

SAFETY & HEALTH HAZARDS ALERT

Assistant Secretary for Environment, Safety & Health • U.S. Department of Energy • Washington, D.C. 20585

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Rotating Shaft Accident at Ames Laboratory

This notice is provided to help inform departmental facilities of a serious accident involving severe worker injuries so that appropriate actions can be taken to prevent the occurrence of similar incidents. This notice also provides guidance with respect to a finding that compliance with the existing and relevant OSHA standard may not confer adequate worker protection.

On March 27, 1998, an electrician sustained severe bodily and internal injuries at the Ames Laboratory in Ames, Iowa when his unbuttoned jacket was caught on the end of a supply fan's exposed rotating shaft. The electrician and a mechanic had entered the supply fan room located in the basement of an administration building initially to evaluate work needed on a duct smoke detector that had sounded a false fire alarm earlier in the day.

Having initially entered the fan room to determine the requisite tools needed for the job, the electrician reentered the room wearing an unbuttoned nylon jacket to protect against the cool temperature in the room. Although the employees had turned off the fan at the control panel outside the room, both reentered the cramped supply fan room before the fan had coasted to a full stop. As the electrician approached the duct smoke detector side of the fan, carrying a five-foot ladder he had grabbed on his way in, the still moving but decelerating shaft pulled his loose jacket pinning him for 10 seconds. The electrician sustained severe injuries and was treated for face, head and neck lacerations, a nearly amputated arm, brain injury, an obstructed airway, a severe ear wound and internal (chest) bleeding. He is currently undergoing intensive rehabilitation and physical therapy at Mercy Hospital in Des Moines, Iowa.

As a result of this accident, the DOE Chicago Operations Office, which includes the DOE Ames Group that manages Ames Laboratory, completed a Type B Accident Investigation Report (DOE/CH-A198E). Investigations identified major inadequacies in critical elements of integrated safety management as well as significant inadequacies in the current OSHA standard that should protect workers performing work involving rotating machine parts.

The direct cause of the accident was identified as the electrician's jacket having gotten pulled in to the end of the supply fan's exposed rotating shaft. Investigation findings determined that not only was the shaft end not safeguarded to prevent possible contact as prescribed in the general requirements in 29 CFR 1910.212(a)(1), but that it extended 7/16" beyond the dimensional limits dictated by 29 CFR 1910.219(c)(4)(i). Accident investigation results indicate, however, that even if the exposed shaft end had been in compliance with the OSHA standard, compliance would not have prevented the accident, and that overall, the referenced standard, which is based on the 1953 ANSI standard, is inadequate for protecting workers from hazards associated with rotating shaft ends.

The most current standard ANSI/ASME B15.1-1996 does not allow shaft ends to protrude beyond the ends of pillow blocks. And although safeguarding features should always be part of equipment design and installation, they should also be part of a



Electrician's Jacket



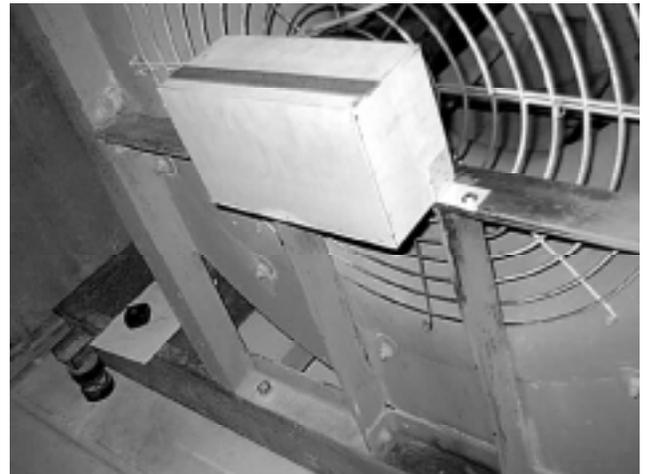
Exposed Shaft

building and its structure according to ANSI/ASME B15.1-1996. The building in which the fan room was located was built in 1994. During a same-year building inspection, the protruding shaft end went unrecognized as not complying with the OSHA standard. In addition, fan room design with its cramped dimensions potentially limited the safe configuration of fan machinery and equipment, as well as access.

Other factors related to deficits in integrated safety management that contributed to the accident include:

- the exposed shaft was not safeguarded in accordance with current OSHA standards or ANSI/ASME B15-1 and so it remained an unidentified and uncontrolled hazard;
- the electrician's work was verbally tasked rather than having been assigned through one of 3 accepted work tasking processes;
- the work had not undergone any formal work planning so that safety precautions were not addressed and the work was therefore not fully understood by the electrician and the mechanic;
- the work environment was not surveyed or assessed for hazards including the room's status as a confined space, which may have required a special permit, special PPE and the need to prohibit loose clothing;
- the lack of energy control or lockout procedures and hazards postings could have controlled and alerted workers to the rotating shaft that appeared to be stopped;
- safety walkthroughs failed to check inside the fan rooms;
- issues similar to the contributing causes of the accident were identified during a 1992 Tiger Team Assessment; and
- training records indicate that neither the electrician nor the mechanic had received training at Ames or from other sources that addresses the safety aspects of working with heavy machinery with rotating parts.

Accident evaluation results show that sole reliance on Subpart O, *Machinery and Machine Guarding*, of the OSHA General Industry Standards and compliance with 29 CFR 1910.219 (c)(4)(i)/212 (a)(1)



Guarded Shaft

are insufficient and inadequate as means by which to control hazards such as those associated with exposed rotating shaft ends. The Board has suggested that DOE HQ EH develop and issue appropriate guidance or requirements for guarding against such, and that it (EH) recommend to OSHA that 29 CFR 1910.219(c)(4)(i) be updated to reflect the requirements of the 1996 ANSI/ASME B15.1 standard (available for purchase on-line at <http://www.ansi.org>).

Facility managers and DOE Operations Office managers should review the issues in this alert, read the Type B Accident Report DOE/CH-A198E (accessible on-line at <http://www.ch.doe.gov/news/news.htm>), and take actions to ensure that all systems are in place within their integrated safety management practices to identify, analyze and control hazards, to conduct adequate work planning, to execute work safely using the appropriate and sufficient procedures, requirements and standards, and to maintain management and worker involvement and feedback. In addition, until updated requirements for guarding exposed rotating shaft ends are issued, managers should ensure that safety envelopes are established in accordance with DOE M 411.1 and that assessments of work spaces, as required by OSHA standards for confined space, and assessments of machinery and equipment, hazardous energy control and personal protective equipment comply minimally with the requirements in the 1996 ANSI/ASME B15.1 standard.

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This Safety & Health Hazards Alert is one in a series of publications issued by EH to share occupational safety and health information throughout the DOE complex. To be added to the Distribution List or to obtain copies of the publication, call **1-800-473-4375** or **(301)903-0449**. For additional information regarding the publications, call Mary Cunningham at **(301) 903-2072**.