EH&S FALL PROTECTION POLICY
UFEHS-SAFE1-01/03/2002
Environmental Health and Safety
Finance and Administration
University of Florida

OBJECTIVE: To establish minimum requirements for practices and procedures to protect employees from hazards of falls when working in elevated work areas such as rooftops, platforms and aerial lifts.

AUTHORITY: OSHA 29CFR 1926 Subpart M, OSHA 29CFR 1910.23, OSHA 29CFR 1910.66, OSHA 29CFR 1910.132, OSHA 29CFR 1910.269, Governors Executive Order 2000-292.

POLICY: All employees, students, volunteers, and contractors working under direct UF supervision shall comply with all elements of the UF Fall Protection Program (see Procedures Section).

RESPONSIBILITIES: EHS – Develop, maintain, distribute, and provide oversight in accordance with all applicable federal and state regulations, and best industry practices. EH&S staff, supervisors and PIs have the responsibility and authority to halt any unsafe practices not in accordance with this policy. Environmental Health and Safety (EH&S) has the responsibility for assisting departments in developing appropriate fall protection plans, providing technical guidance and assisting with employee training.

Departments – Comply with all policy and program elements.

PROCEDURES: All work performed in elevated areas such as aerial lifts, roofs, elevated platforms, on top of industrial equipment, building ledges, etc. shall be in accordance with this policy and the referenced fall protection program.

UF Fall Protection Program

General

Each year over 100,000 injuries and deaths are attributable to work-related falls. The Bureau of Labor Statistics show falls as one of the leading causes of occupational death. An OSHA study

involving 99 fall-related fatalities suggests that all of the deaths could have been prevented by the use of fall protection. Fall protection can be in the form of guardrails, personal fall arrest systems, or under specific conditions, warning line systems.

An employee must be protected from falling when working on a surface that has an unprotected side or edge, which is 6 feet or more above an adjacent lower level, or when working from bucket trucks or other personnel lifts with articulating booms.

In each of these cases, the fall hazards must be evaluated to determine the preferable method to protect the employee.

Responsibilities

Supervisors have the primary responsibility for the implementation of the Fall Protection Program in their work area. The supervisor should be a competent person, as defined by OSHA, or ensure that responsibility for the competent person is assigned to a qualified individual within the work group. OSHA defines a competent person as:

1) A person who is capable of identifying existing and predictable hazards in the surroundings or identifying working conditions which are hazardous or dangerous to employees and
2) Who has authorization to take prompt corrective measures to eliminate them.

Supervisors must assure that only trained individuals are assigned work that requires use of fall protection systems (other than guardrails).

Employees have the primary responsibility for proper care, use and inspection of their assigned fall protection equipment.

Departments have the primary responsibility for providing fall protection systems and appropriate training.

Environmental Health and Safety (EH&S) has the responsibility for assisting departments in developing appropriate fall protection plans, providing technical guidance and assisting with employee training.

Training

Each employee who may be exposed to fall hazards will be trained to recognize the hazards and the procedures to follow to minimize the hazards. A competent person will provide the training.

The competent person must train employees in the following areas:

- fall hazards in the work area
- correct procedures for erecting, maintaining, disassembling and inspecting the fall protection systems used
- use and operation of the fall protection systems used
- role of employees in fall protection plans

- what rescue procedures to follow in case of a fall
- overview of the OSHA fall protection standards

A training record will be maintained for each employee. The record will contain the name of the employee trained, date of training and the signature of the person who conducted the training. Retraining should be done if there is a change in the fall protection system being used or if an employee's actions demonstrate that the employee has not retained the understanding or skills important to fall protection.

Fall Protection Systems

One of the following systems should be in place whenever an employee is exposed to a fall of greater than six feet.

Guardrail systems

Guardrails are needed at the edge of work areas 6 feet or more in height to protect employees from falling. This includes the edge of excavations greater than six feet in depth. Guardrail systems need to meet the following criteria:

- Toprail is 42 inches, +/- 3 inches above the walking/working level
- Midrail is located midway between the top rail and the walking/working level
  * It is important to remember that the working level is that level where the work is being done. Someone working on a stepladder next to an edge may raise his/her working surface well above the walking surface.

- Both top and midrails should be constructed of materials at least one-quarter inch in thickness or diameter. If wire rope is used for toprails, it needs to be flagged with a high-visibility material at least every 6 feet and can have no more than 3" of deflection
- The toprail needs to withstand a force of 200 pounds when applied in any downward or outward direction.
- The midrail needs to withstand a force of 150 pounds applied in any downward or outward direction
- The system should be smooth to prevent punctures, lacerations or snagging of clothing
- The ends of the top rail should not overhang the terminal posts, except when such overhang does not present a projection hazard
- When a hoisting area is needed, a chain, gate or removable guardrail section must be placed across the access opening when hoisting operations are not taking place.

Personal Fall Arrest Systems

Personnel requiring the use of personal fall protection equipment shall employ the "Buddy System" or have an observer to render assistance when and if required.

There are three main components to the personal fall arrest system. This includes the personal protective equipment the employee wears, the connecting devices and the anchorage point. Prior to tying off to perform the work a means of rescue in the event of a fall must be immediately available. The system needs to meet the following criteria for each component:

Personal Protective Equipment

- **Full body harnesses are required.** The use of body belts is prohibited.
- The attachment point of the body harness is the center D-ring on the back.
- Employees must **always** tie off at or above the D ring of the harness except when using lanyards 3 feet or less in length.
- Harnesses or lanyards that have been subjected to an impact load shall be destroyed.
- Load testing shall not be performed on fall protection equipment.

Connecting devices

This device can be a rope or web lanyard, rope grab or retractable lifeline.

