electrical Protective Equipment standard to address situations in which employees are exposed to these hazards, regardless of the relative frequency of incidents. The Agency believes, based on analysis of the elements of the hazards identified, that there is sufficient information for OSHA to determine that employees in the covered sectors face significant risks related to electric power generation, transmission, and distribution work and to the non-use or misuse of electrical protective equipment. Therefore, the Agency has determined that all employees within the scope of the Electric Power Generation, Transmission, and Distribution standard and the revised Electrical Protective Equipment standard face a significant risk of material harm and that compliance with these standards is reasonably necessary to protect affected employees from that risk, regardless of the number of injuries or fatalities reported for the SIC code to which the employer has been assigned.

TABLE 6.—SUMMARY OF BENEFITS AND COSTS OF RECENT OSHA SAFETY STANDARDS

Standard (CFR cite)	Final rule date (FR cite)	No. of deaths prevented annually	No. of injuries prevented annually	Annual cost first five yrs (mill)	Annual cost next five yrs (mill)
Grain handling (§ 1910.272)	12–31–87 (52 FR 049622)	18	394	5.9–33.4	5.9–33.4
HAZWOPER (§ 1910.120)	3–6–89 (54 FR 9311)	32	18,700	153	153
Excavations (subpart P)	10–31–89 (54 FR 45,954	74	800	306	306
Process safety mgmt (§ 1910.119)	2–24–92 (57 FR 6356)	330	1,917	880.7	470.8
Permit-required confined spaces (§ 1910.146)	1–14–93 (58 FR 4462)	54	5,041	202.4	202.4

OSHA has considered and responded to all substantive comments regarding the proposed Electric Power Generation, Transmission, and Distribution and Electrical Protective Equipment standards on their merits in section III, *Summary and Explanation of the Final Rule*, earlier in this preamble. In particular, OSHA evaluated all suggested changes to the proposed rule in terms of their impact on worker safety, their feasibility, their cost effectiveness, and their consonance with the OSH Act.

V. Regulatory Impact Assessment

A. Introduction

The Occupational Safety and Health Administration (OSHA) has determined that there is a significant risk to the health and safety of workers who are exposed to the hazards of electric power generation, transmission, and distribution. To protect workers from the unique hazards encountered in these work environments, OSHA is issuing this final standard on electric power generation, transmission, and distribution and the revised general industry standard on electrical protective equipment (29 CFR § 1910.269 and 29 CFR § 1910.137).

The final standard in § 1910.269 addresses work practices to be used during the operation and maintenance of electric power generation, transmission, and distribution installations. Additionally, § 1910.137 incorporates revisions made to the general industry standard on electrical protective equipment. These revisions primarily consist of performance-oriented requirements that are consistent with the latest national consensus standards.

Executive Order 12886 requires that a regulatory analysis be conducted for any rule having major economic consequences on the national economy, individual industries, geographical regions, or levels of government. In addition, the Regulatory Flexibility Act of 1980 (5 U.S.C. 601 et seq.) requires federal agencies to determine whether a regulation will have a significant economic impact on a substantial number of small entities.

Consistent with these requirements, OSHA has prepared this Regulatory Impact and Regulatory Flexibility Analysis for the standards on electric power generation, transmission, and distribution and on electrical protective equipment. This analysis includes an estimate of affected industries and employees, estimated benefits, the technological feasibility of the standards, estimated compliance costs, nonregulatory alternatives, and a discussion of the economic and environmental impacts of these final standards.

B. Industries and Employees Affected by the Standard

The final standard in § 1910.137 consists of revisions made to the general industry standard on electrical protective equipment. Those industries which utilize equipment necessary for electrical protective measures are affected by the scope of this rule. However, OSHA anticipates that these revisions will primarily impact industries involved in electric power generation, transmission, and distribution and industries in the non-utility sector involved with the cogeneration of electric power. This final standard is, therefore, considered to have a *de minimis* effect on all other industries.

Thus, on the basis of OSHA's analysis, these final standards will cover the electric utility industry (SIC 491 and part of SIC 493), contract power line workers, contract line-clearance tree trimmers, independent power producers, industrial generators of electric power, and establishments that perform high-voltage electrical work (including contractors). As Table 7 shows, there are 12,074 affected establishments within the scope of these final standards, and 382,073 employees who are considered exposed.

Within the three phases of electric power operations (that is, generation, transmission, and distribution), employees encounter a variety of occupational hazards. Although many of these hazards are specific to a particular phase, electricity is the most common source of occupational fatalities and serious injuries throughout. The consequences of inadvertent contact with high-voltage electricity are often death or serious injuries such as second-degree and third-degree burns, amputation of limbs, damage to internal organs, and neurological damage.

Electric power generation, transmission, and distribution employees also face occupational hazards other than electrocution. For example, high-pressure steam might be released inadvertently during maintenance work on multi-story boilers, machinery might accidentally be activated during maintenance work, or employees might fall from ladders, scaffolds, poles, or other elevations.

C. Benefits

The final standards mandate a comprehensive approach for the control of the hazards discussed earlier. Included in the standards are provisions for electrical protective equipment, initial training requirements, CPR training, lockout/tagout, equipment inspections, and live-line maintenance, among others. The majority of benefits are expected to be achieved in electric utilities, which account for approximately 80 percent of fatalities to be prevented and nearly two-thirds of the lost-workday injuries to be prevented.

The final rules are expected to significantly reduce the number of fatalities and injuries involving electrical contact, flash burns, and thermal burns, as well as other accidents involving uncontrolled exposure to occupational hazards. The rules are expected to prevent at least 59 fatalities and 323 lost-workday injuries per year. Several provisions within § 1910.269 reference existing OSHA standards. By increased recognition of these referenced standards, through employee training and administrative emphasis on hazard recognition (through job briefings, for example), OSHA estimates that an additional 2 fatalities and 1,310 lost-workday injuries will be prevented annually. Table 8 shows the summary of total benefits expected to be achieved through promulgation of the final rules.

D. Technological Feasibility

In assessing the technological feasibility of these final rules, OSHA reviewed existing electric power generation, transmission, and distribution practices and electrical protective equipment practices among the affected industries. Based on this review, OSHA considers the implementation of the final rules to be technologically feasible.

The final rule in § 1910.269 has included several new provisions or requirements that differ from the proposed rule. These new modifications primarily involve personnel time to develop programs and procedures and to train employees. Any equipment required to comply is either currently in use or readily available. OSHA has determined, based on its review, that all of the work practices and specifications required by the final standard are consistent with equipment procurement, installation, and work practices widely accepted in these industries.

E. Costs of Compliance

The cost of compliance with the final standards were estimated using the baseline of current electric utility practices. Electric utilities have had to comply with other parts of OSHA standards since 1970, and have been subject to various national consensus standards such as the National Electrical Safety Code and those of the American Society for Testing and Materials. Since many costs have already been incurred to comply with these standards, this analysis covers incremental costs that will need to be incurred to comply with new requirements imposed by §§ 1910.137 and 1910.269.

Compliance costs of the standards were based on industry profile information, current compliance rates, unit costs for required equipment, and hourly compensation of labor. For each provision of the standard, OSHA estimated initial costs and annual recurring costs. Initial costs represent up-front expenditures for program development and equipment. Any equipment that will need to be purchased was then annualized over the expected life of the resource in order to show these costs on an annual basis. Other ongoing expenditures incurred annually include refresher training, equipment maintenance, and inspections. OSHA summed the annualized capital costs and ongoing costs to estimate total annual costs.

OSHA estimates that the first year cost of compliance with the final rule will be $40.9 million and that the annual cost of compliance thereafter will be $21.7 million. Table 9 outlines the first year costs and annual costs by each sector affected by the final rule.

F. Nonregulatory Alternatives

The primary objective of OSHA's standards for electric power generation, transmission, and distribution work and for electrical protective equipment is to reduce the number of employee fatalities and injuries associated with the hazards involved in this work. OSHA believes these standards will eliminate to a considerable degree the worker risk experienced within the scope of the rules.

The Agency examined the nonregulatory approaches for promoting safety practices within industries that generate, transmit, and distribute electric power, including: (1) economic forces generated by the private market system, (2) incentives created by workers' compensation programs or the threat of private suits, and (3) related activities of private agencies. Following this review, OSHA determined that the need for government regulation arises from the significant risk of job-related injury or death caused by inadequate safety practices for electric power generation, transmission, and distribution work. Private markets fail to provide enough safety and health resources due to the lack of information on risk, immobility of labor, and externalization of part of the social costs of worker injuries and deaths. Workers' Compensation systems do not offer an adequate remedy because premiums do not reflect specific workplace risk and liability claims are restricted by statutes preventing employees from suing their employers. While certain voluntary industry standards exist, their scope and approach fail to provide adequate protection for all workers. Thus, OSHA has determined that a federal standard is necessary.

G. Economic Impacts

OSHA assessed the potential economic impact of the final standards on the affected industry sectors and has determined that impacts on prices, profits, and sales will be modest for most industries. In order to determine the economic feasibility of the standards, OSHA compared first-year compliance costs and recurring annual costs with revenue per firm (to produce price impact estimates) and before-tax profits per firm (to produce profit impact estimates) by Standard Industrial Classification (SIC) Code. Revenue and profit data were derived from Dun & Bradstreet databases.

Affected industries included SIC 0783, Shrub and Tree Services (line-clearance tree trimmers); SIC 1731, Electrical Work (high-voltage contractors); SIC 491, Electric Services (electric utilities and independent power producers); and SIC 493, Combination Electric and Gas, and Other Utility Services (electric utilities and independent power producers). Industrial generators and high-voltage customers were identified in SIC 13, Oil and Gas Production; SICs 20–39, Manufacturing; SICs 42–48, Transportation and Communications; SICs 50–57, Wholesale and Retail Trade; SICs 60–65, Finance, Insurance, and Real Estate; and SICs 70–87, Services.

Impacts were separately identified for large firms (20 or more employees) and small firms (1 to 19 employees). Among large firms in the electric utility industry, first-year price impacts were estimated to be less than 0.1 percent, assuming full cost pass through of contract power line workers' compliance costs. Estimated maximum profit impacts for large electric utilities in the first year were not expected to exceed 0.5 percent of pre-tax profits, also assuming full cost pass through of contract power line workers' compliance costs. For large line-clearance tree-trimming contractors, first-year price impacts were estimated to be 1.1 percent with maximum profit impacts of 13.1 percent. However, OSHA believes that large line-clearance tree-trimming firms will be able to pass the compliance costs through to their customers and therefore will not experience the decreased profits associated with the maximum profit impact scenario.

Large firms in the non-utility industry were identified among the independent power producers, industrial generators, high-voltage customers, and high-voltage contractors. First-year price and profit impacts for independent power producers are not expected to exceed 0.1 percent and 0.7 percent, respectively. Among industrial generators, first-year price impacts across all affected industries did not exceed 0.11 percent. First-year profit impacts in the industrial generating sector were generally less than 1.0 percent, with the highest impact (2.0 percent) occurring in SIC 82, Education Services. In industries with high-voltage customers, the first-year price impacts across all affected industries did not exceed 0.1 percent. First-year profit impacts for high-voltage customers were less than 1.0 percent in most industries, with the highest impact (1.2 percent) occurring in SIC 82, Education Services. Among high-voltage contractors, first-year price and profit impacts were not expected to be greater than 0.1 percent and 0.4 percent, respectively. OSHA concluded that these low levels of impact make the standards economically feasible for impacted large firms in all affected industries.

Pursuant to the Regulatory Flexibility Act of 1980 (5 U.S.C. 601 et seq.), OSHA assessed the impact of the final standards on small businesses. Within the electric utility industry, small businesses are not expected to experience price or profit impacts in excess of 0.2 percent even assuming full cost pass-through of contract power line workers' compliance costs. Estimated price impacts for small line-clearance tree trimmers were less than 0.6 percent, while the maximum estimated pre-tax profit impact was 8.2 percent. However, OSHA believes that small line-clearance tree-trimming firms will be able to pass the compliance costs through to their customers and therefore will not experience the decreased profits estimated under the maximum profit impact scenario. In the non-utility industries, only the independent power producer sector was identified as having affected small businesses. Small independent power producers are not expected to experience price impacts in excess of 0.1 percent or profit impacts in excess of 1.0 percent. Therefore, consistent with the Regulatory Flexibility Act, OSHA has concluded that the standards are economically feasible and will have no significant impact for small firms.

Thus, OSHA concludes that the economic impacts on affected industry groups will be small. It is not anticipated that small businesses will be disproportionately affected by the standards. OSHA also examined international trade and environmental issues and concludes that the standards will have no major negative impacts in those areas.

TABLE 7.—PROFILE OF ESTABLISHMENTS AND EMPLOYEES IN THE UTILITY AND NON-UTILITY INDUSTRIES

Industry Group[1]	Number of affected establishments	Number of affected large establishments	Number of affected small establishments	Number of exposed employees
Electric Utilities:				
Total Utilities Including: Investor-Owned, Cooperatively-Owned, Publicly Owned,[2] Federally Owned,	2,134	1,693	441	242,164
and Contract Power Line Workers				16,500
Total: Electric Utilities	2,134	1,693	441	258,664
Contract Line-Clearance Tree Trimmers:				
National Arborist Association	55	55	0	26,932
Others	1,750	0	1,750	10,000
Total: Contract Tree Trimmers	1,805	55	1,750	36,932
Independent Power Producers and Industrial Generators:				
Independent Power Producers	2,160	85	2,075	7,647
Industrial Generators	1,682	1,682	0	20,400
Total: IPP's and Generators	3,842	1,767	2,075	28,047
High-Voltage Contractors:				
Union Contractors	200	200	0	9,750
Non-Union Contractors	200	200	0	9,750
Total: High-Voltage Contractors	400	400	0	19,500
High-Voltage Utility Customers:				
Firms Performing In-House Work	3,893	3,893	0	38,930
Total	12,074	7,808	4,266	382,073

[1] Refer to the Industry Profile (Chapter II) of the *Final Regulatory Impact Analysis of the Electric Power Generation, Transmission and Distribution and the Electrical Protective Equipment Final Rules* for a detailed explanation of establishments and employees covered in the final standards.

[2] The number of publicly owned utilities and employees included among Affected Establishments and Exposed Employees excludes publicly owned utilities in non-state-plan states.

Source: OSHA, Office of Regulatory Analysis; Eastern Research Group, 1993.

Table 8.—Summary of Benefits Associated With the Final Electric Power Generation Standard and the Final Electrical Protective Equipment Standard

Type of accident/sector	Accident cases: Baseline	Accident cases: Prevented by final standards
Fatalities:		
Electric utilities[1]	60.7	42.6
Utility contractors		
Electrical contractors	9.4	6.6
Line-clearance tree trimmers	8.6	5.8
Non-utility establishments	6.8	5.6
Total	85.5	60.6
Lost-Workday Injuries:		
Electric utilities[1]	7,773.0	917.2
Utility Contractors		
Electrical contractors	529.0	62.4
Line-clearance tree trimmers	1,920.5	226.6
Non-utility establishments		
Power line workers	1,856.0	259.8
Power plant employees	898.0	167.0
Total	12,976.5	1,633.1

[1] Excludes totals for utility contractors.

Source: Eastern Research Group.

TABLE 9.—TOTAL COSTS OF COMPLIANCE FOR THE FINAL RULES

	First year costs	First year capital	Total costs first year	Recurring costs	Annualized capital	Annual costs (Year 2—)
Small Utilities	$132,630	$7,905	$140,535	$108,894	$7,905	$116,799
Large Utilities	12,906,120	696,719	13,602,840	9,645,738	696,719	10,342,458
Total: Utilities	13,038,750	704,624	13,743,374	9,754,633	704,624	10,459,257
Contract Power Line Workers	1,623,738	0	1,623,738	1,623,738	0	1,623,738
Line-Clearance Tree Trimmers—Small	1,204,789	0	1,204,789	498,851	0	498,851
Line-Clearance Tree Trimmers—Large	3,244,737	0	3,244,737	1,343,506	0	1,343,506
Total: Line-Clearance Tree Trimmers	4,449,525	0	4,449,525	1,842,357	0	1,842,357
Independent Power Producers—Small	2,915,395	386,503	3,301,898	978,182	386,503	1,364,686
Independent Power Producers—Large	1,067,586	15,833	1,083,419	208,910	15,833	224,742
Total: Independent Power Producers	3,982,981	402,336	4,385,317	1,187,092	402,336	1,589,428
Industrial Cogenerators	6,716,043	18,535	6,734,578	2,775,258	18,535	2,793,794
High-Voltage Customers	9,335,958	15,572	9,351,530	2,735,590	15,572	2,751,162
High-Voltage Contractors	648,504	0	648,504	648,504	0	648,504
Total	39,795,499	1,141,068	40,936,567	20,567,171	1,141,068	21,708,238

Source: U.S. Department of Labor, OSHA, Office of Regulatory Analysis, 1993.

VI. International Trade

Increases in the prices of domestically manufactured goods in general result in an increase in the demand for imports and a decrease in the demand for exports. The magnitude of this impact depends on the relevant demand elasticities and the magnitude of the price changes. While the final standard may result in slightly higher prices of manufactured goods, the estimated magnitude of this increase is so small that the Agency has concluded that any resultant impact on foreign trade will be negligible.

VII. Effective Date

In developing the Final Rule, OSHA has considered whether a delayed effective date is necessary for any of the provisions of the standard. Employers will need adequate time to integrate their procedures for complying with the lockout and tagging provisions in this standard into the procedures used under the generic lockout standard, § 1910.147, published on September 1, 1989 (54 FR 36644), and under the lockout requirements of the electrical safety-related work practices standard, published on August 6, 1990 (55 FR 31984). The work practices developed under final § 1910.269 will also have to be blended into the work practices required by the Subpart S standard. A period of 120 days should be adequate for this purpose, since most of the requirements in the Final Rule do not require extensive retrofitting or major modifications of existing equipment. The recently published electrical safety-related work practices and generic lockout standards, which are similar types of standards, also gave employers 120 days delay in effective date. Lastly, this amount of time should be adequate for employers to ensure that their work practices conform to the requirements of the new standard.

However, OSHA received evidence during the Subpart S rulemaking that it could take some electric utility employers a year or more to incorporate the training required by that standard into their existing training programs. The preamble to the final electrical safety-related work practices standard cited the testimony of Mr. Lamont Turner, who stated, on behalf of Edison Electric Institute, that it took his company 15 months to restructure their training program in order to meet regulations on hazardous waste (55 FR 32013–32014). This standard provided a 1-year's delay in effective date for its training requirements, and OSHA found this delay to be appropriate. Therefore, OSHA is similarly making the requirements on training contained in § 1910.269(a)(2) effective one year from the date of publication of the standard.

VIII. Federalism

This Final Rule has been reviewed in accordance with Executive Order 12612 (52 FR 41685, October 30, 1987), regarding Federalism. This Order requires that agencies, to the extent possible, refrain from limiting state policy options, consult with states before taking any actions which would restrict state policy options, and take such actions only if there is clear constitutional authority and the presence of a problem of national scope. The Order provides for preemption of state law only if there is a clear Congressional intent for the Agency to do so. Any such preemption is to be limited to the extent possible.

Section 18 of the Occupational Safety and Health Act (OSH Act) expresses Congress' clear intent to preempt state laws relating to issues on which Federal OSHA has promulgated occupational safety and health standards. Under the OSH Act, a state can avoid preemption only if it submits, and obtains Federal approval of, a plan for the development of such standards and their enforcement. Occupational safety and health standards developed by such Plan-States must, among other things, be at least as effective in providing safe and healthful employment and places of employment as the Federal standards. Where such standards are applicable to products distributed or used in interstate commerce, they may not unduly burden commerce and must be justified by compelling local conditions. (See section 18(c)(2) of the OSH Act).

The Federal standards on the operation and maintenance of electric power generation, transmission, and distribution systems and on electrical protective equipment address hazards which are not unique to any one state or region of the country. Nonetheless, states with occupational safety and health plans approved under Section 18 of the OSH Act will be able to develop their own state standards to deal with any special problems which might be encountered in a particular state. Moreover, because these standards are written in general, performance-oriented terms, there is considerable flexibility for state plans to require, and for affected employers to use, methods of compliance which are appropriate to the working conditions covered by the standard.

In brief, this Final Rule addresses a clear national problem related to occupational safety and health in general industry. States which have elected to participate under section 18 of the OSH Act are not preempted by this standard and will be able to address any special conditions within the framework of the Federal Act, while ensuring that the state standards are at least as effective as this standard.

IX. State Plan Standards

The 23 states and 2 territories with their own OSHA-approved occupational safety and health plans must adopt a comparable standard within 6 months of the publication date of the final standard. These states and territories are: Alaska, Arizona, California, Connecticut,[98] Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, New York,[99] North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Virgin Islands, Washington, and Wyoming. Until such time as a state standard is promulgated, Federal OSHA will provide interim enforcement assistance, as appropriate, in these states.

X. Index Terms and Authority

Authority

This document was prepared under the direction of Joseph A. Dear, Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, 200 Constitution Avenue, NW., Washington, DC 20210.

List of Subjects in 29 CFR Part 1910

Electric power; fire prevention; flammable materials; occupational safety and health; Occupational Safety and Health Administration; safety; signs and symbols; and tools.

Accordingly, pursuant to sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657), Secretary of Labor's Order No. 1–90 (55 FR 9033), and 29 CFR part 1911, 29 CFR part 1910 is amended as set forth below.

[98] Plan covers only State and local government employees.

[99] Plan covers only State and local government employees.

Signed at Washington, DC, this 13th day of January, 1994.

Joseph A. Dear,

Assistant Secretary of Labor.

Part 1910 of Title 29 of the Code of Federal Regulations is amended as follows:

PART 1910—[AMENDED]

Subpart I—Personal Protective Equipment

1. The authority citation for subpart I of part 1910 is revised to read as follows:

Authority: Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12–71 (36 FR 8754), 8–76 (41 FR 25059), 9–83 (48 FR 35736), or 1–90 (55 FR 9033) as applicable. Sections 1910.134 and 1910.137 also issued under 29 CFR part 1911.

2. Section 1910.137 is revised to read as follows:

§ 1910.137 Electrical protective equipment.

(a) *Design requirements.* Insulating blankets, matting, covers, line hose, gloves, and sleeves made of rubber shall meet the following requirements:

(1) *Manufacture and marking.* (i) Blankets, gloves, and sleeves shall be produced by a seamless process.

(ii) Each item shall be clearly marked as follows:

(A) Class 0 equipment shall be marked Class 0.

(B) Class 1 equipment shall be marked Class 1.

(C) Class 2 equipment shall be marked Class 2.

(D) Class 3 equipment shall be marked Class 3.

(E) Class 4 equipment shall be marked Class 4.

(F) Non-ozone-resistant equipment other than matting shall be marked Type I.

(G) Ozone-resistant equipment other than matting shall be marked Type II.

(H) Other relevant markings, such as the manufacturer's identification and the size of the equipment, may also be provided.

(iii) Markings shall be nonconducting and shall be applied in such a manner as not to impair the insulating qualities of the equipment.

(iv) Markings on gloves shall be confined to the cuff portion of the glove.

(2) *Electrical requirements.* (i) Equipment shall be capable of withstanding the a-c proof-test voltage specified in Table I–2 or the d-c proof-test voltage specified in Table I–3.

(A) The proof test shall reliably indicate that the equipment can withstand the voltage involved.

(B) The test voltage shall be applied continuously for 3 minutes for equipment other than matting and shall be applied continuously for 1 minute for matting.

(C) Gloves shall also be capable of withstanding the a-c proof-test voltage specified in Table I–2 after a 16-hour water soak. (See the note following paragraph (a)(3)(ii)(B) of this section.)

(ii) When the a-c proof test is used on gloves, the 60-hertz proof-test current may not exceed the values specified in Table I–2 at any time during the test period.

(A) If the a-c proof test is made at a frequency other than 60 hertz, the permissible proof-test current shall be computed from the direct ratio of the frequencies.

(B) For the test, gloves (right side out) shall be filled with tap water and immersed in water to a depth that is in accordance with Table I–4. Water shall be added to or removed from the glove, as necessary, so that the water level is the same inside and outside the glove.

(C) After the 16-hour water soak specified in paragraph (a)(2)(i)(C) of this section, the 60-hertz proof-test current may exceed the values given in Table I–2 by not more than 2 milliamperes.

(iii) Equipment that has been subjected to a minimum breakdown voltage test may not be used for electrical protection. (See the note following paragraph (a)(3)(ii)(B) of this section.)

(iv) Material used for Type II insulating equipment shall be capable of withstanding an ozone test, with no visible effects. The ozone test shall reliably indicate that the material will resist ozone exposure in actual use. Any visible signs of ozone deterioration of the material, such as checking, cracking, breaks, or pitting, is evidence of failure to meet the requirements for ozone-resistant material. (See the note following paragraph (a)(3)(ii)(B) of this section.)

(3) *Workmanship and finish.* (i) Equipment shall be free of harmful physical irregularities that can be detected by the tests or inspections required under this section.

(ii) Surface irregularities that may be present on all rubber goods because of imperfections on forms or molds or because of inherent difficulties in the manufacturing process and that may appear as indentations, protuberances, or imbedded foreign material are acceptable under the following conditions:

(A) The indentation or protuberance blends into a smooth slope when the material is stretched.

(B) Foreign material remains in place when the insulating material is folded and stretches with the insulating material surrounding it.

Note: Rubber insulating equipment meeting the following national consensus standards is deemed to be in compliance with paragraph (a) of this section:

American Society for Testing and Materials (ASTM) D 120–87, Specification for Rubber Insulating Gloves.

ASTM D 178–88, Specification for Rubber Insulating Matting.

ASTM D 1048–88a, Specification for Rubber Insulating Blankets.

ASTM D 1049–88, Specification for Rubber Insulating Covers.

ASTM D 1050–90, Specification for Rubber Insulating Line Hose.

ASTM D 1051–87, Specification for Rubber Insulating Sleeves.

These standards contain specifications for conducting the various tests required in paragraph (a) of this section. For example, the a-c and d-c proof tests, the breakdown test, the water soak procedure, and the ozone test mentioned in this paragraph are described in detail in the ASTM standards.

(b) *In-service care and use.* (1) Electrical protective equipment shall be maintained in a safe, reliable condition.

(2) The following specific requirements apply to insulating blankets, covers, line hose, gloves, and sleeves made of rubber:

(i) Maximum use voltages shall conform to those listed in Table I–5.

(ii) Insulating equipment shall be inspected for damage before each day's use and immediately following any incident that can reasonably be suspected of having caused damage. Insulating gloves shall be given an air test, along with the inspection.

(iii) Insulating equipment with any of the following defects may not be used:

(A) A hole, tear, puncture, or cut;

(B) Ozone cutting or ozone checking (the cutting action produced by ozone on rubber under mechanical stress into a series of interlacing cracks);

(C) An embedded foreign object;

(D) Any of the following texture changes: swelling, softening, hardening, or becoming sticky or inelastic.

(E) Any other defect that damages the insulating properties.

(iv) Insulating equipment found to have other defects that might affect its insulating properties shall be removed from service and returned for testing under paragraphs (b)(2)(viii) and (b)(2)(ix) of this section.

(v) Insulating equipment shall be cleaned as needed to remove foreign substances.

(vi) Insulating equipment shall be stored in such a location and in such a manner as to protect it from light, temperature extremes, excessive humidity, ozone, and other injurious substances and conditions.

(vii) Protector gloves shall be worn over insulating gloves, except as follows:

(A) Protector gloves need not be used with Class 0 gloves, under limited-use conditions, where small equipment and parts manipulation necessitate unusually high finger dexterity.

Note: Extra care is needed in the visual examination of the glove and in the avoidance of handling sharp objects.

(B) Any other class of glove may be used for similar work without protector gloves if the employer can demonstrate that the possibility of physical damage to the gloves is small and if the class of glove is one class higher than that required for the voltage involved. Insulating gloves that have been used without protector gloves may not be used at a higher voltage until they have been tested under the provisions of paragraphs (b) (2) (viii) and (b) (2) (xi) of this section.

(viii) Electrical protective equipment shall be subjected to periodic electrical tests. Test voltages and the maximum intervals between tests shall be in accordance with Table I–5 and Table I–6.

(ix) The test method used under paragraphs (b)(2)(viii) and (b)(2)(xi) of this section shall reliably indicate whether the insulating equipment can withstand the voltages involved.

Note: Standard electrical test methods considered as meeting this requirement are given in the following national consensus standards:

American Society for Testing and Materials (ASTM) D 120–87, Specification for Rubber Insulating Gloves.

ASTM D 1048–88a, Specification for Rubber Insulating Blankets.

ASTM D 1049–88, Specification for Rubber Insulating Covers.

ASTM D 1050–90, Specification for Rubber Insulating Line Hose.

ASTM D 1051–87, Specification for Rubber Insulating Sleeves.

ASTM F 478–92, Specification for In-Service Care of Insulating Line Hose and Covers.

ASTM F 479–88a, Specification for In-Service Care of Insulating Blankets.

ASTM F 496–91, Specification for In-Service Care of Insulating Gloves and Sleeves.

(x) Insulating equipment failing to pass inspections or electrical tests may not be used by employees, except as follows:

(A) Rubber insulating line hose may be used in shorter lengths with the defective portion cut off.

(B) Rubber insulating blankets may be repaired using a compatible patch that results in physical and electrical properties equal to those of the blanket.

(C) Rubber insulating blankets may be salvaged by severing the defective area from the undamaged portion of the blanket. The resulting undamaged area may not be smaller than 22 inches by 22 inches (560 mm by 560 mm) for Class 1, 2, 3, and 4 blankets.

(D) Rubber insulating gloves and sleeves with minor physical defects, such as small cuts, tears, or punctures, may be repaired by the application of a compatible patch. Also, rubber insulating gloves and sleeves with minor surface blemishes may be repaired with a compatible liquid compound. The patched area shall have electrical and physical properties equal to those of the surrounding material. Repairs to gloves are permitted only in the area between the wrist and the reinforced edge of the opening.

(xi) Repaired insulating equipment shall be retested before it may be used by employees.

(xii) The employer shall certify that equipment has been tested in accordance with the requirements of paragraphs (b)(2)(viii), (b)(2)(ix), and (b)(2)(xi) of this section. The certification shall identify the equipment that passed the test and the date it was tested.

Note: Marking of equipment and entering the results of the tests and the dates of testing onto logs are two acceptable means of meeting this requirement.

TABLE I–2.—A–C PROOF-TEST REQUIREMENTS

Class of equipment	Proof-test voltage rms V	Maximum proof-test current, mA (gloves only)			
		267-mm (10.5-in) glove	356-mm (14-in) glove	406-mm (16-in) glove	457-mm (18-in) glove
0	5,000	8	12	14	16
1	10,000	....	14	16	18

TABLE I-2.—A-C PROOF-TEST REQUIREMENTS—Continued

Class of equipment	Proof-test voltage rms V	Maximum proof-test current, mA (gloves only)			
		267-mm (10.5-in) glove	356-mm (14-in) glove	406-mm (16-in) glove	457-mm (18-in) glove
2	20,000		16	18	20
3	30,000		18	20	22
4	40,000			22	24

TABLE I-3.—D-C PROOF-TEST REQUIREMENTS

Class of equipment	Proof-test voltage
0	20,000
1	40,000
2	50,000
3	60,000
4	70,000

Note: The d-c voltages listed in this table are not appropriate for proof testing rubber insulating line hose or covers. For this equipment, d-c proof tests shall use a voltage high enough to indicate that the equipment can be safely used at the voltages listed in Table I-4. See ASTM D 1050-90 and ASTM D 1049-88 for further information on proof tests for rubber insulating line hose and covers.

TABLE I-4.—GLOVE TESTS—WATER LEVEL [1] [2]

Class of glove	AC proof test		DC proof test	
	mm.	in.	mm.	in.
0	38	1.5	38	1.5
1	38	1.5	51	2.0
2	64	2.5	76	3.0

TABLE I-4.—GLOVE TESTS—WATER LEVEL [1] [2]—Continued

Class of glove	AC proof test		DC proof test	
	mm.	in.	mm.	in.
3	89	3.5	102	4.0
4	127	5.0	153	6.0

[1] The water level is given as the clearance from the cuff of the glove to the water line, with a tolerance of ±13 mm. (±0.5 in.).

[2] If atmospheric conditions make the specified clearances impractical, the clearances may be increased by a maximum of 25 mm. (1 in.).

TABLE I-5.—RUBBER INSULATING EQUIPMENT VOLTAGE REQUIREMENTS

Class of equipment	Maximum use voltage [1] a-c—rms	Retest voltage [2] a-c—rms	Retest voltage [2] d-c—avg
0	1,000	5,000	20,000
1	7,500	10,000	40,000
2	17,000	20,000	50,000
3	26,500	30,000	60,000
4	36,000	40,000	70,000

[1] The maximum use voltage is the a-c voltage (rms) classification of the protective equipment that designates the maximum nominal design voltage of the energized system that may be safely worked. The nominal design voltage is equal to the phase-to-phase voltage on multiphase circuits. However, the phase-to-ground potential is considered to be the nominal design voltage:

(1) If there is no multiphase exposure in a system area and if the voltage exposure is limited to the phase-to-ground potential, or

(2) If the electrical equipment and devices are insulated or isolated or both so that the multiphase exposure on a grounded wye circuit is removed.

[2] The proof-test voltage shall be applied continuously for at least 1 minute, but no more than 3 minutes.

TABLE I-6.—RUBBER INSULATING EQUIPMENT TEST INTERVALS

Type of equipment	When to test
Rubber insulating line hose.	Upon indication that insulating value is suspect.
Rubber insulating covers.	Upon indication that insulating value is suspect.
Rubber insulating blankets.	Before first issue and every 12 months thereafter.[1]
Rubber insulating gloves.	Before first issue and every 6 months thereafter.[1]
Rubber insulating sleeves.	Before first issue and every 12 months thereafter.[1]

[1] If the insulating equipment has been electrically tested but not issued for service, it may not be placed into service unless it has been electrically tested within the previous 12 months.

Subpart R—Special Industries

3. The authority citation for subpart R of part 1910 is revised to read as follows:

Authority: Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), or 1-90 (55 FR 9033) as applicable.

Sections 1910.261, 1910.262, 1910.265, 1910.266, 1910.267, 1910.268, 1910.269, 1910.274, and 1910.275 also issued under 29 CFR Part 1911.

4. A new § 1910.269 is added to Subpart R to read as follows:

§ 1910.269 Electric power generation, transmission, and distribution.

(a) *General.* (1) *Application.* (i) This section covers the operation and maintenance of electric power generation, control, transformation, transmission, and distribution lines and equipment. These provisions apply to:

(A) Power generation, transmission, and distribution installations, including related equipment for the purpose of communication or metering, which are accessible only to qualified employees;

Note: The types of installations covered by this paragraph include the generation, transmission, and distribution installations of electric utilities, as well as equivalent installations of industrial establishments. Supplementary electric generating equipment that is used to supply a workplace for emergency, standby, or similar purposes only is covered under Subpart S of this Part. (See paragraph (a)(1)(ii)(B) of this section.)

(B) Other installations at an electric power generating station, as follows:

(*1*) Fuel and ash handling and processing installations, such as coal conveyors,

(*2*) Water and steam installations, such as penstocks, pipelines, and tanks, providing a source of energy for electric generators, and

(*3*) Chlorine and hydrogen systems.

(C) Test sites where electrical testing involving temporary measurements associated with electric power generation, transmission, and distribution is performed in laboratories, in the field, in substations, and on lines, as opposed to metering, relaying, and routine line work; and

(D) Work on or directly associated with the installations covered in paragraphs (a)(1)(i)(A) through (a)(1)(i)(C) of this section.

(E) Line-clearance tree-trimming operations, as follows:

(*1*) Entire § 1910.269 of this Part, except paragraph (r)(1) of this section, applies to line-clearance tree-trimming operations performed by qualified employees (those who are knowledgeable in the construction and operation of electric power generation, transmission, or distribution equipment involved, along with the associated hazards).

(*2*) Paragraphs (a)(2), (b), (c), (g), (k), (p), and (r) of this section apply to line-clearance tree-trimming operations performed by line-clearance tree trimmers who are not qualified employees.

(ii) Notwithstanding paragraph (A)(1)(I) of this section, § 1910.269 of this Part does not apply:

(A) To construction work, as defined in § 1910.12 of this Part; or

(B) To electrical installations, electrical safety-related work practices, or electrical maintenance considerations covered by Subpart S of this Part.

Note 1: Work practices conforming to §§ 1910.332 through 1910.335 of this Part are considered as complying with the electrical safety-related work practice requirements of this section identified in Table 1 of Appendix A–2 to this section, provided the work is being performed on a generation or distribution installation meeting §§ 1910.303 through 1910.308 of this Part. This table also identifies provisions in this section that apply to work by qualified persons directly on or associated with installations of electric power generation, transmission, and distribution lines or equipment, regardless of compliance with §§ 1910.332 through 1910.335 of this Part.

Note 2: Work practices performed by qualified persons and conforming to § 1910.269 of this Part are considered as complying with § 1910.333(c) and § 1910.335 of this Part.

(iii) This section applies in addition to all other applicable standards contained in this Part 1910. Specific references in this section to other sections of Part 1910 are provided for emphasis only.

(2) *Training.* Employees shall be trained in and familiar with the safety-related work practices, safety procedures, and other safety requirements in this section that pertain to their respective job assignments. Employees shall also be trained in and familiar with any other safety practices, including applicable emergency procedures (such as pole top and manhole rescue), that are not specifically addressed by this section but that are related to their work and are necessary for their safety.

(ii) Qualified employees shall also be trained and competent in:

(A) The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment,

(B) The skills and techniques necessary to determine the nominal voltage of exposed live parts,

(C) The minimum approach distances specified in this section corresponding to the voltages to which the qualified employee will be exposed, and

(D) The proper use of the special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electric equipment.

Note: For the purposes of this section, a person must have this training in order to be considered a qualified person.

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

(iv) An employee shall receive additional training (or retraining) under any of the following conditions:

(A) If the supervision and annual inspections required by paragraph (a)(2)(iii) of this section indicate that the employee is not complying with the safety-related work practices required by this section, or

(B) If new technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices that are different from those which the employee would normally use, or

(C) If he or she must employ safety-related work practices that are not normally used during his or her regular job duties.

Note: OSHA would consider tasks that are performed less often than once per year to necessitate retraining before the performance of the work practices involved.

(v) The training required by paragraph (a)(2) of this section shall be of the classroom or on-the-job type.

(vi) The training shall establish employee proficiency in the work practices required by this section and shall introduce the procedures necessary for compliance with this section.

(vii) The employer shall certify that each employee has received the training required by paragraph (a)(2) of this section. This certification shall be made when the employee demonstrates proficiency in the work practices involved and shall be maintained for the duration of the employee's employment.

Note: Employment records that indicate that an employee has received the required training are an acceptable means of meeting this requirement.

(3) *Existing conditions.* Existing conditions related to the safety of the work to be performed shall be determined before work on or near electric lines or equipment is started. Such conditions include, but are not limited to, the nominal voltages of lines and equipment, the maximum switching transient voltages, the presence of hazardous induced voltages, the presence and condition of protective grounds and equipment grounding conductors, the condition of poles, environmental conditions relative to safety, and the locations of circuits and equipment, including power and communication lines and fire protective signaling circuits.

(b) *Medical services and first aid.* The employer shall provide medical services and first aid as required in § 1910.151 of this Part. In addition to the requirements of § 1910.151 of this Part, the following requirements also apply:

(1) *Cardiopulmonary resuscitation and first aid training.* When employees are performing work on or associated with exposed lines or equipment energized at 50 volts or more, persons trained in first aid including cardiopulmonary resuscitation (CPR) shall be available as follows:

(i) For field work involving two or more employees at a work location, at least two trained persons shall be available. However, only one trained person need be available if all new employees are trained in first aid, including CPR, within 3 months of their hiring dates.

(ii) For fixed work locations such as generating stations, the number of trained persons available shall be sufficient to ensure that each employee exposed to electric shock can be reached within 4 minutes by a trained person. However, where the existing number of employees is insufficient to meet this requirement (at a remote substation, for example), all employees at the work location shall be trained.

(2) *First aid supplies.* First aid supplies required by § 1910.151(b) of

this Part shall be placed in weatherproof containers if the supplies could be exposed to the weather.

(3) *First aid kits.* Each first aid kit shall be maintained, shall be readily available for use, and shall be inspected frequently enough to ensure that expended items are replaced but at least once per year.

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

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

(2) *Extent of briefing.* A brief discussion is satisfactory if the work involved is routine and if the employee, by virtue of training and experience, can reasonably be expected to recognize and avoid the hazards involved in the job. A more extensive discussion shall be conducted:

(i) If the work is complicated or particularly hazardous, or

(ii) If the employee cannot be expected to recognize and avoid the hazards involved in the job.

Note: The briefing is always required to touch on all the subjects listed in the introductory text to paragraph (c) of this section.

(3) *Working alone.* An employee working alone need not conduct a job briefing. However, the employer shall ensure that the tasks to be performed are planned as if a briefing were required.

(d) *Hazardous energy control (lockout/tagout) procedures.* (1) *Application.* The provisions of paragraph (d) of this section apply to the use of lockout/tagout procedures for the control of energy sources in installations for the purpose of electric power generation, including related equipment for communication or metering. Locking and tagging procedures for the deenergizing of electric energy sources which are used exclusively for purposes of transmission and distribution are addressed by paragraph (m) of this section.

