TO:Director, Occupational Health Surveillance Program
Massachusetts Department of Public Health

FROM:Massachusetts Fatality Assessment and Control Evaluation Program
(MA FACE) Field Investigator

SUBJECT:Massachusetts Water Works Specialty Valve Foreman Dies in Oxygen Deficient Valve Chamber - MA-92-18

DATE:December 7, 1993

SUMMARY

During an overtime detail on the evening of September 11, 1992, a 26 year old male public water works specialty valve foreman was overcome and collapsed one to four minutes following entry into in an oxygen deficient underground valve chamber while purging air from an inactive aqueduct (waterline) scheduled for restoration. A co-worker and municipal policeman also overcome during rescue efforts were extricated in time to survive. The victim, however, was pronounced dead approximately one and one-half hours following the incident at the local hospital.

The Massachusetts FACE Program Investigator concluded that to prevent similar occurrences in the future, employers should:

- develop, implement and enforce a comprehensive confined space entry program.

INTRODUCTION

On September 14, 1992, the MA FACE Program learned from a radio report of a confined space fatality occurring on September 11th. An investigation into the incident was immediately initiated. On September 29, 1992, the MA FACE Field Investigator travelled to the incident region and interviewed the corporate safety officer.

Multiple corporate employee handouts, the corporate instruction guide for tripod/winch fall protection and retrieval system equipment, corporate rope grab/lifeline instructions, and the death certificate were obtained during the course of the investigation.

The employer was a large regional public water resources entity in business for seven years. It was comprised of sanitation and waterworks divisions, employing a total of 1,730 persons in various capacities. The victim was one of only two specialty valve foremen and was employed by the

company for 4 years and 5 months.

At the time of the incident, the company employed a designated safety officer who devoted 76-100% of time to safety and had comprehensive written safety rules and procedures in place, although its confined space safety program was still evolving. It was reported that the victim had received some classroom and on-the-job training regarding confined spaces.

INVESTIGATION

On the day of the incident, the victim and two co-workers were instructed to ready an inactive underground aqueduct (water line) for restoration by purging (venting) it of trapped air. The aqueduct had been out of service for nine months, and once restored, would carry water through numerous suburbs to a major downtown area.

The process of purging dormant aqueducts or opening and closing operational aqueducts was routine. Normally this was done from street level by removing the valve chamber cover and using an 8' valve wrench to open or close the valves.

A company spokesman claimed that following the routine opening of the aqueduct valve from street level, the usual "whooshing" sound heard from the purged vessel unexpectedly subsided. To determine if a problem existed, the victim lowered a ladder and descended into the 8'x 4' x 4' valve chamber when he was soon overcome and collapsed on the chamber floor.

Following an elapsed time of approximately four minutes, a co-worker entered the valve chamber to rescue the victim and was quickly overcome and also collapsed. The second co-worker, witnessing both of his colleagues collapsed in the valve chamber ran to a nearby home to summon help. Meanwhile, a municipal police officer had responded to the scene. He was lowered head first into the chamber to attempt a rescue of both men. After one minute he was overcome and had to be pulled from the valve chamber suffering a concussion when his head struck the side of the chamber opening during extrication. Municipal fire department personnel then arrived, donned SCBA, and removed both men. All three men were transported to a local hospital.

Other than the concussion, the police officer and co-worker suffered no ill effects. The victim, however, was officially pronounced dead approximately one and one half hours later.

The responding police officer and local residents described a strong odor in the area at the time of the incident. Measurement of the valve chamber atmosphere conducted the following day yielded an oxygen level of 13%. (An atmosphere containing less than 19.5% oxygen is oxygen deficient and considered hazardous.) This was the only conclusive measurement.

CAUSE OF DEATH

The medical examiner listed the cause of death as asphyxia and methemoglobin due to inhalation of

irrespirable gasses.

RECOMMENDATIONS/DISCUSSION

Recommendation: Employers should develop, implement and enforce a comprehensive confined space entry program.

In this case, the employer's confined space entry program was still in the developmental stages. Employers in industries where employees may confront confined space hazards should develop, implement and enforce a comprehensive confined space entry program to address all provisions outlined in the following NIOSH publications: Working in Confined Spaces: Criteria for a Recommended Standard (Pub. No. 80-106); NIOSH Alert, Request for Assistance in Preventing Occupational Fatalities in Confined Spaces (Pub. No. 86-110); A Guide to Safety in Confined Spaces (Pub. No. 87-113); and NIOSH Guide to Respiratory Protection (Pub. No. 87-116).

A comprehensive confined space entry program should include the following:

- written confined space entry procedures
- evaluation to determine whether entry is necessary
- issuance of a confined space entry permit
- evaluation of the confined space by a qualified person
- testing and monitoring the air quality in the confined space to ensure:
- oxygen level is at least 19.5%
- flammable range is less than 10% of the lower flammable limit
- absence of toxic air contaminants
- initial and annual refresher training of workers and supervisors in the selection and use of:
    - safe entry procedures
    - respiratory protection
    - environmental testing equipment
    - lifelines and retrieval systems
    - protective clothing

- initial and annual refresher training of employees in safe work procedures in and around confined spaces
- initial and annual refresher training of employees in confined space rescue procedures
- conducting regular safety meetings to discuss confined space safety
- availability and use of proper ventilation equipment
- monitoring of the air quality while workers are in the confined space.