Massachusetts Assembler/Welder Crushed To Death Beneath Twelve Ton Steel Tank

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SUMMARY

On January 26, 1995 a 34-year old male assembler/welder was crushed to death by a 12-ton steel tank at a Massachusetts steel fabrication and tank manufacturing plant. The victim had just removed the last of six tack-welded legs that were being used to hold the container in place. The tank became destabilized and rolled over, striking the victim twice as it rocked back and forth. The MA FACE field investigator concluded that in order to prevent similar future occurrences, employers should:

* **design, develop and implement a comprehensive safety program for all employees that includes, but is not limited to, safety training and hazard recognition for tank construction and rigging operations**

* **exercise good site control by the use of a safety monitor who would assure that all personnel are clear before crane operations begin**

* **assure that cranes and rigging are sufficient to control movements of objects being lifted or turned**

* **consider and address manufacturing process alternatives**

INTRODUCTION

On January 26, 1995, the MA FACE Program was informed by the Massachusetts Medical Examiners Office that a 34 year old male assembler/welder had died of crushing injuries received when a large tank rolled over onto him earlier the same day. An investigation was immediately initiated. On February 1, 1995 the FACE Program Director and Field Investigator traveled to the incident site and interviewed the employer and co-workers of the victim. The

police report, death certificate, OSHA Incident Summary, multiple photographs, witness interviews, and newspaper clippings were obtained during the course of the investigation. The employer was a steel fabrication and tank manufacturer in business for sixty-three years. The company employed 11 persons, five of which held the same job title as that of the victim.

The company did not have a designated safety officer, nor any written safety rules or procedures in place for the tasks being performed by the victim at the time of the incident.

The victim had worked for the employer for one month and eight days at the time of his death, but he had also spent time with the company in previous years. His training primarily took place on the job.

INVESTIGATION

On January 26, 1995 a Massachusetts steel fabrication and tank manufacturing company was engaged in producing a custom-fabricated steel tank for a local foundry. The tank, which was to be used as a sand silo, was 35-feet long and 12 feet in diameter. It weighed 24,000 pounds (twelve tons) and was capable of storing 120 tons of sand.

The tank was not like any that had been previously produced by the manufacturer. The company had mostly produced underground storage tanks. This tank was to be used above ground. An additional obstacle was that the tank legs were to be mounted outside rather than within the periphery of the tank because an apron was to be installed around the lower portion of the tank. Therefore, the manufacturer was unable to construct the tank in the usual manner, vertically in a pit with the tank on a turntable. An in-house committee was assembled to devise an alternative method for building the tank.

The strategy ultimately adopted by the company called for leaving the tank on its side after completion of the main body and utilizing "controlled rolls" to place the tank in position for welding the legs to its exterior. Each leg in turn would be welded at the 12 o'clock position (top) of the tank. The legs were made of 10W77 (10"/wide - 77 lbs./ft.) steel I-beam measuring 20 feet long and weighing approximately 1500 pounds each. Four legs were to be welded equally spaced on the tank. This would require the tank to be rolled several times.

In order to stabilize the tank while the welders were working on top, six outriggers were tack welded onto the bottom and sides of the tank. These outriggers would then be removed to allow the tank to roll 90 degrees. At the same time, the tank was held by two cranes. Each crane used one hook. The cross bracing at the bottom opening of the tank was attached to a truck crane, while an overhead crane suspended the tank via a hole in the tank's top. The cranes assisted in rolling the tank after the outriggers were removed. The cranes also were used to prevent the tank from rolling back in the opposite direction. After each 90 degree roll, the cranes would lift the tank back to its original location.

To remove the outriggers, the welds were first weakened by grinding, and the outriggers were knocked from position with a sledge hammer. The last outrigger was knocked from position

while keeping clear of the area where the tank was intended to roll. Removal of the last outrigger, usually located at one end of the tank, indicated that the tank was ready for a controlled rollover.

