FREEPORT-
McMoRan

STUDENT GUIDE

SFT FCX1012C
WORKING AT HEIGHTS

AUGUST / 2018
VERSION 1.1

"We start with looking after our workers' welfare."

Richard C. Adkerson
President and CEO, Freeport-McMoRan[1]

[1] Richard C. Adkerson, "Richard Adkerson CEO Freeport-McMoRan Copper & Gold." *Youtube.com,* May 4 2011, Accessed July 2, 2015. https://www.youtube.com/watch?v=j61aFypdvgE

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LEARNING OBJECTIVES

Learning objectives have been identified and provided to the students to establish guidance and focus throughout the course.

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Upon completion of Module 1, the student will be able to:

- Demonstrate the ability to recognize fall hazards.
- Describe fall hazards in routine and non-routine jobs.

MODULE 2: HIERARCHY OF CONTROLS

Upon completion of Module 2, the student will be able to:

- Explain the differences in the hierarchy of controls.
- Analyze a situation and recommend the most effective control.

MODULE 3: COMPONENT IDENTIFICATION AND SYSTEMS

Upon completion of Module 3, the student will be able to:

- Identify the components of a fall protection system.

MODULE 4: INSPECTION AND STORAGE

Upon completion of Module 4, the student will be able to:

- Define the different types of inspections.
- Demonstrate a pre-use inspection for a piece of fall protection equipment.

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Upon completion of Module 5, the student will be able to:

- Calculate the fall clearances for a given scenario.
- Evaluate a situation and select the appropriate system to use.

MODULE 6: FIT, DONNING, AND ADJUSTMENT

Upon completion of Module 6, the student will be able to:

- Demonstrate proper fit, donning, and adjustments of full body harnesses and lanyards.

MODULE 7: OTHER WORKING AT HEIGHTS SYSTEMS

Upon completion of Module 7, the student will be able to:

- Discuss the other types of equipment used to work at heights.

MODULE 8: RESCUE

Upon completion of Module 8, the student will be able to:

- Describe the components of a rescue plan.
- Demonstrate how to conduct a self-rescue.

FATAL RISKS AND CRITICAL CONTROLS

Fatal Risk Management is a continuation of the Fatality Prevention Program. Focus is placed on identifying Fatal Risks and Critical Controls in an attempt to safeguard all employees within the Company. The Fatal Risk Management Program standardizes Fatal Risk communication by implementing icons, definitions, and Critical Controls for twenty-three Fatal Risks.

Fatal Risks are based on safety issues that have resulted in catastrophic events such as severe injury or death. While all risks have a degree of danger, Fatal Risks are those risks that, when left uncontrolled, will kill you. After identifying a Fatal Risk, Critical Control(s) are implemented to prevent death or mitigate the consequences of the Fatal Risk. The absence or failure of a Critical Control significantly increases the risk of severe injury or death despite the existence of other controls. In short, Critical Controls help keep you from being killed. The Fatal Risk(s) and Critical Controls relevant to this course are provided below.

FALL FROM HEIGHTS

The Fall from Heights Fatal Risk is defined as working at height where the danger of falling exists.

Critical Controls

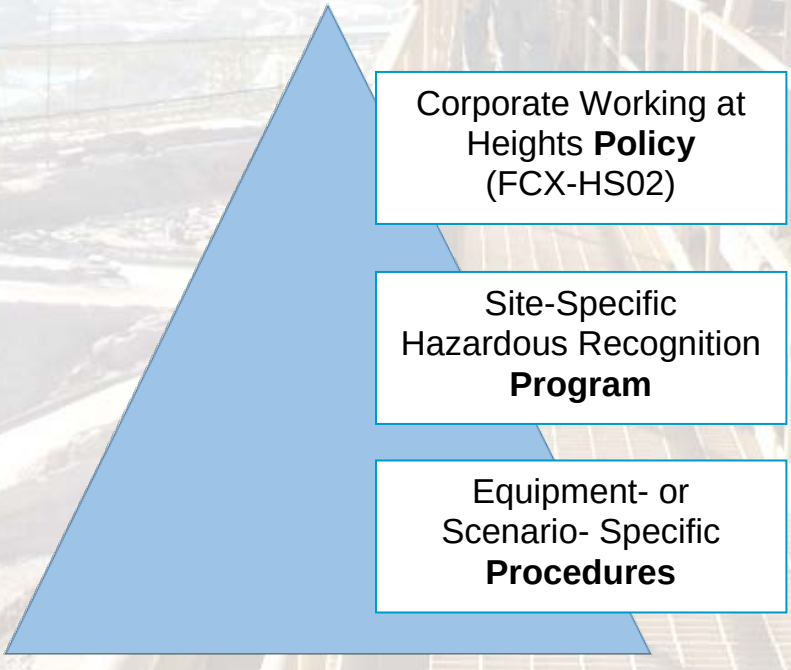
- Fall Protection System
- Fixed Work Platform
- Leading Edge/Open Hole Protection
- Mobile Work Platform
- Scaffold

COURSE INTRODUCTION

According to the U.S. Department of Labor Bureau of Labor Statistics, in 2013 699 people were killed and thousands more were injured as a result of work place falls, slips, or trips in the United States alone. Of those events, 574 (or 82%) were falls to a lower level[2]. Falls continue to be a top contributor of workplace fatalities in general industry, and a leading cause of fatalities in mining. With that staggering percentage, it is critical to focus on tasks that are performed at heights.

