

FACE 93-08

Three Contract Workers Die while Repairing a Sodium Hypochlorite Tank at a Wastewater Treatment Plant - Virginia

SUMMARY

Three contract workers (the victims) died while repairing the interior rubber lining of an 18,000-gallon sodium hypochlorite tank at a wastewater treatment plant. The three workers were working in a confined space, using extremely toxic and flammable chemicals (toluene, xylene, methanol, isopropanol, and methy-lethylketone) with no ventilation, no respiratory protection, no standby person, and no emergency procedures. Their last contact was with a maintenance worker at the wastewater treatment plant on September 23, 1992. They were found by the plant maintenance engineer at the bottom of the tank, near the ladder, two days later. After the victims were discovered, the fire rescue squad was called. A paramedic (donning respiratory protection), entered the tank and determined all three men were dead. Before the victims could be removed the tank had to be thoroughly ventilated to clear the explosive atmosphere. NIOSH investigators determined that, to prevent similar occurrences, employers should:

- develop, implement and enforce a comprehensive confined space entry program
- provide a standby person on the outside of a confined space when work is being done inside the space
- require that all contractors have a written safety program specific to the work to be performed.

INTRODUCTION

On September 25, 1992, three contract tank repair workers (the victims), a 39-year-old male foreman, and two male laborers, ages 53 and 22, were found by the plant maintenance engineer inside a sodium hypochlorite tank at the wastewater treatment plant (WWTP). On November 23, 1992, the Virginia Department of Labor and Industry, Occupational Safety and Health Program (VAOSH) notified the Division of Safety Research (DSR) of these fatalities and requested technical assistance. On December 16, 1992, an environmental health and safety specialist from DSR conducted an investigation of this incident. Representatives of the WWTP, county safety specialists, and VAOSH compliance officers were interviewed and photographs were taken of the incident site.

The employer in this incident was a contractor that specialized in repairing and fabricating storage tanks. The company had 13 employees, including the company owner, a secretary, 2 shop workers, 2 welders, 3 rubber workers (the victims), 2 sales personnel, and 2 field workers. The employer had entered into an agreement with a county WWTP to spark test the interior of

two 18,000-gallon, rubber-lined, horizontally mounted sodium hypochlorite tanks. After testing was completed, the contractor provided the county a written report of the test results and the cost of repairs. The county hired the contractor to repair the tanks in accordance with the test results.

The contractor did not have a written safety program or a confined space entry program; therefore, the contractor hired a consultant to provide training to the employees on hazard communication, which included the chemicals used by the contractor, the effects of these chemicals on the body, and the need for ventilation in enclosed spaces. The county that issued the contract has a comprehensive safety and confined space entry program; however, the contractor was not required to comply with the county's safety policies. The contract required the contractor to follow all applicable federal and state regulations.

INVESTIGATION

The site of this incident was a wastewater treatment plant (WWTP) for a large metropolitan area. The WWTP had eight rubber-lined chlorination tanks, six of which were repaired in 1989. The two remaining tanks were to be repaired in 1992. The rubber lining of these two sodium hypochlorite tanks had been spark tested (an electronic test device used to locate holes or imperfections in a rubber lining) by the contractor in July, 1992. The tests revealed that the rubber lining of the tanks was in need of repair.

The three rubber workers (1 foreman and 2 workers) arrived at the WWTP at 8 a.m. on September 22, 1992, and met with the plant maintenance engineer to discuss the proposed repair work on the tanks. Since the workers did not have hard hats or an atmospheric gas testing instrument, the plant maintenance engineer provided the workers with hard hats and an atmospheric testing instrument capable of testing oxygen content, flammability, and hydrogen sulfide, and instructions on how to use the instrument. The plant maintenance engineer also told the foreman that the tanks were confined spaces and that the foreman would be required to test and monitor the atmosphere. The foreman stated they had airline respirators in the truck and requested permission to use the compressed air system in the building. The plant maintenance engineer told them to use the air piping connection next to tank number 4; however, this type of air supply system did not have provisions for supplying breathing-quality air. The foreman asked if there were any equipment rental places in the area where they could rent an air mover. The plant maintenance engineer gave the foreman the name of the closest equipment rental shop, assuming they would rent appropriate ventilation equipment. Before leaving, the plant maintenance engineer told the men where the telephone was located, and directed them to dial 911 for emergency assistance or contact the plant operator to reach him by radio.

The next morning, September 23, 1992, at the beginning of the shift, the plant maintenance engineer observed the three workers at their van outside the building that housed the chlorination tanks and stopped to talk. The foreman told the plant maintenance engineer that the day before, after approximately 6 hours of use, the atmospheric gas test instrument had been displaying a low battery reading. The plant maintenance engineer told him he would need to exchange the instrument when a low battery reading was indicated. The three workers then went into the

building to continue the repair work on the interior of the tanks. They carried a gas testing instrument with them; however, the plant maintenance engineer did not know if they took the instrument they had used the day before or another one.

