**May 28, 1997**

**FACE 97-AK-011**

**To:** **Ted Pettit, NIOSH, Division of Safety Research**

**From:** **Deborah Choromanski**
**Occupational Injury Prevention Program**

**Subject:** **Bulldozer operator dies following equipment submersion -- Alaska**

## SUMMARY

On April 13, 1997, a 46-year-old male heavy equipment operator (the victim) was presumed dead when a bulldozer he was operating submerged in an adjacent tailing pond. The victim was in the process of removing a rock layer from the top of a tailing impoundment structure. As the victim backed the bulldozer to continue the removal process, the bulldozer proceeded over the edge of an embankment, down a slope, and into the tailing pond covered with 2 to 3 inches of ice. Emergency rescue services were notified immediately after discovery of the incident. Divers located the bulldozer in approximately 20 feet of heavily silted water. The operator's compartment door was found open, but divers were unable to locate and recover the victim.

Based on the findings of the investigation, to prevent similar occurrences, employers should:

- incorporate a clearly defined entry level curricula into their training program for inexperienced equipment operators;
- ensure that all operators receive adequate equipment-specific training and supervision including emergency arrest techniques;
- consider implementing a training checklist to ensure all operation and safety aspects have been reviewed with and understood by trainees.

## INTRODUCTION

At 3:51 PM on April 13, 1997, a 46-year-old male heavy equipment operator (the victim) was reported missing and presumed drowned when the bulldozer he was operating rolled into an ice covered tailing pond and submerged in 20 feet of water. Recovery of the victim's body is still pending. On April 14, 1997, the Alaska State Troopers (AST) notified the Alaska Division of Public Health, Section of Epidemiology. An investigation involving an Injury Prevention Specialist for the Alaska Department of Health and Social Services, Division of Public Health, Section of Epidemiology ensued on April 15, 1997. The incident was reviewed with Mine Safety and Health Administration (MSHA) officials. AST reports, as well as MSHA reports, were requested.

The mining operation in this incident was privately owned and employed 260 workers, including certified bulldozer operators. The mine had been operating since 1995. The victim had worked for the mining operation as a truck driver for nine months preceding the incident. He was currently training to operate the bulldozer involved in this incident.

As part of the training, the trainee received a copy of the equipment maintenance and operation manual which he reviewed with an assigned equipment trainer. Subsequently, he had received approximately 18 hours of operator training including instruction with a trainer in the operator's compartment and solo operation adjacent to a second bulldozer of this specific model. All training was documented by the trainer and filed in the trainee's personnel file. The mining operation maintained a written general safety policy and procedure manual with access to manufacturer's maintenance and operation manuals. This was the second fatality for the mining operation.

## INVESTIGATION

The incident occurred on a site approximately 152 feet up slope from a tailing pond (Figure 1). The top of the tailing impoundment structure was level and consisted of

loose rock with a depth of approximately 6 feet. The bulldozer operators assigned to the work site were removing the layer of loose rock (or frost cap) from the top of the tailing impoundment structure to the sides, the first stage of enlarging the earth-filled containment structure.

The bulldozer in this incident was a 1995 Caterpillar Model D10N with an enclosed operator's compartment. Entry into the compartment was by either of two side doors with posterior hinges. This design allowed the operator to egress from the compartment toward the front of the bulldozer. The height from the ground to the top of the compartment was nearly 14 feet. The width over the trunnions was 12 feet with a blade width of 17 feet. The track width was 24 inches. The overall length of the bulldozer and blade was 25 1/2 feet. The bulldozer was equipped with an automatic torque converter which allowed the operator to shift freely between forward and reverse gears without bringing the unit to a complete stop.

Employees were transported to their assigned work areas after attending a pre-shift meeting. The victim was working a 3:00 PM to 11:00 PM shift. On the day of the incident, the victim was assigned to clear a portion of the frost cap from the top of the tailing impoundment structure. Due to the limited experience of the operator, he was assigned to clear the half of the frost cap farthest from the tailing pond, pushing the material away from the tailing pond. The physical dimensions of the assigned work area would provide a minimum safety zone of two bulldozer lengths from the pond side edge of the embankment (Figure 1). The victim had completed his pre-shift equipment inspection and had begun operating the bulldozer. As part of the training criteria, the trainer was to be in the general area observing his work.

