OSHA Small Business Advocacy Review Panel

Telecommunications Towers Preliminary Initial Regulatory Flexibility Analysis

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OSHA

Telecommunications Towers Preliminary Initial Regulatory Flexibility Analysis (PIRFA)

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I. Introduction

OSHA is considering promulgating a new standard covering telecommunications tower[1] work activities. This potential standard would cover both construction and maintenance activities.

In accordance with the Regulatory Flexibility Act or RFA (Sections 601 through 612 of Title 5 of the United States Code), OSHA is convening a Small Business Advocacy Review Panel ("SBAR Panel"). This Panel consists of members from OSHA, the U.S. Small Business Administration's Office of Advocacy (SBA Office of Advocacy or Advocacy), and the Office of Information and Regulatory Affairs (OIRA) within the Office of Management and Budget (OMB). The SBAR Panel identifies individuals who are representatives of affected small entities, termed "Small Entity Representatives" (SERs). Small entities under the RFA include small businesses, small not-for-profit organizations, and small governmental jurisdictions with a population less than 50,000. For purposes of defining small businesses, OSHA uses the industry-specific size standard published by the Small Business Administration (SBA) (for more information, please see https://www.sba.gov/content/summary-size-standards-industry-sector).

The SBAR Panel has several purposes. First, the Panel provides an opportunity for affected small employers to provide comments to OSHA. Second, by reviewing OSHA's potential provisions that may be included in a telecommunications towers standard and estimates of the potential impacts of that rule, SERs and the Panel can offer recommendations to OSHA on ways to tailor the rule to make it more cost effective and less burdensome for affected small entities. Third, early comments permit identification of different regulatory alternatives the agency might consider. Finally, the SBAR Panel report can provide specific recommendations for OSHA to consider on issues such as reporting requirements, timetables of

[1] Throughout this document, OSHA will refer to "telecommunications towers" as the structures on which the regulated work is undertaken. On occasion, OSHA will use the shorter version, "towers," in this text. Other agencies and organizations may use different terms for telecommunications towers including broadcast towers, cell towers, communication towers, comm. towers, wireless towers, antennas or antenna supporting towers. Those terms will only appear in this document if OSHA is quoting from or citing an outside source.

compliance, and whether some groups, including small entities, should be exempt from all or part of any proposed rule.

Following the SBAR Panel, if the agency were to move forward with rulemaking, OSHA's next step would be to publicly propose the new rule in the *Federal Register*. The Preamble to the proposed rule would include an Initial Regulatory Flexibility Analysis (IRFA) to accompany the proposal to focus attention on the potential impacts on small entities. The IRFA would include a description of the Panel's recommendations and OSHA's responses to those recommendations. Sections 603(b) and (c) of the RFA set out the requirements for the IRFA:

> (b)(1) a description of the reasons why action by the agency is being considered;
>
> (b)(2) a succinct statement of the objectives of, and legal basis for, the proposed rule;
>
> (b)(3) a description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply;
>
> (b)(4) a description of the proposed reporting, recordkeeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities that will be subject to the requirements and the type of professional skills necessary for preparation of the report or record;
>
> (b)(5) an identification to the extent practicable, of all relevant federal rules that may duplicate, overlap, or conflict with the proposed rule; and
>
> (c) a description of any significant alternatives to the proposed rule that accomplish the stated objectives of applicable statutes that minimize any significant economic impact of the proposed rule on small entities.

An alternative under Section 603(c) need not be unique to small entities. Rather, an alternative that meets OSHA's goals and reduces impacts for all affected entities can and should be considered as part of the Panel and regulatory flexibility analysis process.

Under Section 609(b) of the RFA, the SBAR Panel must be provided any information that OSHA has available on issues related to paragraphs (3), (4), and (5) of Section 603(b), as well as Section 603(c), of the RFA. The SBAR Panel collects comments on these issues.

This PIRFA provides such information to the members of the SBAR Panel and to individual SERs who have agreed to participate in this SBAR Panel. The PIRFA also satisfies the RFA's legal requirement that OSHA provide certain information to the Chief Counsel for Advocacy. OSHA has placed all references in this document in the public docket, OSHA-2014-0018, and can help SERs obtain any references they would like to see. All non-copyrighted references will be available online at regulations.gov in the docket for this potential rulemaking. Copyrighted materials are available for inspection through OSHA's docket office.

II. Legal Basis for an OSHA Standard Addressing Telecommunications Tower Safety

The legal basis for a potential draft proposal is the responsibility delegated to the Secretary of Labor by the Occupational Safety and Health (OSH) Act of 1970 (29 U.S.C. § 651 *et seq.*). The OSH Act was enacted "to assure so far as possible every working man and woman in the Nation safe and healthful working conditions and to preserve our human resources." 29 U.S.C. § 651(b). The legal authority for issuing safety and health standards is found in Section 6(b) of the OSH Act (29 U.S.C. § 655).

The OSH Act imposes a number of requirements OSHA must satisfy before adopting a safety standard. Among other things, the standard must be highly protective, materially reduce a significant risk to workers, be technologically feasible, and be economically feasible. *See* 58 FR 16612, 16614-16 (Mar. 30, 1993); *Int'l Union, United Auto., Aerospace & Agric. Implement Workers of Am. v. OSHA*, 37 F.3d 665, 668-69 (D.C. Cir 1994). A standard is technologically feasible if the protective measures it requires already exist, can be brought into existence with available technology, or can be created with technology that can reasonably be expected to be developed. *United Steelworkers of Am. v. Marshall*, 647 F.2d 1189, 1272 (D.C. Cir. 1980). In determining economic feasibility, OSHA must consider the cost of compliance on an industry rather than cost on individual employers. In its proposed and final economic analyses, OSHA follows the advice of the U.S. Court of Appeals for the D.C. Circuit to "construct a reasonable estimate of compliance costs and demonstrate a reasonable likelihood that these costs will not threaten the existence or competitive structure of an industry." *Id.*

III. Why Regulation is Being Considered

The construction and maintenance of telecommunications towers is highly specialized work. This work often involves workers climbing towers via ladders or being hoisted to workstations on the tower via base-mounted drum hoists. New towers are constructed piece by piece; workers bolt each section or piece into place before raising the next section. Tower sections or structural parts are hoisted to their elevated positions using a crane or base-mounted drum hoist, with or without a gin pole, which is a device attached to the tower used to raise sections of tower steel or equipment into position. After towers are erected, related construction activities include reinforcing the structure, upgrading antennas, and installing new antennas on existing towers (referred to as collocation). Workers also climb telecommunications towers to perform maintenance activities such as painting structural steel members, changing light bulbs, and troubleshooting malfunctioning equipment. During the performance of work activities involving telecommunications towers in general, workers are exposed to a variety of serious hazards including: falls, structural collapses, struck-by hazards, worker fatigue, radio frequency exposure, inclement weather (including extreme heat and cold), electrical, and cuts and lacerations due to the use of sharp, heavy tools and materials.

The available data show a substantial number of fatalities and injuries are associated with telecommunications towers work.

<u>Fatalities</u>:

To identify hazards associated with construction and maintenance work on telecommunications towers, OSHA searched the Fatality and Catastrophe Investigation Summaries of its Integrated Management

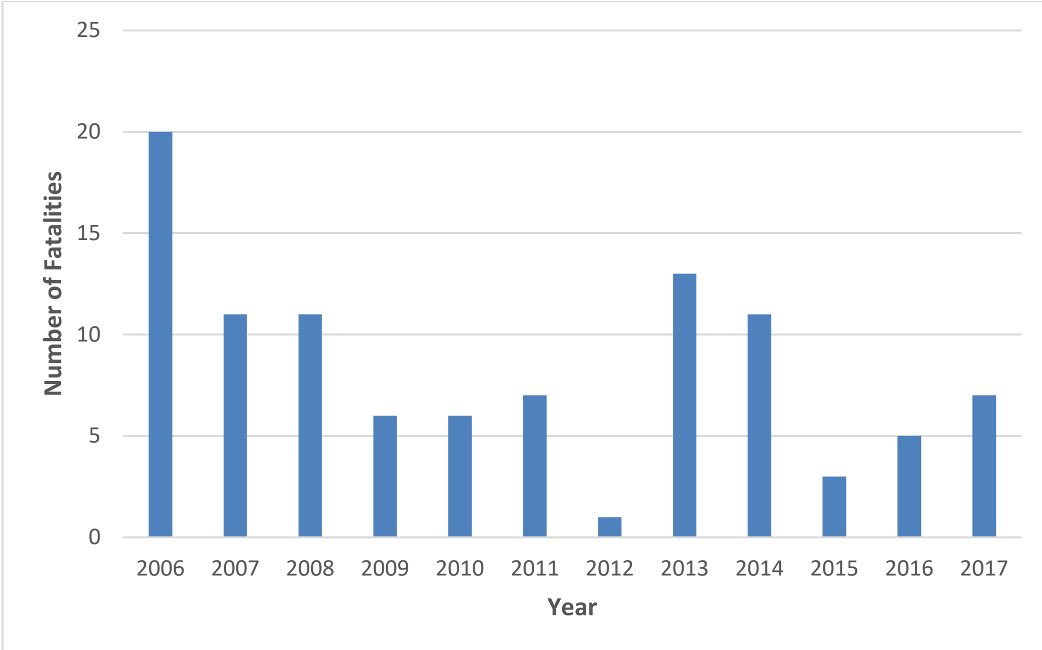
Information System (IMIS) and the Occupational Safety and Health Information System (OIS).[2] These reporting systems are based on self-reports by employers of fatalities and a limited number of injuries. Using the keyword “tower” as the search criteria and limiting the results to fatalities only, 141 accident reports were generated in the two databases from the period of January 1, 2006 to December 31, 2017. OSHA manually reviewed the incident summary of each report to determine which incidents the provisions OSHA is considering including in the potential telecommunications tower standard would apply. OSHA rejected traffic accidents or workplace violence incidents as irrelevant to this standard, but considered falls or structure collapses as potentially relevant. More commonly, incidents were rejected because, though they included the word “tower,” the incident did not involve a telecommunications tower (for example, some involved tower cranes). OSHA identified 77 accidents with 86 fatalities. Falls from telecommunications towers due to the lack of fall protection equipment, improper use of fall protection equipment, and equipment failure were the most common hazards associated with these accidents.

This PIRFA uses a combination of IMIS/OIS fatalities data and data from Wireless Estimator, a “web-based industry portal for the design, development, construction and maintenance of communications towers and other wireless structures.” Wireless Estimator identified 15 fatalities that were not captured by the IMIS/OIS system from 2006-2017. Adding those 15 fatalities to the 86 identified in OSHA’s databases shows there were 101 fatalities resulting from work on telecommunications towers over a 12-year period. OSHA verified the fatalities reported by Wireless Estimator but absent from the OSHA databases through its regional and area offices.

As shown in Figure 1, the number of fatalities in the telecommunications tower industry vary greatly from year to year. While there may be many reasons for this variation, such as using a small sample size, there seems to be an increase in the years the major wireless carriers engaged in large-scale new technology upgrades and rollouts. For example, the major carrier networks began a number of intensive, large-scale work projects to deploy 4G technology in 2012 and 2013.

[2] OSHA was transitioning from the IMIS to the OIS system during the time period in question. As of November 2011, only some State-plan States were submitting data to IMIS, but all States are now reporting data to the OIS.

Figure 1 - Telecommunications Towers Fatalities, 2006-2017



Source: ORA based on IMIS/OIS and Wireless Estimator

The 101 fatalities over a 12-year period imply an average of 8.4 fatalities a year. OSHA estimated 10,000 to 29,000 workers work on telecommunications towers. Assuming that employment is at the maximum of this range, this industry has an annual fatality rate of 2.89 per 10,000 full time employees. The overall private industry fatality rate in 2014 was 0.33 per 10,000 full time equivalent workers (Bureau of Labor Statistics, 2015). This shows that there is considerable risk to workers working on telecommunications towers as compared to workers in other industries.

Injuries:

A typical ratio of occupational injuries to fatalities for the entire economy is nearly 600 to 1, while even in dangerous occupations the ratio of injuries to fatalities is closer to 100 to 1. Because injury data are generally not reported to OSHA, the IMIS/OIS database that was used for fatalities only contains a minute percentage of injuries and as a result, this PIRFA will estimate the number of injuries per year in the telecommunications tower industry using the ratio of injuries to fatalities in a similar industry. OSHA has preliminarily estimated that the injury profile will be similar to that in the rest of the construction industry. Thus, the construction industry's ratio of injuries to fatalities resulting from a fall to a lower level can be applied to the available fatality data for the telecommunications tower industry to derive a profile of potential injuries related to work on telecommunications towers.

The BLS website on the Injuries, Illnesses, and Fatalities program contains a table that presents a detailed event or exposure involving days away from work by industry division. This table reports that there were 12,130 injuries resulting from falls to a lower level for the construction industry in 2016.[3] The BLS

[3] Table "R64. Detailed event or exposure by industry division" (https://www.bls.gov/iif/oshcdnew2016.htm)

Census of Fatal Occupational Injuries reports the event or exposure leading to a fatal injury by major private industry division and reported 320 fatalities resulting from a fall to a lower level in the construction industry in 2016.[4] The ratio of injuries to fatalities for a fall to a lower level for the construction industry in 2016 is therefore 38 injuries to 1 fatality. Applying this ratio to the average annual number of fatalities on telecommunications towers of 8.4 for the years 2006 to 2017 suggests there are likely 312 days-away-from-work injuries annually to workers working on telecommunications towers. For the Construction industry as a whole in 2016, there were 217,952 total recordable injuries and 1,034 fatalities (OSHA calculation, based on: https://www.bls.gov/iag/tgs/iag23.htm). This is a ratio of recordable injuries to fatalities of 211 to 1. This ratio, if applied to the telecommunications tower worker average annual fatalities, would suggest 1,688 recordable injuries per year among telecommunications tower workers.

Potential Monetary Benefits

OSHA does not base its standards on benefit-cost analysis and has not yet determined what percentage of fatalities and/or injuries are preventable by this potential standard. However, for informational purposes, OSHA estimates that if 100 percent of the average annual fatalities for the years 2006 to 2017 (8.4 per year) could be prevented, this potential standard will produce benefits of $81.6 million (using a value of statistical life of $9.72 million derived from U.S. Department of Transportation, 2014). As mentioned above, OSHA estimates the annual number of injuries from 2006 to 2017 is 312 injuries with days away from work per year. If all of those injuries could be prevented by this potential rule, then the potential rule would result in benefits of $24.8 million per year (assuming a value of statistical injury of $79,621 per injury derived from Viscusi and Gentry, 2015). The estimated total benefits if all fatalities and injuries were prevented by this rule would be $106.40 million annually ($81.6 million + $24.8 million).

IV. Description of the Potential Draft Standard

Introduction

This section provides an overview of the potential requirements OSHA is considering for work operations involving telecommunications towers. These potential provisions are based on industry best practices, comments received in response to a 2015 Request for Information (RFI), and lessons learned from accidents involving falls from telecommunications towers and other types of incidents.

Recognizing a critical need to address the root causes of the high fatality rate in the industry, OSHA developed an RFI on Communication Tower Safety to solicit information about the hazards that telecommunications tower workers are exposed to as well as safe work practices implemented within the industry to address those hazards. The RFI was published on April 15, 2015, and the comment period closed on June 15, 2015. OSHA received over 900 individual responses to the RFI questions. In addition to obtaining information from the RFI responses, OSHA has continued to engage the industry in related discussions on industry hazards and safe practices during ongoing site visits, meetings/conference calls with stakeholders, public workshops in collaboration with the Federal Communications Commission (FCC), and at other stakeholder outreach venues. These inputs have been extremely valuable to OSHA while crafting the PIRFA.

[4] Table "Event or exposure by major private industry division, 2016" (https://www.bls.gov/iif/oshcfoi1.htm)

Below OSHA summarizes provisions that the agency, based on its research, currently believes could potentially be appropriate in a workplace standard. These potential provisions are discussed in terms of what an employer "would" be required to do. However, OSHA emphasizes that its thoughts about what might be in a standard are merely preliminary, and the PIRFA has been developed to generate discussion and receive feedback at this early stage. OSHA seeks comments on both these potential provisions and about new and different abatement methods to address the hazards associated with telecommunications tower work. The agency will carefully consider all input received during this SBAR Panel process and throughout the rulemaking process if the agency proceeds with a proposed rule and, ultimately, a final rule.

Scope

OSHA is considering a standard that would apply to all work activities performed on telecommunications towers, which includes antennas, and communication and broadcast towers. This would be a comprehensive vertical standard addressing both construction activities that are included in 29 CFR 1926 and maintenance activities that are covered by 29 CFR 1910. A vertical standard is a standard that applies to one particular industry, such as the telecommunications tower industry. The scope of the standard would be similar to the scope of related consensus standards, including the recently finalized ANSI A10.48 standard, "Criteria for Safety Practices with the Construction, Demolition, Modification and Maintenance of Communication Towers," as well as the Telecommunications Industry Association (TIA) consensus standards, including TIA 222-G, "Structural Standard for Antenna Supporting Structures and Antennas," and TIA 322, "Loading Criteria, Analysis, and Design Related to the Installation, Alteration and Maintenance of Communication Structures," which became effective in January 2017.

OSHA is also considering how the standard's scope would interact with other, existing OSHA standards and how to best communicate those interactions. Topics under consideration include:

- Work on antennas collocated on electric transmission and distribution towers. Work on towers of this type would be subject to relevant requirements located in Subpart V Electric Power Transmission and Distribution as well as the requirements in this standard.
- Work covered by OSHA's Telecommunications Standard, 29 CFR 1910.268. The potential telecommunications towers standard would clarify the types of work that it covers and the work that would remain covered by 1910.268 and therefore be exempted from coverage by this standard.

The standard would not address exposure to radio frequency radiation, because occupational exposures are covered by FCC requirements.

Definitions

The following definitions are based on definitions used in ANSI Standard A10.48 related to work practices on telecommunications towers (American National Standards Institute, 2015), as well as other definitions drawn from TIA 322, TIA 222-G, existing OSHA standards, and common industry practice. OSHA uses them in the PIRFA below and in developing its estimate of costs.[5]

+ **Authorized Climber**: An employee who is physically capable of climbing and who has completed training as an authorized climber. Authorized climber training includes the recognition and avoidance of hazards typically found in telecommunications tower work, the proper use of fall protection systems and requirements, the means and methods of climbing a telecommunications tower in a safe manner, and the proper methods to inspect personal fall protection equipment. A competent climber always supervises an authorized climber.

+ **Authorized Ground Based Rescuer**: An employee who remains on the ground while work activities are being conducted and is trained to provide effective rescue or assistance to employees working aloft.

+ **Authorized Rescuer**: An authorized climber who has been trained to perform self-rescue and assists in the rescue of other climbers.

+ **Basket**: The basket is the lower attachment for a gin pole, and it stabilizes the gin pole vertically and horizontally.

+ **Boatswain's chair:** A single-point adjustable suspension scaffold consisting of a seat or sling (which may be incorporated into a full body harness) designed to support one employee in a sitting position.

+ **Competent Climber**: An employee who has successfully completed training beyond the authorized climber level and has climbing experience. A competent climber is trained in advanced fall protection systems and fall protection requirements and meets the criteria for competent person with regards to climbing and both existing and potential fall hazards. The competent climber is responsible for supervising authorized climbers on site.

+ **Competent Person**: An individual who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees and who has authorization to take prompt corrective measures to eliminate the hazards.

+ **Competent Trainer**: An individual prepared by education, training, or experience to develop, instruct, and implement various elements of a training program. This individual is deemed competent to train others in the roles described in this section.

+ **Competent Rescuer**: An individual who has the experience, knowledge, and training to plan, implement, and oversee rescue on telecommunications towers. The competent rescuer may also be tasked with creating a site-specific rescue plan for a worksite.

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[5] In this section, there is a plus sign (+) next to definitions that appear in the referenced consensus standards but where OSHA's definitions are not identical to those in the standards. OSHA uses these definitions to avoid copyright issues and to maintain consistency with other existing OSHA definitions. An asterisk (*) identifies definitions that do not appear in the consensus standards.

+ Gin Pole: A device attached to the tower used to raise sections of tower steel or equipment into position. The gin pole allows for additional headroom above the top level of the structure to provide assistance with lifting.

+ Guys: The ropes or wires used to provide structural stability to a tower.

+ Guyed Tower: A telecommunications tower that gets structural stability from a series of guys that are attached at points along the length of the structure. The guy wires are anchored into the ground.

*** Hoist system**: A hoist is a complete system for hoisting materials and/or personnel, including, but not limited to: the frame, mounts and/or anchorages, prime mover (winch assembly), motors, drums, truck chassis (if used as the base for the hoist), wheel chocks, wire rope, foot blocks, gin pole (if used), and rooster head, as applicable.

*** Monopole**: A tubular self-supporting telecommunications tower.

+ Qualified Engineer: A professional engineer who has both knowledge and experience in engineering-related practices for telecommunications towers and/or lifting systems and rigging components commonly used in the telecommunications tower industry.

+ Qualified Person: One who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project.

+ Qualified Rigger: A rigger who meets the criteria for a qualified person with regards to rigging.

+ Rooster Head: A rotating sheave located at the top of a gin pole or structure that is used in hoisting systems.

*** Self-Supporting/Lattice Tower**: A self-supporting trussed telecommunications tower constructed of flat iron lattice or tubular steel sections that are hoisted and bolted into place.

*** Stealth Tower**: A self-supporting telecommunications tower that is designed to blend into the surrounding environment. Examples of stealth towers include towers disguised as trees, church steeples, or flagpoles.

Training

- Minimum safety training. OSHA is considering a requirement that all employees working on a telecommunications tower worksite have certain minimum safety training. This would be consistent with the general requirements in ANSI A10.48 that all employees are appropriately trained to perform expected tasks and recognize hazards that might be encountered. Training topics would include:

    - **Fall arrest system training**: training in the safe use of personal fall arrest systems (PFAS), including inspecting all fall protection equipment and the safe use of positioning lanyards/belts for work at height.
    - **Environmental hazard recognition**: training in the recognition and avoidance of any environmental hazards that might be found at that worksite. This includes the identification and use of appropriate personal protective equipment (PPE), such as dust masks, heavy gloves, protective clothing, and hardhats.
    - **Electrical hazard recognition**: training in the recognition and avoidance of electrical hazards. This includes training on the selection and use of appropriate PPE.
- Assignment and roles training. In addition, OSHA is considering specific training requirements, consistent with the requirements in ANSI A10.48, for specific worker assignments and roles, including:
    - **Authorized climber/rescuer**: This is an employee with limited experience in telecommunications tower work. The training for this employee would include fall protection systems and requirements, self-rescue and assisted rescue techniques, and familiarity with all of the rules, regulations, and standards applicable to his/her work. Once an employee has completed the authorized climber/rescuer training, he/she will only work under the supervision of a competent climber/rescuer.
    - **Competent climber/rescuer**: This is an employee who has completed authorized climber/rescuer training, and has climbing experience (which could include 90 full days of climbing experience or other experiences that show that the competent climber has the training, knowledge, and experience to perform the expected tasks assigned to a competent climber). Training for the competent climber/rescuer would include advanced fall protection systems and requirements, self-rescue and assisted rescue techniques, and familiarity with all of the rules, regulations, and standards applicable to his/her work. Competent climber/rescuer training would also address the skills required to supervise authorized climbers/rescuers.
    - **Qualified rigger**: Qualified rigger training would include basic rigging principles and techniques, familiarity with the equipment associated with rigging (such as gin poles, hoists, tag lines, etc.), familiarity with all of the rules, regulations, and standards applicable to his/her work, understanding of structural loading considerations, and the ability to write and execute rigging plans.
    - **Hoist operator**: Training for hoist operators would include hoist operations, as well as practical experience on the type of hoist that the employee will be expected to operate. Training would also address personnel hoisting requirements and ensure familiarity with the rules, regulations, and standards applicable to his/her work.
    - **Crane operator**: Crane operators working on telecommunications tower worksites are covered by the requirements found in 29 CFR 1926.1427. The proposed standard would maintain these requirements.
- Recordkeeping. OSHA is considering requiring employers to maintain written training records. This is consistent with ANSI A10.48 and is a requirement in many OSHA standards. Records would include the type of training, the name of the company or individual providing the training, and copies of any relevant certifications.

