

**NIOSH Comments to DOL on the Occupational Safety and  
Health Administration's Proposed Rule on  
Electric Power Generation, Transmission, and Distribution  
Electrical Protective Equipment by R. Niemeier, May 1, 1989**

**(U.S.) Centers for Disease Control, Atlanta, GA**

**1 May 89**

<b>REPORT DOCUMENTATION PAGE</b>		1. REPORT NO.	2.	PB91-135160
4. Title and Subtitle NIOSH Testimony on the Occupational Safety and Health Administration Proposed Rule on Electric Power Generation, Transmission, and Distribution; Electrical Protective Equipment by R. Niemeier, May 1, 1989			5. Report Date 1989/05/01	6.
7. Author(s) NIOSH			8. Performing Organization Rept. No.	
9. Performing Organization Name and Address NIOSH			10. Project/Task/Work Unit No.	11. Contract (C) or Grant(S) No. (C) (S)
12. Sponsoring Organization Name and Address			13. Type of Report & Period Covered	
15. Supplementary Notes			14.	
16. Abstract (Limit: 200 words) This testimony reported the concerns of NIOSH with regard to the proposed rule of OSHA on electrical protective equipment. The NIOSH Fatal Accident Circumstances and Epidemiology project identified lineman or line mechanic as a high risk occupation. The testimony covers such matters as the rate of injuries and fatalities among line mechanics, the lockout versus tagout procedures, noise exposures, training of workers, medical services and first aid, job briefing, enclosed spaces, calibration of test instruments, ventilation and monitoring, specific ventilation requirements, open flames, ladders, platforms, step bolts, manhole steps, hand and portable power tools, live line tools, working on or near energized poles, line clearance tree trimming, communications facilities, underground electric installations, and working under special conditions.				
17. Document Analysis a. Descriptors				
b. Identifiers/Open-Ended Terms NIOSH-Publication, NIOSH-Author, NIOSH-Testimony, Niemeier-R, Electrical-shock, Electrical-workers, Work-practices, Safety-practices, Accident-prevention				
c. COSATI Field/Group				
18. Availability Statement			19. Security Class (This Report)	21. No. of Pages 13
			22. Security Class (This Page)	22. Price



Comments to DOL

COMMENTS OF THE  
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH  
ON  
THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION'S  
PROPOSED RULE ON  
ELECTRIC POWER GENERATION, TRANSMISSION, AND DISTRIBUTION;  
ELECTRICAL PROTECTIVE EQUIPMENT

29 CFR Part 1910  
Docust No. 8-015

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Public Health Service  
Centers for Disease Control  
National Institute for Occupational Safety and Health

5/1/89

The National Institute for Occupational Safety and Health (NIOSH) appreciates the opportunity to comment on the Occupational Safety and Health Administration's (OSHA's) proposed rule on 29 CFR Part 1910 on electric power generation, transmission and distribution as published in the Federal Register on Tuesday, January 31, 1989.

NIOSH commends OSHA on the scope of this rule and the additional protection that the rule affords to the nation's workers employed in power generation, transmission, and distribution.

#### NIOSH FACE Investigations

NIOSH is concerned about the rate of injuries and fatalities among line mechanics. NIOSH's Division of Safety Research (DSR) first identified lineman or line mechanics as a high-risk occupation in the Fatal Accident Circumstances and Epidemiology (FACE) project. DSR personnel have performed 162 field evaluations involving 175 electrical-related fatalities from November 1982 through December 1988 in the FACE project. The most frequently involved classifications included laborers (34), linemen (26), and electricians (21). Twenty-three FACE reports related to linemen are attached.

The FACE project does not consider worker deaths from all occupations, nor does the FACE project provide the rate of fatalities for a given exposure. NIOSH relies on its National Traumatic Occupational Fatality data base (NTOF) to identify the number of fatalities associated with an occupational group and the employment and earning statistics from the Bureau of Labor Statistics to determine the exposed population. Using these data bases\*, we have identified a total of 374 line mechanic fatalities between 1980-1985 (an average of 62.3 line mechanic fatalities per year from an average annual employment of 110,883 line mechanics). From these data, NIOSH estimates a death rate of 56.2 per 100,000 (56.2/100,000) line mechanics per year. Using this same approach, the rate of fatalities among electricians in all industries is 8.3/100,000 (NTOF).

