

MISSOURI OCCUPATIONAL FATALITY ASSESSMENT AND CONTROL EVALUATION (MO FACE)

Tower Construction Worker Dies Following 40-Foot Fall From Cellular Tower

MO FACE Investigation #99MO138

Date: May 22, 2001

Type: Fall

SUMMARY

On November 26, 1999, a 38-year-old tower construction worker fell approximately 40 feet from a cellular tower. The victim and co-workers were in the process of constructing a 180-foot monopole tower. The victim was working outside of the tower at the 40-foot level where he was bolting together two tower sections. The tower design allowed the workers to reach through access ports from the outside, place the bolt through the section flange and tighten the nut to specifications. There were several bolts that could not be reached from the outside of the tower. The co-worker climbed down to the ground and climbed up the inside of the tower. The co-worker then could slide the bolt through the flange and the victim could tighten the nut to specifications. At the time of the incident the victim was wearing a saddle style-positioning belt. Attached to his positioning D-rings was a spreader bar, with a large hook. Apparently, the victim unhooked from the tower and was moving to the next bolt location when he fell. The victim was taken by ambulance to a local hospital and then life-flighted to a trauma center where he died the morning of November 27, 1999.

The MO FACE investigator concluded that in order to prevent similar occurrences all employers should:

- **provide employees with a 100% fall protection system compatible with the work being performed, instruct employees in the proper use of the system and equipment, and ensure their use;**
- **employers should ensure that proper personal protective equipment is available and instruct workers in the proper use and limitations of the system, and ensure its use;**
- **develop, implement, and enforce a comprehensive written safety program which includes a commitment to 100% tie off and written procedures to implement 100% fall protection.**

Additionally, manufactures of tower components and tower owners should:

- **consider installing fall-protection fixtures on tower components during fabrication or erection that would facilitate the use of fall protection.**

INTRODUCTION

The MO FACE investigator was notified of an occupational fatality at a tower construction site in Missouri at approximately 11:00 a.m., November 27, 1999, by the county sheriff's office. The investigator responded to the incident site on Monday November 29, 1999. Upon arrival the investigator found that the company had returned home to be with their families and the family of the victim. Employees of the cellular service company who owned tower were present and were also there at the time of the incident. The company returned to the site on Thursday, December 2, 1999. On-site at this time were the company owners, the president of the tower manufacturing company and a compliance officer for the Occupational Safety and Health Administration (OSHA).

The employer is a tower erection company who has been in business for approximately five years and, at the time of the incident, employed one employee. The company did not have written safety rules and procedures in place for the tasks performed by the workers. According to the employer, the victim was experienced in tower construction and had received training that specifically addressed the hazards associated with the fatality. The victim was a temporary employee for this company, employed just for the construction of this tower. This was his second day on this job and was the first fatality the company had experienced.

INVESTIGATION

The tower construction company contracted with the cellular service company to erect a 180-foot monopole cellular telephone tower. The company had been on-site for three days when the incident occurred. The victim had arrived at the site working for his regular employer three days before the incident. His regular job was to deliver and install the prefabricated electronics building which was located next to the base of the tower. The victim had prearranged with the tower contractor to stay on-site after he had completed the installation of the electronics building and work for them in the construction of the tower.

On the day of the incident the workers began setting tower sections with the assistance of a crane service company. They had set and bolted the 20-foot base section to the concrete foundation and slab. Section two had been set and bolted to the base section. The tower had been completed to the height of 40-feet. The next 20-foot section was set in place by the crane. The victim and one co-worker were on the tower at the 40-foot height. They were bolting the flanges of the two sections together using a total of 48 bolts. Most of the bolts and corresponding nuts could be placed by reaching through access ports, placing the bolt up through the flange and tightening the nut down from the outside. There were several bolts that could not be reached from the outside and the co-worker climbed down from the outside of the tower and climbed up the inside to the 40-foot level. From inside the tower the co-worker could place the bolts up through the flange and victim could tighten the on the bolt. As the victim was repositioning himself on the tower he unhooked his positioning belt. At this time he lost his grip and fell 40-feet. The workers onsite immediately came to the victim's aid. A worker with the cellular company called 911 from their cell phone and helped direct the ambulance to the site. The victim was taken by ambulance to a local hospital then life-flighted to a trauma center where he did not survive the injuries and died the next

morning.