- First aid training. OSHA is considering requiring that at worksites where an infirmary, clinic, hospital, or physician is not reasonably accessible in terms of distance and/or time, at least one member of each crew has current certifications in both first aid and CPR. This requirement generally aligns with current OSHA requirements. Although OSHA standards currently only require first aid training, typical first aid courses also provide CPR training as part of the course offering.

<u>Worksite Conditions</u>

OSHA is considering requirements that address worksite conditions, which may include a job hazard analysis, toolbox talks to discuss safety issues, and rigging plans. These general requirements are recommended or required by current recognized consensus standards, including ANSI A10.48, TIA 322, and TIA 222-G.

- **Job hazard analysis (JHA):** OSHA is considering requiring employers to prepare a written JHA prior to each job or project. The JHA is a tool that identifies the hazards present at the worksite related to the specific nature of the tasks to be performed, the nature of the worksite itself, and the specific conditions present at the worksite at the time the work is to be performed. A JHA not only identifies potential hazards, but also includes specific means of abatement or avoidance of each of the hazards. OSHA is considering the inclusion of reference sample templates of Job Hazard Analyses in a non-mandatory appendix in the potential standard. Employers would be required to update the JHA on a daily basis, as well as when worksite conditions or hazards change. Sample topics in a JHA would include, but are not limited to:
    - Emergency contact information for the nearest medical facility and/or first responders
    - General jobsite information, including the tower type
    - Specific job tasks to be completed, along with the hazards associated with each task
    - Identification of all other hazards present at the jobsite
    - Methods of reducing or eliminating each hazard
- **Toolbox talks:** OSHA is considering a requirement that employers hold a meeting with employees before each shift to discuss relevant safety topics, including a discussion of unique hazards presented by the scheduled work activities and methods for avoiding those hazards. OSHA is considering the inclusion of possible toolbox talk topics in a non-mandatory appendix in the potential standard. Sample topics addressed during a toolbox talk would include, but are not limited to:
    - A pre-job checklist, including questions about physical fitness, adequate sleep, and fatigue levels due to factors such as long driving/commuting times;
    - A review of the JHA and a discussion of specific issues that will be factors in the day’s work;
    - Review of safety equipment inspection and utilization procedures;
    - Refresher training in company safety policies and any applicable safety standards or regulations; and
    - A reminder of the importance of maintaining 100 percent fall protection.
- **Rigging, hoisting, and gin pole use**: OSHA is considering requirements for a detailed rigging plan for hoisting materials or employees. The agency is also considering requirements for the use of gin poles. Both sets of requirements would be consistent with the requirements of TIA 322 and

ANSI 10.48. Subjects addressed could include the use of load charts, attachment points, and test loading before hoisting begins.

Environmental Hazards

- **Weather and other environmental hazards:** OSHA is considering a requirement that the employer address weather-related and other environmental hazards. In particular, the employer would be required to address:
  - **Weather hazards:** Employers would be required to check weather reports before commencing work and to monitor weather conditions periodically as work activities are taking place. Employers would also be required to ensure that their employees are not climbing towers in hazardous weather. Some examples of hazardous weather conditions include lightning, storms, high winds, and extreme temperatures.
  - **Wildlife**: On sites where wildlife hazards (such as venomous snakes, stinging insects, birds, etc.) are present, employers would be required to discuss them with employees prior to beginning work and in the JHA. Employers would be required to provide effective protection against wildlife hazards if there is no higher method of control available, such as eliminating the hazard. For example, if a beehive is present, the employer would be required to provide protective clothing or equipment for climbers who will be working near the beehive.
  - **Worksite locations**: For remote or inaccessible worksite locations and sites where emergency rescue is not available, the employer would be required to plan for the rescue of climbers and to respond to other emergency situations.

Safe Work Practices

- **General:** OSHA is considering general requirements addressing safe work practice considerations for all telecommunications tower worksites, including:
  - Requiring the employer to include breaks in the JHA to avoid hazards presented by fatigue, and to discuss them in toolbox talks.
  - Requiring the employer to provide adequate access to restroom facilities as required by current OSHA standards.
  - Requiring the employer to complete a rescue plan that includes the location of, directions to, and direct contact information for the nearest hospital, and identifying employees who hold current first aid and CPR certification. If self-rescue or partner rescue is included in the rescue plan, the employer would be required to provide proper rescue equipment. This could include, but is not limited to belts, lanyards, and safety lines. The location and use of this equipment would be a required part of the JHA and included in toolbox talks.
  - Requiring the employer to provide PPE to protect against environmental hazards.
  - Requiring employers to eliminate falling object hazards for workers on the ground or at lower elevations on the tower.
- **Structural work on telecommunications towers**. OSHA is considering a requirement that structural work (new construction, modification, and demolition) that could potentially compromise the stability of the tower be supervised and/or planned by a qualified engineer who has experience working with telecommunications towers, and that it complies with relevant consensus standards, including ANSI A10.48, TIA 222-G, and TIA 322. The level of involvement of a qualified engineer would vary according to the degree of complexity of the

structural work to be done (note: these complexity categories are modeled on rigging plan complexity categories contained in consensus standards):

  - Structural modifications of a low degree of complexity would require a structural analysis by a qualified engineer, and the work on site would be supervised by a competent person with an understanding of the structural modifications to be made. These would be structural modifications that do not have any impact on the structural stability of the tower.
  - Structural modifications of a medium degree of complexity are modifications that would potentially have an impact on the structural stability of the tower. These modifications would require a structural analysis by a qualified engineer. In addition, the qualified engineer would prepare detailed, step-by-step instructions for the work to be done. The structural work would be supervised by a competent person.
  - Structural modifications of a high degree of complexity are modifications that have a critical impact on the structural stability of a tower. These modifications would require a structural analysis conducted by a qualified engineer, and the work would need to be planned and supervised by a qualified engineer.

Multi-Entity Considerations

- **Communication requirements**: OSHA is considering a requirement that all contract firms present on the jobsite communicate with one another about hazardous conditions, safe work procedures, and tower installation and modification specifications. This would occur prior to beginning work, by phone or in person, and additional communication would be required if work conditions change substantially.
- **Considerations for structural alterations and/or modifications**: OSHA is considering requirements for structural alterations and modifications that vary by the complexity of the work involved. For structural modifications of a low degree of complexity, the controlling employer would be required to ensure that prior to beginning, a structural analysis had been done, and that a competent person is on site to supervise the structural modifications. Prior to beginning modifications of a medium degree of complexity, the controlling employer would be required to provide tower crews with detailed, step-by-step instructions to safely perform structural modifications. The controlling employer must also ensure that a competent person would supervise the work. For structural modifications that are of a high degree of complexity, the controlling employer would be required to ensure that a qualified engineer planned and supervised the work.

Fall Protection

- **Duty to have 100 percent fall protection:** OSHA is considering a requirement that employers protect workers from fall hazards at all times when climbing and when working at a position above 6 feet. This is a requirement for 100 percent fall protection. Employees may be required to be protected from falling 6 feet or more by a personal fall arrest system, guardrail system, and/or a safety net. Through industry research, interviews, and site visits, OSHA has learned that the most prevalent form of fall protection in the industry is a personal fall arrest system.

    - If fall protection through these means is infeasible, for example, when accessing certain types of antenna mounts such as T-booms, employers would be required to provide access to the work station through alternate means such as a crane and man basket or aerial lift.
- **Personal fall arrest systems**: All personal fall arrest systems would conform to the requirements contained in 29 CFR 1926.502(d) *Personal fall arrest systems*. In addition to meeting the criteria in §1926.502(d), employers would be required to provide a boatswain seat-type full body harness to employees climbing telecommunications towers to prevent hazards associated with suspension trauma.
- **Safety climb systems:** OSHA is considering requirements that address the installation, maintenance, and inspection of safety climb systems where they are already installed on towers. Employers would have a responsibility to report broken or non-functional safety climb systems to telecommunications tower owners, and would have a responsibility to prevent their employees from relying on inoperable safety climb systems for fall protection.

<u>Support Equipment Requirements</u>

- **Hoisting:** OSHA is considering including requirements for equipment used while hoisting both materials and personnel, based on provisions in ANSI A10.48 and TIA 322. Requirements would include:
    - **Base-mounted drum hoists**: This section would include requirements for the design, mounting and anchorage, inspection, and operation of base-mounted drum hoists.
    - **Capstan hoists**: This section would include the requirements for the design, mounting and anchorage, inspection, and operation of capstan hoists.
    - **Materials hoisting**: This section would include requirements for materials hoisting. Topics addressed would include hoisting procedures, requirements for controlled access zones, requirements for load lines and tag lines, and requirements for load testing and verification.
    - **Personnel hoisting**: This section would include specific requirements for personnel hoisting. It would require the use of a base-mounted drum hoist when hoisting personnel, and would also address the specifications for any hoist used to hoist personnel. The use of capstan hoists to hoist personnel would be prohibited.
    - **Rigging**: This section would address requirements for the rigging of loads, including rigging components, safety factors, and inspections.
    - **Gin poles**: This section would address the requirements for the use of gin poles to hoist materials, including gin pole components, connections, and load charts, and for the labelling and identification of gin poles.
- **Use of cranes in telecommunications tower work activities:** The standard would apply OSHA's Cranes and Derricks in Construction standard (29 CFR 1926 Subpart CC) to all uses of cranes at telecommunications tower worksites.

<u>Structural Requirements for Telecommunications Towers</u>

- **Structural loading considerations:** OSHA is considering the inclusion of structural loading considerations consistent with TIA 222-G, and TIA-322, which became effective January 1, 2017.
- **Tower inspection requirements**: OSHA is considering several requirements for the inspection of telecommunications towers. In particular, employers would be required to inspect the following on a pre-job or pre-shift basis:
  - Safety climb system condition
  - Tie-off points, including condition and placement
  - Ladders

  In addition, tower owners would be required to conduct regular structural inspections every three to five years, which would include:
  - Bolts, particularly loose or missing bolts
  - Structural members, including inspecting for damaged, loose, or missing members
  - Coaxial cable inspections for fire hazards
  - Guy wires, including condition, tensioning, and connectors
  - Tower foundation, including condition of concrete foundations, and ground conditions

Use of Unmanned Aerial Vehicles (UAVs): OSHA has learned that small UAVs (i.e., small drones) are now being used for telecommunications tower inspections, and requests comment from SERs regarding the potential uses and benefits of UAVs in telecommunications tower work and inspections.

Types of Incidents and Provisions that Might Prevent Them

To estimate the total number of injuries and fatalities, OSHA relied on both the IMIS Fatality and Catastrophe reports and on data pulled together by Wireless Estimator. However, to determine the types of fatalities, OSHA has relied on its own IMIS and OIS reports that provide information on the nature of the accidents. This information is limited, sometimes to a single sentence, sometimes to a paragraph. For the purposes of developing a broad classification, OSHA counted the percentage of incidents involving each type of incident, where incidents could be an injury only, multiple injuries, and fatalities or multiple fatalities.

OSHA classified incidents into the following categories:

Fall—Not Tied Off—Incidents were classified under this heading if the accident report clearly indicated the worker was not tied off. In almost all cases, the worker was wearing a fall protection harness, but had not tied off. Some descriptions suggested the failure of tie-off was quite temporary (e.g., while doing x, the worker temporarily unhooked his carabiner) while others suggest the worker might not have been tied off for some time.

Fall—Bad Choice of Anchor—Incidents were classified under this heading if the accident report clearly indicated the worker was tied off, but was tied off to a portion of the structure incapable of bearing the necessary weight or if the anchor otherwise posed a hazard. Incidents classified here include tie-offs to weak or temporary structures, and tie-offs to structures that could not reasonably be expected to remain in place. This category does not include situations where a worker was tied off to an intended anchor point and the anchor point broke.

Fall--Equipment Failure—Incidents were classified in this category if the worker who fell was tied off to a proper and intended anchor point, but either the harness failed or the anchor point failed. This category also includes incidents involving man lifts and safety climb systems where those lifts or systems were used correctly by the worker but the lifts or system failed and either caused, or failed to stop, a fatal fall.

Generic Fall— Incidents were classified in this category if the incident involved a fall but the incident report provided insufficient information to classify it in any of the above categories.

Structural Collapse—Incidents were classified in this category if the incident was either a fall caused by a structural collapse or if a worker was struck by a part of the structure following a structural collapse. These incidents are more serious than the percentage of incidents they account for might indicate because structural collapse incidents more commonly involve multiple injuries or fatalities than other sorts of incidents.

Gin Pole— Incidents were classified in this category if the incident occurred to workers using a gin pole.

Environmental Hazards— Incidents were classified in this category if the incident report explicitly mentioned weather conditions as a possible contributor to the incident. OSHA found no incidents where environmental hazards other than weather conditions resulted in an injury or fatality.

Multi-Entity— Incidents were classified in this category if the incident report explicitly mentioned the presence of more than one contractor on the site.

The first five categories in this list are mutually exclusive but the last three can occur in combination with other classifications.

Table 1 below presents the summation of total incidents by type for the years 2006-2017.

Table 1 - Percent of Total Incidents by Type, 2006-2017

Falls no tie-off	32%	26
Fall Bad Anchor	6%	5
Fall Equipment Failure	10%	8
Generic Falls	33%	27
Subtotal of Falls	**81%**	**66**
Structural Collapse	16%	13
Gin Pole	4%	3
Environmental Hazards	5%	4
Multi-entity	2%	2

Source: ORA based on IMIS/OIS database.

* There may be more than one type of incident classification per incident therefore the percent total does not sum to 100.

Table 2 - Annual Number of Incident by Type, 2006-2017

Falls no tie-off	5	3	3	3	1	0	1	3	4	1	1	1	**26**
Fall Bad Anchor	1	0	0	0	0	0	0	1	0	1	1	1	**5**
Fall Equipment Failure	2	2	1	0	1	0	0	2	0	0	0	0	**8**
Generic Falls	4	3	6	1	2	4	0	1	1	1	3	1	**27**
Subtotal Falls	**12**	**8**	**10**	**4**	**4**	**4**	**1**	**7**	**5**	**3**	**5**	**3**	**66**
Structural Collapse	3	1	0	2	1	1	0	2	2	0	0	1	**13**
Gin Pole	0	1	0	0	0	0	0	0	1	0	0	1	**3**
Environmental hazards	0	1	0	0	0	0	0	0	1	1	0	1	**4**
Multi-entity	1	0	0	0	1	0	0	0	0	0	0	0	**2**
Total	**16**	**11**	**10**	**6**	**6**	**5**	**1**	**9**	**9**	**4**	**5**	**6**	**88**

Source: ORA based on IMIS/OIS database.

Potential Effects of the Possible Provisions of this Rule in Preventing Fatalities and Injuries

The provisions described in the previous section are intended to prevent these fatalities and injuries from occurring. This section addresses which provisions are most relevant to the possible prevention of particular types of incidents. It is not possible at this time, from the data available, to determine that a particular provision would have prevented a particular incident. For example, it is impossible to determine, based on incident reports, what kind of training an employee received. As a result, OSHA states that training could have potentially prevented the accident. Further, multiple provisions may impact the likelihood of certain fatal incidents occurring. For example, a fatality may result when a worker fails to tie off his or her fall protection, but the worker's failure might have resulted from inadequate training or lack of toolbox talks that emphasize the importance of 100 percent fall protection. Thus, prevention can often be attributed to a combination of provisions working together that help avert an accident. Below, OSHA explains how various possible provisions of a telecommunications tower standard are designed to prevent the different types of incidents detailed above from occurring in the future.

Fall--Not Tied Off

Falls resulting from the failure to be properly tied off represent the largest category of falls for which the cause can be specified. OSHA's Subpart M on fall protection includes an exemption for the erection of telecommunications towers (29 CFR 1926.500(v)). This does not mean that telecommunications towers employers need not provide any fall protection; in fact, based on interviews with industry experts, OSHA learned that virtually all employers provide their employees with fall protection equipment. However, under existing OSHA standards, all climbers are not necessarily required to maintain 100 percent tie-off fall protection at all times.

As mentioned earlier, OSHA is considering a 100 percent fall protection provision, which would require employers to protect workers from fall hazards at all times when climbing and working at a position above 6 feet. The provision would require protection for employees from falling 6 feet or more by a personal fall arrest system, guardrail system, or safety net. If fall protection through these means is infeasible, for example, when accessing certain types of antenna mounts such as T-booms, employers would be required to provide access to the work station through alternate means such as a crane and man basket or aerial lift. Maintaining 100 percent fall protection by climbers does require additional time during a climb. However, the additional amount of time required varies substantially based on climber experience, tower type, rigging and safety systems present on the tower, weather conditions, and other features of the site (Crown Castle, 2016).

The potential training provision mentioned earlier would require certain minimum training for specific worker assignments, including authorized climber, competent climber, qualified rigger, and hoist operator. Climbers would receive training in fall protection systems and requirements, self-rescue, assisted rescue techniques, and familiarity with all the rules, regulations, and standards applicable to his/her work.

Job hazard analyses and toolbox talks would also help to prevent falls resulting from not properly using fall protection. The job hazard analysis would include analyses of situations where employees might find it difficult to tie off and, therefore, be tempted to forgo tying off. Toolbox talks would provide an opportunity to emphasize the importance of 100 percent fall protection, to remind employees of situations where tying off may be difficult, and to inform or remind workers how they can achieve 100 percent fall protection.

Fall--Bad Choice of Anchor

Before performing a task on a telecommunications tower, workers are required to anchor their fall protection properly. Falls due to a bad choice of anchor are the direct result of poor training and failure to understand what constitutes a valid and adequately strong and stable anchor. These falls could potentially be prevented by good training, job hazard analysis, and toolbox talks. Job hazard analysis would identify what are valid anchor points, and, ideally, identify anchor points that are inadequate to fully secure a worker’s fall protection.

Fall--Equipment Failure

During work on telecommunications towers, broken or non-functional equipment can lead to falls. A broken cable brake system may fail and not stop a falling worker, or a defective carabiner may break and result in a fall. Other times, a supposedly valid anchor point fails to hold. The standard could help prevent falls of this type by requiring inspections of fall prevention equipment as part of toolbox talks--which can help assure workers understand how systems should work and how to identify systems and equipment that do not work properly--and inspections of the tower to assure the anchor points and safety fall systems are working as designed. The potential fall protection provision would include requirements that address the installation, maintenance, and inspection of safety climb systems where they are already installed on towers. Employers would have the responsibility to report broken or non-functional safety climb systems to telecommunications tower owners, and the tower's owners would have the duty to ensure the safe functioning of that safety climb system.

In addition, training can help assure workers understand what properly working fall protection equipment, anchor points, and fall safety systems should look like. Job hazard analysis and toolbox talks are also opportunities to assure workers understand how systems should work and how to recognize systems and equipment that may not work properly.

Generic Fall

Generic falls are falls for which the more detailed cause is unknown. They likely would fall into one of the categories discussed above and likely could be prevented by any of the provisions listed above.

Structural Collapse

These events occur largely in the construction and dismantling of telecommunications towers, and when towers are being reinforced or strengthened for the installation of new equipment. OSHA believes structural collapses in future work on telecommunications towers can be prevented by the potential structural requirements provision. This provision would require a qualified engineer, who has experience working with telecommunications towers, to supervise and/or plan any structural work on telecommunications towers (new construction, modification, and demolition) that could compromise the stability of the tower. The provision would also require compliance with relevant consensus standards, including ANSI A10.48, TIA 222-G, and TIA 322. Structural modifications of a low degree of complexity would require a structural analysis by a qualified engineer, and the work on site would be supervised by a competent person with an understanding of the structural modifications to be made. Structural modifications of a medium degree of complexity would require a structural analysis by a qualified engineer. In addition, the qualified engineer would be required to prepare detailed, step-by-step instructions for the work to be done. The structural work would be supervised by a competent person. Structural modifications of a high degree of complexity would require a structural analysis conducted by a qualified engineer, and the work would need to be planned and supervised by a qualified engineer.

The provision on structural requirements for telecommunications towers could require the inspection of telecommunications towers for issues such as loose or missing bolts or damaged, loose, or missing structural members. The inspections would also cover guy wires, including tensioning and connectors, along with tower foundations and ground conditions.

Training in following a clear, engineered plan for construction or dismantling, and job hazard analysis and toolbox talks that emphasize the importance of following that plan may help prevent fatalities resulting from structural collapses.

Gin Poles

The mechanics of hoisting materials using gin poles may put a strain on the structure, causing it to buckle and collapse. Based on OSHA's investigations of a number of gin pole-related tower collapses, and the risk of improperly loading the structure to the point of failure that is associated with gin poles, OSHA includes a potential provision addressing their use. The section on gin poles would include requirements on using gin poles to hoist materials, including gin pole components, connections, and load charts, and on the labelling and identification of gin poles. The section on materials hoisting would include topics on hoisting procedures, requirements for controlled access zones, requirements for load lines and tag lines, and requirements for load testing and verification. This section on gin poles would require a base-mounted drum hoist to be used when hoisting personnel, and would address the specifications for any hoist used to hoist personnel. The use of capstan hoists to hoist personnel would be prohibited. The rigging section would address requirements for the rigging of loads, including rigging components, safety factors, and inspections.

The standard would require training on the use of gin poles, and would require job hazard analysis and toolbox talks to cover all the uses of and hazards of gin poles.

Environmental Hazards

While climbers are working on telecommunications towers, weather changes can increase the hazards involved in performing tasks. The environmental hazards provision would require employers to check weather reports before commencing work and to monitor weather conditions periodically as work activities are taking place. The provision would also require employers to ensure that their employees are not climbing towers in hazardous weather. Some examples of hazardous weather conditions include lightning, storms, high winds, and extreme temperatures.

The standard's training provisions would require discussion on environmental hazards.

Multi-Entity Considerations

More than one employer may be involved with work performed on a telecommunications tower. For example, a crane operator may be employed by a different company than the climbers and riggers. The multi-entity provision would address these concerns and would require that all contract firms present on the jobsite communicate with one another about hazardous conditions, safe work procedures, and tower installation and modification of specifications. This would occur prior to beginning work, by phone or in person, and additional communication would be required if work conditions change substantially.

V. Potentially Affected Worksites and Entities

This section presents estimates of the number of affected firms and their characteristics.

Establishments and Employees Affected by Potential Rule

While broadcast or cell phone companies (carriers) own some telecommunications towers, many are owned by dedicated tower companies. Tower companies then lease space on towers to wireless carriers. When a carrier undertakes a large-scale installation or upgrade project, it usually contracts with a specialized construction management company that specializes in tower-related work known as a turfing vendor. The turfing vendor then typically hires specialized subcontractors to perform specific project activities, and those subcontractors may further subcontract with other companies to perform certain aspects of the work. It is not uncommon to have several layers of subcontractors between the carrier and the company that employs the workers who actually perform the work (or certain parts of the work) on the telecommunications towers.

The scope of the rule OSHA is considering would address employers who have employees that work on telecommunications towers, regardless of the formal industry in which these employers are classified. The affected establishments will most commonly be subcontracted climbing companies. However, tower owners and turfing vendors could also fall within the scope of the rule to the extent that they have employees directly involved in tower work. The potential rule could indirectly affect even telecommunications tower owners and turfing vendors who do not employ workers that work on telecommunications towers. The requirements on multi-entity communication and on the maintenance of safety climbing systems installed on towers could also affect establishments that do not employ workers who perform tasks on telecommunications towers.

OSHA has preliminarily determined that entities affected by this potential rule would fall in one of three NAICS industries: 237130 - Power and Communication Line and Related Structures Construction; 517919 - All Other Telecommunications; or 811213 - Communication Equipment Repair and Maintenance. However, the firms that would be affected by this potential rule only make up a small fraction of the total firms in the three industries. To determine how many firms are engaged in telecommunications tower work, OSHA utilized other sources.