OSHA has estimated 68 to 75 fatalities annually (54 FR 4975) for an estimated population of 657,775 electric utility workers. Comparing the OSHA estimates to the NIOSH estimates raises a strong inference that the majority of the fatalities occurring in the industry are among the line mechanics. While less than 20% of the workers (110,883/657,775) in the estimated exposed population are line mechanics, approximately 80% to 90% of the estimated fatalities (62.3/75 to 62.3/68) occur to the line mechanics.

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\*NIOSH acknowledges that, based on the limitations of the data bases employed, the NIOSH estimates for the number of fatalities and the rate of fatalities are probably less than the actual number.

## Lockout/Tagout

We have expressed our position on the control of hazardous energy sources at the recent OSHA hearings on that subject [NIOSH 1988]. Although we do not have specific expertise in the application of lockout to the area of electric power generation, NIOSH continues to endorse the use of locks to control hazardous energy sources. We acknowledge that some instances may exist where lockout is not possible, but NIOSH considers the employer to have the burden to present evidence of such an exceptional condition. Lockout should be required except when evidence in the record establishes that a lockout device is not possible for a specific operation or that specific unique conditions exist which preclude a need for a lockout device in a specific operation. When lockout is not possible, training, adequate supervision, and controlled access to the energy isolating device are all necessary and critical elements of the energy isolation procedure.

In considering the appropriate form of protection and securement of an energy isolating device, OSHA should consider two classes of actions that may result in reactivation of the system. First, intentional actions to reactivate the system are all actions where the energy isolating device is intentionally removed or the switch is intentionally activated. These include cases where the tag is ignored, where the tag has been removed without authorization, or where the tag has unintentionally become detached. Second, unintentional actions which reactivate the systems are actions which involve the activation of the system by contact with workers or objects in motion, activation when an adjacent energy device was intended, or activation when a lock and tag is placed on the wrong energy isolating device.

Intentional activations can be controlled most positively by securely locking the energy isolating device. Training and restriction of access to the area of the energy isolating device are also effective protective measures but are not as positive a protection as a lockout procedure. In specific operations there may be risk associated with the attachment of a lock (i.e., utility pole operations), and a balancing of the risk factors may be essential to determine the appropriate energy isolation procedure.

Unintentional activations in general reflect design problems with the energy isolating device or system. These design problems can often be overcome by utilizing a locking device controlled by the worker. It is also possible to reduce the possibility of unintentional activation by other design factors such as switch location and safety catches.

NIOSH commends OSHA for having addressed these issues in principal in this proposed rule but would suggest that OSHA consider providing more specific guidance than the generic performance language used in the rule. OSHA uses the term "rendered inoperable, if design permits" in paragraph (m)(3). This term would indicate that the devices covered

must be made incapable of being operated "if design permits." OSHA should consider requiring that all covered devices be required to be designed so that they may be "rendered inoperable." NIOSH also recommends that situations covered by paragraph (a)(2)(iv), where the general public may have access to the energy isolating device, require mandatory lockout.

## **Noise**

NIOSH urges OSHA to consider incorporating by reference in this standard the requirements for noise reduction and hearing protection from the general industry standards (29 CFR 1910.95).

## **Specific Comments**

NIOSH has the following specific comments to the proposed standard; our comments are based in part on actual investigations conducted as part of the FACE program and copies of applicable FACE reports are attached for OSHA's consideration in formulating the final rule.

### **1910.137 Electrical Protective Equipment**

1910.137(a)(2)(iii): Breakdown test should be defined, and the difference between breakdown test and proof test should be clarified. The way the rule now reads it seems that any gloves that are tested must be removed from service. If that were the case, there would be no gloves to use or no testing being performed.

1910.137(b)(2)(vii): Eliminate the use of class 0 gloves without leather protective gloves, or require testing before use without the leather protective gloves. If no testing is performed on class 0 gloves, class 1 gloves should be the lowest rated gloves used for work without leather protective gloves. Pinholes in protective rubber gloves will negate the dielectric constant of the glove. Arcing will occur at less than 1000 volts.

1910.137(b)(2)(vi): Logs and stamping of dates on equipment should require certification by a designated person. Establishing responsibility for the completion of the task would assure completion on a regular basis.