- Only locking snaphooks may be used.
- Horizontal lifelines will be designed by a qualified person and installed in accordance with the design requirements.
- Lanyards and vertical lifelines need a minimum breaking strength of 5,000 pounds.
- Lanyards may not be clipped back to itself (e.g. around an anchor point) unless specifically designed to do so.
- If vertical lifelines are used, each employee will be attached to a separate lifeline.
- Lifelines need to be protected against being cut or abraded

Anchorage

Secure anchor points are the most critical component when employees must use fall arrest equipment. UF buildings may have existing structures (e.g., steel beams that may meet the criteria for a secure anchor point). Other work locations and assignments may require the installation of a temporary or permanent anchor. As a minimum, the following criteria must be considered for each type of anchor point:

- Structure must be sound and capable of withstanding a 5000 lb. static load/person attached.
- Structure/anchor must be easily accessible to avoid fall hazards during hook up.
- Direct tying off around sharp edged structures can reduce breaking strength by 70% therefore; chafing pads or abrasion resistant straps must be used around sharp edged structures to prevent cutting action against safety lanyards or lifelines.
- Structures used as anchor points must be at the worker's shoulder level or higher to limit free fall to 6 feet or less and prevent contact with any lower level (exception – when self retracting lifelines and or 3 foot lanyards are used)
- Choose structures for anchor points that will prevent swing fall hazards. Potentially dangerous "pendulum" like swing falls can result when a worker moves horizontally away from a fixed anchor point and falls. The arc of the swing produces as much energy as a vertical free fall and the hazard of swinging into an obstruction becomes a major factor. Raising the height of the anchor point can reduce the angle of the arc and the force of the swing. Horizontal lifelines can help maintain the attachment point overhead and limit the fall vertically. A qualified person must design a horizontal lifeline.

Permanent Anchor Requirements

In addition to all the criteria listed above, the following points must be considered:

- Environmental factors and dissimilarity of materials can degrade exposed anchors.
- Compatibility of permanent anchors with employee's fall arrest equipment.
- Inclusion of permanent anchors into a Preventive Maintenance Program with scheduled annual re-certification.
- Visibly label permanent anchors.
- Anchors must be immediately removed from service and re-certified if subjected to fall arrest forces.

Reusable Temporary Anchors:

- Reusable temporary roof anchors must be installed and used following the manufacturer's installation guidelines.
- Roof anchors must be compatible with employee's fall arrest equipment.
- Roof anchors must be removed from service at the completion of the job and inspected prior to reuse following the manufacturer's inspection guidelines.
- Roof anchors must be immediately removed from service and disposed of if subjected to fall arrest forces.

Complete system

- If a fall occurs, the employee should not be able to free fall more than 6 feet nor contact a lower level.
  To ensure this, add the height of the worker, the lanyard length and an elongation length of 3.5 feet. Using this formula, a six-foot worker with a six-foot lanyard would require a tie-off point at least 15.5 feet above the next lower level.
- A personal fall arrest system that was subjected to an impact needs to be removed from service immediately.
- Personal fall arrest systems need to be inspected prior to each use and damaged or deteriorated components removed from service.
- Personal fall arrest systems should not be attached to guardrails nor hoists.

Work from Aerial Lifts and Self Powered Work Platforms

Body harnesses must be worn with a shock-absorbing lanyard (preferably not to exceed 3 feet in length) and must be worn when working from an elevated work platform (exception: scissor lifts and telescoping lifts that can move only vertically do not require the use of a harness and lanyard as long as the work platform is protected by a guardrail system). The point of attachment must be the lift's boom or work platform. Personnel cannot attach lanyards to adjacent poles, structures or equipment while they are working from the aerial lift.
Personnel cannot move an aerial lift while the boom is in an elevated working position and the operator is inside of the lift platform.

Inspection

The employee will inspect the entire personal fall arrest system prior to every use. The competent person will inspect the entire system in use at the initial installation and weekly thereafter. The visual inspection of a personal fall arrest system periodically will follow the manufacturer's

recommendations. An example of a complete inspection is in Appendix A.

Warning Line Systems and Controlled Access Zones
Warning line systems and work in controlled access zones must be developed in accordance with OSHA regulation 1926.502 and must be approved by EH&S or their designee before employees are exposed to fall hazards.

Monitoring System
OSHA emphasizes that safety-monitoring systems are a last resort and may only be used when other systems are infeasible or present a greater hazard. Monitoring systems must be developed in accordance with OSHA regulation 1926.502 and must be approved by EH&S or their designee before employees are exposed to fall hazards.

Appendix A
Personal Fall Arrest System Inspection

All fall protection equipment shall be inspected before each use in accordance with the manufacturers instructions. The following is general guidance for the inspection of this equipment.

Harness Inspection Webbing

- Inspect the entire surface of webbing for damage. Beginning at one end, bend the webbing in an inverted "U". Holding the body side of the belt toward you, grasp the belt with your hands six to eight inches apart. This surface tension makes the damaged fibers or cuts easier to see. Watch for frayed edges, broken fibers, pulled stitches, cuts, burns, and chemical damage.

"D" Rings/Back Pads

- Check "D" rings for distortion, cracks, breaks, and rough or sharp edges. The "D" ring should pivot freely. "D" ring back pads should also be inspected for damage.

Attachment of Buckles

- Note any unusual wear, frayed or cut fiber, or distortion of the buckles.

Tongue/Grommet

- The tongue receives heavy wear from repeated buckling and unbuckling. Inspect for loose, distorted or broken grommets. The webbing should not have any additional punched holes.

Tongue Buckle

- Buckle tongues should be free of distortion in shape and motion. They should overlap the buckle frame and move freely back and forth in their socket. The roller should turn freely on the frame. Check for distortion or sharp edges.

Friction and Mating Buckles

- Inspect the buckle for distortion. The outer bars and center bars must be straight. Pay special attention to corners and attachment points of the center bar.

Lanyard Inspection Hardware

- **Snaps:** Inspect closely for hook and eye distortions, cracks, corrosion, or pitted surfaces. The keeper (latch) should seat into the nose without binding and should not be distorted or obstructed. The keeper spring should exert sufficient force to firmly close the keeper. Keeper locks must prevent the keeper from opening when the keeper closes.
- **Thimbles:** The thimble must be firmly seated in the eye of the splice, and splice should have no loose or cut strands. The edges of the thimble must be free of sharp edges, distortion, or cracks.

Web Lanyard

- While bending the webbing over a curved surface such as a pipe, observe each side of the webbed lanyard. This will reveal any cuts or breaks. Examine the webbing for swelling, discoloration, cracks, or burns. Observe closely for any breaks in the stitching.