Wireless Estimator's "Blue Book" directory of contact information for companies that work on telecommunications towers and antennas contains contact information for 1,172 subcontracting companies working on telecommunications towers (Wireless Estimator, 2016c). Wireless Estimator estimates that 80 percent of the industry is part of this Blue Book (Wireless Estimator, 2016a). In order to estimate the total number of companies working on telecommunications towers, OSHA divided 1,172 by 80 percent to estimate a total industry count of 1,465 climbing companies that may be affected by this potential rule.

The potential rule could affect construction management companies or turfing vendors that work on or provide services relating to telecommunication towers. The National Association of Tower Erectors (NATE) and Wireless Estimator estimate that there are approximately 15 turfing vendors who do telecommunications tower construction management (NATE, 2016b; Wireless Estimator, 2016c). Based on these estimates, OSHA determined that a potential telecommunications towers rule may affect a total of 1,480 entities.

To determine how many entities were in each affected NAICS industry, the agency distributed the total number of companies estimated above proportionately across the three affected NAICS industries. For example, data from the Statistics of U.S. Business (SUSB) show that there are 8,113 total entities in these 3 NAICS industries and that 56 percent of those total entities are in NAICS 237130 - Power and Communication Line and Related Structures Construction (Census, 2015). By multiplying the estimated total affected establishments by 56 percent, OSHA estimated that 823 entities in NAICS 237130 are potentially affected by this rule. See Table 3 below.

Table 3 – Total and Affected Entities by NAICS Code

237130	Power and Communication Line and Related Structures Construction	4,511	56%	823
517919	All Other Telecommunications	2,174	27%	397
811213	Communication Equipment Repair and Maintenance	1,428	18%	260
	Total	8,113	100%	1,480

Source: OSHA, Office of Regulatory Analysis

Note: Rows may not sum exactly due to rounding.

To estimate the number of affected employees and what size firms they are employed at, OSHA turned to Department of Commerce's SUSB data by NAICS code.[6] To use these data for the purpose of this PIRFA, OSHA first divided the affected firms into small and large firms.

For the purposes of defining small business, OSHA used the SBA's Table of Small Business Size Standards, which defines a small business based on either number employees or revenue for each NAICS code. SBA definitions for small businesses under each of the relevant NAICS codes are listed in Table 4. The SUSB data come in categories, such as all firms with X million to Y million in revenue. OSHA included all businesses in categories where the high end of the category was less than the small business definition. When the threshold to be considered a small business fell within a SUSB size category, OSHA assumed that the number of entities and employees within that size category was distributed uniformly and estimated a proportional amount within the category. For example, the SBA definition for NAICS 811213 of $11,000,000 in revenue falls within the size category of $10,000,000 to $15,000,000 in revenue. Therefore, OSHA summed the total number of entities and employees in all size categories with revenues of less than $10,000,000. Then, in order to capture those entities with revenues between $10,000,000 and $11,000,000, OSHA calculated one-fifth of the entities and employees in the $10,000,000 to $15,000,000 in revenue size category. By adding those two values together, OSHA determined the total number of entities and employees in the less than $11,000,000 in revenues size category.

[6] Although more recent data are available, the most recent SUSB dataset that also includes receipts data is the 2012 SUSB dataset. For this reason, the 2012 dataset is used for both revenue data based on the receipts information, as well as any estimates related to entities or employees. Note that a quick comparison of the percentage of employees at entities with fewer than 20 employees suggests that the results for the most recent year available from the SUSB (2015) are similar to those in the 2012 SUSB, and using the most recent data for entities and employees would not significantly impact the universe or cost estimates.

Table 4 - Small Business Administration Small Entity Classification Definitions

237130	Power and Communication Line and Related Structures Construction	< $36,500,000 in revenue
517919	All Other Telecommunications	< $32,500,000 in revenue
811213	Communication Equipment Repair and Maintenance	< $11,000,000 in revenue
Source: Small Business Administration (2016)		

To calculate the number of affected small and large entities and employees at affected small and large entities, OSHA used 2016 SUSB data for the three affected NAICS industries and calculated what percentage of entities in those industries were considered small and what percentage of employees were employed at those small entities. The agency then applied those percentages from the entire NAICS industry to the portion of the industry that OSHA preliminarily estimated could be affected by this rule. Table 5 below shows the total number of entities in each NAICS industry, the percentage and number of entities in each affected NAICS code that are small based on the SBA size classifications, and the number of small entities that might be affected by this rule. Table 5 also shows the total number of employees in each affected NAICS industry, the number of employees employed at small entities, and the number of employees at affected small entities. The total number of affected employees at small entities is calculated assuming that small entities working on telecommunications towers are the same size as other small entities in the NAICS industry. In addition, based on the conversations with industry experts, the agency understands that there are few or no large firms in the affected industries that are devoted entirely to telecommunications tower work – most large firms in these industries undertake a variety of work of which only a small portion is covered by this potential rule. For example, many larger engineering firms that perform some telecommunications tower work also engage in other building and/or infrastructure construction projects. Based on this understanding, OSHA includes 40 percent of workers at affected large firms in the affected worker population. This means that OSHA estimates that there are about 24,000 affected workers performing telecommunications tower work. This is consistent with estimates from industry sources that estimate there are between 10,000 and 30,000 workers, who work on telecommunications towers.

Table 5 – Total Affected Small Entities and Employees at Affected Small Entities by NAICS Code										
		Entities					**Employees**			
NAICS										
237130	Power and Communication Line and Related Structures Construction	4,511	4,344	96%	823	790	169,929	51,562	18,852	9,480
517919	All Other Telecommunications	2,174	2,113	97%	397	385	28,227	11,125	3,221	1,925
811213	Communication Equipment Repair and Maintenance	1,428	1,361	95%	260	247	14,381	7,132	1,851	1,235
	Total	8,113	7,818		1,480	1,422	212,537	69,819	23,924	12,640
Source: OSHA, Office of Regulatory Analysis										

Estimate of Total Number of Telecommunications Towers

The Federal Communications Commission (FCC) maintains several separate databases that track antennae, which include telecommunications towers. FCC's Office of Engineering and Technology developed its Spectrum Utilization Study Software (SUSS) to compile multiple FCC databases into a single data set.[7] In addition, commercial tower data from several large tower companies supplements FCC's data. SUSS' AntSiteInfo data table includes site-specific antenna information from the relevant FCC databases (see footnote 7), but where multiple entries show antennas sharing the same latitude/longitude location (when data are available) or located in the same city/state, those antennae are assumed to be duplicate entries and any of these identified duplicates are removed. The FCC database shows that there are 1,018,132 antennae located on top of other structures in the U.S., of which 497,932 are the kind of towers covered by the potential standard. This information is summarized in Table 33.

Antenna and Tower Construction and Dismantlement

To estimate the cost of this potential rule, OSHA needed to estimate how many towers are constructed or dismantled each year since there are additional requirements for telecommunications tower construction work relative to telecommunications tower maintenance work such as upgrading an antenna.

The FCC's Antenna Structure Registration (ASR) database requires that antenna structures higher than 200 feet above ground level or within a range of nearby airports register with the FCC. Although limited in its scope, the ASR database provides information on the number of new antenna structures registered with the FCC each year, as well as the number of antennae that were dismantled. The FCC defines "antenna structure" as the following, "[T]he radiating and/or receive system, its supporting structures and any appurtenances mounted thereon." In practical terms, an antenna structure could be a free standing structure, built specifically to support antennas or act as an antenna, or it could be a structure mounted on some other man-made object (such as a building or bridge). If the structure is mounted on some other man-made object such as a building or bridge, the structure must be registered with the FCC, not the building or bridge" (source: https://www.fcc.gov/wireless/support/antenna-structure-registration-asr-resources/antenna-structure-registration-asr). By the FCC definition, a telecommunications tower is one of many types of antenna structures.

Table 6 presents the number of new antenna construction applications and notifications of dismantlement filed with the ASR database from 2010-2015 as reported in the database's public access files. The data on construction were limited to applications where the field Application Purpose indicated that the application was a notification of a new antenna structure (Federal Communications Commission, 2016b).[8]

Because not all work on antennae is required to be registered with the FCC, the actual number of telecommunications towers constructed and dismantled annually is likely larger. Since OSHA has no

[7] The SUSS data set includes the following databases and systems: Antenna Structure Registration, Consolidated Database System, Cable Operation and Licensing System, International Bureau Electronic Filing System, and Universal Licensing System.

[8] In 2013, the ASR new antenna structure registration became a two-step process, requiring a preliminary amendment application followed by a new antenna structure notification after the structure is built (Federal Communications Commission, 2016b).

basis to inflate the reported number of telecommunications towers constructed each year, these unadjusted (and likely underestimated) numbers of constructed antennae will be used for this analysis.

Table 6 - Number of Telecommunications Towers Constructed and Dismantled from 2010-2015

Year	Number Constructed	Number Dismantled
2010	615	509
2011	596	379
2012	2,737	401
2013	3,537	565
2014	3,079	482
2015	1,905	663
Average per Year, 2010-2015	**2,078**	**500**

Source: FCC Antenna Structure Registration (2016a)

Industry representatives estimate that new tower construction jobs represent approximately 5 to 15 percent of telecommunications tower projects (Crown Castle, 2016; MUTI, 2016; NTCH-Cleartalk, 2016). Based on that estimate and an annual average of approximately 2,000 new telecommunications towers, OSHA calculated that there are between 13,333 - 40,000 total telecommunications tower projects per year. Based on the average construction and dismantlement numbers from the FCC, OSHA estimates that there are between 11,000 - 17,500 telecommunications tower maintenance projects per year. For the purposes of this analysis, OSHA has taken the mid-point of the most likely range of annual projects per year.

Characteristics of Regulated Entities

A number of the costs of this potential rule are based on the number of crews per entity. Based on Wireless Estimator's survey, OSHA has preliminarily determined that a standard crew consists of four employees (Wireless Estimator, 2015b). To determine the number of crews for each entity, OSHA divided the total number of affected employees of 23,924 (see Table 5) by 4.

Table 7 - Characteristics of Regulated Entities Used to Derive Total Costs

237130	12	281	3	70	790	33
517919	5	108	1	27	385	12
811213	5	44	1	11	247	14

Sources: OSHA, Office of Regulatory Analysis based on U.S. Census Bureau (2015); Wireless Estimator (2015b)

Additionally, unit costs based on project-level unit costs require an estimate of the number of projects a crew can do in a single year. Industry sources suggest the average crew will do 30 projects a year (NTCH-Cleartalk, 2016; Sky Climber Tower Solutions, 2016). However, because only half of all telecommunication facilities are towers of the kind covered by this possible standard, for the purposes of this analysis, OSHA estimates that each crew will do only 15 projects a year that are covered by this possible standard (see Table 33, "Number of Antenna-Supporting Structures by Structure Type," for an accounting of all the types of antenna supporting structures in the United States; telecommunications towers make up approximately one-half of all antenna supporting structures).

Table 8 presents the number of climbing employees affected by the potential standard. Approximately 25 percent of the workers are in supervisory roles on the climbing site, assuming an average four-person crew, and another 25 percent may fulfill any one of a number of other roles, including riggers, heavy equipment operators, engineers, and other technicians (Wireless Estimator, 2015a). OSHA multiplied the number of total climbers by 25 percent to determine the number of foremen and the number of other workers, and determined that the remaining crew members are tower technicians (Wireless Estimator, 2015a).

Table 8 - Number of Employees by Type

Climber (tower technician)	11,962
Other (riggers, engineers, etc.)	5,981
Foreman (crew chief)	5,981
Total	**23,924**

Sources: OSHA, Office of Regulatory Analysis based on Wireless Estimator (2015a), NATE (2016b)

Notes: Survey asked for number of employees, including foremen and tower technicians that "worked on elevated structures." The number of employees by employee type above assumes four-person crews and 25 percent of climbing employees being foremen.

VI. Unit Compliance Costs

Compliance cost estimates for each of the requirements under the potential standard are detailed in the following sections. Several sources were used to derive the estimates, including previous rulemakings by OSHA and other Federal agencies, as well as conversations with tower climbing companies and industry trade associations. Compliance cost estimates are presented at the most relevant unit level. For example, rule familiarization costs are estimated at the company level, whereas equipment costs are often estimated per employee or per crew. In cases where there are multiple labor categories involved in compliance (i.e., Training, Job Hazard Analysis, and Rigging Plans), wage rates are shown for NAICS 237130 to provide an example of the costs associated with each requirement. Wage rates for other NAICS codes are included in Appendix A.

Many employers are already doing much of what this potential rule may require, and OSHA used information on how much these employers are spending on these activities to derive the unit costs in this analysis.

Wage Rates
Wage data for all industry labor categories were taken from the September 2017 Employer Costs for Employee Compensation (ECEC) (Bureau of Labor Statistics, 2017a) and the May 2016 Occupational Employment Statistics (OES) (Bureau of Labor Statistics, 2017b). To estimate the wages for occupations affected by this potential rule, OSHA matched relevant ANSI standard occupational categories to the appropriate OES occupation code in the affected NAICS industries. The cost of fringe benefits such as paid leave and insurance are also specific to each labor category and industry, and were taken from the most relevant ECEC series as a percent of wages.

For this PIRFA, OSHA included an overhead rate when estimating the marginal cost of labor in its primary cost calculation. Overhead costs are indirect expenses that cannot be tied to producing a specific product or service. Common examples include rent, utilities, and office equipment. Unfortunately, there is no general consensus on the cost elements that fit this definition, which has led to a wide range of overhead estimates. Consequently, the treatment of overhead costs needs to be case-specific. OSHA adopted an overhead rate of 17 percent of base wages.[9] This is consistent with the overhead rate used for sensitivity analyses in the 2017 Improved Tracking Final Economic Analysis (FEA) and the FEA in support of OSHA's 2016 final standard on Occupational Exposure to Respirable Crystalline Silica. For example, to calculate the total labor cost for an authorized climber (SOC: 49-2021), the base wage ($23.20) was combined with the percent of total compensation (67.5 percent) to derive the loaded wage ($23.20 /67.5% = $34.37). Overhead costs ($3.94, 17 percent of $23.20) were then added to the loaded wage to derive the fully-loaded wage. This increases the labor cost of the fully-loaded wage for an authorized climber to $38.31.

All wage rates are presented in detail in Appendix A. Wage rates are used to translate burden estimates into unit cost estimates for each potential provision discussed in the following sections.

Rule Familiarization
Rule familiarization covers the time required for a manager within each potentially affected entity to review the requirements of the rule and determine their applicability; the cost is a direct result of rule promulgation. Many rulemakings, by OSHA and other federal agencies, include rule familiarization costs, which can vary widely depending upon the complexity of the rule. For this potential rule, OSHA preliminarily estimates that it will take small entities in all affected NAICS industries four hours to become familiar with this potential rule and that it will take large entities eight hours to do so. The associated unit costs per entity are listed below in Table 9.

[9] The methodology was modeled after an approach used by the Environmental Protection Agency. More information on this approach can be found at: U.S. Environmental Protection Agency, "Wage Rates for Economic Analyses of the Toxics Release Inventory Program," June 10, 2002. This analysis itself was based on a survey of several large chemical manufacturing plants: Heiden Associates, *Final Report: A Study of Industry Compliance Costs Under the Final Comprehensive Assessment Information Rule*, Prepared for the Chemical Manufacturers Association, December 14, 1989.

Table 9 - Unit Cost Estimates for Rule Familiarization Per Company				
Power and Communication Line and Related Structures Construction	237130	Small	4.0	$329
		Large	8.0	$658
All Other Telecommunications	517919	Small	4.0	$331
		Large	8.0	$662
Electronic Precision Equipment Repair and Maintenance	811200	Small	4.0	$311
		Large	8.0	$622
Source: OSHA, Office of Regulatory Analysis~~;~~ Bureau of Labor Statistics (2017b)				

Training

Climbing training currently occurs via two types of programs: 1) internal training programs overseen by climbing companies; and 2) commercial training provided by dedicated training companies. Approximately 30 to 50 percent of climbers complete commercial training, while the other 50 to 70 percent of climbers are trained through internal programs (Comtrain, 2016b; Safety Connection, 2016). For the purposes of this analysis, OSHA prelimilarily estimated that 60 percent of workers will be trained internally and the remaining 40 percent will be trained through commercial training. Both internal training and commercial training can meet the requirements of the potential rule, so affected employers will have the freedom to choose what best meets their needs.

Different levels of climbing expertise require different training commitments. Based on current practices, which OSHA has preliminarily determined will meet the requirements of this potential rule, commercial training courses for affected employees will take 8 to 32 hours, depending on the job requirements (Comtrain, 2016b). Current industry guidelines require that all workers be recertified in their training every two years. OSHA has preliminarily determined that complying with those industries guidelines will satisfy the requirements of this potential rule.

The unit cost per employee for commercial training is presented below. These estimates include the cost of the commercial course as well as the labor cost of employees receiving training. Unit costs presented in Table 10 show costs incurred for new employees and employees receiving training for the first time, and the annual costs incurred for recertification courses for all employees.

Table 10 - Unit Cost of Commercial Training per Employee for New Hires or Employees Receiving Training for the First Time and for Annual Recertification (NAICS 237130)							
Climber	Authorized Climber	$38.31	$935	16	$613	$1,548	$774
Climber	Competent Climber	$48.90	$1,630	24	$1,174	$2,804	$1,402
Rigger	Competent Rigger	$40.35	$695	8	$323	$1,018	$509
Rigging Supervisor	Crew Chief / Supervisor / Foreman	$52.98	$2,930	24	$1,272	$4,202	$2,101
Supervisor / Crew Chief	Crew Chief / Supervisor / Foreman	$52.98	$3,465	32	$1,695	$5,160	$2,580

Note: Annual cost per employee reflects the sum of the course cost and labor costs, split over the two-year period between re-certifications.

Sources: OSHA, Office of Regulatory Analysis, based on Comtrain, 2016b; Gravitec, 2016; NATE, 2016b; Safety Connection, 2016

If an employer opts to train employees internally, that employer will incur the following costs. The cost to train the employee who will then train others includes the cost of an external “train the trainer” course and the cost of the loaded wages of the worker for the time spent attending that course. For each employee trained in-house by that trainer, the per-employee cost will include the cost of the trainer’s time (divided by the number of workers trained in each class) plus the wages for the time of the employee receiving training. The unit cost per employee for internal training is presented in Table 11 below and includes the cost of training for new employees and employees receiving training for the first time as well as for biannual recertification of training.

While it is likely that commercial trainers would be able to provide training at a lower cost due to standardized training materials and economies of scale, employers may still wish to train their employees internally because those economies of scale may be outstripped by travel costs depending upon the relative locations of the employer and training centers. Further, for almost all kinds of OSHA training, sample training modules are available for free online, and to conduct training courses, the few training centers that exist need a lot of equipment, including towers, so it can be an expensive multi-day trip to attend off-site training. In addition, whenever OSHA creates a rule, private companies produce standardized online training materials that can be downloaded by small entities who wish to train their own employees.

Table 11 - Unit Cost of Internal Training per Employee for New Hires or Employees Receiving Training for the First Time and for Annual Recertification (NAICS 237130)								
Trainer	Trainer	$60.97	$3,465	--	32	$1,951	$5,416	$2,708
Climber	Authorized Climber	$38.31	--	2	16	$1,101	$1,101	$550
Climber	Competent Climber	$48.90	--	2	24	$1,905	$1,905	$953
Rigger	Competent Rigger	$40.35	--	2	8	$567	$567	$283
Rigging Supervisor	Crew Chief / Supervisor / Foreman	$52.98	--	2	24	$2,003	$2,003	$1,002
Supervisor / Crew Chief	Crew Chief / Supervisor / Foreman	$52.98	--	2	32	$2,671	$2,671	$1,335
Sources: OSHA, Office of Regulatory Analysis, based on Comtrain, 2016b; Gravitec, 2016; NATE, 2016b; Safety Connection, 2016; Bureau of Labor Statistics (2017b)								

Recordkeeping

Recordkeeping requirements under the potential standard complement the training requirements, as they ensure that employee certifications and training documentation are up to date and accessible. Documented training informs managers and supervisors whether the employee is proficient in the skills required for the assigned tasks. Having training records available to managers and supervisors will better protect employees.

While some firms may opt to use external commercial recordkeeping services to maintain their training records, OSHA has preliminarily estimated that affected firms will keep these records internally. The process of keeping training records is estimated to require 1.5 minutes per training record based on unit cost estimates for training recordkeeping from OSHA's final Confined Spaces in Construction Standard (Occupational Safety and Health Administration, 2015). For larger companies, this task is likely undertaken by a clerical worker, but small companies may not employ a worker whose sole duties are clerical work, so OSHA assumes that these recordkeeping tasks are done by an engineer at small firms. While 1.5 minutes seems like a small time cost, this represents the cost to retain the record per employee, not per course, and does not include the cost to create the record. Even in small entities, OSHA expects the records to often be retained in computerized storage.

OSHA's analysis estimates that workers will need to take refresher training every two years. This means that 50 percent of workers will need to be recertified, and their training records updated, every two years.

To develop an average estimate of company-level costs, OSHA took the average number of employees based on size and NAICS code from the SUSB data for 2013 (U.S. Census Bureau, 2016).

Table 12 - Unit and Total Cost of Recordkeeping per Average Company

Power and Communication Line and Related Structures Construction	237130	Small	12	0.30	$22	0.15	$11	0.30	$22	0.15	$11
		Large	157	3.93	$129	1.96	$65	3.93	$129	1.96	$65
All Other Telecommunications	517919	Small	5	0.13	$9	0.06	$5	0.13	$9	0.06	$5
		Large	50	1.25	$45	0.63	$22	1.25	$45	0.63	$22
Electronic Precision Equipment Repair and Maintenance	811200	Small	5	0.13	$9	0.06	$5	0.13	$9	0.06	$5
		Large	46	1.15	$36	0.58	$18	1.15	$36	0.58	$18

Sources: OSHA, Office of Regulatory Analysis based on Comtrain (2016a, 2016b); OSHA (2015); U.S. Census Bureau (2016)

Job Hazard Analysis and Toolbox Talk

This provision would require that, prior to initiating work at the project site, a crew supervisor conduct a job hazard analysis (JHA). A JHA essentially records potential job site hazards and identifies the measures to be used to alleviate them, and ensure the safety of employees at the job. Employers would be required to update the JHA on a daily basis, as well as when conditions change. The provision would also require the crew to gather for a discussion of the day's relevant hazards as well as other relevant safety information before any climbing commences. This discussion is often referred to as a "toolbox talk."

OSHA estimates that a standard JHA on the first day of a new project requires 30 minutes on average to review topics, including site characteristics and hazards, equipment maintenance, and weather (Crown Castle, 2016; NATE, 2016b; NTCH-Cleartalk, 2016; Sky Climber Tower Solutions, 2016). However, for new construction or demolition of a tower, or for a project with complex and specialized requirements, the initial JHA could take as long as a day and a half. Most of the additional costs for JHA for these additional activities are covered under structural work costs. Generally, a JHA is completed on a form or checklist specific to the company. Templates for JHAs are readily available online (Wireless Estimator, 2012). After the first day of a project, the JHA process is less time consuming since the crew supervisor has already reviewed the site and is familiar with site characteristics such as the location of the nearest hospital. OSHA estimates that subsequent JHAs will take 20 minutes to complete each day.

Once the crew supervisor has completed the JHA for the day, members of the project crew gather for a "toolbox talk" to review site hazards, such as how to handle inclement weather or unusual site characteristics. A typical toolbox talk on the first day of a project is estimated to take 30 minutes and require participation from each crewmember (Crown Castle, 2016; NTCH-Cleartalk, 2016). As with the JHA, toolbox talks are often shorter after the first day of a project and OSHA estimates that these talks will take 15 minutes each day.

JHA and toolbox talk costs are estimated based on crew time requirements. Individual crews are assumed to be made up of four members and to work on an average of approximately 15 telecommunications towers projects per year (NTCH-Cleartalk, 2016; Sky Climber Tower Solutions, 2016). Based on these estimates, OSHA has preliminarily determined that each project will take on average 8.33 days. Tables 13 and 14 present these time estimates per project crew member with associated unit costs.

