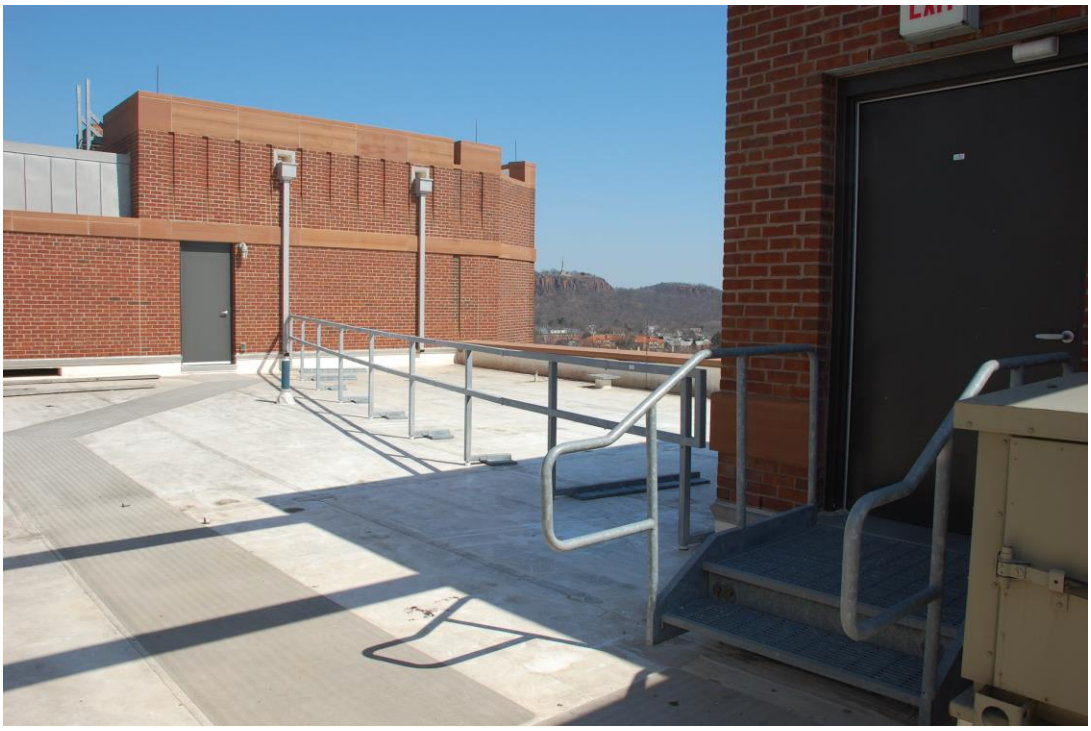
Environmental Health & Safety

Fall Protection Program



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CONTENTS:

1. Introduction

This document establishes Yale University's written compliance program for fall protection.

The purpose of the program is to establish guidelines to protect all employees and members of the Yale community engaged in outdoor and indoor work activities that exposes them to fall hazards. Fall hazards are defined as a risk of falling from a height of four or more feet or when working over dangerous equipment and/or machinery. Falls may also occur at the same level resulting from trips and slips. The goal of this program is to establish safe working conditions through effective education, engineering and administrative controls, use of fall protection systems and equipment, and enforcement of the program. Additional requirements apply to the use of scaffolds, portable ladders, or personnel lifts (i.e. elevated work platforms, man lifts, powered platforms, and aerial lifts) for which other programs must be referenced.

The Safety Engineer in the office of Environmental Health & Safety (EHS) is the Fall Protection Program Administrator. Please direct questions to ehs@yale.edu.

