The National Institute for Occupational Safety and Health (NIOSH)

Construction Worker Falls to His Death From a Collapsed Scaffold Tower in New Jersey

New Jersey Case Report: 90NJ004 (formerly NJ9002)

DATE: November 2, 1990

SUMMARY

On April 24, 1990, a 28-year-old construction worker in New Jersey was killed after falling 33 feet from a collapsed scaffold tower. The victim was a member of a crew that specialized in erection of steel storage tank. They were erecting waste water tanks in the site of a chemical company. Standing on top of a tubular welded steel scaffold tower, in the center of the tank under construction, the victim reached forward to adjust a section of the roof dome being assembled. As he did so, the unstable scaffold tipped backward and the worker fell 33 feet to his death. New Jersey Department of Health FACE investigators concluded that, in order to prevent similar occurrences in the future, employers and employees must:

- assess each job for potential hazards and plan according to this assessment;
- provide safety training to all employees that addresses all potential hazards to which workers mat be exposed;
- securely construct and stabilize all scaffolding to prevent tipping;
- ensure safety by fully planking and utilizing guardrails on scaffold towers;
- utilize alternate methods of construction when feasible.

INTRODUCTION

FACE project personnel of the New Jersey Department of Health were informed on April 24,1990 of the fatality by an OSHA area safety supervisor. An OSHA safety compliance officer inspected the site immediately and New Jersey Department of Health FACE personnel conducted a joint investigation with OSHA on April 25, 1990. An expanded opening conference was conducted by the OSHA compliance officer. Also present were the employer, company foreman, chemical company representatives and FACE project personnel. Photographs of the site were taken. Information about co-workers' statements was derived from the OSHA file. The OSHA safety compliance officer supplied important background information.

The victim had been employed for more than two years as a boiler maker-welder by the company and had seven years of ironworking experience prior to his employment with them. The company has been installing storage tanks for 17 years and employs 15 people. There are a maximum of five workers at a construction site. The company has no written safety program. All instruction and training are done on-the-job by the foreman and co-workers. Several citations, related to the fall and other unsafe work practices, were issued by OSHA because of this incident.

INVESTIGATION

The construction company crew, under contract to the chemical company, had been on-site for two months and had completed construction of three steel storage tanks at the plant site. The concrete pad on which the tanks are erected was constructed by another contractor. The construction crew planned to have fourth tank finished in the next week. The fourth tank has a 250,000 gallon capacity and measures 40 feet in diameter, 29 feet to the top of the rim and 35 feet to the peak of the dome.

The tank and dome are constructed by assembling pre-cut, numbered, sheets of steel. (See diagram number 1.) The steel dome sections are assembled by fitting them to a center steel “hanging ring” which rests on the scaffold tower. The dome sections are then tack welded at the outside perimeter of each sheet and further secured by key plates and bull pins. The center steel ring, the inside of which remains open when the roof is completed, is 4 feet in diameter with four 30 inch legs. The legs of the center ring are supported by planks on the scaffold tower, in the center of the tank, while the dome is being assembled. Using this method, the “hanging ring” cannot be secured to the planks because it has to be adjusted while the dome is being assembled; it is used as a template for the dome assembly. After the entire dome is assembled, the legs of the center ring are removed and permanent welding is done. All equipment used in the tank must be able to be disassembled to be moved in and out of the tank through a side opening 24 inches in diameter. This is also the only entrance to the tank interior for workers.

