

CHAPTER 10 – FALL PROTECTION

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CHAPTER 10 – FALL PROTECTION

A. INTRODUCTION

1. This Chapter applies to Smithsonian Institution employees working in an area where they may be exposed to fall hazards of 4 feet or higher. Fall hazards may be encountered while performing work involving:
 - a. Unprotected sides and edges, including ramps, runways, and other elevated walking/working surfaces, excavations, roof work;
 - b. Leading edges, including formwork and reinforcing steel;
 - c. Bucket trucks or aerial lifts;
 - d. Floor and wall openings and holes, including hoist areas; and
 - e. Improper ladder use.
2. Fall hazards must be minimized through the use of fall prevention or fall protection. Fall prevention should always be considered first. Fall prevention refers to using permanent engineering controls so that hazards associated with working at elevated locations are reduced or eliminated. Fall protection is a temporary system that is designed to protect personnel from the risk of falls when working at elevated heights. Fall protection includes:
 - a. Scaffolds;
 - b. Stairways with railings;
 - c. Floor and wall opening/hole covers;
 - d. Guardrails;
 - e. Bucket trucks or aerial lifts with work platforms;
 - f. Personal fall arrest equipment; and
 - g. Other fall arrest systems/programs, including safety monitoring, safety nets, controlled access zones, warning lines, and site-/project-specific fall protection plans.
3. All elevated work shall be performed in accordance with the requirements contained in the following Occupation Safety and Health Administration (OSHA) standards:
 - a. 29 Code of Federal Regulations (CFR) 1926 Subpart L, “Scaffolds;”
 - b. 29 CFR 1926 Subpart M, “Fall Protection;”
 - c. 29 CFR 1926 Subpart X, “Stairways and Ladders; and
 - d. 29 CFR 1910 Subpart D - Walking-Working Surfaces.
4. This Chapter does not apply to projects controlled by the Smithsonian Office of Contracting and performed by a contractor.

B. CHAPTER-SPECIFIC ROLES and RESPONSIBILITIES

1. Safety Coordinators
 - a. Assist supervisors in performing a Job Hazard Analysis for situations involving risk of a fall from an elevation.
 - b. Ensuring that all affected employees, supervisors and designated competent persons are fully trained and capable in carrying out their duties per this Chapter.
 - c. Maintain records specified by Section E, "Records and Reports" of this Chapter.
2. Supervisors
 - a. Evaluate the access requirements of each work assignment and choose the best means of access for the job. Consider the following job requirements before deciding on the means of access:
 - (1) Number of employees requiring access to areas where the use of fall protection is required or where fall hazards have been identified;
 - (2) Extent and duration of the work;
 - (3) Amount of material and/or tools involved;
 - (4) Time employees spend on the access equipment and/or on the elevated work location;
 - (5) Weather conditions;
 - (6) Equipment available on-site;
 - (7) Condition of surface from which access must be made; and
 - (8) Room available on the access equipment and/or on the elevated work location.
 - b. If there is no practical alternative to ladders, supervisors shall ensure that the correct ladder is used and employees receive ladder use and safety training.
 - c. Exercise control of access to all work areas.
 - d. Assign a Competent Person. Each supervisor shall be responsible for assigning a Competent Person for the following fall hazards:
 - (1) [1910.28](#), Scaffolds
 - (2) [1926.502](#), Fall protection systems criteria and practices
 - (3) [1926.552](#), Material hoists, personnel hoists, and elevators
 - (4) [1926.1053](#), Ladders
3. Employees shall
 - a. Inspect their work area for potential fall hazards and correct or report any identified hazards.

- b. Be trained in and use the proper fall protection equipment required for the task.
 - c. Inspect fall protection components and devices for visible damage and defects before each use.
 - d. Each employee who may be exposed to fall hazards must attend a specific fall protection-training program designed to instruct employees on the nature of the fall hazards in the specific work area or specific project. Refer to Section C.3, "Training," of this Chapter.
4. Competent Person
- a. A "Competent Person" is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate the hazards
 - b. The competent person shall conduct periodic inspections of workplace fall hazards, fall protection and prevention methods and equipment.
 - c. Where the competent person finds evidence of a situation that is unsafe the competent person shall ensure the necessary precautions have been taken to ensure the employees safety.

