Electric T&D Service Field-Work Lighting Standards

The True Cost of Working in the Dark

> "Sufficient illumination shall be provided to enable the employee to perform the work safely."[1]
>
> —*OSHA Electric Power Generation, Transmission and Distribution Regulations*

Of the more than 80 pages that the Occupational Safety & Health Association (OSHA) Standards 1910.269 devotes to safe work practices in the Electric Transmission & Distribution (T&D) industry, the vague sentence above is the only reference to **field-work illumination.** This lack of specificity is problematic given that the quality of work-area illumination is literally a matter of life and death for electric T&D linemen, and has a significant economic impact on utility suppliers.

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Dramatically improving the definition of safe utility-service illumination is of critical importance to lineman, service organizations, utility providers, and end users for a number of reasons including:

- Ensuring the protection and safety of linemen, especially those operating in single-person crews;
- Decreasing service-call expenses including labor, fleet usage and potential liability costs;
- Increasing billable kilowatt hours for electrical utility providers, and;
- Improving uninterrupted electrical delivery to commercial and residential customers.

This paper summarizes the lack of well-defined electric T&D task-lighting standards, the resultant human safety and economic implications, and, most importantly, practical advice for service organizations and utility providers to improve safe working practices in ways that reduce field-work related expenses

The Lack of T&D Industry Standards

The lack of clear, well-defined standards for task-related illumination is not unique to the electric T&D industry. Consider the OSHA standards for the Telecommunications industry (1910.268):

> "**Illumination of field work:** Whenever natural light is insufficient to adequately illuminate the worksite, artificial illumination shall be provided to enable the employee to perform work safely."[2]

While this standard does include more information than that of the T&D Industry by specifying the use of artificial illumination when natural light is insufficient, this standard is also subject to broad interpretation by not providing concrete specifications such as recommended illumination levels in footcandles based on the distance from the light to the area being serviced.

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The Lack of T&D Industry Standards (cont.)

The need for service-related illumination standards is recognized in other industries at both the federal and state levels. For example, in 2003 the National Transportation Board issued an 83-page report entitled *Illumination Guidelines for Nighttime Highway Work (NCHR Report 498)*. This document provides detailed information on almost every aspect of nighttime roadwork illumination including guidelines for required light output for specific tasks, workzone lighting design, and guidelines for the use of temporary lighting.[3]

"It is interesting to note the disparity between the detailed nighttime illumination guidelines for highway workers and OSHA's single sentence for electrical power line installers and repairer."

It is interesting to note the disparity between the detailed nighttime illumination guidelines for highway workers and OSHA's single sentence for electrical power line installers and repairers who have the eighth highest fatality rate among all occupations in the U.S.[3]

Also pertinent is the fact that "nearly half of all fatal work injuries occurred among workers who drive or move material around for a living"[4] which, of course, including linemen.

State governments have been stepping up to the plate by setting their own standards for work-related task illumination. In 1996, California's Occupational Safety and Health Standards Board incorporated lighting-related policies into the state's Code of Regulations for Electronic News Gathering (ENG) vehicles that employ telescoping aerial antenna and/or masts.

Subsection (c) of these new regulations describes illumination requirements to prevent aerial boom contact with overhead power lines which has caused a number of deaths and serious injuries to ENG crews and reporters:

> "This subsection will require ENG vehicles to be equipped with spotlights or similar devices that can be aimed upward to illuminate obstructions in the path of the antenna and/or mast."[5]

While these and other industries with less dangerous working conditions have worked to create meaningful standards to protect workers, electric T&D utility crews continue to work in the dark.

Health and Human Safety Issues

Electrical maintenance workers operate in what has long been recognized as a dangerous work environment that includes the risk of electric shock, electrocution, electric arcs, fires and explosions.[6]

In fact, on average, the more than 227,500 employees in the power distribution industry will experience 444 injuries and 74 fatalities each year.[7]

According to federal workplace standards, more than 14 electrical distribution workers per 1,000 will die as a result of job-related hazards.[8] These numbers illustrate the inherent dangers posed to lineman and other work crew members on a daily basis.