Note 1: Installations in electric power generation facilities that are not an integral part of, or inextricably commingled with, power generation processes or equipment are covered under § 1910.147 and Subpart S of this Part.

Note 2: Lockout and tagging procedures that comply with paragraphs (c) through (f) of § 1910.147 of this Part will also be deemed to comply with paragraph of this section if the procedures address the hazards covered by paragraph (d) of this section.

(2) *General.* (i) The employer shall establish a program consisting of energy control procedures, employee training, and periodic inspections to ensure that, before any employee performs any servicing or maintenance on a machine or equipment where the unexpected energizing, start up, or release of stored energy could occur and cause injury, the machine or equipment is isolated from the energy source and rendered inoperative.

(ii) The employer's energy control program under paragraph (d)(2) of this section shall meet the following requirements:

(A) If an energy isolating device is not capable of being locked out, the employer's program shall use a tagout system.

(B) If an energy isolating device is capable of being locked out, the employer's program shall use lockout, unless the employer can demonstrate that the use of a tagout system will provide full employee protection as follows:

(*1*) When a tagout device is used on an energy isolating device which is capable of being locked out, the tagout device shall be attached at the same location that the lockout device would have been attached, and the employer shall demonstrate that the tagout program will provide a level of safety equivalent to that obtained by the use of a lockout program.

(*2*) In demonstrating that a level of safety is achieved in the tagout program equivalent to the level of safety obtained by the use of a lockout program, the employer shall demonstrate full compliance with all tagout-related provisions of this standard together with such additional elements as are necessary to provide the equivalent safety available from the use of a lockout device. Additional means to be considered as part of the demonstration of full employee protection shall include the implementation of additional safety measures such as the removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device, or the removal of a valve handle to reduce the likelihood of inadvertent energizing.

(C) After [insert date 120 days after publication], whenever replacement or major repair, renovation, or modification of a machine or equipment is performed, and whenever new machines or equipment are installed, energy isolating devices for such machines or equipment shall be designed to accept a lockout device.

(iii) Procedures shall be developed, documented, and used for the control of potentially hazardous energy covered by paragraph (d) of this section.

(iv) The procedure shall clearly and specifically outline the scope, purpose, responsibility, authorization, rules, and techniques to be applied to the control of hazardous energy, and the measures to enforce compliance including, but not limited to, the following:

(A) A specific statement of the intended use of this procedure;

(B) Specific procedural steps for shutting down, isolating, blocking and securing machines or equipment to control hazardous energy;

(C) Specific procedural steps for the placement, removal, and transfer of lockout devices or tagout devices and the responsibility for them; and

(D) Specific requirements for testing a machine or equipment to determine and verify the effectiveness of lockout devices, tagout devices, and other energy control measures.

(v) The employer shall conduct a periodic inspection of the energy control procedure at least annually to ensure that the procedure and the provisions of paragraph (d) of this section are being followed.

(A) The periodic inspection shall be performed by an authorized employee who is not using the energy control procedure being inspected.

(B) The periodic inspection shall be designed to identify and correct any deviations or inadequacies.

(C) If lockout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized employee, of that employee's responsibilities under the energy control procedure being inspected.

(D) Where tagout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized and affected employee, of that employee's responsibilities under the energy control procedure being inspected, and the elements set forth in paragraph (d)(2)(vii) of this section.

(E) The employer shall certify that the inspections required by paragraph (d)(2)(v) of this section have been accomplished. The certification shall identify the machine or equipment on which the energy control procedure was being used, the date of the inspection, the employees included in the inspection, and the person performing the inspection.

Note: If normal work schedule and operation records demonstrate adequate inspection activity and contain the required information, no additional certification is required.

(vi) The employer shall provide training to ensure that the purpose and function of the energy control program are understood by employees and that the knowledge and skills required for the safe application, usage, and removal of energy controls are acquired by employees. The training shall include the following:

(A) Each authorized employee shall receive training in the recognition of applicable hazardous energy sources, the type and magnitude of energy available in the workplace, and in the methods and means necessary for energy isolation and control.

(B) Each affected employee shall be instructed in the purpose and use of the energy control procedure.

(C) All other employees whose work operations are or may be in an area where energy control procedures may be used shall be instructed about the procedures and about the prohibition relating to attempts to restart or reenergize machines or equipment that are locked out or tagged out.

(vii) When tagout systems are used, employees shall also be trained in the following limitations of tags:

(A) Tags are essentially warning devices affixed to energy isolating devices and do not provide the physical restraint on those devices that is provided by a lock.

(B) When a tag is attached to an energy isolating means, it is not to be removed without authorization of the authorized person responsible for it, and it is never to be bypassed, ignored, or otherwise defeated.

(C) Tags must be legible and understandable by all authorized employees, affected employees, and all other employees whose work operations are or may be in the area, in order to be effective.

(D) Tags and their means of attachment must be made of materials which will withstand the environmental conditions encountered in the workplace.

(E) Tags may evoke a false sense of security, and their meaning needs to be understood as part of the overall energy control program.

(F) Tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use.

(viii) Retraining shall be provided by the employer as follows:

(A) Retraining shall be provided for all authorized and affected employees whenever there is a change in their job assignments, a change in machines, equipment, or processes that present a new hazard or whenever there is a change in the energy control procedures.

(B) Retraining shall also be conducted whenever a periodic inspection under paragraph (d)(2)(v) of this section reveals, or whenever the employer has reason to believe, that there are deviations from or inadequacies in an employee's knowledge or use of the energy control procedures.

(C) The retraining shall reestablish employee proficiency and shall introduce new or revised control methods and procedures, as necessary.

(ix) The employer shall certify that employee training has been accomplished and is being kept up to date. The certification shall contain each employee's name and dates of training.

(3) *Protective materials and hardware.* (i) Locks, tags, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware shall be provided by the employer for isolating, securing, or blocking of machines or equipment from energy sources.

(ii) Lockout devices and tagout devices shall be singularly identified; shall be the only devices used for controlling energy; may not be used for other purposes; and shall meet the following requirements:

(A) Lockout devices and tagout devices shall be capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected.

(*1*) Tagout devices shall be constructed and printed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible.

(*2*) Tagout devices shall be so constructed as not to deteriorate when used in corrosive environments.

(B) Lockout devices and tagout devices shall be standardized within the facility in at least one of the following criteria: color, shape, size. Additionally, in the case of tagout devices, print and format shall be standardized.

(C) Lockout devices shall be substantial enough to prevent removal without the use of excessive force or unusual techniques, such as with the use of bolt cutters or metal cutting tools.

(D) Tagout devices, including their means of attachment, shall be substantial enough to prevent inadvertent or accidental removal. Tagout device attachment means shall be of a non-reusable type, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of no less than 50 pounds and shall have the general design and basic characteristics of being at least equivalent to a one-piece, all-environment-tolerant nylon cable tie.

(E) Each lockout device or tagout device shall include provisions for the identification of the employee applying the device.

(F) Tagout devices shall warn against hazardous conditions if the machine or equipment is energized and shall include a legend such as the following: Do Not Start, Do Not Open, Do Not Close, Do Not Energize, Do Not Operate.

Note: For specific provisions covering accident prevention tags, see § 1910.145 of this Part.

(4) *Energy isolation.* Lockout and tagout device application and removal may only be performed by the authorized employees who are performing the servicing or maintenance.

(5) *Notification.* Affected employees shall be notified by the employer or authorized employee of the application and removal of lockout or tagout devices. Notification shall be given before the controls are applied and after they are removed from the machine or equipment.

Note: See also paragraph (d)(7) of this section, which requires that the second notification take place before the machine or equipment is reenergized.

(6) *Lockout/tagout application.* The established procedures for the application of energy control (the lockout or tagout procedures) shall include the following elements and actions, and these procedures shall be performed in the following sequence:

(i) Before an authorized or affected employee turns off a machine or equipment, the authorized employee shall have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy.

(ii) The machine or equipment shall be turned off or shut down using the procedures established for the machine or equipment. An orderly shutdown shall be used to avoid any additional or increased hazards to employees as a result of the equipment stoppage.

(iii) All energy isolating devices that are needed to control the energy to the machine or equipment shall be physically located and operated in such a manner as to isolate the machine or equipment from energy sources.

(iv) Lockout or tagout devices shall be affixed to each energy isolating device by authorized employees.

(A) Lockout devices shall be attached in a manner that will hold the energy isolating devices in a "safe" or "off" position.

(B) Tagout devices shall be affixed in such a manner as will clearly indicate that the operation or movement of energy isolating devices from the "safe" or "off" position is prohibited.

(*1*) Where tagout devices are used with energy isolating devices designed with the capability of being locked out, the tag attachment shall be fastened at the same point at which the lock would have been attached.

(*2*) Where a tag cannot be affixed directly to the energy isolating device, the tag shall be located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.

(v) Following the application of lockout or tagout devices to energy isolating devices, all potentially hazardous stored or residual energy shall be relieved, disconnected, restrained, or otherwise rendered safe.

(vi) If there is a possibility of reaccumulation of stored energy to a hazardous level, verification of isolation shall be continued until the servicing or maintenance is completed or until the possibility of such accumulation no longer exists.

(vii) Before starting work on machines or equipment that have been locked out or tagged out, the authorized employee shall verify that isolation and deenergizing of the machine or equipment have been accomplished. If normally energized parts will be exposed to contact by an employee while the machine or equipment is deenergized, a test shall be performed to ensure that these parts are deenergized.

(7) *Release from lockout/tagout.* Before lockout or tagout devices are removed and energy is restored to the machine or equipment, procedures shall be followed and actions taken by the authorized employees to ensure the following:

(i) The work area shall be inspected to ensure that nonessential items have been removed and that machine or equipment components are operationally intact.

(ii) The work area shall be checked to ensure that all employees have been safely positioned or removed.

(iii) After lockout or tagout devices have been removed and before a machine or equipment is started, affected employees shall be notified that the lockout or tagout devices have been removed.

(iv) Each lockout or tagout device shall be removed from each energy isolating device by the authorized employee who applied the lockout or tagout device. However, if that employee is not available to remove it, the device may be removed under the direction of the employer, provided that specific procedures and training for such removal have been developed, documented, and incorporated into the employer's energy control program. The employer shall demonstrate that the specific procedure provides a degree of safety equivalent to that provided by the removal of the device by the authorized employee who applied it. The specific procedure shall include at least the following elements:

(A) Verification by the employer that the authorized employee who applied the device is not at the facility;

(B) Making all reasonable efforts to contact the authorized employee to inform him or her that his or her lockout or tagout device has been removed; and

(C) Ensuring that the authorized employee has this knowledge before he or she resumes work at that facility.

(8) *Additional requirements.* (i) If the lockout or tagout devices must be temporarily removed from energy isolating devices and the machine or equipment must be energized to test or position the machine, equipment, or component thereof, the following sequence of actions shall be followed:

(A) Clear the machine or equipment of tools and materials in accordance with paragraph (d)(7)(i) of this section;

(B) Remove employees from the machine or equipment area in accordance with paragraphs (d)(7)(ii) and (d)(7)(iii) of this section;

(C) Remove the lockout or tagout devices as specified in paragraph (d)(7)(iv) of this section;

(D) Energize and proceed with the testing or positioning; and

(E) Deenergize all systems and reapply energy control measures in accordance with paragraph (d)(6) of this section to continue the servicing or maintenance.

(ii) When servicing or maintenance is performed by a crew, craft, department, or other group, they shall use a procedure which affords the employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device. Group lockout or tagout devices shall be used in accordance with the procedures required by paragraphs (d)(2)(iii) and(d)(2)(iv) of this section including, but not limited to, the following specific requirements:

(A) Primary responsibility shall be vested in an authorized employee for a set number of employees working under the protection of a group lockout or tagout device (such as an operations lock);

(B) Provision shall be made for the authorized employee to ascertain the exposure status of all individual group members with regard to the lockout or tagout of the machine or equipment;

(C) When more than one crew, craft, department, or other group is involved, assignment of overall job-associated lockout or tagout control responsibility shall be given to an authorized employee designated to coordinate affected work forces and ensure continuity of protection; and

(D) Each authorized employee shall affix a personal lockout or tagout device to the group lockout device, group lockbox, or comparable mechanism when he or she begins work and shall remove those devices when he or she stops working on the machine or equipment being serviced or maintained.

(iii) Procedures shall be used during shift or personnel changes to ensure the continuity of lockout or tagout protection, including provision for the orderly transfer of lockout or tagout device protection between off-going and on-coming employees, to minimize their exposure to hazards from the unexpected energizing or start-up of the machine or equipment or from the release of stored energy.

(iv) Whenever outside servicing personnel are to be engaged in activities covered by paragraph (d) of this section, the on-site employer and the outside employer shall inform each other of their respective lockout or tagout procedures, and each employer shall ensure that his or her personnel understand and comply with restrictions and prohibitions of the energy control procedures being used.

(v) If energy isolating devices are installed in a central location under the exclusive control of a system operator, the following requirements apply:

(A) The employer shall use a procedure that affords employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device.

(B) The system operator shall place and remove lockout and tagout devices in place of the authorized employee under paragraphs (d)(4), (d)(6)(iv) and (d)(7)(iv) of this section.

(C) Provisions shall be made to identify the authorized employee who is responsible for (that is, being protected by) the lockout or tagout device, to transfer responsibility for lockout and tagout devices, and to ensure that an authorized employee requesting removal or transfer of a lockout or tagout device is the one responsible for it before the device is removed or transferred.

(e) *Enclosed spaces.* This paragraph covers enclosed spaces that may be entered by employees. It does not apply to vented vaults if a determination is made that the ventilation system is operating to protect employees before they enter the space. This paragraph applies to routine entry into enclosed spaces in lieu of the permit-space entry requirements contained in paragraphs (d) through (k) of § 1910.146 of this Part. If, after the precautions given in paragraphs (e) and (t) of this section are taken, the hazards remaining in the enclosed space endanger the life of an entrant or could interfere with escape from the space, then entry into the enclosed space shall meet the permit-space entry requirements of paragraphs (d) through (k) of § 1910.146 of this Part.

Note: Entries into enclosed spaces conducted in accordance with the permit-space entry requirements of paragraphs (d) through (k) of § 1910.146 of this Part are considered as complying with paragraph (e) of this section.

(1) *Safe work practices.* The employer shall ensure the use of safe work practices for entry into and work in enclosed spaces and for rescue of employees from such spaces.

(2) *Training.* Employees who enter enclosed spaces or who serve as attendants shall be trained in the hazards of enclosed space entry, in enclosed space entry procedures, and in enclosed space rescue procedures.

(3) *Rescue equipment.* Employers shall provide equipment to ensure the prompt and safe rescue of employees from the enclosed space.

(4) *Evaluation of potential hazards.* Before any entrance cover to an enclosed space is removed, the employer shall determine whether it is safe to do so by checking for the presence of any atmospheric pressure or temperature differences and by evaluating whether there might be a hazardous atmosphere in the space. Any conditions making it unsafe to remove the cover shall be eliminated before the cover is removed.

Note: The evaluation called for in this paragraph may take the form of a check of the conditions expected to be in the enclosed space. For example, the cover could be checked to see if it is hot and, if it is fastened in place, could be loosened gradually to release any residual pressure. A determination must also be made of whether conditions at the site could cause a hazardous atmosphere, such as an oxygen deficient or flammable atmosphere, to develop within the space.

(5) *Removal of covers.* When covers are removed from enclosed spaces, the opening shall be promptly guarded by a railing, temporary cover, or other barrier intended to prevent an accidental fall through the opening and to protect employees working in the space from objects entering the space.

(6) *Hazardous atmosphere.* Employees may not enter any enclosed space while it contains a hazardous atmosphere, unless the entry conforms to the generic permit-required confined spaces standard in § 1910.146 of this Part.

Note: The term "entry" is defined in § 1910.146(b) of this Part.

(7) *Attendants.* While work is being performed in the enclosed space, a person with first aid training meeting paragraph (b) of this section shall be immediately available outside the enclosed space to render emergency assistance if there is reason to believe that a hazard may exist in the space or if a hazard exists because of traffic patterns in the area of the opening used for entry. That person is not precluded from performing other duties outside the enclosed space if these duties do not distract the attendant from monitoring employees within the space.

Note: See paragraph of this section for additional requirements on attendants for work in manholes.

(8) *Calibration of test instruments.* Test instruments used to monitor atmospheres in enclosed spaces shall be kept in calibration, with a minimum accuracy of ±10 percent.

(9) *Testing for oxygen deficiency.* Before an employee enters an enclosed space, the internal atmosphere shall be tested for oxygen deficiency with a direct-reading meter or similar instrument, capable of collection and immediate analysis of data samples without the need for off-site evaluation. If continuous forced air ventilation is provided, testing is not required provided that the procedures used ensure that employees are not exposed to the hazards posed by oxygen deficiency.

(10) *Testing for flammable gases and vapors.* Before an employee enters an enclosed space, the internal atmosphere shall be tested for flammable gases and vapors with a direct-reading meter or similar instrument capable of collection and immediate analysis of data samples without the need for off-site evaluation. This test shall be performed after the oxygen testing and ventilation required by paragraph (e)(9) of this section demonstrate that there is sufficient oxygen to ensure the accuracy of the test for flammability.

(11) *Ventilation and monitoring.* If flammable gases or vapors are detected or if an oxygen deficiency is found, forced air ventilation shall be used to maintain oxygen at a safe level and to prevent a hazardous concentration of flammable gases and vapors from accumulating. A continuous monitoring program to ensure that no increase in flammable gas or vapor concentration occurs may be followed in lieu of ventilation, if flammable gases or vapors are detected at safe levels.

Note: See the definition of hazardous atmosphere for guidance in determining whether or not a given concentration of a substances is considered to be hazardous.

(12) *Specific ventilation requirements.* If continuous forced air ventilation is used, it shall begin before entry is made and shall be maintained long enough to ensure that a safe atmosphere exists before employees are allowed to enter the work area. The forced air ventilation shall be so directed as to ventilate the immediate area where employees are present within the enclosed space and shall continue until all employees leave the enclosed space.

(13) *Air supply.* The air supply for the continuous forced air ventilation shall be from a clean source and may not increase the hazards in the enclosed space.

(14) *Open flames.* If open flames are used in enclosed spaces, a test for flammable gases and vapors shall be made immediately before the open flame device is used and at least once per hour while the device is used in the space. Testing shall be conducted more frequently if conditions present in the enclosed space indicate that once per hour is insufficient to detect hazardous accumulations of flammable gases or vapors.

Note: See the definition of hazardous atmosphere for guidance in determining whether or not a given concentration of a substances is considered to be hazardous.

(f) *Excavations.* Excavation operations shall comply with Subpart P of Part 1926 of this chapter.

(g) *Personal protective equipment.* (1) *General.* Personal protective equipment shall meet the requirements of Subpart I of this Part.

(2) *Fall protection.* (i) Personal fall arrest equipment shall meet the requirements of Subpart E of Part 1926 of this Chapter.

(ii) Body belts and safety straps for work positioning shall meet the requirements of § 1926.959 of this Chapter.

(iii) Body belts, safety straps, lanyards, lifelines, and body harnesses shall be inspected before use each day to determine that the equipment is in safe working condition. Defective equipment may not be used.

(iv) Lifelines shall be protected against being cut or abraded.

(v) Fall arrest equipment, work positioning equipment, or travel restricting equipment shall be used by employees working at elevated locations more than 4 feet (1.2 m) above the ground on poles, towers, or similar structures if other fall protection has not been provided. The use of fall protection equipment is not required to be used by a qualified employee climbing or changing location on poles, towers, or similar structures, unless conditions, such as, but not limited to, ice, high winds, the design of the structure (for example, no provision for holding on with hands), or the presence of contaminants on the structure, could cause the employee to lose his or her grip or footing.

Note 1: This paragraph applies to structures that support overhead electric power generation, transmission, and distribution lines and equipment. It does not apply to portions of buildings, such as loading docks, to electric equipment, such as transformers and capacitors, nor to aerial lifts. Requirements for fall protection associated with walking and working surfaces are contained in Subpart D of this Part; requirements for fall protection associated with aerial lifts are contained in § 1910.67 of this Part.

Note 2: Employees undergoing training are not considered "qualified employees" for the purposes of this provision. Unqualified employees (including trainees) are required to use fall protection any time they are more than 4 feet (1.2 m) above the ground.

(vi) The following requirements apply to personal fall arrest systems:

(A) When stopping or arresting a fall, personal fall arrest systems shall limit the maximum arresting force on an employee to 900 pounds (4 kN) if used with a body belt.

(B) When stopping or arresting a fall, personal fall arrest systems shall limit the maximum arresting force on an employee to 1800 pounds (8 kN) if used with a body harness.

(C) Personal fall arrest systems shall be rigged such that an employee can neither free fall more than 6 feet (1.8 m) nor contact any lower level.

(vii) If vertical lifelines or droplines are used, not more than one employee may be attached to any one lifeline.

(viii) Snaphooks may not be connected to loops made in webbing-type lanyards.

(ix) Snaphooks may not be connected to each other.

(h) *Ladders, platforms, step bolts, and manhole steps.* (1) *General.* Requirements for ladders contained in Subpart D of this Part apply, except as specifically noted in paragraph (h)(2) of this section.

(2) *Special ladders and platforms.* Portable ladders and platforms used on structures or conductors in conjunction with overhead line work need not meet paragraphs (d)(2)(i) and (d)(2)(iii) of § 1910.25 of this Part or paragraph (c)(3)(iii) of § 1910.26 of this Part. However, these ladders and platforms shall meet the following requirements:

(i) Ladders and platforms shall be secured to prevent their becoming accidentally dislodged.

(ii) Ladders and platforms may not be loaded in excess of the working loads for which they are designed.

(iii) Ladders and platforms may be used only in applications for which they were designed.

(iv) In the configurations in which they are used, ladders and platforms shall be capable of supporting without failure at least 2.5 times the maximum intended load.

(3) *Conductive ladders.* Portable metal ladders and other portable conductive ladders may not be used near exposed energized lines or equipment. However, in specialized high-voltage work, conductive ladders shall be used where the employer can demonstrate that nonconductive ladders would present a greater hazard than conductive ladders.

(i) *Hand and portable power tools.* (1) *General.* Paragraph (i)(2) of this section applies to electric equipment connected by cord and plug. Paragraph (i)(3) of this section applies to portable and vehicle-mounted generators used to supply cord-and plug-connected equipment. Paragraph (i)(4) of this section applies to hydraulic and pneumatic tools.

(2) *Cord- and plug-connected equipment.* (i) Cord-and plug-connected equipment supplied by premises wiring is covered by Subpart S of this Part.

(ii) Any cord- and plug-connected equipment supplied by other than premises wiring shall comply with one of the following in lieu of § 1910.243(a)(5) of this Part:

(A) It shall be equipped with a cord containing an equipment grounding conductor connected to the tool frame and to a means for grounding the other end (however, this option may not be used where the introduction of the ground into the work environment increases the hazard to an employee); or

(B) It shall be of the double-insulated type conforming to Subpart S of this Part; or

(C) It shall be connected to the power supply through an isolating transformer with an ungrounded secondary.

(3) *Portable and vehicle-mounted generators.* Portable and vehicle-mounted generators used to supply cord- and plug-connected equipment shall meet the following requirements:

(i) The generator may only supply equipment located on the generator or the vehicle and cord- and plug-connected equipment through receptacles mounted on the generator or the vehicle.

(ii) The non-current-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles shall be bonded to the generator frame.

(iii) In the case of vehicle-mounted generators, the frame of the generator shall be bonded to the vehicle frame.

(iv) Any neutral conductor shall be bonded to the generator frame.

(4) *Hydraulic and pneumatic tools.* (i) Safe operating pressures for hydraulic and pneumatic tools, hoses, valves, pipes, filters, and fittings may not be exceeded.

Note: If any hazardous defects are present, no operating pressure would be safe, and the hydraulic or pneumatic equipment involved may not be used. In the absence of defects, the maximum rated operating pressure is the maximum safe pressure.

(ii) A hydraulic or pneumatic tool used where it may contact exposed live parts shall be designed and maintained for such use.

(iii) The hydraulic system supplying a hydraulic tool used where it may contact exposed live parts shall provide protection against loss of insulating value for the voltage involved due to the formation of a partial vacuum in the hydraulic line.

Note: Hydraulic lines without check valves having a separation of more than 35 feet (10.7 m) between the oil reservoir and the upper end of the hydraulic system promote the formation of a partial vacuum.

(iv) A pneumatic tool used on energized electrical lines or equipment or used where it may contact exposed live parts shall provide protection against the accumulation of moisture in the air supply.

(v) Pressure shall be released before connections are broken, unless quick acting, self-closing connectors are used. Hoses may not be kinked.

(vi) Employees may not use any part of their bodies to locate or attempt to stop a hydraulic leak.

(j) *Live-line tools.* (1) *Design of tools.* Live-line tool rods, tubes, and poles shall be designed and constructed to withstand the following minimum tests:

(i) 100,000 volts per foot (3281 volts per centimeter) of length for 5 minutes if the tool is made of fiberglass-reinforced plastic (FRP), or

(ii) 75,000 volts per foot (2461 volts per centimeter) of length for 3 minutes if the tool is made of wood, or

(iii) Other tests that the employer can demonstrate are equivalent.

Note: Live-line tools using rod and tube that meet ASTM F711–89, Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live-Line Tools, conform to paragraph (j)(1)(i) of this section.

(2) *Condition of tools*. (i) Each live-line tool shall be wiped clean and visually inspected for defects before use each day.

(ii) If any defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live-line tool is present after wiping, the tool shall be removed from service and examined and tested according to paragraph (j)(2)(iii) of this section before being returned to service.

(iii) Live-line tools used for primary employee protection shall be removed from service every 2 years and whenever required under paragraph (j)(2)(ii) of this section for examination, cleaning, repair, and testing as follows:

(A) Each tool shall be thoroughly examined for defects.

(B) If a defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live-line tool is found, the tool shall be repaired and refinished or shall be permanently removed from service. If no such defect or contamination is found, the tool shall be cleaned and waxed.

(C) The tool shall be tested in accordance with paragraphs (j)(2)(iii)(D) and (j)(2)(iii)(E) of this section under the following conditions:

(*1*) After the tool has been repaired or refinished; and

(*2*) After the examination if repair or refinishing is not performed, unless the tool is made of FRP rod or foam-filled FRP tube and the employer can demonstrate that the tool has no defects that could cause it to fail in use.

(D) The test method used shall be designed to verify the tool's integrity along its entire working length and, if the tool is made of fiberglass-reinforced plastic, its integrity under wet conditions.

(E) The voltage applied during the tests shall be as follows:

(*1*) 75,000 volts per foot (2461 volts per centimeter) of length for 1 minute if the tool is made of fiberglass, or

(*2*) 50,000 volts per foot (1640 volts per centimeter) of length for 1 minute if the tool is made of wood, or

(*3*) Other tests that the employer can demonstrate are equivalent.

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

(k) *Materials handling and storage*. (1) *General*. Material handling and storage shall conform to the requirements of Subpart N of this Part.

(2) *Materials storage near energized lines or equipment*. (i) In areas not restricted to qualified persons only, materials or equipment may not be stored closer to energized lines or exposed energized parts of equipment than the following distances plus an amount providing for the maximum sag and side swing of all conductors and providing for the height and movement of material handling equipment:

(A) For lines and equipment energized at 50 kV or less, the distance is 10 feet (305 cm).

(B) For lines and equipment energized at more than 50 kV, the distance is 10 feet (305 cm) plus 4 inches (10 cm) for every 10 kV over 50 kV.

(ii) In areas restricted to qualified employees, material may not be stored within the working space about energized lines or equipment.

Note: Requirements for the size of the working space are contained in paragraphs (u)(1) and (v)(3) of this section.

(l) *Working on or near exposed energized parts*. This paragraph applies to work on exposed live parts, or near enough to them, to expose the employee to any hazard they present.

(1) *General*. Only qualified employees may work on or with exposed energized lines or parts of equipment. Only qualified employees may work in areas containing unguarded, uninsulated energized lines or parts of equipment operating at 50 volts or more. Electric lines and equipment shall be considered and treated as energized unless the provisions of paragraph (d) or paragraph (m) of this section have been followed.

(i) Except as provided in paragraph (l)(1)(ii) of this section, at least two employees shall be present while the following types of work are being performed:

(A) Installation, removal, or repair of lines that are energized at more than 600 volts,

(B) Installation, removal, or repair of deenergized lines if an employee is exposed to contact with other parts energized at more than 600 volts,

(C) Installation, removal, or repair of equipment, such as transformers, capacitors, and regulators, if an employee is exposed to contact with parts energized at more than 600 volts,

(D) Work involving the use of mechanical equipment, other than insulated aerial lifts, near parts energized at more than 600 volts, and

(E) Other work that exposes an employee to electrical hazards greater than or equal to those posed by operations that are specifically listed in paragraphs (l)(1)(i)(A) through (l)(1)(i)(D) of this section.

(ii) Paragraph (l)(1)(i) of this section does not apply to the following operations:

(A) Routine switching of circuits, if the employer can demonstrate that conditions at the site allow this work to be performed safely,

(B) Work performed with live-line tools if the employee is positioned so that he or she is neither within reach of nor otherwise exposed to contact with energized parts, and

(C) Emergency repairs to the extent necessary to safeguard the general public.

(2) *Minimum approach distances*. The employer shall ensure that no employee approaches or takes any conductive object closer to exposed energized parts than set forth in Table R–6 through Table R–10, unless:

(i) The employee is insulated from the energized part (insulating gloves or insulating gloves and sleeves worn in accordance with paragraph (l)(3) of this section are considered insulation of the employee only with regard to the energized part upon which work is being performed), or

(ii) The energized part is insulated from the employee and from any other conductive object at a different potential, or

(iii) The employee is insulated from any other exposed conductive object, as during live-line bare-hand work.

Note: Paragraphs (v)(5)(i) and of this section contain requirements for the guarding and isolation of live parts. Parts of electric circuits that meet these two provisions are not considered as "exposed" unless a guard is removed or an employee enters the space intended to provide isolation from the live parts.

(3) *Type of insulation*. If the employee is to be insulated from energized parts by the use of insulating gloves (under paragraph (l)(2)(i) of this section), insulating sleeves shall also be used. However, insulating sleeves need not be used under the following conditions:

(i) If exposed energized parts on which work is not being performed are insulated from the employee and

(ii) If such insulation is placed from a position not exposing the employee's upper arm to contact with other energized parts.

(4) *Working position.* The employer shall ensure that each employee, to the extent that other safety-related conditions at the worksite permit, works in a position from which a slip or shock will not bring the employee's body into contact with exposed, uninsulated parts energized at a potential different from the employee.

(5) *Making connections.* The employer shall ensure that connections are made as follows:

(i) In connecting deenergized equipment or lines to an energized circuit by means of a conducting wire or device, an employee shall first attach the wire to the deenergized part;

(ii) When disconnecting equipment or lines from an energized circuit by means of a conducting wire or device, an employee shall remove the source end first; and

(iii) When lines or equipment are connected to or disconnected from energized circuits, loose conductors shall be kept away from exposed energized parts.

(6) *Apparel.* (i) When work is performed within reaching distance of exposed energized parts of equipment, the employer shall ensure that each employee removes or renders nonconductive all exposed conductive articles, such as key or watch chains, rings, or wrist watches or bands, unless such articles do not increase the hazards associated with contact with the energized parts.

(ii) The employer shall train each employee who is exposed to the hazards of flames or electric arcs in the hazards involved.

(iii) The employer shall ensure that each employee who is exposed to the hazards of flames or electric arcs does not wear clothing that, when exposed to flames or electric arcs, could increase the extent of injury that would be sustained by the employee.

Note: Clothing made from the following types of fabrics, either alone or in blends, is prohibited by this paragraph, unless the employer can demonstrate that the fabric has been treated to withstand the conditions that may be encountered or that the clothing is worn in such a manner as to eliminate the hazard involved: acetate, nylon, polyester, rayon.

(7) *Fuse handling.* When fuses must be installed or removed with one or both terminals energized at more than 300 volts or with exposed parts energized at more than 50 volts, the employer shall ensure that tools or gloves rated for the voltage are used. When expulsion-type fuses are installed with one or both terminals energized at more than 300 volts, the employer shall ensure that each employee wears eye protection meeting the requirements of Subpart I of this Part, uses a tool rated for the voltage, and is clear of the exhaust path of the fuse barrel.

(8) *Covered (noninsulated) conductors.* The requirements of this section which pertain to the hazards of exposed live parts also apply when work is performed in the proximity of covered (noninsulated) wires.

(9) *Noncurrent-carrying metal parts.* Noncurrent-carrying metal parts of equipment or devices, such as transformer cases and circuit breaker housings, shall be treated as energized at the highest voltage to which they are exposed, unless the employer inspects the installation and determines that these parts are grounded before work is performed.

(10) *Opening circuits under load.* Devices used to open circuits under load conditions shall be designed to interrupt the current involved.

TABLE R–6.—AC Live-Line Work Minimum Approach Distance

Nominal voltage in kilovolts phase to phase	Distance			
	Phase to ground exposure		Phase to phase exposure	
	(ft-in)	(m)	(ft-in)	(m)
0.05 to 1.0	(4)	(4)	(4)	(4)
1.1 to 15.0	2–1	0.64	2–2	0.66
15.1 to 36.0	2–4	0.72	2–7	0.77
36.1 to 46.0	2–7	0.77	2–10	0.85
46.1 to 72.5	3–0	0.90	3–6	1.05
72.6 to 121	3–2	0.95	4–3	1.29
138 to 145	3–7	1.09	4–11	1.50
161 to 169	4–0	1.22	5–8	1.71
230 to 242	5–3	1.59	7–6	2.27
345 to 362	8–6	2.59	12–6	3.80
500 to 550	11–3	3.42	18–1	5.50
765 to 800	14–11	4.53	26–0	7.91

NOTE 1: These distances take into consideration the highest switching surge an employee will be exposed to on any system with air as the insulating medium and the maximum voltages shown.

NOTE 2: The clear live-line tool distance shall equal or exceed the values for the indicated voltage ranges.

NOTE 3: See Appendix B of this part for information on how the minimum approach distances listed in the tables were derived.

[4] Avoid contact.

TABLE R–7.—AC LIVE-LINE WORK MINIMUM APPROACH DISTANCE WITH OVERVOLTAGE FACTOR PHASE-TO-GROUND EXPOSURE

Maximum anticipated per-unit transient overvoltage	Distance in feet-inches						
	Maximum phase-to-phase voltage in kilovolts						
	121	145	169	242	362	552	800
1.5	....	....	....	....	....	6–0	9–8
1.6	....	....	....	....	....	6–6	10–8
1.7	....	....	....	....	....	7–0	11–8
1.8	....	....	....	....	....	7–7	12–8
1.9	....	....	....	....	....	8–1	13–9
2.0	2–5	2–9	3–0	3–10	5–3	8–9	14–11
2.1	2–6	2–10	3–2	4–0	5–5	9–4	....
2.2	2–7	2–11	3–3	4–1	5–9	9–11	....
2.3	2–8	3–0	3–4	4–3	6–1	10–6	....
2.4	2–9	3–1	3–5	4–5	6–4	11–3	....
2.5	2–9	3–2	3–6	4–6	6–8	....	....
2.6	2–10	3–3	3–8	4–8	7–1	....	....
2.7	2–11	3–4	3–9	4–10	7–5	....	....
2.8	3–0	3–5	3–10	4–11	7–9	....	....
2.9	3–1	3–6	3–11	5–1	8–2	....	....

TABLE R-7.—AC LIVE-LINE WORK MINIMUM APPROACH DISTANCE WITH OVERVOLTAGE FACTOR PHASE-TO-GROUND EXPOSURE—CONTINUED

Maximum anticipated per-unit transient overvoltage	Distance in feet-inches						
	Maximum phase-to-phase voltage in kilovolts						
	121	145	169	242	362	552	800
3.0	3–2	3–7	4–0	5–3	8–6	....	....

NOTE 1: The distance specified in this table may be applied only where the maximum anticipated per-unit transient overvoltage has been determined by engineering analysis and has been supplied by the employer. Table R–6 applies otherwise.
NOTE 2: The distances specified in this table are the air, bare-hand, and live-line tool distances.
NOTE 3: See Appendix B of this part for information on how the minimum approach distances listed in the tables were derived and on how to calculate revised minimum approach distances based on the control of transient overvoltages.

TABLE R–8.—AC LIVE-LINE WORK MINIMUM APPROACH DISTANCE WITH OVERVOLTAGE FACTOR PHASE-TO-PHASE EXPOSURE

Maximum anticipated per-unit transient overvoltage	Distance in feet-inches						
	Maximum phase-to-phase voltage in kilovolts						
	121	145	169	242	362	552	800
1.5	....	....	....	....	....	7–4	12–1
1.6	....	....	....	....	....	8–9	14–6
1.7	....	....	....	....	....	10–2	17–2
1.8	....	....	....	....	....	11–7	19–11
1.9	....	....	....	....	....	13–2	22–11
2.0	3–7	4–1	4–8	6–1	8–7	14–10	26–0
2.1	3–7	4–2	4–9	6–3	8–10	15–7	....
2.2	3–8	4–3	4–10	6–4	9–2	16–4	....
2.3	3–9	4–4	4–11	6–6	9–6	17–2	....
2.4	3–10	4–5	5–0	6–7	9–11	18–1	....
2.5	3–11	4–6	5–2	6–9	10–4	....	....
2.6	4–0	4–7	5–3	6–11	10–9	....	....
2.7	4–1	4–8	5–4	7–0	11–2	....	....
2.8	4–1	4–9	5–5	7–2	11–7	....	....
2.9	4–2	4–10	5–6	7–4	12–1	....	....
3.0	4–3	4–11	5–8	7–6	12–6	....	....

NOTE 1: The distance specified in this table may be applied only where the maximum anticipated per-unit transient overvoltage has been determined by engineering analysis and has been supplied by the employer. Table R–6 applies otherwise.
NOTE 2: The distances specified in this table are the air, bare-hand, and live-line tool distances.
NOTE 3: See Appendix B of this part for information on how the minimum approach distances listed in the tables were derived and on how to calculate revised minimum approach distances based on the control of transient overvoltages.

TABLE R–9.—DC Live-Line Work Minimum Approach Distance With Overvoltage Factor

Maximum anticipated per-unit transient overvoltage	Distance in feet-inches				
	Maximum line-to-ground voltage in kilovolts				
	250	400	500	600	750
1.5 or lower	3–8	5–3	6–9	8–7	11–10
1.6	3–10	5–7	7–4	9–5	13–1
1.7	4–1	6–0	7–11	10–3	14–4
1.8	4–3	6–5	8–7	11–2	15–9

NOTE 1: The distances specified in this table may be applied only where the maximum anticipated per-unit transient overvoltage has been determined by engineering analysis and has been supplied by the employer. However, if the transient overvoltage factor is not known, a factor of 1.8 shall be assumed.
NOTE 2: The distances specified in this table are the air, bare-hand, and live-line tool distances.

TABLE R–10.—ALTITUDE CORRECTION FACTOR

Altitude				Correction factor	
ft	ft	m	m		
3000	10000	900	3000	1.00	1.20
4000	12000	1200	3600	1.02	1.25
5000	14000	1500	4200	1.05	1.30
6000	16000	1800	4800	1.08	1.35
7000	18000	2100	5400	1.11	1.39
8000	20000	2400	6000	1.14	1.44
9000		2700		1.17	

NOTE: If the work is performed at elevations greater than 3000 ft (900 m) above mean sea level, the minimum approach distance shall be determined by multiplying the distances in Table R–6 through Table R–9 by the correction factor corresponding to the altitude at which work is performed.

(m) *Deenergizing lines and equipment for employee protection.* (1) *Application.* Paragraph (m) of this section applies to the deenergizing of transmission and distribution lines and equipment for the purpose of protecting employees. Control of hazardous energy sources used in the generation of electric energy is covered in paragraph (d) of this section. Conductors and parts of electric equipment that have been deenergized under procedures other than those required by paragraphs (d) or (m) of this section, as applicable, shall be treated as energized.

(2) *General.* (i) If a system operator is in charge of the lines or equipment and their means of disconnection, all of the requirements of paragraph (m)(3) of this section shall be observed, in the order given, before work is begun.

(ii) If no system operator is in charge of the lines or equipment and their means of disconnection, one employee in the crew shall be designated as being in charge of the clearance. All of the requirements of paragraph (m)(3) of this section apply, in the order given, except as provided in paragraph (m)(2)(iii) of this section. The employee in charge of the clearance shall take the place of the system operator, as necessary.

(iii) If only one crew will be working on the lines or equipment and if the means of disconnection is accessible and visible to and under the sole control of the employee in charge of the clearance, paragraphs (m)(3)(i), (m)(3)(iii), (m)(3)(iv), (m)(3)(viii) and (m)(3)(xii) of this section do not apply. Additionally, tags required by the remaining provisions of paragraph (m)(3) of this section need not be used.

(iv) Any disconnecting means that are accessible to persons outside the employer's control (for example, the general public) shall be rendered inoperable while they are open for the purpose of protecting employees.

(3) *Deenergizing lines and equipment.* (i) A designated employee shall make a request of the system operator to have the particular section of line or equipment deenergized. The designated employee becomes the employee in charge (as this term is used in paragraph (m)(3) of this section) and is responsible for the clearance.

