

TO: Director, National Institute for Occupational Safety and Health

FROM: California Fatality Assessment and Control Evaluation (FACE) Program

SUBJECT: Warehouseman Dies from Asphyxiation in Salt Storage Bin in California

SUMMARY

**California FACE Report #94CA009
December 22, 1994**

A 27-year-old white, Hispanic male warehouseman (employee #1) died from asphyxiation when he fell through a salt bridge into an air pocket and was buried by salt in a storage bin. The decedent and a co-worker (employee #2) had been instructed to enter the salt storage bin from the top entrance and to use shovels to loosen salt which had stuck to the walls of the bin. Both employee # 1 and #2 were wearing personal protective equipment (PPE), including a harness and lanyard. Two other co-workers (employees 3 & 4) "tied off" their lanyards and attached a manual winch to raise and lower employees inside the bin. Both employee #1 and #2 at work inside the bin when the surface of salt gave way. Employee #2 fell approximately 15 feet into the air pocket below the salt bridge and employee #1 fell approximately 20 feet into the air pocket. Employee #2 was restrained by his lanyard and did not suffer any serious injury. Employee #1's lanyard had more slack allowing him to be buried by the salt. Co-workers called 911 and began to dig the salt away from the bottom entrance to the bin. The Fire Department arrived and the decedent was brought out of the bin approximately 15 to 20 minutes after the incident occurred. He was in full arrest at that time and cardiopulmonary resuscitation (CPR) was administered. He was transported to a local hospital where he was pronounced dead at 8:44 a.m. The CA/FACE investigator concluded that in order to prevent similar future occurrences, employers should:

- install devices that prevent stored granular materials from lodging on the inside of bins.
- identify salt bins as confined spaces and post hazard warning signs at all entrances and develop written comprehensive policies and procedures for confined space entry.
- address rescue operations whenever workers are assigned to areas where the potential for falls or entrapment exists.
- provide fall protection equipment and training for all workers who may be exposed to fall hazards and conduct inspections on equipment to assure proper fit and use.

- not allow workers to stand on or work from the surface of loose, granular materials, capable of bridging, even when the surface appears to be stable.
- ensure that employees are trained in hazard recognition and safety awareness.

INTRODUCTION

On May 9, 1994, a 27-year-old warehouseman (the decedent) died after being asphyxiated when he was covered by salt in the bin where he was working. The CA/FACE investigator was informed of this incident on May 10, 1994 by the California Occupational Safety and Health Administration's (Cal/OSHA) Bureau of Investigations (BOI) office. The CA/FACE investigator and a National Institute of Occupational Safety and Health (NIOSH) Trauma Investigator went to the site on May 11, 1994 and conducted an interview and site investigation with the employer and his attorney. Copies of the Cal/OSHA Report and the Coroner's Autopsy Report were also obtained by the CA/FACE investigator.

The employer in this incident was a salt processing plant. Imported raw salt is processed into several different grades used for industrial purposes. The raw materials are stored in large storage containers (5'wide x 34'high x 14'long), processed and eventually shipped to customers. There were 29 employees working for the company at the time of the incident, and 13 of those employees had the same job title as the decedent. The company had been in business for 8 months at this location and the decedent was employed with the company for the same amount of time.

The decedent in this incident was a union employee and there was a joint labor/management safety and health committee. A safety officer, who devoted between 25-50% of his time to safety issues, was on staff. Safety rules were maintained and several types of safety training (classroom, on-the-job, and reference manuals) were conducted according to management. There were also specific safety procedures in place for the job the decedent was doing at the time of the incident.

INVESTIGATION

On the day of the incident, the decedent (employee #1) and a co-worker (employee #2) were told by their supervisor to clean the inside of a salt storage bin (see exhibit 1A). The company had installed large screw conveyors at the lower part of the bin so that the salt could easily flow through to the auger. However, air pockets occasionally developed above the conveyor. When this occurred, the conveyor could not move the salt. The workers' job involved entering the bin and loosening salt stuck to the sides of the bin with shovels so that the salt could be pulled by conveyors to an auger below. The decedent had only performed this task on one other occasion, and it was employee #2's first time performing this type of work.