At approximately 3:30 PM, during a discussion with the trainer, the shift supervisor noted the absence of the bulldozer from the assigned work area and began looking around the work site. When the trainer and supervisor went to the victim's assigned

work area, they saw track markings leading toward the edge of the impoundment structure nearest the tailing pond. Upon closer examination of the slope, the track markings extended down the length of the slope to a hole through the ice covering the tailing pond. Emergency rescue services were notified. Divers were transported via helicopter to the scene. The bulldozer was found submerged in 20 feet of heavily silted water, approximately 35 feet from the waters edge. The left door of the operator's compartment was found open, suggesting the operator had exited the compartment. The blade and ripper were both found in raised positions. The transmission directional control lever was found in 3F[forward]. Examination of the bulldozer's braking system, decelerator linkage, and transmission did not indicate mechanical failure. It was surmised the victim either was unable to surface due to the pond ice or succumbed to hypothermia before he was able to exit the water.

## CAUSE OF DEATH

The cause of death was presumed drowning and/or hypothermia.

## RECOMMENDATIONS/DISCUSSION

**Recommendation #1: Employers should incorporate a clearly defined entry level curricula into their training program for inexperienced equipment operators.**

*Discussion:* In this case, the victim was participating in a training program originally created to enhance the skills of an experienced operator. The victim's knowledge and skills of operating heavy equipment was not sufficient to be recognized by the industry as "experienced." Employers who offer in-house apprenticeship programs should contact manufacturers and trade organizations to develop a structured academic and on-the-job training program oriented toward the entry-level operator and meeting a minimum standard of competency. Employers may consult organizations such as the

National Center for Construction Education and Research who provide accredited and/or standardized, multi-level training for construction industries. Employers, manufacturers, and safety and training experts may want to explore the desirability of establishing minimum training guidelines for entry-level workers.

**Recommendation #2: Employers should ensure that all operators receive adequate equipment-specific training and supervision including emergency arrest techniques.**

*Discussion:* Although the victim in this case was training to operate a specific type of heavy equipment, the overall design of the training curricula pertained to experienced operators. Operators normally have 1000 hours or more of experience on a specific type of equipment prior to being classified as an "experienced operator." While a trainee may demonstrate an acceptable level of ability for solo operation during the initial training period, close observation and communication with the trainer when beginning a new assignment and at the beginning of each shift is imperative to aid in the development of appropriate skills and knowledge necessary to certify the operator's competency.

In addition, trainers should stress emergency procedures during the training period. A normal transmission feature of the current models is an automatic torque converter allowing the operator to engage the bulldozer in an opposing gear without bringing the unit to a complete stop. In this case the rearward momentum must be overcome by the forward torque of the engine.

Since the incident was not witnessed and the victim's body has not yet been recovered, it is impossible to determine if the incident was precipitated by a catastrophic medical event such as a myocardial infarction (heart attack), cerebral vascular accident (stroke),

[1]1 Communication. Caterpillar Inc.

or a seizure. However, since the operator's compartment door was open, the victim was probably at least well enough to open the door and should have been able to perform an emergency arrest of an operating bulldozer. Braking and shifting into first gear to minimize the transmission response time is recommended to stop the equipment's direction of travel while pushing the governor control lever forward through the stop engine detent will stop the engine and cause the brakes to automatically be applied. The blade or the ripper may also be used during an emergency arrest.

**Recommendation #3: The employer should consider implementing a training checklist to ensure all operation and safety aspects have been reviewed with and understood by trainees.**

*Discussion:* A training checklist for the trainer could provide an effective means to ensure all operation and safety aspects have been reviewed and discussed with trainees. In addition, demonstrative skills and knowledge could be detailed to eliminate arbitrary evaluation of competency by trainers.

Michael Beller, MD, MPH

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Medical Epidemiologist
Division of Public Health
Alaska Department of Health and Social Services

Deborah Choromanski, MPH
Program Manager
Occupational Injury Prevention
Alaska Department of Health and Social Services