The National Institute for Occupational Safety and Health (NIOSH)

Promoting productive workplaces through safety and health research

Farm Worker Asphyxiated in Grain Silo in Indiana

FACE 8739

Introduction:

The National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR) is currently conducting the Fatal Accident Circumstances and Epidemiology (FACE) Project, Which Is focusing primarily upon selected electrical-related and confined space-related fatalities. The purpose of the FACE program is to identify and rank factors that influence the risk of fatal injuries for selected employees.

On November 1, 1986, a 51 year-old farm worker (for unknown reasons) entered an oxygen limiting silo through the top opening and was asphyxiated.

Contacts/Activities:

Officials of the Occupational Safety and Health Program for the State of Indiana notified DSR concerning this fatality and requested technical assistance. This case has been included in the FACE Project. On May 5, 1987, a DSR research industrial hygienist conducted a site visit, collected incident data, met with the farm owner and his advisor, and photographed the accident site.

Overview of Employer's Safety Program:

The employer is a privately owned farm which has one full-time worker and one part-time worker. The farm has no written safety program. Safety is left up to the individual worker. However, the owner has standing orders that no one is to enter any of the silos.

Synopsis of Events:

On November 1, 1986, the owner of the farm and his full-time employee (the victim) were filling an 80 foot high silo with alfalfa silage at the farm's feed lot. The feed lot has four 80 foot high oxygen limiting silos. on the day before this incident one of the other silos had been filled with alfalfa silage to within five feet of the top and sealed.

Around 3:00 p.m. on the day of the incident, the farm owner told the victim he had to go into town. while the owner was gone, the victim was to clean up the spillage around the silo being filled and to put away the equipment. When the laborer had completed these tasks he could go home.

A part-time employee at the farm arrived at 4:00 p.m. Upon arrival, he noticed the tractor's engine was running; however, the victim could not be found. The part-time employee went home and brought his parents back to help look for the victim. The father noticed a ten foot ladder was located under the ladder permanently attached to the silo filled previously. (The ten foot ladder was needed to access the first rung of the ladder permanently attached to the silo.) The part-time employee proceeded up the ladder searching for the victim. When he reached the top of the silo, he observed that someone had opened the 17 inch diameter hatch, removed the breather bags, and tied them off on the top of the silo. The part-time employee looked into the silo and did not see anyone. The father then ascended the silo, looked inside, and saw the victim approximately ten feet from the opening. The father yelled down to his wife to go for help. The father then entered the silo and crawled over to the victim. The victim was unresponsive. The father pulled the victim over to the opening where he was assisted by his son in removing the victim from the silo.

The emergency call was responded to by the county sheriff's office, the volunteer five department, ambulance personnel, and the farm owner. Fire department personnel began CPR on top of the silo and CPR was continued during transport to a nearby hospital. The victim did not respond to resuscitative efforts and was pronounced dead in the emergency room.

Cause of Death:

The coroner's report stated "accidental suffocation as a result of aspiration of plant material." The coroner's verdict and the sheriff's report proposed similar scenarios; when the victim opened the door on top of the silo, he was overcome by fumes (nitrous oxide) and fell through the opening into the silo.

NOTE: Following interviews with the farm owner and his advisor, the manufacturer of the silo, and review of the sheriff's report and the coroner's verdict, these points of interest and unanswered questions were brought out.

• No one "except the owner" is to enter the silos, when silo entry is required.

• The silo entered was filled and the top hatch sealed the previous day. The farm owner and the victim were filling another silo on the day of the incident.

• The victim moved the ladder from the silo being filled to the silo previously filled, climbed to the top of the silo, opened the hatch, removed the breather bags, and tied the bags to the top of the silo. The coroner and police reports state that the victim then fell through a 17 inch diameter opening and crawled or staggered approximately ten feet from the opening to the side of the silo.

• The work procedure assigned (cleaning around the silo being filled) did not require ascending or entering the silo previously filled.

• A representative of the manufacturer of the silo stated the convection potential of the silo gases would be vented when the first cam (of four cam latches) was released on the hatch on top of the silo. After being closed for 24 hours the 02 level inside the silo would be less than ten percent and the C02 level would be in excess of 25%. Also, small quantities of nitrous gases (nitrous oxide and dioxide) could be present. Since C02 and N02 are heavier than air, they would not come out the top except through the convection current potential, which would be released immediately upon removal of the hatch. The heavier than air gases would settle along the top of the silage. The gases coming out of the top opening would have a pungent odor and cause some eye irritation; however, these gases would not be of sufficient concentration to overcome a worker.

Recommendations/Discussion:

Recommendation #1: Personnel evaluating this accident and formulating conclusions should reevaluate these conclusions, as they do not coincide with the sequence of events.

Discussion: The coroner's verdict stated the victim was overcome by nitrous oxide, fell into the silo, and died of suffocation as a result of aspiration of plant material. As stated, the cause of death was apparent. However, the possibility that opening the hatch, pulling out the breather bags, tying these bags off at the top, and then passing out from the nitrous oxide, falling through a 17 inch diameter opening, and crawling away from that opening is extremely remote. The silo manufacturer's representative stated the gases would be vented when the first cam on the hatch was opened. By the time all four cams were opened and the hatch removed, the interior of the silo should have reached equilibrium with the exterior. Residual gases heavier than air would remain inside the silo.

Recommendation #2: The employer should develop comprehensive policies and procedures for confined space entry.

Discussion: All employees who are required to work in or around confined spaces should be aware of potential hazards, possible emergencies, and specific procedures that are to be followed. NIOSH Publication No. 80-106 "Working in Confined Spaces" was left with the employer as a reference for developing confined space entry procedures. Prior to entry into a confined space, the following should be addressed:

1. Is entry necessary? Can the task be completed from the outside?

2. Has a permit been issued for entry?

3. Has the air quality in the confined space been tested?

• Oxygen supply at least 19.5% • Flammable range less than 10% of the lower flammable limit • Absence of toxic air contaminants

4. Has the confined space been isolated/locked out from other systems?

5. Have employees and supervisors been trained in selection and use of personal protective equipment and clothing?

• Protective clothing

• Respiratory protection

• Hard hats

• Eye protection

• Gloves

• Life lines

• Emergency rescue equipment

6. Have employees been trained for confined space entry?

7. Is ventilation equipment available and/or used?

B. Is the air quality tested when the ventilation system is operating?

Return to In-house FACE reports

Last Reviewed: November 18, 2015