The entrance to the bin was located at the top of the bin. The bin had a maximum capacity of 60 tons of salt or a volume of 2380 cubic feet. There were no confined space warning signs or labels at the entrance to the bin. According to management officials the bin had been ventilated prior to the workers' entry. However, Employee #2 was not aware of any air monitoring tests prior to his entry into the bin. Employee #2 stated that the safety harnesses had already been put together when he arrived at the bin entrance so he and the decedent put them on with help from co-workers. The safety lanyards were tied off to a steel rail several feet from the entrance by the co-workers stationed there. The decedent entered the bin first followed by employee #2. Neither employee wore a respirator. PPE worn by the employees included dust

masks, boots, hardhats, safety glasses, safety harnesses, and safety lanyards. Two co-workers were stationed at the entrance to the bin in order to provide assistance to the workers inside and also to operate the manual winch.

At approximately 7:15 am, the decedent and employee #2 were at work inside the bin when the surface (salt) on which they were standing on gave way and they fell through an air pocket. The decedent's lanyard had too much slack. Consequently, he fell to the lowest portion of the air pocket, or approximately 20 feet, where he was buried by the falling salt. Employee #2 was restrained by his protective lanyard at the upper portion of the air pocket, after falling approximately 15 feet. He suffered no serious injury. The employees had not been provided with a safe working platform and a rescue team was not immediately available. Employee #2 stated that after the incident occurred he looked down but could not see the decedent below him.

Employee #2 alerted employee #3 and #4 as to what had happened, and asked them to pull the decedent out from under the salt. The co-workers stated that they tried to pull up the decedent but that the weight of the overlying salt made this impossible. Employee #2 also tried to help dig the salt away from the decedent but was unable to do so because his position would not allow him the necessary leverage. He asked his two co-workers not to pull him up through the top entrance because of the way the salt was positioned around him. Instead, he asked them to untie his lanyard and let him drop approximately 4 to 5 feet to the surface below. He was then pulled out through a halfway hatch in the bin.

Co-workers called 911 and began to dig the salt away at the base entrance of the bin. Fire Department personnel arrived and the decedent was pulled from the bin approximately 15 to 20 minutes after the incident occurred. The decedent was in full cardiac arrest and CPR was attempted. The victim was transported to a local hospital where he was pronounced dead at 8:44 am.

CAUSE OF DEATH

The Coroner's Autopsy Report has not been received yet, but according to a Doctor's First Report form the decedent died from asphyxiation.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should install devices which will prevent stored granular materials from lodging on the inside of bins.

Discussion: Devices are available which, when installed in a bin, can prevent material from bridging or can dislodge bridged material without the need for workers to be exposed to the hazards of confined spaces or unstable materials. These devices range in complexity from a simple chain hung down the center of the bin, to mechanical vibrators.

Recommendation #2: Employers should develop written comprehensive policies and 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 level.
2. Ventilation of the space to remove air contaminants.
3. Monitoring of the space so a safe oxygen level is maintained.
4. Employee training in confined space entry, testing, and use of personal protection equipment (respirators, clothing, etc.)
5. Placement of a standby person outside the confined space for communication and visual monitoring.
6. Emergency rescue procedures.

Even though there were no dangerous air contaminants in the confined space, entry into a confined space should not be attempted until atmospheric testing of the confined space ensures that the atmosphere is safe. This testing requirement applies to all confined spaces. Testing must be done by a qualified person prior to entry. Specific recommendations regarding safe work practices in confined spaces can be found in the NIOSH Publication No, 80-106, "Working in Confined Spaces." This publication also defines and provides recommendations for ventilation, communication, entry and rescue, posting, safety equipment, clothing, etc. It is also required under Title 8 of the California Code of Regulations (CCRs) section 5157 (c) (4) that if an employer decides that its employees will enter permit spaces, the employer shall develop and implement a written permit space program that complies with this section. The written program shall be available for inspection by employees and their authorized representatives.

Recommendation #3: Employers should address rescue operations whenever workers are assigned to areas where the potential for falls or entrapment exist.