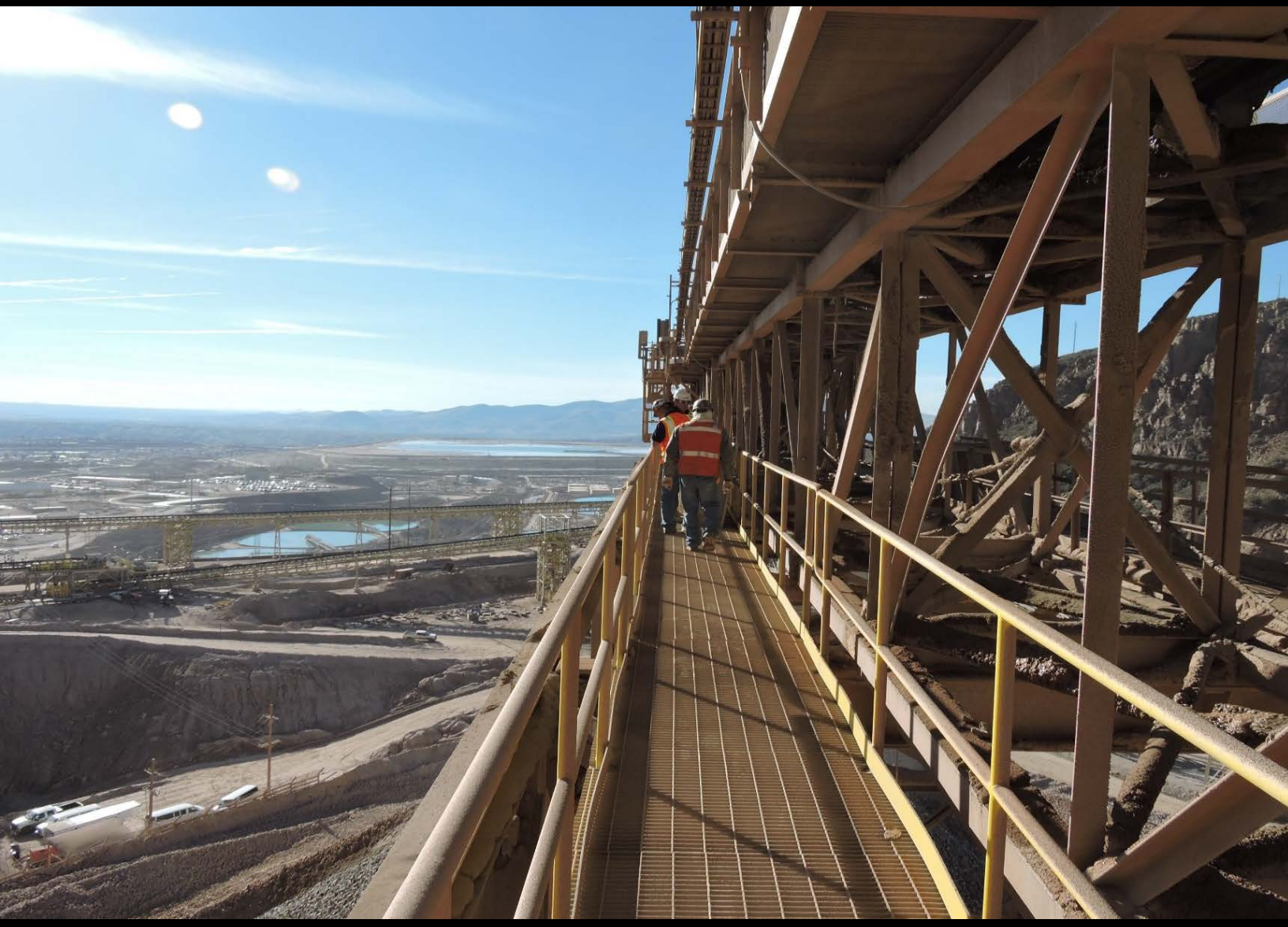
In alignment with Freeport-McMoRan's Fatality Prevention Initiative, the Department of Health and Safety has identified Working at Heights as a **"Fatal Risk"** and the Working at Heights Policy (FCX-HS02) addresses the minimum requirements and procedures when performing jobs where fall hazards exist. A Fatal Risk is considered anything that can kill you. Many of the tragedies that occurred were the result of taking unnecessary short cuts and here at Freeport-McMoRan, the time to do the job safely is built into every job.

This course was designed to meet the minimum requirements for an authorized user. If at any time you have a question in this class or while you are working in the field, it is your responsibility to stop and seek clarification.



[2]U.S. Department of Labor, "Census of Fatal Occupational Injuries Summary, 2013," *Bls.gov*, (2014). http://www.bls.gov/news.release/cfoi.nr0.htm

Fall Hazard Recognition



MODULE 1

MODULE 1: FALL HAZARD RECOGNITION

MODULE 1 LEARNING OBJECTIVES

Upon completion of Module 1, the students will be able to:

- Demonstrate the ability to recognize fall hazards.
- Describe fall hazards in routine and non-routine jobs.

INTRODUCTION

Fall hazards are present in our work environment. Typically, they occur where there is an unprotected change in elevation. Any walking or working surface that is four feet or more above the lower level must be provided with some sort of fall protection. Walking or working surfaces that are less than four feet, but are above sharp objects, corrosive substances, entrapment hazards, moving machinery, or other significant hazards, must also be provided some sort of fall protection.

Examples of fall hazards that are commonly found on our properties.

- Overhead crane maintenance
- Accessing equipment
- Aerial work platform
- Leading edges
- Retaining walls
- Electrowinning tanks
- Bio-reactors
- Grated walkways
- Ladders
- Open hole
- Bucket truck
- Tanks or containers
- Scaffolding
- In-pit crusher
- Shafts

FALL HAZARD IDENTIFICATION

Freeport-McMoRan's Working at Heights Policy (FCX-HS02) states that fall protection must be provided and used 100% of the time whenever persons are exposed to a fall hazard that could reasonably result in an injury to an employee working at height. This course will help employees identify these hazards, assess the risk, and know how to appropriately control for the situation.

Before the work begins, you should be thinking about and identifying any fall hazard in the surrounding area. Employees may not consider hazards above them, even though they exist. Falling objects are a common manner in which employees are injured. When working at heights, secure the area below you. It is important that you are aware of any hazard above, below or around you, prior to beginning a job. Maintain that awareness throughout your shift, even after preventative steps have been made, you could still be at risk.

Learn from Others

In 2012, a Sierrita mill operator was using a walkway at the end of the mill. He noticed that the existing barrier only came to knee level at one point on the walkway and was able to recognize this as a fall hazard. He immediately notified his supervisor and a handrail was installed. Through his actions, he reduced the risk and possibly prevented a serious injury or fatality.

FALLS FROM HEIGHTS

Falls from heights are unguarded falls from an elevation, which typically result in a serious injury or death. As stated earlier, in 2013, 574 people who were working at heights did not go home to their family or friends. That means that 574 moms, dads, sisters, brothers, aunts, or uncles never celebrated another birthday, holiday, or special event. Safety begins with you. Do not become a statistic.

In order to assess the risk of an assigned task, you must first understand the hazards. When determining if your job is considered one at heights, you should refer back to Freeport-McMoRan's Working at Heights Policy (FCX-HS02). Keep in mind that there are several factors involved; familiarize yourself with those details. It is up to you, as the employee, to identify any existing fall hazards prior to beginning a job. Missing or loose handrails, not tying off at the appropriate locations, or telling yourself that you have done this a hundred times before can all contribute to deadly consequences. Make the right decisions and use the appropriate tools that are available to you.

