

# Fall Prevention & Protection

# After this training you will be able to...

- Describe the dangers of working at elevated heights
- Differentiate between fall prevention and fall protection
- List in order the steps to put on a body harness
- List and describe different types of lanyards
- Describe different types of anchorage points
- List factors that are needed when calculating fall space clearance
- List inspecting and maintenance guidelines

# Falls in the workplace

- Working at elevated levels presents the danger of falling
- Falls can be caused by:
  - Inattentiveness
  - Slippery surfaces
  - Working in awkward or out-of-balance positions
  - Insufficient training
- Falls can happen while at work, during construction, and at home

- Falls are one of the leading causes of workplace injuries
  - Account for approximately 600-900 deaths every year!
  
- There are three primary lines of defense against fall related injuries
  1. Stay Alert
  2. Fall Prevention
  3. Fall Protection

1. Stay Alert

- Watching out for potentially dangerous situations and proceeding cautiously is the best way to avoid potential falls

## 2. Fall Prevention

- Railings, hole covers, and ladder cages are all examples of fall prevention engineering controls
  - These help to prevent falls in case someone loses their balance, slips on a grate, or is exposed to an open hole in the floor

- Handrails and guardrails are a major part of fall prevention
- Handrails consist of a vertical barrier placed along exposed edges of a walking or working surface to prevent falls
  - A standard handrail must consist of
    - Top rail
    - Intermediate rail
    - Support post
    - Vertical height of 42" above the working surface

- Handrails must also:
  - Create no projection hazard
  - Have a smooth surface
  - Be able to withstand at least 200 pounds of force in any direction



- Where the potential exists for an individual to fall over a standard top rail, additional fall protection must be provided
- The intermediate rail must be approximately half way between the top rail and the walking/working surface
- A toeboard must be provided on the railing if falling materials might create a hazard

- Stairways are also considered a fall prevention system
- Every flight of stairs with 4 or more risers must be equipped with standard stair rails or standard handrails
  - Stairways, whether it has open or enclosed sides, must be equipped with one handrail
  - If it's an open stairwell with no wall on either side, a stair rail must be installed on the open sides

- When it is necessary to travel between levels on a regular basis, fixed stairs must be provided
  - \*Travel on a regular basis includes travel that happens every day or every shift
- Where handrails are provided, they must be used

- Work platforms, such as scaffolds also serve as fall prevention
- Work platforms must be erected under guidance of a competent person
  - Competent person
    - Properly trained
    - Authorized by facility
    - Capable of identifying dangerous or hazardous conditions in personal fall arrest systems

- Every open sided work platform erected 4 feet or more above lower levels or the ground level must be equipped with standard railings
- All equipment used to erect work platforms, including boards, must be approved for use
- Employees required to use work platforms must be trained on the specific type of platform being used

- Work platform tags – color coated tags that give warnings and indications for use
  - May give information about the fall protection required

- Using ladders safely can also prevent falls
  - Fixed or portable
- Portable ladders must be inspected before use
  - When inspecting ladders, make sure:
    - Side rails do not have dents or bends
    - Rungs are not excessively dented
    - Run-to-side-rail connections are not damaged
    - All hardware connections are not damaged
    - Rivets do not have shear damage

- If a portable ladder is defective, it must not be used
  - Never leave a defective ladder in the field because other workers might use it
- After inspection, make sure the ladder is properly erected



- Fixed ladders higher than 20 feet must be equipped with:
  - Cages
  - Wells
  - Landing platforms
  - Or Safety devices

- General safety rules for using ladders include:
  - Always face the ladder
  - Maintain a body position that is in between the ladder's side rails
  - Never stand on the ladder's top two steps
  - Always maintain 3 points of contact
  - If 3 points of contact cannot be maintained, additional fall protection is required

### 3) Fall Protection

- Sometimes it is not practical to have railings or fall prevention measures
- In these cases, the emphasis is on fall protection
- The goal of fall protection is to minimize the effects of a fall that has already occurred

- Personal Fall Arrest System is used to stop an employee who has fallen from working level
  - Consists of:
    - Body belt or body harness
    - Anchorage point
    - Connectors
  - Equipment used consists of:
    - Lanyards
    - Deceleration devices
    - Lifelines

- For personal fall protection, a body harness or body belt can be used
  - Body harness – uses straps secured around an employee that distribute fall arrest forces over the thighs, pelvis, waist, chest and shoulders
    - Secured around the waist using a buckle and has a back-mounted “D” Ring for attaching it to other components of a personal fall arrest system
    - Distributes the fall arrest forces over a much wider area of the body as well as keeps the body in an upright position during a fall exerting far less strain on the body
  - Body belt – singular strap secured around the waist of the individual using a buckle attached to a lanyard or lifeline
    - This device should only be used with fall restraint systems and should not be used with fall arrest systems

- To properly put on a body harness follow these steps:
  1. Hold the harness by the D-ring located in the back (if leg, waist, or chest straps are buckled, release the straps and unbuckle)
  2. Slip the straps over the shoulders so that the D-ring is located between shoulder blades in the middle of the back
  3. Pull the leg strap between the legs and connect to the opposite end, repeat with second leg strap
  4. Connect the waist strap if you are using a belted type harness
  5. Connect the chest strap and position in the mid chest area, tighten straps as needed
  6. Tighten all buckles so the harness fits snug but not binding

- **Remember!**

- Not all harnesses are the same so always check the manufacturers donning and doffing instructions before use