Applicable standards and references include:

- OSHA General Industry Standards, 29 CFR 1910 Subpart D - Walking-Working Surfaces
- OSHA General Industry Standards, 29 CFR 1910.140 - Personal Fall Protection Systems
- OSHA Construction Standards, 29 CFR 1926 Subpart M - Fall Protection
- ANSI/ASSE Z359, Fall Protection Code
- ANSI/ASSE A1264.1, Safety Requirements for Workplace Walking/Working Surfaces and Their Access; Workplace, Floor, Wall and Roof Openings; Stairs and Guardrails Systems
- ANSI ASC A14.3, American National Standards for Ladders - Fixed - Safety Requirements
- ANSI/NFSI B101.3, Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials

2. Responsibilities

Yale University provides required fall protection training, personal protective equipment, and documentation resources to all eligible university employees. Various Yale University departments and employees have responsibilities under this program, including:

A. Office of Environmental Health & Safety – Fall Protection Program Administrator

- Preparing, reviewing, and periodically revising this program.
- Providing and/or overseeing program related training.
- Monitoring and evaluating fall hazards in the workplace.
- Providing guidance to supervisors in the selection and purchase of approved fall protection equipment.
- Maintaining records of exposure assessments and training.
- Coordinating recordkeeping and notifications through the Training Management System (TMS).
- Reviewing qualifications for Qualified Persons designing, analyzing, evaluating, and specifying fall protection and rescue systems.

- Maintaining a listing of identified Qualified, Competent and Authorized Persons.
- Ensuring all incidents related to falls from heights are investigated and corrective action is taken to prevent a reoccurrence.

B. Supervisors/Managers

- Notifying Yale Environmental Health & Safety about workplace conditions and potentially affected employees.
- Providing new employees with informal on-the-job instructions about potential fall hazards they may encounter in their work environment.
- Ensuring that affected employees receive necessary training before beginning work and are provided with the correct protective equipment.
- Ensuring pre-use inspections are performed and recorded by Authorized employees.
- Ensuring that equipment used by employees is inspected annually by a Competent Person and that appropriate records are maintained. A Supervisor or Manager may function as a Competent Person with appropriate documented training.
- Ensuring overall employee compliance with this program.

C. Authorized Person/Rescuer

- Observing the procedures and requirements outlined in this Program.
- Understanding and following any procedures and instructions provided by the Competent Person regarding the use of fall protection and rescue systems.
- Acknowledging the fall hazards associated with the work to be performed.
- Attending/participating in all required training sessions.
- Correctly using and inspecting the personal fall protective equipment and supplies provided.
- Performing or assisting in workplace rescues.
- Inspecting and maintaining fall protection and rescue equipment in a safe and sanitary condition.
- Bringing to the competent person's attention all unsafe or hazardous conditions or actions that may cause injury to either themselves or any other authorized person before proceeding with their workplace activities.
- Prior to utilizing a personal fall arrest system, verifying a rescue procedure has been developed and reviewing the procedure.
- Prior to performing a rescue, carefully evaluating the circumstances and hazards of the rescue in determining whether or not it is safe to perform a rescue.

D. Competent Person /Rescuer

- Conducting a fall hazard survey to identify all fall hazards before Authorized Persons are exposed to those hazards.
- Ensuring Authorized Persons have been adequately trained and are proficient at utilizing applicable personal fall arrest systems and performing rescue.
- Identifying, evaluating, and imposing limits on the workplace activities to control fall hazard exposures.
- Stopping work immediately if it is determined that it is unsafe to proceed with the workplace activities.

- Anticipating the foreseeable potential for planned rescue and develop rescue procedures and methods accordingly before the authorized persons start their workplace activities at heights.
- Preparing, updating, reviewing and approving the planned rescue procedures before the Authorized Persons start their workplace activities at heights.

3. Program Evaluation

The Fall Protection Program will be reviewed at least once a year by a committee composed of representatives from EHS, union and supervisory personnel from effected departments. This review will be documented and encompass the following:

- Assignment of duties and responsibilities
- Adequacy of training
- Equipment storage, use, rescue, inspection and maintenance procedures
- Changes in regulations
- New and existing fall hazards and exposure assessments
- Changing demands of the program
- Changes in technology
- Equipment inspection records
- Records related to incidents covered by this Program

The annual review will be conducted on, or about, the same time every year.