Table 13 - Unit Cost of Job Hazard Analysis per Project per Crew (NAICS 237130)

Crew Chief / Supervisor / Foreman	$52.98	0.5	0.33	8.33	$155
Sources: OSHA, Office of Regulatory Analysis, based on Crown Castle, 2016; MUTI, 2016; NATE, 2016b; NTCH-Cleartalk, 2016; Sky Climber Tower Solutions, 2016; Bureau of Labor Statistics (2017b)					

Table 14 - Unit Cost of Toolbox Talk per Project per Crew Member (NAICS 237130)

Authorized Climber	$38.31	0.5	0.25	8.33	$89
Competent Climber	$48.90	0.5	0.25	8.33	$114
Competent Rigger	$40.35	0.5	0.25	8.33	$94
Crew Chief / Supervisor / Foreman	$52.98	0.5	0.25	8.33	$124
				Total	$421
Sources: OSHA, Office of Regulatory Analysis based on Crown Castle, 2016; MUTI, 2016; NATE, 2016b; NTCH-Cleartalk, 2016; Sky Climber Tower Solutions, 2016; Bureau of Labor Statistics (2017b)					

Rigging Plans

OSHA is considering a requirement for detailed rigging plans when hoisting materials and employees, which would be similar to what is currently required by TIA Standard 322 (American National Standards Institute, 2016). These rigging plans would include details depending on the scope of work and should consider elements such as operational loads, equipment requirements, structural elements, and required testing and monitoring for the duration of the project. Projects that do not exceed rigging forces of 1,000 pounds would require, at a minimum, a competent rigger involved in the drafting of the rigging plan, whereas other projects, such as those with more than 1,000 pounds of rigging force or in unique situations, would require the involvement of at least a qualified engineer.

Burden estimates for developing a rigging plan range from four hours for a small tower to up to three weeks of work for large and complex towers (Tashjian Towers, 2016). For the purposes of this analysis, OSHA estimates that most towers will be on the small end and require four hours of work split evenly between a rigger who drafts the plans and an engineer who reviews the plans. The per-project unit costs are shown in Table 15.

Table 15 - Unit Cost of Rigging Plans (NAICS 237130)			
Competent Rigger	$40.35	2	$81
Qualified Engineer	$74.73	2	$149
	Total	4	$230
Sources: OSHA, Office of Regulatory Analysis based on American National Standards Institute (2012); Tashjian Towers (2016); Bureau of Labor Statistics (2017b)			

Environmental Hazards

Weather

For climbers, weather hazards include storm conditions that might make climbing unstable or difficult, as well as the potential for lightning. These hazards can be mitigated by regular review of weather predictions for the day.

OSHA is considering requiring employers to check weather reports before commencing work for the day and to monitor weather conditions periodically. Current standard industry practice includes one formal written assessment of weather hazards for the day that occurs as part of the JHA (Wireless Estimator, 2012). However, experienced climbers know to keep an eye on the weather and to regularly check the weather depending on the circumstances of the day and climb. Climbers often personally check the weather using a smart phone although sometimes a designated crew member or employee will check for the team and provide updates as necessary (TRS Group, 2016). Checking one or two weather applications on a smart phone takes a climber approximately two minutes (TRS Group, 2016) or about $11.00 per project ($38.31 x 2 minutes per day x 8.33 days per project). Workers may need to check the weather more frequently, especially in volatile weather areas. Recent changes in technology have made this less necessary as there are numerous mobile phone weather applications (including free applications) which can provide local weather information and localized weather alerts automatically, with no intervention by employees. In an estimated 5 percent of projects, a crew might be out of mobile phone range, requiring an alternate approach to weather hazard monitoring. Crews may be required to work out of mobile phone range for several reasons. For example, a crew may be working on a tower that is de-energized, and no other towers are within range, or crews are building telecommunications infrastructure in a new area, and the service on the tower being built is not yet active. Crews restoring telecommunications services to areas in the wake of natural disasters may also be working without regular access to mobile phone service. The potential standard might require a central-office administrator to monitor weather conditions for a field crew and report updates or changing conditions on a periodic basis when the crew is out of mobile phone range or, for some reason, cannot monitor the weather with a smartphone. Those exceptions are not costed separately in Table 16 because the average unit cost shown in the table is expected to be the same whether monitoring happens on-site with a mobile phone or off-site with a weather radio or other monitoring device and there should be no difference in the number of minutes to monitor weather on-site or off-site.

Table 16 - Cost of Weather Monitoring per Crew per Project (NAICS 237130)					
Authorized Climber	$38.31	1	0.03	8.33	$11.00
Sources: OSHA, Office of Regulatory Analysis, based on Bureau of Labor Statistics (2017b)					

Wildlife

Wildlife hazards at climbing sites include venomous snakes, stinging insects, poisonous plants, and protected nesting birds. The potential standard may require reviewing potentially hazardous or dangerous wildlife of which climbers should be aware. JHA procedures typically include time for a site survey, which usually explicitly include the identification and consideration of these potential hazards for the day's climb site. OSHA currently does not have unit cost estimates for wildlife abatement but welcomes comments on the potential unit costs. In some cases, when protected wildlife species are encountered, crews may have to leave the jobsite and work elsewhere that day.

Note also that crews must check for the presence of migratory as well as endangered and threatened species at the site (US Department of Interior, Fish and Wildlife Service).

Structural Modifications

OSHA is considering a requirement that any structural modifications to telecommunications towers be overseen and planned by a qualified engineer, who has experience working on telecommunications towers.[10] There are many ways in which an engineer may be involved in structural modifications to telecommunications towers, including structural analysis of a tower, planning structural work for a tower, supervising structural work on a tower, and preparing step-by-step instructions for structural work on a tower. The cost of structural modifications to a tower varies widely, depending on the degree of oversight and involvement of a qualified engineer.

Table 17 below presents the potential requirements for structural modification based on high, medium, and low degrees of complexity. The costs associated with these requirements are calculated in the remainder of this section.

[10] This analysis is limited to structural modifications and does not include demolition or construction. In construction, the unit cost is very low; engineers are primarily involved in the structural analysis prior to the start of a project. These analyses take anywhere from one to five hours, depending on the size and complexity of the tower (Rohn Products, 2016; Tashjian Towers, 2016).

Table 17 - Descriptions of Potential Structural Modification Requirements by Complexity	
High	• Detailed structural analysis is required • Planning and supervising of structural work is done by a qualified engineer (step-by-step instructions are not required because the engineer is supervising and providing instructions)
Medium	• Detailed structural analysis is required • Planning of structural work is done by a qualified engineer, who prepares detailed step-by-step instructions for the work to be done • The structural work occurring during the job is supervised by a qualified person
Low	• Detailed structural analysis is required • The structural work occurring during the job is supervised by a competent person with an understanding of the structural modifications to be made

Structural Analysis of Telecommunications Towers

A structural analysis should occur before any modifications are done to an existing tower (OSHA Washington State Plan Office, 2016). The purpose of a structural analysis is to confirm whether parts of a tower can hold the weight that will be applied to it by the climber performing the work on the tower, or by the new structural additions to the tower (OSHA Washington State Plan Office, 2016). In a structural analysis, the engineer considers such factors as the tower size, the wind speed, the topography, the number of antennae, and the location of antennae on the tower (Rohn Products, 2016). There is a fixed cost across the industry of approximately $2,000, but costs can increase up to $2,500 if the tower is larger and more complex (Rohn Products, 2016; Tashjian Towers, 2016).

Planning Structural Modifications

The cost of developing plans for structural modifications varies widely depending on the type of work, and the size and complexity of the tower. Common types of structural modifications can require up to 32 hours of work, with some time spent in an office and additional time spent visiting the tower site (OSHA Washington State Plan Office, 2016). Plans for smaller modifications can take anywhere from two to eight hours (Rohn Products, 2016).

Table 18 - Unit Cost of Planning Structural Modifications				
Qualified Engineer	$74.73	Small	2	$149
		Medium	8	$598
		Large	32	$2,391
Source: OSHA, Office of Regulatory Analysis, based on OSHA Washington State Plan Office (2016); Rohn Products (2016)				

Supervising Structural Work

It is not currently common practice in the telecommunications tower industry for an engineer to supervise most modifications to a tower (OSHA Washington State Plan Office, 2016; Rohn Products, 2016; Tashjian Towers, 2016). The potential provision addressing structural work would require supervision by qualified engineers only for the most complicated jobs, allow projects of medium complexity to be supervised by a competent person while using step-by-step instructions prepared by an engineer, and allow low complexity modifications to be supervised by a competent person. It is most common for an engineer to supervise riskier work that involves heavy loading, such as rigging or installing a new antenna (OSHA Washington State Plan Office, 2016). These jobs can take up to two weeks of work (Tashjian Towers, 2016), whereas smaller modifications, such as reinforcing existing supports or braces, can take as little as one day of work (OSHA Washington State Plan Office, 2016). **Table** 19 consolidates both the complexity of the structural modification, based on the complexity defined previously in Table 17, and the length of the job (varying from one day to two weeks) to estimate the total cost of supervision per structural modification project.

Table 19 - Unit Cost of Supervising Structural Modifications

Low	Competent Person	$40.35	Small	8	$323
			Medium	40	$1,614
			Large	80	$3,228
Medium	Competent Person	$40.35	Small	8	$323
			Medium	40	$1,614
			Large	80	$3,228
High	Qualified Engineer	$74.73	Small	8	$598
			Medium	40	$2,989
			Large	80	$5,978

Source: OSHA, Office of Regulatory Analysis, based on OSHA Washington State Plan Office (2016); Rohn Products (2016); Tashjian Towers (2016)

Developing Step-by-Step Instructions

For structural modifications of medium complexity, the potential provision would allow a qualified engineer to prepare step-by-step instructions to be carried out by a climbing crew under the supervision of a competent person. In most cases, these instructions are written by the contractor, and then reviewed by a qualified engineer (see Table 20), which takes anywhere from four to six hours depending on the size and complexity of the structural modifications (Tashjian Towers, 2016).

Table 20 - Unit Cost of Developing Step-by-Step Instructions for Structural Work (Medium Complexity)

Qualified Engineer	$74.73	Small	4	$299
		Medium	5	$374
		Large	6	$448

Source: OSHA, Office of Regulatory Analysis, based on Julian (2016); Tashjian (2016)

Comparison of Costs for Structural Modifications of High, Medium, and Low Complexity

A summary of the costs for each level of complexity is included in Table 21 below. The fixed cost for conducting a structural analysis is also included. Note that step-by-step instructions are not included for low complexity projects because such projects are simple enough that they do not need this type of detailed instruction or for high complexity projects because experts must be present on site directing the work.

Table 21 - Unit Costs per Structural Modification, by Complexity and Tower Size

Low	Small	$2,000	2	$149	--	--	8	$323	10	$2,472
	Medium	$2,000	8	$598	--	--	40	$1,614	48	$4,212
	Large	$2,500	32	$2,391	--	--	80	$3,228	112	$8,119
Medium	Small	$2,000	2	$149	4	$299	8	$323	14	$2,771
	Medium	$2,000	8	$598	5	$374	40	$1,614	53	$4,585
	Large	$2,500	32	$2,391	6	$448	80	$3,228	118	$8,567
High	Small	$2,000	2	$149	--	--	8	$598	10	$2747
	Medium	$2,000	8	$598	--	--	40	$2,989	48	$5,587
	Large	$2,500	32	$2,391	--	--	80	$5,978	112	$10,870

Source: OSHA, Office of Regulatory Analysis

Multi-Entity Communication

OSHA is considering a requirement for communication, especially regarding known hazards, between all relevant entities to occur before starting the job. OSHA believes the requirement is important to ensure that telecommunications tower-specific hazards are sufficiently identified and addressed in the JHA and toolbox talks. If the entity creating the JHA and/or conducting the toolbox talk is not adequately informed of all relevant hazards, the JHA will be correspondingly inadequate. Relevant entities include telecommunications tower companies, carriers, turfing vendors, and potentially multiple specialized subcontractors. Communication must occur between all of these layers regarding safety protocol, hazardous conditions, safe work procedures, as well as tower installation and modification specifications. Typically, such communication will occur prior to beginning work, but could be an ongoing requirement if work conditions change.

OSHA estimates that communication of hazards would require 10 minutes of a worker's time for small companies and 15 minutes of a worker's time for large companies based on unit cost estimates for similar activities included in the Subpart V Electric Power Transmission and Distribution Standard (Occupational Safety and Health Administration, 2014). Due to the high variance in the number of contracting layers in a typical job (Hubble Foundation, 2016), OSHA uses a range when developing the estimates of the number of communication exchanges per company type per project. Turfing vendors communicate with the tower owner and at least one direct subcontractor, with an assumed upper bound of six total communications for larger projects. Based on the estimates above, OSHA developed upper and lower bounds for the total time required for communicating hazards by multiplying the number of communications per day by 10 minutes for small companies and 15 minutes for large companies. Costs are then calculated by multiplying wage rates for the workers who are engaging in communication by the amount of time required for the communication exchange. Communication costs are aggregated across NAICS codes. OSHA assumes that turfing vendors and subcontractors are distributed evenly in NAICS 237130, 517919, and 811213 and that the time needed to complete any communication exchanges is the same no matter which of these NAICS industries a firm falls in. Table 22 presents the lower and upper bound estimates of the time, in hours, needed to fulfill the communication requirements broken down by company type, and Table 23 presents lower and upper bound estimates of unit costs for communications per project by NAICS code.

Table 22 - Unit Time for Multi-Entity Communication Per Project by Company Type

Subcontracting Companies	Small	0.17	0.17	0.34
	Large	0.25	0.25	0.5
Turfing Vendors	Small	0.17	0.34	1.02
	Large	0.25	0.5	1.5
Source: OSHA, Office of Regulatory Analysis				

Table 23 - Unit Cost of Multi-Entity Communication Per Project by NAICS Code

Power and Communication Line and Related Structures Construction	237130	Small	0.5	$28	1.4	$76
		Large	0.8	$42	2.0	$112
All Other Telecommunications	517919	Small	0.5	$33	1.4	$87
		Large	0.8	$48	2.0	$128
Electronic Precision Equipment Repair and Maintenance	811200	Small	0.5	$30	1.4	$81
		Large	0.8	$44	2.0	$120

100 Percent Fall Protection

Under the potential standard, employers must ensure that they provide 100 percent fall protection for workers who are working at a height above six feet. Fall protection can consist of guardrails, safety nets, or personal fall arrest systems. Based on information obtained through interviews and site visits, OSHA believes that often guardrails and safety nets are difficult to use effectively. Most companies equip their climbers with personal fall arrest systems as the preferred method of fall protection. Simply providing PPE in the form of personal fall arrest systems to workers does not meet the requirements to ensure 100 percent fall protection. In order to meet this requirement, employers must also ensure that workers are always tying off the provided PPE to appropriate anchors. It is a common policy among companies (and a strong recommendation among industry groups) to ensure that climbers follow a 100 percent tie-off requirement diligently. For the purposes of costing this potential rule, OSHA is assuming that all climbers are being provided the correct PPE but are not tying their PPE off correctly. Climbing companies will incur costs for the additional time that workers will spend securing their PPE when they otherwise would have failed to do so.

Maintaining 100 percent tie-off by climbers does require additional time during a climb. However, the additional amount of time required varies substantially based on climber experience, structure type, rigging and safety systems present on the tower, weather conditions, and other features of the site (Crown Castle, 2016). As an example, climbing a 30-foot monopole with anchorage points and a y-lanyard might require 10 minutes with 100 percent tie-off, and 3 to 5 minutes without 100 percent tie off (Crown Castle, 2016). For the purposes of this analysis, OSHA has preliminarily estimated that 100 percent tie off will increase by 50 percent the time necessary to climb a tower.

The estimated unit costs for a standard crew are presented in **Error! Reference source not found.**Table 24, and costs represent the additional labor costs per project day for slower and safer climbs. This estimate assumes a standard crew with two climbers who climb and descend the tower once per day. The average tower height is derived from the average of structures listed in the FCC's ASR database.

Table 24 - Unit Cost of 100 Percent Fall Protection per Project-day per Crew (NAICS 237130)

Competent Climber	$48.90	2	72	180	0.8	0.4	$39.12
Sources: OSHA, Office of Regulatory Analysis, based on Crown Castle, 2016							

Telecommunications Tower Inspections

OSHA is considering a requirement for regular structure inspections. The TIA-222-G Standard for antennae supporting structures recommends inspecting and performing maintenance on guyed towers every three years and self-supporting towers every five years (TIA 222-G, Section 14). Many telecommunications structure companies already follow the consensus standard (Crown Castle, 2016). Structure owners hire subcontractors that specialize in tower inspection and maintenance, and the subcontractors (two or more workers) climb the tower when doing the inspection.

The cost of the inspection is proportional to how long the inspection will take. Typically, inspecting one tower will take half a day to a full day of work. Factors that affect the length of inspection include height of the tower, tower type (i.e., guyed, self-supporting, monopole, or other antenna-supporting structure), and how much minor maintenance is done during the inspection (Crown Castle, 2016). OSHA assumes that the time to inspect towers depends on the overall height and complexity of the tower, and that a guyed tower takes three quarters of a day to a full day to inspect while other towers take half a day to three quarters of a day. The costs in Table 25 assume that two climbers do the inspection and are based on the loaded wages of one authorized climber and one competent climber in NAICS 237130.

Table 25 - Annual Cost of Tower Inspection per Tower			
Tower Type	**Size**	**Time (hours)**	**Cost**
Guyed Tower	Small	6	$524
Guyed Tower	Large	8	$698
All Others	Small	4	$349
All Others	Large	6	$523
Source: OSHA, Office of Regulatory Analysis, based on Cullum (2016)			

VII. Total Cost of Compliance

Assumptions Used to Derive Total Costs

Total costs of compliance are estimated by establishing a compliance baseline for those entities that already follow the practices and requirements in each of the potential regulatory provisions. For those entities that are either not in compliance or only partially in compliance with the proposed requirements, the individual unit cost components can be aggregated to determine an average entity (i.e., company) cost by NAICS code and size category. Average company costs can then be multiplied by the estimated number of affected entities to derive total costs. A series of assumptions (described in the following sections) is necessary to model baseline compliance and translate all unit costs into cost per company.

Economic principles would normally indicate that large firms have economies of scale compared to small firms. That might not be the case in the telecommunications tower industry where nearly all entities are very small, yet still in business and presumably profitable, suggesting there might not be economies of scale or that there are so few large firms because of diseconomies of scale.

Current Adherence to Consensus Standards

For training, OSHA adopted an estimate based on a question in the Wireless Estimator Survey on training that 80 percent now provide appropriate training.

For all other provisions of the rule, OSHA has preliminarily determined that all companies that are members of NATE adhere to the consensus standards that are described in Section IV. The consensus standards are similar to the proposed actions under each unit cost category in most cases, such as the requirements for a job hazard analysis. Other proposed actions go beyond consensus standard requirements, such as the frequency of monitoring weather forecasts.

As of March 2017, 441 of the 1,193 listed contractors in the Wireless Estimator Blue Book who employ aerial workers are members of NATE (37 percent) (Wireless Estimator, 2016b). Of the remaining 63 percent of the industry, it is likely that some entities that are not NATE members also adhere to the consensus standards and may already comply with many of the potential provisions discussed earlier in this PIRFA. Due to the lack of more specific data, OSHA preliminarily estimates that 75 percent of the remaining non-NATE member entities (or 47 percent of all affected entities) are in compliance with consensus standards and therefore, the potential rule. After taking into account those NATE member companies that are in compliance and the estimated 47 percent of potentially affected entities that are not

NATE members but who are estimated to be in compliance, that leaves the remaining 16 percent of the regulated entities whom OSHA estimates are not in compliance with the proposed potential rule detailed in this PIRFA. These entities would incur costs to comply with the proposed actions.

Rule Familiarization

Unit costs are estimated at the entity level. Regardless of baseline compliance, all entities will need to conduct rule familiarization and therefore all entities will incur costs.

Training

Unit costs are estimated at the employee level. In order to aggregate training costs per employee to the entity level, OSHA preliminarily determined that each crew at a company consists of an Authorized Climber, a Competent Climber, a Competent Rigger, and a Crew Chief/Supervisor/Foreman. The total costs of training for these four employees are then multiplied by the number of crews at each entity derived earlier (see Tables 10 and 11).

Based on the Wireless Estimator survey, 80 percent of companies train new hires within the first month of employment (including those who were already certified under a previous employer) on proper tower safety and rescue procedures (Wireless Estimator, 2015b). Although this rate describes the percent of entities providing timely training for new hires, it serves as a proxy for entities that would provide appropriate training as well. The baseline for this analysis estimates that 80 percent of entities will already be providing appropriate training that complies with the potential provision and will incur no costs for training newly hired workers.

Although training rates for refresher training may differ from the rate of training for new hires, in the absence of additional information, the same rate is assumed for the ongoing training baseline. Note that in the Wireless Estimator survey, a similar percent of entities (81 percent) indicated that they have at least one full-time safety instructor on staff, which could serve as a proxy for continued compliance with training requirements in the ongoing period (Wireless Estimator, 2015b).

Recordkeeping

Currently, most climbers are expected to have a climber certification card, and many employers would keep a record that the climber had the certification card. Unit costs are estimated at the employee level based on the number of workers receiving training. Since the proposed recordkeeping requirement is tied to training, the same baseline rates used for training are also used for recordkeeping.

Job Hazard Analysis and Toolbox Talk

Unit costs are estimated at the project level for both of these cost categories. To aggregate costs to the entity level, the total project cost was multiplied by the average annual number of projects per crew and the average number of crews per entity.

Job hazard analyses are included in the ANSI A10.48 consensus standards for safe practices associated with the construction of communication structures (American National Standards Institute, 2015), so as estimated previously, 16 percent of affected entities are estimated to not be complying with these requirements and would incur costs under this potential rule.

Similar estimates are made for adherence to a potential requirement for toolbox talks. OSHA has preliminarily determined that even entities that do not adhere to the full requirements for toolbox talks under the consensus standards still perform some kind of daily check-in. However, the length and quality may not be sufficient to fully comply with the requirements. If the estimated unit costs are based on a 30-minute toolbox talk on the first day of a project and 15 minutes on subsequent days, then a reasonable assumption for entities not already complying with consensus standards may be a fraction of this amount, such as 10 minutes on the first day and 5 minutes on others (or 33 percent of the full unit cost estimate).

Rigging Plans

Unit costs are estimated at the project level. To aggregate costs to the entity level, the total project cost was multiplied by the average number of projects per crew and the average number of crews per entity.

The potential requirements for rigging plans are aligned with those recommended in the ANSI A10.48 consensus standards. As previously discussed, OSHA estimates that 16 percent of affected entities are not in compliance with these potential requirements and would incur additional costs for rigging plans.

Environmental Hazards

Unit costs are estimated at the project level. To aggregate costs to the entity level, the total project cost was multiplied by the average number of projects per crew and the average number of crews per entity.

The proposed requirement to address environmental hazards is similar in scope to the provision on toolbox talks, and in many cases is included as part of the job hazard analysis and/or toolbox talk. As a result, based on the estimate of affected entities discussed above, OSHA estimates that 16 percent of affected entities would incur additional costs to comply with the potential environmental hazard requirements.

Structural Modifications

Unit costs are estimated per structural modification. The number of structural modifications was derived from estimates of maintenance projects per year (14,250, based on an estimated range of 11,000 to 17,500 projects as discussed previously). To calculate the costs per affected entity, OSHA assumed these maintenance projects are distributed evenly among crews. OSHA estimated that there are approximately 5,900 crews in the affected universe (23,924 total employees divided by four employees per crew), meaning there are approximately two structural modifications per crew in a given year. Total costs per entity for this potential provision were estimated by multiplying this estimate of structural modifications per crew by the estimated number of crews per entity for each size class and by the unit costs per structural modification.

OSHA has preliminarily determined that the proposed requirements for structural modifications are likely similar to those recommended in the TIA-222-G consensus standards for antenna supporting structures (American National Standards Institute, 2012). As discussed above, OSHA estimates that approximately 84 percent of affected establishments are in compliance with the applicable consensus standards, leaving 16 percent of affected entities that would incur new, additional costs to comply with the potential provision on structural modification.