### **1910.269(a)(2) Training**

The utilities that were interviewed as part of the FACE project had retraining of their workers incorporated into their safety program.

Regular retraining reinforces memory, keeps workers updated on new technology, and provides a motivational factor in emphasizing safety as an ongoing employer concern [Cohan et al. 1985].

We suggest that OSHA consider specifying a minimum length of time for training and retraining and further consider specifying both classroom and field training, particularly for line mechanics.

#### 1910.269(b) Medical Services & First Aid

NIOSH agrees that cardiopulmonary resuscitation (CPR) should be available as soon as possible with four minutes as the maximum delay time [NIOSH 1986]. This time limit should apply to both field work and fixed work location. However, for emergency measures to significantly impact the survival rates following cardiac arrest, CPR (which may be administered by a trained coworker) must be followed by Advanced Cardiac Life Support (ACLS) within 8 minutes (ACLS is usually provided by medical professionals using special equipment) [JAMA 1986]. Generally, this requires coordinating with the local emergency medical service (EMS) to ensure that ACLS is available and can be provided in a timely manner. The availability of ACLS and the means of obtaining it should be a subject of the job briefing required by the proposed 1910.269(c). In situations where defibrillation (a critical component of ACLS) is not readily available, it is possible to provide an Automatic External Defibrillator (AED), a device which analyzes the patient's cardiac rhythm electronically and delivers a defibrillatory counter shock if appropriate [Middleton and Trent 1988]. While a physician must accept responsibility for such a device, they can be successfully used by trained nonprofessionals [Eisenberg and Cummins 1986].

OSHA should specify what first aid supplies are to be kept on hand. Such a list could be developed in conjunction with the American Red Cross and NIOSH would be happy to assist OSHA in this determination. While it is often appropriate for OSHA to rely on judgments made by individual physicians, certain circumstances are more amenable to "specification-oriented" standards. This rule covers similar worksites with certain well-defined hazards and potential for injury. It would seem appropriate for OSHA to specify the basic first-aid supplies and equipment that must be on hand, since relying on individual recommendations would result in needless confusion and inconsistency, as well as making enforcement far more difficult. Company physicians could, of course, add to the basic requirements as they feel necessary.

Training in CPR (one-person rescue) can be obtained in 4-hour courses similar to those taught by the American Heart Association or the American Red Cross. OSHA should also specify intervals for retraining in CPR; some professionals have suggested that regular practice

sessions at three- to six-month intervals are effective in maintaining skills [Starr and Waymaster 1986]. At a minimum, OSHA should require annual recertification in CPR for appropriate workers.

#### 1910.269(c) Job Briefing

NIOSH is supportive of OSHA in the requirements for job briefings. The FACE reports on electrocutions related to electric utility workers indicate that there are a number of instances where a thorough job briefing at the site may have prevented a fatality. NIOSH does not consider the exemption for workers working alone to be appropriate for line mechanics or linemen. The acknowledged hazards of overhead line work should require prior planning with a supervisor for each day's task and each new location [FACE reports 88-47, 86-26-II, 86-4-II].

#### 1910.269(e) Enclosed Spaces

OSHA has identified and defined "enclosed spaces" as work areas requiring special precautions. "Enclosed spaces" as defined in the proposed rule have three special hazards—escape and rescue are difficult because of restricted access, hazardous electrical energy is present, and hazardous atmospheric conditions may exist. NIOSH supports OSHA in this determination.

NIOSH has accumulated a body of data from the FACE project since 1982 that should be used to supplement the guidelines contained in the NIOSH criteria document on confined spaces [NIOSH 1979]. OSHA should consider two additional factors contributing to confined space fatalities in formulating the final rule for enclosed spaces—oxygen deficiency and lack of hazard recognition by attendants. Oxygen deficiency can occur for a number of reasons (e.g., decay of organic material [rotting leaves] or displacement of oxygen by CO, CO<sub>2</sub>, or other gas accumulations). Rescue efforts by well meaning but improperly trained attendants often have resulted in additional casualties.

OSHA should require monitoring for oxygen deficiency in addition to monitoring for flammable or toxic gases/vapors before all enclosed space entry. The FACE data imply that oxygen deficiency is a frequent cause of fatalities. Portable and relatively inexpensive devices are available for monitoring oxygen deficiency and flammability. They are commonly used in underground mining environments. A requirement to monitor for flammable or toxic gases/vapors and oxygen-deficient atmospheres before entry of any enclosed space would be a prudent, safe practice, and protect against a potentially fatal error in judgment regarding the need for oxygen deficiency monitoring.

