

**MARYLAND DIVISION OF LABOR AND INDUSTRY
CASES: 97MD04901 & 97MD04902**

TO: Project Officer, State FACE Project, Division of Safety Research

FROM: Maryland FACE Program, Division of Labor and Industry

SUBJECT: Two utility workers, were working in a trench next to a road, when a valve blew off a 10" water main and rapidly filled the excavation before they could be rescued.

SUMMARY:

On Tuesday, July 22, 1997, at approximately 10:30 a.m., a valve that they had replaced, blew off a 10" diameter water main. Water, under pressure of about 100 p.s.i., quickly filled a trench approximately 4'-6" deep by 6'-0" long and 6'-0" wide. The valve struck a 43-year-old, male, Utility Worker #1 (victim 1), injuring him severely and caused him to be lost in the swirling water. As the 28-year-old, male, Crew Chief (victim 2) was attempting to rescue Utility Worker #1, the ground on which he was standing was undermined by the water and collapsed. He fell into the excavation and was pulled under the muddy water.

The utility company Backhoe Operator, who was trying to help those in the excavation, stopped an ambulance returning to its station. Ambulance personnel immediately called for assistance and within fifteen minutes several rescue units were at the scene. The Backhoe Operator also called in an emergency to the company dispatcher. He and Utility Worker #2 went on to shut the valves and stop the rapid flow of water from the 10" main into the excavation.

The body of the Crew Chief (victim # 2), was recovered after the water was pumped out of the excavation (20 - 30 minutes) by the fire department and the utility company. Utility Worker #1(victim #1) was removed approximately four hours later, since his body was buried in the mud and had become entangled in ground roots and a gas line. Both were pronounced dead at the scene.

The MD/FACE Field Investigator concluded that to prevent similar future occurrences, employers should:

- *Ensure that all employees working on high pressure water mains understand and recognize the hazards associated with hazardous hydraulic energy and the methods of avoidance*
- *Require that water mains be isolated and de-energized before working on the system.*
- *Require the use of a trench box, shoring or properly sloped sides when working in an excavation.*

INTRODUCTION:

On Tuesday, July 22, 1997, a 43-year-old, male, Utility Worker (victim #1) and a 28-year-old, male, Crew Chief (victim #2) drowned when a six-inch diameter water pipe and valve disengaged from a 10" diameter water main and flooded the excavation in which they were working. The MD/FACE Field Investigator was informed of the incident on Wednesday, July 23, 1997, by a MOSH Preliminary Report and a newspaper account of the incident. Additional information was gathered over an extended period from eyewitnesses, the company's Safety Manager, Director of Maintenance, newspaper accounts of the incident, Workers Compensation Employer's First Report of Injury and the Medical Examiner's Post Mortem Report.

The employer was a quasi governmental agency, in a large suburban metropolitan area and was responsible for the installation and maintenance of sewer and water lines. The agency had been in operation for 80 years and employed approximately 2,100, four of who were at the site of the accident. Utility workers are subject to work various shifts and to be available for emergency work.

The employer had an established safety program. Its rule book addressed issues as they apply to the site where the crew of four employees was working. Records show that the employer had a systematic training program and conducted training, on a variety of topics, at regular intervals.

Victim #1 had approximately five years of service; victim #2 had eight years of service, the last two-and-a-half, as a crew chief.

INVESTIGATION:

On July 21, 1997, a crew of four utility company workers (a Crew Chief, two Utility Workers and an Equipment Operator) had been assigned to replace a defective underground valve on a fire hydrant. The valve was approximately four feet underground, next to a roadway, in a residential area. They arrived on the site at approximately 9:00 A. M., as the rush hour was ending. They prepared the site by positioning traffic control cones. The Backhoe Operator removed some dirt from around the fire hydrant. Utility Workers #1 and #2, using shovels and a probing rod dug down until they found the valve to the fire hydrant. When they found the defective valve, they shut off valves to four water mains, that supply water to the hydrant. When they completely uncovered the valve, the excavation was approximately 4'-7" deep by 6'-0" long by 6'-0" wide. The Crew Chief, who had installed many fire hydrant valves and fire hydrant connections, elected not to use the mini-trench box brought to the site, because of other water and gas pipes in the trench, and the cramped working area.