Rope Lanyard

- Rotation of the rope lanyard while inspecting from end to end will bring to light any fuzzy, worn, broken or cut fibers. Weakened areas from extreme loads will appear as a noticeable change from the original diameter. The rope diameter should be uniform throughout, following a short break-in period. Make sure the rope has no knots tied in it. Knots can reduce the strength of the rope by up to 60%.

Shock-absorbing Lanyard

- Shock-absorbing lanyards should be examined as a web lanyard. However, also look for signs of deployment. If the lanyard shows signs of having been put under load (e.g. torn out stitching), remove it from service.

Appendix B Definitions

Fall Protection System - Fall Protection Systems are designed to protect personnel from the risk of falls when working at elevated heights. Recognized systems include:

Fall Prevention - a structural design to limit a fall to the same level (e.g., guardrails, positioning/restraint systems).

Fall Arrest System - an approved full body harness, shock absorbing lanyard or self retractable lifeline, locking snap hooks and anchor points approved for a static load of 5000 pounds or engineered to meet a two to one safety factor.

Aerial Lift - Vehicle mounted elevating work platform (e.g. Boom Lifts, Articulating Telescoping Boom Lifts).

Competent Person - A person who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are hazardous to personnel and who has authorization to quickly correct the situation.

Qualified Person - A person with a recognized degree or professional certificate, (e.g. civil or mechanical engineering profession or Certified Safety Professional) and extensive knowledge and experience in this area, capable of doing design, analysis, evaluation and specifications.

Certification - ANSI (American National Standards Institute) defines certification as documentation that determines criteria meets the requirements of the standard through testing or proven analytical method (e.g. engineering calculations) or both, carried out under the supervision of a Qualified Person..

DISCLAIMER

Mention of any company or product does not constitute endorsement by NIOSH.

ORDERING INFORMATION

To receive documents or other information about occupational safety and health topics, contact the National Institute for Occupational Safety and Health (NIOSH) at

NIOSH—Publications Dissemination
4676 Columbia Parkway
Cincinnati, OH 45226–1998

Telephone: **1–800–35–NIOSH** (1–800–356–4674)
Fax: 513–533–8573
E-mail: pubstaft@cdc.gov

or visit the NIOSH Web site at www.cdc.gov/niosh

DHHS (NIOSH) Publication Number 2001–156

July 2001

SAFER • HEALTHIER • PEOPLE

NIOSH

ALERT

Preventing Injuries and Deaths from Falls during Construction and Maintenance of Telecommunication Towers

WARNING!

Workers involved in construction and maintenance of telecommunication towers are at high risk of fatal falls.

WORKERS *should take the following steps to protect themselves from falls during tower construction and maintenance:*

- Use 100% fall protection when working on towers at heights above 25 feet.
- Participate in all training programs offered by your employer.
- Follow safe work practices identified by worker training programs.
- Use OSHA-required personal protective equipment and make sure you are trained in its proper use.
- Inspect equipment daily and report any damage or deficiencies to your supervisor immediately.

EMPLOYERS *should take the following steps to reduce the risk of worker injuries and deaths from falls during tower construction and maintenance:*

- Comply with OSHA Compliance Directive 2–1.29.
- Ensure that hoisting equipment used to lift workers is designed to prevent uncontrolled descent and is properly rated for the intended use.
- Ensure that hoist operators are properly trained.
- Ensure that workers use 100% fall protection when working on towers at heights above 25 feet.
- Provide workers with a 100% fall-protection system compatible with tower components and the tasks to be performed.
- Ensure that gin poles are installed and used according to the specifications of the manufacturer or a registered professional engineer.
- Ensure that tower erectors are adequately trained in proper climbing techniques, including sustaining three-point contact.
- Provide workers with OSHA-required personal protective equipment and training in its proper use.
- Ensure that workers inspect their equipment daily to identify any damage or deficiencies.
- Provide workers with an adequate work-positioning device system. Connectors on positioning systems must be compatible with the tower components to which they are attached.
- Supplement worker training on safe work practices with discussions of FACE case reports.
- Know and comply with child labor laws that prohibit hazardous work by workers under age 18.

Please tear out and post. Distribute copies to workers.

See back of sheet to order complete Alert.

For additional information, see ***NIOSH Alert: Preventing Injuries and Deaths from Falls during Construction and Maintenance of Telecommunication Towers*** [DHHS (NIOSH) Publication No. 2001–156]. Single copies of the Alert are available free from the following:

NIOSH—Publications Dissemination
4676 Columbia Parkway
Cincinnati, OH 45226–1998

Telephone: 1–800–35–NIOSH (1–800–356–4674)
Fax: 513–533–8573
E-mail: pubstaft@cdc.gov

or visit the NIOSH Web site at www.cdc.gov/niosh

Department of Health and Human Services
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

NIOSH ALERT

Preventing Injuries and Deaths from Falls during Construction and Maintenance of Telecommunication Towers

WARNING!

Workers involved in construction and maintenance of telecommunication towers are at high risk of fatal falls.

The National Institute for Occupational Safety and Health (NIOSH) requests assistance in preventing deaths and injuries from falls of workers during construction and maintenance of telecommunication towers. Recent NIOSH fatality investigations suggest that employers, supervisors, workers, tower owners, tower manufacturers, and wireless service carriers may not recognize or appreciate the serious fall hazards associated with tower construction and maintenance. As a result, they may not follow safe work practices for controlling these hazards. This Alert describes seven deaths resulting from falls during construction and maintenance of telecommunication towers. The Alert also includes recommendations for preventing similar incidents. The seven deaths were investigated by the NIOSH Fatality Assessment and Control Evaluation (FACE) Program.

BACKGROUND

The widespread use of wireless communication services has resulted in the construction of telecommunication towers to hold transmitting devices for cellular phones, personal communication services, and television and radio broadcast antennas. The Federal Communications Commission (FCC) estimates that at least 75,000 telecommunication towers have been constructed in the United States, and industry groups indicate that more than 1,000 telecommunication towers are erected each year [Chiles 1997]. The Telecommunications Act of 1996 (Public Law 104–104) is expected to promote more tower construction to meet the increased demand for wireless communication services [OSHA 1998].