After the first leg was welded onto the tank at a 12 o'clock position, two 90-degree rolls were executed as planned to bring the tank to rest on the installed leg now at the 6 o'clock position. The outriggers were reinstalled and the second leg was welded onto the tank at the 12 o'clock position. One 90-degree roll was needed to place the tank at rest for attaching the third leg. This was done, leaving legs at the twelve, three, and six o'clock positions.

As the crew removed the outriggers and readied the tank for its final roll, the senior tank builder walked by the tank to deposit his welding hood and spotted the victim standing to the right side of the last outrigger, the precise spot where the tank was about to roll. He yelled to the victim to get out of there and continued walking towards the welding machine. As he did, he heard the sledge hammer strike the outrigger behind him. He turned to see the tank roll onto the victim. The leg at the 3 o'clock position rolled and struck the victim, rolled back, and rolled over once again, striking the victim a second time. Workers at the scene immediately yelled for 911 to be called. The crane operator was an emergency medical technician and tended to the victim until fire, police, and municipal rescue personnel responded.

The investigation revealed that when the last outrigger was knocked from position, the cranes could still prevent an accidental backwards rotation. However, with an added 1,500 pounds of weight at the three o'clock position, the cranes could no longer prevent an accidental forward rollover.

The victim was transported to a local facility and then air-lifted to a regional trauma center. He died as a result of his injuries less than three and a half hours after the incident.

CAUSE OF DEATH

The medical examiner listed the cause of death as multiple injuries.

RECOMMENDATIONS

Recommendation #1: Employers should design, develop and implement a comprehensive safety program for all employees that includes, but is not limited to, safety training and hazard recognition for tank construction and rigging operations

Discussion: The company did not have a written safety program, training program, or a designated safety officer. Employers should select a trained individual to develop, implement, and enforce a comprehensive safety program that includes, but is not limited to, job site hazard surveys, special project considerations, and worker training in specialty tank manufacturing and hazard recognition. All employees should be trained to recognize the hazards associated with rigging heavy materials. On special projects, such as this one, a brief pre-lift meeting that

informed all workers as to what precautions needed to be taken during the lift might have prevented the incident from occurring.

Recommendation #2: Employers should exercise good site control by the use of a safety monitor who would assure that all personnel are clear before crane operations begin

Discussion: The victim was working in a location which exposed him to crushing injuries when the tank was turned. Although an employer representative was alert enough to identify the hazard, his specific duties did not include identifying and controlling the hazards of the operation. Therefore, he did not take it upon himself to stop the operation until the area was cleared. Had a person been assigned such responsibility, the victim's death may have been prevented.

Recommendation #3: Employers should assure that cranes and rigging are sufficient to control movements of objects being lifted or turned

Discussion: The ability of the tank to rollover was recognized and controlled during the welding operation. At that time, the tank was secured using tack-welded outriggers. The hazards of tank rollover or movement during the installation and removal of the outriggers and during the actual turning of the tank were not controlled. The cranes were used to assist in rolling the tank, but the rigging was insufficient to control the movement of the tank. The rigging should have been such that the cranes were actively turning the tank rather than allowing the tank to roll. An example would be the installation of welded lifting lugs located such that the tank could have been hooked at two or more points, rather than one point at each end. If the cranes had full control over tank movements, the uncontrolled rollover and subsequent death may have been prevented.

Recommendation #4: Employers should consider and address manufacturing process alternatives

Discussion: From the very beginning of this tank building process, new company technology was developed and utilized. While the end result was a product which met the buyer's specifications, perhaps not all possible manufacturing processes were explored to make the project safer. For example, if the tank were left in a fixed position to install the legs, rather than being rotated so often to weld all legs at the twelve o'clock position, perhaps the incident may have been averted.

REFERENCES

U.S. Dept. of Labor, OSHA, 29 CFR 1926 Subpart N Cranes, Derricks, Hoists, Elevators and Conveyors

U. S. Department of Energy, Hoisting and Rigging Manual, Washington, DC, April 1993, DOE/ID-10500