(ii) 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 shall be opened. Such means shall be rendered inoperable, unless its design does not so permit, and tagged to indicate that employees are at work.

(iii) Automatically and remotely controlled switches that could cause the opened disconnecting means to close shall also be tagged at the point of control. The automatic or remote control feature shall be rendered inoperable, unless its design does not so permit.

(iv) Tags shall prohibit operation of the disconnecting means and shall indicate that employees are at work.

(v) After the applicable requirements in paragraphs (m)(3)(i) through (m)(3)(iv) of this section have been followed and the employee in charge of the work has been given a clearance by the system operator, the lines and equipment to be worked shall be tested to ensure that they are deenergized.

(vi) Protective grounds shall be installed as required by paragraph (n) of this section.

(vii) After the applicable requirements of paragraphs (m)(3)(i) through (m)(3)(vi) of this section have been followed, the lines and equipment involved may be worked as deenergized.

(viii) If two or more independent crews will be working on the same lines or equipment, each crew shall independently comply with the requirements in paragraph (m)(3) of this section.

(ix) To transfer the clearance, the employee in charge (or, if the employee in charge is forced to leave the worksite due to illness or other emergency, the employee's supervisor) shall inform the system operator; employees in the crew shall be informed of the transfer; and the new employee in charge shall be responsible for the clearance.

(x) To release a clearance, the employee in charge shall:

(A) Notify employees under his or her direction that the clearance is to be released;

(B) Determine that all employees in the crew are clear of the lines and equipment;

(C) Determine that all protective grounds installed by the crew have been removed; and

(D) Report this information to the system operator and release the clearance.

(xi) The person releasing a clearance shall be the same person that requested the clearance, unless responsibility has been transferred under paragraph (m)(3)(ix) of this section.

(xii) Tags may not be removed unless the associated clearance has been released under paragraph (m)(3)(x) of this section.

(xiii) Only after all protective grounds have been removed, after all crews working on the lines or equipment have released their clearances, after all employees are clear of the lines and equipment, and after all protective tags have been removed from a given point of disconnection, may action be initiated to reenergize the lines or equipment at that point of disconnection.

(n) *Grounding for the protection of employees.* (1) *Application.* Paragraph (n) of this section applies to the grounding of transmission and distribution lines and equipment for the purpose of protecting employees. Paragraph (n)(4) of this section also applies to the protective grounding of other equipment as required elsewhere in this section.

(2) *General.* For the employee to work lines or equipment as deenergized, the lines or equipment shall be deenergized under the provisions of paragraph (m) of this section and shall be grounded as specified in paragraphs (n)(3) through (n)(9) of this section. However, if the employer can demonstrate that installation of a ground is impracticable or that the conditions resulting from the installation of a ground would present greater hazards than working without grounds, the lines and equipment may be treated as deenergized provided all of the following conditions are met:

(i) The lines and equipment have been deenergized under the provisions of paragraph (m) of this section.

(ii) There is no possibility of contact with another energized source.

(iii) The hazard of induced voltage is not present.

(3) *Equipotential zone.* Temporary protective grounds shall 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.

(4) *Protective grounding equipment.* (i) Protective grounding equipment shall be capable of conducting the maximum fault current that could flow at the point of grounding for the time necessary to clear the fault. This equipment shall have an ampacity greater than or equal to that of No. 2 AWG copper.

Note: Guidelines for protective grounding equipment are contained in American Society for Testing and Materials Standard Specifications for Temporary Grounding Systems to be Used on De-Energized Electric Power Lines and Equipment, ASTM F855–1990.

(ii) Protective grounds shall have an impedance low enough to cause immediate operation of protective devices in case of accidental energizing of the lines or equipment.

(5) *Testing.* Before any ground is installed, lines and equipment shall be tested and found absent of nominal voltage, unless a previously installed ground is present.

(6) *Order of connection.* When a ground is to be attached to a line or to equipment, the ground-end connection shall be attached first, and then the other end shall be attached by means of a live-line tool.

(7) *Order of removal.* When a ground is to be removed, the grounding device shall be removed from the line or equipment using a live-line tool before the ground-end connection is removed.

(8) *Additional precautions.* 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.

(9) *Removal of grounds for test.* Grounds may be removed temporarily during tests. During the test procedure, the employer shall ensure that each employee uses insulating equipment and is isolated from any hazards involved, and the employer shall institute any additional measures as may be necessary to protect each exposed employee in case the previously grounded lines and equipment become energized.

(o) *Testing and test facilities.* (1) *Application.* Paragraph (o) of this section provides for safe work practices for high-voltage and high-power testing performed in laboratories, shops, and substations, and in the field and on electric transmission and distribution lines and equipment. It applies only to testing involving interim measurements utilizing high voltage, high power, or combinations of both, and not to testing involving continuous measurements as in routine metering, relaying, and normal line work.

Note: Routine inspection and maintenance measurements made by qualified employees are considered to be routine line work and are not included in the scope of paragraph (o) of this section, as long as the hazards related to the use of intrinsic high-voltage or high-power sources require only the normal precautions associated with routine operation and maintenance work required in the other paragraphs of this section. Two typical examples of such excluded test work procedures are "phasing-out" testing and testing for a "no-voltage" condition.

(2) *General requirements.* (i) The employer shall establish and enforce work practices for the protection of each worker from the hazards of high-voltage or high-power testing at all test areas, temporary and permanent. Such work practices shall include, as a minimum, test area guarding, grounding, and the safe use of measuring and control circuits. A means providing for periodic safety checks of field test areas shall also be included. (See paragraph (o)(6) of this section.)

(ii) Employees shall be trained in safe work practices upon their initial assignment to the test area, with periodic reviews and updates provided as required by paragraph (a)(2) of this section.

(3) *Guarding of test areas.* (i) Permanent test areas shall be guarded by walls, fences, or barriers designed to keep employees out of the test areas.

(ii) In field testing, or at a temporary test site where permanent fences and gates are not provided, one of the following means shall be used to prevent unauthorized employees from entering:

(A) The test area shall be guarded by the use of distinctively colored safety tape that is supported approximately waist high and to which safety signs are attached,

(B) The test area shall be guarded by a barrier or barricade that limits access to the test area to a degree equivalent, physically and visually, to the barricade specified in paragraph (o)(3)(ii)(A) of this section, or

(C) The test area shall be guarded by one or more test observers stationed so that the entire area can be monitored.

(iii) The barriers required by paragraph (o)(3)(ii) of this section shall be removed when the protection they provide is no longer needed.

(iv) Guarding shall be provided within test areas to control access to test equipment or to apparatus under test that may become energized as part of the testing by either direct or inductive coupling, in order to prevent accidental employee contact with energized parts.

(4) *Grounding practices.* (i) The employer shall establish and implement safe grounding practices for the test facility.

(A) All conductive parts accessible to the test operator during the time the equipment is operating at high voltage shall be maintained at ground potential except for portions of the equipment that are isolated from the test operator by guarding.

(B) Wherever ungrounded terminals of test equipment or apparatus under test may be present, they shall be treated as energized until determined by tests to be deenergized.

(ii) Visible grounds shall be applied, either automatically or manually with properly insulated tools, to the high-voltage circuits after they are deenergized and before work is performed on the circuit or item or apparatus under test. Common ground connections shall be solidly connected to the test equipment and the apparatus under test.

(iii) In high-power testing, an isolated ground-return conductor system shall be provided so that no intentional passage of current, with its attendant voltage rise, can occur in the ground grid or in the earth. However, an isolated ground-return conductor need not be provided if the employer can demonstrate that both the following conditions are met:

(A) An isolated ground-return conductor cannot be provided due to the distance of the test site from the electric energy source, and

(B) Employees are protected from any hazardous step and touch potentials that may develop during the test.

Note: See Appendix C of this part for information on measures that can be taken to protect employees from hazardous step and touch potentials.

(iv) In tests in which grounding of test equipment by means of the equipment grounding conductor located in the equipment power cord cannot be used due to increased hazards to test personnel or the prevention of satisfactory measurements, a ground that the employer can demonstrate affords equivalent safety shall be provided, and the safety ground shall be clearly indicated in the test set-up.

(v) When the test area is entered after equipment is deenergized, a ground shall be placed on the high-voltage terminal and any other exposed terminals.

(A) High capacitance equipment or apparatus shall be discharged through a resistor rated for the available energy.

(B) A direct ground shall be applied to the exposed terminals when the stored energy drops to a level at which it is safe to do so.

(vi) If a test trailer or test vehicle is used in field testing, its chassis shall be grounded. Protection against hazardous touch potentials with respect to the vehicle, instrument panels, and other conductive parts accessible to employees shall be provided by bonding, insulation, or isolation.

(5) *Control and measuring circuits.* (i) Control wiring, meter connections, test leads and cables may not be run from a test area unless they are contained in a grounded metallic sheath and terminated in a grounded metallic enclosure or unless other precautions are taken that the employer can demonstrate as ensuring equivalent safety.

(ii) Meters and other instruments with accessible terminals or parts shall be isolated from test personnel to protect against hazards arising from such terminals and parts becoming energized during testing. If this isolation is provided by locating test equipment in metal compartments with viewing windows, interlocks shall be provided to interrupt the power supply if the compartment cover is opened.

(iii) The routing and connections of temporary wiring shall be made secure against damage, accidental interruptions and other hazards. To the maximum extent possible, signal, control, ground, and power cables shall be kept separate.

(iv) If employees will be present in the test area during testing, a test observer shall be present. The test observer shall be capable of implementing the immediate deenergizing of test circuits for safety purposes.

(6) *Safety check.* (i) Safety practices governing employee work at temporary or field test areas shall provide for a routine check of such test areas for safety at the beginning of each series of tests.

(ii) The test operator in charge shall conduct these routine safety checks before each series of tests and shall verify at least the following conditions:

(A) That barriers and guards are in workable condition and are properly placed to isolate hazardous areas;

(B) That system test status signals, if used, are in operable condition;

(C) That test power disconnects are clearly marked and readily available in an emergency;

(D) That ground connections are clearly identifiable;

(E) That personal protective equipment is provided and used as required by Subpart I of this Part and by this section; and

(F) That signal, ground, and power cables are properly separated.

(p) *Mechanical equipment.* (1) *General requirements.* (i) The critical safety components of mechanical elevating and rotating equipment shall receive a thorough visual inspection before use on each shift.

Note: Critical safety components of mechanical elevating and rotating equipment are components whose failure would result in a free fall or free rotation of the boom.

(ii) No vehicular equipment having an obstructed view to the rear may be operated on off-highway jobsites where any employee is exposed to the hazards created by the moving vehicle, unless:

(A) The vehicle has a reverse signal alarm audible above the surrounding noise level, or

(B) The vehicle is backed up only when a designated employee signals that it is safe to do so.

(iii) The operator of an electric line truck may not leave his or her position at the controls while a load is suspended, unless the employer can demonstrate that no employee (including the operator) might be endangered.

(iv) Rubber-tired, self-propelled scrapers, rubber-tired front-end loaders, rubber-tired dozers, wheel-type agricultural and industrial tractors, crawler-type tractors, crawler-type loaders, and motor graders, with or without attachments, shall have roll-over protective structures that meet the requirements of Subpart W of Part 1926 of this chapter.

(2) *Outriggers.* (i) Vehicular equipment, if provided with outriggers, shall be operated with the outriggers extended and firmly set as necessary for the stability of the specific configuration of the equipment. Outriggers may not be extended or retracted outside of clear view of the operator unless all employees are outside the range of possible equipment motion.

(ii) If the work area or the terrain precludes the use of outriggers, the equipment may be operated only within its maximum load ratings for the particular configuration of the equipment without outriggers.

(3) *Applied loads.* Mechanical equipment used to lift or move lines or other material shall be used within its maximum load rating and other design limitations for the conditions under which the work is being performed.

(4) *Operations near energized lines or equipment.* (i) Mechanical equipment shall be operated so that the minimum approach distances of Table R–6 through Table R–10 are maintained from exposed energized lines and equipment. However, the insulated portion of an aerial lift operated by a qualified employee in the lift is exempt from this requirement.

(ii) A designated employee other than the equipment operator shall observe the approach distance to exposed lines and equipment and give timely warnings before the minimum approach distance required by paragraph (p)(4)(i) is reached, unless the employer can demonstrate that the operator can accurately determine that the minimum approach distance is being maintained.

(iii) If, during operation of the mechanical equipment, the equipment could become energized, the operation shall also comply with at least one of paragraphs (p)(4)(iii)(A) through (p)(4)(iii)(C) of this section.

(A) The energized lines exposed to contact shall be covered with insulating protective material that will withstand the type of contact that might be made during the operation.

(B) The equipment shall be insulated for the voltage involved. The equipment shall be positioned so that its uninsulated portions cannot approach the lines or equipment any closer than the minimum approach distances specified in Table R–6 through Table R–10.

(C) Each employee shall be protected from hazards that might arise from equipment contact with the energized lines. The measures used shall ensure that employees will not be exposed to hazardous differences in potential. Unless the employer can demonstrate that the methods in use protect each employee from the hazards that might arise if the equipment contacts the energized line, the measures used shall include all of the following techniques:

(*1*) Using the best available ground to minimize the time the lines remain energized,

(*2*) Bonding equipment together to minimize potential differences,

(*3*) Providing ground mats to extend areas of equipotential, and

(*4*) Employing insulating protective equipment or barricades to guard against any remaining hazardous potential differences.

Note: Appendix C of this part contains information on hazardous step and touch potentials and on methods of protecting employees from hazards resulting from such potentials.

(q) *Overhead lines.* This paragraph provides additional requirements for work performed on or near overhead lines and equipment.

(1) *General.* (i) Before elevated structures, such as poles or towers, are subjected to such stresses as climbing or the installation or removal of equipment may impose, the employer shall ascertain that the structures are capable of sustaining the additional or unbalanced stresses. If the pole or other structure cannot withstand the loads which will be imposed, it shall be braced or otherwise supported so as to prevent failure.

Note: Appendix D of this part contains test methods that can be used in ascertaining whether a wood pole is capable of sustaining the forces that would be imposed by an employee climbing the pole. This paragraph also requires the employer to ascertain that the pole can sustain all other forces that will be imposed by the work to be performed.

(ii) When poles are set, moved, or removed near exposed energized overhead conductors, the pole may not contact the conductors.

(iii) When a pole is set, moved, or removed near an exposed energized overhead conductor, the employer shall ensure that each employee wears electrical protective equipment or uses insulated devices when handling the pole and that no employee contacts the pole with uninsulated parts of his or her body.

(iv) To protect employees from falling into holes into which poles are to be placed, the holes shall be attended by employees or physically guarded whenever anyone is working nearby.

(2) *Installing and removing overhead lines.* The following provisions apply to the installation and removal of overhead conductors or cable.

(i) The employer shall use the tension stringing method, barriers, or other equivalent measures to minimize the possibility that conductors and cables being installed or removed will contact energized power lines or equipment.

(ii) The protective measures required by paragraph (p)(4)(iii) of this section for mechanical equipment shall also be provided for conductors, cables, and pulling and tensioning equipment when the conductor or cable is being installed or removed close enough to energized conductors that any of the following failures could energize the pulling or tensioning equipment or the wire or cable being installed or removed:

(A) Failure of the pulling or tensioning equipment,

(B) Failure of the wire or cable being pulled, or

(C) Failure of the previously installed lines or equipment.

(iii) If the conductors being installed or removed cross over energized conductors in excess of 600 volts and if the design of the circuit-interrupting devices protecting the lines so permits, the automatic-reclosing feature of these devices shall be made inoperative.

(iv) Before lines are installed parallel to existing energized lines, the employer shall make a determination of the approximate voltage to be induced in the new lines, or work shall proceed on the assumption that the induced voltage is hazardous. Unless the employer can demonstrate that the lines being installed are not subject to the induction of a hazardous voltage or unless the lines are treated as energized, the following requirements also apply:

(A) Each bare conductor shall be grounded in increments so that no point along the conductor is more than 2 miles (3.22 km) from a ground.

(B) The grounds required in paragraph (q)(2)(iv)(A) of this section shall be left in place until the conductor installation is completed between dead ends.

(C) The grounds required in paragraph (q)(2)(iv)(A) of this section shall be removed as the last phase of aerial cleanup.

(D) If employees are working on bare conductors, grounds shall also be installed at each location where these employees are working, and grounds shall be installed at all open dead-end or catch-off points or the next adjacent structure.

(E) If two bare conductors are to be spliced, the conductors shall be bonded and grounded before being spliced.

(v) Reel handling equipment, including pulling and tensioning devices, shall be in safe operating condition and shall be leveled and aligned.

(vi) Load ratings of stringing lines, pulling lines, conductor grips, load-bearing hardware and accessories, rigging, and hoists may not be exceeded.

(vii) Pulling lines and accessories shall be repaired or replaced when defective.

(viii) Conductor grips may not be used on wire rope, unless the grip is specifically designed for this application.

(ix) Reliable communications, through two-way radios or other equivalent means, shall be maintained between the reel tender and the pulling rig operator.

(x) The pulling rig may only be operated when it is safe to do so.

Note: Examples of unsafe conditions include employees in locations prohibited by paragraph (q)(2)(xi) of this section, conductor and pulling line hang-ups, and slipping of the conductor grip.

(xi) While the conductor or pulling line is being pulled (in motion) with a power-driven device, employees are not permitted directly under overhead operations or on the cross arm, except as necessary to guide the stringing sock or board over or through the stringing sheave.

(3) *Live-line bare-hand work.* In addition to other applicable provisions contained in this section, the following requirements apply to live-line bare-hand work:

(i) Before using or supervising the use of the live-line bare-hand technique on energized circuits, employees shall be trained in the technique and in the safety requirements of paragraph (q)(3) of this section. Employees shall receive refresher training as required by paragraph (a)(2).

(ii) Before any employee uses the live-line bare-hand technique on energized high-voltage conductors or parts, the following information shall be ascertained:

(A) The nominal voltage rating of the circuit on which the work is to be performed,

(B) The minimum approach distances to ground of lines and other energized parts on which work is to be performed, and

(C) The voltage limitations of equipment to be used.

(iii) The insulated equipment, insulated tools, and aerial devices and platforms used shall be designed, tested, and intended for live-line bare-hand work. Tools and equipment shall be kept clean and dry while they are in use.

(iv) The automatic-reclosing feature of circuit-interrupting devices protecting the lines shall be made inoperative, if the design of the devices permits.

(v) Work may not be performed when adverse weather conditions would make the work hazardous even after the work practices required by this section are employed. Additionally, work may not be performed when winds reduce the phase-to-phase or phase-to-ground minimum approach distances at the work location below that specified in paragraph (q)(3)(xiii) of this section, unless the grounded objects and other lines and equipment are covered by insulating guards.

Note: Thunderstorms in the immediate vicinity, high winds, snow storms, and ice storms are examples of adverse weather conditions that are presumed to make live-line bare-hand work too hazardous to perform safely.

(vi) A conductive bucket liner or other conductive device shall be provided for bonding the insulated aerial device to the energized line or equipment.

(A) The employee shall be connected to the bucket liner or other conductive device by the use of conductive shoes, leg clips, or other means.

(B) Where differences in potentials at the worksite pose a hazard to employees, electrostatic shielding designed for the voltage being worked shall be provided.

(vii) Before the employee contacts the energized part, the conductive bucket liner or other conductive device shall be bonded to the energized conductor by means of a positive connection. This connection shall remain attached to the energized conductor until the work on the energized circuit is completed.

(viii) Aerial lifts to be used for live-line bare-hand work shall have dual controls (lower and upper) as follows:

(A) The upper controls shall be within easy reach of the employee in the basket. On a two-basket-type lift, access to the controls shall be within easy reach from either basket.

(B) The lower set of controls shall be located near the base of the boom, and they shall be so designed that they can override operation of the equipment at any time.

(ix) Lower (ground-level) lift controls may not be operated with an employee in the lift, except in case of emergency.

(x) Before employees are elevated into the work position, all controls (ground level and bucket) shall be checked to determine that they are in proper working condition.

(xi) Before the boom of an aerial lift is elevated, the body of the truck shall be grounded, or the body of the truck shall be barricaded and treated as energized.

(xii) A boom-current test shall be made before work is started each day, each time during the day when higher voltage is encountered, and when changed conditions indicate a need for an additional test. This test shall consist of placing the bucket in contact with an energized source equal to the voltage to be encountered for a minimum of 3 minutes. The leakage current may not exceed 1 microampere per kilovolt of nominal phase-to-ground voltage. Work from the aerial lift shall be immediately suspended upon indication of a malfunction in the equipment.

(xiii) The minimum approach distances specified in Table R–6 through Table R–10 shall be maintained from all grounded objects and from lines and equipment at a potential different from that to which the live-line bare-hand equipment is bonded, unless such grounded objects and other lines and equipment are covered by insulating guards.

(xiv) While an employee is approaching, leaving, or bonding to an energized circuit, the minimum distances in Table R–6 through Table R–10 shall be maintained between the employee and any grounded parts, including the lower boom and portions of the truck.

(xv) While the bucket is positioned alongside an energized bushing or insulator string, the phase-to-ground minimum approach distances of Table R–6 through Table R–10 shall be maintained between all parts of the bucket and the grounded end of the bushing or insulator string or any other grounded surface.

(xvi) Hand lines may not be used between the bucket and the boom or between the bucket and the ground. However, non-conductive-type hand lines may be used from conductor to ground if not supported from the bucket. Ropes used for live-line bare-hand work may not be used for other purposes.

(xvii) Uninsulated equipment or material may not be passed between a pole or structure and an aerial lift while an employee working from the bucket is bonded to an energized part.

(xviii) A minimum approach distance table reflecting the minimum approach distances listed in Table R–6 through Table R–10 shall be printed on a plate of durable non-conductive material. This table shall be mounted so as to be visible to the operator of the boom.

(xix) A non-conductive measuring device shall be readily accessible to assist employees in maintaining the required minimum approach distance.

(4) *Towers and structures*. The following requirements apply to work performed on towers or other structures which support overhead lines.

(i) The employer shall ensure that no employee is under a tower or structure while work is in progress, except where the employer can demonstrate that such a working position is necessary to assist employees working above.

(ii) Tag lines or other similar devices shall be used to maintain control of tower sections being raised or positioned, unless the employer can demonstrate that the use of such devices would create a greater hazard.

(iii) The loadline may not be detached from a member or section until the load is safely secured.

(iv) Except during emergency restoration procedures, work shall be discontinued when adverse weather conditions make the work hazardous in spite of the work practices required by this section.

Note: Thunderstorms in the immediate vicinity, high winds, snow storms, and ice storms are examples of adverse weather conditions that are presumed to make this work too hazardous to perform, except under emergency conditions.

(r) *Line-clearance tree trimming operations*. This paragraph provides additional requirements for line-clearance tree-trimming operations and for equipment used in these operations.

(1) *Electrical hazards*. This paragraph does not apply to qualified employees.

(i) Before an employee climbs, enters, or works around any tree, a determination shall be made of the nominal voltage of electric power lines posing a hazard to employees. However, a determination of the maximum nominal voltage to which an employee will be exposed may be made instead, if all lines are considered as energized at this maximum voltage.

(ii) There shall be a second line-clearance tree trimmer within normal (that is, unassisted) voice communication under any of the following conditions:

(A) If a line-clearance tree trimmer is to approach more closely than 10 feet (305 cm) any conductor or electrical apparatus energized at more than 750 volts or

(B) If branches or limbs being removed are closer to lines energized at more than 750 volts than the distances listed in Table R–6, Table R–9, and Table R–10 or

(C) If roping is necessary to remove branches or limbs from such conductors or apparatus.

(iii) Line-clearance tree trimmers shall maintain the minimum approach distances from energized conductors given in Table R–6, Table R–9, and Table R–10.

(iv) Branches that are contacting exposed energized conductors or equipment or that are within the distances specified in Table R–6, Table R–9, and Table R–10 may be removed only through the use of insulating equipment.

Note: A tool constructed of a material that the employer can demonstrate has insulating qualities meeting paragraph (j)(1) of this section are considered as insulated under this paragraph if the tool is clean and dry.

(v) Ladders, platforms, and aerial devices may not be brought closer to an energized part than the distances listed in Table R–6, Table R–9, and Table R–10.

(vi) Line-clearance tree-trimming work may not be performed when adverse weather conditions make the work hazardous in spite of the work practices required by this section. Each employee performing line-clearance tree trimming work in the aftermath of a storm or under similar emergency conditions shall be trained in the special hazards related to this type of work.

Note: Thunderstorms in the immediate vicinity, high winds, snow storms, and ice storms are examples of adverse weather conditions that are presumed to make line-clearance tree trimming work too hazardous to perform safely.

(2) *Brush chippers*. (i) Brush chippers shall be equipped with a locking device in the ignition system.

(ii) Access panels for maintenance and adjustment of the chipper blades and associated drive train shall be in place and secure during operation of the equipment.

(iii) Brush chippers not equipped with a mechanical infeed system shall be equipped with an infeed hopper of length sufficient to prevent employees from contacting the blades or knives of the machine during operation.

(iv) Trailer chippers detached from trucks shall be chocked or otherwise secured.

(v) Each employee in the immediate area of an operating chipper feed table shall wear personal protective equipment as required by Subpart I of this Part.

(3) *Sprayers and related equipment.* (i) Walking and working surfaces of sprayers and related equipment shall be covered with slip-resistant material. If slipping hazards cannot be eliminated, slip-resistant footwear or handrails and stair rails meeting the requirements of Subpart D may be used instead of slip-resistant material.

(ii) Equipment on which employees stand to spray while the vehicle is in motion shall be equipped with guardrails around the working area. The guardrail shall be constructed in accordance with Subpart D of this Part.

(4) *Stump cutters.* (i) Stump cutters shall be equipped with enclosures or guards to protect employees.

(ii) Each employee in the immediate area of stump grinding operations (including the stump cutter operator) shall wear personal protective equipment as required by Subpart I of this Part.

(5) *Gasoline-engine power saws.* Gasoline-engine power saw operations shall meet the requirements of § 1910.266(c)(5) of this Part and the following:

(i) Each power saw weighing more than 15 pounds (6.8 kilograms, service weight) that is used in trees shall be supported by a separate line, except when work is performed from an aerial lift and except during topping or removing operations where no supporting limb will be available.

(ii) Each power saw shall be equipped with a control that will return the saw to idling speed when released.

(iii) Each power saw shall be equipped with a clutch and shall be so adjusted that the clutch will not engage the chain drive at idling speed.

(iv) A power saw shall be started on the ground or where it is otherwise firmly supported. Drop starting of saws over 15 pounds (6.8 kg) is permitted outside of the bucket of an aerial lift only if the area below the lift is clear of personnel.

(v) A power saw engine may be started and operated only when all employees other than the operator are clear of the saw.

(vi) A power saw may not be running when the saw is being carried up into a tree by an employee.

(vii) Power saw engines shall be stopped for all cleaning, refueling, adjustments, and repairs to the saw or motor, except as the manufacturer's servicing procedures require otherwise.

(6) *Backpack power units for use in pruning and clearing.* (i) While a backpack power unit is running, no one other than the operator may be within 10 feet (305 cm) of the cutting head of a brush saw.

(ii) A backpack power unit shall be equipped with a quick shutoff switch readily accessible to the operator.

(iii) Backpack power unit engines shall be stopped for all cleaning, refueling, adjustments, and repairs to the saw or motor, except as the manufacturer's servicing procedures require otherwise.

(7) *Rope.* (i) Climbing ropes shall be used by employees working aloft in trees. These ropes shall have a minimum diameter of 0.5 inch (1.2 cm) with a minimum breaking strength of 2300 pounds (10.2 kN). Synthetic rope shall have elasticity of not more than 7 percent.

(ii) Rope shall be inspected before each use and, if unsafe (for example, because of damage or defect), may not be used.

(iii) Rope shall be stored away from cutting edges and sharp tools. Rope contact with corrosive chemicals, gas, and oil shall be avoided.

(iv) When stored, rope shall be coiled and piled, or shall be suspended, so that air can circulate through the coils.

(v) Rope ends shall be secured to prevent their unraveling.

(vi) Climbing rope may not be spliced to effect repair.

(vii) A rope that is wet, that is contaminated to the extent that its insulating capacity is impaired, or that is otherwise not considered to be insulated for the voltage involved may not be used near exposed energized lines.

(8) *Fall protection.* Each employee shall be tied in with a climbing rope and safety saddle when the employee is working above the ground in a tree, unless he or she is ascending into the tree.

(s) *Communication facilities.* (1) *Microwave transmission.* (i) The employer shall ensure that no employee looks into an open waveguide or antenna that is connected to an energized microwave source.

(ii) If the electromagnetic radiation level within an accessible area associated with microwave communications systems exceeds the radiation protection guide given in § 1910.97(a)(2) of this Part, the area shall be posted with the warning symbol described in § 1910.97(a)(3) of this Part. The lower half of the warning symbol shall include the following statements or ones that the employer can demonstrate are equivalent:

Radiation in this area may exceed hazard limitations and special precautions are required. Obtain specific instruction before entering.

(iii) When an employee works in an area where the electromagnetic radiation could exceed the radiation protection guide, the employer shall institute measures that ensure that the employee's exposure is not greater than that permitted by that guide. Such measures may include administrative and engineering controls and personal protective equipment.

(2) *Power line carrier.* Power line carrier work, including work on equipment used for coupling carrier current to power line conductors, shall be performed in accordance with the requirements of this section pertaining to work on energized lines.

(t) *Underground electrical installations.* This paragraph provides additional requirements for work on underground electrical installations.

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

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

(3) *Attendants for manholes.* (i) While work is being performed in a manhole containing energized electric equipment, an employee with first aid and CPR training meeting paragraph (b)(1) of this section shall be available on the surface in the immediate vicinity to render emergency assistance.

(ii) Occasionally, the employee on the surface may briefly enter a manhole to provide assistance, other than emergency.

Note 1: An attendant may also be required under paragraph (e)(7) of this section. One person may serve to fulfill both requirements. However, attendants required under paragraph (e)(7) of this section are not permitted to enter the manhole.

Note 2: Employees entering manholes containing unguarded, uninsulated energized lines or parts of electric equipment operating at 50 volts or more are required to be qualified under paragraph (l)(1) of this section.

(iii) For the purpose of inspection, housekeeping, taking readings, or similar work, an employee working alone may enter, for brief periods of time, a manhole where energized cables or equipment are in service, if the employer can demonstrate that the employee will be protected from all electrical hazards.

(iv) Reliable communications, through two-way radios or other equivalent means, shall be maintained among all employees involved in the job.

(4) *Duct rods.* If duct rods are used, they shall be installed in the direction presenting the least hazard to employees. An employee shall be stationed at the far end of the duct line being rodded to ensure that the required minimum approach distances are maintained.

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

(6) *Moving cables.* Energized cables that are to be moved shall be inspected for defects.

(7) *Defective cables.* Where a cable in a manhole has one or more abnormalities that could lead to or be an indication of an impending fault, the defective cable shall be deenergized before any employee may work in the manhole, except when service load conditions and a lack of feasible alternatives require that the cable remain energized. In that case, employees may enter the manhole provided they are protected from the possible effects of a failure by shields or other devices that are capable of containing the adverse effects of a fault in the joint.

Note: Abnormalities such as oil or compound leaking from cable or joints, broken cable sheaths or joint sleeves, hot localized surface temperatures of cables or joints, or joints that are swollen beyond normal tolerance are presumed to lead to or be an indication of an impending fault.

(8) *Sheath continuity.* When work is performed on buried cable or on cable in manholes, metallic sheath continuity shall be maintained or the cable sheath shall be treated as energized.

(u) *Substations.* This paragraph provides additional requirements for substations and for work performed in them.

(1) *Access and working space.* Sufficient access and working space shall be provided and maintained about electric equipment to permit ready and safe operation and maintenance of such equipment.

Note: Guidelines for the dimensions of access and workspace about electric equipment in substations are contained in American National Standard—National Electrical Safety Code, ANSI C2–1987. Installations meeting the ANSI provisions comply with paragraph (u)(1) of this section. An installation that does not conform to this ANSI standard will, nonetheless, be considered as complying with paragraph (u)(1) of this section if the employer can demonstrate that the installation provides ready and safe access based on the following evidence:

(1) That the installation conforms to the edition of ANSI C2 that was in effect at the time the installation was made,

(2) That the configuration of the installation enables employees to maintain the minimum approach distances required by paragraph (l)(2) of this section while they are working on exposed, energized parts, and

(3) That the precautions taken when work is performed on the installation provide protection equivalent to the protection that would be provided by access and working space meeting ANSI C2–1987.

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

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

(4) *Guarding of rooms containing electric supply equipment.* (i) Rooms and spaces in which electric supply lines or equipment are installed shall meet the requirements of paragraphs (u)(4)(ii) through (u)(4)(v) of this section under the following conditions:

(A) If exposed live parts operating at 50 to 150 volts to ground are located within 8 feet of the ground or other working surface inside the room or space,

(B) If live parts operating at 151 to 600 volts and located within 8 feet of the ground or other working surface inside the room or space are guarded only by location, as permitted under paragraph (u)(5)(i) of this section, or

(C) If live parts operating at more than 600 volts are located within the room or space, unless:

(*1*) The live parts are enclosed within grounded, metal-enclosed equipment whose only openings are designed so that foreign objects inserted in these openings will be deflected from energized parts, or

(*2*) The live parts are installed at a height above ground and any other working surface that provides protection at the voltage to which they are energized corresponding to the protection provided by an 8-foot height at 50 volts.

(ii) The rooms and spaces shall be so enclosed within fences, screens, partitions, or walls as to minimize the possibility that unqualified persons will enter.

(iii) Signs warning unqualified persons to keep out shall be displayed at entrances to the rooms and spaces.

(iv) Entrances to rooms and spaces that are not under the observation of an attendant shall be kept locked.

(v) Unqualified persons may not enter the rooms or spaces while the electric supply lines or equipment are energized.

(5) *Guarding of energized parts.* (i) Guards shall be provided around all live parts operating at more than 150 volts to ground without an insulating covering, unless the location of the live parts gives sufficient horizontal or vertical or a combination of these clearances to minimize the possibility of accidental employee contact.

Note: Guidelines for the dimensions of clearance distances about electric equipment in substations are contained in American National Standard—National Electrical Safety Code, ANSI C2–1987. Installations meeting the ANSI provisions comply with paragraph (u)(5)(i) of this section. An installation that does not conform to this ANSI standard will, nonetheless, be considered as complying with paragraph (u)(5)(i) of this section if the employer can demonstrate that the installation provides sufficient clearance based on the following evidence:

(1) That the installation conforms to the edition of ANSI C2 that was in effect at the time the installation was made,

(2) That each employee is isolated from energized parts at the point of closest approach, and

(3) That the precautions taken when work is performed on the installation provide protection equivalent to the protection that would be provided by horizontal and vertical clearances meeting ANSI C2–1987.

(ii) Except for fuse replacement and other necessary access by qualified persons, the guarding of energized parts within a compartment shall be maintained during operation and maintenance functions to prevent accidental contact with energized parts and to prevent tools or other equipment from being dropped on energized parts.

(iii) When guards are removed from energized equipment, barriers shall be installed around the work area to prevent employees who are not working on the equipment, but who are in the area, from contacting the exposed live parts.

(6) *Substation entry.* (i) Upon entering an attended substation, each employee other than those regularly working in

the station shall report his or her presence to the employee in charge in order to receive information on special system conditions affecting employee safety.

(ii) The job briefing required by paragraph (c) of this section shall cover such additional subjects as the location of energized equipment in or adjacent to the work area and the limits of any deenergized work area.

(v) *Power generation.* This paragraph provides additional requirements and related work practices for power generating plants.

(1) *Interlocks and other safety devices.* (i) Interlocks and other safety devices shall be maintained in a safe, operable condition.

(ii) No interlock or other safety device may be modified to defeat its function, except for test, repair, or adjustment of the device.

(2) *Changing brushes.* Before exciter or generator brushes are changed while the generator is in service, the exciter or generator field shall be checked to determine whether a ground condition exists. The brushes may not be changed while the generator is energized if a ground condition exists.

(3) *Access and working space.* Sufficient access and working space shall be provided and maintained about electric equipment to permit ready and safe operation and maintenance of such equipment.

Note: Guidelines for the dimensions of access and workspace about electric equipment in generating stations are contained in American National Standard—National Electrical Safety Code, ANSI C2-1987. Installations meeting the ANSI provisions comply with paragraph (v)(3) of this section. An installation that does not conform to this ANSI standard will, nonetheless, be considered as complying with paragraph (v)(3) of this section if the employer can demonstrate that the installation provides ready and safe access based on the following evidence:

(1) That the installation conforms to the edition of ANSI C2 that was in effect at the time the installation was made,

(2) That the configuration of the installation enables employees to maintain the minimum approach distances required by paragraph (l)(2) of this section while they work on exposed, energized parts, and

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

(4) *Guarding of rooms containing electric supply equipment.* (i) Rooms and spaces in which electric supply lines or equipment are installed shall meet the requirements of paragraphs (v)(4)(ii) through (v)(4)(v) of this section under the following conditions:

(A) If exposed live parts operating at 50 to 150 volts to ground are located within 8 feet of the ground or other working surface inside the room or space,

(B) If live parts operating at 151 to 600 volts and located within 8 feet of the ground or other working surface inside the room or space are guarded only by location, as permitted under paragraph (v)(5)(i) of this section, or

(C) If live parts operating at more than 600 volts are located within the room or space, unless:

(*1*) The live parts are enclosed within grounded, metal-enclosed equipment whose only openings are designed so that foreign objects inserted in these openings will be deflected from energized parts, or

(*2*) The live parts are installed at a height above ground and any other working surface that provides protection at the voltage to which they are energized corresponding to the protection provided by an 8-foot height at 50 volts.

(ii) The rooms and spaces shall be so enclosed within fences, screens, partitions, or walls as to minimize the possibility that unqualified persons will enter.

(iii) Signs warning unqualified persons to keep out shall be displayed at entrances to the rooms and spaces.

(iv) Entrances to rooms and spaces that are not under the observation of an attendant shall be kept locked.

(v) Unqualified persons may not enter the rooms or spaces while the electric supply lines or equipment are energized.

(5) *Guarding of energized parts.* (i) Guards shall be provided around all live parts operating at more than 150 volts to ground without an insulating covering, unless the location of the live parts gives sufficient horizontal or vertical or a combination of these clearances to minimize the possibility of accidental employee contact.

Note: Guidelines for the dimensions of clearance distances about electric equipment in generating stations are contained in American National Standard—National Electrical Safety Code, ANSI C2-1987. Installations meeting the ANSI provisions comply with paragraph (v)(5)(i) of this section. An installation that does not conform to this ANSI standard will, nonetheless, be considered as complying with paragraph (v)(5)(i) of this section if the employer can demonstrate that the installation provides sufficient clearance based on the following evidence:

(1) That the installation conforms to the edition of ANSI C2 that was in effect at the time the installation was made,

(2) That each employee is isolated from energized parts at the point of closest approach, and

(3) That the precautions taken when work is performed on the installation provide protection equivalent to the protection that would be provided by horizontal and vertical clearances meeting ANSI C2-1987.

(ii) Except for fuse replacement or other necessary access by qualified persons, the guarding of energized parts within a compartment shall be maintained during operation and maintenance functions to prevent accidental contact with energized parts and to prevent tools or other equipment from being dropped on energized parts.

(iii) When guards are removed from energized equipment, barriers shall be installed around the work area to prevent employees who are not working on the equipment, but who are in the area, from contacting the exposed live parts.

(6) *Water or steam spaces.* The following requirements apply to work in water and steam spaces associated with boilers:

(i) A designated employee shall inspect conditions before work is permitted and after its completion. Eye protection, or full face protection if necessary, shall be worn at all times when condenser, heater, or boiler tubes are being cleaned.

(ii) Where it is necessary for employees to work near tube ends during cleaning, shielding shall be installed at the tube ends.

(7) *Chemical cleaning of boilers and pressure vessels.* The following requirements apply to chemical cleaning of boilers and pressure vessels:

(i) Areas where chemical cleaning is in progress shall be cordoned off to restrict access during cleaning. If flammable liquids, gases, or vapors or combustible materials will be used or might be produced during the cleaning process, the following requirements also apply:

(A) The area shall be posted with signs restricting entry and warning of the hazards of fire and explosion; and

(B) Smoking, welding, and other possible ignition sources are prohibited in these restricted areas.

(ii) The number of personnel in the restricted area shall be limited to those necessary to accomplish the task safely.

(iii) There shall be ready access to water or showers for emergency use.

Note: See § 1910.141 of this Part for requirements that apply to the water supply and to washing facilities.

(iv) Employees in restricted areas shall wear protective equipment meeting the requirements of Subpart I of this Part and including, but not limited to, protective clothing, boots, goggles, and gloves.

(8) *Chlorine systems.* (i) Chlorine system enclosures shall be posted with signs restricting entry and warning of the hazard to health and the hazards of fire and explosion.

Note: See Subpart Z of this Part for requirements necessary to protect the health of employees from the effects of chlorine.

(ii) Only designated employees may enter the restricted area. Additionally, the number of personnel shall be limited to those necessary to accomplish the task safely.

(iii) Emergency repair kits shall be available near the shelter or enclosure to allow for the prompt repair of leaks in chlorine lines, equipment, or containers.

(iv) Before repair procedures are started, chlorine tanks, pipes, and equipment shall be purged with dry air and isolated from other sources of chlorine.