Telecommunication towers may be of several types and range in height from 100 to 2,150 feet or more [OSHA 1998]. Three general forms of telecommunication towers are

— monopoles that consist of tapered steel tubes that fit over each other to form a stable pole,

— guyed towers that are stabilized by tethered wires, and

— self-supporting towers that are free-standing lattice structures (Figure 1).

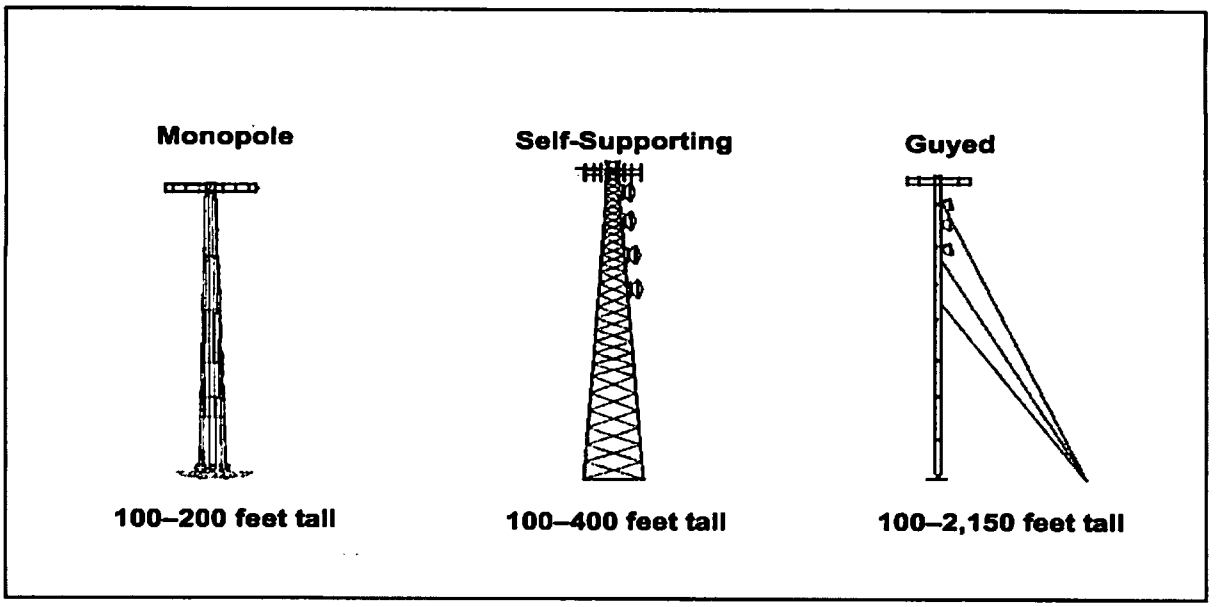

Figure 1. Tower types.

Telecommunication towers are generally manufactured as sections and constructed onsite by hoisting each section into place and bolting sections together. Some models of shorter towers are self-erecting. For most towers that are constructed onsite, cranes and gin poles attached to the tower being erected are generally used to hoist each section into place. A gin pole is a device unique to the telecommunication tower industry. The gin pole is used to raise successive sections of steel, equipment, or workers into position. This temporary lifting device uses cables and pulleys to allow enough head room to accommodate the length of the next tower section or equipment being installed (Figure 2).

The exact number of workers involved in tower construction and maintenance is unknown. Workers are categorized in a variety of occupational subgroups for which employment data are collected. These groups include communications workers, painters, steel erectors, and electrical and electronic equipment repairers. This type of work also occurs in several industrial subgroups such as the following:

- SIC* 623—Water, sewer, pipeline, and communications and power line construction (subcategory—radio transmitting tower construction)
- SIC 1731—Electrical work (subcategory—telecommunications equipment installation)
- SIC 1791—Structural steel erection
- SIC 1799—Special trade contractors not elsewhere classified (subcategory—antenna installation, except household type)

In addition to telecommunication towers, transmitting devices for wireless communication services are often mounted on the roof perimeters of buildings, exposing workers to fall hazards. However, the mounting and maintenance of these devices on buildings require fall protection measures that are not addressed in this document.

*Standard Industrial Classification (SIC) [OMB 1987].

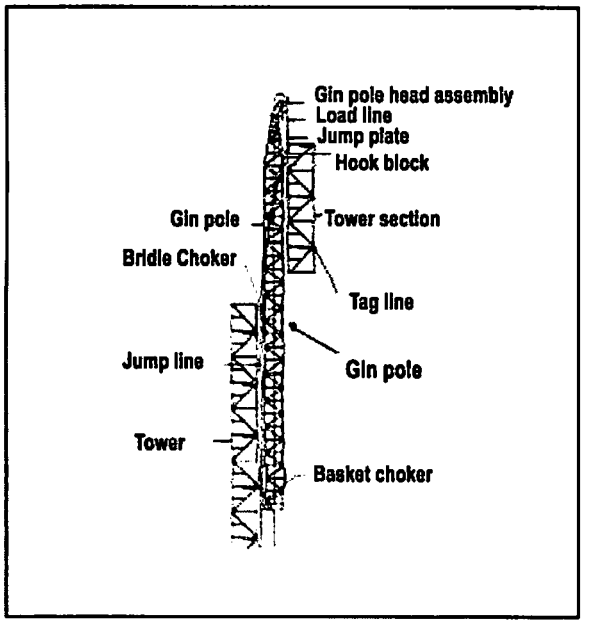

Figure 2. Gin pole attached to communication tower.

FATALITY DATA

The Census of Fatal Occupational Injuries (CFOI) is a multisource data system maintained by the Bureau of Labor Statistics to identify work-related deaths in the United States. A NIOSH review of the CFOI data identified 118 deaths associated with work on telecommunication towers from 1992 through 1998. These deaths included 93 falls, 18 telecommunication tower collapses, and 4 electrocutions. However, the number of deaths identified here should be considered a minimum because identification methods are not exact [NIOSH 2000a].

