



The National Institute for Occupational Safety and Health (NIOSH)

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Worker Dies in Fermentation Tank in Montana

FACE 8613

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. By scientifically collecting data from a sample of fatal accidents, it will be possible to identify and rank factors that influence the risk of fatal injuries for selected employees.

On January 29, 1986, a 35-year-old worker was hosing down the interior (from the outside-top opening) of a fermentation tank when the accident occurred. For some unknown reason, the worker entered the tank and was confronted with an atmosphere of 6% oxygen (O₂) and 48% carbon dioxide (CO₂).

Contacts/Activities:

The Division of Safety Research was notified of this confined space fatality by the NIOSH Region VIII Consultant. The employer and the OSHA Area office were agreeable to the NIOSH evaluation of this case. This case has been included in the FACE Project and technical assistance was provided the employer. On March 10, 1986, the DSR FACE Project Director and the NIOSH Region VIII Consultant met with the OSHA Area Director and Compliance Officer investigating this fatality. On March 11, 1986, the site of the fatality was visited and evaluated via interviews with the owner and plant manager, and photographs were taken.

Overview of Employer's Safety Program:

The victim worked for an alcohol and feed mash producing operation which employs 9 workers (including the plant manager). The plant contains thirty stainless steel fermentation tanks, 84 inch diameter by 88 inches high, which hold approximately 1200 gallons each. The fermentation process is cyclic so when some tanks are coming down, others are starting up. The victim had been on the job for approximately three weeks, and had received on-the-job training only. On-the-job training primarily focused on plant operation with very little emphasis on safety. The only training received regarding confined spaces was a warning not to enter the tanks because of the CO₂ hazard. All on-the-job training is taken from a plant operations manual, with extremely basic safety recommendations. The plant has no written safety policies or confined space entry procedures with the exception of the plant operations manual.

Synopsis of Events:

The plant operates on two twelve hour shifts, with four days on and three days off . The late shift consists of two workmen, of which one is the team leader or shift foreman. After a fermentation cycle is completed, the tank is drained and pumped into the separator. At this time it is necessary to hose down the interior of the tank to remove the slurry that adheres to the sides. The workman usually lays down on top of the tank, and sprays water through the 18" diameter opening, located at the center of the tank.

The incident occurred at approximately 9:00 p.m. on January 29, 1986 after the foreman told the victim to hose down the interior of one of the fermentation tanks that was being drained. It is believed the workman's hat fell into the tank and he was attempting to retrieve it when the fatal incident occurred. The tank agitator had been turned off, which meant the victim had gone over to the control room to turn off the motor before attempting to remove his hat. It is believed the victim leaned in through the top opening, head first, and slipped/fell through the opening and struck his head on one of the agitator blades located at the bottom of the tank. (The coroner's report listed a semi-circular cut above the right eye.) The tank had approximately 12-18 inches of fermented slurry in the bottom. The foreman came out of the dehydration (final distillation) room and heard a thumping-thrashing noise in one of the tanks. He checked and found the victim trying to get out of the tank. Unable to reach the victim, he secured a rope and looped it around the victim's arm; however, he was still unable to pull the victim out of the tank. The foreman then called the plant owner and rescue squad. It was approximately two hours from the time the victim was discovered until his removal from the tank. The victim was dead when removed.

The atmosphere In the tank was tested by the OSHA Compliance Officer and revealed the atmosphere was 48% C02 and the O2 level was displaced to 6%.

A by-product of fermentation is C02, a simple asphyxiant, which will displace O2 in a confined space. This is known by the plant owner and plant manager and is stressed to all employees. The plant owner stated "entry into a tank is forbidden without the approval of the plant manager or plant owner." The owner also stated if the victim had been trying to retrieve his hat from the tank, a nearby pole could have been used.

It should be noted the plant owner has installed a steel bar across the top opening of every tank so entry is impossible without unbolting this bar. Also, the owner has ordered atmospheric test equipment to test the O2 and C02 levels in the tank before any entry is made. It should also be noted the shift foreman who attempted to pull the victim out of the tank did not enter the tank, which is an all too common response to a man-down in a confined space which frequently results in a double fatality.

Cause of Death:

The coroner's report listed the cause of death as: of asphyxia due to the exclusion of oxygen by carbon dioxide."

Recommendations/Discussion:

Recommendation #1: In addition to the operations manual and it's limited safety sections, a comprehensive safety program should be developed. As part of this written safety program, the employer should develop procedures for confined space entry.

Discussion: All employees who work in or around confined spaces should be aware of potential hazards, possible emergencies, and specific procedures to be followed prior to entering a confined space. These procedures should include, but not be limited to:

1. Air quality testing to determine adequate O2 supply and level of C02.
2. Ventilation of the space to remove air contaminants.
3. Monitoring of the space to determine a safe oxygen level is maintained.

- 4. Lockout/tagout procedures to control hazardous energy, i.e., agitator blades.

- 5. Employee and supervisory training in confined space entry, testing, and use of personal protective equipment (respirators, clothing, etc.).

- 6. Emergency rescue procedures.

Air quality (O2 level and CO2 level) was not tested prior to this unauthorized enter. O2 and CO2 testing devices have been ordered for testing the atmosphere. Training on correct use of these devices, plus calibration of each should be stressed. Respirator training, fitting, and proper maintenance procedures should be required of all plant employees.

The plant manager and owner were provided the following:

- NIOSH Document Criteria for a Recommended Standard, Working in Confined Spaces. DHEW, NIOSH Publication No. 80-106.

- NIOSH Alert on Confined Spaces. DHHS Publication No. 86-110.


- Confined Spaces Hazard Recognition. Article by Ted Pettit.

- NIOSH Recommended Guidelines – Controlling Hazardous Energy During Maintenance and Servicing. DHHS Publication No. 83-125.

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