The National Institute for Occupational Safety and Health (NIOSH)

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Two Workers Die in Underground Valve Pit in Oklahoma

FACE 8637

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 July 10, 1986, a three man crew was attempting to shut down a 24 inch water main when the accident occurred. One worker entered the ten foot deep valve pit through the 22 inch manhole opening via a built-in steel ladder (steel rungs secured into the concrete wall) and a few minutes later called for help. One of the workers on top went in to assist and was overcome. The third worker started in and realized he would soon be in trouble. He immediately exited and called for help. Both workers died at a local hospital.

Contacts/Activities:

The Water Pollution Control Federation (WPCF) notified the Division of Safety Research of these fatalities and requested technical assistance. This case has been included in the FACE Project. On July 28 and 29, 1986, a research industrial hygienist conducted a site visit, met with the safety manager and crew supervisor for the employer, interviewed comparison workers and a surrogate for the victim, and photographed the accident site.

Background/Overview of Employer's Safety Program:

The employer in this incident is a Midwest city. The victims worked in the water distribution division of the water and sewer department. The water and sewer department has a total of 736 employees in 9 divisions. Other divisions include: waste water collection, waste treatment, raw water supply, engineering, utilities service, pre-treatment, and sludge removal. The water distribution division has 140 employees that are responsible for maintaining water service for the city (i.e., conduct inspections and make necessary repairs to water lines, add new service, etc.). The water distribution division has a supervisor, crew leaders, and crew workers.

New employees are given a half day orientation which consists of a discussion of benefits and operating policy of the city. When they report to their respective department for work (e.g., the water and sewer department), each new employee is given a small 66 page safety manual which covers: employee responsibility, safety guidelines, confined space entry, vehicle

policy, tools, first aid, etc. It is the responsibility of each employee to read the booklet. There is no formal classroom safety indoctrination. Meetings are held monthly to discuss basic safety issues. On the job safety is the responsibility of each employee. No training is given on confined space entry; however, city policy requires that each confined space be tested prior to entry. The supervisors have necessary testing equipment available to test a confined space atmosphere for oxygen (02), hydrogen sulfide (H2S), and methane (CH4).

Synopsis of Events:

On July 10, 1986, a work crew for the water distribution division of the water and sewer department was running a water service from one side of the street to the opposite side. The men were boring under the street with an air ram when they hit a 24 inch water line and water started gushing from the bore hole, flooding the street. The crew leader notified the supervisor (by two-way radio in the truck) of the line rupture and the crew was instructed to close valves at three different locations to shut-off the water supply to the 24 inch line.

The three men proceeded to the first valve pit (approximately 200 yards away) and closed the gate valve. The men then proceeded to the second valve pit (approximately two miles away). A crew worker entered the chamber (6'x 8'x 10') and after two or three minutes called for help. The crew leader on the outside went in to assist the downed worker and was overcome. The third worker started in and realized he was in trouble and exited immediately to call for help.

The fire department and rescue squad arrived on the scene within a few minutes and started rescue procedures. Two firemen donned full turnout gear with self-contained breathing apparatus (SCBA) and entered the valve pit to remove the workmen. The firemen had four 30-minute, 2215 PSI, 45 cubic feet cylinders lowered into the pit and discharged them in an attempt to improve the air quality. Both workmen were removed and transported to a local hospital by the EMS where they died a short time later.

After the men were removed from the valve pit, the fire department tested the atmosphere and found:

02 17% and 18% H2S Negative CH4 Negative co Negative

Cause of Death: Asphyxia due to oxygen deficiency.

NOTE: While doing the evaluation of this incident, the safety manager and the NIOSH research industrial hygienist tested two manholes for 02, H2S, and CH4. A manhole approximately one mile upstream of the accident site had an 02 level of 20.0%, H2S and CH4 were negative. The second manhole tested was approximately two miles downstream of the accident site and the 02 level was 3.0%, H2S and CH4 were negative. Any workman entering a confined space with a 3% 02 atmosphere is entering a death chamber. Also, both valve pits checked had stagnant water in the bottom (two or three inches) and the steel valves were rusting.

The valve pit where the accident occurred was at a busy intersection so it was not opened and tested. It should also be noted that this valve pit had not been open in three years.

Recommendations/Discussion:

Recommendation #1: Employers should be certain employees are aware of hazards associated with the tasks they are performing.

Discussion: The victims were aware of the requirements for having the valve pits tested before entry. However, during an emergency situation (shutting down a water main because of a break), the valve pit was not tested for oxygen and safe work practices were not followed. The only consideration was to shut off the water.

Recommendation #2: Employers should provide specific information in their employee safety manuals, especially when tasks to be performed are life threatening.

Discussion: The employees safety manual devotes two pages to confined spaces and includes general recommendations. The safety manual states entry should not be “considered safe until it has been determined to be free of harmful gases and to contain sufficient oxygen to sustain life.- Ambiguous phrases such as “determined to be free” and “sufficient oxygen to sustain” should be clarified. Also, who is responsible for testing the atmosphere and making recommendations for safe entry should be identified. Specific recommendations regarding safe work practices in confined spaces can be found in the NIOSH Publication No. 80-106, “Working In Confined Spaces.” A safe oxygen level is stated (19.5%) and flammability limits (not to exceed 10% of the lower flammability limit), and toxic air contaminants (not to exceed the limits referenced in 29 CFR Part 1910, Sub Part Z) are specified. Testing shall be done by a qualified person prior to entry. This publication also defines and provides recommendations on hot work, isolation, purging, ventilating, entry and rescue, training, posting, safety equipment, clothing, etc.

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