Estimates vary greatly about the number of workers in telecommunication tower construction and maintenance. In 1993, estimates ranged from 2,300 to 23,000 workers in this field [OSHA 1998]. These estimates suggest fatality rates of 49 to 468 deaths per 100,000 workers—nearly 10 to 100 times the average rate of 5 deaths per 100,000 workers across all industries.

CURRENT STANDARDS

OSHA

The Occupational Safety and Health Administration (OSHA) safety standard for fall protection in the construction industry [29 CFR† 1926, Subpart M] excludes steel erection activities on nonbuilding structures such as towers. Subpart R of the OSHA fall protection standard in construction [29 CFR 1926] has a proposed effective date of September 18, 2001, and does not apply to transmission towers, communication and broadcast towers, and tanks.

Compliance Directive

To address hazards associated with telecommunication tower construction and maintenance, OSHA formed a multiagency Tower Task Force in August 1997. The Task Force (with representatives from Regional and Federal OSHA offices, the Federal Aviation Administration, the U.S. Army Corps of Engineers, NIOSH, the U.S. Navy, and others) has worked with the National Association of Tower Erectors (NATE) to develop a compliance directive to protect workers from hazards in the tower construction industry.

The OSHA compliance directive (CPL 2–1.29, *Interim Inspection Procedures During Communication Tower Construction Activities*) became effective January 15, 1999 [OSHA 1999]. The directive addresses fall protection and safe tower access during construction. Specifically, the directive does the following:

†*Code of Federal Regulations*. See CFR in references.

- Establishes uniform policies and procedures for OSHA compliance officers when conducting inspections of towers under construction

- Describes best practices for use by the industry

- Requires telecommunication tower workers to maintain 100% fall protection when working 25 feet or more above the ground (this requirement applies to workers ascending, descending, or moving from point to point)

- Specifies procedures and allowable conditions under which workers may access the tower by "riding the line" (a practice in which workers are directly lifted up a tower by a hoist line):

  — Prohibits riding the line for work at heights less than 200 feet above the ground. Requires instead that workers access workstations at these heights using conventional methods such as climbing with fall protection or use of a personnel platform

  — Permits up to two tower erectors at a time to ride the line for work at heights more than 200 feet above the ground when (1) towers are erected with gin poles, (2) conditions preclude the use of a personnel platform, and (3) other conventional methods of climbing using a ladder or other approved climbing devices might create a greater hazard from fatigue or repetitive stress

- Specifies minimum requirements for allowing workers to be hoisted on the hoist line, such as the following:

  — Worker training

  — Use of hoisting equipment that has been approved, certified, and/or inspected by a registered professional engineer or other designated professional

  — Trial lift and proof-testing procedures

  — Pre-lift meetings

  — Documentation of procedures used

  — Continuous communication between hoist operator and workers being hoisted

  — Consideration of environmental conditions

  — Specifications and maintenance for hydraulic hoists and gin poles

Addendum on the Use of Gin Poles

The OSHA Tower Task Force may develop an addendum to the OSHA compliance directive (CPL 2.129) or a new directive specific to the use of gin poles. Such a directive would draw on guidelines that already exist or are under development [NATE 1998, 1999]. For example, NATE has developed industry guidelines for the use of gin poles. In addition, the Telecommunications Industry Association/ Electronic Industries Association (TIA/EIA) is developing a gin pole standard [TIA/EIA 2001]. OSHA is considering components from both the NATE gin pole guidelines and the TIA/EIA standard for use in any future compliance directive addressing gin poles.

At a minimum, any future directive on gin poles would require that a registered professional engineer's drawing be available at the site. The drawing must

— show the gin pole and its track (if any) and indicate lifting capacity and the manner of attachment to the tower,

— indicate track attachment to at least two places (top and bottom), and

— indicate how high the gin pole can be raised above its uppermost attachment to the tower.

In addition, any future directive would require inspection records, documented worker training, and an anti-two block device (a device that prevents contact between the lower load block or hook assembly and the gin pole head assembly).

Fair Labor Standards Act and Youth Employment

The Fair Labor Standards Act (FLSA) [29 USC[‡] 201 et seq.] includes work declared hazardous for youth by the Secretary of Labor. Hazardous Order No. 7 *Power Driven Hoisting Apparatus Occupations* prohibits workers under age 18 from work in all occupations involved in the operation of a power-driven hoisting apparatus, including riding on a manlift. The Act defines the term *manlift* as "a device intended for the conveyance of persons which consists of platforms or brackets mounted on, or attached to, an endless belt, cable, chain, or similar method of suspension; such belt, cable, or chain operating in a substantially vertical direction and being supported by and driven through pulleys, sheaves, or sprockets at the top and bottom."

[‡]*United States Code.*

CASE REPORTS

The cases presented here were investigated by the NIOSH FACE Program. The goal of this program is to prevent occupational fatalities across the Nation by (1) identifying and investigating work situations that involve high risk for worker injury and (2) formulating and disseminating prevention strategies.

Case 1

On December 3, 1999, the 40-year-old owner of a tower-painting company, his 16-year-old stepson, and a 19-year-old employee died after falling 1,200 feet to the ground. The company had been at the site for 2 weeks repairing the beacon light at the top of a 1,500-foot radio broadcast tower, painting the tower, and installing rest platforms. On the day of the incident, the owner had planned to work on the beacon light at the top of the tower while the other two workers continued painting the tower. A 3,000-foot length of ¾-inch nylon rope and a 1,000-pound-capacity portable electric capstan hoist were used to raise the workers up the outside of the tower. Three loops were tied into the hoist line approximately 6 feet apart. The workers used these loops to help them ride the hoist line. The stepson was first on the line, followed by the 19-year-old, and then the company owner. Using a length of woven rope, the workers had attached one of the rest platforms to the end of the nylon rope 62 inches below the last loop. The company owner's wife was operating the capstan hoist using a foot pedal located on the ground. As the wife was hoisting the workers up the side of the tower, the hoist line began to slip around the capstan. The wife was unable to hold the rope and the workers fell to the ground. The hoist used in this

incident was not manufactured or rated for lifting people. In addition, the load was likely to have exceeded the lifting capacity of the hoist [NIOSH 2000b].