Learn from Others

On January 10, 2014, employees noticed a strong odor in the Pond Shop lunchroom. They decided it was probably a dead rodent between the mezzanine floor and false ceiling above the lunchroom. After lunch, the pond operator decided to investigate the cause of the odor. Using a 6 ft. ladder, he climbed to the mezzanine 8 ft. 5 in. above him and started removing the plywood flooring above the false ceiling. He lost his balance, fell through the false ceiling tiles, and landed on the lunchroom floor. He suffered a punctured lung and fractured skull, ribs, and thoracic vertebra.

The operator was not wearing fall protection or fall restraint.

Fig. 1 Mezzanine floor where plywood was removed above false ceiling

Fig. 2 Employee used 6ft ladder to reach up 8ft 5in

Discussion Question:

What was the hazard in this situation?

When a fall hazard is discovered in your work area:

- Remove yourself from the hazard.
- Secure the area and do not allow others to enter until the hazard has been controlled.
- Contact your supervisor immediately.

ROUTINE TASKS

Work that is regularly or frequently performed is considered a routine job. Any task, duty, or procedure that is repetitive and familiar places the employee at risk for complacency. Complacency is best described as feeling secure or comfortable performing a task or job, while overlooking potential dangers or risks.

For example, personal car accidents often occur within a short distance from home[3]. The idea being that the driver is performing a task so routine and familiar to them that they allow their focus to relax and shift away from potential hazards. When driving in a new location, drivers typically are more likely to watch for potential hazards or risks since they do not know the area.

The same can be said for our employees who conduct routine tasks multiple times throughout their day. Contrary to what many people may think, the majority of our serious incidents occur during routine activities. There are many positions within Freeport-McMoRan that include repetitive tasks, and because of this, our employees are at a higher risk of losing focus and not maintaining an awareness of changing situations. These changing situations can be anything from pedestrians, shift change, or equipment placement to light vehicle traffic, weather, or blasting.

Examples of routine work are when the:

- Job duties do not differ from day to day functions.
- Procedure is documented, such as in a Standard Operating Procedure (SOP).
- Job has a low-level risk.

Each department should be conducting their own risk assessments on their routine tasks. The following examples are tools that are available on all of the properties.

- Work area examinations.
- Pre-job risk assessment.
- Tailgate meeting.
- Fit for duty checks.
- Review of SOPs and other documents.

[3]Tom Ripley, "Where Crashes Occur," *drivingtoday.com*, http://www.drivingtoday.com/features/archive/crashes/index.html#axzz3YdZ7uwzI

FALL HAZARDS WITHIN A ROUTINE JOB

Overhead cranes are a common sight on our properties today. Without this piece of equipment, many tasks could not be performed. Cranes are used in the tank house, mill, crusher, and the smelter, to name a few. In this particular instance, the overhead crane assists the smelter by moving the ladle of molten copper throughout the building.

To keep this machine running in a safe and efficient manner, maintenance must be performed. The maintenance mechanic will lock out, tag out, try out the overhead crane, and proceed to the crane bay. The crane bay is a platform that is accessible by a staircase and is approximately four stories off the ground. It has a metal grate for a floor and is surrounded by permanent metal guardrails. There is room to walk and perform job duties.

Once the maintenance mechanic arrives at the platform, there are tie-off points available for his/her lanyard so that they can conduct their job safely. A work area inspection is conducted and then the maintenance is performed.

Fig. 3 Overhead crane in the smelter

Fig. 4 Overhead crane in smelter

EXPLANATION

This is a routine job because the maintenance on the crane is performed frequently. This is highly important so that the crane is kept in good working order, according to the manufacturer's specifications. It is also another line of defense against wear and tear. Maintenance mechanics regularly perform preventative maintenance on cranes multiple times throughout their work week. Due to the frequency and regularity of performing maintenance, this job would be considered routine.

NON-ROUTINE TASKS

At Freeport-McMoRan, we consider non-routine work as any job or task that is performed for the first time or on an irregular schedule. Routine jobs can quickly become non-routine jobs if the conditions change.

Examples of non-routine work are when the:

- Job duties differ from normal job duties.
- Procedure is without a documented process.
- Job is performed in a different way from the documented process, such as the original, Standard Operating Procedure (SOP).
- Routine tasks have a high level risk.
- Job turns into an emergency situation (unexpected).

While you can use the same tools available for routine tasks, there are additional options available as well. The following tools are some examples of other options:

- Gantt chart.
- Regular planning meetings leading up to the task.
- Higher level leadership involvement.
- Conducting a full risk assessment.

FALL HAZARDS WITHIN A NON-ROUTINE JOB

Using the same scenario with the overhead crane in the smelter, the situation will now change. The maintenance mechanic arrives at the crane bay and is about to perform the work area inspection. Upon arrival, he notices that the platform gate is missing. It appears that someone left the gate ajar and a crane operator has hit the open gate, causing the gate to fall off the platform. The property damage was not reported and therefore, the gate was not repaired. The routine job has now become a non-routine job.

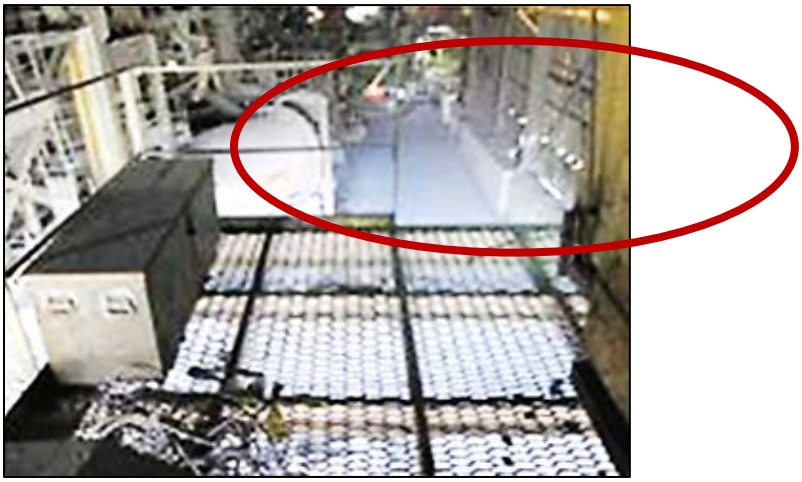


Fig. 5 Crane bay platform with missing gate

EXPLANATION

The crane bay platform gate has been broken off and there is no gate to protect that employee from falling off the platform. The area is no longer secure. Now, the maintenance mechanic must take the necessary steps to call in the repair for the gate prior to starting the maintenance on the overhead crane.