Discussion: In this case the decedent was working at an elevation within a confined space. Because of this, the potential for falling within the confined space existed. Despite the hazards involved, no pre-planning for any type of rescue operation had been made. When working in similar locations employers should develop a written rescue procedure to be used in the event an incident should develop. This rescue procedure should include actions to be taken by other employees as well as prior notification of local fire department/rescue personnel. It is also required under Title 8 of the CCRs section 5157 (d) (9) that employers develop and implement procedures for rescuing entrants from permit spaces, for providing necessary emergency services to rescued employees, for summoning additional rescue and emergency services, and for preventing unauthorized personnel from attempting a rescue.

Recommendation #4: Employers should provide appropriate fall protection equipment and training for all workers who may be exposed to a fall hazard. In addition, employers should have employees and supervisors inspect lanyards and harnesses to assure proper fit and use before such use by employees.

Discussion: In this incident the decedent had an additional 5 feet of slack in his lanyard when compared with his co-worker who survived. Employers should provide fall protection equipment for all workers exposed to fall hazards, and should provide worker training in the

proper use of this equipment. Once this training is provided, employers should initiate measures to ensure its proper use. A safety belt and lanyard, suitably anchored, would be appropriate fall protection for use in the bin in this incident. When properly installed, such fall protection equipment prevents workers from being engulfed if they fall into a bin or other confined space containing unstable materials, providing additional life-saving benefits. In this situation, had the additional slack in the lanyard been identified and corrected, it would have restrained the decedent above the salt.

Recommendation #5: Employers should not allow workers to stand on or work from the surface of loose, granular materials, even when the surface appears to be stable.

Discussion: Workers should be made aware of the hazards, such as engulfment, bridging, and crusting, associated with unstable surfaces. Workers should be instructed in the identification of these hazards and appropriate methods needed to avoid them. Under Title 8 of the CCRs section 3270 (b) every permanent elevated location, where there is machinery, equipment, or material which is customarily operated or frequently repaired, serviced, adjusted, or otherwise handled shall be provided with a safe platform or maintenance runway. Access shall be by means of either fixed ladders or permanent ramps or stairways.

Recommendation #6: Employers should identify salt bins as confined spaces and post hazard warning signs at all entrances.

Discussion: Employers should identify potentially hazardous areas within their facilities, and provide Caution/Warning signs to be affixed at or near the points of access to the hazardous areas (e.g., at or near the opening to a confined space). Such warning signs should be easily visible to anyone approaching the area, should contain specific information of procedures, notification, and/or authorizations required in the event entry becomes necessary; and should be periodically inspected on a routine basis. Under Title 8 of the CCRs section 5157(c)(2) If the workplace contains permit spaces, the employer shall inform exposed employees, by posting danger signs or by any other equally effective means, of the existence and location of, and the danger posed by the permit spaces.

Recommendation #7: Employers should ensure that employees are trained in hazard recognition and safety awareness for all potentially hazardous tasks.

Discussion: Although employees had received on-the-job training in this case, they had received no formal training for the tasks to which they were assigned. The decedent in this incident had only worked cleaning the inside of a storage bin on one other occasion. This was employee #2's first time inside the bin. A comprehensive safety training program which stresses the importance of using the safety equipment provided by the employer, and which increases employee understanding of hazards and how to utilize protective equipment might have prevented this fatality. Under Title 8 of the CCRs section 3203(a)(7)(c) & (f) requires employers to have in their Injury and Illness Prevention Program (IIPP) a section on employee training and instruction. This shall apply to training needed for employees given new job assignments for which training had not previously been provided and also requires that supervisors familiarize themselves with the safety and health hazards to which employees under their immediate direction and control may be exposed.

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FATALITY ASSESSMENT AND CONTROL EVALUATION PROGRAM

The California Department of Health Services, in cooperation with the Public Health Institute and the National Institute for Occupational Safety and Health (NIOSH), conducts investigations of work-related fatalities. The goal of this program, known as the California Fatality Assessment and Control Evaluation (CA/FACE), is to prevent fatal work injuries in the future. CA/FACE aims to achieve this goal by studying the work environment, the worker, the task the worker was performing, the tools the worker was using, the energy exchange resulting in fatal injury, and the role of management in controlling how these factors interact. NIOSH-funded, state-based FACE programs include: Alaska, California, Iowa, Kentucky, Massachusetts, Michigan, Minnesota, Nebraska, New Jersey, New York, Oklahoma, Oregon, Washington, West Virginia, and Wisconsin.

Additional information regarding the CA/FACE program is available from:

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