C. HAZARD IDENTIFICATION

1. ***JOB HAZARD ANALYSIS (JHA).***

A Job Hazard Analysis (JHA) must be performed for situations involving risk of a fall from an elevation. Refer to [Chapter 4, "Safety Risk Management Program"](#), of this *Manual* for directions on how to prepare a JHA.

2. ***FALL HAZARDS***

a. Unprotected sides and edges

Unprotected sides and edges include elevated walking/working surfaces ramps, runways, excavations, and roof work. Employees on a walking/working with an unprotected side or edge that is 4 feet or more above a lower level must be protected from falling by the use of a guardrail system or a personal fall arrest system.

b. Aerial lifts/bucket trucks

Aerial lifts include the following types of vehicle-mounted aerial devices used to elevate personnel to job-sites above ground: extensible boom platforms, aerial ladders, articulating boom platforms, and vertical towers. Employees working on an aerial lift that is 4 feet or more above a lower level must wear personal fall arrest systems, with the lanyard attached to the boom or basket.

c. Floor and wall openings and holes

- (1) There are eight main types of wall/floor opening that may present a fall hazard for employees:
 - (a) *Floor hole* – an opening measuring more than 1 inch and less than 12 inches in its least dimension.
 - (b) *Floor or roof opening* – an opening measuring 12 or more inches in its least dimension.
 - (c) *Wall hole* – an opening measuring more than 1 inch and less than 30 inches in height and is unrestricted in width.
 - (d) *Wall opening* – an opening measuring 30 or more inches in height and a minimum of 18 inches wide.
 - (e) *Hoist openings* – openings constructed for the use of temporary material and/or personnel hoists, and/or for the use of freight and/or personnel elevators.
 - (f) *Open-sided floor/platform* – openings constructed 4 feet or more above the adjacent ground level.
 - (g) *Chute* – an opening into which debris is dumped.
 - (h) *Temporary stairs/ladders* – entrances and openings to stairs and/or ladders.
 - (2) Employees on walking/working surfaces shall be protected from falling through holes more than 4 feet above lower levels by the use of a guardrail system, a personal fall arrest system, or covers.
- d. **Portable Ladders.** Many falls occur because portable ladders are not placed or used safely. Ladder users are at risk of falling if a ladder is not safely positioned and moves or slips from its supports. A stairway or ladder must be provided at all worker points of access where there is a break in elevation of 19 inches or more **and** no ramp, runway, embankment, or personnel hoist is provided. The Supervisor, in conjunction with the Safety Coordinator, shall determine when portable ladders may be used instead of scaffolding or aerial lifts.

D. HAZARD CONTROL

1. The basic rule for fall hazard control is the “4-Foot Rule,” which states any employee exposed to fall hazards of 4 feet or greater must be protected. In addition, any employee who may be exposed to falling into dangerous equipment must be protected. It shall be the SI Supervisor, in conjunction with the Facility Safety Coordinator, who shall decide which type of fall protection system would work best for their specific operation. Refer to [Attachment 1](#), of this Chapter, for guidance.
 - a. **SCAFFOLD USE.** Scaffolding is a temporary framework used to support workers and materials in the construction or repair of buildings and other

large structures. It is usually a modular system of metal pipes, although it can be made out of other materials. Scaffolds shall be furnished and erected for workers engaged in work that cannot be done safely from the ground, from ladders, or from solid construction.

b. STAIRS, HANDRAIL, AND STAIR RAIL SYSTEMS

- (1) Stairs shall be provided for access from one structure level to another where operations require regular travel between levels and for access to operating platforms for any equipment that requires attention during operation. Stairs shall also be provided where regular access is required to work areas that may expose employees to acids, caustics, gases, or other harmful substances, or if carrying tools or equipment by hand is required.
- (2) OSHA Standard 29 CFR [1910.24 - Fixed industrial stairs](#) contains specifications for the safe design and construction of fixed general industrial stairs. This classification includes interior and exterior stairs around machinery, tanks and other equipment, and stairs leading to or from floors, platforms, or pits.
- (3) A stair rail system shall be provided on all unprotected sides and edges of stairways and stair landings, unless otherwise enclosed, with a fall hazard of 4 feet or more. Unprotected sides and edges are any side or edge of a surface, except at entrances to points of access, where there is no wall or guardrail or stair rail system. Hand rails shall provide an adequate handhold for employees grasping them to avoid falling. The ends of stair rail systems and hand rails shall be constructed so as not to constitute a projection hazard. Unprotected sides and edges of stairway landings shall be provided with guardrail systems.