This is a non-routine job because the duties will differ from what was already planned for this time period. In addition, the situation has turned into an unexpected or emergency situation with the maintenance mechanic's safety now at risk. The risk is due to the missing gate and the potential fall off the platform, which is approximately four stories high.

ACTIVITY 3: FALL HAZARD DETECTIVE

Identify the existing fall hazard(s) in each picture. If there is not one present, write "none."

1.

Fall Hazard(s)

2.

Fall Hazard(s)

3.

Fall Hazard(s)

4.

Fall Hazard(s)

5.

Fall Hazard(s)

6.

Fall Hazard(s)

MODULE 1 QUIZ

Complete the following quiz.

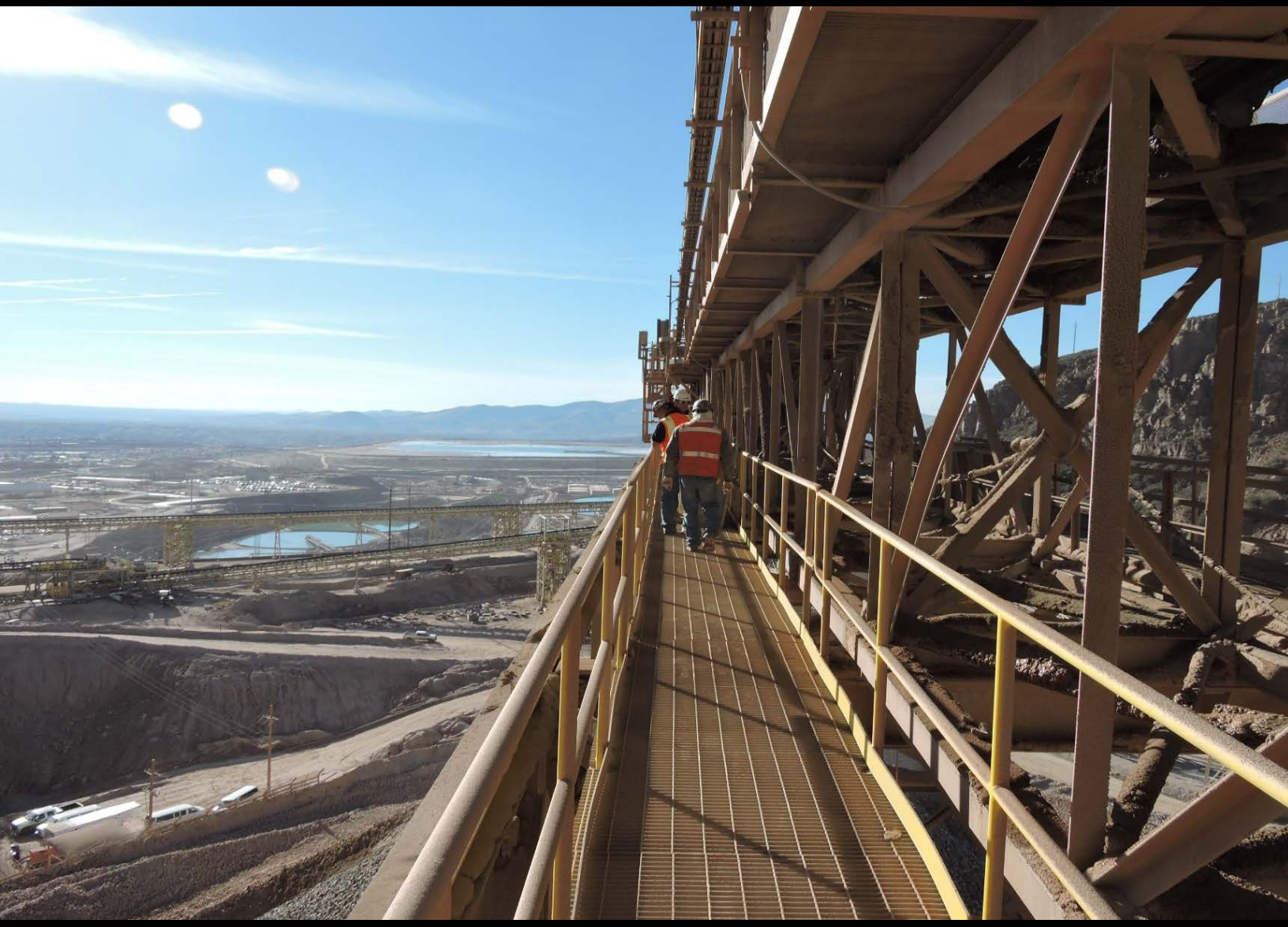
1. Which of the following is a fall hazard? Circle all that apply.
    a. Open hole
    b. Scaffolding
    c. Retaining walls
    d. Aerial work platform

2. What should you do if you encounter a fall hazard?
    a. Tell your co-worker and continue with your work.
    b. Leave it alone. Someone must be working on it.
    c. Remove yourself from the hazard, secure the area, and contact your supervisor.
    d. Set up proper flagging and continue with your work.

3. Using your work experience, list five routine working at height tasks from your work area in the columns on the left. For every routine task that you have listed, identify at least one factor in the columns to the right that could turn this into a non-routine task.

Routine task	Factors that impact the task

Hierarchy of Controls



MODULE 2

MODULE 2: HIERARCHY OF CONTROLS

MODULE 2 LEARNING OBJECTIVES

Upon completion of Module 2, the students will be able to:

- Explain the differences in the hierarchy of controls.
- Analyze a situation and recommend the most effective control.

INTRODUCTION

When determining which controls to use while assessing a job, you should begin with the question "Which one or ones are the most effective way to reduce a hazard?" This module will examine that approach, as well as looking at varying levels of controls and their effectiveness, when they should be implemented, and how to identify them.

Before beginning to work at heights, we need to assess the risk and put appropriate controls in place. Here at Freeport-McMoRan, we use the Hierarchy of Controls (Figure 6) to help us remove or reduce our exposure to hazards. The most effective control is at the top of the pyramid – Elimination. These are highly reliable controls where worker behavior plays only a small role. Controls at the bottom of the pyramid (such as Personal Protective Equipment, or PPE) are less reliable because worker behavior plays a much larger role.