4. Definitions

Active Fall Arrest System: equipment used to arrest an employee experiencing a fall from a working level. The primary components are: the anchorage, connectors from the anchorage (such as a lanyard) to the individual, and a full body harness.

Anchorage: a secure point of attachment for lifelines, lanyards or deceleration devices. For fall arrest systems it must be capable of supporting 5000 pounds per individual tied off. It must be capable of supporting 1000 pounds for fall restraint systems.

Authorized Person (and Authorized Rescuer) : A person assigned by Yale to perform duties at a location where the person will be exposed to a fall hazard (unprotected heights greater than 4 feet). The Authorized Person shall through experience and training have a working knowledge of and experience in the selection, use, storage and care of all equipment necessary to use an active fall arrest system and perform a rescue.

Designated Area: a space which has a perimeter barrier erected to warn employees when they approach an unprotected side or edge and serves to designate an area where work may be performed without additional fall protection. Designated areas cannot be erected less than 15 feet from an unprotected side or edge and are only allowed for work of a temporary nature such as maintenance of roof top equipment. A designated area must be surrounded by a rope, wire, or chain supported by stanchions.

Competent Person (and Competent Rescuer): An individual designated by Yale to be responsible for the immediate supervision, implementation, and monitoring of this Program who, through training and knowledge, is capable of identifying, evaluating, and addressing existing and potential fall

hazards, and who has the authority to take prompt, corrective action with regards to such hazards. The Competent Person shall have a working knowledge through experience and training of current fall protection and planned rescue regulations, standards, equipment and systems.

Fall Restraint System: Differs from the Fall Arrest System in that it limits the individuals travel in such a manner that the user is prevented from reaching a fall point (such as the edge of a roof or an elevated working surface). The Fall Restraint System is not designed to support an individual and as such does not require the same design capacities. However, like the arrest system, it requires a full body harness, an anchorage, connectors and a lanyard. All fall restraint system components must meet the rating requirements for fall arrest to ensure adequate protection is provided regardless of the application.

Floor Holes: are openings measuring less than 12 inches but more than 1 inch in its least dimension, in any floor, platform or other work surface through which materials may fall or which may present a tripping hazard (examples include a pipe opening, or slot opening).

Floor Openings: are openings measuring 12 inches or more in its least dimension, in any floor, roof, platform or other working surface through which a person may fall (examples include skylights, hatchways, stair or ladder openings, pits, or manholes).

Harness: an array of straps secured around the wearer in a manner that distributes the fall arresting forces over the thighs, shoulders, and pelvis and contains provisions for attaching it to a lanyard, lifeline, or deceleration device. Attachment must only occur at the harness rear "D" ring.

Low-Slope Roof: a roof having a slope less than or equal to 4 in 12 (vertical to horizontal).

Passive fall arrest system: includes, but is not limited to, a standard railing system or parapet or a designated area.

Program Administrator: A person authorized by Yale to be responsible for managing this Program and is trained to have a working knowledge of current fall protection regulations, standards, fall protection equipment and systems.

Qualified Person: A person with a recognized degree or professional certificate and with extensive knowledge, training, and experience in the fall protection and rescue field who is capable of designing, analyzing, evaluating, and specifying fall protection and rescue systems to the extent required by this standard. The Qualified Person must be identified for each application by the Program Administrator.

Rope Descent System: a suspension system usually consisting of a roof anchorage, support rope, a descent device, connectors and a chair/seatboard that allows an employee to descend in a controlled manner and, as needed, stop at any point during the descent.

Standard Railing: a barrier consisting of top rail, mid-rail, posts and toe board designed to prevent employees from falling. The tools section of this document contains specifications for various types of guardrail systems.