c. FLOOR OPENING/HOLE COVERS

- (1) Coverings may be installed over floor holes and floor or roof openings that will be open for a brief period of time.
- (2) Covers must be constructed with material and bracing capable of supporting, without failure, at least twice the weight of any load that may be placed on them. Loads on covers include employees, any type of equipment that may drive over the cover, and material loads.
- (3) Warnings must be painted on each covering, such as "Floor Hole Cover-Do Not Remove."
- (4) Coverings must be secured in order to prevent accidental displacement by employees, equipment, or wind.

d. GUARDRAIL SYSTEMS. Guardrail systems are the primary fall protection system for walking and working surfaces. All holes, openings, ramps, runways, and other walkways crossing or covering openings 4 feet or more in depth shall be protected with a guardrail system on all unprotected sides or edges in accordance with OSHA 29 CFR 1926.502(b).

- e. AERIAL LIFTS BUCKET TRUCKS. Safe aerial lift use includes:
 - (1) Only authorized personnel may operate aerial lifts.
 - (2) The manufacturer or equivalent must certify any modification.
 - (3) The insulated portion must not be altered to reduce its insulating value.
 - (4) Test lift controls daily.
 - (5) Controls must be clearly marked.
 - (6) Brakes must be set and outriggers used.
 - (7) Boom and basket load limits must not be exceeded.
 - (8) Employees must wear personal fall arrest systems, with the lanyard attached to the boom or basket.
 - (9) Do not use any devices to raise the employee above the basket floor.
- f. PERSONAL FALL ARREST SYSTEMS
 - (1) Use of personal fall arrest systems shall be required on all unprotected elevations of 4 feet or more above a lower level. Fall arrest systems shall be set up so that employees cannot free fall more than 4 feet, **and** will not contact a lower level. Where this system is impractical, an alternative form of fall protection, as outlined in this Chapter, must be provided.
 - (2) Safety belts (body belts) are prohibited.
 - (3) Use only a full body harness, shock-absorbing lanyards, life lines, and anchorage points in accordance with OSHA 29 CFR 1926.502(d), "Personal Fall Arrest Systems."
 - (4) The attachment point (D-ring) of a body harness must be located in the center of the wearer's back, shoulder level, or above the wearer's head.
 - (5) Horizontal life lines must be designed, installed, and used under the supervision of a Competent Person. Horizontal life lines must be capable of supporting at least 5,000 pounds per employee attached and maintain a safety factor of 2.
 - (6) Vertical life lines and lanyards must have a minimum breaking strength of 5,000 pounds.
 - (7) Anchorage points for personal fall arrest systems must be independent of any anchorage point used to support/suspend a platform. Anchorage points must be capable of supporting at least 5,000 pounds per employee attached. Unsafe anchorage points include (but are not limited to) the following locations:
 - (a) Stand-pipes or other piping systems
 - (b) Vents
 - (c) Electrical conduit

- (d) Outrigger beams
 - (e) Counterweights
 - (f) Guardrails
 - (g) Hoists
- (8) Inspect all personal fall arrest components prior to **each** use for wear, damage, and deterioration.
 - (9) Protect life lines against cuts and abrasions.
 - (10) Use rope grabs to attach vertical life lines, and never use knots to attach vertical life lines.
 - (11) Any component that may be damaged or has been subjected to impact loading must be immediately removed from service and tagged with a “Do Not Use” sign. The component must be inspected by a Competent Person and determined to be undamaged and suitable for re-use before it is used again. If the component is determined to be damaged, it shall be destroyed and discarded.
 - (12) Employees must be trained with donning body harnesses, tie-off techniques, and acceptable anchorage points.
 - (11) Set up fall arrest systems so employees cannot free fall more than 4 feet, and will not contact a lower level.
 - (12) Employees **must remain tied-off 100 percent of the time** while working at or above 4 feet by attaching to a horizontal life line, vertical life line, a double lanyard system, or other acceptable location.
 - (13) Provisions shall be made for the prompt rescue of an employee in the event of a fall; or employees must be capable of self-rescue.
- g. OTHER FALL ARREST SYSTEMS/PROGRAMS
- (1) Safety Net Systems. A safety net system may be installed below a work surface to protect any location where a fall hazard exists. Safety nets may be used under specialized working conditions, and must be designed by a professional engineer. A project-specific program must be developed in accordance with 29 CFR 1926.502(c) if a safety net system will be used.
 - (2) Controlled Access Zone (CAZ). A controlled access zone (CAZ) is an area in which certain work (such as overhand brick laying) may take place without the use of guardrail systems, personal fall arrest systems, or safety net systems. When zone access is controlled, it must be installed in accordance with 29 CFR 1926.502(g). A project-specific program must be developed if a CAZ will be used.
 - (3) Warning Lines. A warning line system is a barrier erected on a roof to warn employees they are approaching an unprotected roof edge, and designates an area where roofing work may take place without using a guardrail, personal fall arrest system, or safety net. Warning line systems