By applying these controls, hazards can potentially be avoided, or at least managed. Each control, when used appropriately, plays a role in protecting employees. Even when controls are put in place, there is another critical factor that can impact the end result – behavior. As you can see from this image, behavior is present in every level of control. Taking shortcuts, ignoring regulations, incorrectly applying a control, or thinking "this cannot happen to me" can all contribute to an injury or a fatality. We discuss each control in the following pages.

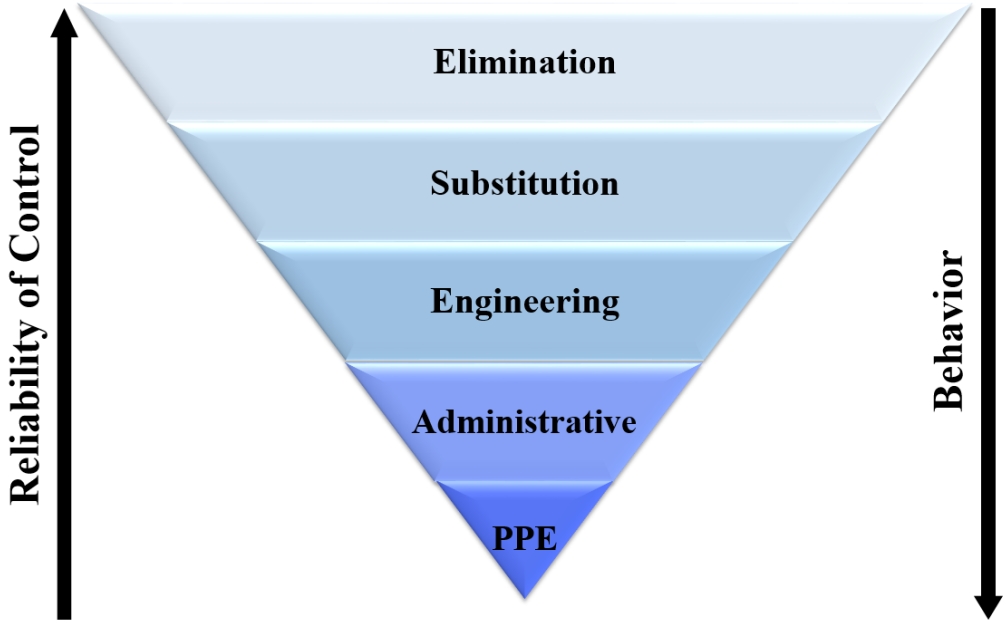


Fig. 6 Hierarchy of Controls

ELIMINATION

The best defense is to apply the most effective control, which is elimination. This control should be used whenever possible. Essentially, elimination is the process of getting rid of the hazard entirely from the workplace.

Specific to jobs that are performed at heights, you should ask yourself "Is there a way that I can eliminate the hazard of working from a height? Can I do this job with my feet on the ground?" By beginning the job with that mindset, you are analyzing the situation with elimination in mind.

EXAMPLE OF ELIMINATION

In the past, water trucks were filled manually. This involved the employee climbing on top of the water truck, opening the hatch, and visually examining the interior of the tank. When the water reached capacity, the employee would stop the water flow.

It was determined for this task that a fall hazard was present with the height of the truck, the potential slippery surface, and the lack of guardrails. To eliminate the employee climbing on to or across the top of the water truck, a solution was needed.

The end result was a device that allowed the water level to be monitored remotely. When the water overflows, the employee can stop the flow with a remote switch. This is a successful use of applying elimination. The employee remains on the ground and the task is no longer performed at a height.

Fig. 7 Filling a water truck

There are a few different reasons why this task can result in a fall. The greatest risk being that the employee must climb a ladder to reach the top of the water truck, thus elevating their working space. In addition to this, there are no guardrails or tie-off points on the top of the truck. Finally, working with water can create a slippery surface. With these reasons alone, the employee has placed themselves in a situation with an increased risk of falling.

SUBSTITUTION

When elimination is not possible, the next recommended control in the hierarchy is substitution. Substitution is using a less hazardous chemical, substance, or practice in place of a highly hazardous one. Unlike elimination which completely removes the hazard, substitution replaces the hazard with a less hazardous option.

EXAMPLE OF SUBSTITUTION

First-Man-Up™ system allows an anchor point to be installed from the ground rather than having to climb a ladder. The fall hazard still exists, as working from a height, or an open hole, cannot be avoided; however, the risk has decreased. The employee no longer needs to use a ladder or aerial work platform to install the strap. The risk of elevating the employee is substituted with installing the strap on the beam from the ground.

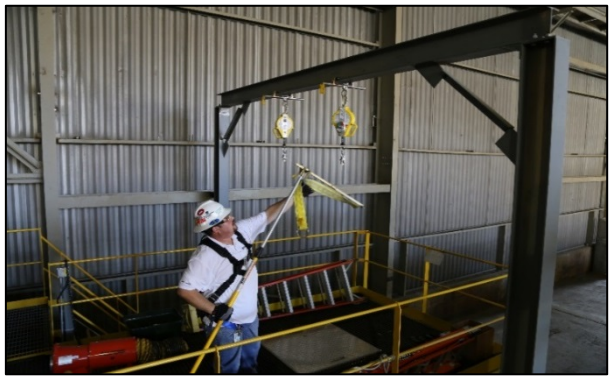


Fig. 8 Using First-Man-Up™ in simulated environment

ENGINEERING

When hazards cannot be eliminated or substituted, we can attempt to engineer a control. This typically involves the creation of a device or barrier to prevent employees from coming in contact with the hazard. The devices can be permanent, semi-permanent or temporary and include such items as, guardrails, handrails, work platforms, or covers, to name a few.

If you encounter a situation that you believe needs an engineering control, ask yourself "Is there something that can be built, installed, or used (such as tools) that will keep me away from the hazard?"

EXAMPLE OF ENGINEERING

An open hole was identified at the top of the access ladder. A hatch was installed to stop workers from falling to another level. Unfortunately, when the hatch is open and the ladder is being used, there is once again an open hole. The original engineering control was not completely effective. In order to resolve this issue, a second engineered control was created. Handrails were installed around the hatch to protect the employee when the hatch is left open.