CAUSE OF DEATH

Severe Brain Injury, Multiple Trauma.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should provide employees with a 100% fall protection system compatible with the work being performed, instruct employees in the proper use of the system and equipment, and ensure their use.

Discussion: In this incident, the employee was using a positioning safety belt sometimes described as a tree-trimmers belt, but no other fall-protection system was in place to protect him as he moved on the tower. OSHA Compliance Directive, CPL 2-1.29 - Interim Inspection Procedures During Communication Tower Construction Activities describes measures to be taken during the construction of telecommunication towers:

1. When climbing the tower during construction activities, employees must be protected from falls using a fall arrest system meeting the criteria of 29CFR1926.502 or a ladder assist safety device meeting the requirements of 29CFR1926.1053(a). These are acceptable methods of accessing tower workstations regardless of height. All employees climbing or otherwise accessing towers must be trained in the recognition and avoidance of fall hazards and in the use of the fall protection systems to be used, pursuant to 1926.21 or where applicable, 1926.1060.
2. Some industry representatives have joined with OSHA in recommending that each employee six feet or more above a lower level should be protected from falling by a guardrail system, safety net system, ladder safety device, fall arrest system or positioning device system. However, current OSHA standards only require fall protection at heights of more than 25 feet.

Fall-protection is defined as follows: Employees at risk of falling from work levels more than six feet above the ground or working surface should be protected by some conventional means of fall protection, which may include an integral fall-arrest system. This applies to ascending, descending, moving point-to-point, or any other tower construction or alteration-work activity conducted at an elevated workplace. Employers should also require a minimum of three-point contact (two hands and one foot or two feet and one hand) at all times when employees are moving on the tower.

Fall protection for tower work is more easily provided when the employee is stationary and can tie-off at one location on the structure. When employees are required to move about on the tower, other means of fall protection are recommended, which can include, but are not limited to, a Y-style lanyard with connectors at each end that:

1. can attach to anchorage points incorporated into the design of the tower;
2. are large enough to completely encircle tower members to which they are to be attached (these large connectors may require a special order from a fall-protection equipment manufacturer as the throat opening must be large enough to encircle the member); or
3. a Y-style lanyard made of reinforced fabric. The reinforced lanyards can be

looped around the tower member and attached back to themselves.

These lanyards attach to the D-ring at the center back (dorsal position) of the employee's full-body harness.

A fall-arrestor should also be incorporated into the lanyard. Using this system allows the worker to move about the structure alternating the use of each leg of the Y lanyard providing 100 percent fall protection.

This may be the most feasible method for fall protection when moving horizontally on the tower.

When there is an anchor point above the worker's head a properly installed and used retractable lifeline or retractable lanyard may be considered. These fall limiting devices are a preferred method of fall protection due to they engage almost immediately minimizing the fall distance and significantly reducing the impact on the worker. Other means of providing vertical fall protection is incorporating lifeline and rope-grab system. Lifelines can be attached to the tower sections on the ground before they are raised into position. After the higher tower section is set and bolted in place and the worker is securely attached to

the tower with his positioning lanyards he can easily switch the rope grab from the lower lifeline and upper lifeline and then continue to ascend vertically. These lifelines need to remain in place for descending tower as well.

The first person going up the tower is at greatest risk if there has been no vertical lifeline established. To ensure 100 percent fall protection during the initial ascent, an anchor hook can be used to establish temporary anchor points. The anchor hook is attached to a telescoping pole to which a lifeline or retractable lanyard is attached. The retractable lanyard extends between the D-ring in the middle of the harness back and the anchor hook. If a lifeline is used, a rope grab travels on the rope and is attached to the center D-ring on the harness back. The other end attaches to the anchor hook. When the employee moves the hook, he must always be attached to the structure using his positioning system. Once he reaches the top of the structure he secures the lifeline to an anchor point and can then use the lifeline and rope grab for future climbs.

Tie-off adapters should be issued to each employee to allow them to establish an anchorage on the tower.

Once the tower is fully constructed a permanent system should be in place to protect the worker while climbing the tower using permanently installed climbing pegs or ladder.