Multi-Entity Communication

Unit costs are estimated at the project level. To aggregate costs to the entity level, the total project cost was multiplied by the average number of projects per crew (15, see earlier discussion) and the average number of crews per entity.

Although it is not specifically covered in consensus standards, in the absence of other data, the generic estimate of non-compliance is used as a proxy to assume that 16 percent of the affected entities would be subject to the costs associated with the potential provision requiring communication between contracting layers.

100 Percent Fall Protection

Unit costs are estimated per project day. To aggregate costs to the entity level, the total daily cost was multiplied by the assumed number of working days (5 days per week over 52 weeks, or 260) and the average number of crews per entity.

Based on a conversation with a tower climbing company representative, the form of fall protection most tower technicians already practice is 100 percent tie-off using a personal fall arrest system (Crown Castle, 2016). In addition, NATE has a prominent initiative called *100% Tie-Off 24/7* to encourage 100 percent tie-off. Assuming a basis of 95 percent compliance with the 100 percent tie-off requirements, only 5 percent of entities would incur costs to comply with this requirement.[11]

Summary of Baseline Estimates

A summary of the baseline estimates by unit cost category, as well as the associated estimate for the percent of affected entities that would newly incur each cost, is shown in Table 26.

[11]While this compliance rate may seem high given the number of fatalities related to falls, 95 percent compliance means there are still an estimated 125 crews (250 climbers) per day climbing without 100 percent tie-off.

Table 26 - Baseline Estimates for Calculating Total Costs			
Category	**Assumption**	**Firms in Compliance**	**Non-compliant Firms**
Rule Familiarization	Affects all companies.	0%	100%
Training, Initial	80% of affected workers are trained in the first year per Wireless Estimator survey, which adheres to A10.48 Standard requirements for training.	80%	20%
Training, Ongoing	Same training rate as first year in absence of other information.	80%	20%
Recordkeeping	Same rate as training.	80%	20%
Job Hazard Analysis	All tower technician companies that are NATE members already do a daily job hazard analysis, and 3/4 of non-NATE members already do as well.	84%	16%
Toolbox Talk	Same as Job Hazard Analysis.	84%	16%
Rigging Plans	All tower technician companies that are NATE members already follow the requirements for rigging plans based on A10.48 Standard, and 3/4 of non-NATE members already do as well.	84%	16%
Environmental Hazards	Same rate as Toolbox Talk.	84%	16%
Structural Modifications	All tower technician companies that are NATE members already follow the requirements for structural analyses based on TIA-222-G Standard, and 3/4 of non-NATE members already do as well.	84%	16%
Multi-Entity Communication	Same rate as Job Hazard Analysis.	84%	16%
100% Tie-Off	Almost all tower climbers already observe 100% Tie-Off, based on discussion with industry representatives.	95%	5%
Sources: OSHA, Office of Regulatory Analysis, based on Wireless Estimator (2015b, 2016b); ANSI (2012, 2015); Crown Castle (2016)			

Total Costs per Entity

Based on the baseline estimates and calculations outlined in this section, total costs per entity were derived for both the first year and in the annual ongoing period (Table 27). These costs were then annualized using a 3 percent discount rate (Table 28).

Table 27- First Year and Annual Ongoing Costs per Company by Provision, Size, and NAICS Code												
	First Year						**Annual Ongoing**					
	NAICS 237130		**NAICS 517919**		**NAICS 811213**		**NAICS 237130**		**NAICS 517919**		**NAICS 811213**	
Cost Category	**Small**	**Large**	**Small**	**Large**	**Small**	**Large**	**Small**	**Large**	**Small**	**Large**	**Small**	**Large**
Rule Familiarization	$329	$658	$331	$662	$311	$622	$0	$0	$0	$0	$0	$0
Training	$5,425	$113,654	$2,242	$43,623	$2,242	$18,158	$2,861	$62,805	$1,098	$24,018	$1,098	$9,913
Recordkeeping	$4	$47	$2	$19	$2	$7	$2	$23	$1	$10	$1	$3
Job Hazard Analysis	$1,114	$26,321	$407	$10,993	$362	$3,987	$1,114	$26,361	$407	$10,993	$362	$3,987
Toolbox Talk	$2,022	$47,855	$674	$18,198	$674	$7.414	$2,022	$47,855	$674	$18,198	$674	$7,414
Rigging Plans	$1,657	$39,218	$552	$14,914	$552	$6,076	$1,657	$39,218	$552	$17,914	$552	$6,076
Environmental Hazards	$76	$1,795	$25	$683	$25	$278	$76	$1,795	$25	$683	$25	$278
Structural Modifications	$2,201	$52,089	$734	$19,809	$734	$8,070	$2,201	$52,089	$734	$19,809	$734	$8,070
Multi-Entity Communications (Upper Bound)	$551	$19,163	$210	$8,322	$196	$3,163	$551	$19,163	$210	$9,322	$196	$3,163
100% Tie-Off	$734	$17,360	$245	$6,602	$245	$2,690	$734	$17,360	$245	$6,602	$245	$2,690
Total for Average Company	$14,112	$318,199	$5,421	$123,826	$5,342	$50,465	$11,217	$266,669	$9,945	$103,549	$3,887	$41,595
Source: OSHA, Office of Regulatory Analysis												

Table 28 - Annualized Costs by Provision, Size, and NAICS Code												
Size Category	**NAICS 237130**			**NAICS 517919**			**NAICS 811213**			**Total**		
	Small	Large	***Total***	Small	Large	***Total***	Small	Large	***Total***	Small	Large	***Total***
Rule Familiarization	$29,582	$2,471	***$32,053***	$14,504	$904	***$15,408***	$8,743	$991	***$9,734***	$52,829	$4,367	***$57,196***
Training	$2,490,731	$2,263,550	***$4,754,281***	$472,859	$314,992	***$787,851***	$303,367	$151,920	***$455,287***	$3,266,957	$2,730,462	***$5,997,419***
Recordkeeping	$1,760	$849	***$2,609***	$429	$132	***$561***	$275	$48	***$323***	$2,464	$1,030	***$3,494***
Job Hazard Analysis and Toolbox Talk	$2,477,440	$2,449,128	***$4,926,568***	$416,185	$350,304	***$766,489***	$255,892	$159,614	***$415,506***	$3,149,517	$2,959,046	***$6,108,563***
Rigging Plans	$1,309,030	$1,294,194	***$2,603,224***	$212,520	$178,968	***$391,488***	$136,344	$85,064	***$221,408***	$1,657,894	$1,558,226	***$3,216,120***
Environmental Hazards	$60,040	$59,235	***$119,275***	$9,625	$8,196	***$17,821***	$6,175	$3,892	***$10,067***	$75,840	$71,323	***$147,163***
Structural Modifications	$1,738,790	$1,718,937	***$3,457,727***	$282,590	$237,708	***$520,298***	$181,298	$112,980	***$294,278***	$2,202,678	$2,069,625	***$4,272,303***
Multi-Entity Communications	$435,290	$632,379	***$1,067,669***	$80,850	$99,864	***$180,714***	$48,412	$44,282	***$92,694***	$564,552	$776,525	***$1,341,077***
100% Tie-Off	$579,860	$572,880	***$1,152,740***	$94,325	$79,224	***$173,549***	$60,515	$37,660	***$98,175***	$734,700	$689,764	***$1,424,464***
Total	$9,122,523	$8,993,624	***$18,116,147***	$1,583,887	$1,270,293	***$2,854,180***	$1,001,021	$596,451	***$1,597,472***	$11,707,431	$10,860,368	***$22,567,799***
Source: OSHA, Office of Regulatory Analysis												

To provide an estimate of the economic significance of the impacts of the costs presented above, the average annualized costs per entity were compared to the average revenue and average profit of a given company. These comparisons were made based on NAICS code and size classification. Average revenue was estimated using total receipts and total entities from SUSB 2012 data, since this is the most recent year of SUSB data with receipt information (U.S. Census Bureau, 2015), and revenues were converted to 2016 dollars using a GDP inflation factor (Bureau of Economic Analysis, 2016). Average profits were derived by applying a NAICS-specific profit rate to each average revenue estimate.

The profit rates are calculated using the 2013 Corporation Source Book (Internal Revenue Service, 2016). Each of the three NAICS codes was matched to the relevant industry sector in the Statistics of Income data, which is roughly analogous to a 3-digit NAICS code. This information includes the total receipts and net income for each industry code. Profit rates were calculated by dividing the net income by total receipts for each industry sector, and averaged over the 2004 through 2011 time span to calculate an average profit rate to apply to the average revenue figures. Average revenue and profits are summarized in Table 29.

Table 29 - Average Revenue and Profit Rates by NAICS Code and Size Category

237130	$2,390,782	$182,183,643	6.20%	$148,229	$11,295,452
517919	$1,202,517	$235,064,278	9.20%	$110,599	$21,619,549
811213	$837,629	$29,001,139	7.27%	$60,900	$2,108,546

Sources: OSHA, Office of Regulatory Analysis, based on U.S. Census Bureau (2015); Bureau of Economic Analysis (2016); Internal Revenue Service (2016)

For purposes of determining the economic significance of the impacts, OSHA uses threshold values of costs exceeding 1 percent of revenues or 5 percent of profits. Table 30 shows estimated impact as a percentage of revenues and profits for the average small entity in the three affected NAICS industries.

Table 30 - Comparison of Average Entity Revenue and Profit to Significant Impacts Thresholds by NAICS Code and Size Category

237130	$11,547	$272,534	0.48%	0.15%	8%	2%
517919	$4,114	$105,858	0.34%	0.05%	4%	0.5%
811213	$4,053	$42,604	0.48%	0.15%	7%	2%

Source: OSHA, Office of Regulatory Analysis

VIII. Description of Any Duplicative, Overlapping, or Conflicting Rules

The prior sections of this document discuss OSHA's preliminary thinking on what a proposed rule would encompass to address telecommunications tower safety. OSHA has identified several existing Federal rules it would need to consider if OSHA proceeds with rulemaking. Below, the agency discusses whether these rules could potentially duplicate, overlap, or conflict with a future rule.

OSHA Standards

OSHA's general industry standards at 29 CFR part 1910 governs maintenance work on telecommunications towers and have the potential to overlap with OSHA's potential new telecommunications tower safety standard.

OSHA's existing telecommunications standard, 29 CFR 1910.268, regulates "the work conditions, practices, means, methods, operations, installations and processes," other than construction work, performed at "telecommunications field installations," which includes telecommunications towers (See 29 CFR 1910.268(a)(1)). In issuing a standard addressing telecommunications tower safety, OSHA may also modify (and/or clarify) 29 CFR 1910.268 where existing provisions, including those discussed above, come into conflict with the new telecommunications tower rule. A number of provisions of the existing telecommunications standard that could overlap with the requirements of the new standard include:

- Application (Section 1910.268(a)): This section sets the scope of Section 1910.268, and covers field work, which "includes the installation, operation, maintenance, rearrangement, and removal of conductors and other equipment used for signal or communication service, and of their supporting or containing structures, overhead or underground, on public or private rights of way, including buildings or other structures." This section has the potential to overlap with the scope of the new standard, which would likely cover all work activities performed on telecommunications towers.
- Training (Section 1910.268(c)): Section 1910.268(c) describes the training that employers are required to provide to employees. Topics include the "recognition and avoidance of dangers relating to encounters with harmful substances and animal, insect, or plant life," as well as emergency response procedures, and first aid. The new standard may include detailed training provisions that address environmental hazards, emergency response and rescue procedures, and first aid training for employees.
- Personal climbing equipment (Section 1910.268(g)): Section 1910.268(g)(1) states, "Safety belts and straps shall be provided and the employer shall ensure their use when work is performed at positions more than 4 feet above ground, on poles, and on towers . . . " The new standard may address fall protection requirements on towers for both maintenance and construction activities.
- Tools and personal protective equipment (Section 1910.268(e), (i)): Section 1910.268(e) requires the employer to provide "[p]ersonal protective equipment, protective devices and special tools needed for the work of employees." The provision also requires daily inspection of those devices, tools, and equipment. Section 1910.268(i), Other tools and personal protective equipment, covers many of the tools used in work covered by this standard, including head protection, eye protection, use of tent heaters, torches, and portable power equipment, vehicle-mounted utility generators, portable lights, tools and appliances, soldering devices, and lead work.

If OSHA moves forward with a telecommunications tower standard, it will address areas of potential overlap to avoid duplicative and conflicting requirements.

OSHA addresses fall protection requirements for the construction of new telecommunications towers in 29 CFR 1926.105, which requires the use of safety nets "...when workplaces are more than 25 feet above the ground or water surface, or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors, safety lines, or safety belts is impractical" (see 29 CFR 1926.105(a)). Safety nets may not completely cover the fall area surrounding telecommunications towers; equipment or other debris may also fall and damage netting, thereby rendering the nets ineffective. OSHA's new standard will likely consider how best to address the shortcomings of other preexisting standards and will remove, modify, and/or clarify them where they overlap.

OSHA's standards for fall protection in construction (29 CFR 1926, Subpart M), which generally require the use of fall protection at heights of six feet and greater, will overlap, duplicate, or conflict with the new telecommunications tower standard in some circumstances. While "[r]equirements relating to fall protection for employees engaged in the erection of tanks and communication and broadcast towers are provided in §1926.105," 29 CFR 1926.500(a)(2)(v), non-erection construction activities (such as upgrading antennas or installing structural reinforcements on existing towers) may be covered by Subpart M. In the process of adopting a new telecommunications tower standard, OSHA may delete the reference to 1926.105 in Subpart M or change that reference to point to the new standard, noting that fall protection requirements for new structure construction and other telecommunications tower construction activities will be located there. Subpart M also covers "walking and working surfaces," and specifically reads that a "walking and working surface" can be vertical as well as horizontal (See 1926.500(b)). Where Subpart M conflicts or overlaps with OSHA's potential telecommunications tower safety standard, OSHA will remove, modify, and/or clarify such preexisting standards.

Where a telecommunications tower has an installed ladder that conforms to the definitions found in 29 CFR 1926.1050(b), Subpart X (Stairways and Ladders) applies. This includes any applicable provisions contained in 29 CFR 1926.1051, General Requirements, as well as the structural and usage requirements contained in §1926.1053, Ladders, as well as the training requirements contained in §1926.1060. However, many telecommunications towers are accessed by climbing foot pegs, removable "Z" pegs, or other methods of access that do not fall under Subpart X. OSHA will consider whether to specifically address the potentially-overlapping issue of installed ladders in a potential telecommunications tower safety standard.

When cranes are used in telecommunications tower construction activities, employers must meet all of the relevant requirements in Subpart CC (Cranes & Derricks in Construction). Under Subpart CC using cranes to hoist personnel is addressed, see 29 CFR 1926.1431, but Subpart CC does not apply to using base-mounted drums to hoist personnel (see Compliance Directive CPL 02-01-056). OSHA does not anticipate specifically addressing cranes in the potential new standard but will consider how to regulate the use of base-mounted drums in telecommunications tower work.

Telecommunications tower construction activities are exempt from OSHA's requirements for steel erection activities (29 CFR 1926 Subpart R); Subpart R "does not cover electrical transmission towers, communication and broadcast towers, or tanks" (29 CFR 1926.750(a)). Therefore, this subpart will not conflict with or be duplicative of a potential standard addressing telecommunications towers.

OSHA will consider how OSHA's revisions to 29 CFR 1910 Subparts D (Walking-Working Surfaces) and I (Personal Protective Equipment) might apply to non-construction work on telecommunications towers. In general, OSHA anticipates that the requirements of the telecommunication standard would apply in these situations where non-construction work is performed on telecommunications towers. Nonetheless, if OSHA were to proceed with rulemaking, OSHA will take steps to ensure consistency among the standards and to confirm the telecommunications tower standard has the appropriate scope and level of specificity.

Other Agency Standards
Section 4(b)(1) of the OSH Act states that "nothing in this chapter shall apply to working conditions of employees with respect to which other Federal agencies . . . exercise statutory authority to prescribe or enforce standards or regulations affecting occupational safety or health." Therefore, once another Federal agency exercises its authority over specific working conditions, OSHA cannot enforce its own regulations covering the same conditions.

The Federal Communications Commission (FCC) regulates occupational radio frequency (RF) radiation exposure (See 47 CFR 1.1310). Because FCC regulations address occupational exposure to RF radiation, pursuant to Section 4(b)(1) of the OSH Act, OSHA does not plan to address RF radiation exposure in a potential telecommunications tower safety standard. The FCC's broad coverage, including training requirements concerning RF radiation exposure, should cover all tower climbing workers who are exposed to RF energy while working on antennas.

The Federal Aviation Administration (FAA) has marking and lighting regulations that apply to telecommunications towers. See 14 CFR 77. In its Advisory Circular No. 70/7460-1, the FAA "sets forth standards for marking and lighting obstructions that have been deemed to be a hazard to navigable airspace." The Advisory Circular is generally non-mandatory, and OSHA has determined that the FAA's regulations will not likely conflict with a potential new telecommunications tower standard. OSHA's potential new regulation should apply when workers install or maintain lighting and marking because, to do so, workers must climb and work on structures, causing exposure to attendant hazards.

As far as OSHA is aware, other agency standards (such as those from the FCC, FAA, U.S. Department of Energy, the U.S. Forest Service, or the Bureau of Land Management) that address the telecommunications tower industry are not overlapping or duplicative with any potential occupational safety and health provisions addressed in this PIRFA. Federal standards and regulations that apply to the telecommunications tower industry predominantly focus on telecommunications tower siting requirements and requirements that ensure that towers remain visible to aircraft. These include requirements for tower approval processes, environmental impact studies, studies on the impact of a proposed tower on wildlife and endangered species, and related issues.

Consensus Standards and State Standards
There are several consensus standards that address hazards in the erection, construction, and maintenance of telecommunications towers. The Telecommunications Industry Association's "Structural Standard for Antenna Supporting Structures and Antennas" (TIA-222-G), addresses the structural design elements associated with the fabrication of new, and the modification of existing, antenna-supporting structures. TIA's "Standard for Installation, Alteration and Maintenance of Antenna Supporting Structures and Antennas" (TIA-1019-A) addresses the loading of telecommunications structures under construction and

the use of specialized equipment, including gin poles, hoists, and temporary guys. In January 2017, TIA-1019-A was replaced by TIA-322, “Loading, Analysis, and Design Criteria Related to the Installation, Alteration and Maintenance of Communication Structures.” ANSI A10.48, “Criteria for Safety Practices with the Construction, Demolition, Modification and Maintenance of Communications Structures,” which addresses safety practices for the construction and maintenance of telecommunications towers, was approved by ANSI on August 3, 2016. Topics addressed in the new ANSI standard include pre-job planning, jobsite conditions, fall protection requirements, radio frequency energy hazards, base-mounted and capstan hoists, hoisting of materials and personnel, rigging, gin poles, climbing facilities, structural loading considerations, training of employees, demolition of telecommunications towers, and the use of helicopters in lifting loads.

The ANSI A10.48, TIA-222-G, and TIA-322 standards contain valuable information, and OSHA, in accordance with the OSH Act, will carefully consider the content of all relevant consensus standards in any potential rulemaking. Although OSHA finds the consensus standards informative and helpful, it is likely that OSHA would be unable to enforce many of the provisions in the standards, which were drafted with unenforceable language. For example, there are provisions in these standards that would require employers to ensure that their employees do not have evidence of “physical or emotional instability” (Hoist Operator Requirements and Responsibilities, section 8.12.6) that could prove to be a hazard; it is unlikely that OSHA would enforce such a provision, as it runs a risk of violating employment laws. Additionally, other provisions in the consensus standards lack enough detail to provide clear notice to employers on the requirements for compliance. One example of this is the provisions covering Vegetation/Plant/Animal Hazards (ANSI A10.48 Section 5.10.9). These sections are primarily definition-based, and do not provide detailed guidance on how employers are to respond to these hazards. While this may not be a problem in a voluntary consensus standard, it may not provide enough specificity for OSHA enforcement. Thus, OSHA may consider promulgating a comprehensive standard that would more thoroughly protect covered workers.

North Carolina, Michigan, and Washington have dedicated standards governing telecommunications tower construction and maintenance. North Carolina’s standard covers the construction, alteration, repair, operation, inspection, and maintenance of telecommunications towers (See 13 NCAC 07F.0600 *et seq.*). It includes provisions for employer responsibilities, fall protection and fall protection systems, non-ionizing radiation, hoists and gin poles, and employee training. The Michigan standard governs construction, alteration, repair, operation, inspections, maintenance, and demolition activities on telecommunications towers (See Michigan Administrative Code R 408.42901 et seq.). It contains provisions on fall protection, emergency response protocols, training, training certification, hazard identification, hoists, hoisting personnel, gin poles, catheads, and capstans. Washington’s telecommunications standard includes provisions addressing telecommunications tower safety, including PPE, fall protection, hoisting requirements, rigging plans, gin poles, and personnel lifting, among other topics (see Chapter 296-32 WAC, Safety Standards for Telecommunications).

IX. **Regulatory Options and Alternatives**

This Section describes regulatory alternatives OSHA is considering. The total costs of the potential provisions are summarized in Table 31. OSHA requests comments on the need for each provision, which OSHA may or may not include in a potential proposed rule.

Table 31 - Total Costs by Provision and Size Category			
	Size Category		
Provision	Small	Large	**Total**
Rule Familiarization	$52,829	$4,367	***$57,196***
Training	$3,266,957	$2,730,462	***$5,997,419***
Recordkeeping	$2,464	$1,030	***$3,494***
Job Hazard Analysis and Toolbox Talk	$3,149,517	$2,959,046	***$6,108,563***
Rigging Plans	$1,657,894	$1,558,226	***$3,216,120***
Environmental Hazards	$75,840	$71,323	***$147,163***
Structural Modifications	$2,202,678	$2,069,625	***$4,272,303***
Multi-Entity Communications	$564,552	$776,525	***$1,341,077***
100% Tie-Off	$734,700	$689,764	***$1,424,464***
Total	$11,707,431	$10,860,368	***$22,567,799***
Source: OSHA, Office of Regulatory Analysis			

The total costs of the potential regulatory alternatives, both cost-saving and those with additional costs, are summarized in Table 32.

