The National Institute for Occupational Safety and Health (NIOSH)

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Worker Dies in 20,000 Gallon Gasoline Bulk Tank While Wearing Closed Circuit SCBA in Vermont

FACE-8509

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 La foaming primarily upon selected electrically-related fatal injuries and confined space fatalities. By scientifically collecting data from a supple of fatal accidents, It will be possible to identify and rank factors Which influence the risk of fatal Injury for selected employees.

On January 30, 1985, at approximately 11:30 a.m., two members of a family owned and operated waste oil service company and one employee arrived at a tank farm and began their preparations for cleaning a gasoline storage tank. The tank was entered by the son who was wearing a closed circuit, constant flow self contained breathing apparatus (SCBA). After descending the ladder and motioning that he was okay, he took several steps and fell forward into the sludge where he died before he could be rescued.

Contacts/Activities

The Vermont Department of Health originally contacted DSR about this case in early February requesting an examination of the closed circuit SCBA which was worn by the victim. They also extended an invitation for us to come to Vermont to collect research information. On March 6 and 7, 1985, a research occupational health nurse and a fire protection engineer visited the Vermont OSHA (VOSHA) inspector in charge of the investigation, the family of the victim, the employee, and one of the fireman who entered the tank in the rescue attempt. The manager of the tank farm denied the team entry to take on-site photos.

Synopsis of Events

On January 28, 1985, a waste oil service company was subcontracted to clean a bulk storage plant tank. The waste oil service company was a family-owned and operated business. The father and son had employed a laborer to help them with this clean-up operation. Upon arrival at the bulk plant, they discovered that the tank to be cleaned was a 20,000 gallon elevated horizontal gasoline tank. They had come prepared to clean a fuel oil tank. Because the gasoline tank presented an explosion hazard they couldn't exhaust the tank by use of a truck mounted blower which was their usual procedure for oil tanks. Instead, they pumped 200-300 gallons of waste gasoline from the tank, opened the 16-inch diameter top access hole and left the site.

Two days later, on January 30, the three men purchased a used closed circuit SCBA, which was adequate for the job to be done, and returned to the bulk plant. The son, a trained volunteer fireman, skimmed through the closed circuit SCBA instruction manual, donned the unit and fitted it in preparation for entry to the tank. He then removed the closed circuit

SCBA and ascended the ladder to the top of the storage tank. In order to enter the tank, he put the facepiece on and had the laborer hold the unit above his head while he descended the ladder several rungs to clear the access opening. The laborer handed him the closed circuit SCBA and he mounted the unit on his chest, cinching it up after reaching the bottom of the tank. The laborer asked if he was okay and the victim nodded no then circled to the other side of the ladder, took one more stop and collapsed face down into approximately 1 1/2 inches of sludge.

The laborer yelled to the victim's father to call for help and then descended into the tank. He had on no protective equipment and was not equipped with any rescue equipment (lifelines, harnesses). The laborer entered the tank and shook the victim. When there was no response, he tried to tie a rope around the victim's chest, but had to leave the tank to got some fresh air. He re-entered the tank and was again unsuccessful at getting a rope around the victim.

The fire department arrived approximately five to six minutes after the victim went down. Two firefighters attempted to enter the tank wearing protective clothing and open circuit SCBA. Because of the size of the opening, they had to remove their turnout coats and the harness-backpack assembly of their SCBA prior to the entry. They, too, had their open circuit SCBAs held over their heads to permit entry through the small diameter access hole. One of the firemen checked the seal on the victim's facepiece and thought it was adequate. He then broke the seal in an attempt to determine whether or not there was air flow. Upon sensing that there was no flow, he felt for a valve. (He noted that it was dark in the tank, and that there was poor visibility.) When he felt the valve which he believed to be the by-pass valve, he turned it and heard a flow of oxygen. The two firefighters tried to remove the victim from the tank but because of the small (16 inch) access port, they were unable to. After approximately 20 minutes, when their low pressure alarms sounded, they exited the tank. Another firefighter entered the tank, tied a rope around the victim's feet and hoisted him out feet first. A ladder truck was used to lower the victim to the ground.

It should be noted that with this unit, there is a constant 0_2 flow of approximately 3 1/m. This flow would probably not have been discernible to the firemen.

Resuscitation was initiated and the victim was transported to a local hospital where he was pronounced dead.

Various factors contributed to the occurrence of this fatal accident. Some of the factors follow:

1. The victim was a volunteer fireman who was experienced in wearing an open circuit SCBA. The unit he purchased and used to enter the gasoline tank was a closed circuit unit. There are major differences in the way these units operate. For example, if an open circuit doesn't have the air cylinder turned on, you can't inhale. ln a closed circuit unit with a breathing bag, (such as the one worn by the victim) there is enough residual volume in the bag to allow you to inhale and exhale normally even without the oxygen cylinder turned on. lf, however, the oxygen cylinder is not adding oxygen to the breathing environment. the user quickly depletes the oxygen in the breathing bag and becomes anoxic. It is not known whether this occurred, but inadequate training and experience with the unit could be considered to be a factor in this incident.

2. Access into and out of the confined space was via a 16-inch port–at the top of tank. There were no openings in the bottom or sides of the tank.

3. This small, family-owned and operated company has no written safety procedures, no SCBA use procedures and no confined space entry procedures. Furthermore, the company does not take 0_2, CO, or combustible gas measurements prior to tank entry.

6. The victim was not wearing emergency escape equipment such as a harness or wrist harness with attached life line.

5. The top man was not equipped with emergency rescue equipment, i.e. SCBA, protective clothing, rescue lifting device, etc.

6. The bulk plant management and the contractor presumably have access to reports published by the American Petroleum Institute and by various oil companies about the hazards of confined spaces and their entry procedures. The family owned and operated subcontract company, on the other hand, did not have access to this information and was not aware of confined space safe work practices.

Recommendations

1. Prior to donning and using any SCBAs the user should be thoroughly familiar with the unit's operation, intended uses, limitations and emergency air flow. In addition, firefighters, paramedics and anyone else responsible for emergency rescue from confined spaces should be cognizant of the differences between open and closed circuit SCBA's. Knowledge of one SCBA does not presume adequate knowledge of all SCBA.

2. Working and emergency access and egress plans should be made prior to entering any confined space. Entry into a confined space with only one access and/or a small access should be considered a high-risk activity and emergency egress plans should be carefully made.

3. Owners of storage tanks which must be entered for maintenance or repair, and which have only a single, small access portal, should have an additional portal cut into the tank at a location which would permit easy egress in case of emergency.

4. A confined space entry policy and procedure should be written and utilized for each entry. The policy and procedures should indicate: work areas designated as confined spaces, conditions when entry into confined spaces is authorized, procedures to be followed before entry is permitted (testing, entry, permit, training, personal protective equipment, lockout/tagout procedures, etc.) and rescue procedures.

Workers who, in the course of their work, may have to enter confined spaces should complete a training program designed to inform them of the hazards they may encounter, procedures to be used in evaluating a confined space, entry procedures and emergency rescue procedures.

5. Employers who elect to contract out hazardous work. such as cleaning fuel storage tanks, should consider safety procedures part of the contract and should enforce those safety procedures.

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