This valve and hydrant had been originally installed in 1957. They found the valve was not "strapped in" (secured), to the existing six-inch diameter pipe that was left buried approximately four-feet underground, at the edge of the road way and traveled back under the road. The old valve and fire hydrant were removed from the excavation by using the backhoe. The crew did not know what type of valve they would find. After unearthing the valve, they realized that a new valve was required. When a new valve is installed, a new hydrant is also required. The Crew Chief and Utility Worker #2 returned to their base to pick up a new valve and fire hydrant. They also picked up a load of wash gravel (one inch and larger) and wood blocking material.

The new valve was lowered into the excavating using the backhoe. It was installed by connecting it to the existing pipe, protruding from under the roadway, by using a megalug restraining system. The megalug restraining system assures that the valve remains on the pipe after water pressure is returned to normal ranges. With the completion of the installation of the valve, not enough time was left to complete the fire hydrant installation, due to the upcoming evening rush hour. The crew decided to block the newly installed valve, charge the main and cover the excavation with boards.

On July 22, 1997, the same crew of four workers, returned to the site. To complete the fire hydrant installation, the bottom of the excavation would have to be leveled and drainage gravel added. Then the new fire hydrant would be maneuvered into position on the valve, leveled and secured. The excavation could then be backfilled and the hydrant charged. However, this time they did not shut the main down as they had the day before. They believed that the megalug restraining system would prevent the six-inch diameter pipe and new valve from separating. As the Equipment Operator positioned the backhoe next to the excavation, the two utility workers used a ladder to enter the excavation. They removed the blocking, which they had placed the day before and began to lubricate the bolts, that would be used to connect the fire hydrant and the newly installed valve. Suggesting that they needed something better to stand on in the excavation, the two workers climbed out so the Equipment Operator could dump wash gravel into the hole.

Both climbed back down into the excavation Utility Worker #2 was leveling the wash gravel as Utility Worker #1 (victim #1) prepared a base for the bottom of the fire hydrant. The fire hydrant was lowered by a chain into the excavation using the backhoe. Victim #1 was maneuvering the hydrant assembly and attempting to place it onto the new valve and bolt it in place. Utility Worker #2 was standing out of the way on the bottom rung of the ladder. As the hydrant assembly was placed onto the new valve, the section of pipe connected to the 10" main broke loose. The six-inch megalug connector held the valve in place. However, removing the wood blocking left the worker exposed to the pressurized main. The upstream six-inch branch mechanical joint tee ran into the 10" main. Investigation revealed that the tee joint, which was partially covered, came loose. Water at a force estimated at more than 3,000 pounds, rapidly filled the excavation. The valve assembly apparently struck Utility Worker #1 (victim #1) and he was swept around by the swirling water. Utility Worker #2 was able to be pulled out of the excavation by the Equipment Operator and the Crew Chief (victim #2). The Equipment Operator managed to grab the hand of victim #1 and was holding onto it as the Crew Chief (victim #2) went to the other side of the excavation. As the Crew Chief was trying to grab victim #1's legs, the ground washed away under him and he fell into the excavation and was pulled under by the swirling water. The Equipment Operator lost his grip on victim #1, due to the force of the water and the rocks pounding his arms.

An ambulance, returning to its station, was flagged down by the Equipment Operator to seek assistance. He then radioed his dispatcher for additional help. The Equipment Operator and Utility Worker #2 then went to shut down the water main valves, to stop the flow of water into the excavation.

Within fifteen minutes several rescue units were on the scene. Both victims were under water for the entire period. Fire department and utility crews pumped out the excavation and were then able to recover the body of victim #2 within 30 minutes. Victim #1 was recovered approximately four hours later, since his body was buried in the mud and entangled in roots and a gas line.

