DATE: June 9, 1993

FROM: Minnesota Fatality Assessment and Control Evaluation (MN FACE) Project
Minnesota Department of Health

SUBJECT: MN FACE Investigation 93MN00101
Male Maintenance Worker Buried and Suffocated in Sand Hopper

SUMMARY

A 39-year-old male maintenance worker (victim) at a ready-mix concrete batch plant suffocated after falling into or entering a sand hopper and being buried by approximately 9 feet of sand. There were no witnesses and no personal protective equipment was being used by the victim at the time of the incident. Six cement ingredient hoppers, approximately 6 x 12 feet wide and 15 feet deep, were being cleared in preparation for spring start-up operations. They were located in an unheated mixing tower about 30 feet above the control room level. A caged, outdoor ladder led from the control level to the mixing tower. A window in the control room allowed plant operators to watch while ingredients emptied from the bottom chutes of the hoppers during the weighing process. When sand ceased to flow from one of the sand hoppers, the victim proceeded to the mixing tower to dislodge sand which had stuck to its sides. A steel pole approximately 7 feet long was used for this process. The victim either fell into the hopper from a catwalk spanning one side of its open top or descended into it to gain better access to sand near the bottom of the hopper. While he was in the hopper, the lodged sand released and he was buried. Plant personnel in the control room observed the steel pole falling from the hopper's bottom chute to the control level. When the victim could not be located in the mixing tower a 911 call was placed. Rescuers recovered the victim at the bottom of the hopper about 30 minutes after he was last seen; he died from suffocation.

MN FACE investigators concluded that, in order to prevent similar occurrences, the following guidelines should be followed:

> employees should be trained to recognize and avoid the hazards of confined spaces. The necessity of personal protective equipment use and the presence of a properly equipped stand-by person during entry should be stressed;

> fall protection should be used when working above confined spaces such as open-top tanks and hoppers;

> employees should be protected from the engulfment hazards of open-topped hoppers by installing hopper covers to prohibit entry; and

> mechanical devices should be installed to loosen material from sides of hoppers.

INTRODUCTION

On February 4, 1993, MN FACE was notified of a February 3, 1993, work-related confined space fatality. MN OSHA was notified and releasable information was taken. The city police report was obtained. Telephone interviews with both the county coroner and employer were conducted. A site investigation could not be arranged.

The incident occurred at a batch plant belonging to a ready-mix cement company. The company itself was 65 years old; this particular plant had been in operation for approximately eight years. The victim had worked as a plant maintenance man for seven years. The company had a safety officer and safety and health committees at its various plant locations. Written safety rules and procedures for tasks performed by workers, including the victim's task, were in place at the time of the incident. Confined space entry training, including a system of lockout-tagout and entry permits, was received by workers required to weld in empty hoppers. Other workers were instructed never to enter hoppers with material in them.

INVESTIGATION

Six cement ingredient hoppers, located in an unheated mixing tower, were being cleared of material in preparation for spring start-up operations. Each hopper was approximately 6 by 12 feet wide and 15 feet deep. A caged ladder on the outside of the plant building led to the entrance of the mixing tower, approximately 30 feet above the control room level. A railed 2-foot wide cat-walk spanned the outside edges of the open-topped hoppers in the mixing tower. A window in the control room allowed plant operators to watch while ingredients emptied from the bottom chutes of the hoppers during the weighing process. Four or five loads of sand had been unloaded from one of the hoppers when it ceased dropping material at 11:00 a.m.

The victim ascended the ladder and entered the mixing tower to dislodge sand from the sides of the hopper. He intended to use a 7-foot steel pole to reach down into the hopper during this process. He was alone in the mixing tower; there were no witnesses to the incident. It could not be determined whether the victim fell into the hopper from the catwalk or if he intentionally entered the hopper to gain better access to the lodged sand. It is clear that while he was in the hopper the sand loosened and fell from the sides, burying and trapping him. There was approximately 9 feet of sand in the hopper after the incident occurred.

The steel pole was observed falling from the hopper's bottom chute by personnel in the control room. When members of the plant crew could not locate the victim in the mixing tower they suspected that he was in the hopper and rescuers were summoned. Rescuers were unable to locate the victim after probing the surface of the sand; he was eventually removed from beneath the sand through the hopper's bottom chute. CPR was initiated on site, but the victim died of his injuries.

CAUSE OF DEATH

The cause of death reported by the county coroner's office was suffocation.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employees should be trained to recognize and avoid the hazards of confined spaces. The necessity of personal protective equipment use and the presence of a properly equipped stand-by person during entry should be stressed. This recommendation is in accordance with MN Rules 5205.1040, Subp. 2 (A, B, and C).

Discussion: Workers were instructed not to enter hoppers with material in them, but since entry was possible, the hazard of being buried should have been specifically addressed during confined space training. Confined space training should stress that death is the likely outcome if proper precautions are not taken before entry is made. These precautions include the use of safety belts or harnesses equipped with properly fastened life lines by the person entering the confined space and the presence of a properly equipped stand-by person within visual, voice, or signal communication. (NIOSH, 1986, 1987).

Recommendation #2: Fall protection should be used when working above confined spaces such as open-top tanks and hoppers.

Discussion: The use of fall protection (safety belt or body harness and life line) by employees working from catwalks above the open-topped hoppers was required but the victim was not using any at the time of the incident. Although the catwalk had a guardrail around its outer edge, it is conceivable that the victim fell over the top or slipped under the railing while trying to dislodge material with the pole. Guardrail measurements at the plant were not taken by MN FACE, but 29 CFR 1910.23 (e)(1) specifies that standard guardrails in work environments should be 42 inches high with a top and intermediate rail installed.

Recommendation #3: Employees should be protected from the engulfment hazards of open-topped hoppers by installing hopper covers to prohibit entry.

Discussion: The hopper in this incident was open-topped and guarded only by the railing on the catwalk. Hoppers could be covered with solid sheeting, or grating to allow access for tools, to prohibit intentional or inadvertent entry by workers. The use of fall

protection equipment and/or covers on hopper tops may have prevented this fatality.

Recommendation #4: Mechanical devices should be installed to loosen material from sides of hoppers.

Discussion: Mechanical vibrators are available to assist in keeping material from becoming lodged on the sides of hoppers. Installation of these devices could eliminate the need for workers to enter hoppers or put themselves in precarious positions while loosening sand or other lodged materials.

REFERENCES

1. Minnesota Department of Labor and Industry, Occupational Safety and Health Standards, Chapters 5205, 5206, 5207, 5210, 5215, Extract from 1991 MN Rules. 5205.1040, Subp. 2, (A, B, and C), St. Paul, MN.

2. NIOSH (1986) Alert: request for assistance in preventing occupational fatalities in confined spaces. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, NIOSH Publication No. 86-110.

3. NIOSH (1987) Alert: request for assistance in preventing entrapment and suffocation caused by the unstable surfaces of stored grain and other materials. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, NIOSH Publication No. 88-102.

4. Office of the Federal Register, Code of Federal Regulations, Labor, 29 CFR Part 1910.23 (e)(1), U.S. Department of Labor, Occupational Safety and Health Administration, Washington, D.C., July 1, 1991.

Georjean Madery, M.S.	David L. Parker, M.D., M.P.H.	Debora Boyle, D.V.M., M.P.H.
Safety Field Investigator	Principal Investigator	Epidemiologist
MN FACE	MN FACE	MN FACE