Table 32 – Cost Savings and Costs of Alternatives		
OSHA Regulatory Framework (Preferred Alternative)	**Suggested Alternative**	**Cost Difference**
Cost Reducing Alternatives		
$22,567,799 per year (Telecommunications Towers Rule)	$19,204,649 per year not including additional unquantified costs (Alternative 1-- Adoption of ANSI A10.48 Standard)	-$3,363,150 per year (not including additional unquantified costs)
$6,108,563 per year Job Hazard Analysis and Toolbox talks	$4,908,563 per year (Alternative 2--_Replace the requirements for a detailed JHA and toolbox talks)	-$1,200,000 per year
$2,300,000 per year Written Job Hazard Analysis	$0 (Alternative 3-- Eliminate the requirement for a written JHA)	-$2,300,000 per year
$2,700,000 Initial plus cost savings due to lesser need for training Hoist Operator Training	$0 (Alternative 4-- Eliminate specific training requirements for hoist operators)	-$2,700,000 Initial plus cost savings due to lesser need for training
$1,341,077 per year Multi-Entity Communications	$628,577 per year (Alternative 5-- No requirements for multi-entity communications)	-$712,500 per year

Table 32 – Cost Savings and Costs of Alternatives		
OSHA Regulatory Framework (Preferred Alternative)	**Suggested Alternative**	**Cost Difference**
Cost Increasing Alternatives		
Telecommunications Towers Only	(Alternative 6-- Expand the scope to include non-dedicated telecommunications structures)	$12,100,000
$0 Requirement for Safety Climb System	$7,200,000 per year (Alternative 7-- Require a safety climb system for all climbs)	$7,200,000 per year
$0 Requirement of Safety Climb Inspection	$136,000 per year (Alternative 8-- Require safety climb system inspections)	$136,000 per year
$0 Engineered Anchorage Refitting	$5,500,000 (Alternative 9-- Require engineered anchorages to be retrofitted on all towers)	$5,500,000 per year
$0 Crane and Lift Usage	$99,000,000 per year (Alternative 10-- Require that lifts or cranes be used as much as practicable to minimize climbing)	$99,000,000 per year
$0 Training Provision	$1,900,000 (Alternative 11-- Require that training be provided by independent third party providers)	$1,900,000 per year
$0 MIOSHA Training for Hoist Operators	$2,900,000 Initial (Alternative 12-- Adopt the Michigan Occupational Safety and Health Administration (MIOSHA) training requirement for hoist operators)	$2,900,000 Initial plus cost from turnover and training
$0 Specialized Training For Hoist Operators	$3,800,000 Initial plus cost of turnover and retraining (Alternative 13-- Require hoist operators to have equipment-specific training and specialized training on safe hoisting of personnel)	$3,800,000 Initial plus cost of turnover and retraining
$0 First Aid and CPR Certification	$4,900,000 per year (Alternative 14-- Require first aid and CPR certification for each crewmember)	$4,900,000 per year
$0 On site Rescue Personnel	$46,000,000 per year (Alternative 15-- Require dedicated, on site rescue personnel)	$46,000,000 per year
$0 Weather Monitoring	$3,500,000 per year (Alternative 16-- Require monitoring of weather conditions on an hourly basis)	$3,500,000 per year
$0 Wildlife Hazards	$10,900 (Alternative 17-- Require elimination of wildlife hazards)	$10,900 per year
$0 Mandatory Rest Breaks	$4,500,000 (Alternative 18-- Require mandatory rest breaks for climbers)	$4,500,000 per year

Table 32 – Cost Savings and Costs of Alternatives		
OSHA Regulatory Framework (Preferred Alternative)	**Suggested Alternative**	**Cost Difference**
$0 Rest Breaks and mandatory Climate-Controlled Vehicles	$4,500,000 (Alternative 19-- Require mandatory rest breaks and the availability of climate-controlled vehicles for these breaks)	$4,500,000 per year
$0 Training for Exhaustion	$510,800 per year (Alternative 20-- Require training in recognizing and avoiding exhaustion related hazards)	$510,800 per year
$0 Structural Planning by a CPE	$1,300,00 per year (Alternative 21-- Require planning by a certified professional engineer (CPE) when work could compromise structural integrity)	$1,300,000 per year
$0 Analysis and Supervision of Structures by a CPE	$3,000,000 per year (Alternative 22-- Require a CPE to provide structural analysis and detailed instructions for structural work and supervision of all structural work by a qualified person)	$3,000,000 per year
$0 Daily Communication	$3,200,000 per year (Alternative 23--Require daily communication among multiple contractors on site)	$3,200,000 per year

Alternatives That Will Minimize the Economic Impact on Small Businesses

This section includes alternatives that have the potential to meet the agency's statutory objectives, are feasible, and minimize costs to small firms. OSHA is also soliciting comments on alternatives that increase costs to small entities because OSHA has not yet determined to exclude them.

Alternative 1: OSHA would adopt by reference the ANSI A10.48 standard.

OSHA has produced a preliminary cost estimate for adoption of the ANSI standard, using many of the same unit costs used in the PIRFA. Some parts of the ANSI standard require using less expensive labor, for example using a qualified person rather than a structural engineer for structural planning. The ANSI standard does not have a toolbox talk requirement so that cost is not included. In one cost category, the ANSI standard was slightly more expensive, requiring retention of additional training records.

OSHA considered only the costs of those provisions paralleling the provisions that OSHA is considering. OSHA did not cost provisions where OSHA is not considering similar provisions, such as the ANSI Multi-Employer requirements and a number of other requirements regulating Helicopters, Hoists, Demolition, and Electromagnetic Energy which might duplicate or conflict with OSHA or other federal safety regulations. The ANSI standard appears to have more expensive training requirements, but OSHA was not able to quantify the higher training costs for these requirements.

For the portions of the ANSI standard that OSHA costed, the total estimated annual cost of the ANSI standard is less than the total annual cost of the potential standard outlined above in the PIRFA. If the additional consensus standard requirements were considered and costed, the ANSI standard might be more expensive to implement than the OSHA standard. The total estimated cost of this alternative would be about $19.2 million per year – about $3.4 million less than the $22.6 million OSHA estimated as the total cost of the rule as detailed in the PIRFA but this does not include any of the unquantified costs of the ANSI standard.

Total cost: $19,204,649 per year.

Below is a brief analysis comparing OSHA's potential standard to the ANSI standard. A side-by-side analysis comparing the potential rule outlined in this PIRFA to the ANSI standard is available in Appendix C.

Aspects where OSHA's potential rule as described in this PIRFA is more stringent than the ANSI standard:

- **Safe Work Practices:** under *Structural work on telecommunications towers*, OSHA's categories of structural modifications of low, medium, and high degrees of complexity are in general alignment with the construction classes I-IV, contained in ANSI A10.48, section 4.8. There are two areas that OSHA has exceeded the recommendations in the ANSI standard;
  - Involvement of a qualified engineer: The ANSI standard requires that for class III and IV construction, "a qualified person shall coordinate the involvement of a qualified engineer as required when establishing rigging plans. A qualified engineer shall perform the analysis of structures and/or components for Class IV construction." (Section 4.8). OSHA's potential rule requires that structural modifications of a high degree of complexity "would require a structural analysis conducted by a qualified engineer, and the work would need to be planned and supervised by a qualified engineer." The reason for this more robust involvement of a qualified engineer is based on multiple structural collapses where the ongoing engagement of a qualified engineer might have avoided many of the conditions that led to these collapses.
  - Step-by-step instructions: For structural modifications of a medium degree of complexity, in addition to performing the structural analysis prior to beginning work, OSHA's potential rule requires that the qualified engineer also "prepare detailed, step-by-step instructions for the work to be done." This has been included due to structural collapses where having more detailed information might have prevented the conditions that led to the structural collapse, such as removing structural members in the incorrect order.

- **Environmental Hazards**: In the ANSI A10.48 standard, the environmental hazard sections (sections 5.10.9, Vegetation/Plant/Animal Hazards, 5.10.10, Toxins, and 5.10.11, Biohazards) are primarily definition-based, and do not provide a great deal of detail on the employer's responsibility to recognize and abate these hazards. OSHA's potential rule requires wildlife hazards to be included in the JHA where present. If a hazard cannot be eliminated, the employer is required to provide appropriate PPE if necessary.

- **Toolbox Talks**: OSHA is considering a requirement that employers hold a meeting before each shift to review the JHA and to discuss specific issues that will be factors in the day's work.

Sample topics addressed during a toolbox talk would include, but are not limited to: A pre-job checklist, including questions about physical fitness, adequate sleep, and fatigue levels due to factors such as long driving/commuting times; A discussion of unique hazards presented by the day's scheduled work activities and methods for avoiding those hazards; Review of safety equipment inspection procedures; Refresher training in company safety policies and any applicable safety standards or regulations. The ANSI A10.48 standard does not have a specific requirement for a toolbox talk. Section 4.7 of the ANSI standard contains a note that recommends that the competent person involve the entire crew in the process of detecting "hazardous conditions, equipment, or materials or unsafe work practices and to ensure compliance with the applicable regulations and standards." However, this does not specify how or to what extent to involve the entire crew in this process.

Aspects where ANSI A10.48 recommendations conflict or overlap with existing OSHA policy and standards or other existing laws.

- **Multi-Employer issues**: The ANSI standard states in section 4.6, that "… all of the employers shall work together to identify and control hazards to meet OSHA and applicable ANSI standards for employee health and safety. It is recommended in this standard that the owner or general contractor have overall responsibility for the worksite or designate responsibility to a lower tier contractor in writing." This does not conform to OSHA's multi-employer policy. An entity cannot delegate their responsibility under the OSH Act for worksite safety and health to another party.

- **Radio frequency/Electromagnetic Energy**: Section 7 of the ANSI standard addresses radio frequency. This section would need to be excluded should OSHA incorporate the ANSI standard. Currently, the FCC regulates occupational exposure to radio frequency (RF); therefore OSHA cannot regulate RF exposure in accordance with §4(b)(1) of the OSH Act.

- **Hoist Operators**: In section 8.12, Operator Requirements and Responsibilities, the ANSI standard requires that hoist operators have "no evidence of having physical or emotional instability that could render a hazard to the operator or others." OSHA does not require that employers evaluate the emotional stability of their employees, and this might risk violating existing employment law. If OSHA incorporates the ANSI standard, this section would need to be excluded from the incorporated rule.

- **Demolition**: Section 16 of the ANSI standard covers demolition. OSHA has standards that cover the demolition of structures (29 CFR 1926 Subpart T, Demolition), so OSHA would likely not incorporate this section to avoid overlapping and/or conflicting standards.

- **Helicopters**: Section 17 of the ANSI standard covers Helicopters used for lifting loads. OSHA has standards that govern the use of helicopters for hoisting materials (§1926.551), so OSHA would likely not incorporate this to avoid overlapping and/or conflicting standards.

Aspects where the ANSI standard is more stringent than OSHA's Framework:

- **Training**: The ANSI standard contains recommendations on training that in some aspects exceed OSHA's potential framework, in particular where they address recordkeeping requirements. For example, section 14.9 states, “The employer shall keep the following documented records: a) The course outline or description; b) The sources used to develop the training; c) The names of individuals that designed and put the course together; d) The delivery materials used or course content; e) The trainees participating in the class; and f) The trainees successfully passing the class.” It is unlikely OSHA would require the employer maintain every single one of these records.

Other training provisions would generate high levels of paperwork, and could end up being burdensome for employers. For example, §14.10 states: “Training Module Evaluation. The owner or training provider shall evaluate their training programs annually to ensure the program provides the employee(s) with up-to-date training referencing the latest industry standards, federal, state and local requirements as they apply to the employer’s work product. This evaluation may also take into account the analytical data on injuries, accidents, near misses compiled by the employer and adjustments shall be made to reduce these types of issues.” There are very few OSHA standards that require this level of detailed annual review of training programs.

<u>Alternative 2: Replace the requirements for a detailed JHA and toolbox talks with requirements for a hazard checklist and confirmation that workers reviewed the checklist.</u>

Under this alternative, requirements for a brief hazard checklist and verbal confirmation from workers confirming that they reviewed the checklist would replace requirements for a detailed JHA and toolbox talk. This alternative would have lower costs and might eliminate any written material from the JHA process.

Unit cost: 70 percent reduction per project in the cost relative to the cost of a JHA and toolbox talk under the potential requirements in this PIRFA or $179.40 (thirty percent of $598) (source: OSHA).

Total cost: Saving of $1.2 million per year ($179.40 times 7,125 projects) (source: Tables 13 and 14).

<u>Alternative 3: Eliminate the requirement for a written JHA.</u>

This alternative would require only that a competent climber complete a visual evaluation of the hazards present at the worksite; there would be no requirement for a written JHA for each site.

Unit cost: Would reduce costs by $324 per job relative to the cost of the potential regulatory provisions in the PIRFA (source: OSHA based on competent climber wage).

Total Cost: Savings of $2.3 million per year ($324 per project times 7,125 projects per year).

<u>Alternative 4: Eliminate specific training requirements for hoist operators.</u>

Under this alternative, there would be no specific training requirements for hoist operators. However, the employer would still be required to ensure that all workers are adequately trained and prepared to perform their assigned duties in a safe manner.

Unit cost: Savings of between $475 and $951 per worker in avoided training costs compared to the estimated costs for specific training for hoist operators as required by the training provisions outlined in the potential rule in this PIRFA.

Total cost: Initial savings of $2.7 million in addition to ongoing cost savings due to lesser need for turnover replacement training and retraining, based on the higher cost savings ($951) and 2,900 hoist operators (source: OSHA).

Alternative 5: No requirements for multi-entity communications.

This alternative would be less strict than either the potential communications requirements discussed earlier or the consensus standard requirements. This alternative requires no multi-entity communications.

Unit cost: $100 (mid-point of per-project communications cost).

Total cost: Savings of $712,500 per year ($100 times 7,125 projects).

Alternatives Addressing the Potential Standard's Scope:

Alternative 6: Expand the scope to include non-dedicated telecommunications structures.

In this alternative, the scope would potentially be phrased: "OSHA is considering a standard that would apply to all work activities performed on telecommunications structures, including but not limited to antennas and antenna-supporting structures, telecommunications and broadcast towers, and antennas collocated on existing structures such as rooftops, water towers, and billboards." Employees who perform work on antennas collocated on non-dedicated telecommunications structures like water towers experience many of the same hazards experienced by employees working on dedicated telecommunications structures. Expanding the scope of the potential standard to cover employees performing work on these types of structures would offer additional protection.

FCC data suggest that there are over one million antenna-supporting structures in the United States. A summary of the antenna-supporting structures in this database is presented in Table 33 by structure type. As shown in Table 33, towers are the most common type of antenna-supporting structure, followed by buildings.[12]

Under this alternative, the number of projects per year would double to 30. A simple estimate would be a doubling of the cost estimate found in Table 31, or an additional $22.5 million. However, complying with similar provisions for working on structures instead of communications towers would be less expensive and would require fewer resources relative to performing similar work on communications towers because about 60 percent of the work on non-towers structures would be on buildings, specifically

[12] For about 40 percent of the antenna-supporting structures recorded in the SUSS database, information on structure type is missing. To account for these structures, OSHA proportionately distributed the 419,199 towers without a specified type across the identified structure types and grouped miscellaneous structure types including indecipherably labelled or rare structure types into an aggregate "Other" category. Towers missing data in the structure types field were distributed proportionately into existing categories. The FCC database also includes towers used for other activities, and towers that may never be climbed. Other tower types could include government and military towers and homeowner-owned towers or antennas for either TV reception or amateur radio uses.

building rooftops, which are easier to access and typically require no climbing. Further, some of the work performed on rooftops already requires compliance with other OSHA standards.

For example, structural modifications would be less complicated and less expensive to produce plans; job hazard analysis would be simpler; fall protection would be cheaper as less time would be needed to climb onto a structure; training requirements would be shorter; and rigging plans would be less involved or unneeded.

To estimate a total cost for this alternative, OSHA reduced the cost of fall protection, job hazard analysis, structural analysis, rigging plans, and training as applied to the additional telecommunications structures by one-half.

Total cost: $12.1 million per year in addition to the cost of the rule as outlined in this PIRFA.

Table 33 - Number of Antenna-Supporting Structures by Structure Type

Structure Type[1]	Number of Structures
Tower	497,932
Building	309,363
Pole	94,195
Tank	34,347
Utility Pole	24,572
Mast	21,330
Pipe	11,836
Silo	10,145
Other[2]	6,205
Smokestack	2,876
Tree	2,225
Rig	1,741
Sign	1,363
Total	**1,018,132**

Source: FCC Spectrum Utilization Study Software (2016b)

Notes:

[1] 419,199 towers are missing the structure type and are distributed proportionally across each structure type.

[2] “Other” structures includes structure types that are less common as well as types that are not defined in the database data dictionary: BRIDG, Concea, Concre, COW, Frame, ft. Mo, G, Grain, H Type, Land, Land O, Lattic, LIGHT, Lightp, Microw, N/A, NULL, OTHER, Pico C, Raw La, Rawlan, Rock, S, SCA, Side M, Stealt, STEATH, Struct, TBD, Type 1, Type 3, Type 5, Windmi, Wood P, Wooden.

Alternatives Addressing Fall Protection Hazards:

<u>Alternative 7: Require a safety climb system for all climbs.</u>

Under this alternative, OSHA would require the employer to only allow its employees to climb a tower if it has a safety climb system. For most (if not all) systems, this would involve installing the safety climb device to the tower itself, as well as purchasing and ensuring the use of a cable grab device for each climber to connect the climber's harnesses to the safety climb system. Employers could remove the safety climb system after the work was concluded (this would reduce the cost as the system could be reused).

Unit cost: $1,015 per tower (Source: DBI LAD-SAF Flexible Cable Safety System - 80-500' Tower http://www.sitepro1.com/store/cart.php?m=product_list&c=584).

Total cost: $7.2 million (based on 7,125 projects times $1,015 per tower) per year.

Alternative 8: Require safety climb system inspections.

Under this alternative, where safety climb systems are installed on structures, the contractors working on the tower would have a duty to ensure the safe functioning of that safety climb system. OSHA estimates it will take one hour per inspection by a crew of two climbers, and that 25 percent of projects will have a safety climb system.

Unit cost: $76.62 per project ($38.31 times 2).

Total cost: $136,000 annually ($76.62 times 0.25 times 7,125 projects per year).

Alternative 9: Require engineered anchorages to be retrofitted on all towers.

This alternative would require engineered anchorages on every tower and that each climber use the anchorages. To be used as fall protection, these anchorages must be capable of withstanding at least 5,000 pounds of force (22.2 kN) per employee attached, and must be clearly marked or identified as anchors for personal fall arrest systems.

Unit cost: $43 to $1,000 per anchor not including labor time for installation. However, there would be some productivity improvements on the job site because anchors would allow faster climbs (Source: Subparts D&I Final Rule, https://www.gpo.gov/fdsys/pkg/FR-2016-11-18/pdf/2016-24557.pdf, pp. 344-45).

Total cost: OSHA assumes that each project requires upgraded anchorages, and, with 7,125 projects on towers of average 70 feet in height, these upgrades would require about 18 anchorages per tower. Based on these inputs, the total cost of this alternative would be $5.5 million per year ($43 per anchor times 18 anchors per tower times 7,125 projects). There would also be additional ongoing costs for replacing broken or worn out anchorages as needed.

Alternative 10: Require that lifts or cranes be used as much as practicable to minimize climbing.

This alternative would require for all climbs, as well as the use of a lift or crane when practicable to minimize the amount of climbing that employees must do. Under this alternative, an aerial lift or crane would lift the employee to the workstation or close to the workstation, and then the employee, using 100 percent fall protection, would either complete the work from the basket of the crane or lift when possible, or would exit the basket close to the workstation. This would diminish the fatigue and other hazards associated with long climbs on towers.

Unit cost: $210 per hour for the lift or crane equipment plus the cost of the crane operator's time.

Total cost: $99 million per year ($210 per hour times 8 hours per day times 8.33 days per project times 7,125 projects). However, there would likely be worker productivity improvements associated with this alternative as workers would be transported onto the tower faster, and they would experience less fatigue (source: OSHA based on hourly crane rental cost).

Alternative Addressing Training:

<u>Alternative 11: Require that training be provided by independent third party providers.</u>

This alternative would require that training be provided by independent third party providers. This alternative is suggested here because some comments to the RFI indicated that in-house training might not be rigorous enough or sufficient to provide employees with the skills needed to safely climb.

Unit cost: this alternative would increase costs by 40 percent relative to the cost of training under the potential training provisions detailed in this PIRFA (source: OSHA).

Total cost: $1.9 million per year based on Training Costs in Tables 10 and 11.

Alternatives Addressing Hoist Operator Training:

<u>Alternative 12: Adopt the Michigan Occupational Safety and Health Administration (MIOSHA) training requirement for hoist operators.</u>

Under this alternative, employers would be required to follow the MIOSHA standard that states: "The hoist operator shall have classroom training, a minimum of 40 hours experience as a hoist operator, not less than 8 hours experience in the operation of the specified hoist or one of the same type and demonstrated the ability to safely operate the hoist."

Unit cost: $695 for a one-day class through NATE plus one day of wages for the operator attending the training ($316.96 or $39.62 per hour times 8 hours) for a total of $1,011.96 per hoist operator (source: NATE, OSHA). There could be some productivity benefits from having very experienced, well-trained operators running hoists on the job site.

Total costs: $2.9 million initial cost, then ongoing costs because of turnover and retraining requirements, based on an estimate of 2,900 hoist operators (source: OSHA estimate).

<u>Alternative 13: Require hoist operators to have equipment-specific training and specialized training on safe hoisting of personnel.</u>

This alternative would require hoist operators to be trained in the safe operation of the specific hoist equipment that they are using and to be specifically trained or qualified to hoist personnel if they will be hoisting personnel. This training would be somewhat more robust than the training requirements of Alternative 12 requiring about 30 percent more hours of training. This training would consist of additional classroom and on-the-job training, and the employer would be responsible for ensuring that the hoist operator is adequately prepared to safely perform all hoisting activities. Moreover, this alternative would require at least four additional classroom training hours plus on the job training hours in addition to any training required by the potential rule or any of these alternatives.

Unit cost: $695 for a one-day class through NATE plus one day of wages for the operator attending the training and one day of wages for on the job training ($633.92 or $39.62 per hour times 16 hours) for a total of $1,328.92 per hoist operator (source: NATE, OSHA).

Total cost: $3.8 million initial cost, then ongoing costs because of turnover and retraining requirements (based on 2,900 hoist operators).

Alternatives Addressing Emergency Response:

Alternative 14: Require first aid and CPR certification for each crewmember regardless of proximity to emergency services and require that crews be able to contact 911 regardless of work location.

This alternative would require current certification in both first aid and CPR for each member of the crew, rather than just one crewmember as required by the potential provision discussed earlier. A working phone or radio must be available for a crewmember to contact 911. The ability to perform both first aid and CPR is important because crews must often perform their own rescues.

Unit cost: Three to four hours of worker time for first aid training plus an additional three to four hours of worker time for CPR training. At the loaded wage of $38.31 for a climber, the total unit cost would be between $229.86 and $306.48 per worker (source: OSHA, based on the climber wage). OSHA preliminarily estimates that one-third of affected workers are already trained in first aid and CPR so that employers can meet the current OSHA requirements. The remaining two-thirds of affected workers are estimated to need training to meet the requirements of this alternative.

Total cost: $4.9 million per year ($306.48 per worker times 16,000 additional employees requiring training).

Alternative 15: Require dedicated, on site rescue personnel.

This alternative would require a dedicated rescue service team of one to two rescuers to be stationed on site.

Unit cost: $782.40 per worksite per day (competent rescuer loaded wage of $48.90 times 2 rescuers times 8 hours). (Source: OSHA, based on hourly wage of a rescuer, Appendix A)

Total cost: $46 million per year ($782 per day times 8.33 days per project times 7,125 projects per year).

Alternative Addressing Weather Hazards:

Alternative 16: Require monitoring of weather conditions on an hourly basis.

This alternative would require weather conditions to be monitored or checked on an hourly basis when climbers are on the tower. It would also require the employer to create and retain documentation that the weather was checked each hour during the day.

Unit cost: $57.38 per worksite per day (10 weather checks per day, 5 minutes per check, times the loaded supervisor wage of $52.98) plus daily paperwork recording and retention costs of $13.24 (1.5 minutes times 10 times $44.15) or $498 per project (daily cost times 8.33 days per project) (source: OSHA).

Total cost: $3.5 million per year ($498 per project times 7,125 projects).

Alternative Addressing Wildlife Hazards:

<u>Alternative 17: Require elimination of wildlife hazards to the fullest extent possible.</u>

Under this alternative, wildlife hazards must be eliminated to the fullest extent possible, while considering environmental protection issues, before technical work can commence. This alternative would remove whatever hazards wildlife pose to climbers. Eliminating wildlife hazards would take a team of two climbers one hour per project. OSHA preliminarily estimates that wildlife hazards are encountered at 2 percent of all projects, or 285 projects per year (OSHA estimate).

Unit cost: $76.62 per project (two hours at a climber's wage rate of $38.31, plus the cost of equipment to eliminate wildlife from the tower) (source: OSHA, based on hourly wage rates).

Total cost: $10,900 per year ($76.62 per project times 2 percent times 7,125 projects).

Alternatives Addressing Exhaustion Related Hazards:

<u>Alternative 18: Require mandatory rest breaks for climbers</u>.

This alternative would require mandatory rest breaks throughout the day.

Unit cost: $38.31 per climber per shift (one hour of total rest breaks times the climber wage rate of $38.31) or $76.62 per crew (assuming two climbers per crew) (source: OSHA based on climber average wage).

Total cost: $4.5 million per year ($76.62 times 8.33 days per project times 7,125 projects per year).