NIOSH is requesting that OSHA consider the following specific changes in paragraph (e), "enclosed spaces" to provide additional protection to workers from exposure to flammable or toxic gases/vapors and oxygen deficiency. Although NIOSH is requesting that OSHA consider additional protective measures, we strongly support all of the provisions of paragraph (e) that OSHA has proposed.

OSHA should consider if the definition of "vented vault" in paragraph (x) is adequately protective without requiring the testing for flammable and toxic gases, vapors and oxygen deficiency.

1910.269(e)(1): All workers entering an enclosed space or serving as an attendant shall be trained in the hazards of enclosed space entry, enclosed space entry procedures, and enclosed space rescue procedures.

1910.269(e)(3): All confined or enclosed spaces should be clearly marked or labeled with a warning sign or label that will warn all workers of the potential dangers that may exist. These signs or labels should be able to withstand any environmental conditions to which they may be exposed.

1910.269(e)(5): Because an emergency may arise at any time, an attendant should be used any time that work is being performed inside an enclosed space [NIOSH 1979].

#### 1910.269(e)(6) Calibration of Test Instruments

This paragraph should be modified to read:

"Test instruments used to monitor atmospheres in enclosed spaces shall be calibrated according to the test instrument manufacturer's recommendations when available and shall be kept in calibration."

An adequate level of accuracy should be achieved automatically if the test instrument is calibrated according to the manufacturer's recommendations.

1910.269(e)(8): NIOSH, as previously stated, recommends flammability and oxygen deficiency testing before entry into and while continuously occupying any enclosed space. If OSHA should consider a provision exempting oxygen deficiency testing, this exemption should only apply if the forced air ventilation is operating at all times. Testing of the atmosphere should be performed while a crew is setting up forced air ventilation upon their arrival at the scene.

#### 1910.269(e) (9) Ventilation and Monitoring

NIOSH recommends that continuous ventilation and monitoring be required for all confined and enclosed space operations [NIOSH 1979]. NIOSH cautions that allowing workers to continuously monitor for hazardous atmospheres in lieu of ventilation should not be based solely on assuring safe initial atmospheric conditions. Safe atmospheric conditions inside a confined space can change quickly due to the work being performed inside the space. A personal gas monitor alarm may sound if atmospheric conditions deteriorate. However, these conditions can deteriorate so quickly that a worker may be overcome before being able to exit or before ventilation equipment is brought in and turned on. Removing the ventilation requirement would be removing a very basic and necessary fail-safe approach with confined space entry.

#### 1910.269(e) (10) Specific Ventilation Requirements

When continuous forced air ventilation is used in a confined or enclosed space, air monitoring should be required to assure that atmospheric conditions are safe before entry into the space. Requiring a certain number of air changes does not necessarily assure that a confined space is safe to enter. In addition, it may be impractical and unrealistic to expect workers to determine the correct number of air changes.

Requiring forced air ventilation to be directed to the "immediate area where employees are present" may also be somewhat unrealistic and places an undue burden on the worker. Workers may not stay in one area of an enclosed space long enough for this to be practical. It would be preferable to simply require the entire confined space to be adequately ventilated.

#### 1910.269(e) (12) Open Flames

A test for flammable gases immediately before and then only once every hour while the open flame device is in use is not frequent enough, especially in small utility vaults where atmospheric conditions could change within minutes. Continuous monitoring for flammable gases during open flame operations is feasible with the type of test equipment currently available, and provides an added degree of safety to cover different types of situations. OSHA should consider requiring forced air ventilation for open flame operations in enclosed spaces.

**1910.269(h) Ladders, Platforms, Step Bolts and Manhole Steps**

1910.269(h) (5): Numerous falls investigated as part of the FACE project, though not concerning employees of utilities, occurred when workers were repositioning themselves on structures without their fall protection in place. For this reason it would be safe practice to maintain some form of fall protection whenever possible [FACE Reports 89-3, 88-39].