One such system includes the use of a safety-climb device/system. This system incorporates a metal cable stretched the entire length of the tower and equipped with a cable-grab device. The worker attaches the front (sternal) D-ring on his harness to the cable-grab using a connector or short lanyard. The cable grab ascends with the worker.

If the worker slips or falls from the climbing pegs or ladder the cable grab immediately engages limiting the fall distance.

For more information regarding these and other available methods to achieve 100% fall protection, employers should consult with safety professionals and fall-protection-equipment sales representatives to learn more about systems available that meet their particular needs. Employers should keep in mind that when there are no specific OSHA regulations governing the safety of workers performing these tasks, and the OSHA general duty clause (Public Law 91-596, Section 5 (a) (1)) may apply.

Recommendation #2: Employers should ensure that required personal protective equipment is available and instruct workers in the proper use and limitations of the system, and ensure its use.

Discussion: In this incident, the employee was not equipped with proper personal protective equipment. The system the victim was using to tie off to the tower was a tree-trimmers belt. The belt consisted of a safety belt with two positioning D-Rings and a sling across the back to which the worker would place across his buttocks and sit into. This did not provide sufficient protection from falls and does not comply with OSHA Compliance Directive CPL2-129 and 29CFR1926.502(d), which requires the use of a full body harness as a personal fall arrest system.^{1, 2}

Recommendation #3: Employers should develop, implement, and enforce a comprehensive written safety program which includes a commitment to 100% tie off and written procedures to implement 100% fall protection.

Discussion: The evaluation of tasks to be performed at the work-site forms the basis for development, implementation, and enforcement of a safety program. Key elements of such a program should include, at minimum, frequent and regular inspection of the work-site and should include provisions for training employees in hazard identification, avoidance and abatement. The comprehensive safety program should include a clear statement indicating the employer's commitment to providing 100% fall protection, to preventing worker death and minimizing injury due to falls, and a commitment to meeting OSHA safety requirements, including the general-duty requirements. The fall protection plan should include, but may not be limited to:

- identification of work-site activities that require fall protection;
- any methods to be used to eliminate the fall hazard;
- all protective systems and PPE to be used for worker protection;
- training for workers;
- minimum standards for protection systems and their use;
- ongoing evaluation to correct any deficiencies in the system or in the use of the system by workers,
- a plan for worker involvement in identifying fall hazards;

- a plan for systematic review of the plan.

Recommendation #4: Manufacturers of tower components and tower owners should consider installing fall-protection fixtures on tower components during fabrication or erection that would facilitate the use of fall protection.

There are fall protection fixtures that can be engineered into the tower design and added during component fabrication or erection that would facilitate the use of fall protection systems. For example, the installation of safety-climb devices/systems on all tower legs, the installation of permanent horizontal and vertical lifelines, and the installation of anchorage points. These and other methods should be researched and evaluated keeping in mind that employees will need to perform work on existing towers whenever services are to be changed or maintained.

The manufacturer of this tower did incorporate fall protection into the tower design. Anchorage points were welded onto the outside and the inside at all strategic points where workers would be located during tower construction.

REFERENCES

1. OSHA Compliance Directive, CPL 2-1.29 - Interim Inspection Procedures During Communication Tower Construction [1999]. United States Department of Labor, Occupational Safety and Health Administration, Washington, D.C.
2. Code of Federal Regulations 29 CFR 1926.502, U.S. Government Printing Office, Office of the Federal Register, Washington, DC.

The Missouri Department of Health, in co-operation with the National Institute for Occupational Safety and Health (NIOSH), is conducting a research project on work-related fatalities in Missouri. The goal of this project, known as the Missouri Occupational Fatality Assessment and Control Evaluation Program (MO FACE) is to show a measurable reduction in traumatic occupational fatalities in the state of Missouri.

This goal is being met by identifying causal and risk factors that contribute to work-related fatalities. Identifying these factors will enable more effective intervention strategies to be developed and implemented by employers and employees. This project does not determine fault or legal liability associated with a fatal incident or with current regulations. All MO FACE data will be reported to NIOSH for trend analysis on a national basis. This will help NIOSH provide employers with effective recommendations for injury prevention. All personal and company identifiers are removed from all reports sent to NIOSH to protect the confidentiality of those who voluntarily participate with the program.

SIGNATURES:

Thomas D. Ray
MO FACE Program Coordinator
Chief Investigator