- The harness is attached to a lanyard, which is attached to an anchorage point (or anchor point)
  - Anchor points serve as secure point for lifelines, lanyards, or other deceleration devices
- The distance to the next lower level must be considered when selecting the length of the lanyard
  - Lanyard must NEVER be tied in knots to reduce their length
    - This can reduce the strength of the lanyard by half
- If needed, just a tied off adapter or doubled legged lanyards to maintain continuous tie off safety



- Examples of deceleration devices are:
  - Rope grabs
  - Rip-stitch lanyards
  - Specially-woven lanyards
  - Tearing/Deforming lanyards
  - Self-retracting lanyards

- Self-retracting lanyard (SRL) – deceleration device that functions like a seatbelt
  - During normal employee movement, the line can be released or retracted
- If a fall does occur, the device automatically locks minimizing the length of the fall
- Before attaching your lanyard to an anchor point, make sure the other end is attached to the D-ring in the back

- Avoid wrapping the lanyard around sharp or rough surfaces
  - If necessary use a beam clamp to protect it from being cut
- Lanyards can also be used for personal fall restraint when working near a roof edge or floor or wall opening

- There are several types of lanyards:
  - Self-retracting lanyard – (previous discussed)
  - Shock absorbing – slows and eventually stops the descent and absorb force
  - Synthetic rope – absorb some force by stretching
  - Synthetic webbing – strong and absorb little force
- When working on jobs that have risk of fall hazards, lanyards with shock absorption are required

- Lanyard hooks should be designed to lock for maximum safety
  - This design prevents the hook from opening accidentally

- One of the most important components of a fall protection system is the anchorage point
- There are two types of anchor points
  - Temporary
  - Permanent

- Temporary anchor points
  - Employees should use solid, structural supports
    - Structural support members
- Personal fall arrest systems must be attached to structures that can withstand the forces exerted by falling
  - OSHA standard states that the anchor point must be able to withstand 5,000 lbs for each person anchored to it
  - All connecting pieces must also be able to meet the 5,000 lb requirement

- Employees must not tie-off to:
  - Conduit
  - Sprinkler piping
  - Cable trays
  - Handrails
  - Other inadequate anchorage points
- Sharp edged supports (I-beams) must only be used as anchorage points in conjunction with beam straps



- Permanent anchor points
  - All permanent anchor points must be designed by a qualified person and approved by a registered professional engineer
- Free fall distance - the vertical displacement of the fall arrest attachment point on employees harness between onset of the fall and just before the system begins to apply force, arresting the fall

- The height of the anchor point effects the potential free fall distance
  - The higher the anchor point is from the D-ring, the shorter the free fall distance – this decreases the likelihood of injury during a fall
  - The lower the anchor point is from the D-ring, the longer the free fall distance – this increases the likelihood of injury during a fall
- Maximum free fall distance permitted is 6 feet
  - If an anchor point cannot be located above the D-ring, use a lanyard which is less than 6 feet long

- To reduce the risk of injury during a fall, there needs to be enough fall space below the worker to allow them to come to a complete stop

- When calculating the amount of fall space needed, take into consideration the following:
  - Distance of rope the grabbing device descended until fully locked
  - Extra length of webbing released by shock-absorbing lanyard
  - Extra amount of stretch when using vertical lifeline
- Ex. 6 ft. tall employee using 6 ft. long lanyard anchored to a rope-grabbing device attached with D-ring that is 5 ft. above working surface
  - If the worker falls 6 ft. he will be 1 ft. below the platform/working surface. The rope-grabbing device will activate and lock after about 2 ft. of sliding. If the lanyard releases its maximum amount of length, plus the additional stretch left in the lifeline – the total fall distance will equal about 13 feet (or 8 ft. from the platform).

- Harness Suspension Syndrome occurs when a person is held in the upright position (like in a body harness) for an extended period of time, resulting in the person fainting
  - If the person is not taken down in time, the brain will eventually lose blood supply which can lead to physical injury or death

- The following rules apply to all fall protection systems
  1. Before using any fall protection system, you must be properly trained to inspect and operate the system
  2. The user must perform an inspection of the fall protection equipment prior to using it, following manufacturer's instructions
  3. If equipment is found to be defective, it must immediately be taken out of service and discarded
    1. **ALL fall protection equipment is to be taken out of service if involved in a fall!**
  4. Always make sure equipment is kept clean and in good condition
    1. Oil, dirt, grease, etc. can soak into webbing and damage the webbing
    2. Always use soap and water to clean equipment, never solvents or bleach

- Equipment should not be exposed to:
  - Heat
  - Steam
  - Sunlight
- Check harness for:
  - Cuts
  - Tears
  - Abrasions

- Inspect hardware for:
  - Discoloration
  - Cracks
  - Charring
  - Distortion
  - Corrosion
  - Pitted Surfaces



- Do not use rope that is tied in knots
  - Ropes should not have any frays or broken fibers
- Do not use wire rope that has broken wire or kinks
  - Do not use lubricants on wire rope

- Training or retraining on fall prevention and protection must be conducted by a competent person and should take place:
  - Before worker is first assigned to duties that might expose him or her to falls
  - Whenever there is a change in the workplace or equipment that renders previous training obsolete
  - When there is reason to believe that previously-trained employee does not have necessary knowledge

# Questions?

- Contact Radiological & Environmental Management (REM)

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