Pipefitter Testing Chill Water Lines Dies Following an Unexpected Pressure Release Which Resulted in a Four-Foot Fall From a Stepladder in West Virginia.

SUMMARY

On April 16, 1997, a 26-year-old male pipefitter died and a co-worker was injured when air pressure released unexpectedly in a chill water line they were testing, precipitating a fall. The two men were standing on opposite sides of a stepladder reaching overhead to remove a blank they had placed in the water line earlier in the day. Air pressure in the water line caused the blank to blow-out and both workers fell from the ladder. Following prompt emergency response, the co-worker was treated the local hospital and released, while the victim was transported to a local hospital where he was officially pronounced dead approximately thirty minutes following the incident. The WV FACE investigator concluded that to prevent similar occurrences, the following recommendations should be followed:

- **Develop, implement, and enforce a comprehensive safety program that includes, but is not limited to, a thorough hazard analysis and utilization of controls specific to the job**
- **Instruct each employee to recognize and avoid unsafe conditions applicable to their work environment, including but not limited to, pressure testing procedures and safe access to elevated work areas**
- **Incorporate worker safety in the planning phases of construction projects.**

INTRODUCTION

On April 17, 1997, the WV FACE Program was notified by the Center for Rural Emergency Medicine (CREM) that on April 16, 1997, a 26- year-old male pipefitter fell at work and was fatally injured. The WV FACE field investigator traveled to the jobsite on April 28, 1997 to review the fatality incident. The foreman of the victim's employer and the jobsite superintendent were interviewed and photographs were taken. During the course of the investigation, the death certificate was obtained. Phone or personal interviews were conducted with the employer, the union business manager, and the State Trooper who had also investigated the incident.

The employer in this incident was a mechanical contractor that had been in operation for 17 years and employed 40 workers, six of whom were pipefitters. The employer had a written general safety program. The company foreman was designated as the competent person on-site and conducted weekly safety training. Specific training addressing hazards associated with testing water lines was not included in the safety program and/or training. The victim was a journeyman pipefitter with six years experience. He had worked for the company for five months prior to the incident. The injured co-worker was a also a journeyman pipefitter who had worked for the company five months and had approximately 25 years experience as a pipefitter. This was the first fatality the company had experienced.

INVESTIGATION

The employer was under contract to install and test a water heating and cooling system in a building under construction. The installation of the heating and cooling system had taken approximately five months to complete and was at the testing phase at the time of the fatal incident.

On April 16, 1997, the victim and co-worker were assigned to test the chill water lines. Interviews with the victim's foreman, site superintendent, union business manager, and the State Trooper who viewed the site shortly following the incident indicate that the following events occurred. The workers spent the morning making blanks and then placing a blank at the end of each supply and return line in the chill water system. (Six blanks were placed: two on the south end (1, 2), two on the north (3, 4), and two in the mechanical room (5, 6) [see Figure 1]). A blank is a plug designed to completely seal off sections of pipe in a system so that the system can be tested for leaks using air pressure. The blanks made by the pipefitters at the jobsite had a solid metal face. They had no built-in mechanism to allow for release of air pressure where the blanks were located in the tested lines. With all valves in the chill water system in the open position, the workers attached a pressure gauge at the south end of the chill water line. Using an air pump, they pressurized the system to 80 pounds of air pressure per square inch. They then walked the line to listen for air leaks. Finding none, they returned to the location of the air pump and released the stored pressure. Workers nearby heard the sound of air under pressure coming out of the system, as expected.

The victim and co-worker then set out to remove the blanks from both the supply and the return chill water lines at the south and the north ends of the system (blanks 1, 2, 3, 4). To access the overhead water lines, where the blanks were placed, the workers used a stepladder designed for use by one person. One man stood on the step side, the other on the rung side and each reached up to release and to hold the 35 pound blank and remove it. They removed the blanks on the south and north lines without incident and proceeded to the mechanical room where they were to remove the final two blanks (5, 6)

Blanks that had been removed without incident were on water lines that had only single-function butterfly valves. These valves were open and the air pressure flowed out as designed. There were, however, other valves with a triple function in the chill water system with which the workers may not have been familiar. One triple valve was placed a short distance to the north on the north return water line, and one was placed on another section of the return water line approximately 40 feet from the mechanical room. Triple valves function to: open/close the flow, regulate flow volume, and operate in a check capacity. The check function is what makes the triple valve different from the other, more commonly-used single function butterfly valves. The check function can open flow on a section of pipe on one side of the valve and, at the same time, close off the flow in the section of pipe on the other side of the valve. This check function is important in large commercial buildings where specific areas of the building need the heat/chill service selectively directed.

