# STATE OF NEW YORK
# DEPARTMENT OF HEALTH

## FATALITY ASSESSMENT AND CONTROL EVALUATION

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# City Engineer Killed in Landfill Manhole When Retrieving Flow Meter

Case Report: 03NY027

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**SUMMARY**

On May 28, 2003, a 32-year-old male city engineer collapsed in a manhole while attempting to retrieve a flow meter and was pronounced dead after he was transported to a hospital. On the day of the incident, the victim, a co-worker (an assistant engineer) and a student intern drove to a landfill to replace a battery of a flow meter that had been placed in a manhole. Once they arrived at the site, the victim opened the manhole cover with a pickaxe. The manhole was 7'4" deep and 24" in diameter at the point of entry. There were four iron rungs mounted into the cement wall of the manhole to form a ladder. The flow meter was attached to the top rung that was 34 inches below the manhole opening by a "U" shaped spring loaded handle. The victim used a hook made of a wire hanger to catch a string that was looped and tied around the handle of the flow meter. When he was pulling and lifting the meter, the weight of the flow meter caused the wire hook to straighten and the meter fell to the bottom of the manhole. The victim quickly descended into the manhole to retrieve the meter. Once at the bottom, the victim picked up and placed the flow meter on the top rung. Just as he was about to ascend, he lost consciousness and collapsed in the bottom of the manhole. The assistant engineer immediately called "911" on his cell phone. The fire department arrived at the site and immediately started the confined space rescue procedure. The victim was extricated from the manhole in approximately 20 minutes. He was transported to a nearby hospital where he was pronounced dead. According to the fire department monitoring data, the oxygen concentration at the bottom of the manhole was 2.1% and the flammable vapors exceeded 60% of the lower explosive level (LEL) at the time of the rescue.

New York State Fatality Assessment and Control Evaluation (NY FACE) investigators concluded that to prevent similar incidents from occurring in the future, employers should:

- ***Implement a confined space entry program for all workers who are or could be exposed to confined space hazards;***
- ***Provide immediate training and periodic refresher training to all employees who may be exposed to confined space hazards;***
- ***Evaluate the sewer flow monitoring procedure and modify it to reduce workers' risk;***
- ***Assign a trained safety and health professional to oversee the implementation and maintenance of the city's safety and health programs;***

- ***Establish a centralized safety committee with both management and employee representatives to assist in the development, implementation, and oversight of the safety and health programs.***

## INTRODUCTION

On May 28, 2003 at approximately 2:30 PM, a 32-year-old male city engineer collapsed after entering a manhole to retrieve a flow meter. He was extricated from the manhole by the fire department and transported to a hospital where he was pronounced dead. New York State Fatality Assessment and Control Evaluation (NY FACE) staff initially learned of the incident through a newspaper article on May 29, 2003. On June 17, 2003, two NY FACE investigators conducted an on-site fatality evaluation. During the site visit, the investigators met with the representatives of the city government that employed the victim, interviewed the witnesses to the fatal incident, and inspected the landfill manhole where the fatal incident occurred. Additional information was provided by the city police and fire departments and the regional office of the Public Employees Safety and Health Bureau (PESH) of the New York State Department of Labor (NYSDOL). The police report and Medical Examiner's report were also reviewed.

The victim's employer, a city government, employed a total of 150 full-time and 70 part-time employees at the time of the investigation. Non-managerial employees were represented by four labor unions. The victim was classified as managerial personnel and was not represented by a union. At the time of the incident, the city did not have a safety and health professional on staff to oversee the implementation and maintenance of the city's safety and health programs. All the safety and health programs were administered and maintained by individual department managers. The city did not have an active safety committee at the time of the incident. According to the city administration, the engineering department where the victim worked did not have a confined space program nor did it provide employees with awareness training on confined space hazards.

## INVESTIGATION

One of the tasks performed by the engineering department was to monitor the city's sanitary sewer. Material from the city's sanitary sewer was treated by a water treatment plant in an adjacent town. As required by the town, the city had to monitor the sewer flow rate. The flow rate was monitored by battery-operated flow meters that were placed in three manholes: two located on a city street and one in an inactive landfill. The monitoring procedure that started in the summer of 2002 included replacing the rechargeable batteries every Wednesday and downloading the flow rate data every Friday.