Fig. 9 Closed hatch

Fig. 10 Handrails around the hatch

ADMINISTRATIVE

Administrative controls are less effective than elimination, substitution and engineering. Typically, administrative controls include things like policies, regulations, signage, Job Safety Analyses (JSA), Risk Assessments, and SOPs. Since this level of control is not a physical barrier, it is critical that employees pay attention to the information that is communicated to them. Administrative controls can be seen around the properties in the form of flagging, forms, and signage. These are considered less effective because the hazard still exists and the safety of the employee is entirely dependent on their behavior and choice to abide by the control in place.

EXAMPLE OF ADMINISTRATIVE

Training is another type of administrative control. Employees are required to have training prior to working where a fall hazard exists. Training may take place in a classroom, as well as in the field. In addition to the initial training, there is also annual refresher training. Annual refresher training revisits current policy requirements, as well as updates to existing procedures. Employees working with personal fall protection systems will receive more specific training on the equipment they are using.

Signage is also used to communicate administrative controls, such as handrail weight capacity and warning not to use to tie-off points.

Fig. 11 Signage

Fig. 12 Employees in training

PERSONAL PROTECTIVE EQUIPMENT (PPE)

PPE is considered the least effective control within the hierarchy, as it relies on the behavior of the employee to properly use it. The employee must locate the appropriate PPE, wear it correctly and then use it for the manner in which it was intended. This can result in human error or shortcuts.

Some examples of PPE for jobs performed at heights include:

- Lanyards
- Body harnesses
- Hardhats
- Face shields

EXAMPLE OF PPE

Fig. 13 Using a harness

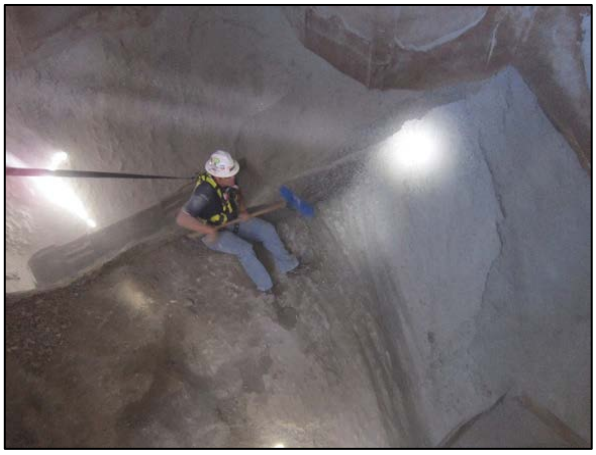


Fig. 14 Using a lanyard

BEHAVIOR

Although not directly a control in the hierarchy, behavior plays a key role in the effectiveness of the established controls. Behavior can cause a person to walk around a barrier, ignore a sign, or choose not to wear the proper PPE. It is ultimately up to each person to be aware of the hazards present in their work area and fully commit to making the right choices each and every time. There is not a single shortcut worth your life or the lives of your coworkers.

EXAMPLE OF BEHAVIOR

"An employee was repairing a piece of equipment while he was tied off to a beam with a 6 ft. Long beam strap. Since he was working at a height of 9 ft., I asked if I could talk to him for a second. As he descended down and reached the floor, he only then realized that he had not un-hooked his snap hook. At that point, I asked him if his fall protection would have worked. He shook his head no and then thanked me." -Mike L., Sierrita

Learn from Others

On April 6, 2015, while installing floor grating for a walkway, a section of grating was removed to be cut. The resulting gap in the walkway was hard barricaded. An employee identified a lifeline hanging loose across the incomplete sections. Two employees began tightening and securing the line properly before leaving the area for lunch. When they returned to complete the job, one employee climbed over the hard barricade, walked along the incomplete sections of grating, and fell through the gap to the concrete floor 6.8 meters (approximately 22 feet) below. He suffered facial lacerations, a small fracture on the back of his skull, and a fractured nose.

The employee did not secure his harness.

Fig. 15 Barricade employee crossed

Fig. 16 Gap between floor grating sections

ACTIVITY 4: APPLYING THE HIERARCHY

Read through the scenarios. Create a solution for each control within the hierarchy. What is the most likely control that you can implement? Be prepared to discuss the risk in each scenario.

Scenario 1
You are a warehouse employee and are given the task of replacing a light bulb in the shop. The light fixture is eight feet off the ground. Complete the chart below by supplying a solution for each control. Then, circle the most effective option based on the Hierarchy of Controls.

Control	Solution
Elimination	
Substitution	
Engineering	
Administrative	
PPE	

Scenario 2
You are told that a pump has malfunctioned on top of a 20-foot lime tank. There is a fixed ladder attached to the tank. Complete the chart below by supplying a solution for each control. Then, circle the most effective option based on the Hierarchy of Controls.

Control	Solution
Elimination	
Substitution	
Engineering	
Administrative	
PPE	

CONTROLLING HAZARDS IN ROUTINE TASKS

Routine tasks are the day to day tasks and procedures that are common to your work area or job duties. During these routine tasks, the scope of the work should begin with a Formal Risk Assessment. These risk assessments can be in the form of a JSA, Risk Analysis, or Open Hole Permits, for example. This procedure assists with the identification of hazards and outlines the steps for the department Risk/Task Register.

While completing the risk assessment, apply the hierarchy of controls, beginning with elimination. Since it is often not possible to eliminate the hazard, be prepared to use the appropriate PPE only as a last resort. The assessments are followed by field assessments to ensure identified controls are used, and are effective, and also, help determine if new risks have been introduced.

CONTROLLING HAZARDS IN NON-ROUTINE TASKS

Non-routine tasks are anything that deviates from your normal job duties. These include emergency situations, changes in the environment (e.g.: erosion, weather, hazardous fumes, moving equipment, etc.), or infrequent procedures. When encountering a non-routine task, the hierarchy of controls should also be applied. This can be accomplished through a generic SOP or informal risk assessment.

MODULE 2 QUIZ

Complete the following quiz.