(v) The employer shall ensure that chlorine is not mixed with materials that would react with the chlorine in a dangerously exothermic or other hazardous manner.

(9) *Boilers.* (i) Before internal furnace or ash hopper repair work is started, overhead areas shall be inspected for possible falling objects. If the hazard of falling objects exists, overhead protection such as planking or nets shall be provided.

(ii) When opening an operating boiler door, employees shall stand clear of the opening of the door to avoid the heat blast and gases which may escape from the boiler.

(10) *Turbine generators.* (i) Smoking and other ignition sources are prohibited near hydrogen or hydrogen sealing systems, and signs warning of the danger of explosion and fire shall be posted.

(ii) Excessive hydrogen makeup or abnormal loss of pressure shall be considered as an emergency and shall be corrected immediately.

(iii) A sufficient quantity of inert gas shall be available to purge the hydrogen from the largest generator.

(11) *Coal and ash handling.* (i) Only designated persons may operate railroad equipment.

(ii) Before a locomotive or locomotive crane is moved, a warning shall be given to employees in the area.

(iii) Employees engaged in switching or dumping cars may not use their feet to line up drawheads.

(iv) Drawheads and knuckles may not be shifted while locomotives or cars are in motion.

(v) When a railroad car is stopped for unloading, the car shall be secured from displacement that could endanger employees.

(vi) An emergency means of stopping dump operations shall be provided at railcar dumps.

(vii) The employer shall ensure that employees who work in coal- or ash-handling conveyor areas are trained and knowledgeable in conveyor operation and in the requirements of paragraphs (v)(11)(viii) through (v)(11)(xii) of this section.

(viii) Employees may not ride a coal- or ash-handling conveyor belt at any time. Employees may not cross over the conveyor belt, except at walkways, unless the conveyor's energy source has been deenergized and has been locked out or tagged in accordance with paragraph (d) of this section.

(ix) A conveyor that could cause injury when started may not be started until personnel in the area are alerted by a signal or by a designated person that the conveyor is about to start.

(x) If a conveyor that could cause injury when started is automatically controlled or is controlled from a remote location, an audible device shall be provided that sounds an alarm that will be recognized by each employee as a warning that the conveyor will start and that can be clearly heard at all points along the conveyor where personnel may be present. The warning device shall be actuated by the device starting the conveyor and shall continue for a period of time before the conveyor starts that is long enough to allow employees to move clear of the conveyor system. A visual warning may be used in place of the audible device if the employer can demonstrate that it will provide an equally effective warning in the particular circumstances involved.

Note: *Exception:* If the employer can demonstrate that the system's function would be seriously hindered by the required time delay, warning signs may be provided in place of the audible warning device. If the system was installed before [insert date 1 year after publication date], warning signs may be provided in place of the audible warning device until such time as the conveyor or its control system is rebuilt or rewired. These warning signs shall be clear, concise, and legible and shall indicate that conveyors and allied equipment may be started at any time, that danger exists, and that personnel must keep clear. These warning signs shall be provided along the conveyor at areas not guarded by position or location.

(xi) Remotely and automatically controlled conveyors, and conveyors that have operating stations which are not manned or which are beyond voice and visual contact from drive areas, loading areas, transfer points, and other locations on the conveyor path not guarded by location, position, or guards shall be furnished with emergency stop buttons, pull cords, limit switches, or similar emergency stop devices. However, if the employer can demonstrate that the design, function, and operation of the conveyor do not expose an employee to hazards, an emergency stop device is not required.

(A) Emergency stop devices shall be easily identifiable in the immediate vicinity of such locations.

(B) An emergency stop device shall act directly on the control of the conveyor involved and may not depend on the stopping of any other equipment.

(C) Emergency stop devices shall be installed so that they cannot be overridden from other locations.

(xii) Where coal-handling operations may produce a combustible atmosphere from fuel sources or from flammable gases or dust, sources of ignition shall be eliminated or safely controlled to prevent ignition of the combustible atmosphere.

Note: Locations that are hazardous because of the presence of combustible dust are classified as Class II hazardous locations. See § 1910.307 of this Part.

(xiii) An employee may not work on or beneath overhanging coal in coal bunkers, coal silos, or coal storage areas, unless the employee is protected from all hazards posed by shifting coal.

(xiv) An employee entering a bunker or silo to dislodge the contents shall wear a body harness with lifeline attached. The lifeline shall be secured to a fixed support outside the bunker and shall be attended at all times by an employee located outside the bunker or facility.

(12) *Hydroplants and equipment.* Employees working on or close to water gates, valves, intakes, forebays, flumes, or other locations where increased or decreased water flow or levels may pose a significant hazard shall be warned and shall vacate such dangerous areas before water flow changes are made.

(w) *Special conditions.* (1) *Capacitors.* The following additional requirements apply to work on capacitors and on lines connected to capacitors.

Note: See paragraphs (m) and (n) of this section for requirements pertaining to the deenergizing and grounding of capacitor installations.

(i) Before employees work on capacitors, the capacitors shall be disconnected from energized sources and, after a wait of at least 5 minutes from the time of disconnection, short-circuited.

(ii) Before the units are handled, each unit in series-parallel capacitor banks shall be short-circuited between all terminals and the capacitor case or its rack. If the cases of capacitors are on ungrounded substation racks, the racks shall be bonded to ground.

(iii) Any line to which capacitors are connected shall be short-circuited before it is considered deenergized.

(2) *Current transformer secondaries.* The secondary of a current transformer may not be opened while the transformer is energized. If the primary of the current transformer cannot be deenergized before work is performed on an instrument, a relay, or other section of a current transformer secondary circuit, the circuit shall be bridged so that the current transformer secondary will not be opened.

(3) *Series streetlighting.* If the open-circuit voltage exceeds 600 volts, the series streetlighting circuit shall be worked in accordance with paragraph (q) or (t) of this section, as appropriate. A series loop may only be opened after the streetlighting transformer has been deenergized and isolated from the source of supply or after the loop is bridged to avoid an open-circuit condition.

(4) *Illumination.* Sufficient illumination shall be provided to enable the employee to perform the work safely.

(5) *Protection against drowning.* (i) Whenever an employee may be pulled or pushed or may fall into water where the danger of drowning exists, the employee shall be provided with and shall use U.S. Coast Guard approved personal flotation devices.

(ii) Each personal flotation device shall be maintained in safe condition and shall be inspected frequently enough to ensure that it does not have rot, mildew, water saturation, and or any other condition that could render the device unsuitable for use.

(iii) An employee may cross streams or other bodies of water only if a safe means of passage, such as a bridge, is provided.

(6) *Employee protection in public work areas.*

(i) Traffic control signs and traffic control devices used for the protection of employees shall meet the requirements of § 1926.200(g)(2) of this Chapter.

(ii) Before work is begun in the vicinity of vehicular or pedestrian traffic that may endanger employees, warning signs or flags and other traffic control devices shall be placed in conspicuous locations to alert and channel approaching traffic.

(iii) Where additional employee protection is necessary, barricades shall be used.

(iv) Excavated areas shall be protected with barricades.

(v) At night, warning lights shall be prominently displayed.

(7) *Backfeed.* If there is a possibility of voltage backfeed from sources of cogeneration or from the secondary system (for example, backfeed from more than one energized phase feeding a common load), the requirements of paragraph (l) of this section apply if the lines or equipment are to be worked as energized, and the requirements of paragraphs (m) and (n) of this section apply if the lines or equipment are to be worked as deenergized.

(8) *Lasers.* Laser equipment shall be installed, adjusted, and operated in accordance with § 1926.54 of this Chapter.

(9) *Hydraulic fluids.* Hydraulic fluids used for the insulated sections of equipment shall provide insulation for the voltage involved.

(x) *Definitions.*

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

Attendant. An employee assigned to remain immediately outside the entrance to an enclosed or other space to render assistance as needed to employees inside the space.

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

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

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

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

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

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

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

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

Cable sheath. A conductive protective covering applied to cables.

Note: A cable sheath may consist of multiple layers of which one or more is conductive.

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

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

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

Communication lines. (See *Lines, communication.*)

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

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

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

Deenergized. Free from any electrical connection to a source of potential difference and from electric charge; not having a potential different from that of the earth.

Note: The term is used only with reference to current-carrying parts, which are sometimes energized (alive).

Designated employee (designated person). An employee (or person) who is designated by the employer to perform specific duties under the terms of this section and who is knowledgeable in the construction and operation of the equipment and the hazards involved.

Electric line truck. A truck used to transport personnel, tools, and material for electric supply line work.

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

Electric supply lines. (See *Lines, electric supply.*)

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

Enclosed space. A working space, such as a manhole, vault, tunnel, or shaft, that has a limited means of egress or entry, that is designed for periodic employee entry under normal operating conditions, and that under normal conditions does not contain a hazardous atmosphere, but that may contain a hazardous atmosphere under abnormal conditions.

Note: Spaces that are enclosed but not designed for employee entry under normal operating conditions are not considered to be enclosed spaces for the purposes of this section. Similarly, spaces that are enclosed and that are expected to contain a hazardous atmosphere are not considered to be enclosed spaces for the purposes of this section. Such spaces meet the definition of permit spaces in § 1910.146 of this Part, and entry into them must be performed in accordance with that standard.

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

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

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

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

Exposed. Not isolated or guarded.

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

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

Guarded. Covered, fenced, enclosed, or otherwise protected, by means of suitable covers or casings, barrier rails or screens, mats, or platforms, designed to minimize the possibility, under normal conditions, of dangerous approach or accidental contact by persons or objects.

Note: Wires which are insulated, but not otherwise protected, are not considered as guarded.

Hazardous atmosphere means an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from an enclosed space), injury, or acute illness from one or more of the following causes:

(*1*) Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);

(*2*) Airborne combustible dust at a concentration that meets or exceeds its LFL;

Note: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet (1.52 m) or less.

(*3*) Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;

(*4*) Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in Subpart G, *Occupational Health and Environmental Control*, or in Subpart Z, *Toxic and Hazardous Substances*, of this Part and which could result in employee exposure in excess of its dose or permissible exposure limit;

Note: An atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to its health effects is not covered by this provision.

(*5*) Any other atmospheric condition that is immediately dangerous to life or health.

Note: For air contaminants for which OSHA has not determined a dose or permissible exposure limit, other sources of information, such as Material Safety Data Sheets that comply with the Hazard Communication Standard, § 1910.1200 of this Part, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.

High-power tests. Tests in which fault currents, load currents, magnetizing currents, and line-dropping currents are used to test equipment, either at the equipment's rated voltage or at lower voltages.

High-voltage tests. Tests in which voltages of approximately 1000 volts are used as a practical minimum and in which the voltage source has sufficient energy to cause injury.

High wind. A wind of such velocity that the following hazards would be present:

(*1*) An employee would be exposed to being blown from elevated locations, or

(*2*) An employee or material handling equipment could lose control of material being handled, or

(*3*) An employee would be exposed to other hazards not controlled by the standard involved.

Note: Winds exceeding 40 miles per hour (64.4 kilometers per hour), or 30 miles per hour (48.3 kilometers per hour) if material handling is involved, are normally considered as meeting this criteria unless precautions are taken to protect employees from the hazardous effects of the wind.

Immediately dangerous to life or health (IDLH) means any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

Note: Some materials—hydrogen fluoride gas and cadmium vapor, for example—may produce immediate transient effects that, even if severe, may pass without medical attention, but are followed by sudden, possibly fatal collapse 12–72 hours after exposure. The victim "feels normal" from recovery from transient effects until collapse. Such materials in hazardous quantities are considered to be "immediately" dangerous to life or health.

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

Note: When any object is said to be insulated, it is understood to be insulated for the conditions to which it is normally subjected. Otherwise, it is, within the purpose of this section, uninsulated.

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

Line-clearance tree trimm. An employee who, through related training or on-the-job experience or both, is familiar with the special techniques and hazards involved in line-clearance tree trimming.

Note 1: An employee who is regularly assigned to a line-clearance tree-trimming crew and who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who is under the direct supervision of a line-clearance tree trimmer is considered to be a line-clearance tree trimmer.

Note 2: A line-clearance tree trimmer is not considered to be a "qualified employee" under this section unless he or she has the training required for a qualified employee under paragraph (a)(2)(ii) of this section.

However, under the electrical safety-related work practices standard, a line-clearance tree trimmer *is* considered to be a "qualified employee". Tree trimming performed by such "qualified employees" is not subject to the electrical safety-related work practice requirements contained in §§ 1910.331 through 1910.335 of this Part. (See also the note following § 1910.332(b)(3) of this Part for information regarding the training an employee must have to be considered a qualified employee under §§ 1910.331 through 1910.335 of this part.)

Line-clearance tree trimming. The pruning, trimming, repairing, maintaining, removing, or clearing of trees or the cutting of brush that is within 10 feet (305 cm) of electric supply lines and equipment.

Lines. (*1*) *Communication lines.* The conductors and their supporting or containing structures which are used for public or private signal or communication service, and which operate at potentials not exceeding 400 volts to ground or 750 volts between any two points of the circuit, and the transmitted power of which does not exceed 150 watts. If the lines are operating at less than 150 volts, no limit is placed on the transmitted power of the system. Under certain conditions, communication cables may include communication circuits exceeding these limitations where such circuits are also used to supply power solely to communication equipment.

Note: Telephone, telegraph, railroad signal, data, clock, fire, police alarm, cable television, and other systems conforming with this definition are included. Lines used for signaling purposes, but not included under this definition, are considered as electric supply lines of the same voltage.

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

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

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

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

Qualified employee (qualified person). One knowledgeable in the construction and operation of the electric power generation, transmission, and distribution equipment involved, along with the associated hazards.

Note 1: An employee must have the training required by paragraph (a)(2)(ii) of this section in order to be considered a qualified employee.

Note 2: Except under paragraph (g)(2)(v) of this section, an employee who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who is under the direct supervision of a qualified person is considered to be a qualified person for the performance of those duties.

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

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

System operator. A qualified person designated to operate the system or its parts.

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

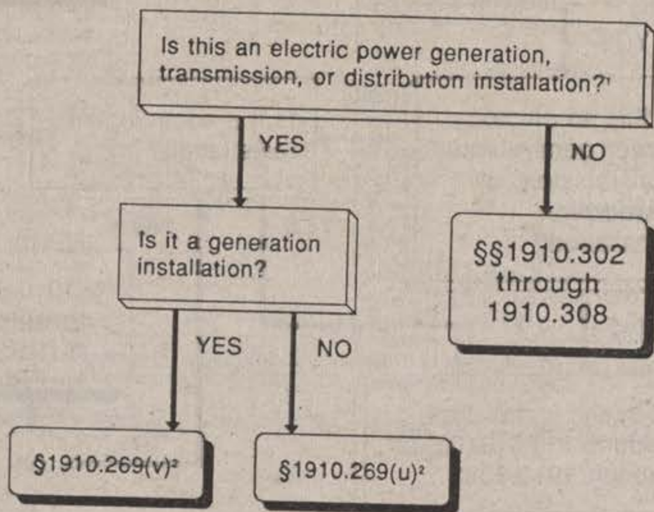
Vented vault. A vault that has provision for air changes using exhaust flue stacks and low level air intakes operating on differentials of pressure and temperature providing for airflow which precludes a hazardous atmosphere from developing.

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

Appendix A to § 1910.269 Flow Charts

This appendix presents information, in the form of flow charts, that illustrates the scope and application of § 1910.269. This appendix addresses the interface between § 1910.269 and Subpart S of this Part (*Electrical*), between § 1910.269 and § 1910.146 of this Part (*Permit-required confined spaces*), and between § 1910.269 and § 1910.147 of this Part (*The control of hazardous energy (lockout/tagout)*). These flow charts provide guidance for employers trying to implement the requirements of § 1910.269 in combination with other General Industry Standards contained in Part 1910.

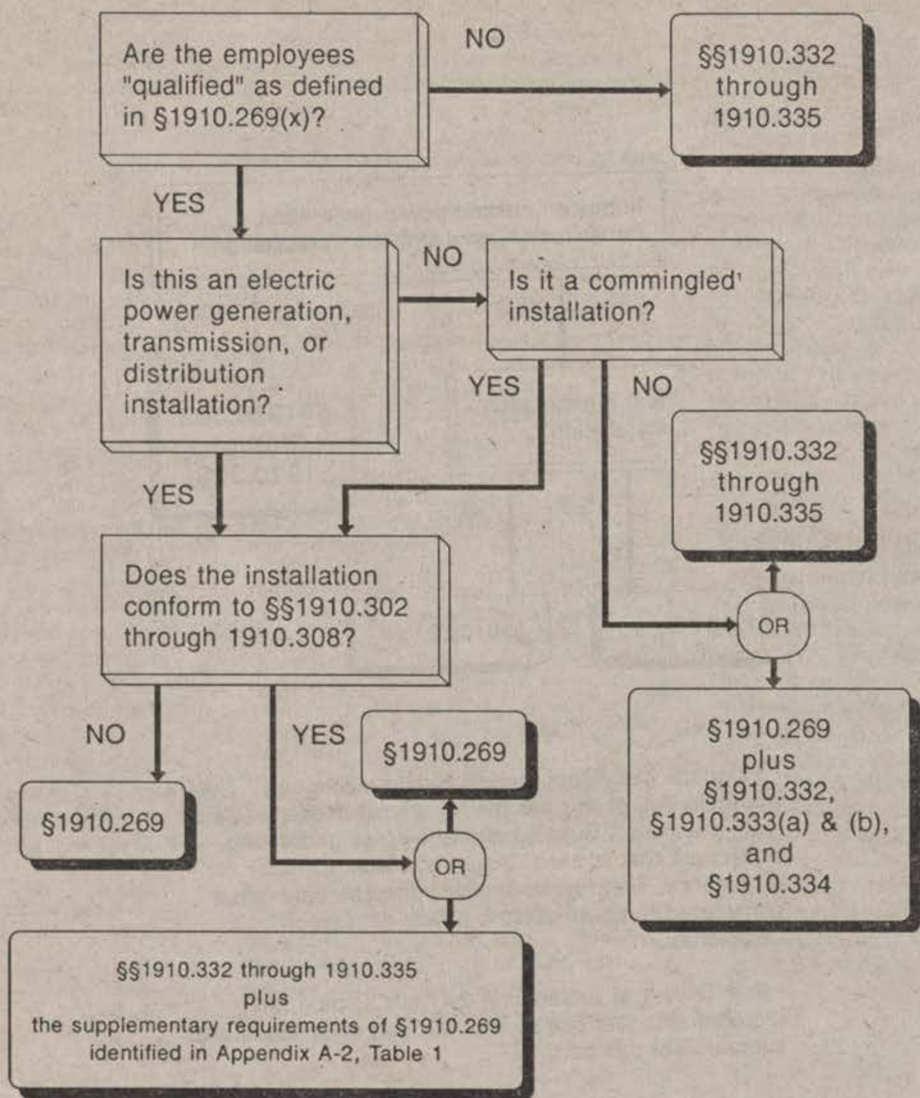
Appendix A–1 to Section 1910.269—Application of Section 1910.269 and Subpart S of this Part to Electrical Installations.



[1] Electrical installation design requirements only. See Appendix A-2 of this section for electrical safety-related work practices. Supplementary electric generating equipment that is used to supply a workplace for emergency, standby, or similar purposes only is not considered to be an electric power generation installation.

[2] See Table 1 of Appendix A-2 of this section for requirements that can be met through compliance with subpart S of this part.

Appendix A–2 to Section 1910.269—Application of Section 1910.269 and Subpart S of this Part to Electrical Safety-Related Work Practices.



[1] Commingled to the extent that the electric power generation, transmission, or distribution installation poses the greater hazard.

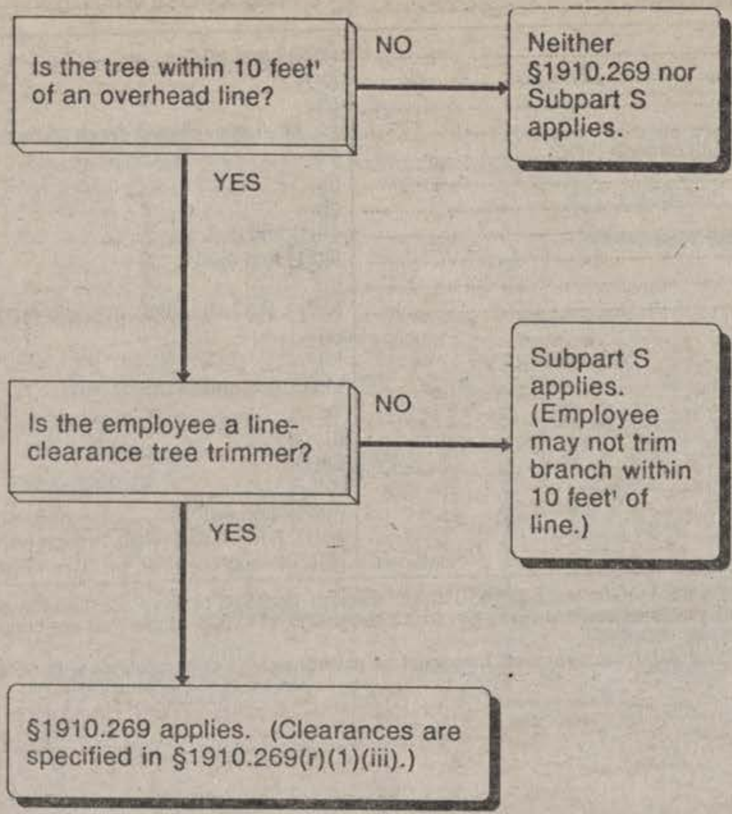
TABLE 1.—ELECTRICAL SAFETY-RELATED WORK PRACTICES IN SECTION 1910.269

Compliance with subpart S is considered as compliance with § 1910.269 [1]	Paragraphs that apply regardless of compliance with subpart S
(d), electric shock hazards only	(a)(2) [2] and (a)(3) [2].
(h)(3)	(b) [2].
(i)(2)	(c) [2].
(k)	(d), other than electric shock hazards.
(l)(1) through (l)(4), (l)(6)(i), and (l)(8) through (l)(10)	(e).
(m)	(f).
(p)(4)	(g).
(s)(2)	(h)(1) and (h)(2).
(u)(1) and (u)(3) through (u)(5)	(i)(3) [2] and (i)(4) [2].
(v)(3) through (v)(5)	(j) [2].
(w)(1) and (w)(7)	(l)(5) [2], (l)(6)(iii) [2], (l)(6)(iii) [2], and (l)(7) [2].
	(n) [2].
	(o) [2].
	(p)(1) through (p)(3).
	(q) [2].
	(r).
	(s)(1).
	(t) [2].
	(u)(2) [2] and (u)(6) [2].
	(v)(1), (v)(2) [2], and (v)(6) through (v)(12).
	(w)(2) through (w)(6) [2], (w)(8), and (w)(9) [2].

[1] If the electrical installation meets the requirements of §§ 1910.332 through 1910.308 of this Part, then the electrical installation and any associated electrical safety-related work practices conforming to §§ 1910.332 through 1910.335 of this Part are considered to comply with these provisions of § 1910.269 of this Part.

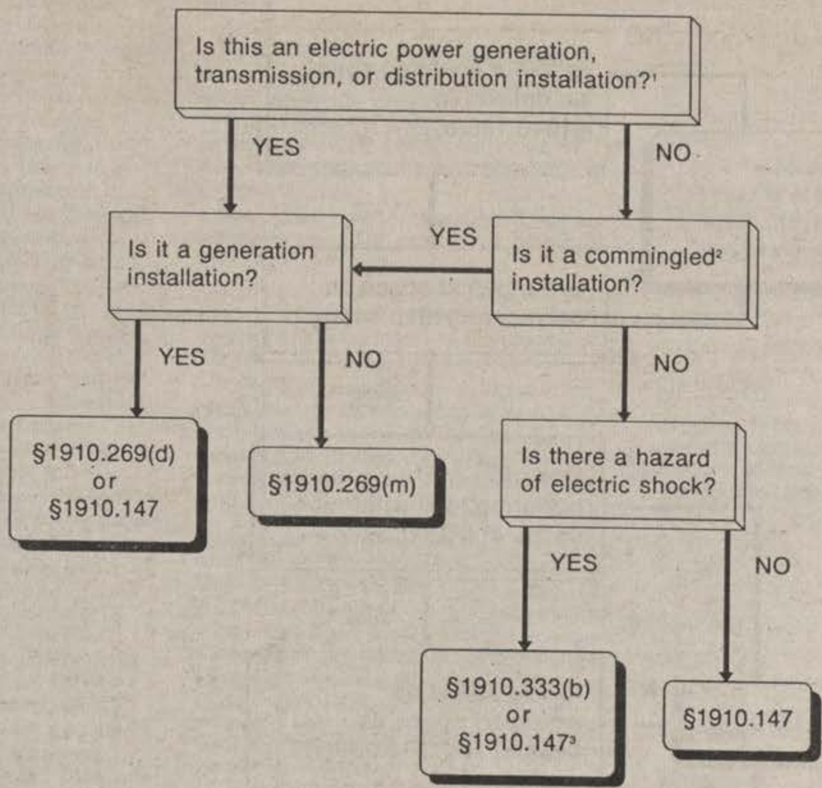
[2] These provisions include electrical safety requirements that must be met regardless of compliance with Subpart S of this Part.

Appendix A-3 to Section 1910.269—Application of Section 1910.269 and Subpart S of This Part to Tree-Trimming Operations



' 10 feet plus 4 inches for every 10 kilovolts over 50 kilovolts.

Appendix A–4 to Section 1910.269—Application of Section 1910.147, Section 1910.269 and Section 1910.333 to Hazardous Energy Control Procedures (Lockout/Tagout).

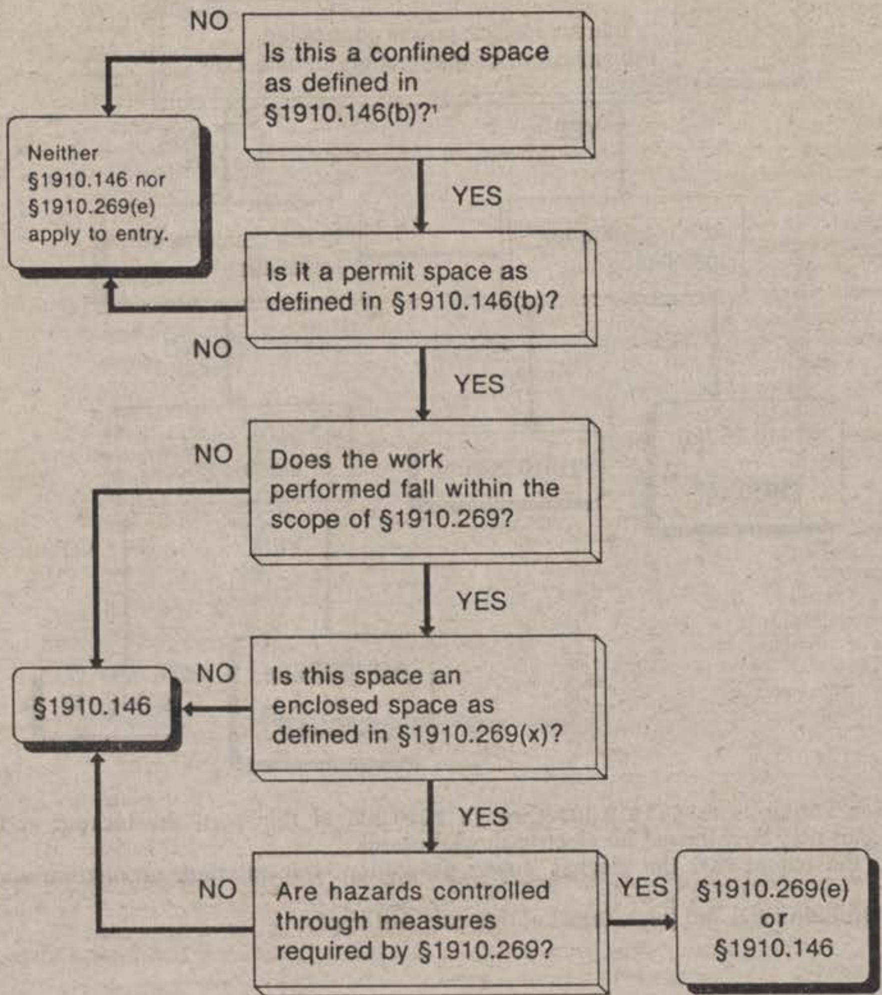


[1] If the installation conforms to §§ 1910.303 through 1910.308 of this part, the lockout and tagging procedures of § 1910.333(b) of this part may be followed for electric shock hazards.

[2] Commingled to the extent that the electric power generation, transmission, or distribution installation poses the greater hazard.

[3] Section 1910.333(b)(2)(iii)(D) and (b)(2)(iv)(B) of this part still apply.

Appendix A–5 to Section 1910.269—Application of Section 1910.146 and Section 1910.269 to Permit-Required Confined Spaces.



[1] See §1910.146(c) for general non-entry requirements that apply to all confined spaces.

Appendix B to Section 1910.269—Working on Exposed Energized Parts

I. Introduction

Electric transmission and distribution line installations have been designed to meet National Electrical Safety Code (NESC), ANSI C2, requirements and to provide the level of line outage performance required by system reliability criteria. Transmission and distribution lines are also designed to withstand the maximum overvoltages expected to be impressed on the system. Such overvoltages can be caused by such conditions as switching surges, faults, or lightning. Insulator design and lengths and the clearances to structural parts (which, for low voltage through extra-high voltage, or EHV, facilities, are generally based on the performance of the line as a result of contamination of the insulation or during storms) have, over the years, come closer to the minimum approach distances used by workers (which are generally based on non-storm conditions). Thus, as minimum approach (working) distances and structural distances (clearances) converge, it is increasingly important that basic considerations for establishing safe approach distances for performing work be understood by the designers and the operating and maintenance personnel involved.

The information in this Appendix will assist employers in complying with the minimum approach distance requirements contained in paragraphs (l)(2) and (q)(3) of this section. The technical criteria and methodology presented herein is mandatory for employers using reduced minimum approach distances as permitted in Table R-7 and Table R-8. This Appendix is intended to provide essential background information and technical criteria for the development or modification, if possible, of the safe minimum approach distances for electric transmission and distribution live-line work. The development of these safe distances must be undertaken by persons knowledgeable in the techniques discussed in this appendix and competent in the field of electric transmission and distribution system design.

II. General

A. Definitions

The following definitions from § 1910.269(x) relate to work on or near transmission and distribution lines and equipment and the electrical hazards they present.

Exposed. Not isolated or guarded.

Guarded. Covered, fenced, enclosed, or otherwise protected, by means of suitable covers or casings, barrier rails or screens, mats, or platforms, designed to minimize the possibility, under normal conditions, of dangerous approach or accidental contact by persons or objects.

Note: Wires which are insulated, but not otherwise protected, are not considered as guarded.

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

Note: When any object is said to be insulated, it is understood to be insulated for the conditions to which it is normally subjected. Otherwise, it is, within the purpose of this section, uninsulated.

B. Installations Energized at 50 to 300 Volts

The hazards posed by installations energized at 50 to 300 volts are the same as those found in many other workplaces. That is not to say that there is no hazard, but the complexity of electrical protection required does not compare to that required for high voltage systems. The employee must avoid contact with the exposed parts, and the protective equipment used (such as rubber insulating gloves) must provide insulation for the voltages involved.

C. Exposed Energized Parts Over 300 Volts AC

Table R-6, Table R-7, and Table R-8 of § 1910.269 provide safe approach and working distances in the vicinity of energized electrical apparatus so that work can be done safely without risk of electrical flashover.

The working distances must withstand the maximum transient overvoltage that can reach the work site under the working conditions and practices in use. Normal system design may provide or include a means to control transient overvoltages, or temporary devices may be employed to achieve the same result. The use of technically correct practices or procedures to control overvoltages (for example, portable gaps or preventing the automatic control from initiating breaker reclosing) enables line design and operation to be based on reduced transient overvoltage values. Technical information for U.S. electrical systems indicates that current design provides for the following maximum transient overvoltage values (usually produced by switching surges): 362 kV and less—3.0 per unit; 552 kV—2.4 per unit; 800 kV—2.0 per unit.

Additional discussion of maximum transient overvoltages can be found in paragraph IV.A.2, later in this Appendix.

III. Determination of the Electrical Component of Minimum Approach Distances

A. Voltages of 1.1 kV to 72.5 kV

For voltages of 1.1 kV to 72.5 kV, the electrical component of minimum approach distances is based on American National Standards Institute (ANSI)/American Institute of Electrical Engineers (AIEE) Standard No.4, March 1943, Tables III and IV. (AIEE is the predecessor technical society to the Institute of Electrical and Electronic Engineers (IEEE).) These distances are calculated by the following formula:

Equation (1)—For voltages of 1.1 kV to 72.5 kV

$$D = \left(\frac{V_{max} \times pu}{124}\right)^{1.63}$$

Where:

D=Electrical component of the minimum approach distance in air in feet

V_{max}=Maximum rated line-to-ground rms voltage in kV

pu=Maximum transient overvoltage factor in per unit

Source: AIEE Standard No. 4, 1943.

This formula has been used to generate Table 1.

TABLE 1.—AC ENERGIZED LINE-WORK PHASE-TO-GROUND ELECTRICAL COMPONENT OF THE MINIMUM APPROACH DISTANCE—1.1 TO 72.5 KV

Maximum anticipated per-unit transient overvoltage	Phase to phase voltage			
	15,000	36,000	46,000	72,500
3.0	0.08	0.33	0.49	1.03

Note: The distances given (in feet) are for *air* as the insulating medium and provide *no* additional clearance for inadvertent movement.

B. Voltages of 72.6 kV to 800 kV

For voltages of 72.6 kV to 800 kV, the electrical component of minimum approach distances is based on ANSI/IEEE Standard 516–1987, "IEEE Guide for Maintenance Methods on Energized Power Lines." This standard gives the electrical component of the minimum approach distance based on power frequency rod-gap data, supplemented with transient overvoltage information and a saturation factor for high voltages. The distances listed in ANSI/IEEE Standard 516 have been calculated according to the following formula:

Equation (2)—For voltages of 72.6 kV to 800 kV

$$D = (C + a)pu\,V_{MAX})$$

Where:

D=Electrical component of the minimum approach distance in air in feet
C=0.01 to take care of correction factors associated with the variation of gap sparkover with voltage
a=A factor relating to the saturation of air at voltages of 345 kV or higher
pu=Maximum anticipated transient overvoltage, in per unit (p.u.)
V_{max}=Maximum rms system line-to-ground voltage in kilovolts—it should be the "actual" maximum, or the normal highest voltage for the range (for example, 10 percent above the nominal voltage)

Source: Formula developed from ANSI/IEEE Standard No. 516, 1987.

This formula is used to calculate the electrical component of the minimum approach distances in air and is used in the development of Table 2 and Table 3.

TABLE 2.—AC ENERGIZED LINE-WORK PHASE-TO-GROUND ELECTRICAL COMPONENT OF THE MINIMUM APPROACH DISTANCE—121TO 242 KV

Maximum anticipated per-unit transient overvoltage	Phase to phase voltage			
	121,000	145,000	169,000	242,000
2.0	1.40	1.70	2.00	2.80
2.1	1.47	1.79	2.10	2.94
2.2	1.54	1.87	2.20	3.08
2.3	1.61	1.96	2.30	3.22
2.4	1.68	2.04	2.40	3.35
2.5	1.75	2.13	2.50	3.50
2.6	1.82	2.21	2.60	3.64
2.7	1.89	2.30	2.70	3.76
2.8	1.96	2.38	2.80	3.92
2.9	2.03	2.47	2.90	4.05
3.0	2.10	2.55	3.00	4.29

Note: The distances given (in feet) are for *air* as the insulating medium and provide *no* additional clearance for inadvertent movement.

TABLE 3.—AC ENERGIZED LINE-WORK PHASE-TO-GROUND ELECTRICAL COMPONENT OF THE MINIMUM APPROACH DISTANCE—362 TO 800 KV

Maximum anticipated per-unit transient overvoltage	Phase to phase voltage		
	362,000	552,000	800,000
1.5		4.97	8.66
1.6		5.46	9.60
1.7		5.98	10.60
1.8		6.51	11.64
1.9		7.08	12.73
2.0	4.20	7.68	13.86
2.1	4.41	8.27	
2.2	4.70	8.87	
2.3	5.01	9.49	
2.4	5.34	10.21	
2.5	5.67		
2.6	6.01		
2.7	6.36		
2.8	6.73		
2.9	7.10		
3.0	7.48		

Note: The distances given (in feet) are for *air* as the insulating medium and provide *no* additional clearance for inadvertent movement.

C. Provisions for Inadvertent Movement

The minimum approach distances (working distances) must include an "adder" to compensate for the inadvertent movement of the worker relative to an energized part or the movement of the part relative to the worker. A certain allowance must be made to account for this possible inadvertent movement and to provide the worker with a comfortable and safe zone in which to work. A distance for inadvertent movement (called the "ergonomic component of the minimum approach distance") must be added to the electrical component to determine the total safe minimum approach distances used in live-line work.

One approach that can be used to estimate the ergonomic component of the minimum approach distance is response time-distance analysis. When this technique is used, the total response time to a hazardous incident is estimated and converted to distance travelled. For example, the driver of a car takes a given amount of time to respond to a "stimulus" and stop the vehicle. The elapsed time involved results in a distance being travelled before the car comes to a complete stop. This distance is dependent on the speed of the car at the time the stimulus appears.

In the case of live-line work, the employee must first perceive that he or she is approaching the danger zone. Then, the worker responds to the danger and must decelerate and stop all motion toward the energized part. During the time it takes to stop, a distance will have been traversed. It is this distance that must be added to the electrical component of the minimum approach distance to obtain the total safe minimum approach distance.

At voltages below 72.5 kV, the electrical component of the minimum approach distance is smaller than the ergonomic component. At 72.5 kV the electrical component is only a little more than 1 foot. An ergonomic component of the minimum approach distance is needed that will provide for all the worker's expected movements. The usual live-line work method for these voltages is the use of rubber insulating equipment, frequently rubber gloves. The energized object needs to be far enough away to provide the worker's face with a safe approach distance, as his or her hands and arms are insulated. In this case, 2 feet has been accepted as a sufficient and practical value.

For voltages between 72.6 and 800 kV, there is a change in the work practices employed during energized line work. Generally, live-line tools (hot sticks) are employed to perform work while equipment is energized. These tools, by design, keep the energized part at a constant distance from the employee and thus maintain the appropriate minimum approach distance automatically.

The length of the ergonomic component of the minimum approach distance is also influenced by the location of the worker and by the nature of the work. In these higher voltage ranges, the employees use work methods that more tightly control their movements than when the workers perform rubber glove work. The worker is farther from energized line or equipment and needs to be more precise in his or her movements just to perform the work.

For these reasons, a smaller ergonomic component of the minimum approach distance is needed, and a distance of 1 foot has been selected for voltages between 72.6 and 800 kV.

Table 4 summarizes the ergonomic component of the minimum approach distance for the two voltage ranges.

TABLE 4.—ERGONOMIC COMPONENT OF MINIMUM APPROACH DISTANCE

Voltage range (kV)	Distance (feet)
1.1 to 72.5	2.0
72.6 to 800	1.0

Note: This distance must be added to the electrical component of the minimum approach distance to obtain the full minimum approach distance.

D. Bare-Hand Live-Line Minimum Approach Distances

Calculating the strength of phase-to-phase transient overvoltages is complicated by the varying time displacement between overvoltages on parallel conductors (electrodes) and by the varying ratio between the positive and negative voltages on the two electrodes. The time displacement causes the maximum voltage between phases to be less than the sum of the phase-to-ground voltages. The International Electrotechnical Commission (IEC) Technical Committee 28, Working Group 2, has developed the following formula for determining the phase-to-phase maximum transient overvoltage, based on the per unit (p.u.) of the system nominal voltage phase-to-ground crest:

$pu_p = pu_g + 1.6.$

Where:

pu_g=p.u. phase-to-ground maximum transient overvoltage

pu_p=p.u. phase-to-phase maximum transient overvoltage

This value of maximum anticipated transient overvoltage must be used in Equation (2) to calculate the phase-to-phase minimum approach distances for live-line bare-hand work.

E. Compiling the Minimum Approach Distance Tables

For each voltage involved, the distance in table 4 in this appendix has been added to the distance in Table 1, Table 2 or Table 3 in this appendix to determine the resulting minimum approach distances in Table R–6, Table R–7, and in Table R–8 in § 1910.269.

F. Miscellaneous Correction Factors

The strength of an air gap is influenced by the changes in the air medium that forms the insulation. A brief discussion of each factor follows, with a summary at the end.

1. *Dielectric strength of air.* The dielectric strength of air in a uniform electric field at standard atmospheric conditions is approximately 31 kV (crest) per cm at 60 Hz. The disruptive gradient is affected by the air pressure, temperature, and humidity, by the shape, dimensions, and separation of the electrodes, and by the characteristics of the applied voltage (wave shape).

2. *Atmospheric effect.* Flashover for a given air gap is inhibited by an increase in the density (humidity) of the air. The empirically determined electrical strength of a given gap is normally applicable at standard atmospheric conditions (20°C, 101.3 kPa, 11 g/cm3 humidity).