The fatal incident occurred in the landfill manhole. The landfill was formerly a solid waste management facility that was operated by the city until 1985 when it ceased operation. The manhole was a primary location that received the total leachate flow from the entire landfill. The flow meter had not registered any leachate flow since the monitoring started until the date of the incident when the monitoring was temporarily suspended.

On Wednesday, May 28th, 2003, the day of the incident, the victim drove the assistant engineer and the intern to the manhole locations to replace the flow meter batteries. Prior to the incident, they had finished changing batteries on two of the three flow meters. At approximately 2:30 PM, they

drove to the landfill to replace the last battery. They parked the city vehicle at the landfill entrance and walked approximately a quarter mile through the field toward the manhole located on the south side of the landfill. The victim was carrying a pickaxe and the intern the spare battery. Once they arrived at the manhole, the victim mentioned that there should be a wire hanger lying on the grass somewhere that he used to assist in lifting the meter out of the manhole. He searched and found the hanger. The victim then opened the manhole cover with the pickaxe.

The manhole was 7'4" deep and its inner diameter was 24" (Figure 1). It looked dry at the time of the incident according to the witnesses. There were four iron rungs mounted into the cement wall of the manhole to form a ladder. The flow meter (Figure 2), weighing approximately 15 pounds, was attached to the top rung (34 inches below the manhole opening) by means of a "U" shaped spring loaded handle. A string was looped and tied around the handle of the flow meter.

**Figure 1**. The landfill manhole where the fatality occurred.

After removing the manhole cover, the victim proceeded to retrieve the flow meter. He knelt next to the manhole opening and reached down with the wire hanger that was bent on one end to hook the string on the flow meter handle. The victim leaned over and across the manhole opening when trying to hook the string, which took a couple of seconds. He then pulled the string toward himself on an angle to disengage the spring-loaded flow meter handle. He successfully freed the meter from the rung and started lifting the meter with the wire hanger. The weight of the flow meter caused the wire hook to straighten and the meter fell to the bottom of the manhole. The plastic cover of the meter appeared to have come open. Although the battery bounced out of its case and the two bottles of desiccants fell out of their holders, they were all still attached to the meter. According to the

witnesses, the victim commented that the meter did not look too damaged. He then quickly climbed down into the manhole to retrieve the meter.


**Figure 2**. The flow meter that was used to measure the flow rate in the manhole.

Once at the bottom, the victim made a comment about a foul odor in the manhole. He then knelt down, picked up the flow meter, turned around toward the ladder, and placed the meter on the top rung. While he grasped the top rung with both hands as if in preparation to ascend, his arms began to shake violently and he lost consciousness and collapsed backwards onto the floor of the manhole.

According to both witnesses, the entire incident from the time that the victim entered the manhole until he collapsed took only a minute or less. The assistant engineer immediately called "911" on his cell phone while the intern ran to the street to call for help. The fire department arrived at the site within four minutes and immediately started the rescue procedure by following the confined space rescue protocol. The victim was extricated from the manhole in approximately 20 minutes, and transported to a nearby hospital where he was pronounced dead. According to the fire department monitoring data taken at the time of the rescue, the oxygen concentration at the bottom of the manhole was 2.1% and the flammable gas or vapor exceeded 60% of the lower explosive level (LEL).

## CAUSE OF DEATH

The cause of death was reported as asphyxia with methane gas.

## RECOMMENDATIONS/DISCUSSION

**Recommendation #1*: Employers should implement a confined space entry program for all workers who are or could be exposed to confined space hazards.***

**Discussion:** At the time of the incident, the engineering department did not have a confined space entry program, nor were there any effective measures in place to prevent the workers from entering permit-required confined spaces. Employers should conduct a worksite inspection to identify and then appropriately mark all confined spaces. A confined space entry program should then be developed and implemented that would include:

- evaluation to determine whether entry is necessary or whether the task can be performed from the outside;
- issuance of a confined space entry permit by the employer;
- posting of confined space entry warning signs;
- testing the air quality in the confined space when entry is necessary, to ensure:
  - ✓ oxygen levels of at least 19.5%,
  - ✓ flammable range of less than 10% of the lower explosive limit (LEL),
  - ✓ absence of toxic air contaminants;
- training of workers and supervisors in the selection and use of:
  - ✓ respiratory equipment,
  - ✓ environmental test equipment,
  - ✓ lifelines,
  - ✓ rescue equipment,
- training of employees in safe work procedures in and around confined spaces;
- training of employees in confined space rescue procedures;
- use of proper ventilation in confined spaces;
- monitoring of air quality prior to entering confines spaces.