Case 2

On December 8, 1998, a 21-year-old male tower erector died after sliding approximately 1,000 feet down a supporting guy wire. The victim and coworkers were attaching dampeners to the tower guy wires when the incident occurred. The tower being constructed was a 1,040-foot, high-definition digital television tower. When the incident occurred, the victim was at the 1,000-foot level and was wearing a positioning safety belt with a T-bar attached to the D-rings on his belt. Attached to one end of the T-bar was an adjustable-length lanyard with a large hook as its terminal device. Attached to the other end of the lanyard was a large hook. The victim placed the large hook over the guy wire but did not attach the adjustable lanyard to the tower before sliding out on the guy wire. Although he had one foot draped over the wire, he could not keep himself from sliding. The victim slid rapidly down the wire, striking the anchor point of the guy wire. He was pronounced dead at the scene [Missouri FACE 1998].

Case 3

On November 13, 1998, a 41-year-old male tower erector fell 240 feet from a 260-foot telecommunication tower while attempting to install a new phone service device on the tower. The victim and a coworker attached their lanyards to the cable climb positioned on one leg of the tower and climbed to the 240-foot level of the tower. The owner and a third tower erector remained on the ground. Both workers wore two 6-foot lanyards attached to the side D-rings on their body harnesses. The terminal devices on the coworker's lanyards were two large pelican hooks. The terminal device on one of the victim's lanyards was a large pelican hook, but the other lanyard had a smaller snaphook as a terminal device. The victim began to attach a coaxial phone cable to an antenna arm while the coworker, with his back to the victim, was attaching cable tray components to the tower. A short time later, the victim fell, unwitnessed, from the tower to the ground. The coworker stated that two pelican hooks were necessary because the smaller snaphook could not be attached to the larger tower components [NIOSH 1999].

Case 4

On July 16, 1998, a 23-year-old male tower erector died after falling 200 feet from a telecommunication tower while attached to an 80-foot section of cable tray. He was a member of a nine-man crew erecting a 240-foot, three-sided telecommunication tower. The crew bolted a 140-foot section of the tower together on the ground. Next this section was set in place by a crane. The workers then erected the final 100-foot section on the ground, and three tower erectors climbed the 140-foot section. The final section was set in place by the crane, and the workers bolted the two sections together. The crane then lifted an 80-foot section of cable tray to the top of each side of the tower. As each section was lifted into place, an erector began to attach it to the tower using four J bolts every 10 feet. The victim began working down the tower, attaching the cable tray and tightening all bolted connections as he descended. After approximately 1 hour, the victim was at the 200-foot level of the tower. The victim then repositioned himself and connected both of his lanyards to

the partially attached cable tray. Shortly thereafter, the section of cable tray gave way, falling to the ground with the victim attached [NIOSH 1998a].

Case 5

On December 8, 1997, a 32-year-old male tower erector was working with a crew of two others on a 160-foot cellular phone tower. The crew had completed the tower erection and was in the process of lowering the gin pole (the lifting device used to hoist tower sections into place) to the ground. The tower erector had removed two choker cables securing the upper section of the gin pole to the tower and was attempting to ride the hoist cable down to the two lower chokers. The terminal device on the victim's lanyard was a pelican hook with a 4-inch-wide by 7¼-inch-long interior opening. The terminal device on the hoist cable was a 3-inch clevis. Either the victim tried to hook to the cable and missed or the larger opening of the pelican hook on his lanyard slipped off the hoist cable. He fell 130 feet to the ground [NIOSH 1998b].

CONCLUSIONS

These incidents suggest that employers, workers, tower owners, tower manufacturers, and wireless service carriers may not fully appreciate or recognize the serious hazards associated with the construction and maintenance of telecommunication towers and the need to follow safe work procedures that include the use of 100% fall protection.

FACE investigations identified the following contributing factors in fatal falls from telecommunication towers:

- Hoist failure
- A hoist that is not rated to hoist workers
- Truck-crane failure
- Inadequate fall protection
- Failure to attach the lanyard to the tower
- Terminal devices on the lanyard that are not compatible with tower components
- Attachment of lanyard to unstable tower components
- Failure to ride the line under prescribed conditions
- Inadequate worker training
- Potential fatigue and repetitive strain

Failure by employers, workers, tower owners, tower manufacturers, and wireless service carriers to address these factors could result in future fatalities.

RECOMMENDATIONS

NIOSH recommends that employers and workers comply with OSHA directives, maintain equipment, and take the following measures to prevent injuries and deaths when constructing or maintaining telecommunication towers.

Employers

Employers should take the following steps to reduce the risk of worker injuries and deaths during tower construction and maintenance:

- Comply with OSHA Compliance Directive 2–1.29 *Interim Inspection Procedures During Communication Tower*

Construction Activities. OSHA inspectors use these guidelines in tower inspections. Employers should ensure that workers follow these guidelines.

- Ensure that hoisting equipment used to lift workers is designed to prevent uncontrolled descent and is properly rated for the intended use.
- Ensure that hoist operators are properly trained.
- Ensure that workers use 100% fall protection when working on towers at heights above 25 feet.
- Provide workers with a 100% fall-protection system compatible with tower components and the tasks to be performed.
- Ensure that gin poles are installed and used according to the specifications of the manufacturer or a registered professional engineer.
- Ensure that tower erectors are adequately trained in proper climbing techniques, including sustaining three-point contact.
- Provide workers with OSHA-required personal protective equipment and training in its proper use.
- Ensure that workers inspect their equipment daily to identify any damage or deficiencies.
- Provide workers with an adequate work-positioning device system. Connectors on positioning systems must be compatible with the tower components to which they are attached. (Note that a work-positioning device system does not constitute 100% fall protection.)
- Supplement worker training on safe work practices with discussions of FACE case reports to help assure that workers fully appreciate the serious hazards involved with their tasks and the need for strict safe work practices.
- Know and comply with child labor laws that prohibit hazardous work by workers under age 18. An example of hazardous work is any task involving power-driven hoisting apparatus.