***Steep-slope Roof*:** a roof having a slope greater than 4 in 12 (vertical to horizontal).

Walking/Working Surface: is any surface upon which an individual walks or works.

Wall Opening: an opening at least 30 inches high and 18 inches wide in any wall or partition through which employees can fall to a lower level.

5. Exposure Assessments

Environmental Health & Safety takes all practical steps to ensure that engineering or other controls, i.e. passive fall protection systems, are available to eliminate the need to utilize active fall arrest systems. When designing new buildings and facilities, special consideration shall be given to eliminating and controlling fall hazards. However, certain situations and tasks are performed at locations were passive fall protection is not available and will therefore require the use of personal fall protection equipment and systems. Potential exposures to falls at Yale University are routinely evaluated through regular workplace inspections and upon employee or supervisor request. Such evaluations must be performed using a standard form by a Qualified Person identified by the Program Administrator. The evaluations are maintained by EHS. Locations where active fall protection systems exist or are required must be identified with signage at the access point. A review of evaluations where active fall protection systems are necessary will be reviewed annually.

An often overlooked cause of falls is those resulting from slips and trips. A fall of this nature generally occurs at the same elevation and is often the result of poor housekeeping, spills, and/or inadequate maintenance of the walking and working surfaces. Due to the unpredictable nature of the exposure, personnel are encouraged to self-assess conditions and to act quickly to eliminate the hazard. These hazards may include icy sidewalks, wet floors, torn floor coverings and stair treads, and missing or broken hand rails and guard rails.

6. Work Practices – Walking and Working Surfaces

A. Housekeeping

Proper housekeeping assists in preventing falls from slips and trips. All work areas should be kept clean, orderly and in a sanitary condition. The floors of work areas should be maintained in a clean and dry condition. Where wet processes are used, drainage must be maintained and gratings, mats, or raised platforms provided. If work surfaces are temporarily wet or otherwise slippery, warning cones should be positioned in plain sight directly in front of the affected area. Every floor, working space, and passageway should be kept free of protruding nails, metal, splinters, holes, or loose grating/boards. Always sweep your work area, removing any debris, after completing your task.

B. Floor Slip Resistance

Walking and working surfaces should be maintained in a stable, firm, and slip resistant condition. This is particularly important when employees are likely to be exposed to wet floor conditions or perform material handling tasks involving the use of carts. The design of such environments should include considerations for how to maintain the floor; the appropriate selection of floor material to provide adequate slip resistance; and controls to reduce exposure such as floor drains and slip-resistant drainage mats. When selecting floor material, the surface's coefficient of friction (COF) should be based on the anticipated conditions. Generally, for dry conditions a surface with a static COF of 0.60 and for wet conditions a surface with a dynamic COF greater than 0.42 are consider slip resistant.

C. Floor Openings, Holes and Wall Openings

Standard guardrail systems should be provided to prevent falls from every open-sided floor or platform except where there is an entrance to a ramp, stairway, a fixed ladder, or working side of a

platform such as a loading dock. Floor openings may be guarded with a guardrail system or covered by a cover capable of sustaining at least twice the anticipated load. When the floor opening cover is removed a temporary guardrail shall be put in place or an attendant must be stationed at the opening to warn personnel. Wall openings with a lower edge less than 36 inches and representing a fall hazard must be protected with a guardrail system. Wall opening may also be protected with screens, grills, doors or other barriers. Every floor hole into which a person can accidentally walk should be guarded by either a standard guardrail system or a floor hole cover of sufficient strength. The cover should not create a tripping hazard.

In some cases, a Restraining System may be used to prevent an employee from falling through a floor opening or over an edge when the floor cover or guardrail system is temporarily removed. This may be done to facilitate the transfer of materials as when an overhead crane is used to load in material or equipment and the railing is removed to facilitate material transfer. All employees utilizing a restraint system must be specifically trained in their use and limitations. The Definitions section of this document describes the very important differences between a restraint and fall arrest system. Only harnesses shall be used with restraining systems; body belts are not to be used under this program.