1. List the Hierarchy of Controls in order of effectiveness.

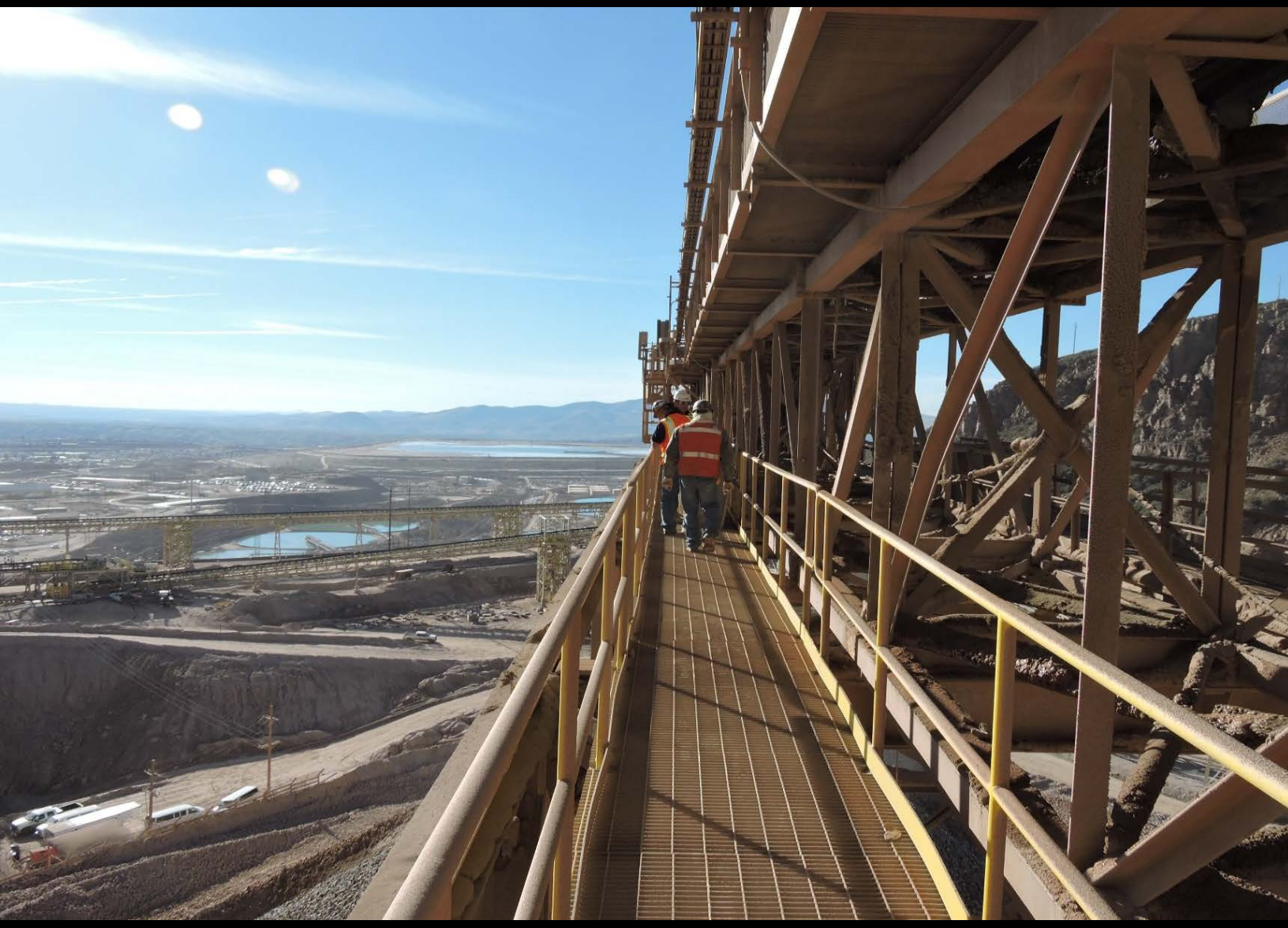
2. You notice a grate missing in the catwalk that is 10 feet off the ground, but you are able to find assistance with putting a temporary guardrail around the hole. What control is this an example of?
   a. Substitution
   b. Elimination
   c. Engineering
   d. Administrative

3. Your co-worker is using the top rung of the ladder to perform maintenance on a haul truck. You remember hearing at your tailgate meeting about ladder safety and suggest using a scissor lift (a form of mobile scaffolding that elevates employees in a vertical motion) instead. What control is this an example of?
   a. PPE
   b. Substitution
   c. Elimination
   d. Administrative

4. At the safety meeting, they announce that guardrails are being installed in the tankhouse to prevent employees from falling off the platform. What control is this an example of?
   a. PPE
   b. Substitution
   c. Engineering
   d. Administrative

5. You notice a sign stating “D-ring Tie-off Point. This is for employee use only.” What control is this an example of?
   a. PPE
   b. Elimination
   c. Engineering
   d. Administrative

Component Identification and Systems



MODULE 3

MODULE 3: COMPONENT IDENTIFICATION AND SYSTEMS

MODULE 3 LEARNING OBJECTIVES

Upon completion of Module 3, the students will be able to:

- Identify the components of a fall protection system.

INTRODUCTION

The policy (FCX-HS02) states that fall protection must be provided and used 100% of the time when an employee is exposed to a fall. Simply put, fall protection is a means of protecting the employee through permanent barriers, fall restraint systems, fall positioning systems, and fall arrest systems. These systems will be discussed in more detail later in the course.

Deciding which system to use requires knowledge of the specific pieces of equipment available. Each system is comprised of different components. It is critical that every employee that works at heights can correctly identify these components. This skill can aid the employee in selecting the appropriate system, properly inspecting it, and donning or connecting it in the safest manner possible.

There are three basic methods for active fall protection.

1. Fall restraint: designed to prevent workers from reaching a fall hazard
2. Fall positioning: holds the employee in place while keeping his/her hands free to work; however, the positioning system is not specifically designed for fall arrest purposes.
3. Fall arrest: designed to protect the employee by stopping them before hitting a lower level and minimizing injury

Check with your Health and Safety Professional, or Supervisor for site-specific equipment.

ABC'S

The ABCs of fall protection are the three components that are identified for maximum protection of the employee. These will vary depending on the fall protection system that is used for the job.

The "**A**" stands for anchors or anchor points. They are a secure point of attachment for lifelines, lanyards or deceleration devices.[4] Guardrails and handrails are not considered anchor points, unless they are specifically designed for that. In general, for any fall restraint, the anchorage point must be able to withstand 1000 lbs.; with the positioning system, the anchorage must be able to withstand 3000 lbs.; for fall arrest systems, they must be able to withstand 5000 lbs. If the strength of the anchor point is not known or if there are any questions, seek clarification with your supervisor.

Fig. 17 Tie-off point on a haul truck

Fig. 18 Tie-off point on an aerial work platform

The "**B**" stands for body wear (also known as PPE). As it relates to harnesses, the body wear would be the series of straps which secure the employee so that the fall arrest forces are distributed over at least the thighs, pelvis, and waist.