Tower Owners and Manufacturers

Tower owners should take the following steps:

- Use contracts requiring that workers adhere to OSHA-required safety measures (including Compliance Directive 2–1.29) while construction or maintenance is being performed on your towers.
- Require contractors to have a formal safety and health program relating to tower construction and maintenance.
- Include a provision in your contracts for frequent and regular jobsite inspections by a competent person who has expertise in tower erection and worker fall protection.

Both manufacturers and tower owners should install fall-protection fixtures for workers to use as anchor points on tower components during fabrication or erection.

Workers

Workers should take the following steps to protect themselves during tower construction and maintenance:

- Use 100% fall protection when working on towers at heights above 25 feet.
- Participate in all training programs offered by your employer.
- Follow safe work practices identified by worker training programs.
- Use OSHA-required personal protective equipment and make sure you are trained in its proper use.
- Inspect equipment daily and report any damage or deficiencies to your supervisor immediately.

ACKNOWLEDGMENTS

The principal contributors to this Alert were Virgil Casini and Dawn N. Castillo of the NIOSH Division of Safety Research, and T.J. Lentz of the NIOSH Education and Information Division. Cases presented in this Alert were contributed by the NIOSH FACE Project and by Thomas D. Ray of the Missouri State-Based FACE Project. Additional reports from FACE investigations are available at the NIOSH internet site: www.cdc.gov/niosh/face/faceweb.html.

Please direct comments, questions, or requests for additional information to the following:

Dr. Nancy A. Stout, Director
Division of Safety Research
National Institute for Occupational Safety and Health
1095 Willowdale Road
Morgantown, West Virginia 26505–2888
Telephone: 304–285–5894

For further information about occupational safety and health topics, call 1–800–35–NIOSH (1–800–356–4674), or visit the NIOSH Web site at www.cdc.gov/niosh.

We greatly appreciate your help in protecting the safety and health of U.S. workers.

Kathleen M. Rest, Ph.D., M.P.A.
Acting Director
National Institute for Occupational Safety and Health
Centers for Disease Control and Prevention

REFERENCES

CFR. Code of Federal regulations. Washington, DC: U.S. Government Printing Office, Office of the Federal Register.

Chiles, JR [1997]. We got us some sky today, boys. Smithsonian *28*:44–52.

Missouri FACE [1998]. Tower construction worker dies following 940-foot fall from television tower. Jefferson City, MO: FACE Investigation No. 98MO161.

NATE [1998]. NATE Gin Pole Procedures. San Diego, CA: National Association of Tower Erectors. February 6.

NATE [1999]. NATE Large Gin Pole Procedures. New Orleans, LA: National Association of Tower Erectors. February 19.

NIOSH [1998a]. Tower erector dies after falling 200 feet from telecommunication tower—North Carolina. Morgantown, WV: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, FACE Report No. 98–20.

NIOSH [1998b]. Tower erector dies after falling 130 feet from hoist cable to ground—Pennsylvania. Morgantown, WV: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, FACE Report No. 98–5.

NIOSH [1999]. Tower erector dies after falling 240 feet from a telecommunications tower—North Carolina. Morgantown, WV: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, FACE Report No. 99–01.

NIOSH [2000a]. NIOSH analysis of the Census of Fatal Occupational Injuries. Morgantown, WV: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Division of Safety Research. Unpublished.

NIOSH [2000b]. Three tower painters die after falling 1,200 feet when riding the hoist line—North Carolina. Morgantown, WV: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, FACE Report No. 2000–07.

OSHA [1998]. Profile of the wireless telecommunications industry and the telecommunications tower industry. (Contract No. J–9–F–4–0013, Jack Faucett Associates, Bethesda, Maryland.) Washington, DC: U.S. Department of Labor, Occupational Safety and Health Administration.

OSHA [1999]. CPL 2–1.29 Interim inspection procedures during communication tower construction activities. Washington, DC: U.S. Department of Labor, Occupational Safety and Health.

OMB [1987]. Standard industrial classification manual. Washington, DC: Executive Office of the President, Office of Management and Budget.

TIA/EIA [2001]. Draft Standard, TIA/EIA-PN-4860-Gin Poles. Structural standards for steel gin poles used for the installation of antenna towers and antenna supporting structures. Telecommunication Industry Association/Electronic Industries Association, TR 14.7 Sub-committee, Safety Facilities Task Group.

USC. United States code. Washington, DC: U.S. Government Printing Office.

UNIVERSITY OF FLORIDA

E H& S DIRECTORY

DIRECTOR'S OFFICE
P.O.B. 112190 / BLDG 1079
392-1591 / FAX 392-3647

Ayleen Alexander	X 222
Philip Collis, Aso. Dir.	X 226
Receptionist (OPS)	X 221
William Properzio, Dir.	X 222

BIOLOGICAL SAFETY
P.O.B. 112190 BLDG 1079
392-1591 / FAX 392-3647

Barbara Fox Nellis	X 230
Gail Roser	X 234
Gary Smith	X 231
(OPS)	X 237

BUSINESS OFFICE
P.O.B. 112190 / BLDG 1079
392-1591 / FAX 392-3647

Donna Stilwell	X 232
Ralph Haskew	X 225

COMPUTER APPLICATION
P.O.B. 112725/BLDG. 831
392-8400/FAX 392-7286

Michael Bielby	392-8543

DIVING SCIENCE & SAFETY PROGRAM
P.O.B. 112205/BLDG. 175
392-8008 / FAX 392-0303
OR 2-1661 (HHP POOL)
Cheryl Thacker

FACILITY & FIRE SAFETY
P.O.B. 112200 / BLDG. 179
392-1904 / FAX 392-6367

David Kramer	X 243
Jim Van Nostrand	X 240

Building Codes Program

Eric Brunn	X 238
Fred Berbig (UNF 904-620-2026)	X 239
Mike Lee	X 239
Stephen Ciuffetelli	X 244
Tony McMahon	X 241

Fire Equipment Services
392-2365

Carlos Delgado	X 233
Eric Vasholz	X 233
Richard Graves	X 242
Russell Sebree	X 233
Todd Eberst	X 233

HAZARDOUS MATERIALS MGMT.
P.O.B. 112725/BLDG. 831
392-8400 / FAX 392-7286
Bill Coughlin
Brian Winston
Dennis Fleetwood
Jerry Ansardi
Keit Quach
Matt Doty
Steve Musson
Steven Ladendorf

