



The National Institute for Occupational Safety and Health (NIOSH)

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Painter Dies Following a 40-foot Fall from Scaffold Inside Water Tank in Ohio

FACE 9016

SUMMARY

A painter sandblasting the interior of a water tank, died after falling 40 feet from a four-point suspension scaffold when one of the nylon suspension ropes broke. The painter had previously welded some steel brackets to the inside top wall of the tank in order to install a fall protection anchor cable. Later, as the painter, a co-worker, and the company owner were raising one end of the scaffold platform during a sandblasting operation, a suspension rope broke, causing the painter to fall. An OSHA investigation determined that the rope broke at a point where it had been burned, presumably when the steel brackets were welded. NIOSH investigators concluded that, in order to prevent future similar occurrences, employers should:

- **prohibit welding in the vicinity of synthetic rope suspension scaffolding**
- **construct and maintain suspension scaffolding in accordance with OSHA and ANSI Standards**
- **ensure that fall protection equipment is provided and used by workers as needed**
- **develop and implement a safety program to help workers recognize and control hazards**
- **develop and implement procedures for entry and work in confined spaces.**

Additionally, tank designers/manufacturers should:

- **design and install appropriate tank anchor points for maintenance purposes**

INTRODUCTION

On November 20, 1989, a 39-year-old male painter (victim) fell 40 feet from a scaffold, when one of the nylon suspension ropes supporting the scaffold broke. Although the incident occurred in Ohio, the victim died in a Pennsylvania hospital. On November 30, 1989, officials from a county coroner's office in Pennsylvania notified the Division of Safety Research (DSR) of the death, and requested technical assistance. On December 12, 1989, a research industrial hygienist from DSR traveled to the incident site to conduct an investigation. The DSR investigator reviewed the incident with company representatives and the OSHA compliance officer assigned to the case, and obtained photographs and diagrams of the incident site.

The employer is an industrial painting contractor who has been in business for 10 years. Most of the employer's business involves painting building exteriors and other outdoor structures. Contracted work is either done by the owner himself or with the help of one or two hired workers, depending on the job. The victim in this incident was the owner's brother, who

also owned his own painting company and had been an industrial painter for 15 years. The employer has no safety program.

INVESTIGATION

The employer had been contracted by a manufacturing company to sandblast and paint the interior and exterior of a 250,000-gallon steel water tank, which measures 48 feet high by 30 feet in diameter. The tank has an 18-inch-diameter manway on the side 12 inches from the bottom, and a 3-foot-square hatch on top of the tank near the edge.

The employer hired a laborer to help him with the job. The owner and laborer had sandblasted and painted the outside of the tank 3 weeks prior to the incident, using a two-point suspension scaffold. The scaffold consisted of a platform (20 feet long and 2 feet wide) constructed of angle iron and wood planks with a metal guardrail. The top rail of the guardrail was 40 inches above the platform. The platform was suspended by two, 5/8-inch-diameter nylon ropes from a triangular framework ("stirrup") of angle iron at the ends of the platform. The nylon ropes passed through a block and tackle hoist at both ends of the platform. The other end of each rope was tied to a vent pipe on top of the tank. By pulling and letting up on the individual ropes and tying them to the platform, the scaffold platform could be positioned at the desired height.

After painting the exterior of the tank, the owner hired his brother (the victim) to help him sandblast and paint the interior. In order to remove the moisture and condensation inside the tank, the owner opened the manway and hatch, and positioned two propane salamander heaters equipped with blowers just outside the manway to blow warm air into the tank. The owner, the victim, and the laborer entered the tank through the manway and hatch with the necessary scaffold parts, and set up a suspension scaffold similar to the two-point suspension scaffold used on the outside of the tank. However, with this scaffold, three platforms were joined together by overlapping the ends of two other platforms inside the stirrups at the ends of the center platform. The resulting configuration formed a "U"-shaped, four-point suspension scaffold (Figures 1 and 2).

Before the suspension scaffold was raised into position, the victim climbed a ladder to weld steel brackets to the opposite side walls at the top of the tank. The brackets were used to anchor a horizontal 3/8-inch-diameter steel cable (to be used as a fall protection anchor cable). The nylon suspension ropes were lying on the floor of the tank while the brackets were being welded. After the welding, the owner inspected the suspension ropes by passing each rope length through his hands, but did not notice any apparent damage to the ropes.

The four suspension ropes and two, 300-watt portable utility lights were then tied to angle iron roof support beams at the top of the tank. Another 300-watt utility light was secured to the center scaffold platform. The entire scaffold platform was raised to approximately 40 feet above the floor and the victim began sandblasting the top portion of the tank wall. During the sandblasting, the victim wore a supplied air respirator (without an auxiliary, escape-only SCBA), a sandblaster's hood, gloves, and coveralls. The owner urged the victim to wear a safety belt, secure it to a vertical rope (lifeline) with a rope-grab device, and secure the other end of the lifeline to the horizontal steel cable at the top of the tank. The victim chose not to wear the fall protection equipment, saying that it would get in his way. After the victim had sandblasted as much of the top portion of the tank as he could reach, the platform was lowered to the floor of the tank and the nylon suspension ropes were reattached to roof support beams above the portion of the tank which had yet to be sandblasted. The three men began raising the scaffold platform by alternately raising each suspension point a few feet at a time. Again, the victim did not wear any type of fall protection equipment. The laborer, however, did wear a safety belt/lifeline tied off to the steel cable as the owner had suggested. The owner was standing at the bottom of the tank during this time.