D. Special Case – Protection from Falling into Dangerous Equipment

Regardless of height, open-sided floors, walkways, platforms, or runways above or adjacent to dangerous equipment, tanks, pits and similar hazards must be guarded with a standard guardrail system or employees should be provided personnel fall arrest gear selected to prevent contact with the hazardous equipment, material, and/or condition.

E. Special Case – Ditches

Ditches, holes and other depressions greater than four feet deep should be surrounded by a guardrail system or other substantial physical barrier to prevent falls into the opening.

F. Special Case – Fixed Ladders

Fixed ladders, including manhole ladders, must meet OSHA and ANSI standards to include being constructed of a material that is appropriate for the environment, capacity, dimensions and clearances. Fixed ladders extending more than 24 feet above the lower level must be equipped with a personal fall arrest system.

G. Floor Loading Protection

Load rating limits should be conspicuously posted on plates, raised platforms, and other engineered elevated structures or projections. Never place a load on a floor or roof greater than its approved limit. Temporary covers should be able to withstand at least twice the anticipated load.

7. Work Practices – Roofs and Other Elevated Locations

Falls from roofs may occur when an employee falls over an edge, through a skylight or down an access hatch. Employees may be protected from these fall hazards with either a passive control system, such as a guard rail or a parapet, or an active fall control system such as a personal fall arrest system. Roofs may be of different pitches, from flat to very steep. The roof slope will determine what fall protection systems are practical. Roofs with a slope greater than 8 in 12 (8 vertical to 12

horizontal) require special considerations. In all cases, doors and access hatches leading to roofs or elevated surfaces with fall hazards must be locked, restricting access to authorized, trained individuals only. On buildings that are only a few stories, it is advisable to perform this work from the ground using ladders, scaffolds, or aerial lifts.

A. Flat Roofs and Elevated Surfaces

Flat roofs and elevated surfaces are typically accessed by fixed ladders through access hatches or fixed stairs and doors. Fall hazards may include unprotected edges, skylights and access hatches. The preferred protection for these exposures is to use a passive protection system. In a passive system, the roof or elevated surface edge is protected by a standard guardrail system or a parapet that is a nominal 42 inches in height. Parapets less than 42 inches are not considered acceptable fall protection. An access hatch must be protected with guardrails. Skylights subject to maintenance workers must either be protected with guardrails; with a screen capable of withstanding a concentrated load of at least 400 pounds applied perpendicular to any one area of one square foot dimension or twice the maximum intended load, whichever is higher. Skylights must be labeled with a performance grade rating.

An acceptable alternative for protecting employees accessing equipment on flat roofs with unprotected edges is through the use of a designated area. The designated area must be surrounded by a rope or wire and supporting stanchions that can withstand a force of at least 25 pounds before tipping over and cannot be closer than 15 feet to the unprotected edge[1]. Access to and from the designated area from the roof entry point must also be delineated with lines and stanchions meeting the same criteria. The lines are intended to keep workers from straying too close to the roof edge and must be clearly visible (day and night) as well as meet additional strength and height requirements. In cases where the equipment to be serviced is located within 15 feet of a roof edge, the roof edge immediately adjacent to the equipment must be protected with a guardrail. The guardrail should extend around the equipment to a distance of 15 feet in from the roof edge. Access to and from this area from the roof entry point must also be delineated with lines and stanchions meeting the same criteria identified for establishing a designated area. Work performed outside the designated area or lines require the use of a personal fall arrest or restraint system.

If an adequate passive system is not in place, an active system of fall protection must be employed such as a fall arrest or restraint system. Such systems must meet all OSHA standards and be designed by a Qualified Person.

