



The National Institute for Occupational Safety and Health (NIOSH)

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Two Construction Workers Die Inside Sewer Manhole in Indiana

FACE 8767

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 on selected work-related fatalities.

On July 21, 1987, a worker for a construction company entered a seven foot deep sewer manhole that had a toxic and oxygen deficient atmosphere. When the worker collapsed, another worker entered the manhole in a rescue attempt and also collapsed. Both workers were pronounced dead at the scene.

Contacts/Activities:

Officials of the Occupational Safety and Health Administration for the State of Indiana notified DSR concerning the fatalities and requested technical assistance. This case has been included in the FACE Project. On September 16, 1987, a DSR research team (a research industrial hygienist and a safety specialist) met with the company owner, interviewed workers, and visited and photographed the accident site.

Overview of Employer's Safety Program:

The employer in this incident is a family owned construction company with approximately 50 workers (mostly laborers and heavy equipment operators). The majority of the company business involves general excavation and the construction of water systems, sewers, and roads. The company has a written, one-page safety policy which addresses employee responsibility, general safety guidelines, confined space safety, and reporting injuries.

It is the responsibility of each employee to read this policy. All management level employees are trained in cardiopulmonary resuscitation (CPR). other than the CPR training, there is no formal classroom safety instruction for employees. Tool box 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, company policy requires that each manhole be tested and ventilated prior to entry. The company has gas monitoring devices available at the main office to test confined spaces for oxygen (O₂), hydrogen sulfide (H₂S), and methane (CH₄) . It should be noted that the company also experienced a confined space fatality five years prior to this incident.

Synopsis of Events:

On July 21, 1987, at approximately 11:00 a.m. a company work crew (a 36 year-old foreman with 17 years experience with the company, a 50 year-old heavy equipment operator with 21 years experience with the company, and two laborers) began clearing brush in a vacant field in preparation for setting grade stakes to extend an existing sewer line for a new housing subdivision. At 11:30 a.m. when the two laborers broke for lunch, the foreman and equipment operator both left to look for an existing sewer manhole.

Although there were no eye witnesses to the incident, it is presumed (based on circumstantial evidence) that the following occurred: The foreman and equipment operator, upon locating the sewer manhole, removed the manhole cover. In an effort to check the existing sewer grade, the foreman then entered the seven foot-deep manhole through a 24 inch diameter "manway" opening, and collapsed at the bottom. In an attempt to rescue the downed foreman, the equipment operator entered the manhole and also collapsed.

After lunch, when the foreman and equipment operator did not return to the field that was being cleared, the two laborers began to search for them. At approximately 1:30 p.m. the two laborers found the foreman and equipment operator at the bottom of the manhole with their heads submerged in about 12 inches of water. One of the laborers told two other company workers (who had just arrived at the scene) to call for an ambulance. When the rescue squad from the local fire department arrived (after approximately 15 minutes), two fire department rescuers, donned self-contained breathing apparatus (SCBA's), entered the manhole and, using ropes and harnesses, removed the two victims from the manhole.

Fire department and emergency medical service (EMS) personnel noted that the two victims were "obviously dead", and they were pronounced dead at the scene by the county coroner. After the victims were removed from the manhole, the atmosphere of the manhole was tested by a private analytical laboratory and by the City Water Pollution Control Maintenance Department. Results of these tests are as follows:

O₂ at depth of 3 feet 15.7% O₂ at depth of 6 feet 7.2% CH₄ at depth of 6 feet 2% H₂S at depth of 6 feet 0.1% and 0.2% CO at depth of 6 feet >5%

Investigator's Comment:

The foreman and equipment operator were both employed by the company five years previous to this incident when the company experienced its first confined space fatality.

Cause of Death:

Autopsies were performed on both victims. The cause of death for both men was listed as asphyxiation.

Recommendations/Discussion

Recommendation #1: Employers engaged in the business of sewer construction or maintenance should assure that workers are trained sufficiently in recognition and awareness of confined space hazards they may encounter in the daily performance of their duties.

Discussion: According to the employer, the work being performed at the construction site did not require the workers to enter any sewer manhole. However, the foreman did enter the manhole without testing and ventilating the atmosphere of the manhole prior to entry as required by company safety policy. The fact that this is the second confined space fatality incident within the last five years (resulting in three confined space fatalities) underscores the importance of employee training in safe confined space work practices.

Recommendation #2: The employer should develop and implement a more comprehensive safety policy with specific procedures for confined space entry.

Discussion: The one page safety policy devotes one paragraph to confined space entry: "Employees shall not enter manholes, underground vaults, chambers, tanks, silos, or other similar places that receive little ventilation, unless it has been determined that the air contains no flammable or toxic gases or vapors. Ventilate thoroughly, detectors are available at office."

Phrases such as "... unless it has been determined ..." and "ventilate thoroughly ..." should be expanded and clarified to describe a detailed confined space entry procedure. Also, the individuals responsible for testing the atmosphere and making recommendations for safe entry should be identified. Minimally, the following confined space safe work practices should be addressed in the company safety policy and implemented on the job:

1. Is confined space entry necessary? Can the task be completed from the outside?
2. Has a company safe entry permit been issued?
3. If entry is to be made, has the air quality in the confined space been tested?
 - Oxygen supply at least 19.5%
 - Flammable range less than 10% of the lower flammable limit
 - Absence of toxic air contaminants
4. Have employees and supervisors been trained in selection and use of personal protective equipment and clothing?
 - Protective clothing
 - Respiratory protection
 - Hard hats
 - Eye protection
 - Gloves
 - Life lines
 - Emergency rescue equipment
5. Have employees been trained for confined space entry?
6. Have employees been trained in confined space rescue procedures?
7. If ventilation equipment is needed, is it available and/or used?
8. Is the air quality tested when the ventilation system is operating?

The two fatalities would have been prevented if these recommendations had been followed. Specific recommendations regarding safe work practices in confined spaces can be found in NIOSH publications 80-106, "Working In Confined Spaces", and 87-113, "A Guide to Safety in confined Spaces".

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