

### **Request for Assistance in Preventing Electrocutions from Contact Between Cranes and Power Lines**

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REQUEST FOR ASSISTANCE IN PREVENTING  
ELECTROCUTIONS FROM CONTACT BETWEEN CRANES AND POWER LINES

BACKGROUND

Contact between cranes and overhead power lines is a major cause of fatal occupational injuries in the United States. Based upon an analysis by the National Institute for Occupational Safety and Health (NIOSH) of the data from the Supplementary Data System [1] of the Bureau of Labor Statistics, there were approximately 2,300 lost workday occupational injuries in the United States in 1981 which resulted from contact with electrical current by crane booms, cables, or loads. These 2,300 injuries were extremely severe, resulting in 115 fatalities and 200 permanent total disabilities. Comparable statistics obtained in studies conducted by the National Safety Council from 1964 to 1976 produced an estimated annual average of 150 fatalities resulting from such incidents [2]. NIOSH believes that this type of event is the most common cause of fatalities associated with mobile crane operations [3] and is responsible for approximately 1.5% of all fatal work-related injuries each year.

CASE REPORTS

As part of the Fatal Accident Circumstances and Epidemiology (FACE) Project conducted by NIOSH, six fatal injuries involving crane-related electrocutions were investigated. The synopses of these cases are as follows:

Case #1:

A 28-year-old construction worker was holding on to a steel ladder being moved by a telescoping boom crane. As the crane's boom was swung in the direction of 7,200 volt power lines, the cable contacted the closest of the lines and the worker was electrocuted.

Case #2:

A co-owner of a steel erection company and three workers were using a telescoping boom crane to move a section of a steel framing member at the construction site of a commercial storage shed. As the section was moved, it came into contact with a 23,000 volt overhead power line. Two of the three workers who were in direct contact with the load were electrocuted while the third received serious electrical burns.

Case #3:

Roof materials for an addition to a commercial building were stored outside the building directly beneath a 7,200 volt power line. While hooking a load (joist angle bracing) to the crane, a worker was electrocuted when the cable came into contact with the power line as the boom swung.

Case #4:

A construction company was in the process of laying concrete water pipe with a crane. As workmen were placing support timbers beneath the crane's outrigger pads, the operator began extending the crane boom for the next lift when the boom came into contact with a 3 phase 13,800 volt overhead power line. One worker touching an outrigger of the crane was electrocuted.

Case #5:

At a highway construction site, a carpenter attached a 4' x 8' wood and metal form to a crane. While holding on to the form in attempting to guide it into place, the carpenter was electrocuted when the boom or cable came into contact with a 34,000 volt power line.

APPROPRIATE STANDARDS AND RECOMMENDED WORK PRACTICES

The Occupational Safety and Health Administration (OSHA) Safety and Health Regulations for Construction, Subpart N--Cranes, Derricks, Hoists, Elevators, and Conveyors (29 CFR 1926.550(a)(15)) contains specific requirements for the safe use of cranes proximate to overhead power lines. Electrical distribution and transmission lines are required to be de-energized and visibly grounded, moved, or separated from cranes with independent insulating barriers. The regulation states that when it is not possible to meet these requirements, cranes may operate proximate to power lines only if:

- a) minimum clearance (absolute limit of approach) is maintained between the crane and the lines (10 feet for <50 kV and 10 feet plus 0.4 inch for each 1 kV over 50 kV, or twice the length of the line insulator but never less than 10 feet); or,
- b) in transit with no load and boom lowered, minimum clearance (absolute limit of approach) is maintained (4 feet for <50 kV, 10 feet for 50 kV to 345 kV, or 16 feet for up to and including 750 kV).

Additionally, 1926.550(a)(15) requires that: a person be designated to observe the clearance of the crane when it is difficult for the crane operator to use direct observation; cage-type boom guards, insulating lines, or proximity warning devices may be used, but their use does not eliminate the need to adhere to the other parts of the regulation; any overhead wire is to be considered energized until the owner of the line or the electric utility indicates that it is not energized and that it has been visibly grounded; transmitter towers should also be de-energized or tests shall be conducted to determine if an electrical charge has been induced on the crane. Induced charges shall be dissipated by providing an electrical ground directly to the upper rotating structure supporting the boom; ground jumper cables shall be attached to materials when an electrical charge is induced; crews shall be provided with nonconductive poles to attach the ground cable to the load; combustible and flammable materials shall be removed from the immediate area prior to operations.

The Construction Safety Association of Ontario, Canada (CSA-Ontario), recommends safe work practices [4] beyond those addressed in the OSHA standard including the use of nonconductive taglines to guide loads and the use of insulating personal protective equipment by exposed workers.