**Recommendation #2:** ***The employer should identify the workers who are exposed to confined space hazards and provide immediate employee training and periodic refresher training.***

**Discussion:** The employer should identify the workers who are potentially exposed to confined space hazards through job hazard analysis and provide immediate training to those employees. The employer should ensure that the workers understand the nature of the confined space hazards and are familiar with the standard confined space entry procedures. The training should be provided before an employee is assigned the specific tasks. Refresher training should be provided at least annually or whenever there is a change in assigned duties, a change in confined space operations, or a change or update in the confined space entry procedures.

**Recommendation #3*: The employer should evaluate the sewer flow monitoring procedure and modify it to reduce employee exposures to the confined space hazards.***

**Discussion:** The employer should evaluate and modify the flow monitoring procedure to reduce the risk by implementing feasible engineering controls. For example, the flow meter may be placed outside a manhole to avoid confined space entry; and downloading data and battery replacement may be performed at the same time, instead of on different days. At the time of the incident, the victim used a regular pickaxe to open the cover of the manhole where the flammable gas and vapor concentration exceeded 60% of LEL. Spark proof tools should be used for manhole cover removal and inside the manhole to reduce the fire and explosion hazard. Proper sturdy tools should be used to retrieve the flow meters. When installing the engineering controls, the confined space entry procedures should be strictly followed.

**Recommendation #4*: The employer should assign a trained safety and health professional to oversee the development, implementation, and oversight of the city's safety and health programs.***

**Discussion:** At the time of the fatal incident, all the safety and health responsibilities were placed at the department level. The employer should assign a trained safety and health professional who has the knowledge in recognizing, evaluating and controlling specific occupational hazards to oversee the city's safety and health programs. The chain-of-command and individual responsibility and accountability should be clearly defined.

**Recommendation #5*: The employer should establish a centralized safety committee with both management and employee representatives to assist in the development, implementation, and oversight of the safety and health programs.***

**Discussion:** A safety committee is an important component of a comprehensive safety and health program. A functioning safety committee can be an effective tool in identifying occupational hazards and implementing control and preventive measures. A citywide safety committee with both management and employee representatives should be established. The committee should conduct monthly meetings and periodic workplace safety and health inspections.

***Keywords: manhole, oxygen deficiency, confined space***

## REFERENCES

Code of Federal Regulations [2002]. 29 CFR 1910.146. Permit-required confined spaces. Washington, D.C.: U.S. Government Printing Office, Office of the Federal Register.

NIOSH [1994]. Worker deaths in confined spaces. Cincinnati, OH: U. S. department of Health and Human Services, Centers for Disease Control, National Institute for Occupational Safety and Health, Division of Safety Research. DHHS (NIOSH) Publication 94-103.

The Fatality Assessment and Control Evaluation (FACE) program is one of many workplace health and safety programs administered by the New York State Department of Health (NYS DOH). It is a research program designed to identify and study fatal occupational injuries. Under a cooperative agreement with the National Institute for Occupational Safety and Health (NIOSH), the NYS DOH FACE program collects information on occupational fatalities in New York State (excluding New York City) and targets specific types of fatalities for evaluation. NYS FACE investigators evaluate information from multiple sources. Findings are summarized in narrative reports that include recommendations for preventing similar events in the future. These recommendations are distributed to employers, workers, and other organizations interested in promoting workplace safety. The FACE program does not determine fault or legal liability associated with a fatal incident. Names of employers, victims and/or witnesses are not included in written investigative reports or other databases to protect the confidentiality of those who voluntarily participate in the program.

Additional information regarding the New York State FACE program can be obtained from:

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1-866-807-2130

www.health.state.ny.us/nysdoh/face/face.htm