The National Institute for Occupational Safety and Health (NIOSH)

Promoting productive workplaces through safety and health research

# Digester Explosion Kills Two Workers at Wastewater Treatment Plant in Pennsylvania

FACE 8733

## 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 February 6, 1987, two workers at a wastewater treatment plant were re draining a sewage digester when an explosion lifted the 30-ton floating cover, killing both workers instantly.

## Contacts/Activities:

The Division of Safety Research within NIOSH was notified of these fatalities by the Water Pollution Control Federation (WPCF) and technical assistance was requested. On March 3, 1987, a research industrial hygienist visited the wastewater treatment plant where the accident occurred; met with officials representing the borough, two investigators for the Commonwealth's Bureau of Occupational and Industrial Safety, a water quality specialist for the Commonwealth's Bureau of Water Quality Management, and an investigator from the State Police. Photographs were taken of the accident site.

## Overview of Employer's Safety Program:

The employer in this incident was a small borough within the Commonwealth. The victims worked for the wastewater treatment plant which is under the public works department. The public works department has a total of ten employees (two in the wastewater treatment section and eight, including a public works supervisor, in the street maintenance section).

Now employees are given a brief orientation on benefits and policies and receive on-the-job training that addresses their assigned duties. Additionally, employees- are sent to any pertinent seminars that would be of value in their training. No safety training or safety meetings are conducted at the wastewater treatment plant. Employees are not trained in confined space hazards or safe entry procedures. The only confined space procedures are four basic recommendations that are posted on the bulletin board at the wastewater treatment plant.

## Synopsis of Events:

On February 6, 1987, the two operators (a father and son) of the wastewater treatment plant were in the final stages of draining a digester (30' deep x 27' in diameter) that had been taken out of service for routine cleaning. The heavy sludge remaining in the bottom of the digester was approximately eight feet deep. Two tank pumper trucks were brought in to remove the heavy sludge; however, the sludge was not pumping well. The operator of the wastewater treatment plant told the driver of the pumper truck that he would go up on top of the digester and spray water into the sludge to make it pump easier. The driver of the pumper truck reversed his pump to blow air up through the sludge to help loosen the heavy mass. The two plant operators climbed up onto the floating cover of the digester and using a one inch garden type hose, they began spraying water into the bottom of the digester to loosen up the heavy sludge. The operators lowered a 200 watt light bulb on an extension cord into the digester through a 22" diameter manhole on top of the floating cover to view the sludge level. The light and cord were not designed or approved for use in hazardous (classified) locations. Apparently the light bulb either struck the concrete and broke, or the cold water spray made contact with the hot glass light bulb, causing it to break. The broken light provided a source of ignition for the combustible gas(s) in the digester, probably methane.

The truck driver who remained on the ground stated he heard a “whoomp” but the sound didn’t appear to be an explosion. However, his truck and pump were running at the time of the explosion increasing the ambient noise level. After a few minutes the driver went up the ladder to the top of the digester and saw that the 30 ton floating cover was wedged in the digester on a 45 degree angle. Neither of the workmen were visible.

The rescue squad was called and arrived within a few minutes. However, to remove the victims, a large crane was brought in to tip the wedged cover enough to send in a diver to retrieve the victims.

It took approximately four hours before the victims were removed from the digester. They were both pronounced dead at the scene by the local coroner.

NOTE: When agitating the sludge, i.e. blowing air up through the heavy sludge, it is possible to release trapped gases such as methane and hydrogen sulfide.

## Cause of Death:

The coroner’s report listed the cause of death of both men as cervical fracture.

## Recommendations/Discussion:

**Recommendation #1: The employer should develop proper work procedures and should train employees concerning safe maintenance procedures.**

Discussion: The municipality did not provide safe operating/maintenance procedures or training in hazard recognition. This training should include recognition of potential hazards associated with digester cleaning operations and proper tools and equipment to be used in a combustible atmosphere. The workers had used this light and extension cord in the past and assumed it was safe. The light and cord were not designed or approved for use in hazardous (classified) locations and should not have been used.

**Recommendation #2: The employer should develop comprehensive policies and procedures for confined space entry.**

Discussion: All employees who are required to work in or around confined spaces should be aware of potential hazards, possible emergencies, and specific procedures that are to be followed. NIOSH Publication No. 80-106 “Working in Confined Spaces” was left with the employer as a reference in developing procedure for confined spaces. Prior to entry into a confined space, the following should be addressed:

1. Is entry necessary? Can the task be completed from the outside?

2. Has a permit been issued for entry?

3. 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. Has the confined space been isolated/locked out from other systems?

5. Have employees and supervisors been trained in selection and use of personal protective equipment and clothing?

o Protective clothing o Respiratory protection o Hard hats o Eye protection o Gloves o Life lines o Emergency rescue equipment

6. Have employees and supervisors been trained in selection and use of approved equipment and tools for use in a confined space?

• Electric tools – approved in accordance with 29 CFR Part 1910, Sub Par 5.

• Lighting – explosion proof design where necessary. Intrinsically safe for the atmosphere involved.

• Electric lines, junctions – approved in accordance with the National Electric Code and National Fire Code.

7. Have employees been trained for confined space entry?

8. Is ventilation equipment available and/or used?

9. Is the air quality tested when the ventilation system is operating?

Return to In-house FACE reports

Last Reviewed: November 18, 2015