The combination of temperature and air pressure that gives the lowest gap flashover voltage is high temperature and low pressure. These are conditions not likely to occur simultaneously. Low air pressure is generally associated with high humidity, and this causes increased electrical strength. An average air pressure is more likely to be associated with low humidity. Hot and dry working conditions are thus normally associated with reduced electrical strength.

The electrical component of the minimum approach distances in Table 1, Table 2, and Table 3 and has been calculated using the maximum transient overvoltages to determine withstand voltages at standard atmospheric conditions.

3. *Altitude.* The electrical strength of an air gap is reduced at high altitude, due principally to the reduced air pressure. An increase of 3% in the minimum approach distance for altitudes above 1000 meters is required. Table R–10 of § 1910.269 presents this information in tabular form.

Summary. After taking all these correction factors into account and after considering their interrelationships relative to the air gap insulation strength and the conditions under which live work is performed, one finds that only a correction for altitude need be made. An elevation of 1000 meters is established as the base elevation, and the values of the electrical component of the minimum approach distances has been derived with this correction factor in mind. Thus, the values used for elevations below 1000 meters are conservative without any change; corrections have to be made only above this base elevation.

IV. Determination of Reduced Minimum Approach Distances

A. Factors Affecting Voltage Stress at the Work Site

1. *System voltage (nominal).* The nominal system voltage range sets the absolute lower limit for the minimum approach distance. The highest value within the range, as given in the relevant table, is selected and used as a reference for per unit calculations.

2. *Transient overvoltages.* Transient overvoltages may be generated on an electrical system by the operation of switches or breakers, by the occurrence of a fault on the line or circuit being worked or on an adjacent circuit, and by similar activities. Most of the overvoltages are caused by switching, and the term "switching surge" is often used to refer generically to all types of overvoltages. However, each overvoltage has an associated transient voltage wave shape. The wave shape arriving at the site and its magnitude vary considerably.

The information used in the development of the minimum approach distances takes into consideration the most common wave shapes; thus, the required minimum approach distances are appropriate for any transient overvoltage level usually found on electric power generation, transmission, and distribution systems. The values of the per unit (p.u.) voltage relative to the nominal maximum voltage are used in the calculation of these distances.

3. *Typical magnitude of overvoltages.* The magnitude of typical transient overvoltages is given in Table 5.

4. *Standard deviation—air-gap withstand.* For each air gap length, and under the same atmospheric conditions, there is a statistical variation in the breakdown voltage. The probability of the breakdown voltage is assumed to have a normal (Gaussian) distribution. The standard deviation of this distribution varies with the wave shape, gap geometry, and the atmospheric conditions. The withstand voltage of the air gap used in calculating the electrical component of the minimum approach distance has been set at three standard deviations (3σ [1]) below the critical flashover voltage. (The critical flashover voltage is the crest value of the impulse wave that, under specified conditions, causes flashover on 50 percent of the applications. An impulse wave of three standard deviations below this value, that is, the withstand voltage, has a probability of flashover of approximately 1 in 1000.)

TABLE 5.—MAGNITUDE OF TYPICAL TRANSIENT OVERVOLTAGES

Cause	Magnitude (per unit)
Energized 200 mile line without closing resistors	3.5
Energized 200 mile line with one step closing resistor	2.1
Energized 200 mile line with multi-step resistor	2.5

[1] Sigma σ is the symbol for standard deviation.

TABLE 5.—MAGNITUDE OF TYPICAL TRANSIENT OVERVOLTAGES—Continued

Cause	Magnitude (per unit)
Reclosed with trapped charge one step resistor	2.2
Opening surge with single restrike	3.0
Fault initiation unfaulted phase	2.1
Fault initiation adjacent circuit	2.5
Fault clearing	1.7–1.9

Source: ANSI/IEEE Standard No. 516, 1987.

5. *Broken Insulators*. Tests have shown that the insulation strength of an insulator string with broken skirts is reduced. Broken units may have lost up to 70% of their withstand capacity. Because the insulating capability of a broken unit cannot be determined without testing it, damaged units in an insulator are usually considered to have no insulating value. Additionally, the overall insulating strength of a string with broken units may be further reduced in the presence of a live-line tool alongside. The number of good units that must be present in a string is based on the maximum overvoltage possible at the worksite.

B. Minimum Approach Distances Based on Known Maximum Anticipated Per-Unit Transient Overvoltages

1. *Reduction of the minimum approach distance for AC systems*. When the transient overvoltage values are known and supplied by the employer, Table R–7 and Table R–8 of § 1910.269 allow the minimum approach distances from energized parts to be reduced. In order to determine what this maximum overvoltage is, the employer must undertake an engineering analysis of the system. As a result of this engineering study, the employer must provide new live work procedures, reflecting the new minimum approach distances, the conditions and limitations of application of the new minimum approach distances, and the specific practices to be used when these procedures are implemented.

2. *Calculation of reduced approach distance values*. The following method of calculating reduced minimum approach distances is based on ANSI/IEEE Standard 516:

Step 1. Determine the maximum voltage (with respect to a given nominal voltage range) for the energized part.

Step 2. Determine the maximum transient overvoltage (normally a switching surge) that can be present at the work site during work operation.

Step 3. Determine the technique to be used to control the maximum transient overvoltage. (See paragraphs IV.C and IV.D of this appendix.) Determine the maximum voltage that can exist at the work site with that form of control in place and with a confidence level of 3σ. This voltage is considered to be the withstand voltage for the purpose of calculating the appropriate minimum approach distance.

Step 4. Specify in detail the control technique to be used, and direct its implementation during the course of the work.

Step 5. Using the new value of transient overvoltage in per unit (p.u.), determine the required phase-to-ground minimum approach distance from Table R–7 or Table R–8 of § 1910.269.

Methods of Controlling Possible Transient Overvoltage Stress Found on a System

1. *Introduction*. There are several means of controlling overvoltages that occur on transmission systems. First, the operation of circuit breakers or other switching devices may be modified to reduce switching transient overvoltages. Second, the overvoltage itself may be forcibly held to an acceptable level by means of installation of surge arresters at the specific location to be protected. Third, the transmission system may be changed to minimize the effect of switching operations.

2. *Operation of circuit breakers*.[2] The maximum transient overvoltage that can reach the work site is often due to switching on the line on which work is being performed. If the automatic-reclosing is removed during energized line work so that the line will not be re-energized after being opened for any reason, the maximum switching surge overvoltage is then limited to the larger of the opening surge or the greatest possible fault-generated surge, provided that the devices (for example, insertion resistors) are operable and will function to limit the transient overvoltage. It is essential that the operating ability of such devices be assured when they are employed to limit the overvoltage level. If it is prudent not to remove the reclosing feature (because of system operating conditions), other methods of controlling the switching surge level may be necessary.

Transient surges on an adjacent line, particularly for double circuit construction, may cause a significant overvoltage on the line on which work is being performed. The coupling to adjacent lines must be accounted for when minimum approach distances are calculated based on the maximum transient overvoltage.

3. *Surge arresters*. The use of modern surge arresters has permitted a reduction in the basic impulse-insulation levels of much transmission system equipment. The primary function of early arresters was to protect the system insulation from the effects of lightning. Modern arresters not only dissipate lightning-caused transients, but may also control many other system transients that may be caused by switching or faults.

It is possible to use properly designed arresters to control transient overvoltages along a transmission line and thereby reduce the requisite length of the insulator string. On the other hand, if the installation of arresters has not been used to reduce the length of the insulator string, it may be used to reduce the minimum approach distance instead.[3]

4. *Switching Restrictions*. Another form of overvoltage control is the establishment of switching restrictions, under which breakers are not permitted to be operated until certain system conditions are satisfied. Restriction of switching is achieved by the use of a tagging system, similar to that used for a "permit", except that the common term used for this activity is a "hold-off" or "restriction". These terms are used to indicate that operation is not prevented, but only modified during the live-work activity.

D. Minimum Approach Distance Based on Control of Voltage Stress (Overvoltages) at the Work Site.

Reduced minimum approach distances can be calculated as follows:

1. *First Method—Determining the reduced minimum approach distance from a given withstand voltage*.[4]

Step 1. Select the appropriate withstand voltage for the protective gap based on system requirements and an acceptable probability of actual gap flashover.

Step 2. Determine a gap distance that provides a withstand voltage[5] greater than or equal to the one selected in the first step.[6]

Step 3. Using 110 percent of the gap's critical flashover voltage, determine the electrical component of the minimum approach distance from Equation (2) or Table 6, which is a tabulation of distance vs. withstand voltage based on Equation (2).

Step 4. Add the 1-foot ergonomic component to obtain the total minimum approach distance to be maintained by the employee.

2. *Second Method—Determining the necessary protective gap length from a desired (reduced) minimum approach distance*.

Step 1. Determine the desired minimum approach distance for the employee. Subtract the 1-foot ergonomic component of the minimum approach distance.

Step 2. Using this distance, calculate the air gap withstand voltage from Equation (2). Alternatively, find the voltage corresponding to the distance in Table 6.[7]

[2] The detailed design of a circuit interrupter, such as the design of the contacts, of resistor insertion, and of breaker timing control, are beyond the scope of this appendix. These features are routinely provided as part of the design for the system. Only features that can limit the maximum switching transient overvoltage on a system are discussed in this appendix.

[3] Surge arrestor application is beyond the scope of this appendix. However, if the arrester is installed near the work site, the application would be similar to protective gaps as discussed in paragraph IV.D. of this appendix.

[4] Since a given rod gap of a given configuration corresponds to a certain withstand voltage, this method can also be used to determine the minimum approach distance for a known gap.

[5] The withstand voltage for the gap is equal to 85 percent of its critical flashover voltage.

[6] Switch steps 1 and 2 if the length of the protective gap is known. The withstand voltage must then be checked to ensure that it provides an acceptable probability of gap flashover. In general, it should be at least 1.25 times the maximum crest operating voltage.

[7] Since the value of the saturation factor, a, in is dependent on the maximum voltage, several iterative computations may be necessary to determine the correct withstand voltage using the equation. A graph of withstand voltage vs. distance is given in ANSI/IEEE Std. 516, 1987. This graph could also be used to determine the appropriate withstand voltage for the minimum approach distance involved.

Step 3. Select a protective gap distance corresponding to a critical flashover voltage that, when multiplied by 110 percent, is less than or equal to the withstand voltage from Step 2.

Step 4. Calculate the withstand voltage of the protective gap (85 percent of the critical flashover voltage) to ensure that it provides an acceptable risk of flashover during the time the gap is installed.

TABLE 6.—WITHSTAND DISTANCES FOR TRANSIENT OVERVOLTAGES

Crest voltage (kV)	Withstand distance (in feet) air gap
100	0.71
150	1.06
200	1.41
250	1.77
300	2.12
350	2.47
400	2.83
450	3.18
500	3.54
550	3.89
600	4.24
650	4.60
700	5.17
750	5.73
800	6.31
850	6.91
900	7.57
950	8.23
1000	8.94
1050	9.65
1100	10.42
1150	11.18
1200	12.05
1250	12.90
1300	13.79
1350	14.70
1400	15.64
1450	16.61
1500	17.61
1550	18.63

Source: Calculations are based on Equation (2).

Note: The air gap is based on the 60-Hz rod-gap withstand distance.

3. *Sample protective gap calculations.*

Problem 1: Work is to be performed on a 500-kV transmission line that is subject to transient overvoltages of 2.4 p.u. The maximum operating voltage of the line is 552 kV. Determine the length of the protective gap that will provide the minimum practical safe approach distance. Also, determine what that minimum approach distance is.

Step 1. Calculate the smallest practical maximum transient overvoltage (1.25 times the crest line-to-ground voltage):[8]

$$552\text{ kV}\times\frac{\sqrt{2}}{\sqrt{3}}\times 1.25 = 563\text{ kV}.$$

This will be the withstand voltage of the protective gap.

Step 2. Using test data for a particular protective gap, select a gap that has a critical flashover voltage greater than or equal to:

$$563\text{ kV} + 0.85 = 662\text{ kV}.$$

For example, if a protective gap with a 4.0-foot spacing tested to a critical flashover voltage of 665 kV, crest, select this gap spacing.

Step 3. This protective gap corresponds to a 110 percent of critical flashover voltage value of:

$$665\text{ kV}\times 1.10 = 732\text{ kV}.$$

This corresponds to the withstand voltage of the electrical component of the minimum approach distance.

Step 4. Using this voltage in Equation (2) results in an electrical component of the minimum approach distance of:

$$D = (0.01 + 0.0006)\times\frac{552\text{ kV}}{\sqrt{3}} = 5.5\text{ ft}.$$

Step 5. Add 1 foot to the distance calculated in step 4, resulting in a total minimum approach distance of 6.5 feet.

Problem 2: For a line operating at a maximum voltage of 552 kV subject to a maximum transient overvoltage of 2.4 p.u., find a protective gap distance that will permit the use of a 9.0-foot minimum approach distance. (A minimum approach distance of 11 feet, 3 inches is normally required.)

Step 1. The electrical component of the minimum approach distance is 8.0 feet (9.0–1.0).

Step 2. From Table 6, select the withstand voltage corresponding to a distance of 8.0 feet. By interpolation:

$$900\text{ kV} + \left[50\times\frac{(8.00-7.57)}{(8.23-7.57)}\right] = 933\text{ kV}.$$

Step 3. The voltage calculated in Step 2 corresponds to 110 percent of the critical flashover voltage of the gap that should be employed. Using test data for a particular protective gap, select a gap that has a critical flashover voltage less than or equal to:

$$933\text{ kV} + 1.10 = 848\text{ kV}.$$

For example, if a protective gap with a 5.8-foot spacing tested to a critical flashover voltage of 820 kV, crest, select this gap spacing.

Step 4. The withstand voltage of this protective gap would be:

$$820\text{ kV}\times 0.85 = 697\text{ kV}.$$

The maximum operating crest voltage would be:

$$552\text{ kV}\times\frac{\sqrt{2}}{\sqrt{3}} = 449\text{ kV},$$

and the maximum per unit transient overvoltage during the time the protective gap is installed would be:

$$697\text{ kV} + 449\text{ kV} = 1.55\text{ p.u.}$$

If this is acceptable, the protective gap could be installed with a 5.8-foot spacing, and the minimum approach distance could then be reduced to 9.0 feet.

4. *Comments and variations.* The 1-foot ergonomic component of the minimum approach distance must be added to the electrical component of the minimum approach distance calculated under paragraph IV.D of this appendix. The calculations may be varied by starting with the protective gap distance or by starting with the minimum approach distance.

E. Location of Protective Gaps

1. Installation of the protective gap on a structure adjacent to the work site is an acceptable practice, as this does not significantly reduce the protection afforded by the gap.

2. Gaps installed at terminal stations of lines or circuits provide a given level of protection. The level may not, however, extend throughout the length of the line to the worksite. The use of gaps at terminal stations must be studied in depth. The use of substation terminal gaps raises the possibility that separate surges could enter the line at opposite ends, each with low enough magnitude to pass the terminal gaps without flashover. When voltage surges are initiated simultaneously at each end of a line and travel toward each other, the total voltage on the line at the point where they meet is the arithmetic sum of the two surges. A gap that is installed within 0.5 mile of the work site will protect against such intersecting waves. Engineering studies of a particular line or system may indicate that adequate protection can be provided by even more distant gaps.

3. If protective gaps are used at the work site, the work site impulse insulation strength is established by the gap setting. Lightning strikes as much as 6 miles away from the worksite may cause a voltage surge greater than the insulation withstand voltage, and a gap flashover may occur. The flashover will not occur between the employee and the line, but across the protective gap instead.

4. There are two reasons to disable the automatic-reclosing feature of circuit-interrupting devices while employees are performing live-line maintenance:

• To prevent the reenergizing of a circuit faulted by actions of a worker, which could possibly create a hazard or compound injuries or damage produced by the original fault;

• To prevent any transient overvoltage caused by the switching surge that would occur if the circuit were reenergized.

However, due to system stability considerations, it may not always be feasible to disable the automatic-reclosing feature.

Appendix C to Section 1910.269—Protection from Step and Touch Potentials

I. Introduction

When a ground fault occurs on a power line, voltage is impressed on the "grounded" object faulting the line. The voltage to which this object rises depends largely on the

[8] To eliminate unwanted flashovers due to minor system disturbances, it is desirable to have the crest withstand voltage no lower than 1.25 p.u.

voltage on the line, on the impedance of the faulted conductor, and on the impedance to "true," or "absolute," ground represented by the object. If the object causing the fault represents a relatively large impedance, the voltage impressed on it is essentially the phase-to-ground system voltage. However, even faults to well grounded transmission towers or substation structures can result in hazardous voltages.[1] The degree of the hazard depends upon the magnitude of the fault current and the time of exposure.

[1] This appendix provides information primarily with respect to employee protection from contact between equipment being used and an energized power line. The information presented is also relevant to ground faults to transmission towers and substation structures; however, grounding systems for these structures should be designed to minimize the step and touch potentials involved.

II. Voltage-Gradient Distribution

A. Voltage-Gradient Distribution Curve

The dissipation of voltage from a grounding electrode (or from the grounded end of an energized grounded object) is called the ground potential gradient. Voltage drops associated with this dissipation of voltage are called ground potentials. Figure 1 is a typical voltage-gradient distribution curve (assuming a uniform soil texture). This graph shows that voltage decreases rapidly with increasing distance from the grounding electrode.

B. Step and Touch Potentials

"Step potential" is the voltage between the feet of a person standing near an energized grounded object. It is equal to the difference in voltage, given by the voltage distribution curve, between two points at different distances from the "electrode". A person could be at risk of injury during a fault simply by standing near the grounding point.

"Touch potential" is the voltage between the energized object and the feet of a person in contact with the object. It is equal to the difference in voltage between the object (which is at a distance of 0 feet) and a point some distance away. It should be noted that the touch potential could be nearly the full voltage across the grounded object if that object is grounded at a point remote from the place where the person is in contact with it. For example, a crane that was grounded to the system neutral and that contacted an energized line would expose any person in contact with the crane or its uninsulated load line to a touch potential nearly equal to the full fault voltage.

Step and touch potentials are illustrated in Figure 2.

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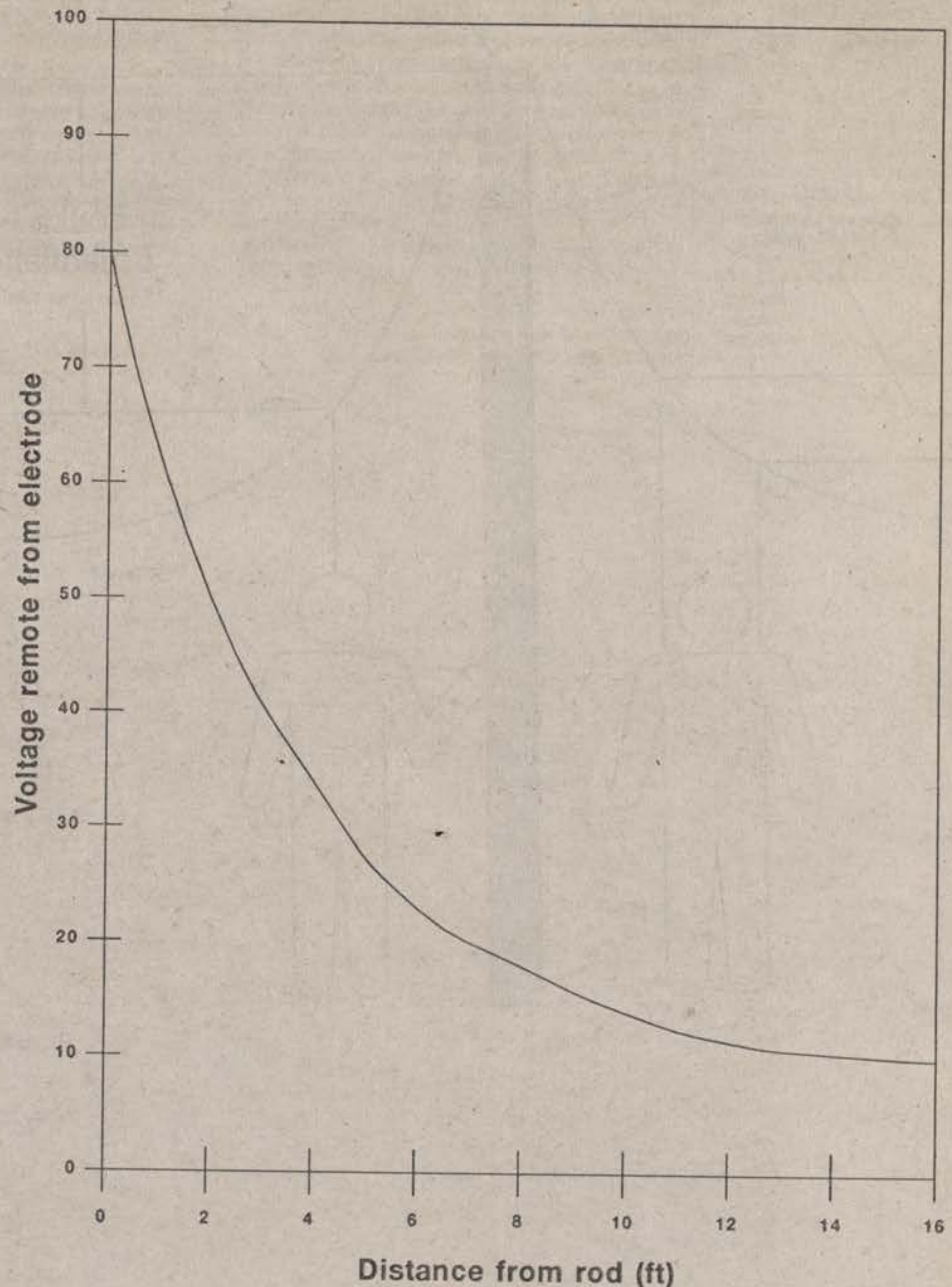

Figure 1 - Typical Voltage-Gradient Distribution Curve

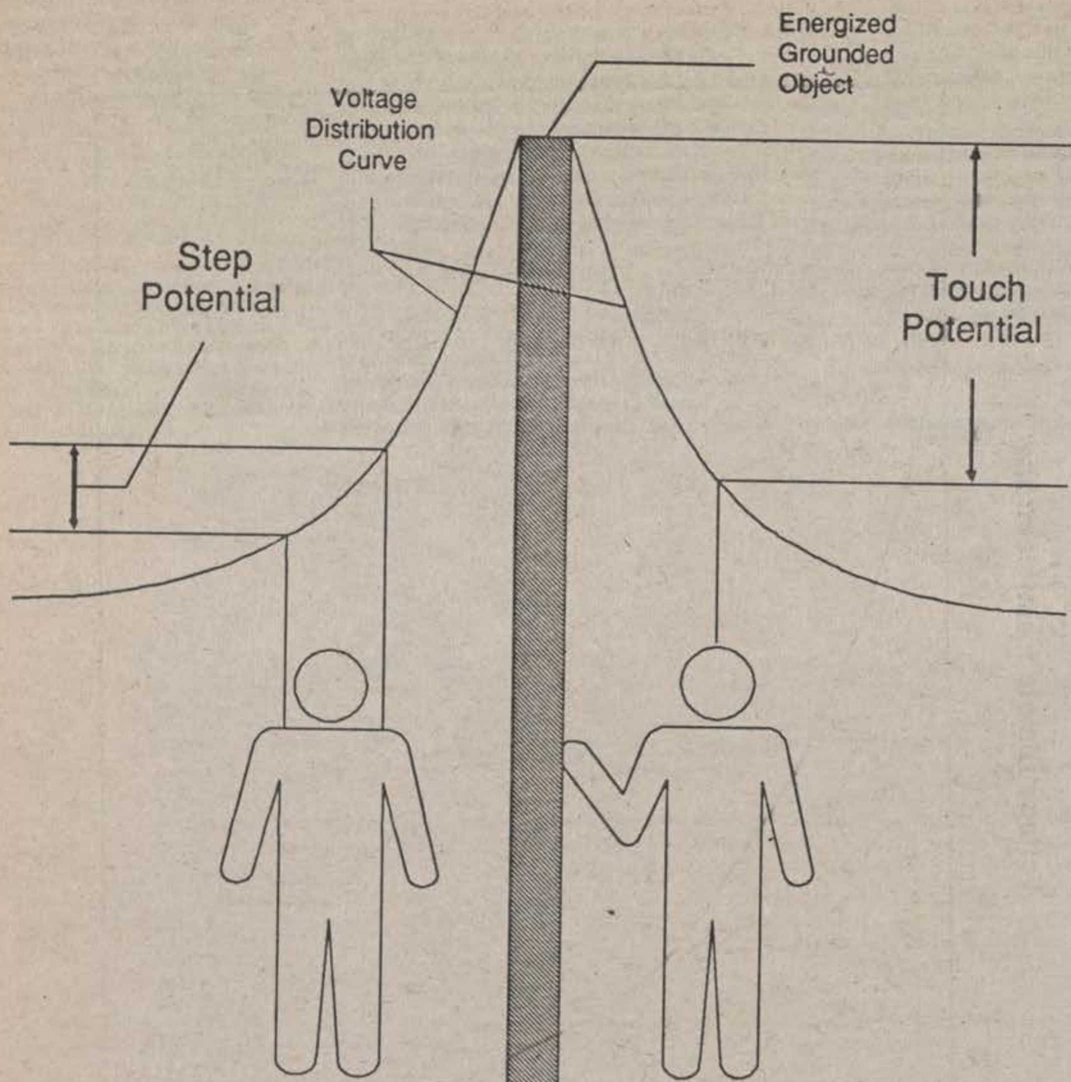

Figure 2 - Step and Touch Potentials

C. Protection From the Hazards of Ground-Potential Gradients. An engineering analysis of the power system under fault conditions can be used to determine whether or not hazardous step and touch voltages will develop. The result of this analysis can ascertain the need for protective measures and can guide the selection of appropriate precautions.

Several methods may be used to protect employees from hazardous ground-potential gradients, including equipotential zones, insulating equipment, and restricted work areas.

1. The creation of an equipotential zone will protect a worker standing within it from hazardous step and touch potentials. (See Figure 3.) Such a zone can be produced through the use of a metal mat connected to the grounded object. In some cases, a grounding grid can be used to equalize the voltage within the grid. Equipotential zones will not, however, protect employees who are either wholly or partially outside the protected area. Bonding conductive objects in the immediate work area can also be used to minimize the potential between the objects and between each object and ground. (Bonding an object outside the work area can increase the touch potential to that object in some cases, however.)

2. The use of insulating equipment, such as rubber gloves, can protect employees handling grounded equipment and conductors from hazardous touch potentials. The insulating equipment must be rated for the highest voltage that can be impressed on the grounded objects under fault conditions (rather than for the full system voltage).

3. Restricting employees from areas where hazardous step or touch potentials could arise can protect employees not directly involved in the operation being performed. Employees on the ground in the vicinity of transmission structures should be kept at a distance where step voltages would be insufficient to cause injury. Employees should not handle grounded conductors or equipment likely to become energized to hazardous voltages unless the employees are within an equipotential zone or are protected by insulating equipment.

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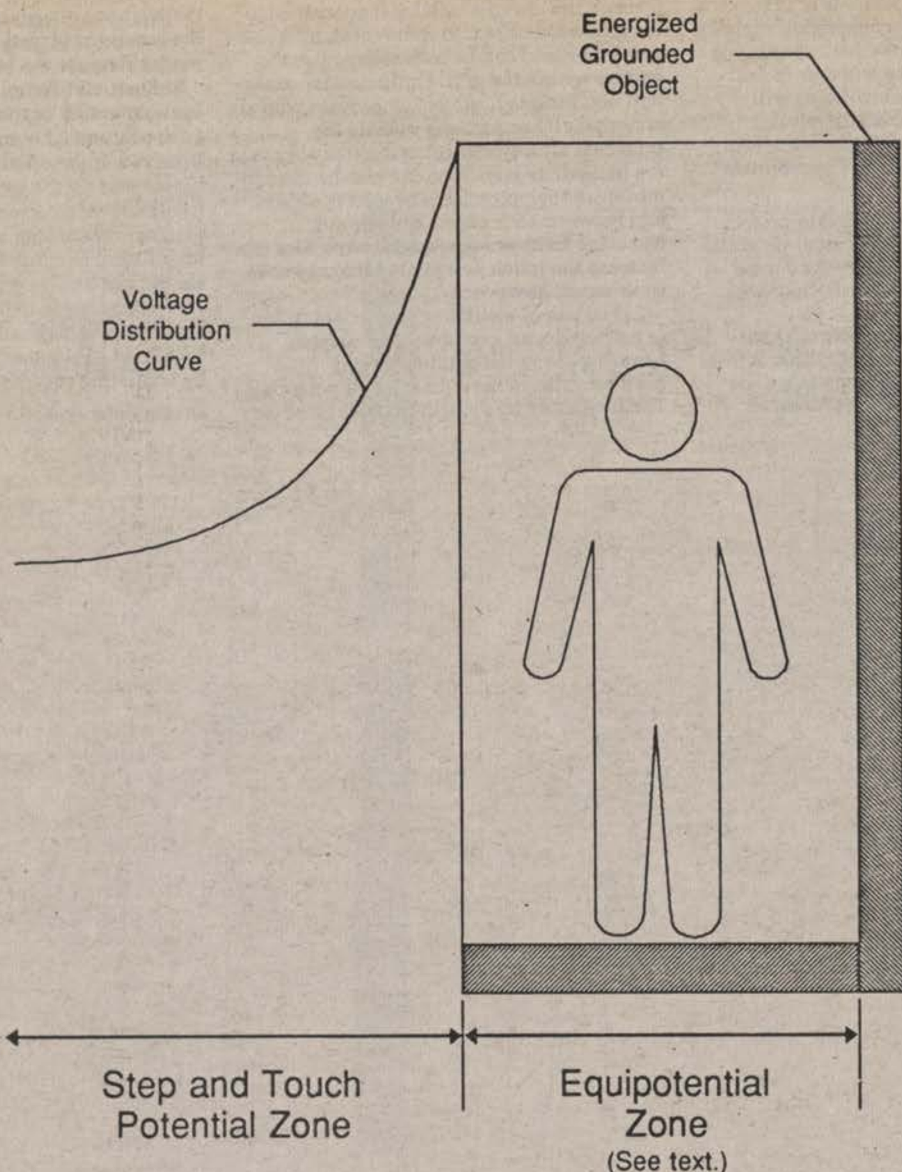

Figure 3 - Protection from Ground-Potential Gradients

Appendix D to Section 1910.269—Methods of Inspecting and Testing Wood Poles

I. Introduction

When work is to be performed on a wood pole, it is important to determine the condition of the pole before it is climbed. The weight of the employee, the weight of equipment being installed, and other working stresses (such as the removal or retensioning of conductors) can lead to the failure of a defective pole or one that is not designed to handle the additional stresses.[1] For these reasons, it is essential that an inspection and test of the condition of a wood pole be performed before it is climbed.

If the pole is found to be unsafe to climb or to work from, it must be secured so that it does not fail while an employee is on it. The pole can be secured by a line truck boom, by ropes or guys, or by lashing a new pole alongside it. If a new one is lashed alongside the defective pole, work should be performed from the new one.

II. Inspection of Wood Poles

Wood poles should be inspected by a qualified employee for the following conditions:[2]

A. General Condition

The pole should be inspected for buckling at the ground line and for an unusual angle with respect to the ground. Buckling and odd angles may indicate that the pole has rotted or is broken.

B. Cracks

The pole should be inspected for cracks. Horizontal cracks perpendicular to the grain of the wood may weaken the pole. Vertical ones, although not considered to be a sign of a defective pole, can pose a hazard to the climber, and the employee should keep his or her gaffs away from them while climbing.

C. Holes

Hollow spots and woodpecker holes can reduce the strength of a wood pole.

D. Shell Rot and Decay.

Rotting and decay is a cutout hazard and a possible indication of the age and internal condition of the pole.

Knots

E. Knots

One large knot or several smaller ones at the same height on the pole may be evidence of a weak point on the pole.

F. Depth of Setting

Evidence of the existence of a former ground line substantially above the existing ground level may be an indication that the pole is no longer buried to a sufficient extent.

[1] A properly guyed pole in good condition should, at a minimum, be able to handle the weight of an employee climbing it.

[2] The presence of any of these conditions is an indication that the pole may not be safe to climb or to work from. The employee performing the inspection must be qualified to make a determination as to whether or not it is safe to perform the work without taking additional precautions.

G. Soil Conditions

Soft, wet, or loose soil may not support any changes of stress on the pole.

H. Burn Marks

Burning from transformer failures or conductor faults could damage the pole so that it cannot withstand mechanical stress changes.

III. Testing of Wood Poles

The following tests, which have been taken from § 1910.268(n)(3), are recognized as acceptable methods of testing wood poles:

A. Hammer Test

Rap the pole sharply with a hammer weighing about 3 pounds, starting near the ground line and continuing upwards circumferentially around the pole to a height of approximately 6 feet. The hammer will produce a clear sound and rebound sharply when striking sound wood. Decay pockets will be indicated by a dull sound or a less pronounced hammer rebound. Also, prod the pole as near the ground line as possible using a pole prod or a screwdriver with a blade at least 5 inches long. If substantial decay is encountered, the pole is considered unsafe.

B. Rocking Test

Apply a horizontal force to the pole and attempt to rock it back and forth in a direction perpendicular to the line. Caution must be exercised to avoid causing power lines to swing together. The force may be applied either by pushing with a pike pole or pulling with a rope. If the pole cracks during the test, it shall be considered unsafe.

Appendix E to Section 1910.269—Reference Documents

The references contained in this appendix provide information that can be helpful in understanding and complying with the requirements contained in § 1910.269. The national consensus standards referenced in this appendix contain detailed specifications that employers may follow in complying with the more performance-oriented requirements of OSHA's final rule. Except as specifically noted in § 1910.269, however, compliance with the national consensus standards is not a substitute for compliance with the provisions of the OSHA standard.

ANSI A92.2–1979, American National Standard for Vehicle-Mounted Elevating and Rotating Aerial Devices.

ANSI C2–1993, National Electrical Safety Code.

ANSI Z133.1–1988, American National Standard Safety Requirements for Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and for Cutting Brush.

ANSI/ASME B20.1–1990, Safety Standard for Conveyors and Related Equipment.

ANSI/IEEE Std. 4–1978 (Fifth Printing), IEEE Standard Techniques for High-Voltage Testing.

ANSI/IEEE Std. 100–1988, IEEE Standard Dictionary of Electrical and Electronic Terms.

ANSI/IEEE Std. 516–1987, IEEE Guide for Maintenance Methods on Energized Power-Lines.

ANSI/IEEE Std. 935–1989, IEEE Guide on Terminology for Tools and Equipment to Be Used in Live Line Working.

ANSI/IEEE Std. 957–1987, IEEE Guide for Cleaning Insulators.

ANSI/IEEE Std. 978–1984 (R1991), IEEE Guide for In-Service Maintenance and Electrical Testing of Live-Line Tools.

ASTM D 120–87, Specification for Rubber Insulating Gloves.

ASTM D 149–92, Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.

ASTM D 178–88, Specification for Rubber Insulating Matting.

ASTM D 1048–88a, Specification for Rubber Insulating Blankets.

ASTM D 1049–88, Specification for Rubber Insulating Covers.

ASTM D 1050–90, Specification for Rubber Insulating Line Hose.

ASTM D 1051–87, Specification for Rubber Insulating Sleeves.

ASTM F 478–92, Specification for In-Service Care of Insulating Line Hose and Covers.

ASTM F 479–88a, Specification for In-Service Care of Insulating Blankets.

ASTM F 496–91, Specification for In-Service Care of Insulating Gloves and Sleeves.

ASTM F 711–89, Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools.

ASTM F 712–88, Test Methods for Electrically Insulating Plastic Guard Equipment for Protection of Workers.

ASTM F 819–83a (1988), Definitions of Terms Relating to Electrical Protective Equipment for Workers.

ASTM F 855–90, Specifications for Temporary Grounding Systems to Be Used on De-Energized Electric Power Lines and Equipment.

ASTM F 887–91a, Specifications for Personal Climbing Equipment.

ASTM F 914–91, Test Method for Acoustic Emission for Insulated Aerial Personnel Devices.

ASTM F 968–93, Specification for Electrically Insulating Plastic Guard Equipment for Protection of Workers.

ASTM F 1116–88, Test Method for Determining Dielectric Strength of Overshoe Footwear.

ASTM F 1117–87, Specification for Dielectric Overshoe Footwear.

ASTM F 1236–89, Guide for Visual Inspection of Electrical Protective Rubber Products.

IEEE Std. 62–1978, IEEE Guide for Field Testing Power Apparatus Insulation.

IEEE Std. 524–1992, IEEE Guide to the Installation of Overhead Transmission Line Conductors.

IEEE Std. 1048–1990, IEEE Guide for Protective Grounding of Power Lines.

IEEE Std. 1067–1990, IEEE Guide for the In-Service Use, Care, Maintenance, and Testing of Conductive Clothing for Use on Voltages up to 765 kV AC.

Subpart S—Electrical

5. The authority citation for subpart S of part 1910 continues to read as follows:

Authority: Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 8-76 (41 FR 25059) or 1-90 (55 FR 9033), as applicable; 29 CFR Part 1911.

6. Note 2 following paragraph (c)(1) of § 1910.331 is redesignated as Note 3.

7. A new Note 2 is added, and existing Note 3 is revised, to read as follows:

§ 1910.331 Scope.

* * * * *

(c) * * *

(1) * * *

Note 2: For work on or directly associated with utilization installations, an employer who complies with the work practices of § 1910.269 (electric power generation, transmission, and distribution) will be deemed to be in compliance with § 1910.333(c) and § 1910.335. However, the requirements of § 1910.332, § 1910.333(a), § 1910.333(b), and § 1910.334 apply to *all* work on or directly associated with utilization installations, regardless of whether the work is performed by qualified or unqualified persons.

Note 3: Work on or directly associated with generation, transmission, or distribution installations includes:

(1) Work performed directly on such installations, such as repairing overhead or underground distribution lines or repairing a feed-water pump for the boiler in a generating plant.

(2) Work directly associated with such installations, such as line-clearance tree trimming and replacing utility poles.

(3) Work on electric utilization circuits in a generating plant provided that:

(A) Such circuits are commingled with installations of power generation equipment or circuits, and

(B) The generation equipment or circuits present greater electrical hazards than those posed by the utilization equipment or circuits (such as exposure to higher voltages or lack of overcurrent protection).

This work is covered by § 1910.269 of this Part.

* * * * *

8. The first sentence of the note after the introductory text in § 1910.333(c)(3) is revised to read as follows:

§ 1910.333 Selection and use of work practices.

* * * * *

(c) * * *

(3) * * *

Note: The work practices used by qualified persons installing insulating devices on overhead power transmission or distribution lines are covered by § 1910.269 of this Part, not by §§ 1910.332 through 1910.335 of this Part. * * *

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[FR Doc. 94-1300 Filed 1-28-94; 8:45 am]

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federal register

Monday
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Part III

Environmental Protection Agency

40 CFR Parts 9 and 68

List of Regulated Substances and Thresholds for Accidental Release Prevention and Risk Management Programs for Chemical Accident Release Prevention; Final Rule and Notice

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 9 and 68

[FRL–4828–6]

List of Regulated Substances and Thresholds for Accidental Release Prevention; Requirements for Petitions Under Section 112(r) of the Clean Air Act as Amended

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: The Environmental Protection Agency (EPA) is promulgating the list of regulated substances and thresholds required under section 112(r) of the Clean Air Act as amended. The list is composed of three categories: A list of 77 toxic substances, a list of 63 flammable substances, and explosive substances with a mass explosion hazard as listed by the United States Department of Transportation (DOT). Threshold quantities are established for toxic substances ranging from 500 to 20,000 pounds. For all listed flammable substances the threshold quantity is established at 10,000 pounds. For explosive substances the threshold quantity is established at 5,000 pounds. The list and threshold quantities will identify facilities subject to chemical accident prevention regulations promulgated under section 112(r) of the Clean Air Act as amended; a proposed regulation for such requirements has been published in the **Federal Register** on October 20, 1993, entitled *Risk Management Programs for Chemical Accidental Release Prevention*. EPA is also promulgating in this regulation the requirements for the petition process for additions to, or deletions from, the list of regulated substances. EPA is deferring action on a proposed exemption from regulation for listed flammable substances when used solely for facility consumption as fuel. For a document relating to the proposed exemption, see a supplemental notice published elsewhere in this issue.

DATES: This rule is effective March 2, 1994.

ADDRESSES: Docket: Supporting information used in developing both the proposed and the final rule is contained in Docket No. A–91–74. The docket is available for public inspection and copying from 8 a.m. to 4 p.m., Monday through Friday, at the EPA's Air Docket Section, Waterside Mall, room M 1500, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460. A reasonable fee may be charged for copying.

FOR FURTHER INFORMATION CONTACT: Vanessa Rodriguez, Chemical Engineer, (202) 260–7913, Chemical Emergency Preparedness and Prevention Office, Mailcode 5101, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460, or the Emergency Planning and Community Right-to-Know Hot Line at 1–800–535–0202.