CAUSE OF DEATH:

The post mortem examination report of the Medical Examiner determined that both deaths were due to drowning.

RECOMMENDATIONS:

Recommendation #1: Ensure that all employees working on high pressure mains understand and recognize the hazards associated with hazardous hydraulic energy and the methods of avoidance.

Discussion: The utility crew apparently made an assumption that the new valve's megalug retainer system could hold the valve onto the charged water line and would not be affected by the hydrant installation. The megalug retainer system did, in fact, hold the new valve onto the six-inch pipe. However, the unexcavated mechanical joint, found a short distance behind the connection, failed under pressure from the 10" main, after the blocking was removed and during the alignment of the hydrant assembly with the valve installed the previous.

Mechanical joints prevent leaks and are not designed to hold connections together. The crew thought that the water main pipe went straight down the street; instead it dog legged across the street to just behind the hydrant and then traveled down the street. The 10" diameter water main was only 22" from where the new valve was attached; not 20'-0" away as they had assumed. The crew failed to verify the distance to the 10" diameter water main by digging, sticking a rod up the six-inch pipe or using a flash light to look up the pipe.

Additional factors associated with the pipe and mechanical joint is that during the normal work processes, on both days, vibration from vehicular traffic, dumping of wash gravel and movement during alignment may have caused the joint to fail.

Recommendation #2: Require that water mains be isolated and de-energized before working on the system.

Discussion: Employers should provide specific written and enforced plans to control hazardous water pressure, associated with the maintenance and repair work on high pressure water mains. No employee should be permitted to work on or near pressurized fire hydrants, valves and other appurtenances exposed by excavating, unless a visual inspection is made of a restraining system to the water main. If verification of a proper restraint system cannot be made, the water main should be shut down and depressurized.

Recommendation #3: Require the use of a trench box, shoring or properly sloped sides when working in an excavation.

Discussion: Employers should require that an excavation, of this size and depth, be properly protected or sloped. In this instance a mini trench box was delivered to the job site. Interviews with the surviving crew members suggest that the Crew Chief (victim #2), was concerned with the number of utilities in the excavation and felt that using the trench box as a protective device was not possible. Failure to install an excavation protective shoring system may not have prevented the death of both workers: however, it may have prevented the excavation from collapsing under the Crew Chief.

Philip P. Weber
Field Investigator

Dr. Keith L. Goddard, P.E.
Principal Investigator

FATALITY ASSESSMENT AND CONTROL EVALUATION

The Maryland Division of Labor and Industry administers the Fatality Assessment and Control Evaluation (FACE) Program under a cooperative agreement with the National Institute for Occupational Safety and Health, Division of Safety Research (NIOSH/DSR). The Maryland FACE Program performs Investigations of selected occupational fatalities, prepares summary reports, and engages in prevention activities. The goal of our program is to prevent fatal work injuries in the future by studying the working environment, the worker, the task being performed, the tools employed, the energy exchange resulting in fatal injury, and the role of management in controlling how these factors interact.

NIOSH/DSR developed the FACE research protocol in the early 1980's and continues to perform FACE investigations. To increase the research and prevention activities of NIOSH/DSR, states across the nation have been invited to participate in the State FACE Project. Maryland and thirteen states listed below currently participate in the State Based FACE Project: Alaska, California, Colorado, Iowa, Indiana, Kentucky, Massachusetts, Minnesota, Missouri, Nebraska, New Jersey, Ohio, Oklahoma, Texas, Washington, Wisconsin, and Wyoming.

Additional information regarding this report or the Maryland FACE Program is available from:

The Maryland FACE Program
Division of Labor and Industry
1100 North Eutaw Street Room 611
Baltimore, Maryland 21201-2206
Phone 410 - 767 - 2380
FAX 410 - 767 - 2003

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