#### APPLICATION OF EXISTING STANDARDS AND RECOMMENDED WORK PRACTICES

Table 1 presents an analysis for each of the five cases described in this alert regarding compliance with the OSHA standard or CSA-Ontario recommended work practices. In two of the cases, neither the OSHA standard nor the CSA-Ontario recommended work practices were being followed. In the remaining three cases, only one of these safe work practices (avoiding the storage of materials directly under power lines) was being followed. In each of these five cases, there was demonstrable lack of compliance with the OSHA standard.

#### CONCLUSION

The principal objective of the investigations undertaken by NIOSH as part of its Fatal Accident Circumstances and Epidemiology (FACE) Project is to determine what factors enabled the fatality to occur. The goal is to learn how such fatalities can be prevented. In this context, whether or not an operation was "in compliance" with existing standards is but one of many variables which may or may not have contributed to the fatality. However, in the course of the investigations reported here, it became obvious that full compliance with relevant OSHA standards and full use of the CSA-Ontario work practices would have prevented each fatality.

As an obvious first step in preventing such fatalities in the future, we conclude that all such operations should be done only in compliance with existing OSHA standards.

TABLE 1

Status of Compliance with OSHA Standards (or Use of CSA-Ontario  
Recommended Work Practices) in Operations Which Resulted in  
Six Crane-related Electrocutions

Relevant OSHA Standard (or CSA-Ontario Recommended Work Practice)	Status of Compliance by Case				
	#1	#2	#3	#4	#5
1. Move, insulate, or de-energize power line before starting work (OSHA)	No	No	No	No	No
2. Maintain recommended absolute limit of approach (minimum clearance) for specific voltage (OSHA)	No	No	No	No	No
3. Utilize a signal man (OSHA)	No	No	No	No	No
4. Utilize nonconductive taglines, rather than direct contact, to stabilize load (CSA-Ontario)	No	No	No	No	No
5. Do not store combustible materials directly beneath power lines (OSHA & CSA-Ontario)	No	Yes	No	Yes	Yes
6. Use boom guards, insulating lines, or proximity warning devices in addition to other requirements (OSHA)	No	No	No	No	No
7. Use insulating boots and gloves when workers connect loads or contact the crane while in the vicinity of overhead power lines (CSA-Ontario)	No	No	No	No	No

No = Data demonstrated lack of compliance with the OSHA standard (or lack of  
use of CSA-Ontario recommended work practices).

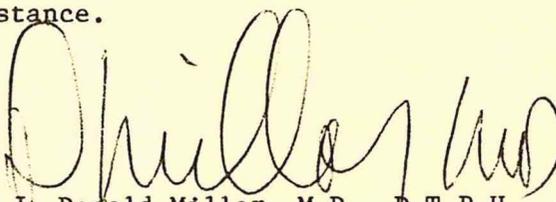
Yes = Data demonstrated compliance with the OSHA standard (or use of  
CSA-Ontario recommended work practices).

RECOMMENDATIONS BY NIOSH

The existing OSHA standard appears sufficient to prevent the crane-related electrocutions described in this alert as well as all others. NIOSH urges all employers who use cranes in the vicinity of overhead power lines to familiarize themselves with and implement the existing OSHA standard. NIOSH urges safety and trade associations, crane manufacturers, electric utility companies, and OSHA state consultative services to bring this standard to the attention of employers who use cranes. Implementation of the work practices described by the CSA of Ontario can provide an additional margin of safety.

Suggestions, requests for additional information on safe work practices, or questions related to this announcement should be directed to Mr. John Moran, Director, Division of Safety Research, 944 Chestnut Ridge Road, Morgantown, West Virginia 26505-2888, Telephone (304) 291-4595.

We greatly appreciate your assistance.



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REFERENCES

1. Bureau of Labor Statistics: Supplementary Data System Microdisk Files User's Guide, 1976-1977, No. PB288258. Springfield, Virginia: National Technical Information Service, 1978.
2. National Safety Council utility study, 1964-1968. Accident Facts. Chicago, Illinois: National Safety Council, 1969-1976.
3. Coleman PJ, Gottlieb MS, Kaplan MC, Knutson SJ, McPeck JS. A human factor analysis of material handling equipment. Madison, Wisconsin: State of Wisconsin, Department of Industry, Labor and Human Relations, January 1978;132-4.
4. Crane handbook. Toronto, Ontario, Canada: Construction Safety Association of Ontario, October 1975;133-50.



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