<u>Alternative 19: Require mandatory rest breaks and the availability of climate-controlled vehicles for these breaks.</u>

This alternative would require employers to provide employees prescribed rest breaks and access to on site climate-controlled vehicles where employees could take their breaks.

Unit cost: $38.31 per climber (one hour of total rest breaks, times the climber wage rate of $38.31) or $76.62 per crew (assuming two climbers per crew). No cost taken for a climate-controlled vehicle because OSHA expects most work vehicles on site will have working climate control (source: OSHA based on climber hourly wage).

Total cost: $4.5 million per year ($76.62 times 8.33 days per project times 7,125 projects per year).

<u>Alternative 20: Require training in recognizing and avoiding exhaustion related hazards.</u>

This alternative would require employees to be trained in the recognition and avoidance of hazards related to exhaustion. Employees must be authorized to take rest breaks as needed to avoid exhaustion.

Unit cost: Two hours of training per climber at a climber's wage rate of $38.31 or $76.62 per climber every three years or $25.54 plus the cost of training materials annually (source: OSHA based on climber hourly wage).

Total cost: $510,800 per year ($25.54 times 24,000 climbers).

Alternatives Addressing Structural Work Hazards:

These alternatives would be more stringent than the potential provisions discussed earlier in this PIRFA. The potential provisions would require that projects be classified according to degree of complexity, and the amount of supervision by a qualified engineer would vary by complexity. The alternatives, however, would require that a qualified engineer oversee all projects regardless of complexity of the work.

<u>Alternative 21: Require planning by a certified professional engineer (CPE) when work could compromise structural integrity.</u>

As discussed earlier, the potential requirements for structural work would require a qualified engineer to plan work that could compromise structural integrity. This alternative, however, would require a CPE, who would have a higher degree of certification and additional qualifications than a qualified engineer. This alternative would require a CPE to create a plan, including a structural analysis, for the work to be completed. Moreover, this alternative would be more stringent and costly than the potential provisions discussed as it would require a CPE for all projects when work could compromise structural integrity.

Unit cost: 8 hours of a CPE's time at a loaded hourly wage rate of $90.73, or $725.84 per project.

Total cost: $1.3 million per year assuming that this alternative would apply to 25 percent of 7,125 projects ($725.84 times 25 percent times 7,125) less some savings for projects that require a qualified engineer under the PIRFA provision that would no longer incur those costs.

<u>Alternative 22: Require a CPE to provide structural analysis and detailed instructions for structural work and supervision of all structural work by a qualified person.</u>

This alternative would require a CPE to provide a structural analysis and detailed step-by-step instructions for any structural modifications being done. The provision for structural work in the potential rule requires that a CPE conduct a structural analysis and provide detailed instructions only when the work is determined to be highly complex. The work itself would need to be supervised by a qualified person (assumed to be a foreman for the purposes of this analysis). This alternative is more stringent, and also more expensive than the potential structural work requirements discussed in this PIRFA, because it specifies that a CPE would need to conduct the analysis and write the instructions for all structural work projects as opposed to just highly complex projects. This alternative would also require supervision by a qualified person for all structural work. This imposes additional costs on projects that would not be incurred under the potential requirement discussed in this PIRFA.

Unit cost: $428.25 for most projects. (Source: Appendix A Wage Tables)

Total cost: $3 million per year based on 7,125 projects per year ($428.25 times 7,125 projects).

Alternative Addressing Communication at Multi-Entity Worksites:

Alternative 23: Require daily communication among multiple contractors on site.

The potential requirements for communication discussed earlier would require communication among contracting layers about hazardous conditions, safe work procedures, and structure installation and modification specifications before the project starts and when conditions change substantially. Under this alternative, communication would be required both at the beginning of the work and throughout the day. OSHA believes that this would be accomplished with a daily 10 to 20 minute conference call between the contracting layers.

Unit cost: 15 minutes of supervisor time, for each of four subcontractors on site for a daily unit cost of $52.98 ($52.98 times 0.25 hours times 4), and a project unit cost of $461 (source: OSHA).

Total cost: $3.2 million per year ($461 times 7,125 projects per year).

Appendix A. Wage Rates by NAICS Code and Labor Category

Labor Category	BLSOES Occupational Code and Wage Category	Wage	Percent of Total Compensation	Fully-Loaded Wage	ECEC Table 2 Category
Authorized Climber	49-2021 (H_MEDIAN)	$23.20	67.5%	$38.31	Installation, maintenance, and repair
Authorized Ground Based Rescuer	49-2021 (H_MEDIAN)	$23.20	67.5%	$38.31	Installation, maintenance, and repair
Authorized Rescuer	49-2021 (H_MEDIAN)	$23.20	67.5%	$38.31	Installation, maintenance, and repair
Competent Climber	49-2021 (H_PCT75)	$29.61	67.5%	$48.90	Installation, maintenance, and repair
Competent Person	49-2021 (H_MEAN)	$24.43	67.5%	$40.35	Installation, maintenance, and repair
Competent Trainer	13-1151 (H_MEAN)	$37.31	68.3%	$60.97	Professional and related
Competent Rescuer	49-2021 (H_PCT75)	$29.61	67.5%	$48.90	Installation, maintenance, and repair
Competent Rigger	49-2021 (H_MEAN)	$24.43	67.5%	$40.35	Installation, maintenance, and repair

Labor Category	BLSOES Occupational Code and Wage Category	Wage	Percent of Total Compensation	Fully-Loaded Wage	ECEC Table 2 Category
Crew Chief / Supervisor / Foreman	49-1011 (H_MEAN)	$32.08	67.5%	$52.98	Installation, maintenance, and repair
Engineer	17-2000 (H_MEAN)	$45.25	67.5%	$74.73	Installation, maintenance, and repair
Non-Supervising Engineer	17-2000 (H_MEAN)	$45.25	67.5%	$74.73	Installation, maintenance, and repair
Operator	47-2073 (H_MEAN)	$23.99	67.5%	$39.62	Installation, maintenance, and repair
Qualified Engineer	17-2000 (H_MEAN)	$45.25	67.5%	$74.73	Installation, maintenance, and repair
Qualified Person	49-2021 (H_MEAN)	$24.43	67.5%	$40.35	Installation, maintenance, and repair
Qualified Trainer	13-1151 (H_MEAN)	$37.31	68.3%	$60.97	Professional and related
Supervising Engineer	17-2000 (H_PCT75)	$54.94	67.5%	$90.73	Installation, maintenance, and repair
Trainer	13-1151 (H_MEAN)	$37.31	68.3%	$60.97	Professional and related
General - Management	11-9021 (H_MEAN)	$49.84	67.5%	$82.31	Installation, maintenance, and repair
General - Clerical	43-3031 (H_MEAN)	$19.95	67.6%	$32.90	Office and administrative support
Mid-Level Project Manager	13-1199 (H_MEAN)	$34.75	67.6%	$57.31	Office and administrative support
Authorized Climber	49-2021 (H_MEDIAN)	$22.41	67.5%	$37.01	Installation, maintenance, and repair
Authorized Ground Based Rescuer	49-2021 (H_MEDIAN)	$22.41	67.5%	$37.01	Installation, maintenance, and repair
Authorized Rescuer	49-2021 (H_MEDIAN)	$22.41	67.5%	$37.01	Installation, maintenance, and repair
Competent Climber	49-2021 (H_PCT75)	$29.97	67.5%	$49.49	Installation, maintenance, and repair
Competent Person	49-2021 (H_MEAN)	$23.89	67.5%	$39.45	Installation, maintenance, and repair
Competent Trainer	13-1151 (H_MEAN)	$33.42	68.3%	$54.61	Professional and related

Labor Category	BLSOES Occupational Code and Wage Category	Wage	Percent of Total Compensation	Fully-Loaded Wage	ECEC Table 2 Category
Competent Rescuer	49-2021 (H_PCT75)	$29.97	67.5%	$49.49	Installation, maintenance, and repair
Competent Rigger	49-2021 (H_MEAN)	$23.89	67.5%	$39.45	Installation, maintenance, and repair
Crew Chief / Supervisor / Foreman	49-1011 (H_MEAN)	$35.18	67.5%	$58.10	Installation, maintenance, and repair
Engineer	17-2000 (H_MEAN)	$45.70	67.5%	$75.47	Installation, maintenance, and repair
Non-Supervising Engineer	17-2000 (H_MEAN)	$45.70	67.5%	$75.47	Installation, maintenance, and repair
Operator	47-2073 (H_MEAN)	$23.46	67.5%	$38.74	Installation, maintenance, and repair
Qualified Engineer	17-2000 (H_MEAN)	$45.70	67.5%	$75.47	Installation, maintenance, and repair
Qualified Person	49-2021 (H_MEAN)	$23.89	67.5%	$39.45	Installation, maintenance, and repair
Qualified Trainer	13-1151 (H_MEAN)	$33.42	68.3%	$54.61	Professional and related
Supervising Engineer	17-2000 (H_PCT75)	$53.10	67.5%	$87.69	Installation, maintenance, and repair
Trainer	13-1151 (H_MEAN)	$33.42	68.3%	$54.61	Professional and related
General - Management	11-9021 (H_MEAN)	$50.14	67.5%	$82.81	Installation, maintenance, and repair
General - Clerical	43-3031 (H_MEAN)	$21.74	67.6%	$35.86	Office and administrative support
Mid-Level Project Manager	13-1199 (H_MEAN)	$38.72	67.6%	$63.86	Office and administrative support
Authorized Climber	49-2021 (H_MEDIAN)	$21.08	67.5%	$34.81	Installation, maintenance, and repair
Authorized Ground Based Rescuer	49-2021 (H_MEDIAN)	$21.08	67.5%	$34.81	Installation, maintenance, and repair
Authorized Rescuer	49-2021 (H_MEDIAN)	$21.08	67.5%	$34.81	Installation, maintenance, and repair
Competent Climber	49-2021 (H_PCT75)	$27.21	67.5%	$44.94	Installation, maintenance, and repair

Labor Category	BLSOES Occupational Code and Wage Category	Wage	Percent of Total Compensation	Fully-Loaded Wage	ECEC Table 2 Category
Competent Person	49-2021 (H_MEAN)	$21.54	67.5%	$35.57	Installation, maintenance, and repair
Competent Trainer	13-1151 (H_MEAN)	$34.24	68.3%	$55.95	Professional and related
Competent Rescuer	49-2021 (H_PCT75)	$27.21	67.5%	$44.94	Installation, maintenance, and repair
Competent Rigger	49-2021 (H_MEAN)	$21.54	67.5%	$35.57	Installation, maintenance, and repair
Crew Chief / Supervisor / Foreman	49-1011 (H_MEAN)	$31.32	67.5%	$51.72	Installation, maintenance, and repair
Engineer	17-2000 (H_MEAN)	$44.14	67.5%	$72.90	Installation, maintenance, and repair
Non-Supervising Engineer	17-2000 (H_MEAN)	$44.14	67.5%	$72.90	Installation, maintenance, and repair
Operator	47-2073 (H_MEAN)	$21.15	67.5%	$34.93	Installation, maintenance, and repair
Qualified Engineer	17-2000 (H_MEAN)	$44.14	67.5%	$72.90	Installation, maintenance, and repair
Qualified Person	49-2021 (H_MEAN)	$21.54	67.5%	$35.57	Installation, maintenance, and repair
Qualified Trainer	13-1151 (H_MEAN)	$34.24	68.3%	$55.95	Professional and related
Supervising Engineer	17-2000 (H_PCT75)	$51.86	67.5%	$85.65	Installation, maintenance, and repair
Trainer	13-1151 (H_MEAN)	$34.24	68.3%	$55.95	Professional and related
General - Management	11-9021 (H_MEAN)	$47.07	67.5%	$77.74	Installation, maintenance, and repair
General - Clerical	43-3031 (H_MEAN)	$19.13	67.6%	$31.55	Office and administrative support
Mid-Level Project Manager	13-1199 (H_MEAN)	$37.98	67.6%	$62.64	Office and administrative support
Sources: Bureau of Labor Statistics (2016a; 2016b)					

Appendix B. Unit Costs for PPE and Equipment

Equipment

Equipment required for ensuring worker safety during tower climbing projects can roughly be divided into two categories: 1) personal protective equipment for each climber; and 2) heavy, job-specific equipment required for each crew team. This information is provided in Appendix B both for informational purposes and so that the SERs have an opportunity to comment on the equipment cost assumptions OSHA is making.

Personal Protective Equipment (PPE)

PPE for climbers includes physical protective wear such as hardhats, glasses, footwear, and gloves, as well as fall arrest systems including harnesses lanyards. Employers are required by law to provide PPE for their employees who climb, but some climbers opt to purchase their own PPE reflecting working preferences. Multiple vendors carry a variety of models across a range of specializations, specifications, and durability (Gravitec, 2016). Cheaper harnesses are generally a simple fall-arrest system; however, a working harness is more commonly used to provide better comfort and maneuverability (NTCH-Cleartalk, 2016).

There is no standard lifetime for PPE, and manufacturers generally decline to provide estimates of usable lifetime (Safety Connection, 2016; Sky Climber Tower Solutions, 2016). Expected lifetime reflects ranges in job types, working conditions, and maintenance practices. For example, large projects involving painting may prematurely damage equipment due to exposure to corrosive chemicals (MUTI, 2016; Safety Connection, 2016). However, equipment maintained diligently with only light strain could last beyond the five-year average estimate used by tower climbing companies (Safety Connection, 2016). Table B1 lists the average annual cost per employee for PPE relevant to the potential OSHA standard.

Table B1 - Unit Cost of Personal Protective Equipment per Employee

Hard Hat	$50	5	$10
Safety Glasses	$50	5	$10
Gloves	$50	5	$10
Footwear	$50	5	$10
Total			$40

Sources: Tower Climbers (Crown Castle, 2016; MUTI, 2016; NTCH-Cleartalk, 2016; Safety Connection, 2016; Sky Climber Tower Solutions, 2016; Vertical Rescue Solutions, 2016)

Note: tool bags and RFF monitors are not included in this list of equipment as they are not directly covered by this standard.

Table B2 lists the average annual cost per employee for personal fall arrest equipment.

Table B2 - Unit Cost of Personal Fall Arrest Equipment per Employee			
Equipment	**Cost**	**Lifetime (in years)**	**Average Annual Cost per employee**
Body Harness	$400	2	$200
Lanyards	$232	5	$46
Positioning Lanyard (or straps)	$60	5	$12
Lanyard for Cordless Tools	$10	5	$2
Cable Grab	$320	5	$64
Steel Carabiner (2x)	$22	5	$4
Total			$329
Sources: Tower Climbers (Crown Castle, 2016; MUTI, 2016; NTCH-Cleartalk, 2016; Safety Connection, 2016; Sky Climber Tower Solutions, 2016; Vertical Rescue Solutions, 2016)			

Heavy, Job-Specific Equipment

While PPE costs are relatively similar across different job types and manufacturers, the cost of heavy equipment required for telecommunications tower maintenance and construction can vary considerably depending on the job (MUTI, 2016). For the purposes of providing heavy equipment unit cost estimates, job types are split into two general categories – (1) maintenance or antennae replacement on an existing tower, and (2) tower construction.

There is a wide range in costs offered by manufacturers for many of these pieces of equipment, particularly the required equipment for new tower construction. This wide range represents the enormous cost differences between constructing different types and sizes of towers (MUTI, 2016). New tower construction jobs represented approximately 5 to 15 percent of project types (Crown Castle, 2016; MUTI, 2016; NTCH-Cleartalk, 2016). Values used in the unit cost tables represent average values used by tower climbing companies for estimating costs.

Table B3 presents the estimated average annual unit cost of heavy, project-specific equipment used for tower maintenance projects. Estimated costs and equipment lifetime were identified through contacts with telecommunications tower climbing companies and equipment vendors, as well as online research into manufacturer and distributor prices.

Table B3 - Unit Cost of Heavy Equipment used for Tower Maintenance Average Annual Project-based Equipment Costs per Crew				
Equipment	**Cost**	**Lifetime (in years)**	**Count per Team**	**Average Annual Project based cost per crew team**
Rescue Kit	$800	5	1	$160
Rope (1 load rope, 1 tag rope)	$600	1	2	$1,200
Rigging for ropes (incl. pulleys)	$544	5	2	$218
Self-retracting lifeline	$215	2	2	$215
AB Chance 1000lb. Capstan Hoist (Essentials Kit, and rope lock)	$2,900	2	1	$1,450
Small Gin pole	$1,250	2	1	$625
			Total	$3,868
Sources: OSHA. Office of Regulatory Analysis, based on Crown Castle, 2016; MUTI, 2016; NTCH-Cleartalk, 2016; Vertical Rescue Solutions, 2016, (GME Supply Co, 2016a, 2016b; Valmont Site Pro 1, 2016a; Wireless Estimator				

Table B4 presents the estimated average annual unit costs of heavy, project-specific equipment used for telecommunications tower construction projects.

Table B4 - Unit Cost of Heavy Equipment used for Telecommunications Tower Construction Average Annual Project-based Equipment Costs per Crew				
Equipment	**Cost**	**Lifetime (in years)**	**Count per Team**	**Average Annual Project based cost per crew team**
Rescue Kit	$800	5	1	$160
Ropes	$600	1	2	$1,200
Rigging for ropes (incl. pulleys)	$300	5	2	$120
Winch	$3,500	5	1	$700
Heavy gin pole	$75,000	10	0.25	$1,875
Drum hoist	$35,000	20	0.25	$438
			Total	$4,493
Sources: OSHA, Office of Regulatory Analysis, based on Crown Castle, 2016; MUTI, 2016; Vertical Rescue Solutions, 2016, GME Supply Co, 2016a, 2016b; Ingersoll Rand, 2016; Landa Mobile Systems, 2016; Valmont Site Pro 1, 2016a; Wireless Estimator, 2016a				

Heavy equipment used at telecommunications tower projects can also include cranes. Although PPE and heavy equipment are typically owned outright by companies, cranes are not. Because cranes require dedicated trained operators, companies generally rent them when they are needed (MUTI, 2016). Unit costs are shown in Table B5.

Table B5 - Unit Cost of Crane Rental per Project				
Equipment Type	**Average Project Days**	**Hourly Crane Rental**	**Hours / Day**	**Total Cost / Project**
Crane	8.33	$210	8	$14,560
Sources: OSHA, Office of Regulatory Analysis, based on Crown Castle, 2016; MUTI, 2016, Duffy Crane and Hauling, 2014; Ensminger's Crane Service, 2016; ICS Inc., 2015				

Some states also have specific requirements that affect telecommunications tower jobs and required equipment. Although these state-specific regulations generally have little influence on average equipment costs, California is notable for requiring man-rated hoists on all projects that require climbing (NTCH-Cleartalk, 2016). Table B6 presents the estimated per-crew cost of man-rated hoists for use in California.

Table B6 – Unit Cost of State Mandated Project-based Equipment (by Crew Team) Incremental to All Job Types					
Job Type	**Required Equipment**	**Cost**	**Lifetime (in years)**	**Count per Team**	**Total**
California Jobs	Man-rated hoist	$7,500	5	1	$1,500
Sources: OSHA, Office of Regulatory Analysis, based on NTCH-Cleartalk, 2016; Wireless Estimator, 2016c					

Table B7 presents the possible alternative labor costs of requiring supervisor time to perform additional maintenance checks.

Table B7 - Unit Cost of Equipment Maintenance Spot Check by Crew Team (NAICS 237130)			
Labor Category	**Wage**	**Time**	**Total**
Crew Chief/ Supervisor/ Foreman	$48.63	0.08	$4
Source: OSHA, Office of Regulatory Analysis, based on NTCH-Cleartalk, 2016			

OSHA is also considering as an additional requirement for the telecommunications tower industry that telecommunications tower owners ensure the installation of a self-supporting telecommunications tower climbing system, also known as safety climb systems. Table B8 presents the estimated potential cost of required safety climb systems per tower.

Table B8 - Cost of Self-Supporting Safety Climb System Equipment per Tower		
Tower Type	**Equipment**	**Cost**
Self-Supporting Tower, 200ft	Safety Climb System	$776
Self-Supporting Tower, any height	Cable Grab	$395
Source: OSHA, Office of Regulatory Analysis, based on Valmont Site Pro 1 (2016b)		

Appendix C. Side-by-Side Comparison of ANSI A10.48, TIA 322, and TIA 222-G and OSHA Potential Rule

OSHA Potential Rule	Recognized Consensus Standards
Definitions	OSHA's definitions are in alignment with definitions contained in relevant consensus standards. There may be some terms defined in the OSHA framework that do not appear in the consensus standards, but there are no conflicting definitions.
Minimum required safety training for personnel, including fall arrest systems, environmental hazards, and electrical hazards.	The ANSI standard has several sections relevant to training: 4.11- General training section, includes a duty for employers to ensure that employees are trained to perform assigned duties. This is in alignment with §1926.21. Section 14 contains more detailed requirements for training programs. It states that all EEs shall be qualified ("may attain qualification through a combination of classroom training, experience and/or demonstrated proficiency"). Section 14 contains requirements for training facilities, periodic retraining, recordkeeping and evaluation. Many of the detailed requirements in the ANSI standard exceed OSHA's requirements, especially regarding certificates, recordkeeping, and training program evaluation. The economic impacts of these requirements could make this potentially a very expensive rule to implement. Furthermore, some of the requirements are not specific enough. For example, the requirement in Section 14.9 that training records be kept does not mention for how long they should be kept. The two TIA standards do not address employee training standards.
Specific training requirements for specific work assignments: authorized climber/rescuer, comp. climber/rescuer, qualified rigger, hoist operator, crane operator.	The framework is in alignment with the ANSI standard in regards to the work assignments/categories- also in alignment with industry standards (these terms are not restricted to the ANSI standard alone- training organizations such as TIRAP use these categories, for example). One issue: The ANSI standard references "the latest version" of the NATE Tower Climber Fall Protection Training Standard (NATE CTS) when outlining training requirements for the following positions: authorized climber, competent climber, authorized rescuer, and competent rescuer. OSHA only incorporates specific versions of consensus standards, as relying on the latest version of a consensus standard would be an improper delegation of rulemaking authority to an outside entity. NATE appears to be making the CTS available to both members and non-members, so non-members can have the information required to be in compliance with the ANSI standard. It does cost an additional $200 for non-members to purchase. TIA 222 and TIA 322 do not address employee training standards.