The crew had erected the steel floor and circular shell of the fourth tank and, on the day if the incident, began assembly of the dome. The first and second roof pieces had been tack welded into place and the crane swung the third piece into position. The foreman stood in an exterior perimeter scaffold with two other men and relayed signals from the victim to the crane operator. The victim stood on a single plank platform at the sixth frame of the center scaffold tower inside the 40 feet diameter tank. The scaffold tower was built of six bays of tubular welded steel, each of which measured five feet in height, plus a three foot guard rail frame. Each bay was five feet ten inches long and five feet two inches wide. The steel ring was placed on two planks at the top of the guardrail frame. The legs of the ring rested on the planks. The victim stood within the ring. (See diagram number 2.) Because the third roof section misaligned with the second, the victim attempted to push against it using both hands. He stood on one plank at the top of the scaffold tower with his head and shoulders through the center ring and pushed a section which was chest height. As he reached with his arms the unstable scaffold tower tipped backward and it collapsed against the inside wall. (See diagram number 3.)

As the tower tipped, the victim fell 33 feet and landed on the steel base on the concrete pad. The center ring also fell to the floor and one of its legs was broken off. The second roof sheet, previously welded in place, broke loose and fell, struck the inside wall and may have struck the victim. Each of the four legs of the scaffold had been set into base plates but were not attached by pins. When the scaffold tipped, two of the four legs came out of the base plates.

The foreman, still standing on the exterior scaffolding, immediately called the crane operator to have an ambulance summoned. Police arrived first on the scene in about 7 minutes followed by emergency services and paramedics. Rescue operations were very dangerous because the first dome section remained attached only at the rim of the tank with no other support. There was the possibility of it falling on rescue personnel. Co- workers returned to the site later that same day to remove the remaining roof section.

CAUSE OF DEATH

The cause of death was listed by the medical examiner as severe trauma to the head and chest.

RECOMMENDATIONS/DISCUSSIONS

Recommendation #1: The employer should perform a job hazard analysis to identify the safety hazards which may be encountered in each phase of the construction process.

Discussion: A job hazard analysis identifies the hazards faced by each worker in his particular role, in each phase of a project. Failure to adequately identify and control these hazards results in unnecessary employee exposure to harmful and potentially fatal occurrences. The analysis forces the construction team to evaluate their present methods of work procedures. As much as possible employees should be included in this process. Their participation may enhance their compliances with safe work practices.

Recommendation #2: Provide appropriate safety training to all employees.

Discussion: Job assessment and planning must be followed by employee education. Increased attention must be paid to safety and safety education by employer and employees. The OSHA inspection revealed that the employer was in violation of CFR 1926.21(b)(s)1 because he failed to provide adequate safety education to his employees.

Recommendation #3: The scaffold tower should have been securely constructed and stabilized.

Discussion: The scaffold tower was not sufficiently braced to prevent diagonal movement of its members. Horizontal diagonal braces should have been provided at sufficient intervals of the tower to keep it square and rigid. This would have prevented its collapse by preventing it from being force out of shape or plumb. In this instance, horizontal bracing at the bottom bay and the fourth bay (approximately 25 feet high) would have helped stabilize the scaffold. The tower should have been secured to the tank or some other structure at intervals no less than four times the minimum base dimension to stabilize it. This would have stabilized the tower and prevented tipping. The center of gravity was at the top center and any movement of the worker on the platform offset the center of gravity.

Outriggers could have increased the base dimensions and may have prevented its tipping when the victim rearranged the misaligned roof section. The scaffold was 33 feet tall with a base measuring 5 feet 10 inches by 5 feet 2 inches. If the structure is more than 4 times taller its smallest base dimension, outriggers provide increased stability.

Recommendation #4: Scaffold tower platforms must be fully planked and provided with guardrails.

Discussion: The victim stood on a single plank platform at the top of an unstable scaffold tower which had no access ladder (a violation of 29 CFR 1926.451(a)(13).) He was unprotected by guardrails. Even if the tower had not collapsed, the worker could have been injured because of the lack of any physical barrier to a fall.

Recommendation #5: The company should utilize alternate methods of construction.

Discussion: The company had previously constructed the dome of another tank by fabricating and welding it on the ground. The entire roof was then hoisted into place by the crane and permanently welded to the rim. Using this method no center scaffold tower is necessary. After the fatality the crew returned to the site and completed the roof in this manner.

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