must be installed in accordance with 29 CFR 1926.502(f) and a project-specific program must be developed if a warning line system will not be used.

- h. **SAFE LADDER USE.** The Supervisor, in conjunction with the Facility Safety Coordinator, shall determine when portable ladders may be used instead of scaffolding or aerial lifts. Ladder use shall comply with OSHA 1926.1053 through 1926.1060, including the following safety requirements:

(1) Safe ladder use table:

STEP	SAFE LADDER USE
1	Choose the right ladder for the task--the proper type and size, with a sufficient rating for the task.
2	<p>Check the condition of the ladder before climbing.</p> <ul style="list-style-type: none"> • Do not use a ladder with broken, loose, or cracked rails or rungs. • Do not use a ladder with oil, grease, or dirt on its rungs. • The ladder should have safety feet.
3	<p>Inspect the ladder every day, prior to use, for the following problems:</p> <ul style="list-style-type: none"> • Rail or rung damage • Broken feet • Rope or pulley damage • Rung lock defects or damage • Excessive dirt, oil, or grease <p>If the ladder fails inspection, it must be removed from service and tagged with a "Do Not Use" sign.</p>
4	Place the ladder on firm footing, with a four-to-one (4:1) pitch.
5	<p>Support the ladder by:</p> <ul style="list-style-type: none"> • Tying it off; • Using ladder outrigger stabilizers; or • Have another worker hold the ladder at the bottom. <p>If another worker holds the ladder, they must:</p> <ul style="list-style-type: none"> • Wear a hard hat;

STEP	SAFE LADDER USE
	<ul style="list-style-type: none"> • Hold the ladder with both hands; • Brace the ladder with their feet: and • Not look up.
6	Keep the areas around the top and bottom of the ladder clear.
7	Extend the top of the ladder at least 36 inches (3 feet) above the landing.
8	<p>Climb the ladder carefully - facing it - and use both hands.</p> <ul style="list-style-type: none"> • Use a tool belt or hand-line to carry material to the top or bottom of the ladder. • Wear shoes in good repair with clean soles.
Table XX, Ladder Safety Requirements	

(2) Ladders with non-conductive side rails must be used when working near electrical conductors, equipment, or other sources. Ladders shall not be used horizontally for platforms, runways, or scaffolds. Overhead protection shall be provided for employees exposed to overhead hazards.

E. TRAINING

1. A specific fall protection training program shall be provided to each employee who might be exposed to fall hazards in accordance with the requirements of 29 CFR 1926.503, "Training Requirements." A Competent Person must provide the fall hazard training. The training program shall include:
 - a. The nature of fall hazards in the work area.
 - b. The types of body harnesses and lanyards employees use and which device employees should use.
 - c. The procedures for assembling, maintaining, disassembling, and inspecting fall protection systems.
 - d. The use and operation of personal fall arrest systems, guardrails, floor/wall coverings, stair rails, scaffolds, and any other type of fall protection scheduled for use.
 - e. The role of employees in site-/program-specific fall protection plans.
 - f. Procedures for equipment and materials handling and storage, and the erection of overhead protection.

- g. The standards contained in OSHA 29 CFR 1926 Subparts L, M, and X and 29 CFR 1910 Subpart D.
- 2. A written certification record shall be prepared, which includes the name of the employee trained, the date(s) of training, and the signature of the Competent Person who conducted the training. Re-training shall be provided if one of the following situations occurs:
 - a. Changes in the work place render previous training obsolete.
 - b. Changes in the types of fall protection systems or equipment to be used render previous training obsolete.
 - c. Affected employee's knowledge or use of fall protection systems is inadequate and indicates that the employee has not retained the required understanding or skill.
- 3. Other fall protection training requirements include:
 - a. Ladder use and safety;
 - b. Aerial lift use and safety; and
 - c. Personal fall arrest system use.