According to OSHA accident inspection data from 1991 – 1998, both electrical utility employees and contractors face an equal risk of job-related

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Health and Human Safety Issues (cont.)

fatalities with employees experiencing 224 on-the-job deaths during these years, while line-clearance tree trimming, power line and electrical contractors had 223 work-related fatalities during this same period.[9]

In addition to the tragic loss of human life, there are also significant economic costs associated with these fatalities for compensation costs to the employees' or contractors' surviving families, as well as increased insurance costs to utility companies and contracting firms alike.

Diagnosing and repairing the source of power outages at night or at times of poor visibility brings added difficulties to already overtaxed work crews:

- Pinpointing the source of the power disruption via visual inspection is especially difficult.
- The likelihood of personnel accidents increases especially when working in areas with wide, dense shadows.
- Additional personnel are often required to assist in night-time troubleshooting and repair which increases costs and decreases productivity.

"The need to provide employees with the proper tools and training they need to perform their jobs safely is critical to improve worker safety while reducing the economic costs associated with work-related injuries and fatalities."

These night-time difficulties are exacerbated in the northern United States during the winter months with longer hours of darkness as well as snow, ice and wind during much of the season.

The need to provide employees with the proper tools and training they need to perform their jobs safely—especially under adverse working conditions such as at night or at other times when visibility is limited—is critical to improve worker safety while reducing the economic costs associated with work-related injuries and fatalities.

Economic Implications

Space satellite photo of the northeast blackout of August 2003 as noted in circle.

The "big blackout" of the summer of 2003 in the northeastern United States underscored, on a national level, the fragility of the nation's aging power-distribution infrastructure.

The U.S. Department of Energy's Office of Electrical Transmission and Distribution recently commissioned a study by the Lawrence Berkeley National Laboratory (Berkeley Lab) to more accurately estimate the economic repercussions of power disruptions in the United States.[10]

According to the results of the study, which was published in February 2005, power outages and blackouts cost the nation about $80 billion annually including:

- $57 billion (73 percent) from losses in the commercial sector;
- $20 billion (25 percent) in the industrial sector, and;
- $1.5 billion (2 percent) in the residential market.

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Economic Implications (cont.)

According to one of the project researchers, the significantly higher losses to the commercial and industrial sectors is based on "the larger number of commercial sector customers which includes small as well as large businesses, and the high cost-per-outage per customer."

Based on the data available to the researchers, the study also broke down the costs of momentary, more frequent interruptions (defined as those lasting five minutes or less) and longer, less frequent power interruptions lasting more than five minutes. Momentary interruptions were responsible for $52 billion (about two-thirds) of the $80 billion annual total, while sustained interruptions accounted for $26 billion.

One consistent issue cited by the researchers was the lack of consistent mandated reporting statistics that make it difficult to ascertain the true cost of power interruptions. For example, "some utilities, by convention, do not include outages caused by natural events, such as hurricanes or ice storms, in their statistics."[11] These numbers would obviously add to the total cost of sustained outages where line crews are under especially significant pressures to restore power to frustrated commercial and residential consumers.

It is estimated that a single power outage can cost a manufacturing facility anywhere from $10,000 to millions of dollars, while the costs to banks, data and call centers can be just as high or higher.[6]

From a residential perspective, 500,000 U.S. customers lose power for an average of about two hours every day.[12]

"Power interruptions cost utility providers and service organizations billions of dollars each year."

In addition to their negative impact on businesses and individuals, power interruptions cost utility providers and service organizations billions of dollars each year based on:

- The cost of service calls including labor, fleet usage and potential liability costs, and;
- The loss of billable kilowatt hours for electrical utility providers.

Utility-service calls, in essence, hit providers in the pocketbook twice—once due to incurring additional direct expenses and a second time due to lost revenue.