A maintenance worker for the WWTP was doing metal repair work to the interior of tank number 3 while the three rubber workers were working in tank number 4. The two 18,000-gallon tanks were approximately 6 feet apart. The maintenance worker needed to talk to the foreman about the metal patch work he was doing, so he went down into tank number 4 via the 24-inch-diameter top opening. The maintenance worker indicated the fumes were so bad, he stated, "I hope nobody smokes, because if anybody lights a match, this place is gonna blow." "I told them I needed to talk with them but I couldn't stand it in there." The maintenance worker was in tank number 4 for approximately 30 seconds. He noted that all three workers were wearing only their street clothing, and the only respiratory protective equipment in use was a dust mask worn by one of the workers. There was no standby person positioned outside of the tank. The maintenance worker exited tank number 4, followed by the three workers. The maintenance worker asked how do you breathe in that tank and they replied they were used to it, but they needed some fresh air anyway. They were using chemicals that contained toluene, xylene, methylethylketone, isopropanol, and methanol for the rubber repair. The foreman advised the maintenance worker not to leave any sharp edges in tank number 3. The maintenance worker then re-entered tank number 3 to finish the metal patch work. When he left tank number 3 at 12:45 p.m. he heard the rubber workers grinding in tank number 4.

Two days later, on September 25, 1992, the plant maintenance engineer stopped by the work site (sodium hypochlorite building) at 9:30 a.m. to see how the rubber repair work was progressing. He climbed the fixed ladder to the top of tank number 4; however, the interior of the tank was dark so he borrowed a flashlight from another county employee. Looking into the tank opening, he saw the three rubber workers lying on the bottom of the tank near the ladder. He immediately telephoned 911. The hazardous materials (hazmat) rescue team arrived on the scene within a few minutes. They tested the atmosphere in the tank and determined it was flammable. A hazmat paramedic wearing a self-contained breathing device was lowered into the tank and verified that the three men were dead. The paramedic exited the tank, and before the victims were removed, the hazmat team thoroughly ventilated the tank to eliminate the possibility of fire or explosion. The only type of ventilation equipment at the site at the time of the incident was a 20-inch-square house fan, which was not approved for flammable atmospheres. It is not known if this fan was ever used while the workers were inside the tank.

CAUSE OF DEATH

The medical examiner listed the cause of death for all three workers as toluene poisoning.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers (the contractor) should develop and implement a comprehensive confined space entry program.

Discussion: Although the employer (the contractor) had provided hazard communication training to the employees, they were not given specific training on confined space entry or the selection and use of respiratory protection. The victims were working with toxic chemicals in a confined space. They had no respiratory protection, no ventilation system, no standby person, no worker rescue retrieval system, and no emergency rescue plan. Although the county had a comprehensive confined space entry program, the contract did not require the contractor to have written confined space entry procedures, or to provide training on the selection and use of respiratory protection. Additionally, it is unclear whether the workers were familiar with the hazards of the toxic chemicals they were using in the confined space. Employers should develop and implement a written confined space entry program to address all provisions outlined in the following NIOSH publications: Working in Confined Spaces: Criteria for a Recommended Standard [Pub. No.80-106] ; NIOSH Alert, Request for Assistance in Preventing Occupational Fatalities in Confined Spaces [Pub. No.86-110]; A Guide to Safety in Confined Spaces [Pub. No.87-113]; and NIOSH Guide to Respiratory Protection [Pub. No.87-116] .A confined space entry program should include the following:

- written confined space entry procedures
- evaluation to determine whether entry is necessary
- issuance of a confined space entry permit
- evaluation of the confined space by a qualified person
- testing and monitoring the air quality in the confined space to ensure:
 - oxygen level is at least 19.5%
 - flammable range if less than 10% of the LFL (lower flammable limit)
 - absence of toxic air contaminants
- training of workers and supervisors in the selection and use of:
 - safe entry procedures
 - respiratory protection
 - environmental test equipment
 - lifelines and retrieval systems
 - protective clothing
- training of employees in safe work procedures in and around confined spaces
- training of employees in confined space rescue procedures
- conducting regular safety meetings to discuss confined space safety
- availability and use of proper ventilation equipment
- monitoring of the air quality while workers are in the confined space

Recommendation #2: Employers should provide a standby person on the outside of a confined space when work is being done inside the space.

Discussion: The employer had assigned three men to this tank repair job. All three men were working in the tank, with no one stationed outside to call for help in case of an emergency. Although the atmosphere in the confined space was considered safe because the county had cleaned and tested the tank, the toxic chemicals being used in the rubber repair changed the atmosphere from safe to hazardous. The standby person on the outside should be in constant visual or audible communication with the workers on the inside, and should assist in adjusting lifelines, airlines, and other safety equipment as necessary. In the event of an emergency, the standby person is to call for help and must not enter the confined space in a rescue attempt.

Recommendation #3: Employers should require that all contractors have a written safety program specific to the work to be performed.

Discussion: Although the employer had a written comprehensive safety program, which included confined space entry procedures, the contractor was not required to have a written safety program or confined space entry procedures. The contract language should address specific safety and health requirements for any contractors. Additionally, worker safety and health issues should be included as one of the evaluation criteria for selecting the appropriate contractor.

REFERENCES

National Institute for Occupational Safety and Health, Criteria Document for a Recommended Standard, Working in Confined Spaces . DHHS (NIOSH) Publication No.80-106, December 1979.

National Institute for Occupational Safety and Health, Request for Assistance in Preventing Occupational Fatalities in Confined Spaces. DHHS (NIOSH) Publication No.86-110, January 1986.

National Institute for Occupational Safety and Health, A Guide to Safety in Confined Spaces. DHHS (NIOSH) Publication No. 87- 113, July 1987.

National Institute for Occupational Safety and Health, Guide to Respiratory Protection. DHHS (NIOSH) Publication No.87-116, September 1987.