1910.269(h) (5): This section should provide additional guidance on climbing in adverse weather conditions and precautions for individuals working alone. A lone worker might have to climb a pole or tower with tools or equipment causing the worker to have trouble maintaining his/her balance. Additionally, a worker climbing a pole or a tower may be subjected to very treacherous footing, high winds, and cold or wet weather.

**1910.269(i) Hand and Portable Power Tools**

1910.269(i) (2) (ii): Although the three methods of preventing shock would be sufficient to prevent electrical shock to workers if properly maintained, a ground fault circuit interrupt (GFCI) could be used in conjunction with the other three methods as a very dependable back-up method of protection. Because GFCIs can cause slight shocks and inadvertent movement that could result in serious injury, GFCIs should not be solely relied upon in many applications.

**1910.269(j) Live Line Tools**

1910.269(j) (1): Hot line tools should be tested if they are visibly damaged. The tools should be able to withstand performance criteria in place at the time of their manufacture.

**1910.269(l) Working On or Near Energized Poles**

1910.269(l) (2): Sleeves should be used where any chance of inadvertent contact with energized equipment or conductor exists. A number of cases investigated by NIOSH personnel have identified inadvertent contact with energized power lines as the cause of the incident [FACE Reports 88-3, 87-24-II, 86-50, 86-9-II].

**1910.269(r) Line Clearance Tree Trimming**

1910.269(r) (1) (iv): The second line clearance tree trimmer should also be in visual contact.

1910.269(r)(7)(ii): Rope should be inspected before each use. Rope made unsafe by damage or defect should not be used.

**1910.269(s) Communications Facilities**

1910.269(s)(1): This proposal adopts by reference 29 CFR 1910.97, 1910.97 is based on the 1966 ANSI standard C95.1. This standard was updated in 1982. NIOSH understands that the 1966 version is outdated and that OSHA should consider adopting the updated 1982 version.

**1910.269(t) Underground Electric Installations**

1910.269(t)(3): Workers should never enter a confined space unless a standby person is provided even if the electrical equipment is deenergized. NIOSH strongly supports OSHA in this proposed requirement [NIOSH 1979].

**1910.269(w) Special Conditions**

1910.269(w)(8): This section adopts by reference the laser regulation in 29 CFR 1926.54. NIOSH understands that this is an outdated standard and that OSHA should consider adopting the updated provisions of ANSI Z136.1-1986.

Enclosures and/or attachments that are not included are available free of charge from the NIOSH Docket Office (513/533-8450).

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**FACE REPORTS SUBMITTED**

<u>Face Report Number</u>	<u>Subject</u>	<u>Date</u>
89-3	Painter dies in 96-foot fall from highway bridge	12/13/88
88-47	Equipment operator/lineman electrocuted	11/29/88
88-45	Electrical contractor crew leader electrocuted	11/29/88
88-39	Lineman dies from fall from utility pole	12/12/88
88-3	Apprentice lineman electrocuted	9/8/88
87-42-II	Apprentice lineman electrocuted in Virginia	6/11/87
87-38-II	Lineman electrocuted in North Carolina	5/8/87
87-35-II	Lineman electrocuted in Maryland	4/1/87
87-24-II	Lineman apprentice electrocuted in Indiana	2/11/87
86-55-II	Lead line mechanic electrocuted in Maryland	10/6/86
86-50-II	40 year-old lineman technician electrocuted in North Carolina	9/16/86
86-42-II	31 year-old groundman electrocuted in North Carolina	9/8/86
86-40-II	37 year-old lineman electrocuted in Georgia	8/7/86
86-26-II	50 year-old utility worker electrocuted in Ohio	6/7/86
86-21-II	Lineman electrocuted in North Carolina	4/23/86
86-20-II	23 year-old lineman electrocuted in North Carolina	4/21/86
86-11-II	Two electrical contractor employees electrocuted in Kentucky	12/19/85
86-9-II	Lineman electrocuted in North Carolina	12/23/85
86-4-II	Electric company employee electrocuted in Ohio	10/23/85

**FACE REPORTS SUBMITTED (continued)**

<u>Face Report Number</u>	<u>Subject</u>	<u>Date</u>
86-3-II	Electric company lineman electrocuted in Indiana	10/21/85
85-25-II	Contract worker electrocuted while repairing 13.2 KV power line in North Carolina	6/26/85
85-4-II	Crew foreman dies due to electric arc from power line	1/3/85