The real value of adequate field-work illumination becomes much clearer when seen within the human-safety and economic context of utility service work.

Inadequate Lighting, Outdated Criteria

Unfortunately, much of the T&D service industry has been lulled into a false sense of security through the use of portable or temporary lights that offer inadequate illumination levels for the task at hand, especially when that task is being performed in a truck bucket 30' above the ground.

While most service vehicles do have some type of temporary lighting device (e.g., handheld and/or vehicle mounted spotlights), there are no published technical criteria regulating the selection and purchase of these products.

In fact, one of the most widely used illumination measurements used when specifying a lighting device is candlepower (c.p.) output. This antiquated, but still often cited, measurement only account for the intensity of the light at the center point **one foot away** from the light source. With line crews working 50–100' away from the truck and 30+' feet in the air, candlepower is obviously inadequate to address the lighting needed to adequately illuminate the entire work area from those distances.

Let There Be Light

Given the lack of nighttime field-work illumination standards and the magnitude of the resultant human-safety and economic implications, what can utility-service organizations do to increase safety and productivity while decreasing related expenses?

"There are a number of things that utility-service organizations can do to increase safety and productivity while decreasing expenses as relating to field-work illumination."

Here are some of the major issues to consider when selecting field-work lighting systems for electric T&D service applications:

- Does the system have a minimum illuminance level from light source to the area of service?
- Does the system allow for flexible positioning of the light source to project both horizontally for road-side visual inspections and vertically for bucket service work?
- Does the system provide for single-person operation and control via a remote control from both the utility truck cab and aerial bucket?
- Is the system designed and constructed to withstand heavy-duty field work usage on a daily basis with reliability and consistent quality?

While creating industry-acceptable standards for field-work illumination will require a collaborative effort between end users, electric T&D service organizations, utility providers and product manufacturers, addressing the criteria listed above when selecting tasks lighting systems will bring immediate benefits to everyone.

Sources

[1] U.S. Department of Labor, Occupational Safety & Health Association: *Electric Power Generation, Transmission, and Distribution Regulations*, article 1910.269 (w) (4), 1994.

[2] *DOL, OSHA: Telecommunications Regulations*, article 1910.268 (b) (8) 2005..

[3] National Cooperative Highway Research Program (NCHRP) Report 498, *Illumination Guidelines for Nighttime Highway Work*, 2003.

[4] "America's Most Dangerous jobs," Les Christie, www.*cnn.com*, Sept. 23, 2005.

[5] State of California, Occupational Safety and Health Standards Board, *Code of Regulations*, May 1996.

[6] "Proposed OSHA Electrical Worker Standards," *Federal Register*, Vol. 70, No. 114, June 15, 2005, page 34824

[7] Ibid

[8] Ibid

[9] *Berkeley Lab Research News*, February 2, 2005

[10] Ibid

[11] *Transmission and Distribution World*, Feb. 1, 2004

[12] Ibid

Calculating Your Organizational Costs of Nighttime Utility Service Calls

Because there are no national standard reporting guidelines relative to nighttime electric T&D utility service calls, the following simple calculation will help you determine the approximate cost of these power interruptions and related service calls to your organization.

Average No. of Nighttime Service Calls Per Year		_____
Approximate Duration of Nighttime Service Call in Hours	(X)	_____
Total Annual Nighttime Service Call Hours Per Year	(=)	_____
Total Average Hourly Cost Per Service Call (labor, fleet usage, etc.)	(X)	_____
1. Total Estimated Annual Nighttime Service Call Cost Per Year	(=)	_____
Total Estimated Lost Kilowatt Hours from Nighttime Outages		_____
Total Average Cost Per Kilowatt Hour	(X)	_____
2. Total Estimated Annual Lost Kilowatt Revenue	(=)	_____
Total Estimated Annual Service Call Cost and Lost Revenue (Total of Lines 1 and 2 Subtotals)	(=)	_____

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