F. REQUIRED INSPECTIONS AND SELF-ASSESSMENTS

- 1. Users shall inspect personal fall arrest system components prior to use.
- 2. The Competent Person shall inspect all scaffold components prior to use.
- 3. Users shall inspect portable ladders prior to use.
- 4. Operators shall inspect aerial lifts prior to use.
- 5. The Competent Person shall inspect all temporary fall protection systems (guardrails, safety nets and warning lines) on a routine basis.

G. RECORDS AND REPORTS

The following records and reports shall be kept on file in the office of the Safety Coordinator:

- 1. Qualifications of each Competent Person
- 2. Scaffold inspection reports
- 3. Employee training documents

H. REFERENCES

For specific requirements related to fall prevention and fall protection systems used in the Smithsonian Institution, refer to the standards listed below.

1. [1910 Subpart D - Walking-Working Surfaces](#)
2. [1926 Subpart L - Scaffolds](#)
3. [1926.453 - Aerial lifts.](#)
4. [1926 Subpart M - Fall Protection](#)
5. Executive Order 12196, "Occupational Safety and Health Programs for Federal Employees," February 26, 1980
6. <http://keats.admin.virginia.edu/os/fall.html>, University of Virginia, Office of Environmental Health and Safety, Occupational Safety Program, "Fall Protection."

FALL PROTECTION SYSTEMS BY TYPE OF EXPOSURE

SITUATION OR FALL EXPOSURE	REFERENCES 29 CFR	ACTION HEIGHT	GUARDRAIL SYSTEM ¹	PFA ¹ SYSTEM	NET ¹ SYSTEM	COMMENTS/OTHER FALL PROTECTION METHODS
Stairways	1910.24 & 1926.1051	> 30"	X			Stair rails, handrails
Ladders	1910.27 & 1926.1053	=>24'	X	X		Cages/wells, ladder safety devices
Aerial Device Platforms	1926.453	=> 10' => 4'	X X	X		Harness & lanyard required
Scaffolding	1910.28 & 1926.451	=> 10'	X X			With a horizontal dimension < 45" in either direction
Runways, walkways, etc.	1910.23 & 1926.501	=> 4'	X			
Wall openings	1910.23 & 1926.501	=> 4'	X	X	X	Barricades/covers
Unprotected Sides/Edges	1910.23 & 1926.501	=> 4'	X	X	X	
Walking/Working Surfaces	1910 Subpart D & 1926.501	=> 4'	X	X	X	
Holes	1910.23 & 1926.501	=> 4'	X	X		Covers

¹ Fall protection systems shall conform to 1926.502 (b)(c) and (d).

Hoist Areas	1926.501	=> 6'	X	X ²		
Dangerous Equipment	1910.23 & 1926.501	< 4' => 6'	X X	X	X	Equipment guards
Excavations	1926.501	=> 6'	X			Barricades/covers ³
Low Slope roof		=> 6'	X	X		Warning Line System ⁴
Steep Slope roof	1926.501	=> 6'	X	X	X	Safety Monitoring System ⁵
Leading Edges	1926.501	=> 6'	X	X	X	Fall Protection Plan ⁶
Overhand Bricklaying	1926.501	=> 6'	X	X	X	Controlled Access Zones (CAZ) ⁷

² When guardrail parts are removed during the operation, and an employee must lean through or over the edge of the access opening, A personal fall arrest (PFA) system is required.

³ Designed and used in accordance with: 1926.502 (f)(1)(iv) and (f)(2), for barricades; and, 1926.502 (h)(4)(i), for covers.

⁴ Warning line systems shall be used either in combination with any one fall protection system (Guardrail, PFA, or Net) or a safety monitoring system.

⁵ Use of Safety Monitoring Systems must conform to 1926.502(h).

⁶ When supervision can demonstrate it is infeasible or creates a greater hazard to use conventional fall protection systems, a Fall Protection Plan conforming to 1926.502(k) may be used with prior approval by OSHSEM.

⁷ CAZ's must conform to 29 CFR 1926.502(g).