Worksite Conditions	
Job hazard analysis: OSHA is considering requiring employers to prepare a written JHA prior to each job or project. The JHA is a tool that identifies the hazards present at the worksite related to the specific nature of the tasks to be performed, the nature of the worksite itself, and the specific conditions present at the worksite at the time the work is to be performed. Some sample topics in a JHA could include: Emergency contact information for the nearest medical facility and/or first responders; General jobsite information, including the tower type; Specific job tasks to be completed, along with the hazards associated with each task; Identification of all other hazards present at the jobsite; Methods of reducing or eliminating each hazard.	ANSI A10.48 addresses JHAs in section 4.4, "A job hazard assessment shall be conducted to address the potential hazards and the methods used to mitigate those hazards. A hazard assessment shall be updated daily or whenever the tasks and hazards change during the construction process." The framework is in general alignment with the ANSI standard. However a JHA is not a requirement unique to this industry, they are required in other OSHA standards. One example is the Job Briefing requirement in Subpart V, Electric Power Transmission and Distribution (29 CFR 1926.952). TIA 222 and TIA 322 do not include requirements for a job hazard analysis.
Toolbox talks: OSHA is considering a requirement that employers hold a meeting before each shift to review the JHA and to discuss specific issues that will be factors in the day's work. Sample topics addressed during a toolbox talk would include, but are not limited to: A pre-job checklist, including questions about physical fitness, adequate sleep, and fatigue levels due to factors such as long driving/commuting times; A discussion of unique hazards presented by the day's scheduled work activities and methods for avoiding those hazards; Review of safety equipment inspection procedures; Refresher training in company safety policies and any applicable safety standards or regulations.	ANSI A10.48: There is no specific requirement for a toolbox talk in the ANSI standard. Section 4.7 contains a note that recommends that the competent person involve the entire crew in the process of detecting "hazardous conditions, equipment, or materials or unsafe work practices and to ensure compliance with the applicable regulations and standards." This does not specify how or to what extent to involve the entire crew in this process. There are no requirements for a tool box talk in either TIA 322 or TIA 222.
Hoisting, rigging, and gin pole use: OSHA is considering requiring a detailed rigging plan when hoisting materials or employees. Also considering specific requirements concerning the use of gin poles (use of load charts, attachment points, test loading, etc.).	ANSI A10.48 contains detailed information on the use of gin poles and gin pole requirements in section 11.0. This section is intended to be used with TIA 322 as a companion standard. Topics addressed include: Gin pole use, components, load charts, inspections, identification, evaluation, lifting personnel, tilted gin poles, special engineered lifts, and training, among other considerations. Section 4.8 addresses rigging plans. The standard states, "All construction activities regardless to the type of activity shall have a rigging plan classification outlining the project and the responsibilities within that project. Class II, III and IV rigging plans shall have a documented rigging plan." The section describes each class of construction and the requirements for planning and executing those lifts. Section 4.8.5, Rigging Plan Considerations, states that "A rigging plan is intended to ensure that the proper procedures,

	equipment and rigging are used for each operation and to ensure that the supporting structure can support the rigging loads." The section then provides a list of the items that should be taken into consideration when devising a rigging plan. Section 2.2 of TIA 322 requires the use of a rigging plan that conforms to the requirements in the ANSI standard for all construction. Section 2.3.2 addresses gin poles: the reactions of the pole on the structure from jumping or lifting shall be included on the rigging plan. Specific gin pole requirements are contained in section 3.0, Lifting Devices. Section 3.0 covers technical requirements for gin pole loading, load charts, reactions, and other considerations. The standard refers to the ANSI standard "for typical gin pole components, operation and use." TIA 222 does not address rigging plans for hoisting, nor does it specifically address gin pole requirements.
Weather hazards: OSHA framework includes a requirement to check for weather hazards before commencing work, and to monitor weather periodically during work. Employers have a responsibility to ensure that employees are not climbing towers in hazardous weather conditions.	ANSI A10.48 section 5.11 states, "Proper clothing and safety equipment must be suitable for the work intended." Also, "[w]hen adverse weather (such as high winds, heat, cold, lightning, rain, snow or sleet) creates a hazardous condition, operations shall be suspended until the hazardous condition no longer exists." TIA 222 addresses wind, ice, and earthquakes as they impact the structural stability of the structure. Annexes contain charts that calculate the strength requirements for various environmental conditions. Although employee safety is not addressed in these sections, the structural stability of a tower and its ability to withstand environmental conditions should be considered central to employee safety. TIA 322 Section 4.5 addresses construction of towers and how high winds impact construction. This refers to wind loads, and how long a tower can remain in "construction configuration" during high winds. The higher the wind speed, the less time a tower can remain in construction configuration. Special instructions are given for tower construction taking place during hurricane season in affected areas of the country.
Wildlife: OSHA framework requires wildlife hazards to be included in the JHA where present. If a hazard cannot be eliminated, the employer is required to provide appropriate PPE if necessary.	ANSI A10.48 section 5.10.9-Vegetation/Plant/Animal Hazards: This is a definition-based section, and does not include any requirements for identifying or abating any wildlife hazards. TIA 222 and TIA 322 do not address wildlife hazards.
Worksite location (remote or inaccessible): OSHA framework requires ER to plan for rescue of climbers and other emergency	The ANSI A10.48 standard does not have any information specific to remote locations. However, the pre-job survey and emergency action plan examples in the appendices leave space to include information

response in situations where sites are so remote or inaccessible that local emergency services may not be reliable or available.	regarding the nearest emergency services as well as include directions for emergency services to the worksite. TIA 222 and TIA 322 do not address remote or inaccessible worksite locations.
General: Framework addresses general considerations, including adequate breaks, access to restroom facilities as required by OSHA standards (§1926.51(c)), a rescue plan including directions to nearest hospital and provision of rescue equipment, provision of PPE to guard against environmental hazards, and elimination of falling object hazards.	ANSI A10.48 does not address adequate rest breaks, restroom facilities, provision of PPE to guard against environmental hazards, or the prevention of falling object hazards (with the exception of 9.7.12 which addresses falling object hazards on personnel platforms). The ANSI standard does recommend rescue plans that include directions to the nearest hospital facility, as well as directions to the worksite for emergency services, and provides example forms in the appendices. Appendix A4(c) is one example of a site-specific rescue plan that includes these directions. TIA 322 and TIA 222 do not address safe work practices.
Structural work on telecommunications towers: OSHA is considering a requirement that structural work (new construction, modification, and demolition) that could potentially compromise the stability of the structure be supervised and/or planned by a qualified engineer who has experience working with telecommunications towers. The level of involvement of a qualified engineer would vary according to the degree of complexity of the structural work to be completed: o Structural modifications of a low degree of complexity would require a structural analysis by a qualified engineer, and the work on site would be supervised by a competent person with an understanding of the structural modifications to be made. o Structural modifications of a medium degree of complexity would require a structural analysis by a qualified engineer. In addition, the qualified engineer would prepare detailed, step-by-step instructions for the work to be done. The structural work would be supervised by a competent person. o Structural modifications of a high degree of complexity would require a structural analysis conducted by a qualified engineer,	ANSI A10.48 Section 4.8 addresses rigging plans. The standard states, “All construction activities regardless to the type of activity shall have a rigging plan classification outlining the project and the responsibilities within that project. Class II, III and IV rigging plans shall have a documented rigging plan.” The section describes each class of construction and the requirements for planning and executing those lifts. TIA 222 Section 15.4: Changed Conditions Requiring a Structural Analysis addresses the need for a structural analysis. “A minimum, existing structures shall be analyzed in accordance with this Standard, regardless of the standard used for the design of the original structure, under any of the following conditions: a) a change in type, size, or number of appurtenances such as antennas, transmission lines, platforms, ladders, etc. b) a structural modification, excepting maintenance, is made to the structure c) a change in serviceability requirements d) a change in the classification of the structure to a higher class in accordance with Table 2-1.” Section 15.5.1 also gives guidelines on conducting a feasibility structural analysis to “identify the impact of proposed changed conditions.” TIA 322 Section 2.0, Structural Considerations During Construction, covers rigging plans, imposed rigging loads on structure, temporary supports and guy installation.

and the work would need to be planned and supervised by a qualified engineer.	
Communication Requirements: OSHA is considering a requirement that all contract firms present on the job site communicate about hazardous conditions, safe work procedures and structure installation and modification specifications, prior to beginning work as well as during work if conditions change. These requirements would be similar to the multi-employer requirements in subparts CC (§1926.1402) and V (§1926.950(c)), and would be in alignment with OSHA's multi-employer policy.	ANSI A10.48 Section 4.6, Multi-Employer Worksites. "all of the employers shall work together to identify and control hazards to meet OSHA and applicable ANSI standards for employee health and safety." ANSI standard also 'recommends' that "the owner or general contractor have overall responsibility for the work site or designate responsibility to a lower tier contractor in writing." This does not conform to OSHA's multi-employer policy. An entity cannot delegate their responsibility under the OSH Act for worksite safety and health to another party. Section 6.4.1, structure owner responsibilities contains additional communication requirements, including responsibility to communicate structural information to contractors (when requested) to assist in the creation of a rescue plan, and requirement "to provide the means to address structural, safety or fall protection system issues." TIA 222 does not address any multi-employer considerations. TIA 322 section 2.2, Rigging Plans, states that the responsibility for the rigging plan is designated to the contractor, however "when a structural analysis is required… the analysis shall be performed in accordance with this Standard by a qualified engineer engaged by the contractor or the owner." Communication between the contractor and owner is implied.
Considerations for structural alterations and modifications: Considering adding requirements for structural alterations & modifications that will vary in accordance with degree of complexity of work to be done. Low degree of complexity will only require supervision of competent person, medium degree of complexity would require supervision of competent person plus provision of step-by-step instructions, for high degree of complexity, would require planning and supervision by qualified engineer.	ANSI A10.48: The differing levels of complexity in OSHA's framework are in general alignment with the ANSI standard's section 4.8, Rigging Plans. Section 4.8.1-4.8.3 outline class I-III construction and the levels of responsibility that accompany each level. The requirements are not identical, however the structure is similar. TIA 222 Section 15.4: Changed Conditions Requiring a Structural Analysis: addresses the need for a structural analysis. "As a minimum, existing structures shall be analyzed in accordance with this Standard, regardless of the standard used for the design of the original structure, under any of the following conditions: a) a change in type, size, or number of appurtenances such as antennas, transmission lines, platforms, ladders, etc. b) a structural modification, excepting maintenance, is made to the structure c) a change in serviceability requirements d) a change in the classification of the structure to a higher class in accordance with Table 2-1." Section 15.5.1 also gives guidelines on conducting a feasibility structural analysis to "identify the impact of proposed changed conditions."

	TIA 322 references the ANSI standard- section 2.2 states, “Rigging plans prepared in accordance with the ANSI/ASSE A10.48 standard shall be utilized for all construction.”
Fall Protection (general)	ANSI A10.48: Fall Protection is addressed in section 6. Section 6.4 addresses stakeholder responsibilities. The stakeholders addressed include: structure owner, qualified engineer, contractor, competent person, authorized climber, competent climber, authorized ground based rescuer, authorized rescuer, and competent rescuer. The sections addressing authorized climber through competent rescuer (sections 6.4.5-6.4.9) seem to be focused largely on training requirements in addition to jobsite responsibilities. TIA 222 section 12.6, Climber Attachment Anchorages, refers to Annex I “for examples of suitable climber attachment anchorages.” TIA 322 does not address specific fall protection requirements.
Duty to have fall protection: The framework addresses the responsibility of the employer to protect workers from fall hazards at all times when climbing and working above 6 feet. Would include either guardrails, safety nets, or personal fall arrest systems. (this would replace telecommunications tower industry exemptions contained in other standards)	ANSI A10.48: Under section 6.4.3, contractor responsibilities, there are “guidelines” that recommend employees “exposed to a fall from height are trained, equipped and properly utilizing their fall protection,”. TIA 222 and TIA 322 do not contain any specific requirements for employers to provide employees with fall protection.
Personal fall arrest systems: All personal fall arrest systems would conform to the requirements contained in 29 CFR 1926.502(d). Employees climbing telecommunications towers would be provided with a boatswain seat-type full body harness.	ANSI A10.48: Personal Fall Arrest (PFAS) systems are addressed in section 6, Fall Protection. Section 6.9, Personal Protective Equipment Requirements for Fall Arrest, sets forth minimum requirements for a PFAS. The standard states that “shock absorbing lanyards, carabiners, hooks or connecting devices used for fall arrest shall meet ANSI/ASSE Z359.” The standard also requires that any fall arrest components shall have a latch mechanism with a load rating of at least 3600 lbs. Full body harnesses are required to have “attachment points at the sternal and dorsal locations for primary fall arrest/rescue application and have fixed locations for work positioning.” TIA 222 section 12.6, Climber Attachment Anchorages, refers to Annex I “for examples of suitable climber attachment anchorages.” Annex I includes information and drawings that detail recommended attachment points on a self-supporting tower, cautions on attaching only to “sound members that do not exhibit signs of damage and/or excessive corrosion” Annex I recommends minimum bracing diameter for members when climbers do not have engineering verification of the tie-off capacity. Annex I contains recommendations for both welded and bolted sections. TIA 322 does not address personal fall arrest systems.

Safety Climb Systems: The framework has a requirement that where safety climb systems are already installed on structures, "employers would have a responsibility to report broken or non-functional safety climb systems to telecommunications structure owners, and where safety climb systems are installed on structures, the structure's owners would have a duty to ensure the safe functioning of that safety climb system."	ANSI A10.48: Section 6.7 sets out minimum standards for the construction of fixed safety climb systems. "A fixed safety climb may be either round or flat and constructed of galvanized steel, stainless steel, aluminum, fiberglass or other material that complies with the applicable standards. If utilizing a fixed safety climb, the applicable safety climb device must match the existing safety climb. The distance between the sternal (chest) D-ring and the fixed safety climb shall not exceed 9 inches." In section 6.4.1, Structure Owner, the standard seems to acknowledge the structure owner's responsibility to maintain safety climb systems in 6.4.1(a): "provide the means to address structural, safety or fall protection issues including working with the engineer of record (EOR) to ensure that the applicable industry design standards are followed." Section 6.4.3(g) requires contractors to "perform and document inspections or evaluations as a part of the engineer's plan for the site. Any hazardous conditions shall be reported." This is in alignment with the framework's requirement for employers to report any broken or non-functional safety climb system to the structure owner. TIA 222: Section 12.0, Climbing Facilities "provides minimum requirements for the design and construction of fixed ladders, safety devices, climber attachment anchorages, platforms and cages used for climbing or working on communication structures." The standard states, "unless otherwise required, antenna supporting structures exceeding 10ft (3m) in height and antennas intended for climbing shall be equipped with a minimum of one climbing facility equipped with a safety climb device." The standard has several exceptions in section 12.3, including a requirement for climber attachment anchorages for towers where the safety climb device is not continuous. This section also does not require a safety climb device for towers where "multiple climbing facilities are provided." One additional note of importance: "Climbing and safety climb devices need not be installed over the entire height of a structure when their installation would adversely affect the performance of an antenna. In such case, the structure shall be equipped with a warning sign or climber attachment anchorages shall be provided . . ." TIA 322 does not address safety climb systems.
Hoisting: OSHA is considering including requirements for equipment used while hoisting both materials and personnel, based on provisions in ANSI A10.48 and TIA 322.	The ANSI A10.48 standard has detailed hoisting requirements for material and personnel hoisting.

	Section 8, Base Mounted Hoists Used for Overhead Material Lifting and Personnel Lifting, addresses the following topics: design, structural design and controls for overhead and personnel lifting, brakes, hour meters, guarding, inspection and maintenance, repair and modifications, and training. The standard also has specific operator requirements and responsibilities, including requirements addressing vision, ability to distinguish colors, hearing, and "no tendencies to dizziness, seizures or similar characteristics," as well as "no evidence of having physical or emotional instability that could render a hazard to the operator or others." The standard also contains detailed specifications on the amount of training required to operate a base mounted hoist. Section 9 addresses personnel hoisting requirements. Section 15 addresses requirements for the operation of capstan hoists. TIA 222 does not address specific hoisting requirements. TIA 322 contains loading criteria and strength requirements for structures as well as gin poles- to assist in determining how much loading a structure can take during hoisting. This is specifically addressed in section 2.3, Imposed Rigging Loads on Structure, but related information can be found throughout the standard, for example how hoisting loads affect gin poles in section 5.0, Analysis and Design of Gin Poles.
Base-mounted drum hoists: The OSHA standard would cover requirements for the design, mounting and anchorage, inspection, and operation of base-mounted drum hoists.	Section 8 of ANSI A10.48 details "the minimum design and use criteria for hoist mechanisms used for overhead material lifting and personnel lifting during the construction and/or maintenance of communication structures." The ANSI standard is in basic alignment with OSHA's existing guidance on base-mounted drum hoists (see CPL 02-01-056, *Inspection Procedures for Accessing Communication Towers by Hoist*), and the ANSI standard states, "All hoist mechanisms shall meet applicable requirements for design, construction, installation, testing, inspection, maintenance and operations as prescribed by the manufacturer or the qualified person designing the system." Section 8 of the standard then sets out minimum standards for those categories. TIA 222 and TIA 322 do not address base-mounted drum hoists.
Capstan hoists: This section would include the requirements for the design, mounting and anchorage, inspection, and operation of capstan hoists.	ANSI A10.48: Section 15, Capstan Hoists, provides detailed requirements for capstan hoists used in telecommunication structures work. Subjects covered include drive train, inspections, anchorage, synthetic rope, rope placement on drum, rope placement during operation, lifting loads, load testing, training, and

	communications and hand signals. The standard has a basic requirement that "[a]ll capstan hoist mechanisms shall meet the applicable requirements for design, construction, installation, testing, inspection, maintenance and operations as prescribed by the manufacturer or the qualified person designing the system." TIA 222 and TIA 322 do not address capstan hoists.
Materials hoisting: The materials hoisting section would include requirements for materials hoisting. Topics addressed would include hoisting procedures, requirements for controlled access zones, requirements for load lines and tag lines, requirements for load testing and verification.	ANSI A10.48 Section 8, Base Mounted Hoists Used for Overhead Material Lifting and Personnel Lifting, addresses the design, use, and requirements for base mounted drum hoists used in materials hoisting. Section 15 covers the use of capstan hoists used for materials hoisting. TIA 222 does not address specific hoisting requirements. TIA 322 contains loading criteria and strength requirements for structures to assist in determining how much loading a structure can take during hoisting. This is specifically addressed in section 2.3, Imposed Rigging Loads on Structure, but related information can be found throughout the standard Section 3.2, Lifting Block Arrangements, contains information on different lifting block configurations with tag lines. TIA 322 does not address hoisting safety measures such as controlled access zones.
Personnel hoisting: This section would include specific requirements for personnel hoisting. Personnel hoisting would be required to be performed only with a base-mounted drum hoist, and this section would address the specifications for any hoist used to hoist personnel. The use of capstan hoists to hoist personnel would be prohibited.	The ANSI A10.48 standard does not explicitly prohibit hoisting of personnel using a capstan hoist. The section on capstan hoists (section 15) does not prohibit hoisting personnel with a capstan hoist. Section 9, Personnel Lifting Accessories and Processes does state that the section sets forth "the minimum requirements for lifting personnel with mechanical devices in platforms deigned for personnel or being lifted with a base mounted hoist under specific parameters." Given that personnel platforms, base mounted hoists and gin poles are the only devices listed, it can be interpreted that the standard restricts personnel hoisting to those devices only. General requirements for personnel hoisting are located in section 9, Personnel Lifting Accessories and Processes. TIA 222 and TIA 322 do not address specific personnel hoisting requirements.

Rigging: The rigging section would address requirements for the rigging of loads, including rigging components, safety factors, and inspections.	ANSI A10.48 Section 4.8 addresses rigging plans. The standard states, “All construction activities regardless to the type of activity shall have a rigging plan classification outlining the project and the responsibilities within that project. Class II, III and IV rigging plans shall have a documented rigging plan.” The section describes each class of construction and the requirements for planning and executing those lifts. Section 4.8.5, Rigging Plan Considerations, states that “A rigging plan is intended to ensure that the proper procedures, equipment and rigging are used for each operation and to ensure that the supporting structure can support the rigging loads.” The section then provides a list of the items that should be taken into consideration when devising a rigging plan. Section 10, Rigging, covers rigging requirements in detail, including inspections, safety factors, components, and rigger and qualified person training. TIA 222 Section 16 does state that “Rigging and temporary supports such as guys, braces, false work, cribbing or other elements required for the erection/modification shall be determined, documented, furnished and installed by the erector accounting for the loads imposed on the structure due to the proposed construction method” TIA 322 Section 2.0, Structural Considerations During Construction, covers rigging plans, imposed rigging loads on structure, temporary supports and guy installation Section 2.2, Rigging Plans, specifies that “[t]he contractor shall be responsible for the rigging plan.” However, “[w]hen a structural analysis is required… the analysis shall be performed in accordance with this Standard by a qualified engineer engaged by the contractor or owner.” Section 2.2.1, Rigging Plan Information, contains guidance on what kinds of information should be included in the rigging plan.
Gin poles: The gin pole section would address the requirements for the use of gin poles to hoist materials, including gin pole components, connections, load charts, and the labelling and identification of gin poles.	ANSI A10.48 Section 11, Gin Poles and Other Lifting Devices sets forth requirements for the use of gin poles. Subjects addressed include: Gin pole use, components, load charts, inspections, gin pole identification, evaluation, lifting personnel, tilted gin poles, special engineered lifts, and training. The ANSI standard seems to draw from the TIA 322 standard as the source of the technical requirements/specifications, and refers to the standard, particularly “for additional information regarding the design of gin poles and the preparation of load charts.” TIA 222 does not contain specific requirements for gin poles.

	TIA 322 contains extensive information on gin poles. Section 3.0, Lifting Devices, contains information on gin poles, and gin pole load charts. Section 5.0, Analysis and Design of Gin Poles, contains detailed standards on gin pole classifications, design method, impact factors, reactions, and standard load charts for vertical and near vertical gin poles. Section 6.0, Gin Pole Construction, contains detailed information on gin pole fabrication, repair and modification as well as methods of gin pole identification and labeling.
Use of cranes in telecommunications tower work activities: The regulatory framework confirms that work performed with cranes will be covered by subpart CC.	In ANSI A10.48 section 1.1, Scope, the standard states: “This standard does not address specific work practices or personnel training requirements involving crane applications which are covered explicitly within other ANSI and OSHA standards and regulations.” TIA 222 and TIA 322 do not address the use of cranes in telecommunication structure work activities.
Structural Requirements for Teleommunications Towers: OSHA is considering the inclusion of structural loading considerations consistent with TIA 222 and TIA 322.	ANSI A10.48: Structural loading requirements for construction can be found in section 13, Structural Construction Loading Considerations. The structural loading requirements are in alignment with TIA 322, and the section frequently advises to consult TIA 322 for more detailed information. TIA 222 “provides the requirements for the structural design and fabrication of new and the modification of existing structural antennas, antenna-supporting structures, mounts, structural components, guy assemblies, insulators and foundations.” TIA 322 includes structural and loading requirements for structures during construction in section 2.0, Structural Considerations During Construction.
Structure inspection requirements: OSHA is considering several requirements for the inspection of towers.	ANSI A10.48 section 4.4, Job Hazard Assessment (JHA), requires that a JHA be conducted “to address the potential hazards and the methods used to mitigate those hazards. A hazard assessment shall be updated daily or whenever the tasks and hazards change during the construction process.” The sample JHA in A-5(a) includes check-off items focused on visual inspections of structural condition: check whether the structure has any visible rust, cracks, bent members, etc. Visual checks of guy wires, climbing ladders, and safety climbs (if the safety climb is a cable, the JHA requires a manual load test before use). TIA 222 section 14.0, Maintenance and Condition Assessment, contains inspection requirements for structures. TIA 322 does not address regularly scheduled, periodic inspection requirements.
Pre-job or pre-shift inspections, including inspecting safety climb condition, tie off points, and ladders.	ANSI A10.48 section 4.4, Job Hazard Assessment (JHA), requires that a JHA be conducted “to address the potential hazards and the methods used to mitigate those hazards. A hazard assessment shall be updated

	daily or whenever the tasks and hazards change during the construction process." The sample JHA in A-5(a) includes check-off items focused on visual inspections of structural condition: check whether the structure has any visible rust, cracks, bent members, etc. Visual checks of guy wires, climbing ladders, and safety climbs (if the safety climb is a cable, the JHA requires a manual load test before use). TIA 222 does not provide any specific guidance on pre-job or pre-shift inspections (as distinct from the engineering analysis required in section 15, Existing Structures). TIA 322 does not include pre-shift inspection requirements of the structure itself.
Periodic structural inspections: Structure owners would be required to conduct regular structural inspections on a periodic basis every 3-5 years (based on recommendations contained in the TIA standards).	ANSI A10.48: Other than the visual checks to be performed as part of the JHA, the ANSI standard does not address periodic structural inspections. Section 11.7 addresses gin pole inspections- the requirements in this section are in alignment with TIA 322, and directs to 322 for more detail. TIA 222 Section 14.1, Maximum Intervals, sets forth the following requirements: a) Three-year intervals for guyed masts and five-year intervals for self-supporting structures. b) After severe wind and/or ice storms or other extreme conditions. c) Shorter inspection intervals may be required for Class III structures and structures in coastal regions, in corrosive environments, and in areas subject to frequent vandalism. "Maintenance and condition assessment guidelines are provided in Annex J" Annex J contains "checklists for: (a) maintenance and condition assessment, and (b) field mapping of structures and appurtenances." TIA 322 does not address periodic structural inspections for the structure. Section 5.1 does provide for the annual inspection of existing gin poles.

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