SUPPLEMENTARY INFORMATION: The information presented in this preamble is organized as follows:

I. Introduction
A. Statutory Authority
B. Background
II. Clean Air Act Amendments of 1990
A. Prevention of Accidental Releases
B. List of Substances and Thresholds; Petitions for Additions and Deletions
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2. Summary of Proposed Rule
III. Public Participation
IV. Discussion of Comments and Major Regulatory Changes
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b. Specific Substances
c. Other List Options Considered
d. Threshold Quantities
e. Other Threshold Quantity Options Considered
2. Flammable Substances
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1. Basis for Threshold Determination
2. Mixture Exemption
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3. Other Threshold Exemptions
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VI. Required Analyses
A. E.O. 12866
B. Regulatory Flexibility Act
C. Paperwork Reduction Act
D. Display of OMB Control Numbers

I. Introduction

A. Statutory Authority

This final rule is being issued under sections 112(r) and 301 of the Clean Air Act (CAA or Act) as amended (42 U.S.C. 7412(r), 7601).

B. Background

Public awareness of the potential danger from accidental releases of hazardous chemicals has increased over the years as serious chemical accidents have occurred around the world (e.g., the 1974 explosion in Flixborough, England, and the 1976 release of dioxin in Seveso, Italy). Public concern intensified following the 1984 release of methyl isocyanate in Bhopal, India, which killed more than 2,000 people living near the facility. A subsequent release from a chemical facility in Institute, West Virginia, sent more than 100 people to the hospital and made Americans aware that such accidents can and do happen in the United States.

In response to this public concern and the hazards that exist, the U.S. Environmental Protection Agency (EPA) began its Chemical Emergency Preparedness Program (CEPP) in 1985, as part of the Agency's Air Toxics Strategy. CEPP was a voluntary program to encourage state and local authorities to identify hazards in their areas and to plan for chemical emergency response actions. In 1986, Congress adopted many of the elements of CEPP in the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA), also known as Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA Title III). EPCRA requires states to establish state and local emergency planning groups, namely the State Emergency Response Commissions (SERCs) and the Local Emergency Planning Committees (LEPCs), to develop emergency response plans for each community. EPCRA requires facilities to provide information on the hazardous chemicals they have on-site; the information collected is available to the public through the SERC/LEPC structure. This information forms the foundation of both the emergency response plans and the public-industry dialogue on risks and risk reduction.

Congress required EPA, under EPCRA (SARA Title III) section 305(b), to conduct a review of emergency systems to monitor, detect, and prevent chemical accidents. The final report to Congress, *Review of Emergency Systems* (EPA, 1988), concluded that the prevention of accidental releases requires an integrated approach that considers technologies, operations, and management practices. The report emphasized the importance of management commitment to safety.

In 1986, EPA established a chemical accident prevention program to collect information on chemical accidents and work with other groups to increase knowledge of prevention practices and encourage industry to improve safety at facilities. Under this program, EPA developed its Accidental Release Information Program (ARIP) to collect data on the causes of chemical accidents and the steps facilities take to prevent recurrences. EPA also developed a program for conducting chemical safety audits at facilities. Through the audit program, EPA headquarters and regional staff, as well as state and local officials, learned about integrated approaches to process safety from facilities. EPA has also worked with trade associations, professional organizations, labor, environmental groups, and other Federal agencies to determine how best to reach smaller operations, which the section 305(b) study indicated are less aware of risks than larger facilities. EPA has also been an active participant in international efforts related to chemical accident prevention, particularly through the Organization for Economic Cooperation and Development (OECD), which has held five international workshops from 1989 through 1991 to discuss issues related to accident prevention, preparedness, and response, and has developed guidelines for member countries.

In addition to EPA's work in this area, other agencies and states have developed programs related to chemical accident prevention. The Occupational Safety and Health Administration (OSHA) promulgated a final rule on chemical process safety management amending 29 CFR 1910.109 and adding 29 CFR 1910.119 (57 FR 6356, February 24, 1992) as required under section 304 of the Clean Air Act Amendments of 1990 (CAA Amendments). Four states—New Jersey, California, Delaware, and Nevada—have operational risk management programs. Additional states have begun to address accidental release prevention as part of their air toxics program development.

Professional and trade organizations have also developed programs in this area. For example, the Center for Chemical Process Safety of the American Institute of Chemical Engineers has published guidance on the management of chemical process safety. The Chemical Manufacturers' Association has adopted a Responsible Care™ program, which all members must comply with to maintain membership. The American Petroleum Institute has developed a similar program, Management of Process Hazards; Recommended Practice 750 (RP 750), for its members. In 1982, the European Community adopted the Seveso Directive (82/501/EEC, as amended), which requires facilities handling certain chemicals to develop a safety report that is similar to a risk management plan.

II. Clean Air Act Amendments of 1990

A. Prevention of Accidental Releases

In the CAA Amendments, signed into law on November 15, 1990, Congress added subsection (r) to CAA section 112 for the prevention of chemical accidents. The goals of the chemical accident prevention provisions are to focus on chemicals that pose a significant hazard to the community should an accident occur, to prevent their accidental release and to minimize the consequences of such releases.

Section 112(r) of the CAA has a number of provisions. Under section 112(r) owners and operators of stationary sources who produce, process, handle, or store substances listed under section 112(r)(3) or any other extremely hazardous substances have a general duty to initiate specific activities to prevent and mitigate accidental releases. The general duty requirements apply to stationary sources regardless of the quantity of substances managed at the facility. Activities such as identifying hazards which may result from accidental releases using appropriate hazard assessment techniques; designing, maintaining and operating a safe facility; and minimizing the consequences of accidental releases if they occur would be essential activities to be taken as necessary to satisfy the general duty requirements. As a matter of business practice, owners and operators of these stationary sources have a duty to conduct these activities under section 112(r) in the same manner and to the same extent as an employer's duties under OSHA's general duty clause in section 654 of title 29 of the United States Code.

Section 112(r)(3) of the CAA requires EPA to promulgate an initial list of at least 100 substances ("regulated substances") that are known to cause, or may be reasonably anticipated to cause, death, injury, or serious adverse effects to human health or the environment if accidentally released. EPA is required to set threshold quantities for each listed substance. Under CAA section 112(r)(7), the Act requires EPA to promulgate reasonable regulations and appropriate guidance to provide for the prevention and detection of accidental releases and for responses to such releases. The accident prevention regulations will apply to stationary sources that have present more than a threshold quantity of a regulated substance. These regulations shall address, as appropriate, the use, operation, repair, and maintenance of equipment to monitor, detect, inspect, and control releases, including training of personnel in the use and maintenance of equipment or in the conduct of periodic inspections. The regulations shall include requirements for the development and submission of Risk Management Plans (RMPs) by regulated sources. The RMP shall include a hazard assessment, a prevention program, and an emergency response program. The proposed rule for accident prevention, *Risk Management Programs for Chemical Accidental Release Prevention*, was published on October 20, 1993 (58 FR 54190).

The Act establishes a Chemical Safety and Hazard Investigation Board to investigate (or cause to be investigated) chemical accidents at facilities and recommend to Congress, Federal, state, local authorities, and the public actions that can be taken to improve chemical safety. Under the Act, EPA is authorized to conduct studies related to accidental releases, including research on hazard assessments, hydrogen fluoride, and air dispersion modeling. A report to Congress on hydrogen fluoride was completed and published by the Agency in September 1993, entitled *Hydrogen Fluoride Study, Report to Congress, section 112(n)(6) of the Clean Air Act as Amended.*

The Clean Air Act also addressed the approval of state programs and delegation of Federal authorities for all section 112 requirements in section 112(l). Thus, state Accidental Release Prevention programs are approved through the authorities in section 112(l). The approval provisions of section 112(l)(5) include a determination that: A state program contains the authorities to assure compliance by all sources within the state with each applicable standard, regulation, or requirement; adequate resources are available to implement the program; an expeditious implementation schedule is in place to ensure that affected sources achieve compliance; and the state program is otherwise in compliance with the objectives of the Act and guidance published under section 112(l)(2).

The Agency promulgated a final rule in November 1993 which addresses the approval requirements of section 112(l) entitled Approval of State Programs and Delegation of Federal Authorities. These requirements can be found in 40 CFR part 63—Subpart E. Section 63.95 specifically address the required components of an accidental release prevention program. The Agency is currently working on developing further guidance to states in regard to the development of an accidental release prevention program.

Under section 304 of the CAA Amendments OSHA was required to promulgate a chemical process safety management standard to protect employees from hazards associated with accidental releases of highly hazardous chemicals in the workplace. OSHA promulgated a final rule amending 29 CFR 1910.109 and adding 29 CFR

1910.119 (57 FR 6356, February 24, 1992) that requires a chemical process safety management (PSM) program for any process involving a highly hazardous chemical at or above a specified threshold quantity. The rule applies to a list of highly hazardous toxic and reactive substances at particular threshold quantities, flammable liquids or flammable gases in quantities of 10,000 pounds or more and to the manufacture of explosives and pyrotechnics.

B. List of Substances and Thresholds; Petitions for Additions and Deletions

1. Legislative Requirements

The Act requires EPA to promulgate an initial list of at least 100 substances that, in the event of an accidental release, are known to cause or may reasonably be anticipated to cause death, injury, or serious adverse effects to human health or the environment. An accidental release is defined under CAA section 112(r)(2)(A) as "an unanticipated emission * * * into the ambient air from a stationary source." In developing this list, EPA was required to consider, but was not limited to, the list of extremely hazardous substances (EHSs) promulgated under EPCRA (SARA Title III) section 302.

Congress listed the following 16 substances to be included in the initial list (the Chemical Abstracts Service (CAS) Registry number is provided in parentheses):

Chlorine (7782–50–5)
Ammonia and anhydrous ammonia (7664–41–7)
Methyl chloride (74–87–3)
Ethylene oxide (75–21–8)
Vinyl chloride (75–01–4)
Methyl isocyanate (624–83–9)
Hydrogen cyanide (74–90–8)
Hydrogen sulfide (7783–06–4)
Toluene diisocyanate, represented by:
—Toluene 2,4-diisocyanate (584–84–9)
—Toluene 2,6-diisocyanate (91–08–7)
—Toluene diisocyanate, unspecified isomer (26471–62–5)
Phosgene (75–44–5)
Bromine (7726–95–6)
Anhydrous hydrogen chloride (7647–01–0)
Hydrogen fluoride (7664–39–3)
Anhydrous sulfur dioxide (7446–09–5), and
Sulfur trioxide (7446–11–9)

No air pollutant for which a national primary ambient air quality standard has been established may be included on the list, with the exception of anhydrous sulfur dioxide and sulfur trioxide, which must be included. No substances regulated under Title VI of the Act as amended may be included on the list. Title VI covers ozone depleters, primarily chlorofluorocarbons (CFCs) and halons. The Act requires EPA to review, and if necessary revise, the list of regulated substances under section 112(r) at least every five years. EPA may also review and if necessary revise the list as a result of petitions. EPA is required to develop procedures for petitions to the Agency for the addition of substances to, and deletion of substances from, the list; these petition procedures are to be consistent with those applicable to the list of hazardous air pollutants found in CAA Amendments section 112(b).

2. Summary of Proposed Rule

On January 19, 1993 (58 FR 5102), EPA proposed a list of 100 toxic substances and threshold quantities, a list of 62 flammable substances (gases and volatile liquids) with threshold quantities of 10,000 pounds, and commercial explosives defined by the Department of Transportation (DOT) as Division 1.1 (explosives with mass explosion hazard) with a threshold quantity of 5,000 pounds. EPA also proposed requirements for a petition process to add or delete chemicals from the list.

Toxic substances were included on the list based on their toxicity, physical state, vapor pressure, production volume, and accident history. Toxicity criteria used to identify chemicals as extremely hazardous substances (EHSs) under EPCRA were used as criteria for the proposed list. The acute toxicity criteria are:

(a) Inhalation $LC_{50} \leq 0.5$ milligrams per liter of air (for exposure time ≤ 8 hours), or

(b) Dermal $LD_{50} \leq 50$ milligrams per kilogram of body weight, or

(c) Oral $LD_{50} \leq 25$ milligrams per kilogram of body weight where LC_{50} is the median concentration in air at which 50 percent of the test animals died, and LD_{50} is the median lethal dose that killed 50 percent of the test animals. In the absence of LC_{50} or LD_{50} data, LC_{Lo} or LD_{Lo} data were used for listing, where LC_{Lo} is the lethal concentration low, or lowest concentration in air at which any of the test animals died, and LD_{Lo} is the lethal dose low, or the lowest concentration at which any of the test animals died. Additional substances on the EHS list meet the secondary EHS toxicity criteria in light of production volume (see appendix B of EPA's Technical Guidance for Hazards Analysis, December 1987, which is in the docket for this rulemaking). A vapor pressure criterion of 0.5 millimeters of mercury (mm Hg) was used as a baseline, based on the vapor pressure of toluene diisocyanate, a substance mandated for the initial list by Congress; toxic gases and liquids with a vapor pressure of 0.5 mm Hg or higher under ambient conditions were considered for listing. Only toxic chemicals in commercial production, verified through EPA's Toxic Substances Control Act (TSCA) Chemical Inventory, were included on the list. By applying these criteria to the 360 chemicals on the EPCRA EHS list, the Agency identified 87 potential regulated substances for the CAA Amendments section 112(r) list. The Agency also looked at other data sources (including the OSHA highly hazardous chemical list) to identify 9 more substances for the section 112(r) list. Four additional substances were identified for listing based on a combination of toxicity, high production volume, and history of accidents involving death or injury. Threshold quantities were set for toxic substances based on a ranking method that considers toxicity and volatility of the chemicals. EPA assigned identical thresholds to chemicals with similar ranking scores, ranging from 500 pounds to 10,000 pounds.

Flammable gases and volatile flammable liquids were included on the list based on the flash point and boiling point criteria used by the National Fire Protection Association (NFPA) for its highest flammability hazard ranking (flash point below 73°F (22.8°C) and boiling point below 100°F (37.8°C)) (*Fire Protection Guide on Hazardous Materials*, 1984, 8th edition). Only flammable substances in commercial production were listed. The threshold quantity for flammable substances was set at 10,000 pounds, based on the potential for a vapor cloud explosion.

Explosives in Division 1.1 were proposed for listing based on their potential to detonate. The threshold quantity for explosives was set at 5,000 pounds because a detonation of this quantity could yield blast wave overpressures of 3.0 pounds per square inch (psi) at a distance of 100 meters from the blast site and could have potentially lethal effects in the community beyond the fenceline.

EPA proposed to apply the threshold quantity to the maximum total quantity of a substance in a process. This definition would apply to the maximum total quantity, at any one time, in a single vessel, in a group of interconnected vessels or in several vessels that could potentially be involved at one time in an accidental release. Substances in mixtures would be exempted from the threshold determination if they represent less than one percent of the mixture by weight. EPA also proposed to exempt substances if (1) they are part of articles; (2) if they are used as structural components; (3) if they are used for janitorial maintenance; or (4) if they are found in consumer products, process water, or in water or air from the environment or municipal sources. Activities in laboratories were also proposed for exemption. In addition, an exemption was proposed for flammable substances present at a facility to be used solely for consumption as fuel at the facility.

The Agency also proposed requirements for petitions to add or delete regulated substances under section 112(r). The Agency proposed to establish that the burden of proof be on the petitioner to demonstrate that the criteria for addition and deletion are met. Basic administrative and documentation requirements for petitions were also included in the proposal.

III. Public Participation

A hearing was held on the proposed rule in the EPA Auditorium, 401 M Street, SW., Washington DC, on Tuesday, April 12, 1993. The hearing was held to provide interested parties the opportunity for oral presentation of data, views, or arguments concerning the proposed rule. This hearing was open to the public; a transcript of the public hearing is available in the docket. A total of 272 letters were received during the public comment period on the proposed rule (an additional 18 were received after the close of the public comment period); copies of all comment letters received are available for public inspection in the docket. A response to comments document, entitled *Proposed List of Substances and Thresholds for Accidental Release Prevention: Summary and Response to Comments*, includes a summary of comments received and the Agency's responses; the document is available in the docket.

IV. Discussion of Comments and Major Regulatory Changes

This portion of the preamble discusses comments on major issues received on the proposed list and thresholds rule and the principal regulatory changes made in the final rule in response to public comments. Included in the discussion is the rationale for these changes and the Agency action on the comments. Where the proposed regulation has not been changed in the final rule, the Agency continues to rely on the rationale provided in the proposal notice, supplemented as appropriate by additional discussion in this preamble and in the response to comments document.

A. List of Substances and Thresholds

The list of substances and thresholds promulgated today identifies sources that are subject to accident prevention regulations promulgated under section 112(r)(7) of the Act. The list of substances is intended to focus accidental release prevention efforts on those stationary sources and substances that pose the most significant risks to the community. These risks may be established either by the potential of the chemical to cause harm (the inherent hazards and physical/chemical properties), known incidents (accident history), or a combination thereof. EPA strongly emphasizes that the substances promulgated in today's listing are not the only substances that may pose a threat to communities upon release. There are large numbers of compounds and mixtures in commerce in the U.S. that in specific circumstances could be considered dangerous to human health or the environment; however, it would not be feasible to include all such substances and circumstances. This list should serve to focus prevention efforts and is not a list of all substances that could be considered for accident prevention. Similarly, the threshold quantities established today may not always represent a level below which no hazard exists. Although stationary sources will be required to comply with the accidental release prevention regulations under section 112(r)(7)(B) only if they have listed substances in quantities exceeding the threshold quantity, it does not mean that these substances in smaller quantities represent no potential hazard to the community in certain circumstances. In support of this principle Congress included general duty provisions under section 112(r)(1) of the Act.

Several commenters objected to the listing of classes of substances such as explosives or particular substances such as various flammable natural gases because these commenters claimed that categorizing these chemicals as regulated substances would also make these chemicals subject to the general duty clause of section 112(r)(1), and that without such listing these chemicals would be outside the scope of section 112(r)(1). The general duty provision in section 112(r)(1) applies to "any substance listed pursuant to section 112(r)(3) or any other extremely hazardous substance." The Agency believes the scope of substances covered by section 112(r)(1) is not affected by this rulemaking except that by including a substance on the regulated substance list, the Agency unambiguously specifies that the general duty provisions apply to such chemicals. The plain language of section 112(r)(1) applies not only to the regulated substances listed today but also to "any other extremely hazardous substance."

In discussing nearly identical language in the Senate's Clean Air Act Amendments bill of 1989, the Environment and Public Works Committee expressed the intent that the term "extremely hazardous substance" would include not only listed substances under the accident prevention provisions and extremely hazardous substances under EPCRA (SARA Title III) section 302 but also "other agents which may or may not be listed or otherwise identified by any Government agency which may as the result of short-term exposures associated with releases to the air cause death, injury or property damage" (Senate Committee on Environment and Public Works, Clean Air Act Amendments of 1989, Senate Report No. 228, 101st Congress, 1st Session 211 (1989)—"Senate Report"). Regardless of whether a substance is listed under today's rule, the general duty to identify and assess hazards associated with accidental releases (as defined in section 112(r)(2)), to design and maintain a facility to prevent such releases, and to minimize the consequences of such releases that do occur, extends to owners and operators of any facility that may cause such impacts due to short-term exposures. As the Senate makes clear, "the release of any substance which causes death or serious injury because of its acute toxic effect or as a result of an explosion or fire or which causes substantial property damage by blast, fire, corrosion or other reaction would create a presumption that such substance is extremely hazardous." Senate Report at 211. No revision to the list promulgated today negates the applicability of the general duty provisions.

1. Toxic Substances

a. *Listing criteria*. Several commenters suggested that EPA modify its listing criteria, largely so that EPA's list would be more consistent with OSHA's list of Highly Hazardous Substances for its Process Safety Management Standard, but also because commenters believed EPA's list includes some chemicals that do not pose the greatest hazards to the public. Some commenters suggested the proposed 0.5 mm Hg vapor pressure cut off was too low. Others suggested an alternative method of choosing the list of toxics, namely the "Substance Hazard Index". Several commenters also objected to EPA's use of accident history as a criterion for listing substances. EPA's proposed toxics list was based on the EHS list under SARA Title III, with additional consideration of the vapor pressures and accident histories for each substance. The proposed list included 50 toxic substances that are not listed by OSHA.

Substance Hazard Index: Some commenters suggested replacing EPA's proposed listing criteria with another method labeled the "Substance Hazard Index" (SHI). The SHI is the ratio of a substance's vapor pressure to its acute toxicity; all substances would be ranked by their SHI and a cut-off would need to be selected to determine the substances to be listed. An SHI value of 1,000 was suggested by commenters as a cut-off, but commenters did not provide a technical basis, or any other rationale, for why this cut-off was selected. The SHI value of 1,000 would derive a list of toxic substances that more closely approximates OSHA's PSM list than EPA's proposed list; provided that the Agency considers only those substances initially proposed for listing as toxics.

EPA generally disagrees with the comments concerning the use of the SHI as a listing criterion. The Agency had considered this approach during the proposed rule development, but decided not to include it as an alternate listing methodology option. EPA instead considered toxicity and vapor pressure separately in identifying chemicals for listing; the SHI combines these factors. EPA believes that using separate toxicity and vapor pressure criteria is a more valid method of identifying chemical candidates for listing. Both EPA's method and the SHI approach consider properties related to the severity of acute health effects (toxicity) and the likelihood of accidental releases of the substances (volatility), as required by the Act. However, as required by the Act, EPA's approach is based on the list of EHSs as a starting point for identification of toxic substances (see Senate Report at 218; listing factors used in EHS list are appropriate for accidental release program). EPA's approach limits toxic chemicals to those meeting the acute toxicity criteria for the EHS list and then applies a vapor pressure cut-off. The SHI approach does not include specific toxicity or vapor pressure cut-offs but instead specifies a cut-off value for a factor combining toxicity and vapor pressure. To identify all chemicals meeting the specific SHI cut-off of 1,000 as recommended by commenters, chemicals with a much wider range of toxicity than those represented by the EHSs would have to be considered. Chemicals that are far less toxic than the EHSs would be potentially included, improperly characterizing the risk associated with them. Moreover, EPA does not believe the SHI method has been systematically applied to all substances for development of any current chemical list. The state of Delaware used the SHI approach to develop a list of substances for its risk management regulation; the SHI methodology was applied to existing lists of substances identified by use of toxicity criteria and not all substances. The Agency considers the SHI to be more appropriate for determining the relative ranking of substances in an already established list. The Agency's threshold quantity methodology for listed toxics is similar on the toxicity/volatility ranking principle; it differs from the SHI in that the vapor pressure is only part of the factor used to account for the potential dispersability of the listed substances. For these reasons, the Agency will not adopt the SHI criteria for listing toxic substances.

Acute Toxicity Criteria: Commenters generally supported EPA's consideration of acute toxicity hazards as a basis for listing toxic substances under section 112(r). Some commenters, however, recommended other measures of toxicity, such as the Emergency Response Planning Guidelines (ERPGs) developed by the American Industrial Hygiene Association, or data developed by the National Academy of Sciences among others. The Agency recognizes the value of these other measures and guidelines for purposes of emergency preparedness and prevention activities. However, these measures are consensus exposure levels judged by the developing organizations to represent concentrations above which there may be serious irreversible health effects, or death, as a result of a single exposure for a relatively short period of time. In addition, the methodology for most of these measures is still in the developmental stages, with recommended guidelines or acute exposure levels presently available only for a limited number of potentially hazardous substances. The Agency believes using acute toxicity data as proposed is more appropriate for the review and selection of hazardous substances for listing under section 112(r) because acute toxicity data directly reflects results of valid mammalian testing and thus is more objectively verifiable than judgmental standards.

Concerns were also expressed about the Agency's focus on acute toxicity rather than on chronic toxicity effects as a basis for listing. Some commenters also opposed the Agency's consideration of acute exposures by the dermal and oral routes. EPA believes that chemical accident prevention efforts should focus on those chemicals that, because of their inherent toxicity, are most likely to cause immediate severe, irreversible health effects following exposures during an accidental release. Consequently, for purposes of this rulemaking, the Agency is primarily interested in substances that are acutely toxic, rather than in substances that could generate a future health effect after repeated long term or chronic exposures. Furthermore, acute toxicity and lethality data are often readily available and the most commonly reported information generated by animal toxicity testing. A greater number of potentially hazardous substances can therefore be screened on the same basis using these values. For purposes of this rule, the listed toxic substances are expected to rapidly become airborne, thus human exposure by the inhalation route is of primary concern. The Agency believes that using data on oral and dermal acute lethality, in addition to inhalation lethality, is appropriate for this listing.

Vapor Pressure Cut-Off: Other commenters suggested that EPA should use a higher vapor pressure level as a listing criterion. EPA's vapor pressure criterion of 0.5 mm Hg was based on the properties of toluene diisocyanate, a substance with relatively low volatility, which was mandated for the initial list by Congress. Commenters noted that Congress listed toluene diisocyanate because it has been involved in accidents, not because of its properties, and that its properties do not necessarily provide a valid basis for EPA's vapor pressure criterion. Several commenters suggested a vapor pressure of 20 mm Hg (18 mm Hg is the approximate vapor pressure of water) but did not provide a basis for choosing this or any other vapor pressure criterion.

EPA has considered the comments concerning the proposed vapor pressure criterion of 0.5 mm Hg and generally agrees that this low vapor pressure level may lead to an overly conservative listing of chemicals that pose a relatively lower potential for air releases. EPA has decided to set the vapor pressure criterion at the higher level of 10 mm Hg. In selecting this new vapor pressure cut-off, the Agency examined the substances on the proposed list that have vapor pressures of less than 10 mm Hg and compared the rate of volatilization expected in a large release to the rate expected for substances with a vapor pressure greater than 10 mm Hg. As expected, volatilization rates increase with increasing vapor pressure and increasing pool sizes. The Agency believes that a timely facility response after the onset of an accidental release will likely limit the amount that could volatilize for substances with vapor pressures lower than 10 mm Hg, thereby reducing the potential public or off-site impact. The Agency believes that a greater amount of substances with vapor pressures above 10 mm Hg is likely to be volatilized and released, even after a timely facility response occurs, potentially causing off-site impacts. The Agency also reviewed accident history and production volume information on the substances that would be delisted at this vapor pressure. This review has led the Agency to conclude that the accident histories or production volumes associated with the delisted substances do not warrant their listing under this rulemaking at this time. The Agency believes that this revised vapor pressure criterion focuses the list on chemicals that present a greater potential for accidental release than would a list using a 0.5 mm Hg criterion.

The new vapor pressure criterion will drop from the list some chemicals that may have a lower likelihood of accidental release to air. Using the new vapor pressure criterion, the following 18 chemicals proposed for listing (shown with their CAS Registry numbers) will not be included in the list promulgated today:

Acetone cyanohydrin (75–86–5)
Aniline (62–53–3)
Antimony pentafluoride (7783–70–2)
Benzal chloride (98–87–3)
Benzenamine, 3-(trifluoromethyl)- (98–16–8)
Benzotrichloride (98–07–7)
Benzyl chloride (100–44–7)
Benzyl cyanide (140–29–4)
Chloroethanol (107–07–3)
Dichloroethyl ether (111–44–4)
Dimethyl phosphorochloridothioate (2524–03–0)
Formaldehyde cyanohydrin (107–16–4)
Hydrogen peroxide (concentration > 52%) (7722–84–1)
Lactonitrile (78–97–7)
Pyridine, 2-methyl-5-vinyl- (140–76–1)
Thiophenol (108–98–5)
Trans-1,4-dichlorobutene (110–57–6)
Trichloroethylsilane (115–21–9)

EPA will be reevaluating the list periodically and as a result of petitions. If additional information is submitted on the accident history or production volume of these substances, EPA may list these substances at a later time. In addition, these substances, as well as any other extremely hazardous substance, are subject to the section 112(r) general duty clause.

Accident History: The Agency disagrees with several commenters who claimed that the Agency lacked authority to list substances based on accident history. The accident history associated with the use of a substance, in combination with toxicity, physical/chemical properties, and production volume considerations, is a permissible basis for the Administrator to list substances under section 112(r). Data from recorded accidents relate to each of the factors identified in section 112(r)(4). Such data can provide information on the severity of impacts when impacts occur, as well as on the likelihood and magnitude of exposure. Substances that "are known to cause * * * death, injury, or serious adverse effects on human health or the environment" may be included on the list under section 112(r)(3). It would be a strained reading of the statute to say the Administrator must ignore documented accidental releases of substances in deciding which chemicals shall be the focus of the accidental release prevention program.

The listing criteria established for toxic substances considers not only acute toxicity, but also physical/chemical properties (physical state, vapor pressure), and accident history. Several commenters argued that in analyzing accident histories EPA should not consider: (1) Transportation accidents; (2) accidents not involving death and/or injuries; (3) accidents involving fires and explosions; (4) accidents involving reactions with other chemicals; and (5) accidents involving elevated temperatures and pressures. The Agency disagrees with these comments. Accident history may indicate, beyond vapor pressure or other physical/chemical properties, unique qualities or circumstances that warrant accident prevention efforts. Evidence from transportation accidents may indicate the potential for airborne releases. For example, chemicals may be supplied in containers, such as tank cars, holding the chemical in similar conditions to storage conditions at stationary source. A failure of a container while in transit may indicate the potential for release while at a fixed location, since it may be stored under similar conditions. Quantities of chemicals are also commonly held at facilities for some period of time in trucks, tank cars, and other shipping containers. Accidents that did not result in off-site deaths or injuries may still indicate the serious potential for off-site impacts; e.g., evacuations may indicate that there was concern that people could suffer adverse effects from exposure. Furthermore, other effects, such as environmental damage, are appropriate to consider as well. While the factors to be considered under section 112(r)(4) do not specifically direct EPA to consider environmental effects, section 112(r)(3) directs the Administrator to consider "substances which pose the greatest risk of causing * * * serious adverse effects to * * * the environment from accidental releases". As noted at several points in this preamble, EPA believes that its decision to consider reported accidental releases involving fire and explosions as events of concern is supported by both the statute and legislative history. See also 136 Congressional Record S16992 (daily ed., Oct. 27, 1990) (statement of Senator Reid addressing the explosion in Henderson, Nevada); 136 Congressional Record H12931 (daily ed., Oct. 26, 1990) (statement of Representative Barton addressing releases from burning material); H.R. Conf. Rep. No. 952, 101st Congress, 2nd sess., 340 (1990) (Board to investigate fires and explosions). It may also be appropriate to consider chemical reactions with common materials such as water; e.g., it may be important to consider whether the reaction of an acid with water, producing heat, could lead to formation of an acid vapor or mist (the Bhopal accident involved a reaction of methyl isocyanate with water, generating heat). Accidents resulting from conditions of elevated temperatures and pressures in chemical processes may provide important information regarding the potential for accidental releases having an effect off-site.

The legislative history of section 112(r) contains extensive discussion of historical accidents and accident history data to support the need for enacting section 112(r) and the particular provisions included in the legislation. See 136 Congressional Record H12940 (daily ed., Oct. 26, 1990) (statement of Representative Richardson); 136 Congressional Record S16921, S16925–26 (daily ed., Oct. 27, 1990) (statement of Senator Durenberger); 136 Congressional Record S16979 (daily ed., Oct. 27, 1990) (statement of Senator Baucus). Incidents such as the explosion in Henderson, Nevada and the releases documented in the Acute Hazardous Events database, as well as statistics concerning the number of releases and evacuations were seen as demonstrating the need for an accident prevention program. See H.R. Rep. No. 490, 101st Congress, 2nd sess., 154–157 (1990); Senate Report at 211–221. The Agency will continue to consider accident history, in conjunction with acute toxicity and vapor pressure, to determine which substances need to be listed under section 112(r), and will consider these same elements in any revisions to the list promulgated today. When determining whether to list a substance based on its accident history, the Agency will analyze and explain the relevance of the accident history to the potential for a stationary source to accidentally release the substance.

b. *Specific substances.* Sulfuric acid, phenol, parathion, and nitrobenzene, proposed to be listed because of accident history, were the focus of a number of comments. As stated above, the Agency believes that accident history, as well as toxicity, physical/chemical properties, and current commercial production volume, are all appropriate elements to be considered in determining the substances to be listed. The Agency reserves the flexibility to consider the listed substances in light of a combination of, or all of these criteria elements. Accident history was targeted by several commenters as not being a valid criteria to use in listing these substances. As discussed above, the Agency disagrees. The Agency has listed substances that meet two or three elements of the criteria only; e.g., there are acutely toxic substances listed that meet the high vapor pressure considerations but have no accident history associated with them. By the same token, the Agency also believes that commercially produced substances that meet the acute toxicity criterion and have an accident history, still could present a high potential for an impact beyond the fenceline even though they do not meet the vapor pressure consideration.

A number of commenters objected to the inclusion of sulfuric acid on the list of substances, noting that because of its high boiling point and low vapor pressure under ambient conditions, it is unlikely to become airborne in a release. EPA recognizes that sulfuric acid does not meet the vapor pressure criterion. EPA originally proposed for listing sulfuric acid because of its toxicity, high production volume, and because it has been involved in a number of accidental releases with reported migration of a vapor cloud off-site; some of these incidents also resulted in worker deaths and injuries on-site. Several commenters indicated that the accidents cited by EPA did not provide a valid basis for listing for a number of reasons. First, some of the accidents, according to commenters, actually involved fuming sulfuric acid (oleum), which is a mixture of sulfuric acid and sulfur trioxide, and vapor clouds reported from these accidents were attributable to sulfur trioxide rather than sulfuric acid. Second, commenters stated that the injuries in some accidents were caused by direct contact with sulfuric acid rather than inhalation of vapor. Third, according to some commenters, some accidents involved reactions of sulfuric acid with other substances. Finally, comments were received which indicated there have been no accidents involving vapor clouds of sulfuric acid that caused off-site deaths or injuries, and that, in fact, the low vapor pressure of sulfuric acid makes it impossible for an accidental release to have any effect beyond the fenceline.

EPA is well aware that sulfuric acid has a low vapor pressure and is unlikely to be released into the air under ambient conditions. However, as noted above, EPA also believes that, exclusive of vapor pressure, accident history can provide a valid basis, in combination with toxicity and/or physical/chemical properties, for adding a substance to the list. The Agency also notes that nothing in the statute limits EPA to consider solely the effects of vapor inhalation as a consequence of a release. As noted above, the EHS toxicity criteria endorsed by the Senate are not limited to inhalation. Furthermore, death, injuries, and environmental impacts caused by direct contact are relevant to the risks posed by a chemical.

While believing the EPA has the authority to list sulfuric acid if its accident history, in conjunction with its toxicity and significant production volume, warrants listing, the comments received by the Agency have created doubt about the accuracy of what has been reported as air releases of sulfuric acid. For purposes of today's rulemaking, the Agency has been unable to determine from accident history whether sulfuric acid has generated an air release that has caused impact off-site. Because of the uncertainty associated with past reported accidental release information and the common confusion between oleum and sulfuric acid in such reporting, the Agency has decided not to list sulfuric acid at this time. Although sulfuric acid is not specifically listed, facilities handling sulfuric acid are still subject to general duty requirements. The Agency will continue to monitor and review sulfuric acid accident reports to determine the need for listing at a future time. EPA also seeks data on the off-site impacts of sulfuric acid that could be used to evaluate whether sulfuric acid should be added to the list.

Related to the sulfuric acid issue are comments suggesting that the Agency specifically list oleum (fuming sulfuric acid), CAS number 8014–95–7. Oleum is a mixture of sulfuric acid and sulfur trioxide. In the proposed rule, the Agency believed oleum would be subject to section 112(r) requirements because both of its components, sulfuric acid and sulfur trioxide, were proposed for listing, and because of the Agency's proposed de-minimis concentration for mixtures. However, two commenters noted that it is "reasonable to include oleum as a regulated chemical" and that "oleum and sulfuric acid must be listed separately, since the fuming effects of an oleum release make it potentially much more serious." The Agency agrees with commenters that oleum should be included in this listing because of its accident history, toxicity, and production volume. Furthermore, the Agency has reviewed the accident history data relevant to oleum and sulfuric acid and agrees with commenters that some of the accidents the Agency had relied on to list sulfuric acid in fact involved oleum. Furthermore, because of the revisions on the de-minimis concentration provisions and the Agency's decision not to finalize the listing of sulfuric acid at this time, oleum would no longer be subject to 112(r) provisions without a specific listing. In order to continue the coverage of oleum in the accidental release prevention provisions, EPA is specifically listing all forms of oleum in the section 112(r) list of substances.

Phenol (in liquid form only), parathion, and nitrobenzene are also included on the proposed list based on accident history. Several commenters objected to the inclusion of these chemicals, for reasons similar to those concerning the listing of sulfuric acid, i.e., the low vapor pressure of these substances and the lack of sufficient supporting accident history to provide a basis for listing. The Agency generally agrees with the comments regarding these three specific substances. Having considered the comments and having conducted further review of accident history for these chemicals, the record indicates that there are not a clearly significant number of accident reports with effects, or potential effects, beyond the fenceline to merit listing at this time.

Several commenters objected to the listing of other specific substances for a variety of reasons, including low vapor pressure, low toxicity, existing safety regulations, and accident history. The chemicals mentioned include hydrogen peroxide, acrylonitrile, and hydrochloric acid, among others. EPA has reviewed the comments on these chemicals and categories of chemicals that were recommended for deletion and has decided to, except as noted, retain them on the list of regulated substances under section 112(r). As noted above, EPA is revising the vapor pressure criterion and not proceeding to list 18 chemicals with vapor pressures below 10 mm Hg. In addition, the Agency has determined that section 112(r)(3) prohibits it from listing methyl bromide because the substance has been listed by regulation as an ozone depleting chemical under CAA Title VI (see 58 FR 65018, December 10, 1993).

The Agency disagrees with commenters that seek deleting substances because of other existing regulations. The listing of substances and thresholds, as mandated by Congress, reflects the potential for these listed substances to cause serious adverse effects to human health or the environment. The Agency believes that considerations of other regulations applicable to these regulated substances are appropriately accounted for in accident prevention requirements developed for facilities handling the regulated substances above the threshold quantities, rather than in determining whether any listed substance poses a potential hazard.

Several commenters recommended the deletion of substances that were mandated for listing by Congress, including ammonia, toluene diisocyanate, and anhydrous sulfur dioxide. The Agency believes that the language of section 112(r)(3) precludes it from omitting these chemicals from the initial list. The Agency will consider petitions to delist these chemicals if such petitions comply with the petition criteria announced today.

Several commenters recommended adding other specific substances, such as chlordane and tetraethyl lead, to the list of regulated substances. The Agency will consider these at the time it revises the list promulgated today, or through the petition process. However, the Agency notes that notwithstanding today's listing, these substances are still subject to the general duty provisions, particularly if they are in commercial production and use.

In the list rule proposal, EPA requested information to determine the need and appropriateness of including radionuclides under this rulemaking. Some commenters objected to including radionuclides while others recommended inclusion. Still other commenters recommended the inclusion of only some radionuclides. However, none of the commenters provided sufficient technical information to assist the Agency in determining whether or not radionuclides should be listed. Due to the uncertainty associated with gaps in EPA's data and the appropriate criteria for listing, the Agency has decided not to include radionuclides in the initial list of regulated substances.

c. *Other list options considered.* EPA considered the option of adopting the entire list of 360 toxic chemicals regulated under EPCRA (SARA Title III) section 302. A small number of commenters favored this option, believing that consistency with EPCRA is desirable, that having a single list would help avoid confusion, and that listing additional toxic substances would be more protective of the public. EPA did not propose to adopt the entire EHS list because it includes a number of solids and non-volatile liquids for which an effect beyond the fenceline in the event of an accidental release is expected to be less likely than for gaseous or volatile liquids. It also includes substances that are not currently in commercial production. Congress did not direct EPA to list all EHS substances. Instead, Congress provided that the Administrator could include as few as 100 substances on the initial list under section 112(r). In directing the Administrator to "use" the EHS list, but not to be "limited to" this list, and in providing that "such modifications as * * * appropriate" be made, the CAA provides the Agency with the flexibility to cull from the EHS list and other sources a more focused list of substances for accidental release prevention regulations. Most commenters supported EPA's decision to propose for listing only those EHSs that best reflect the statutory criteria of likelihood and magnitude of release. For these reasons, EPA is not adopting the entire EHS list.

d. *Threshold quantities.* EPA's proposed thresholds were lower than OSHA's for 15 of the substances listed by both OSHA and EPA. A number of commenters stated that EPA's thresholds should not be lower than OSHA's for any listed substances, since in general, workers face a more immediate threat of exposure in an accidental release than would the public. Several commenters indicated that EPA should adopt the OSHA thresholds for chemicals which EPA had assigned lower thresholds. Conversely, there were other comments supporting the lower thresholds proposed by EPA for several chemicals, based on the commenters' experience with these chemicals.

EPA has reviewed the threshold quantities for the listed substances and the OSHA thresholds for the substances on both the EPA and OSHA lists prior to and after the proposal of EPA's rule. EPA recognizes the practical importance of consistency with the OSHA list to the extent possible, but also believes it is necessary to have a sound methodology for assignment of threshold quantities; the CAA requires the Agency to include an explanation of the basis for establishing the list, and to account for specified factors in setting threshold quantities. OSHA's thresholds were not required to reflect the factors EPA must consider. The statute also provides for petitions to add new chemicals, and requires the development of thresholds for such chemicals when listed. A sound methodology is essential for making changes to the list and thresholds after promulgation. The methodology adopted today considers the factors required by the CAA under section 112(r)(5). No other methodology was identified that EPA could use to derive thresholds that would be consistent and equally applicable to the current listed substances and to those that may be added in the future. Therefore, EPA is not adopting the OSHA thresholds.