In the testing of the chill water line on April 16, 1997, it appears that the victim and co-worker thought all lines in the system had valves in the open position and that all pressure had been bled off when they released air pressure at the pump following the test. However, the triple valve was functioning as a check and on the mechanical room side of the 40-foot section of pipe (schedule 40 carbon steel, 8 inches in diameter) pressure was not allowed to bleed out due to the pressure check mechanism installed within the valve. That 40-foot section of schedule 40 carbon steel pipe, 8 inches in diameter remained pressurized at 80 pounds of air pressure per square inch. When the victim removed the first bolt to allow for the removal of the blank (weighing approximately 35 pounds) in the mechanical room, the blank blew- out and hit a wall approximately ten feet away. The air pressure release caused the victim and co-

worker to fall from the stepladder they were using to reach the blanks in the chill water line. Both workers were standing on a stepladder designed for one person. The victim was standing on the fourth step and the co-worker on the rung side at approximately the same height. When they fell, the victim's head struck a tool box located on the floor behind him and the co-worker fell to the concrete floor. Figure 2 shows the section of pipe where blank 5, which was located on the return water line blew-out. Blank 6 located on the supply side remains in place in the photograph.

Carpenters working nearby heard a loud sound and upon investigating, found the victim lying on the concrete floor next to a tool box, bleeding profusely from the head. The injured co-worker and other workers rushed to the victim's aid and checked for vital signs while other workers called the site superintendent who then proceeded to call 911 for assistance. Cardiopulmonary resuscitation was performed on the victim while other workers tried to stop the bleeding. Paramedics arrived approximately seven minutes after being called and provided emergency care before transporting the victim to a local hospital. He was pronounced dead about 30 minutes after the incident occurred.

CAUSE OF DEATH

The medical examiner's report listed the cause of death as basilar skull fracture.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should develop, implement, and enforce a comprehensive safety program that includes, but is not limited to, a thorough hazard analysis and utilization of controls specific to the job.

Discussion: Although the company owner had a general safety program, the program was not comprehensive in that it did not cover the potential hazards involved with air pressure testing of newly installed heat/chill water lines. Given the potential for energy (air pressure) release within the line, a job safety analysis (JSA) with a step-by-step procedure for testing water lines should be developed and implemented. The competent person should inspect the jobsite regularly for hazards and enforce company safety procedures.

Recommendation #2: Employers should instruct each employee to recognize and avoid unsafe conditions applicable to the work environment, including but not limited to, pressure testing procedures and safe access to elevated work areas.

Discussion: The workers involved in this incident were not trained to recognize and control the potential safety hazards involved with testing chill water lines using air pressure. Although there are practices that some pipefitters use to ensure safe air pressure release after testing and before restoring the line to function, these practices are not specifically mandated by law or universally known by pipefitters. Current OSHA safety regulations for construction do not include specific regulations for safe air pressure testing. National codes written for the plumbing and pipefitters trades do not address worker safety and are written primarily to ensure that work performed meets building standards.

The employer's JSA for pressure testing, developed as a part of the comprehensive safety program, should be universally taught to all pipefitters, and any irregularities or concerns regarding safe practices should be reported to the competent person and the hazards addressed before work begins.

Additionally, the workers involved in this incident were not adequately trained to recognize and control the potential safety hazards related to access to elevated areas. To reach the overhead water lines, both workers were standing on a stepladder designed for use by one person. Training must address the proper choice, use, and placement of equipment designed to provide safe access to elevated areas. Given the weight and placement of the blank and the need for two persons to perform the work, a scaffold or a ladder designed for use by two people may have been a more appropriate choice.

Recommendation #3: Employers should incorporate worker safety in the planning phases of construction projects.

Discussion: During the planning stages of building construction projects, employers should examine the building plans/blueprints and identify any newly-designed equipment or material that replaces older, more familiar equipment or materials. In this incident, both single and triple valves were placed in the chill water line. Employers should inform workers about new equipment/materials and explain any differences between them. Any hazards the changed equipment/materials may create should be identified, if possible. Employers should identify the triple function valve with a warning tag or label. The tag or label should warn workers to seek information from the JSA and the company procedure before performing air pressure testing. In this fatal incident, the workers who performed the testing may not have recognized any difference in the function of the valves placed in the system.

REFERENCES:

29 Code of Federal Regulations Part 1926.20(b)2, Accident Prevention Responsibilities, and 1926.21(b)2, Employer Responsibility for Training.

29 Code of Federal Regulations Part 1926.1060(a)(b) Training requirements Subpart X Ladders and Stairways.

See 29 code of Federal Regulations Part 1926.450..Subpart L for Safety standards for scaffolds.

FATALITY ASSESSMENT AND CONTROL EVALUATION PROGRAM

The WVU Center for Rural Emergency Medicine, through a contract with the West Virginia Department of Health and Human Resources, conducts investigations on the causes of work-related fatalities within the state. The goal of this program is to prevent future fatal work-place injuries. West Virginia FACE intends to achieve this goal by identifying and studying the risk factors that contribute to workplace fatalities, by recommending intervention strategies, and by disseminating prevention information to employers, employees, trade associations, unions, equipment manufacturers, students, teachers, and others with an interest in workplace safety.

Please use information listed on the Contact Sheet on the NIOSH FACE website to contact In-house FACE program personnel regarding In-house FACE reports and to gain assistance when State-FACE program personnel cannot be reached.