DATE: October 18, 1993

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

SUBJECT: MN FACE Investigation 93MN00701
Grain Elevator Worker Dies After Becoming Engulfed in Soy Beans

SUMMARY

A 71-year-old male part-time grain elevator worker (victim) died of injuries he received after becoming engulfed in approximately 5,000 bushels of soy beans. The incident occurred in a 120,000 bushel cement grain silo. The grain elevator had a written bin entry policy, but use of personal protective equipment (i.e., safety belt or harness and lifeline) was not part of it. Three chutes on the floor of the storage silo emptied beans onto an underground conveyor transport system located below it. The middle chute was not functional at the time of the incident; there was approximately 9 feet of beans in the bin when entry took place. The victim entered the silo with a 6-inch diameter hose connected to a rented grain vacuum and began vacuuming the remaining beans into a truck. He had been in the bin approximately 3 minutes when a coworker suspected he had become engulfed in the beans. Emergency medical personnel were summoned and the victim was recovered near the silo entry hatch about 20 minutes after he was discovered missing. Beans were about one foot over his head. Despite resuscitative attempts, he died the next day as a result of his injuries. MN FACE investigators concluded that, in order to prevent similar occurrences, the following guidelines should be followed:

> post warning signs at entrances to confined spaces containing stored material;

> provide lifelines and harnesses, and ensure that workers wear them before entering confined spaces containing unstable materials; and

> evaluate retrofitting grain storage facilities with mechanical leveling or raking devices to minimize the need for workers to enter grain storage bins.

INTRODUCTION

MN FACE was notified of a July 15, 1993, confined space fatality on July 19, 1993. Releasable information was taken from MN OSHA, the county coroner, and the county sheriff. The victim's employer was contacted, and permission to conduct a site investigation was requested. Due to management changes taking place at the grain elevator, the site investigation, including employer and coworker interviews, was delayed until August 10, 1993.

The incident took place in a cement grain silo at a local grain elevator. The elevator, an 88-year-old business, had been in operation at the incident site for 29 years. Six full-time employees and one part-time employee worked at the elevator. Written bin entry rules as well as written rules for other tasks workers performed at the elevator were in place. Worker training for confined space entry was on-the-job; the victim was following standard operating procedures at the time of the incident.

INVESTIGATION

The incident occurred in a 20-year-old, 120,000 bushel cement grain silo containing soy beans at a local grain elevator. The silo was 120 feet high and 55 feet in diameter. A round, 2-foot diameter hatch about 10 feet high on the side of the silo was the point of entry.

Three chutes on the floor of the storage silo emptied beans onto an underground grain conveyor transport system beneath the elevator's silos. As many beans as possible were removed from the silo using the conveyor system on the day of the incident, but the middle chute of the silo was not functional. There were more beans in the silo when entry occurred because of this malfunction than there would have been had the chute been operational. An estimated 5,000 bushels, or about 9 feet, of beans were in the silo when the victim entered; the silo had been ventilated with fans prior to entry.

The victim entered the silo with a 6-inch diameter hose connected to a rented grain vacuum and began emptying the remaining beans into a truck. The vacuum was operating at an estimated 1,200-1,500 bushels per hour. A coworker was present outside the silo during entry, but a safety belt or harness connected to a lifeline was not in use by the victim.

The coworker walked away from the silo momentarily. When he returned, about 3 minutes after entry, the vacuum was still running but the victim was no where in sight. The coworker suspected the victim had become engulfed in the beans and ran to the office to call 911. About 40 bushels of beans had been emptied into the truck at this time.
First responders probed for the victim when they arrived on the scene and began shoveling beans out of the silo. A second grain vacuum was rented and eventually brought to the scene to help empty the silo as well. The victim was found near the silo entry hatch with beans about 1 foot over his head. Oxygen was administered to him in the silo as soon as his face was uncovered; he was removed from the silo about 20 minutes after he was discovered missing and CPR was performed at this time. He was transported to a local hospital and later air-lifted to a larger metropolitan hospital. He died the day after the incident as a result of his injuries.

CAUSE OF DEATH

The cause of death reported by the county coroner's office was asphyxia secondary to immersion in soy beans.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Post warning signs at entrances to confined spaces containing stored material (NIOSH 1987).

Discussion: Signs to warn and remind workers of the hazards of unstable materials in confined spaces should be part of a confined space entry program. Safety signs, while helpful in the implementation of a program to control the hazards associated with confined spaces, are not in and of themselves sufficient to provide the information needed to prevent fatalities.

Recommendation #2: Provide lifelines and harnesses, and ensure that workers wear them before entering confined spaces containing unstable materials. This recommendation is in accordance with 29 CFR 1926.250(b)(2) and MN Rules 5205.1040, Subp. 2 (C).

Discussion: As this incident demonstrates, seconds and minutes are critical during confined space incidents and can mean the difference between life and death. A stand-by person was required by the elevator's confined space entry policy, but there was little he could do after the victim became engulfed except call for help. Lifelines and harnesses should be present at the entrances of confined spaces containing unstable materials, and should be used by all workers (including rescuers) entering them. If the manufacturer does not incorporate lifelines or

harnesses into the design of the storage bin or silo, then the employer should provide the equipment. The use of this equipment should be mandatory, and workers should be trained in how to use it. A stand-by person should tend the lifeline continuously when silos, bins, or other confined spaces are entered according to MN Rules 5205.1040, Subp. 2 (A, B).

Recommendation #3: Evaluate retrofitting grain storage facilities with mechanical leveling or raking devices to minimize the need for workers to enter grain storage bins.

Discussion: Grain bins, silos, hoppers, or tanks where unstable materials are stored, handled, or transferred should be equipped with mechanical leveling or raking devices or other means for remotely handling materials. Devices of this nature would minimize the need for workers to enter storage facilities or assist in minimizing the volume of grain in bins before entry. Usually, cone-shaped piles of loose material can be leveled, the bridging of material prevented, by mechanical agitation or vibration of stored materials. In this incident, repeated leveling of soy beans along with their removal by the conveyor system may have decreased the volume of beans to a safer level before entry for vacuuming took place.

REFERENCES

1. 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, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 88-102.

2. Office of the Federal Register, Code of Federal Regulations, Labor, 29 CFR 1926.250(b)(2), U.S. Department of Labor, Occupational Safety and Health Administration, Washington, D.C., July 1, 1992.

3. 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, C). St. Paul, MN.

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