Nevertheless, EPA agrees with commenters that EPA should review its proposed threshold methodology and quantity categories to ensure that they accurately reflect the range of risks posed by the listed toxic substances. Based on this review, EPA has decided to retain its threshold methodology but revise the range of threshold quantities for toxics. The minimum quantity remains at 500 pounds, representative of drum-size containers, but the maximum threshold quantity is raised to 20,000 pounds, replacing the proposed 10,000 pound maximum. This higher upper limit expands the range of threshold quantities to better reflect the relative hazards among the listed toxics; the upper limit of 20,000 represents typical handling quantities, and would still be protective of the public for those substances which now have the higher thresholds. Threshold quantity categories for toxic substances are now: 500 pounds, 1,000 pounds, 2,500 pounds, 5,000 pounds, 10,000 pounds, 15,000 pounds, and 20,000 pounds.

Using this revised range, higher thresholds have been assigned for most of the toxic substances listed based on the revised vapor pressure criterion. Several toxic substances also meet the flammability criteria, and thus could be assigned two thresholds. Toxic substances that also meet the criteria for listing as flammable substances are assigned the lower of the thresholds. Under the revised methodology, the only substance that has a threshold quantity that is lower under EPA than OSHA's PSM standard is methyl chloride, which meets the criteria for listing for flammability and, therefore, is assigned a threshold quantity of 10,000 pounds, rather than the 20,000 pounds that would apply under the methodology for toxics. The OSHA threshold for methyl chloride is 15,000 pounds. This is to account for those hazards presented by the substance that are considered in this rulemaking; the lowest threshold quantity is assigned to be more protective.

A number of commenters suggested that site-specific factors should be considered in setting or modifying thresholds, such as population density, ecosystem sensitivity, safety devices, experience, uses of the substance, and handling conditions. EPA recognizes that these and many other site-specific factors could affect the likelihood of occurrence or the effects of a release. Accounting for these factors has the advantage of more specifically tailoring threshold quantities based on common use patterns of the substances and on the particular site in which they would be used. One serious disadvantage of applying site-specific factors to setting thresholds would be that such an approach would be inappropriate for ubiquitous chemicals, such as chlorine and ammonia, because of the innumerable applications that would have to be considered. A greater disadvantage to this approach is that the intrinsic hazard of a chemical will still be present even when it is used outside of a "typical" scenario. As stated in the proposed rule, EPA believes it is not feasible to develop a methodology for establishing threshold quantities based on site-specific factors that would be applicable uniformly nationwide. Therefore, EPA did not incorporate site-specific factors in setting or modifying thresholds. As discussed in the preamble section IV.B. Threshold Determination, substance-specific factors and use scenarios are considered in determining whether there is a threshold quantity on-site. Also, site specific factors will more appropriately be accounted for in the accidental release prevention regulations under section 112(r)(7). This Agency rationale is also applicable to similar comments for establishing thresholds for flammable and explosive substances.

e. *Other threshold quantity options considered.* In addition to the proposed methodology for setting thresholds for toxic substances and the use of OSHA thresholds as discussed above, EPA requested comment on several other options. One option was use of the vapor quantity method, based on air dispersion modeling, to determine the quantity in air needed to equal the "Immediately Dangerous to Life and Health" (IDLH, published by the National Institute for Occupational Safety and Health) concentration level at 100 meters from the point of release. This option was not generally supported by commenters. A second option was to adopt the threshold planning quantities (TPQs) under EPCRA section 302. A small number of commenters favored this option, believing that consistency with EPCRA would help to avoid confusion. EPA did not propose this option because the TPQs are intended to represent a level at which the chemical hazards should be considered by localities for discretionary community planning purposes. As mentioned in the preamble of the proposed rule, the thresholds established under this rule have a different purpose, i.e., to indicate which facilities must comply with mandatory facility-based prevention requirements. Any confusion that results from two different threshold quantities applying to the same chemical under two EPA emergency preparedness and prevention programs is mitigated by the fact that the more onerous and detailed planning requirements are triggered when greater, and presumably more dangerous, quantities are present.

The third threshold option considered for toxics was adoption of the OSHA thresholds for all substances listed by both EPA and OSHA. A number of commenters favored this option. As noted above, EPA recognizes the importance of consistency with OSHA. However, because of EPA's statutory obligation to establish a methodology based on specified factors, the Agency has elected not to adopt the OSHA thresholds. The thresholds adopted in today's rule for chemicals listed by EPA are, with the exception of methyl chloride, equal to or higher than OSHA's.

2. Flammable Substances

EPA's listing of flammable gases and volatile flammable liquids was generally supported by commenters, although a few commenters maintained that, because OSHA regulates flammable substances, EPA should not list them. The Agency disagrees that flammable substances should not be listed for accident prevention and potential effects off-site, since such substances pose a potential off-site hazard (namely, a vapor cloud explosion) because of their inherent properties. The proposed threshold for flammables, 10,000 pounds, was generally supported as well. EPA is finalizing the proposed listing for flammables and their threshold quantities.

Commenters also focused on specific flammable substances, including methane, ethane, propane, and butane (some components of natural gas). Commenters argued that special factors (e.g., the low density of methane gas) justify not listing or modifying the listing of these substances. EPA has reviewed the comments on specific flammable substances and disagrees with the commenters. EPA believes there is sufficient information, from both accident reports and modeling results, to support the conclusion that flammable substances that meet the listing criteria, in quantities above the threshold quantity of 10,000 pounds, could present a hazard to the public from a vapor cloud explosion. EPA recognizes that, as noted by commenters, some situations in which these substances are handled may present a lesser hazard than others. However, these substances still pose a potential threat beyond the fenceline in case of an accidental release. Therefore, in order to be protective of the public, EPA is maintaining the same application of the criteria for flammable substances as proposed for all listed flammable substances. EPA's listing decision is based on the substances' demonstrated or potential effects in the event of an accidental release, not on existing regulations, standards, or recommended practices applicable to the listed substances; these factors may more appropriately be accounted for when accident prevention regulations are promulgated under section 112(r)(7).

Several commenters recommended that EPA provide an exemption, similar to the exemption under OSHA's PSM Standard, for flammable liquids kept in atmospheric tanks below their normal boiling points. Unlike OSHA, EPA is listing only flammable gases and volatile flammable liquids. EPA considers these substances to be intrinsically hazardous, regardless of conditions of storage, and, therefore, does not believe it is appropriate to provide an exemption for atmospheric storage.

3. Explosives

Explosives classified by DOT as Class 1, Division 1.1 and listed as such in 49 CFR 172.101 (the *Hazardous Materials Table*) are covered by this rule with a threshold of 5,000 pounds. In 49 CFR 173.50, DOT defines the term "explosive" as any substance or article, including a device, which is designed to function by explosion (i.e., an extremely rapid release of gas and heat) or which, by chemical reaction within itself, is able to function in a similar manner even if not designed to function by explosion, unless the substance or article is otherwise classed under DOT provisions. Division 1.1 consists of explosives with a mass explosion hazard; a mass explosion is one which affects almost the entire load instantaneously. The Agency proposed to list all substances that met the definition of Division 1.1 (58 FR 5110). The Agency is clarifying and modifying its listing of explosive substances to include only those substances listed in 49 CFR 172.101 (DOT's Hazardous Material Table), which is a subset of all substances and mixtures of substances that would meet DOT's Division 1.1 definition.

EPA noted in the preamble to the proposed rule that it believed this threshold would apply primarily to manufacturers of high explosives (58 FR 5112). More than 100 commenters, primarily explosives distributors and users, objected to the listing of explosives in general. These commenters maintained that explosives are regulated adequately by a number of agencies, including the Bureau of Alcohol, Tobacco, and Firearms (BATF), DOT, OSHA, the Mine Safety and Health Administration (MSHA), and the Department of Defense (DOD). The commenters believe the requirements of the existing regulations serve to prevent accidents and cited the safety record of the explosives industry as evidence. The commenters believe the American Table of Distances, used by BATF to set distances for storage of explosives, provides protection for the community from the effects of an accidental explosion; this table is based on a lower overpressure level than the 3.0 psi used by EPA to set the threshold for explosives and, therefore, is more protective of the public. In addition, a number of commenters said the 5,000-pound threshold proposed by EPA would not restrict the effects of the rule to manufacturers, as suggested by EPA, but would also cover many distribution and use sites. They noted that, for example, blasting may require only a small quantity of high explosive (Division 1.1), but that the entire quantity of explosives on-site used in blasting is treated as a high explosive; the high explosive portion serves to initiate the reaction involving the entire quantity.

EPA acknowledged in the proposed rule that explosives are already regulated by a number of agencies. However, these existing regulations do not negate the properties of these substances. The explosives listed in today's rule meet the criteria of section 112(r) (3) and (4) because the inherent properties of the listed explosives plainly indicate that such chemicals may have a severe impact in the event of a detonation. The listed explosives represent the category of explosives that may most easily detonate. In the event of an accidental detonation these substances pose an inherent risk of off-site effects. Industry requirements under other applicable regulations, or recommended standards, are more appropriately accounted for in the development of accidental release prevention requirements. The requirements for accident prevention in section 112(r)(7) specifically allow for recognition of industry-specific circumstances, including voluntary prevention measures, in EPA's prevention regulations. No similar provision is set forth in sections 112(r) (3), (4), or (5), which covers the development of this list of substances and thresholds quantities. Section 112(r)(7) implementing rules, as appropriate, will allow for industry specific circumstances to be considered. Other regulatory requirements, and other practices already in place aimed specifically at protecting the public from adverse effects in case of accidental releases are expected to be integrated with accident prevention requirements of rulemaking under section 112(r)(7).

In particular, EPA's review of existing regulations indicates that public safety would be enhanced if additional information about explosives, such as hazards assessments, were available to emergency response agencies and local emergency planners. Public safety would also be enhanced if there were additional coordination between facilities handling explosives and the local emergency planners and responders. The listing of explosives will make information available under section 112(r) rulemaking and facilitate this coordination. Furthermore, current regulations do not provide for public communication of potential off-site hazards, as do CAA Amendments requirements under section 112(r)(7). Currently, only information related to the quantity and location of explosives is available to the public under sections 311 and 312 of EPCRA. Under the risk management provisions of the CAA, the public will also have available to them information about the measures being taken by the facility to prevent off-site consequences from accidental detonations.

The Agency has noted that the practice of treating the entire quantity of mixtures of high explosives with other explosives as high explosives, coupled with the Agency's proposed threshold determination rule for mixtures, creates the potential for coverage of explosive formulations that are intended to be released (exploded) on-site. The Agency did not intend such coverage in its proposal. In response to this problem identified by the commenters, the Agency is modifying the listing of explosives in today's final rule so that specific explosives on the Hazardous Materials Table are identified as the regulated substances. This avoids the potential circularity in the proposed definition. Mixtures with substances listed on the Hazardous Materials Table are potentially covered only through the operation of the explosive mixture provision in the threshold determination portion of today's rule. The Agency is also clarifying the coverage of explosive mixtures to be used for intentional on-site detonations (not an accidental release) when determining if a threshold quantity is present in a process. This clarification is discussed later in today's preamble.

B. Threshold Determination

Section 68.115 was originally proposed as section 68.5. It has been consolidated with other subpart C provisions that relate to covered substances and applicable thresholds. This section of the regulation establishes how to estimate the presence of a threshold quantity. Exemptions of those quantities that need not be accounted for in determining a threshold are also included.

1. Basis for Threshold Determination

Comments on the proposed rule generally supported a threshold quantity determination that is based on the quantity of a regulated substance in a process. Some commenters, however, suggested that determining threshold quantities should be based on the quantity on-site, the average annual usage, or on-site specific factors. EPA generally disagrees with these statements. The total quantity on-site, while consistent with other regulations in determining threshold quantities (particularly EPCRA, section 302) does not necessarily represent the quantity that could be involved in an accident. The total quantity on-site may include quantities in separate processes, buildings, and locations within the same facility. The average annual usage measures the quantity used by a facility in a year and is not related to the maximum quantity that could be released at a given time. Site-specific factors are appropriately accounted for both in defining the process for which a threshold calculation must be undertaken and in assessing the hazards and preparing the risk management plan for the particular facility. As recommended by most commenters, EPA is retaining the threshold determination based on the total quantity in a process, using the same process definition as OSHA. This approach focuses on the quantity of a substance that might be released in a single accident, and that could be reasonably anticipated to cause effects of concern as a result of an accidental release. This threshold determination approach is consistent with OSHA's PSM standard.

2. Mixture Exemption

a. *Toxic substances*. The proposed rule included a de-minimis concentration of one percent by weight for all listed substances present in a mixture; i.e., quantities of a regulated substance in a mixture did not have to be accounted for purposes of the threshold quantity if the substance were present at concentrations below one percent by weight. A number of comments were received on this exemption for solutions and mixtures.

Several commenters suggested providing a threshold determination method for mixtures based on the SHI. The partial pressure of the listed substance in solution and its toxicity would be used to determine the value of the SHI for the solution; the index value would be compared to a cut-off value (commenters recommended a cut-off of 1,000). EPA does not agree that the SHI criteria should be used to determine the mixture cut-off. Because the SHI approach was not used in determining which chemicals to list, a mixtures score based on this index would not relate to whether a chemical met the listing criteria. EPA also remains concerned about the lack of a basis for the recommended 1,000 SHI cut-off. In addition, EPA believes the SHI approach would be difficult to implement within the structure of section 112(r), especially for facilities outside the chemical manufacturing industry.

Most of the commenters believed the one percent concentration cut-off is too low for solutions of toxic substances; their position being that one percent mixtures of a regulated substance pose essentially no threat to the public. Several commenters also suggested that EPA should provide specific concentration cut-offs for solutions of certain listed substances, such as hydrogen fluoride, nitric acid, and sulfuric acid. Several commenters suggested that the concentration cut-offs should be raised for hydrochloric acid (listed for concentrations of 25 percent or greater) and ammonia (listed for concentrations of 20 percent or greater).

The Agency agrees with commenters that the one percent cut-off may prove to be too conservative in certain circumstances, and that it may not adequately reflect the decreased potential for air release of most regulated substances in dilute mixtures or solutions; at very low concentrations some of these mixtures or solutions fail to meet the listing criteria. The Agency also believes, however, that no justification would exist to exclude the quantities in mixtures or solutions from the threshold calculation if it is uncertain that these mixtures or solutions fail to meet the original listing criteria.

In response to these comments, EPA has modified the one percent mixture exemption to reflect the amount of the regulated substance that may reasonably be anticipated to cause an effect of concern in an accidental release. The Agency has reassessed the concentration at which certain dilute solutions of regulated substances may pose a hazard to the community, sufficient to warrant treatment as a regulated substance, for purposes of determining whether a threshold quantity is present in a process. As part of this modification, EPA has decided to provide specific cut-off concentrations for certain chemicals. These chemicals, in mixtures or solutions with concentrations below the specified cut-off, will not have to be considered in determining whether a threshold quantity is present. For other chemicals, a method, rather than a specific cut-off, will be provided to determine whether mixtures should be considered in the threshold determination. The following chemicals are now listed with concentration cut-offs (in addition to those already proposed with concentrations cut-offs) as shown for weight percent of the substances in water solution:

- Hydrogen fluoride/Hydrofluoric acid (concentration 50 percent or greater); the listing of hydrogen fluoride has been clarified to reflect that it includes the aqueous form of hydrogen fluoride, hydrofluoric acid.
- Nitric acid (concentration 80 percent or greater).

The concentration limits for hydrofluoric and nitric acid are based on the partial pressures of these substances in water solution. At the concentrations listed, the partial pressures of the solutions would meet the vapor pressure criterion of 10 mm Hg. Also, EPA is raising the proposed concentration cut-off for hydrochloric acid from 25 to 30 percent, based on water solutions, to meet the revised vapor pressure criterion. EPA is not changing the concentration cut-off for ammonia because the partial pressure of ammonia in a 20-percent solution still exceeds the 10 mm Hg vapor pressure criterion.

Other listed toxic substances in solutions or mixtures must be included in threshold determination if the partial pressure of the substance in the solution or mixture is equal to, or exceeds, 10 mm Hg. If the partial pressure of the regulated toxic substance in the mixture is determined to be below 10 mm Hg under all conditions in process handling or process storage, the solution or mixture need not be considered in the threshold determination. If the partial pressure of the regulated toxic substance in the mixture equals or exceeds 10 mm Hg in portions of the process, then the quantity of the listed substance contained in the mixture at these portions of the process shall be included in determining whether a threshold is met. The facility will be required to use the one percent de-minimis concentration in determining threshold quantities unless it can measure or estimate, and document, that the partial pressure of the regulated substance in the mixture or solution is less than 10 mm Hg.

The methodology for determining the amount of a regulated substance in a mixture to apply to thresholds does not apply to oleum, toluene 2,4-diisocyanate, toluene 2,6-diisocyanate, and toluene diisocyanate (unspecified isomer). These substances have vapor pressures less than 10 mm Hg.

b. *Flammable substances*. The proposed rule included the same de-minimis concentration of one percent by weight for all listed substances present in a mixture for flammable substances. A number of commenters noted that mixtures of flammable substances in concentrations above one percent may not be flammable. They suggested that a listed flammable substance in a mixture should be included in threshold determination only if the mixture meets the flammability criteria for listing. Other commenters suggested that the entire mixture containing a listed substance should be treated as a regulated substance if the mixture meets the listing criteria for flammable substances. EPA agrees that a mixture containing a listed flammable substance should only be considered in a threshold determination if the mixture itself meets the criteria for an NFPA flammability rating of 4, i.e., flash point below 22.8° C (73° F) and boiling point below 37.8° C (100° F). Again, as for the toxics in mixtures or solutions, a facility is required to use the one percent de-minimis concentration for threshold quantity calculations unless it can measure or estimate, and document, that the mixture or solution does not have a flash point below 22.8° C (73° F) and a boiling point below 37.8° C (100° F).

The Agency agrees with commenters who suggested that a mixture containing a flammable regulated substance should be treated as the regulated substance for purposes of determining whether a threshold quantity is present if the mixture itself meets the boiling point and flash point criteria of today's rule. EPA believes the hazards associated with such highly flammable mixtures make it appropriate to treat such mixtures as regulated substances when such mixtures meet the flammability listing criteria. EPA recognizes that counting the entire quantity of a flammable mixture for threshold determination differs from the proposed rule and from the treatment of mixtures containing regulated toxic substances. However, the Agency believes this different treatment is appropriate because, for flammable substance mixtures, the mixture is known to display the flammability hazard at levels that meet the listing criteria, while for toxic substance mixtures, the mixture is not known to meet the acute toxicity criterion. For toxic substance mixtures, EPA requires counting towards a threshold only the portion of the mixture that would meet the acute toxicity criterion (i.e., the amount of the actual substance).

c. *Explosive substances.* A number of comments were received regarding the threshold calculations for explosives, particularly for mixtures of division 1.1 explosives with low explosives or blasting agents at use sites. In the proposed rule, the Agency had established a de-minimis concentration applicable to all listed substances. Commenters pointed out problems with this mixture consideration, in light of EPA's listing of all explosives meeting DOT's definition of Division 1.1 hazardous materials. This definition treats the entire quantity of a mixture containing a high explosive as a Division 1.1 explosive, hence negating the de-minimis calculation for purposes of threshold quantity determinations. This affected particularly those mixtures formulated on-site, prior to intentional detonations, following BATF regulations. To minimize the potential for accidents, these mixtures generally are made shortly before intentional on-site explosions. The Agency recognizes that the intentional release (or controlled release) in an explosion of mixtures containing a regulated substance is not an accidental release. Thus, the Agency believes that the amount of an explosive in such a mixture cannot be reasonably anticipated to cause effects of concern as a result of an accidental release when such quantities are intended to be released on-site. Therefore, in addition to clarifying the listing of explosives only to include those substances listed by DOT in 49 CFR 172.101, the Agency is also clarifying the applicability of the mixture concentration provision for explosives. For purposes of determining whether a threshold quantity is present in a process involving explosives, mixtures of Division 1.1 explosives listed by DOT in 49 CFR 172.101 (Hazardous Material Table) and other explosives need not to be included when the mixture is intended to be used in an on-site non-accidental release in a manner consistent with applicable BATF regulations. Quantities of explosive regulated substances in mixtures that are not intended to be used on-site in an intentional explosion would not be exempt if such mixture would be treated as a Division 1.1 explosive under 49 CFR parts 172 and 173.

The following two examples demonstrate how this threshold determination provision would operate. An owner or operator of a stationary source receives a mixture, or prepares a mixture, that combines a small quantity of an explosive listed as Division 1.1 hazardous material in 49 CFR 172.101 with a large quantity of a blasting agent, so that the total quantity is above the 5,000 lbs threshold quantity established for listed explosives. If the owner or operator intends to detonate the high explosive/blasting agent mixture at the stationary source in a manner that is consistent with applicable BATF regulations, then the owner or operator need not count the weight of the mixture in determining whether the source has a threshold quantity of the regulated substance on-site. If the owner or operator intends to store, and then transport off-site the high explosive/blasting agent mixture, and the entire mixture would be treated as Division 1.1 explosive under applicable DOT regulations, then the weight of the entire mixture would need to be calculated to determine whether a threshold quantity is present.

3. Other Threshold Exemptions

Except as noted below, all other threshold exemptions in the proposed rule are retained in the final rule. All comments received concerning these exemptions favored the Agency's proposal. The Agency continues to believe that the forms of regulated substances exempted in today's rule cannot reasonably be anticipated to cause effects of concern in the event of an accidental release.

Use for facility consumption as fuel: The Agency has deferred a decision on the proposed exemption for listed flammable substances when used solely for facility consumption as fuel. For a document relating to this proposed exemption, see a supplemental notice published elsewhere in this issue. The Agency intends to decide on whether to promulgate this exemption on or before the date the final risk management program rule is promulgated.

C. Petition Process

Section 68.120 of the rule establishes the specific administrative and technical requirements for the submission of petitions to add or delete substances from the list of regulated substances.

Several comments were received on the criteria for determining whether a substance that is the subject of a petition should be listed or delisted. Two commenters said the listing criteria are too narrow. For example, it was argued that EPA should allow petitioners to develop a case for listing toxic chemicals that do not meet the acute toxicity criteria. Another commenter said the listing criteria are too broad, and the standards for delisting are too stringent; delisting requires demonstrating that the substance "will not" cause death, injury, or environmental harm.

EPA believes the acute toxicity criteria for listing toxics, as well as the volatility and accident history, provide a valid basis for identification of chemicals that pose hazards to the community in case of acute exposures resulting from an accidental release and is retaining these criteria for petition review. The Agency is also retaining the selection criteria for listing flammables and explosives. EPA agrees that the petition requirements for delisting may be too stringent and will delete substances from the list if it can be determined that the substance, in case of an accidental release, "is not known or anticipated to" cause death, injury, or serious adverse effects to human health or the environment.

One commenter said the decision not to accept additional petitions unless new data become available should be modified so that petitions that present significant data not previously considered (whether or not the data are new) can be accepted. The petition process provides that when a petition is received, EPA will publish a notice in the **Federal Register** requesting additional, pertinent scientific information that was not identified by the petitioner. Interested parties will have the opportunity to present significant data not included in the petition. Therefore, EPA believes it is appropriate to accept additional petitions on a substance only if new data become available.

Another commenter said the 18-month period proposed for review of petitions should be shortened to six months. EPA believes the 18-month review period is not excessive for carrying out a thorough review of the petition and any public comments and publishing a decision concerning the petition. Denials shall be published in the **Federal Register** within 18 months of the Agency receiving the petition; for petitions granted, the Agency will publish a proposed new listing within 18 months.

D. Definitions

Section 68.3 of the regulation sets forth the definitions that will apply to all regulations published under section 112(r). Some of the terms used in other parts of the CAA are also applicable to section 112(r). In addition, a number of terms new to the CAA, resulting from the implementation of section 112(r), are defined in section 68.3 for purposes of all accidental release prevention regulations. These definitions include terms necessary to communicate effectively the new regulatory requirements.

Accidental Release: The definition proposed for accidental release has been taken directly from the legislative language. Several commenters, however, thought it appropriate that the Agency clarify this definition to better focus on EPA's intent through this regulation. Several commenters submitted that the definition of accidental release should be clarified not to include routine emissions to the environment. The Agency believes that the definition is clear in specifying that and accidental release is an "unanticipated emission" of a regulated substance and that this would not include routine emissions. Several commenters also had concerns regarding the inclusion of the term "other extremely hazardous substances" in the definition of accidental release. This term has also been taken directly from the legislative language and the Agency believes it to be an important component of this definition. Under section 112(r)(1) the owners and operators of stationary sources have a duty to initiate specific activities to prevent and mitigate accidental releases of any regulated substance under 112(r)(3), or any other extremely hazardous substance.

Process: There were a number of comments related to EPA's definition of process. The proposed definition was consistent with OSHA's definition of process under their PSM standard, and included any activity involving a regulated substance including any use, storage, manufacturing, handling, or on-site movement of such substances, or combination of these activities. Any group of vessels that is interconnected, or separate vessels that are located such that a regulated substance could be involved in a potential release, were proposed to be considered a single process. Because of the need to maintain as much consistency as possible with OSHA, EPA is retaining this definition and is providing, in this preamble, some clarification prompted by comments submitted on this issue.

Many commenters argued that the proposed definition included terms that were not clear, such as interconnected vessels and single processes. The commenters indicated, for example, that in some cases vessels may be connected in indirect ways and still present a low probability that they could be involved in a single release. The Agency believes that this was already accounted for through the proposed definition of process. To serve as clarification, interconnected vessels that could be involved in a single release would include vessels physically connected so that an event could lead to an accidental release involving all these vessels at one time. The Agency still believes that the facility is responsible in accounting for any quantity of a regulated substance that could potentially be released from one or more vessels, whether these are connected or not.

Stationary source: Several commenters requested clarification regarding pipelines and whether listed flammable substances in pipeline transfer stations would be covered by the rule under the stationary source definition. Other commenters had questions regarding the inclusion in this definition of transportation containers not under active shipping orders. The Agency is clarifying the definition of stationary source. For purposes of regulations under section 112(r), the term stationary source does not apply to transportation conditions, which would include storage incident to such transportation, of any 112(r) regulated substance. Pipelines, transfer stations, and other activities already covered under DOT as transportation of hazardous substances by pipeline, or incident to such transportation, under 49 CFR parts 192, 193 and 195 would not be covered. Transportation containers that are not under active shipping papers are not considered by EPA to be storage incident to transportation; the Agency considers the definition of stationary source to include such containers.

E. Exemptions

The Agency is retaining the proposed exemption from this part for ammonia used as an agricultural nutrient, when held by farmers. This exemption was authorized by statute, and it was also generally supported by commenters.

A number of commenters suggested that an exemption should be added for natural gas, mainly because of other existing regulations. As discussed previously in this preamble, EPA's listing of a substance is based on the demonstrated or potential effects in the event of an accidental release. Existing regulations may be targeted to reduce a potential release, or the effects of a release, but do not negate the hazards presented by the substances regulated. Existing requirements under other regulations, standards, or recommended practices are to be accounted for though the requirements of the risk management program and any other prevention regulations under section 112(r).

F. Scope

An issue of concern to a number of commenters were the general duty requirements under section 112(r)(1). Generally, commenters voiced some confusion regarding what the requirements would be, and particularly about which substances would be included. Because of similarities with OSHA's general duty clause, commenters expressed the need for EPA to develop guidance along the OSHA Field Operations Manual to assist facilities in evaluating their compliance with these requirements.

The CAA identified the following activities as part of the general duty requirements: Identification of hazards which may result from an accidental release using appropriate hazard assessment techniques, designing and maintaining a safe facility taking such steps as necessary to prevent accidental releases, and actions which minimize the consequences of an accidental release once it has occurred. Section 112(r)(1) specifically indicates that the general duty provision applies in the same manner and to the same extent as OSHA's general duty clause under section 654, title 29 of the U.S. Code. The Agency is investigating the relationship between requirements under section 112(r) and OSHA's general duty provisions.

Comments were also received on the separate issuance of the list and thresholds rule and the risk management program rule. The comments focused on the difficulties for the regulated community to evaluate and comment on the full impact of the list and thresholds without specific information on the accident prevention requirements. The Agency agrees that the separation of these rules does not allow the regulated community the optimum opportunity to comment on the proposed regulation. While the Agency recognizes that the two rules comprise a single program, the statute allows for proposal and promulgation of the list and thresholds rule prior to the proposal and promulgation of the section 112(r)(7) rule. Because EPA's duty to publish the list and thresholds rule arose before the duty to publish the risk management program rule, the Agency was obligated to publish the proposed list and thresholds rule before the section 112(r)(7)(B) proposed rule was publishable. The Agency has just published a proposed notice for the prevention requirements applicable to facilities having the listed substances above the threshold quantities (Risk Management Programs for Chemical Accidental Release Prevention, 58 FR 54190, October 20, 1993). The comment period for the risk management program rule will be open at the time this rule is finalized. This will give commenters the opportunity to comment on the risk management program with the knowledge of what substances are covered.

V. Summary of Provisions of the Final Rule

EPA is adding part 68 to title 40 of the Code of Federal Regulations, including the list of regulated substances and threshold quantities, as well as the requirements for the petition process to add regulated substances to the list or to delete regulated substances from the list.

Section 68.1 establishes the scope of the Part 68 chemical accident prevention provisions.

Section 68.3 establishes definitions applicable to all Part 68 regulations.

Section 68.100 establishes the purpose of the subpart as the designation of regulated substances and their threshold quantities, and establishment of the requirements for petitions to add substances or delete substances from the list.

Section 68.115 (proposed § 68.5) establishes the procedures to determine whether a threshold quantity of a regulated substance is present at a stationary source. Specific exemptions to the threshold determination procedure are also included for mixture concentrations, articles, and certain uses and activities.

The final rule includes several exemptions for mixtures that have been revised from the proposed rule. These are:

(1) For toxic substances present in a mixture or solution at a concentration of one percent or greater by weight, the facility has the option of demonstrating that the partial pressure of the regulated substance in the solution under any or all storage or handling conditions is less than 10 mm Hg; in this case, the quantity of the regulated substance in the mixture in the portion of the process with a partial pressure of less than 10 mm Hg would be exempt from threshold determination;

(2) Mixtures containing regulated flammable substances are exempt from threshold determination if the facility demonstrates that the mixture itself does not meet the criteria for flammability (flash point below 73°F (22.8°C) and boiling point below 100°F (37.8°C); and

(3) Mixtures of Division 1.1 explosives listed in 49 CFR 172.101 and other explosives need not be considered when determining whether a threshold quantity is present, provided that the mixture is intended to be intentionally released (i.e., a non-accidental release) in a manner consistent with DOT and BATF regulations.

Section 68.120 specifies the requirements for petitions to the Agency to add substances to the list, and to delete substances from the list. Petition requirements have been modified slightly to read that a substance may be deleted from the list if adequate data are available to determine that the substance, in the case of an accidental release, is "unlikely to cause" (rather than "will not cause") death, injury, or serious adverse effects to human health or the environment.

Section 68.125 exempts ammonia used as an agricultural nutrient when held by a farmer.

Section 68.130 establishes the list of regulated substances, including a list of toxic substances, a list of flammable substances, and a list criterion for commercial high explosives. This section also establishes the threshold quantities for all listed substances.

The final rule includes several changes to the proposed list and thresholds. Eighteen substances, with vapor pressures below 10 mm Hg, have been deleted from the proposed list of toxic substances, and one substance (vinyl chloride) has been moved from the list of toxic substances to the list of flammable substances. One substance, methyl bromide, has been deleted because it is listed under Title VI of the CAA. Four substances on the proposed list, included partly because of their accident history, have been deleted while another, oleum, has been specifically listed. The final list contains 77 toxic substances. Concentration cut-off levels have been specified for solutions of two additional substances, hydrogen fluoride and nitric acid. The concentration cut-off level has been raised for hydrochloric acid from 25 to 30 percent by weight. Threshold quantities have been raised for 71 of the 77 toxic substances listed. The final list contains 63 flammable substances, with the threshold quantity remaining at 10,000 lbs. The listing of explosive substances has been modified only to include those substances listed by DOT in 49 CFR 172.101; the Agency is also clarifying the applicability of the mixture concentration provision for explosives.

VI. Required Analyses

A. E.O. 12866

Under Executive Order 12866, 58 Federal Register 51735 (October 4, 1993), the Agency must determine whether the regulatory action is "significant", and therefore subject to OMB review and the requirements of the Executive Order. The Order defines "significant regulatory action" as one that is likely to result in a rule that may:

(1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal government or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

Pursuant to the terms of the Executive Order 12866, it has been determined that this rule is a "significant regulatory action". Even though the list and thresholds rule, by itself, imposes no cost on facilities, the cost impact of the list and thresholds derives from compliance with the risk management program regulations and other reasonable regulations, which are triggered by the presence of a regulated substance above its threshold quantity. The annual effect on the economy for the accidental release prevention regulations that will be triggered by this rule is expected to exceed $100 million. As such, this action is submitted to OMB for review as part of a larger accidental release prevention program. Changes made in response to OMB suggestions or recommendations will be documented in the public record.

The Agency developed a draft Regulatory Impacts Analysis (RIA) for the proposed rule that considered the cost for the accidental release prevention program envisioned under section 112(r); this draft RIA includes the list and thresholds and the risk management program requirements. The list rule, by itself, imposes only very minimal costs associated with the petition requirements for additions to, and deletions from, the list and for the documentation of mixtures; the majority of costs relate to actions that facilities with listed chemicals must undertake as a result of the risk management program rule.

The requirements under the OSHA Process Safety Management Standard, which parallels the EPA risk management planning requirements, have now been in place for some time, and information is becoming available on the costs to facilities working to comply with OSHA. An addendum to the draft RIA was developed for the proposed risk management program rule to reflect public comments and the new information. The Agency estimate of the universe of facilities covered by the final list and thresholds rule has since been revised. EPA now estimates that approximately 118,000 facilities will be covered by the final list and thresholds rule. The distribution of facilities covered includes 11,000 manufacturers and 107,000 non-manufacturers (i.e., refineries; public drinking water and waste treatment systems; cold storage facilities; wholesalers; agricultural retailers; service industry facilities; private utilities; propane retailers, propane users, explosives manufacturers, and gas extraction and processing facilities). The average number of regulated substances per facility varies from one for cold storage facilities to six for highly complex manufacturing facilities.

EPA estimates that the petition process under this rulemaking will cost a facility submitting a petition an average of $5,000. EPA estimates that there will be 11 petitions a year. EPA anticipates that the cost to the Federal government for processing and reviewing the petitions will be approximately equal to the cost to facilities for filing a petition. The total annual cost is estimated to be $110,000 ($5,000x2x11 petitions).

B. Regulatory Flexibility Act

Pursuant to the Regulatory Flexibility Act of 1980, 5 U.S.C. 601 *et seq.*, when an agency publishes a notice of rulemaking, for a rule that will have a significant effect on a substantial number of small entities, the agency must prepare and make available for public comment a regulatory flexibility analysis that considers the effect of the rule on small entities (i.e., small businesses, small organizations, and small governmental jurisdictions).

The list rule, by itself, imposes only very minimal costs associated with the petition requirements for additions to, and deletions from, the list and for the documentation of mixtures; the majority of costs relate to actions that facilities with listed chemicals must undertake as a result of the risk management program rule. The risk management program regulation was proposed by EPA on October 20, 1993 (58 FR 54190); a discussion of the impacts on small entities is included on page 54212. The initial Regulatory Flexibility Analysis is contained in the combined economic analysis entitled Regulatory Impact Analysis in Support of Listing Regulated Substances and Thresholds and Mandating Risk Management Programs for Chemical Accident Prevention, as Required by Section 112(r) of the CAA, available in the docket. A revised economic analysis will be developed in conjunction with the final risk management program regulation.

C. Paperwork Reduction Act

The information collection requirements contained in this rule have been approved by the Office of Management and Budget (OMB) under the provisions of the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.* and have been assigned control number 2050–0127.

Public reporting for this collection of information in the petition process is estimated to be approximately 138 hours per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. EPA estimates that there will be 11 petitions a year. The total annual burden is estimated to be 1,518 hours (138 hours × 11 petitions).

Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to:

Chief, Information Policy Branch, PM–223, U.S., Environmental Protection Agency, 401 M St. SW., Washington, DC 20460; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503, marked "Attention: Desk Officer for EPA."

D. Display of OMB Control Numbers

EPA is also amending the table of currently approved information collection request (ICR) control numbers issued by OMB for various regulations. This amendment updates the table to accurately display those information requirements contained in this final rule. This display of the OMB control number and its subsequent codification in the Code of Federal Regulations satisfies the requirements of the Paperwork Reduction Act (44 U.S.C. 3501 et seq.) and OMB's implementing regulations at 5 CFR part 1320.

The ICR was previously subject to public notice and comment prior to OMB approval. As a result, EPA finds that there is "good cause" under section 553(b)(B) of the Administrative Procedure Act (5 U.S.C. 553(b)(B)) to amend this table without prior notice and comment. Due to the technical nature of the table, further notice and comment would be unnecessary. For the same reasons, EPA also finds that there is good cause under 5 U.S.C. 553(d)(3).

List of Subjects

40 CFR Part 9

Environmental protection, paperwork reduction act.

40 CFR Part 68

Environmental protection, Chemicals, Chemical accident prevention, Clean Air Act, Extremely hazardous substances, Intergovernmental relations, Hazardous substances, Reporting and Recordkeeping requirements.

Dated: January 14, 1994.

Carol M. Browner,

Administrator.

For the reasons set out in the preamble, title 40, chapter I, subchapter A, part 9 of the Code of Federal Regulations is amended, and title 40, chapter I, subchapter C, part 68 of the Code of Federal Regulations is added, as set forth below:

PART 9—OMB APPROVALS UNDER THE PAPERWORK REDUCTION ACT

1. The authority citation for part 9 continues to read as follows:

Authority: 7 U.S.C. 135 et seq., 136–136y; 15 U.S.C. 2001, 2003, 2005, 2006, 2601–2671; 21 U.S.C. 331j, 346a, 348; 31 U.S.C. 9701; 33 U.S.C. 1251 et seq., 1311, 1313d, 1314, 1321, 1326, 1330, 1344, 1345 (d) and (e), 1361; E.O. 11735, 38 FR 21243, 3 CFR, 1971–1975 Comp. p. 973; 42 U.S.C. 241, 242b, 243, 246, 300f, 300g, 300g–1, 300g–2, 300g–3, 300g–4, 300g–5, 300g–6, 300j–1, 300j–2, 300j–3, 300j–4, 300j–9, 1857 et seq., 6901–6992k, 7401–7671q, 7542, 9601–9657, 11023, 11048.

2. Section 9.1 is amended by adding the new entry with a new heading to the table to read as follows:

§ 9.1 OMB approvals under the Paperwork Reduction Act.

* * * * *

40 CFR citation	OMB control No.
* * *	* *
Chemical Accident Prevention Provisions:	
68.120 (a), (e), and (g)	2050–0127
* * *	* *

3. Part 68 is added to read as follows:

PART 68—CHEMICAL ACCIDENT PREVENTION PROVISIONS

Subpart A—General

Sec.
68.1 Scope.
68.3 Definitions.

Subpart B—Risk Management Plan Requirements [Reserved]

Subpart C—Regulated Substances for Accidental Release Prevention

68.100 Purpose.
68.115 Threshold determination.
68.120 Petition process.
68.125 Exemptions.
68.130 List of substances.

Authority: 42 U.S.C. 7412(r), 7601.

Subpart A—General

§ 68.1 Scope.

This Part sets forth the list of regulated substances and thresholds, the petition process for adding or deleting substances to the list of regulated substances, the requirements for owners or operators of stationary sources concerning the prevention of accidental releases, and the State accidental release prevention programs approved under section 112(r). The list of substances, threshold quantities, and accident prevention regulations promulgated under this part do not limit in any way the general duty provisions under section 112(r)(1).

§ 68.3 Definitions.

For the purposes of this Part:

Accidental release means an unanticipated emission of a regulated substance or other extremely hazardous substance into the ambient air from a stationary source.

Administrator means the administrator of the U.S. Environmental Protection Agency.

Article means a manufactured item, as defined under 29 CFR 1910.1200(b), that is formed to a specific shape or design during manufacture, that has end use functions dependent in whole or in part upon the shape or design during end use, and that does not release or otherwise result in exposure to a regulated substance under normal conditions of processing and use.

CAS means the Chemical Abstracts Service.

DOT means the United States Department of Transportation.

Process means any activity involving a regulated substance including any use, storage, manufacturing, handling, or on-site movement of such substances, or combination of these activities. For the purposes of this definition, any group of vessels that are interconnected, or separate vessels that are located such that a regulated substance could be involved in a potential release, shall be considered a single process.

Regulated substance is any substance listed pursuant to section 112(r)(3) of the Clean Air Act as amended, in § 68.130.

Stationary source means any buildings, structures, equipment, installations, or substance emitting stationary activities which belong to the same industrial group, which are located on one or more contiguous properties, which are under the control of the same person (or persons under common control), and from which an accidental release may occur. A stationary source includes transportation containers that are no longer under active shipping papers and transportation containers that are connected to equipment at the stationary source for the purposes of temporary storage, loading, or unloading. The term stationary source does not apply to transportation, including the storage incident to transportation, of any regulated substance or any other extremely hazardous substance under the provisions of this part, provided that such transportation is regulated under 49 CFR parts 192, 193, or 195. Properties shall not be considered contiguous solely because of a railroad or gas pipeline right-of-way.