B. Sloped Roofs

Low-Sloped Roofs are defined as equal to or less than 4 in 12 and Steep Roofs are roofs with a slope greater than 4 in 12 but less than 8 in 12. Low sloped roof edges may be protected with a guardrail system or a parapet that is a nominal 42 inches in height. Weighted guard rail systems are not approved for use on sloped roofs. If an adequate guardrail system or parapet is not present a fall restraint or fall arrest system must be used. Steep sloped roofs require special considerations and must be individually evaluated for fall protection. Generally, a guardrail system or parapet will not provide adequate fall protect on a steep sloped roof.

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[1] The designated area may be as close as 6 feet to the unprotected edge for work that is both infrequent and temporary.

Special precautions must be taken and fall protection techniques utilized when working on Extremely Steep Roofs (8 in 12 and greater). A fall arrest system must be worn at all times and special working surfaces may be required. Special working surfaces may include chicken boards/ladders, toe boards, roof racks, etc.

C. Weather Considerations

When adverse weather conditions exist, such as high winds, heavy rain or snow, or when the accumulation of ice or snow on surfaces significantly increase the risk of slips and falls when performing tasks, a risk assessment should be conducted and where possible the work postponed until better conditions prevail or other precautions taken.

8. Rescue

Before using a fall arrest system consideration must be given as to what emergency rescue strategy will be employed to remove an affected employee. Depending on the location and height of the work this strategy may be as simple as the availability of a retrievable ladder or as complex as involving the local fire and rescue department's ladder trucks and elevated equipment. Prior to performing any work activity where personal fall protection equipment will be used, a written rescue plan must be developed by a Competent Person and reviewed with the Authorized employee. The rescue plan must include the following elements and considerations:

- A description of all equipment to be used by the rescue team specifying the applicable manufacturers.
- Complete instructions for performing the rescue safely and promptly.

A Fall Protection Rescue Plan Form is required to document the rescue plan.

For incidents related to falls and involving fall arrest systems the following actions must be taken:

- Report all incidents to EHS and the Program Administrator immediately.
- Remove and tag all fall arrest system components from service until an inspection can be performed by a Qualified Person and the Program Administrator.
- Ensure all personnel impacted by the activation of a fall arrest system receive medical evaluation to determine the possibilities and potential extent of injuries.
- Complete an online First Report of Injury Form.
- Document the reported incident to include the location, date, equipment involved, cause and corrective action. Documentation will be maintained by the Program Administrator.

9. Training

Individuals exposed to fall hazards must be trained in the recognition of these hazards and in the procedures to be followed in order to minimize these hazards; such as the use of guardrail systems and personal fall arrest systems. Individuals using personal fall protection systems as a means to control fall hazards must receive additional training.

Training is provided at multiple levels. Awareness level training is provided and is recommended for anyone who may be exposed to fall hazards and is required for those who will be exposed to fall hazards. Users of personal fall protection and rescue systems (Authorized Persons and Rescuers)

and those with responsibilities for supervising the users (Competent Persons and Rescuers) must complete training coordinated through the Program Administrator and by a Qualified Person.

Authorized Person and Rescuer training must involve physical usage of applicable active fall protection and rescue equipment and be documented utilizing standard forms provide by the Program Administrator to include at least the following topics:

- The nature of the fall hazards in the work area and how to recognize them;
- The procedures to be followed to minimize those hazards;
- The correct procedures to be followed to minimize those hazards;
- The correct procedures for installing, inspecting, operating, maintaining and disassembling the personal fall protection systems that the employee uses; and
- The correct use of personal fall protection systems and equipment including proper hook-up, anchoring, and tie-off techniques, and methods of equipment pre-use inspection and storage, as specified by the manufacturer.

Competent Person and Rescuer training builds upon Authorized Person training and adds the following topics:

- Detailed inspection procedures of equipment components and systems;
- The procedures for performing fall protection system assessments and determining when a system is unsafe; and
- The correct procedures for the selection and use of anchorages.