While the victim (who was standing on the platform at one end) was pulling on a suspension rope to raise one end of the scaffold, it broke, causing that end of the platform to fall. The victim fell approximately 40 feet, landing on a horizontal, 2-inch-diameter water pipe at the bottom of the tank. The laborer managed to remain standing on the other platform leg which stayed intact (Figure 2). The owner rushed to the victim (who was unconscious but still breathing), placed the victim on a piece of planking, and the owner and laborer subsequently removed him from the tank through the manway. The laborer then ran to the manufacturing plant for help. The county emergency medical service (EMS) was notified and arrived at the site 12 minutes later. The victim was rushed to a local hospital and then air transported to a larger hospital where he died in the operating room 3 hours later. An OSHA investigation determined that the suspension rope broke at a point where it had been burned.

CAUSE OF DEATH

The coroner listed the cause of death as blunt force trauma to the head and trunk.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Synthetic rope used in suspension scaffolding should be protected from heat producing sources.

Discussion: Paragraph 3.25 of the American National Standards Institute (ANSI) "Safety Requirements for Scaffolding," A10.8-1977, states that "Special precautions shall be taken to protect scaffold members, including any wires, fiber, or synthetic rope when using a heat producing process." Occupational Safety and Health Administration (OSHA) standard 29 CFR 1926.451(a)(18) states that "No welding, burning, riveting, or open flame work shall be performed on any staging suspended by means of fiber or synthetic rope." An OSHA investigation after the incident determined that the rope had broken at a point where it had been burned. Exactly how the rope was burned is not clear. The victim had previously welded steel support brackets to the inside of the tank. Although the welding was not done from the scaffolding platform, it was performed above the nylon rope which was lying on the floor of the tank before the scaffolding was raised. Also, the 300-watt utility lights may have come too close or contacted the nylon suspension ropes sometime during the sandblasting operation.

Recommendation #2: Suspension scaffolding should be constructed and maintained in accordance with OSHA Standard 19 CFR 1926.451, and ANSI Standard A10.8-1977.

Discussion: The OSHA and ANSI Standards require synthetic or fiber rope used for scaffold suspension to be capable of supporting at least six times the rated load (29 CFR 1926.451(a)(19) and (i)(5), and ANSI A10.8-1977, 3.23). Due to the size and type of rope being used it is questionable whether it was capable of meeting this requirement.

Recommendation #3: Where the potential for a fall from an elevation exists, employers should ensure that fall protection equipment is provided and used by workers.

Discussion: Although fall protection equipment, consisting of a steel anchor cable secured horizontally across the top of the tank (to secure lifeline ropes), lifeline ropes, safety belts, and rope-grab devices, was available at the site during the incident, it was not used by the victim. The use of a safety belt/lanyard combination is required by 29 CFR 1926.451(i)(8) for use on two-point suspension scaffolds. The use of the safety belt or body harness/lanyard with a rope-grab device is appropriate for persons working from scaffolds at varying heights. Properly used, this type of fall protection would have prevented the victim from falling even when the scaffolding fell.

Recommendation #4: Employers should develop and implement a safety program designed to help workers recognize, understand, and control hazards.

Discussion: OSHA Standard 1926.21(b)(2) states that "the employer shall instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury." Even small companies should evaluate the tasks performed by workers, identify all potential hazards, then develop and implement a safety program addressing these hazards, and provide worker training in safe work procedures. Prior to starting any job, the employer should conduct a jobsite survey, identify all hazards, and implement appropriate control measures.

Recommendation #5: Employers should develop and implement specific procedures for entry and work in confined spaces.

Discussion: The owner and workers in this incident were working inside a confined space. Even though the victim died from the result of a fall, there were other potential hazards associated with the work to be performed inside the tank (i.e., painting the inside of a tank with a toxic and flammable paint). Although most of the work contracted by the employer does not require confined space entry, it is reasonable to expect that future work might require the employer and hired workers

to enter other types of confined spaces. The company should therefore, develop and implement a confined space entry program as outlined in NIOSH publications 80-106, "Working in Confined Spaces," and 87-113, "A Guide to Safety in Confined Spaces." Minimally, the following items should be addressed:

1. Has the air quality in the confined space been tested for safety?
 - Oxygen supply at least 19.5%
 - Flammable range less than 10% of the lower explosive limit
 - Absence of toxic air contaminants
2. Have employees and supervisors been trained in the selection and use of personal protective equipment and clothing?
 - Fall protection
 - Respiratory protection
 - Emergency rescue equipment
 - Protective clothing
3. Have employees been trained for confined space entry?
4. Have employees been trained in confined space rescue procedures?
5. If ventilation equipment is needed, is it available and/or used?
6. Is the air quality tested when the ventilation system is operating?

Recommendation #6: The designers/manufacturers of tanks of this type should design and install appropriate anchor points for maintenance purposes.

Discussion: Permanent structures of this type are known to require extensive maintenance when they are designed. It is essential that designers/owners of these facilities incorporate appropriate anchor points on tanks to which workers can adequately secure scaffolds and lifelines. Omission of designed anchor points causes workers to improvise anchors or not use them at all. This increases the possibility that a scaffold will be erected using improper procedures and components.

REFERENCES

1. American National Standards Institute (ANSI) Inc., Safety Requirements for Scaffolding. ANSI A10.8-1977, 1977.
2. Office of the Federal Register. Code of Federal Regulations. Labor. 29 CFR Part 1926, pages 20, 180-181, U.S. Department of Labor, Occupational Safety and Health Administration, Washington, D.C.
3. National Institute for Occupational Safety and Health, Criteria for a Recommended Standard ... Working in Confined Spaces. DHHS (NIOSH) Publication Number 80-116, December 1979.
4. National Institute for Occupational Safety and Health, A Guide to Safety in Confined Spaces. DHHS (NIOSH) Publication Number 87-113, 1987.

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