INDUSTRIAL HYGIENE
P.O.B. 112195 / BLDG. 104
392-3393 / FAX 392-3414

Bill Burton	X 258
Irina D. (OPS)	X 249
Lewis Johnson	X 257
Vanessa Fayo	X 250

LABORATORY SAFETY.
P.O.B. 112190 / BLDG. 1079
846-2550 OR 392-1591/ FAX 392-3647

Julie Ramsey	846-2550 X 252
Leona Gauthier	846-2550 X 251
Mark Yanchisin	392-1591 X 223
(OPS)	846-2550 X 229

OCCUPATIONAL RESEARCH AND SAFETY
P.O.B. 112195 / BLDG. 104
392-1591 / FAX 392-3414

Peter Gilmore	X 254
Vanessa Fayo	X 250
Vince McLeod	X 235

PEST CONTROL MANAGEMENT
P.O.B. 112205 / BLDG. 175
392-1904 / FAX 392-0303
Bradley Files
Clarence Williams
Curtis Slater
Dennis Gerard
James Mahony
Ken Glover
Otto Ingram

RADIATION CONTROL
P.O.B. 100252 / RM. D8-17
392-1589 / FAX 846-1626
Elizabeth Tamrat
George Snyder
Jason Timm
Julie English

RADIATION CONTROL
P.O.B. 112205 / BLDG. 175
392-8700 / FAX 392-0303
Jeff Daniel
Johnny Weaver

RADIATION SERVICES
P.O.B. 118305 / 212 NSC
392-7359 / FAX 846-0489
Don Munroe
John Parker
Phyllis Kelley

RISK MANAGEMENT.
P.O.B. 112190 / BLDG. 1079
392-1591 / FAX 392-3647

Glenn Ketcham	X 253
Grace Dixon	X 228
Helen Sawyer	X 259 or 392-7256
Jennifer Jonsson	X 256
Lea-An Steiner	X 255

***Important Contact Numbers:**

Animal Contact	2-1591
Animal Control	2-1904
Asbestos Management	2-3392
Biological Safety	2-1591 x 234
Bloodborne Pathogens	2-1591 x 234
Building Codes & Permits	2-1904
Business Office	2-1591
Campus Safety	2-1591 x 223
Chemical Hygiene Plan	846-2550
Chemical Waste	2-8400
Clinic Safety	846-2550
Confined Space	2-1591
Director's Office	2-1591 x 222
Diving Safety	2-1591
Ergonomics - Health Center	2-1591 x 253
Ergonomics - UF	2-1591 x 253
Facility and Fire Safety	2-1904
Film Badges	2-8700
Fire Equipment	2-2365
Fire Safety and Codes	2-1904
First Aid Kits	2-1591 x 232
Freezers/refrigerators -labs	2-3393
Fume Hoods	846-2550
Gas Leaks and Odors:	
Report 1st to Work Mgmt at	2-1121
Then call EH&S 2-1591 or	2-3393
Greek Housing	2-1904
Hazard Communication	2-1591
Hazardous Materials	2-8400
Health Assessments	2-1891 x 228
Hearing Conservation	2-1591 x 228
IFAS Safety	2-1591 x 254
Indoor Air Quality	2-3393
Injury Reports	2-1591 x 223
Insects	2-1904
Insurance	2-1591 x 259
Laboratory Safety	846-2550
Laser Safety	2-1591
Mercury Spills	2-8400
Natural Disaster Planning	2-1591
Occupational Medicine	2-1591 x 228
Occupational Safety	2-1591 x 259
Off-Campus Safety	2-1591 x 254
Permits (Building)	2-1904
Pest Control	2-1904
Radiation Control	2-1589
Radiation Services	2-7359
Radioactive Waste	2-8400
Radioisotope Delivery	2-8700
Radioisotope Use	2-7359
Recombinant DNA	2-1591 x 230
Refrigerators (Labs)	2-3393
Respirator Use	2-3393
Right-to-Know	2-1591
Underground Tanks	2-1591 x 235

Please visit our website
http://www.ehs.ufl.edu/

For more information:

- **A summary of the services offered by each EH&S program**
- **Policies and regulations regarding:**
  - **-Biological Agents**
  - **-Building Codes Compliance**
  - **-Chemical Hygiene Plan**
  - **-DEA Controlled Substances**
  - **-Hazard Communication Std**
  - **-Hazardous Materials Mgmt.**
  - **-Hazardous Materials Disposal**
  - **-Laboratory Animal Use**
  - **-Laboratory Closeouts**
  - **-Laboratory Safety Surveys**
  - **-Radioactive Material Usage**
  - **-UF Natural Disaster Plan**
- **Required forms needed for registration with various programs.**
- **Training Materials**

Fall Protection

Training Evaluation Form

Instructor/s: _____ Date: _____

Please circle the response that best describes your evaluation of the offering (**6 being the most positive response and 1 being the least positive response**).

	Strongly Agree				Strongly Disagree		Not Observed
1. The stated objectives were met.	6	5	4	3	2	1	N/A
2. The content subject matter was accurate.	6	5	4	3	2	1	N/A
3. Information presented was current.	6	5	4	3	2	1	N/A
4. Time allotted to cover the subject matter was adequate.	6	5	4	3	2	1	N/A
5. Delivery of the content was organized and clear.	6	5	4	3	2	1	N/A
6. The speaker was knowledgeable regarding the topic.	6	5	4	3	2	1	N/A
7. The teaching method (style, use of audiovisuals) contributed to learning.	6	5	4	3	2	1	N/A
8. The environment was conducive to learning.	6	5	4	3	2	1	N/A
9. I can apply this material to my work/practice.	6	5	4	3	2	1	N/A
10. The content was appropriate to my educational/ professional level.	6	5	4	3	2	1	N/A
11. The test (if used) was appropriate to the objectives.	6	5	4	3	2	1	N/A

12. Suggestions for improving the overall quality of the offering would include:

_____

_____

_____

_____

13. Suggestions for future programs:

_____

_____

_____