Threshold quantity means the quantity specified for regulated substances pursuant to section 112(r)(5) of the Clean Air Act as amended, listed in § 68.130 and determined to be present at a stationary source as specified in § 68.115 of this Part.

Vessel means any reactor, tank, drum, barrel, cylinder, vat, kettle, boiler, pipe, hose, or other container.

Subpart B—Risk Management Plan Requirements [Reserved]

Subpart C—Regulated Substances for Accidental Release Prevention

§ 68.100 Purpose.

This subpart designates substances to be listed under section 112(r)(3), (4), and (5) of the Clean Air Act, as amended, identifies their threshold quantities, and establishes the requirements for petitioning to add or delete substances from the list.

§ 68.115 Threshold determination.

(a) A threshold quantity of a regulated substance listed in § 68.130 is present at a stationary source if the total quantity of the regulated substance contained in a process exceeds the threshold.

(b) For the purposes of determining whether more than a threshold quantity of a regulated substance is present at the stationary source, the following exemptions apply:

(1) *Concentrations of a regulated toxic substance in a mixture.* If a regulated substance is present in a mixture and the concentration of the substance is below one percent by weight of the mixture, the amount of the substance in the mixture need not be considered when determining whether more than a threshold quantity is present at the stationary source. Except for oleum, toluene 2,4-diisocyanate, toluene 2,6-diisocyanate, and toluene diisocyanate (unspecified isomer), if the concentration of the regulated substance in the mixture is one percent or greater by weight, but the owner or operator can demonstrate that the partial pressure of the regulated substance in the mixture (solution) under handling or storage conditions in any portion of the process is less than 10 millimeters of mercury (mm Hg), the amount of the substance in the mixture in that portion of the process need not be considered when determining whether more than a threshold quantity is present at the stationary source. The owner or operator shall document this partial pressure measurement or estimate.

(2) *Concentrations of a regulated flammable substance in a mixture.* If a regulated substance is present in a mixture and the concentration of the substance is below one percent by weight of the mixture, the mixture need not be considered when determining whether more than a threshold quantity of the regulated substance is present at the stationary source. If the concentration of the regulated substance in the mixture is one percent or greater by weight, then, for purposes of determining whether more than a threshold quantity is present at the stationary source, the entire weight of the mixture shall be treated as the regulated substance unless the owner or operator can demonstrate that the mixture itself does not meet the criteria for flammability of flash point below 73°F (22.8°C) and boiling point below 100°F (37.8°C). The owner or operator shall document these flash point and boiling point measurements or estimates.

(3) *Concentrations of a regulated explosive substance in a mixture.* Mixtures of Division 1.1 explosives listed in 49 CFR 172.101 (Hazardous Materials Table) and other explosives need not be included when determining whether a threshold quantity is present in a process, when the mixture is intended to be used on-site in a non-accidental release in a manner consistent with applicable BATF regulations. Other mixtures of Division 1.1 explosives listed in 49 CFR 172.101 and other explosives shall be included in determining whether more than a threshold quantity is present in a process if such mixtures would be treated as Division 1.1 explosives under 49 CFR Parts 172 and 173.

(4) *Articles.* Regulated substances contained in articles need not be considered when determining whether more than a threshold quantity is present at the stationary source.

(5) *Uses.* Regulated substances, when in use for the following purposes, need not be included in determining whether more than a threshold quantity is present at the stationary source:

(i) Use as a structural component of the stationary source;

(ii) Use of products for routine janitorial maintenance;

(iii) Use by employees of foods, drugs, cosmetics, or other personal items containing the regulated substance; and

(iv) Use of regulated substances present in process water or non-contact cooling water as drawn from the environment or municipal sources, or use of regulated substances present in air used either as compressed air or as part of combustion.

(6) *Activities in Laboratories.* If a regulated substance is manufactured, processed, or used in a laboratory at a stationary source under the supervision of a technically qualified individual as defined in § 720.3(ee) of this chapter, the quantity of the substance need not be considered in determining whether a threshold quantity is present. This exemption does not apply to:

(i) Specialty chemical production;

(ii) Manufacture, processing, or use of substances in pilot plant scale operations; and

(iii) Activities conducted outside the laboratory.

§ 68.120 Petition process.

(a) Any person may petition the Administrator to modify, by addition or deletion, the list of regulated substances identified in § 68.130. Based on the information presented by the petitioner, the Administrator may grant or deny a petition.

(b) A substance may be added to the list if, in the case of an accidental release, it is known to cause or may be reasonably anticipated to cause death, injury, or serious adverse effects to human health or the environment.

(c) A substance may be deleted from the list if adequate data on the health and environmental effects of the substance are available to determine that the substance, in the case of an accidental release, is not known to cause and may not be reasonably anticipated to cause death, injury, or serious adverse effects to human health or the environment.

(d) No substance for which a national primary ambient air quality standard has been established shall be added to the list. No substance regulated under Title VI of the Clean Air Act, as amended, shall be added to the list.

(e) The burden of proof is on the petitioner to demonstrate that the criteria for addition and deletion are met. A petition will be denied if this demonstration is not made.

(f) The Administrator will not accept additional petitions on the same substance following publication of a final notice of the decision to grant or deny a petition, unless new data becomes available that could significantly affect the basis for the decision.

(g) Petitions to modify the list of regulated substances must contain the following:

(1) Name and address of the petitioner and a brief description of the organization(s) that the petitioner represents, if applicable;

(2) Name, address, and telephone number of a contact person for the petition;

(3) Common chemical name(s), common synonym(s), Chemical Abstracts Service number, and chemical formula and structure;

(4) Action requested (add or delete a substance);

(5) Rationale supporting the petitioner's position; that is, how the substance meets the criteria for addition and deletion. A short summary of the rationale must be submitted along with a more detailed narrative; and

(6) Supporting data; that is, the petition must include sufficient information to scientifically support the request to modify the list. Such information shall include:

(i) A list of all support documents;

(ii) Documentation of literature searches conducted, including, but not limited to, identification of the database(s) searched, the search strategy, dates covered, and printed results;

(iii) Effects data (animal, human, and environmental test data) indicating the potential for death, injury, or serious adverse human and environmental impacts from acute exposure following an accidental release; printed copies of the data sources, in English, should be provided; and

(iv) Exposure data or previous accident history data, indicating the potential for serious adverse human health or environmental effects from an accidental release. These data may include, but are not limited to, physical and chemical properties of the substance, such as vapor pressure; modeling results, including data and assumptions used and model documentation; and historical accident data, citing data sources.

(h) Within 18 months of receipt of a petition, the Administrator shall publish in the Federal Register a notice either denying the petition or granting the petition and proposing a listing.

§ 68.125 Exemptions.

Agricultural nutrients. Ammonia used as an agricultural nutrient, when held by farmers, is exempt from all provisions of this part.

§ 68.130 List of substances.

(a) Explosives listed by DOT as Division 1.1 in 49 CFR 172.101 are covered under section 112(r) of the Clean Air Act. The threshold quantity for explosives is 5,000 pounds.

(b) Regulated toxic and flammable substances under section 112(r) of the Clean Air Act are the substances listed in Tables 1, 2, 3, and 4. Threshold quantities for listed toxic and flammable substances are specified in the tables.

(c) The basis for placing toxic and flammable substances on the list of regulated substances are explained in the notes to the list.

TABLE 1 TO § 68.130.—LIST OF REGULATED TOXIC SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION

[Alphabetical Order—77 Substances]

Chemical name	CAS No.	Threshold quantity (lbs)	Basis for listing
Acrolein [2-Propenal]	107–02–8	5,000	b
Acrylonitrile [2-Propenenitrile]	107–13–1	20,000	b
Acrylyl chloride [2-Propenoyl chloride]	814–68–6	5,000	b
Allyl alcohol [2-Propen-l-ol]	107–18–61	15,000	b
Allylamine [2-Propen-l-amine]	107–11–9	10,000	b
Ammonia (anhydrous)	7664–41–7	10,000	a, b
Ammonia (conc 20% or greater)	7664–41–7	20,000	a, b
Arsenous trichloride	7784–34–1	15,000	b
Arsine	7784–42–1	1,000	b
Boron trichloride [Borane, trichloro-]	10294–34–5	5,000	b
Boron trifluoride [Borane, trifluoro-]	7637–07–2	5,000	b
Boron trifluoride compound with methyl ether (1:1) [Boron, trifluoro[oxybis[metane]]-, T-4-	353–42–4	15,000	b
Bromine	7726–95–6	10,000	a, b
Carbon disulfide	75–15–0	20,000	b
Chlorine	7782–50–5	2,500	a, b
Chlorine dioxide [Chlorine oxide (ClO2)]	10049–04–4	1,000	c
Chloroform [Methane, trichloro-]	67–66–3	20,000	b
Chloromethyl ether [Methane, oxybis[chloro-]	542–88–1	1,000	b
Chloromethyl methyl ether [Methane, chloromethoxy-]	107–30–2	5,000	b
Crotonaldehyde [2-Butenal]	4170–30–3	20,000	b
Crotonaldehyde, (E)- [2-Butenal, (E)-]	123–73–9	20,000	b
Cyanogen chloride	506–77–4	10,000	c.
Cyclohexylamine [Cyclohexanamine]	108–91–8	15,000	b
Diborane	19287–45–7	2,500	b
Dimethyldichlorosilane [Silane, dichlorodimethyl-]	75–78–5	5,000	b
1,1-Dimethylhydrazine [Hydrazine, 1,1-dimethyl-]	57–14–7	15,000	b
Epichlorohydrin [Oxirane, (chloromethyl)-]	106–89–8	20,000	b
Ethylenediamine [1,2-Ethanediamine]	107–15–3	20,000	b
Ethyleneimine [Aziridine]	151–56–4	10,000	b
Ethylene oxide [Oxirane]	75–21–8	10,000	a, b
Fluorine	7782–41–4	1,000	b
Formaldehyde (solution)	50–00–0	15,000	b
Furan	110–00–9	5,000	b
Hydrazine	302–01–2	15,000	b
Hydrochloric acid (conc 30% or greater)	7647–01–0	15,000	d
Hydrocyanic acid	74–90–8	2,500	a, b
Hydrogen chloride (anhydrous) [Hydrochloric acid]	7647–01–0	5,000	a
Hydrogen fluoride/Hydrofluoric acid (conc 50% or greater) [Hydrofluoric acid]	7664–39–3	1,000	a, b
Hydrogen selenide	7783–07–5	500	b
Hydrogen sulfide	7783–06–4	10,000	a, b
Iron, pentacarbonyl- [Iron carbonyl (Fe(CO)5), (TB-5-11)-]	13463–40–6	2,500	b
Isobutyronitrile [Propanenitrile, 2-methyl-]	78–82–0	20,000	b
Isopropyl chloroformate [Carbonochloridic acid, 1-methylethyl ester]	108–23–6	15,000	b
Methacrylonitrile [2-Propenenitrile, 2-methyl-]	126–98–7	10,000	b
Methyl chloride [Methane, chloro-]	74–87–3	10,000	a
Methyl chloroformate [Carbonochloridic acid, methylester]	79–22–1	5,000	b
Methyl hydrazine [Hydrazine, methyl-]	60–34–4	15,000	b
Methyl isocyanate [Methane, isocyanato-]	624–83–9	10,000	a, b
Methyl mercaptan [Methanethiol]	74–93–1	10,000	b
Methyl thiocyanate [Thiocyanic acid, methyl ester]	556–64–9	20,000	b
Methyltrichlorosilane [Silane, trichloromethyl-]	75–79–6	5,000	b
Nickel carbonyl	13463–39–3	1,000	b
Nitric acid (conc 80% or greater)	7697–37–2	15,000	b
Nitric oxide [Nitrogen oxide (NO)]	10102–43–9	10,000	b
Oleum (Fuming Sulfuric acid) [Sulfuric acid, mixture with sulfur trioxide] [1]	8014–95–7	10,000	e
Peracetic acid [Ethaneperoxoic acid]	79–21–0	10,000	b
Perchloromethylmercaptan [Methanesulfenyl chloride, trichloro-]	594–42–3	10,000	b
Phosgene [Carbonic dichloride]	75–44–5	500	a, b
Phosphine	7803–51–2	5,000	b
Phosphorus oxychloride [Phosphoryl chloride]	10025–87–3	5,000	b
Phosphorus trichloride [Phosphorous trichloride]	7719–12–2	15,000	b
Piperidine	110–89–4	15,000	b

TABLE 1 TO § 68.130.—LIST OF REGULATED TOXIC SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION—Continued

[Alphabetical Order—77 Substances]

Chemical name	CAS No.	Threshold quantity (lbs)	Basis for listing
Propionitrile [Propanenitrile]	107–12–0	10,000	b
Propyl chloroformate [Carbonochloridic acid, propylester]	109–61–5	15,000	b
Propyleneimine [Aziridine, 2-methyl-]	75–55–8	10,000	b
Propylene oxide [Oxirane, methyl-]	75–56–9	10,000	b
Sulfur dioxide (anhydrous)	7446–09–5	5,000	a, b
Sulfur tetrafluoride [Sulfur fluoride (SF4), (T-4)-]	7783–60–0	2,500	b
Sulfur trioxide	7446–11–9	10,000	a, b
Tetramethyllead [Plumbane, tetramethyl-]	75–74–1	10,000	b
Tetranitromethane [Methane, tetranitro-]	509–14–8	10,000	b
Titanium tetrachloride [Titanium chloride (TiCl4) (T-4)-]	7550–45–0	2,500	b
Toluene 2,4-diisocyanate [Benzene, 2,4-diisocyanato-1-methyl-] [1]	584–84–9	10,000	a
Toluene 2,6-diisocyanate [Benzene, 1,3-diisocyanato-2-methyl-] [1]	91–08–7	10,000	a
Toluene diisocyanate (unspecified isomer) [Benzene, 1,3-diisocyanatomethyl-] [1]	26471–62–5	10,000	a
Trimethylchlorosilane [Silane, chlorotrimethyl-]	75–77–4	10,000	b
Vinyl acetate monomer [Acetic acid ethenyl ester]	108–05–4	15,000	b

[1] The mixture exemption in § 68.115(b)(1) does not apply to the substance.

NOTE: Basis for Listing:
- a Mandated for listing by Congress.
- b On EHS list, vapor pressure 10 mmHg or greater.
- c Toxic gas.
- d Toxicity of hydrogen chloride, potential to release hydrogen chloride, and history of accidents.
- e Toxicity of sulfur trioxide and sulfuric acid, potential to release sulfur trioxide, and history of accidents.

TABLE 2 TO § 68.130.—LIST OF REGULATED TOXIC SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION

[CAS Number Order—77 Substances]

CAS No.	Chemical name	Threshold quantity (lbs)	Basis for listing
50–00–0	Formaldehyde (solution)	15,000	b
57–14–7	1,1-Dimethylhydrazine [Hydrazine, 1,1-dimethyl-]	15,000	b
60–34–4	Methyl hydrazine [Hydrazine, methyl-]	15,000	b
67–66–3	Chloroform [Methane, trichloro-]	20,000	b
74–87–3	Methyl chloride [Methane, chloro-]	10,000	a
74–90–8	Hydrocyanic acid	2,500	a, b
74–93–1	Methyl mercaptan [Methanethiol]	10,000	b
75–15–0	Carbon disulfide	20,000	b
75–21–8	Ethylene oxide [Oxirane]	10,000	a, b
75–44–5	Phosgene [Carbonic dichloride]	500	a, b
75–55–8	Propyleneimine [Aziridine, 2-methyl-]	10,000	b
75–56–9	Propylene oxide [Oxirane, methyl-]	10,000	b
75–74–1	Tetramethyllead [Plumbane, tetramethyl-]	10,000	b
75–77–4	Trimethylchlorosilane [Silane, chlorotrimethyl-]	10,000	b
75–78–5	Dimethyldichlorosilane [Silane, dichlorodimethyl-]	5,000	b
75–79–6	Methyltrichlorosilane [Silane, trichloromethyl-]	5,000	b
78–82–0	Isobutyronitrile [Propanenitrile, 2-methyl-]	20,000	b
79–21–0	Peracetic acid [Ethaneperoxoic acid]	10,000	b
79–22–1	Methyl chloroformate [Carbonochloridic acid, methylester]	5,000	b
91–08–7	Toluene 2,6-diisocyanate [Benzene, 1,3-diisocyanato-2-methyl-] [1]	10,000	a
106–89–8	Epichlorohydrin [Oxirane, (chloromethyl)-]	20,000	b
107–02–8	Acrolein [2-Propenal]	5,000	b
107–11–9	Allylamine [2-Propen-1-amine]	10,000	b
107–12–0	Propionitrile [Propanenitrile]	10,000	b
107–13–1	Acrylonitrile [2-Propenenitrile]	20,000	b
107–15–3	Ethylenediamine [1,2-Ethanediamine]	20,000	b
107–18–6	Allyl alcohol [2-Propen-1-ol]	15,000	b
107–30–2	Chloromethyl methyl ether [Methane, chloromethoxy-]	5,000	b
108–05–4	Vinyl acetate monomer [Acetic acid ethenyl ester]	15,000	b
108–23–6	Isopropyl chloroformate [Carbonochloridic acid, 1-methylethyl ester]	15,000	b
108–91–8	Cyclohexylamine [Cyclohexanamine]	15,000	b
109–61–5	Propyl chloroformate [Carbonochloridic acid, propylester]	15,000	b
110–00–9	Furan	5,000	b
110–89–4	Piperidine	15,000	b
123–73–9	Crotonaldehyde, (E)- [2-Butenal, (E)-]	20,000	b
126–98–7	Methacrylonitrile [2-Propenenitrile, 2-methyl-]	10,000	b

TABLE 2 TO §68.130.—LIST OF REGULATED TOXIC SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION—Continued

[CAS Number Order—77 Substances]

CAS No.	Chemical name	Threshold quantity (lbs)	Basis for listing
151-56-4	Ethyleneimine [Aziridine]	10,000	b
302-01-2	Hydrazine	15,000	b
353-42-4	Boron trifluoride compound with methyl ether (1:1) [Boron, trifluoro[oxybis[methane]]-, T-4-	15,000	b
506-77-4	Cyanogen chloride	10,000	c
509-14-8	Tetranitromethane [Methane, tetranitro-]	10,000	b
542-88-1	Chloromethyl ether [Methane, oxybis[chloro-]	1,000	b
556-64-9	Methyl thiocyanate [Thiocyanic acid, methyl ester]	20,000	b
584-84-9	Toluene 2,4-diisocyanate [Benzene, 2,4-diisocyanato-1-methyl-][1]	10,000	a
594-42-3	Perchloromethylmercaptan [Methanesulfenyl chloride, trichloro-]	10,000	b
624-83-9	Methyl isocyanate [Methane, isocyanato-]	10,000	a, b
814-68-6	Acrylyl chloride [2-Propenoyl chloride]	5,000	b
4170-30-3	Crotonaldehyde [2-Butenal]	20,000	b
7446-09-5	Sulfur dioxide (anhydrous)	5,000	a, b
7446-11-9	Sulfur trioxide	10,000	a, b
7550-45-0	Titanium tetrachloride [Titanium chloride (TiCl4) (T-4)-]	2,500	b
7637-07-2	Boron trifluoride [Borane, trifluoro-]	5,000	b
7647-01-0	Hydrochloric acid (conc 30% or greater)	15,000	d
7647-01-0	Hydrogen chloride (anhydrous) [Hydrochloric acid]	5,000	a
7664-39-3	Hydrogen fluoride/Hydrofluoric acid (conc 50% or greater) [Hydrofluoric acid]	1,000	a, b
7664-41-7	Ammonia (anhydrous)	10,000	a, b
7664-41-7	Ammonia (conc 20% or greater)	20,000	a, b
7697-37-2	Nitric acid (conc 80% or greater)	15,000	b
7719-12-2	Phosphorus trichloride [Phosphorous trichloride]	15,000	b
7726-95-6	Bromine	10,000	a, b
7782-41-4	Fluorine	1,000	b
7782-50-5	Chlorine	2,500	a, b
7783-06-4	Hydrogen sulfide	10,000	a, b
7783-07-5	Hydrogen selenide	500	b
7783-60-0	Sulfur tetrafluoride [Sulfur fluoride (SF4), (T-4)-]	2,500	b
7784-34-1	Arsenous trichloride	15,000	b
7784-42-1	Arsine	1,000	b
7803-51-2	Phosphine	5,000	b
8014-95-7	Oleum (Fuming Sulfuric acid) [Sulfuric acid, mixture with sulfur trioxide][1]	10,000	e
10025-87-3	Phosphorus oxychloride [Phosphoryl chloride]	5,000	b
10049-04-4	Chlorine dioxide [Chlorine oxide (ClO_2)]	1,000	c
10102-43-9	Nitric oxide [Nitrogen oxide (NO)]	10,000	b
10294-34-5	Boron trichloride [Borane, trichloro-]	5,000	b
13463-39-3	Nickel carbonyl	1,000	b
13463-40-6	Iron, pentacarbonyl- [Iron carbonyl ($Fe(CO)_5$), (TB-5-11)-]	2,500	b
19287-45-7	Diborane	2,500	b
26471-62-5	Toluene diisocyanate (unspecified isomer) [Benzene, 1,3-diisocyanatomethyl-1][1]	10,000	a

[1] The mixture exemption in §68.115(b)(1) does not apply to the substance.

NOTE: Basis for Listing:
a Mandated for listing by Congress.
b On EHS list, vapor pressure 10 mmHg or greater.
c Toxic gas.
e Toxicity of sulfur trioxide and sulfuric acid, potential to release sulfur trioxide, and history of accidents.

TABLE 3 TO §68.130.—LIST OF REGULATED FLAMMABLE SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION

[Alphabetical Order—63 Substances]

Chemical name	CAS No.	Threshold quantity (lbs)	Basis for listing
Acetaldehyde	75-07-0	10,000	g
Acetylene [Ethyne]	74-86-2	10,000	f
Bromotrifluorethylene [Ethene, bromotrifluoro-]	598-73-2	10,000	f
1,3-Butadiene	106-99-0	10,000	f
Butane	106-97-8	10,000	f
1-Butene	106-98-9	10,000	f
2-Butene	107-01-7	10,000	f
Butene	25167-67-3	10,000	f
2-Butene-cis	590-18-1	10,000	f
2-Butene-trans [2-Butene, (E)]	624-64-6	10,000	f
Carbon oxysulfide [Carbon oxide sulfide (COS)]	463-58-1	10,000	f

TABLE 3 TO § 68.130.—LIST OF REGULATED FLAMMABLE SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION—Continued

[Alphabetical Order—63 Substances]

Chemical name	CAS No.	Threshold quantity (lbs)	Basis for listing
Chlorine monoxide [Chlorine oxide]	7791–21–1	10,000	f
2-Chloropropylene [1-Propene, 2-chloro-]	557–98–2	10,000	g
1-Chloropropylene [1-Propene, 1-chloro-]	590–21–6	10,000	g
Cyanogen [Ethanedinitrile]	460–19–5	10,000	f
Cyclopropane	75–19–4	10,000	f
Dichlorosilane [Silane, dichloro-]	4109–96–0	10,000	f
Difluoroethane [Ethane, 1,1-difluoro-]	75–37–6	10,000	f
Dimethylamine [Methanamine, N-methyl-]	124–40–3	10,000	f
2,2-Dimethylpropane [Propane, 2,2-dimethyl-]	463–82–1	10,000	f
Ethane	74–84–0	10,000	f
Ethyl acetylene [1-Butyne]	107–00–6	10,000	f
Ethylamine [Ethanamine]	75–04–7	10,000	f
Ethyl chloride [Ethane, chloro-]	75–00–3	10,000	f
Ethylene [Ethene]	74–85–1	10,000	f
Ethyl ether [Ethane, 1,1'-oxybis-]	60–29–7	10,000	g
Ethyl mercaptan [Ethanethiol]	75–08–1	10,000	g
Ethyl nitrite [Nitrous acid, ethyl ester]	109–95–5	10,000	f
Hydrogen	1333–74–0	10,000	f
Isobutane [Propane, 2-methyl]	75–28–5	10,000	f
Isopentane [Butane, 2-methyl-]	78–78–4	10,000	g
Isoprene [1,3-Butadinene, 2-methyl-]	78–79–5	10,000	g
Isopropylamine [2-Propanamine]	75–31–0	10,000	g
Isopropyl chloride [Propane, 2-chloro-]	75–29–6	10,000	g
Methane	74–82–8	10,000	f
Methylamine [Methanamine]	74–89–5	10,000	f
3-Methyl-1-butene	563–45–1	10,000	f
2-Methyl-1-butene	563–46–2	10,000	g
Methyl ether [Methane, oxybis-]	115–10–6	10,000	f
Methyl formate [Formic acid, methyl ester]	107–31–3	10,000	g
2-Methylpropene [1-Propene, 2-methyl-]	115–11–7	10,000	f
1,3-Pentadinene	504–60–9	10,000	f
Pentane	109–66–0	10,000	g
1-Pentene	109–67–1	10,000	g
2-Pentene, (E)-	646–04–8	10,000	g
2-Pentene, (Z)-	627–20–3	10,000	g
Propadiene [1,2-Propadiene]	463–49–0	10,000	f
Propane	74–98–6	10,000	f
Propylene [1-Propene]	115–07–1	10,000	f
Propyne [1-Propyne]	74–99–7	10,000	f
Silane	7803–62–5	10,000	f
Tetrafluoroethylene [Ethene, tetrafluoro-]	116–14–3	10,000	f
Tetramethylsilane [Silane, tetramethyl-]	75–76–3	10,000	g
Trichlorosilane [Silane, trichloro-]	10025–78–2	10,000	g
Trifluorochloroethylene [Ethene, chlorotrifluoro-]	79–38–9	10,000	f
Trimethylamine [Methanamine, N,N-dimethyl-]	75–50–3	10,000	f
Vinyl acetylene [1-Buten-3-yne]	689–97–4	10,000	f
Vinyl chloride [Ethene, chloro-]	75–01–4	10,000	a, f
Vinyl ethyl ether [Ethene, ethoxy-]	109–92–2	10,000	g
Vinyl fluoride [Ethene, fluoro-]	75–02–5	10,000	f
Vinylidene chloride [Ethene, 1,1-dichloro-]	75–35–4	10,000	g
Vinylidene fluoride [Ethene, 1,1-difluoro-]	75–38–7	10,000	f
Vinyl methyl ether [Ethene, methoxy-]	107–25–5	10,000	f

NOTE: Basis for Listing:
a Mandated for listing by Congress.
f Flammable gas.
g Volatile flammable liquid.

TABLE 4 TO § 68.130.—LIST OF REGULATED FLAMMABLE SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION

[CAS Number Order—63 Substances]

CAS No.	Chemical name	CAS No.	Threshold quantity (lbs)	Basis for listing
60–29–7	Ethyl ether [Ethane, 1,1'-oxybis-]	60–29–7	10,000	g
74–82–8	Methane	74–82–8	10,000	f

TABLE 4 TO §68.130.—LIST OF REGULATED FLAMMABLE SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION—Continued

[CAS Number Order—63 Substances]

CAS No.	Chemical name	CAS No.	Threshold quantity (lbs)	Basis for listing
74–84–0	Ethane	74–84–0	10,000	f
74–85–1	Ethylene [Ethene]	74–85–1	10,000	f
74–86–2	Acetylene [Ethyne]	74–86–2	10,000	f
74–89–5	Methylamine [Methanamine]	74–89–5	10,000	f
74–98–6	Propane	74–98–6	10,000	f
74–99–7	Propyne [1-Propyne]	74–99–7	10,000	f
75–00–3	Ethyl chloride [Ethane, chloro-]	75–00–3	10,000	f
75–01–4	Vinyl chloride [Ethene, chloro-]	75–01–4	10,000	a, f
75–02–5	Vinyl fluoride [Ethene, fluoro-]	75–02–5	10,000	f
75–04–7	Ethylamine [Ethanamine]	75–04–7	10,000	f
75–07–0	Acetaldehyde	75–07–0	10,000	g
75–08–1	Ethyl mercaptan [Ethanethiol]	75–08–1	10,000	g
75–19–4	Cyclopropane	75–19–4	10,000	f
75–28–5	Isobutane [Propane, 2-methyl]	75–28–5	10,000	f
75–29–6	Isopropyl chloride [Propane, 2-chloro-]	75–29–6	10,000	g
75–31–0	Isopropylamine [2-Propanamine]	75–31–0	10,000	g
75–35–4	Vinylidene chloride [Ethene, 1,1-dichloro-]	75–35–4	10,000	g
75–37–6	Difluoroethane [Ethane, 1,1-difluoro-]	75–37–6	10,000	f
75–38–7	Vinylidene fluoride [Ethene, 1,1-difluoro-]	75–38–7	10,000	f
75–50–3	Trimethylamine [Methanamine, N, N-dimethyl-]	75–50–3	10,000	f
75–76–3	Tetramethylsilane [Silane, tetramethyl-]	75–76–3	10,000	g
78–78–4	Isopentane [Butane, 2-methyl-]	78–78–4	10,000	g
78–79–5	Isoprene [1,3,-Butadiene, 2-methyl-]	78–79–5	10,000	g
79–38–9	Trifluorochloroethylene [Ethene, chlorotrifluoro-]	79–38–9	10,000	f
106–97–8	Butane	106–97–8	10,000	f
106–98–9	1-Butene	106–98–9	10,000	f
196–99–0	1,3-Butadiene	106–99–0	10,000	f
107–00–6	Ethyl acetylene [1-Butyne]	107–00–6	10,000	f
107–01–7	2-Butene	107–01–7	10,000	f
107–25–5	Vinyl methyl ether [Ethene, methoxy-]	107–25–5	10,000	f
107–31–3	Methyl formate [Formic acid, methyl ester]	107–31–3	10,000	g
109–66–0	Pentane	109–66–0	10,000	g
109–67–1	1-Pentene	109–67–1	10,000	g
109–92–2	Vinyl ethyl ether [Ethene, ethoxy-]	109–92–2	10,000	g
109–95–5	Ethyl nitrite [Nitrous acid, ethyl ester]	109–95–5	10,000	f
115–07–1	Propylene [1-Propene]	115–07–1	10,000	f
115–10–6	Methyl ether [Methane, oxybis-]	115–10–6	10,000	f
115–11–7	2-Methylpropene [1-Propene, 2-methyl-]	115–11–7	10,000	f
116–14–3	Tetrafluoroethylene [Ethene, tetrafluoro-]	116–14–3	10,000	f
124–40–3	Dimethylamine [Methanamine, N-methyl-]	124–40–3	10,000	f
460–19–5	Cyanogen [Ethanedinitrile]	460–19–5	10,000	f
463–49–0	Propadiene [1,2-Propadiene]	463–49–0	10,000	f
463–58–1	Carbon oxysulfide [Carbon oxide sulfide (COS)]	463–58–1	10,000	f
463–82–1	2,2-Dimethylpropane [Propane, 2,2-dimethyl-]	463–82–1	10,000	f
504–60–9	1,3-Pentadiene	504–60–9	10,000	f
557–98–2	2-Chloropropylene [1-Propene, 2-chloro-]	557–98–2	10,000	g
563–45–1	3-Methyl-1-butene	563–45–1	10,000	f
563–46–2	2-Methyl-1-butene	563–46–2	10,000	g
590–18–1	2-Butene-cis	590–18–1	10,000	f
590–21–6	1-Chloropropylene [1-Propene, 1-chloro-]	590–21–6	10,000	g
598–73–2	Bromotrifluorethylene [Ethene, bromotrifluoro-]	598–73–2	10,000	f
624–64–6	2-Butene-trans [2-Butene, (E)]	624–64–6	10,000	f
627–20–3	2-Pentene, (Z)-	627–20–3	10,000	g
646–04–8	2-Pentene, (E)-	646–04–8	10,000	g
689–97–4	Vinyl acetylene [1-Buten-3-yne]	689–97–4	10,000	f
1333–74–0	Hydrogen	1333–74–0	10,000	f
4109–96–0	Dichlorosilane [Silane, dichloro-]	4109–96–0	10,000	f
7791–21–1	Chlorine monoxide [Chlorine oxide]	7791–21–1	10,000	f
7803–62–5	Silane	7803–62–5	10,000	f
10025–78–2	Trichlorosilane [Silane,trichloro-]	10025–78–2	10,000	g
25167–67–3	Butene	25167–67–3	10,000	f

Note: Basis for Listing: a Mandated for listing by Congress. f Flammable gas. g Volatile flammable liquid.

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BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[FRL–4828–7]

List of Regulated Substances for Accidental Release Prevention Under Section 112(r) of the Clean Air Act as Amended; Risk Management Programs for Chemical Accident Release Prevention Under Section 112(r)(7) of the Clean Air Act as Amended

AGENCY: Environmental Protection Agency (EPA).

ACTION: Supplemental notice.

SUMMARY: The Clean Air Act Amendments of 1990, signed into law on November 15, 1990, include provisions for chemical accident prevention. Elsewhere in this issue of the **Federal Register**, the Environmental Protection Agency is promulgating the list of regulated substances and thresholds required under section 112 (r) of the Clean Air Act as amended. The list and threshold quantities will identify facilities subject to chemical accident prevention regulations to be promulgated under section 112(r) of the Clean Air Act as amended; a proposed regulation for such requirements was published in the **Federal Register** on October 20, 1993 (58 FR 54190). In promulgating the list, EPA is deferring action on threshold quantities for listed flammable substances when used solely for facility consumption as fuel (see 58 FR 5102, 5120, (January 19, 1993)). EPA requests additional public comment on the hazards associated with flammables used as fuel and the appropriateness of the proposed exemption. In addition, EPA requests comments on the impacts of proposed accident prevention requirements under section 112(r)(7), on sources that would be covered by the requirements in the absence of an exemption, and on ways of reducing the impacts of these requirements. Comments will be placed in the dockets for both the list of regulated substances and the chemical accident prevention regulations.

DATES: Comments must be submitted on or before March 2, 1994.

ADDRESSES: Comments may be mailed or submitted to: Environmental Protection Agency, Attn: Docket No. (A–91–74), room 1500, Waterside Mall, 401 M Street SW., Washington, DC 20460. Comments must be submitted in triplicate.

DOCKET: Supporting information used in developing both the proposed and final list rules is contained in Docket No. A–91–74. Supporting information used in developing the chemical accident prevention regulations proposed rule is contained in Docket No. A–91–73. These dockets are available for public inspection and copying between 8 a.m. and 4 p.m., Monday through Friday at the address listed above. A reasonable fee may be charged for copying.

FOR FURTHER INFORMATION CONTACT: Vanessa Rodriguez (202) 260–7913, Chemical Emergency Preparedness and Prevention Office (5101), US Environmental Protection Agency, 401 M Street SW., Washington, DC 20460, or the Emergency Planning and Community-Right-to-Know Hot Line at 1–800–535–0202.

SUPPLEMENTARY INFORMATION:

I. Introduction
  A. Statutory Authority
  B. Background
II. Use of Flammable Substances as Fuel
  A. Regulatory History
  B. Hazards Information
  C. Regulatory Impact

I. Introduction

A. Statutory Authority

This notice is being issued under sections 112(r) and 301 of the Clean Air Act (CAA or Act) as amended (42 U.S.C. 7412(r), 7601).

B. Background

Section 112(r) of the Clean Air Act of 1990 establishes chemical accident prevention provisions that focus on chemicals posing a significant hazard to the community. The intent of these provisions is to require facility risk management practices that will prevent chemical accidents from occurring and will minimize the impacts of accidents that do occur. Section 112(r)(3) of the CAA requires EPA to promulgate an initial list of at least 100 substances ("regulated substances") that are known to cause, or may be reasonably anticipated to cause, death, injury, or adverse effects to human health and the environment. Section 112(r)(5) requires EPA to set threshold quantities for each listed substance. EPA is promulgating the list of regulated substances and threshold quantities elsewhere in this issue of the **Federal Register**. The list is composed of three categories: toxic substances, flammable substances, and explosive substances. Threshold quantities for toxic substances range from 500 to 20,000 pounds. For all listed flammable substances, the threshold quantity is 10,000 pounds, and for all explosive substances, the threshold quantity is 5,000 pounds.

Under CAA section 112(r)(7), the Act requires EPA to promulgate reasonable regulations and appropriate guidance to provide for the prevention and detection of accidental releases and for response to such releases. The accident prevention regulations will apply to stationary sources that have present more than a threshold quantity of a regulated substance. These regulations shall address, as appropriate, the use, operation, repair, and maintenance of equipment to monitor, detect, inspect, and control releases, including training of personnel in the use and maintenance of equipment or in the conduct of periodic inspections. The regulations shall include requirements for the development and submission of Risk Management Plans (RMPs) by regulated facilities. The RMP shall include a hazard assessment, a prevention program, and an emergency response program. The proposed rule for accident prevention, Risk Management Programs for Chemical Accidental Release Prevention, was published on October 20, 1993 (58 FR 54190).

II. Use of Flammable Substances as Fuel

A. Regulatory History

In the proposed rule to establish a list of regulated substances (58 FR 5102, 5120 (January 19, 1993)), EPA proposed to exempt from the 10,000-pound threshold determination flammable substances used solely for facility consumption as fuel. The final rule establishing a list of regulated substances (see the final rule published elsewhere in this issue) defers action on this exemption. EPA plans to make a determination on the exemption before or at the time it publishes a final rule for risk management planning.

A number of commenters supported the exemption, arguing that it is appropriate to exclude on-site storage and use of hydrocarbon fuels for what were referred to as "low risk applications" (e.g., heating and drying). Some commenters appeared to interpret the exemption to apply to process-related operations, such as process heaters; this exclusion was not intended by the Agency. It also was argued by commenters that current fire protection standards and emergency procedures provide acceptable means to prevent accidental releases and minimize the impacts in the event of a release.

Other commenters opposed an exemption for facility consumption as fuel. These commenters argued that use of flammable substances for fuel is probably responsible for more public risk than all other uses of flammables combined, and that the Agency had not made hazard- or risk-based arguments in support of the exemption. These commenters noted that the proposed exemption would allow the handling of large quantities of listed flammable substances without the development of risk management plans.

The Agency currently lacks information or evidence to demonstrate that the hazard and potential for an accidental release is different for the storage, transfer, or use of a flammable substance used solely as fuel from the storage, transfer, or use of the same substance in a chemical process. The Agency also has data available in the docket indicating that flammable substances used solely as fuel have been involved in accidental releases. Therefore, the Agency seeks comment on the appropriateness of this exemption.

B. Hazards Information

EPA requests comments supported by data on the hazards associated with the use of EPA-listed flammable substances as fuel. In particular, the Agency seeks data on actual and potential off-site impacts. For example, EPA recognizes that serious hazards are associated with propane, but would like additional information concerning the impacts of propane accidents, as related to propane use as fuel, on the public. EPA also requests comment on whether a hazard-based distinction can be made between flammable substances used as fuel and flammable substances otherwise regulated under the accident prevention program. In particular, are the hazards associated with handling flammables for fuel uses greater or lower than the hazards associated with using the same substances in industrial processes otherwise regulated under the accident prevention program?

The Occupational Safety and Health Administration (OSHA) exempted under its process safety management standards "Hydrocarbon fuels used solely for workplace consumption as a fuel * * * if such fuels are not part of a process containing another highly hazardous chemical covered by the [process safety management] standard" (see 57 FR 6356, 6367 (February 24, 1992)). In part, OSHA's expressed rationale was that this type of use did not have the same catastrophic potential to workers as other uses. Fuel storage and handling may be systematically different (due to industrial standards, technology, and regulation) than storage and handling of a substance for other uses. EPA requests comments supported by available data regarding whether the use of a flammable substance as a fuel affects the amount of the substance that may reasonably be anticipated to cause off-site impacts of concern as a result of an accidental release. Another question concerns the extent to which a hazard-based distinction can be made between the EPA-regulated flammables and the larger OSHA universe of flammable substances when they are used as fuel.

C. Regulatory Impact

EPA requests additional information on: (1) the kinds of substances, (2) the types and number of facilities, especially small businesses, and (3) the uses of flammables that would be affected by an exemption for the use of flammable substances as fuels. EPA also requests comment on the appropriateness of the risk management program as described in the proposed rule of October 20, 1993 (see 58 FR 54190) for this regulated universe.

Comments are sought on the extent and effectiveness of existing voluntary and regulatory programs that may reduce hazards associated with the use of flammables as fuel, as well as the degree to which such requirements accomplish the same goals (e.g., availability of information to the public) as the proposed chemical accident prevention program and plans. For instance, information on the OSHA process safety management standard and on fire protection measures and emergency procedures at the state and local level is requested. As OSHA noted, the OSHA standards for flammable and combustible liquids and liquified petroleum gases address flammables used as fuel (see 57 FR 6367). Do these standards fulfill particular aspects of EPA's proposed program, such as the prevention program element?

EPA also seeks comment on ways to reduce the impact of the risk management planning regulations on users of flammables as fuel if the Agency determines that an exemption is not warranted. Alternatives include the use of model RMPs to assist facility owners and operators and streamlined procedures for meeting accident prevention program and plan requirements. EPA solicits comments on the way in which such approaches can be implemented and on specific components of the risk management and plan requirements that are anticipated to place significant burdens on small business.

List of Subjects

Environmental protection.

Dated: January 14, 1994.

Carol M. Browner,

Administrator.

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