Training will be repeated when changes, such as the introduction of new equipment make previous training obsolete or when an employee has not retained the requisite understanding or skill. Awareness and Authorized Persons and Rescuers training is required at least once every two years. Competent Persons and Rescuers training is required once every year to include a performance assessment of procedures. All training documents required by this program will be maintained by the Program Administrator for at least two years.

10. Equipment Selection and Design

Fall protection must be considered for new buildings, facilities, and equipment. Fall protection is required for all open-sided platforms, floors or walkways that are 4 feet or higher off the ground or next level. The requirement includes elevated surfaces, such as rooftops, where access is needed for maintenance activities. Applicable OSHA and ANSI Standards must be referenced for design requirements for passive fall protection systems and their components. If an adequate passive system is not in place, an active system of fall protection must be employed such as a fall arrest or restraint system. The design and purchase of such systems must be coordinated and approved by the Program Administrator. Below are design requirements for active fall protection systems.

- Systems must meet applicable OSHA and ANSI Standards.
- The system shall be designed to support required number of users (typically two) in case of a fall and to prevent the users from free falling more than 6 feet. All components shall be designed by the fall protection system supplier and shall meet the applicable requirements of ANSI and applicable OSHA regulations.

- The selection, design, and installation of active fall protection systems shall be performed under the supervision of a Qualified Person with experience and trained in design and use of such systems.
- All components must be installed according to the manufacturer's specifications.
- Calculations must be prepared under the supervision of a registered Professional Engineer and Qualified Person.
- The Professional Engineer who oversaw the design of the system must affix their professional seal to each drawing and calculation package issued.
- Operation and Maintenance Data shall be prepared per Z359.2 & ANSI Z359.6.
- A Qualified Person must verify that all manufactured units have been installed in accordance with specifications and details, and will function as intended.
- Systems must be labeled and include user instructions and limitations at the access points.
- Safe access must be provided to anchorages so that users are continuously protected.

Personnel fall arrest and restraint systems are composed of specific appropriate components that must be selected and used properly. Equipment will include: the harness, lanyard and anchorage. All anchorages must be designed or selected by a Qualified Person designated by the Program Administrator. Equipment must be stored in a manner consistent with manufacturer instruction and which protects it from exposure to any conditions that could result in damage.

11. Active Fall Protection Equipment Inspection

All active fall protection equipment manufacturer inspections must be performed. At a minimum, the following inspections are required.

- Anchorages must be inspected by a Competent Person annually.
- Anchorages use for rope descent systems must be certified by a Qualified Person every 10 years.
- All fall arrest and restraint equipment must be inspected by Competent Person annually.
- Both Qualified and Competent Person inspections must be documented and submitted to the Program Administrator for review/retention. The date of the most current documented inspections will be recorded and maintained in a log along with records showing the date of purchase and dates when any service was conducted on the equipment.
- Authorized Persons must inspect all equipment prior to use.

Any deficiencies identified in inspections must be addressed prior to use or the equipment must be removed from service and tagged "out of service, do not use". Equipment taken out of service may be returned to service after a satisfactory inspection has been performed by a Competent Person. All components of a fall arrest system subjected to the impact loading forces of a free-fall must be immediately removed from service and destroyed or sent to the manufacturer for evaluation. Equipment must also be replaced at manufacturer specified intervals if provided.

12. Medical Surveillance/Physical Requirements

Employees utilizing personal fall arrest systems are expected to be physical fit with no physical conditions that could be aggravated by, or cause the employee harm, if he or she was involved in a fall and was to rely on the fall equipment for life safety.

13. Security

Access to areas with fall hazards (roof tops, etc.) will be limited to personnel trained in the recognition of fall hazards and the steps necessary to mitigate those hazards. All roof accesses should be locked and controlled by the building Superintendent, Facilities, or Physical Plant. Procedures for storage of active fall protection equipment must include provisions for limiting access to only those personnel trained in the proper use of the equipment.