Fig. 19 Back of a full body harness

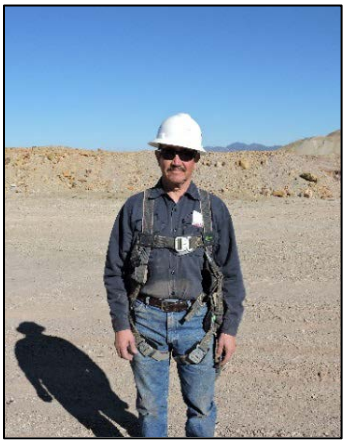


Fig. 20 Front of a full body harness

[4] Unknown author, *OSHA Standards for General Industry* (Davenport, IA: MANCOMM, 2013), 43-44

The "**C**" stands for connecting devices, such as SRLs. These are used to couple (or connect) parts of the system together. All connectors and components need to be able to withstand the maximum possible impact on the system.

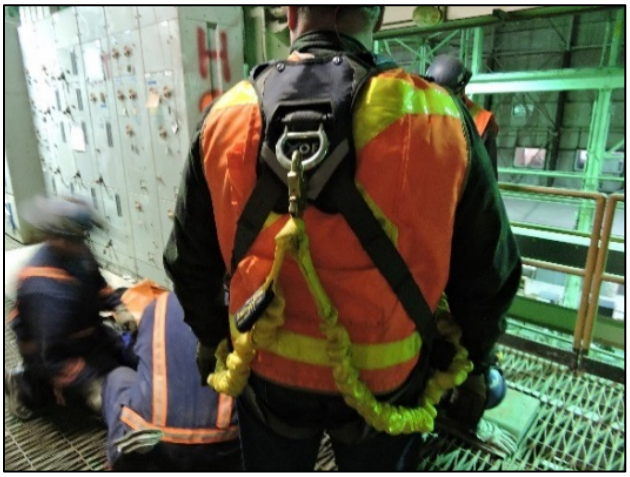


Fig. 21 Shock-absorbing lanyard attached to the D-ring

Be on the Lookout

"While providing pole top and bucket rescue training, an employee wanted to know if it was ok to attach his lanyard to the "da" (double-arming) bolts at the cross arms. I reminded him that line equipment is not rated for fall restraint/protection and it would be best to use the approved tools and equipment to safely attach. He then understood that he was about to tie-off to an unsafe anchor and I gave him two different options.

- *Use the multi-use technical tool (mutt), which is a rated device and easily attaches to the pole or tower structures.*
- *Use a rated strap with "d" rings to wrap around the cross arm for attachment."*

-Craig K., MTI

Fig. 22 Mutt

Fig. 23 Where employee wanted to tie off

Discussion question:

Why was this a safety success?

ANCHORS

Anchors are the foundation of your fall protection system. It may not be obvious when you are using an anchor incorrectly, yet the danger still exists. Educating yourself on anchors is critical as there may be instances where you will have to create your anchorage point.

Handrails and scaffolding are never suitable anchor points, unless engineered by a qualified person to withstand 5000 lbs. of force.

Fig. 24 Example of Engineered Anchor

Fig. 25 Example of Engineered Anchor

BEAM STRAP

Beam straps are a type of temporary anchorage connecter that are used as anchor points when working with structural supports like I-beams. The beam strap has a ring at each end, with one being slightly larger than the other. The strap is wrapped around the support beam, and the small ring is passed through the large ring. The small ring then becomes the anchor point for the lanyard. When using a beam strap, be sure that all slack has been removed from the line prior to attaching your lanyard. You want the strap to be as tight around the beam as possible.

Fig. 26 Example of a Beam Strap

I-BEAM CLAMP

Also known as, a fixed beam anchor, an I-beam clamp is another anchorage connecter. I-beam clamps can either be fixed in one place (when used with a vertical beam), or mobile (when used with a horizontal beam). When used with a horizontal beam, an I-beam clamp can provide protection to the worker while still allowing for mobility.

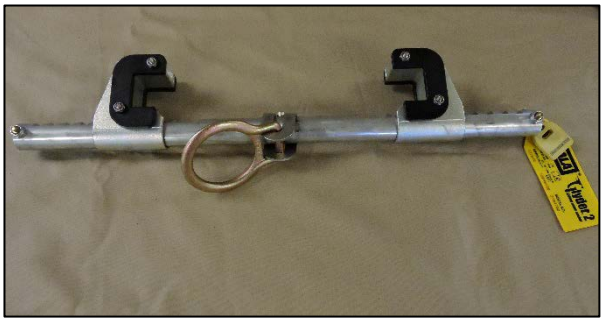


Fig. 27 Example of an I-Beam Clamp

Fig. 28 Example of an I-Beam Clamp

I-BEAM ROLLER

I-beam rollers (beam trolleys), are intended for use with a horizontal beam support. This device allows the worker to move freely in the direction of the beam, while still maintaining a secure anchor point.

Fig. 29 Example of an I-Beam Roller

BODY WEAR

The harness connects the worker to the rest of the fall protection system. Proper understanding about function, fit, and the components associated with the harness being used is crucial. An improperly used, damaged, or ill-fitted harness can severely injure a worker during a fall.

FULL BODY HARNESS

This harness protects the employee by supporting them in an upright position once a fall has been arrested. The harness is designed to distribute the shock from a fall evenly throughout the body. This helps to minimize the internal trauma that can result from a fall. The straps hug the employee around the chest, shoulders, waist, and legs. There are four components of a full body harness: hardware, webbing, labels and stitching.

Fig. 30 Employee using Full Body Harness

Fig. 31 Employee using Full Body Harness

BODY BELT

These belts only secure around the waist. They may be used in conjunction with a fall positioning system, but never in a fall arrest system. Unlike a full body harness, a body belt is NOT designed to distribute the force from a fall throughout the entire body. Body belts have caused severe internal injuries to workers' mid-sections when used in a fall arrest system.

Fig. 32 Example of a Body Belt

CONNECTING DEVICES

Connecting devices are a means of coupling or attaching components of a fall protection system to each other. A large variety of connecting devices exist in order to accommodate a wide array of working conditions. Never use tools or equipment that are homemade or have been modified. Ensure that they are designed for fall protection purposes only. Several of the connecting devices shown (i.e. lanyards and rope grabs) also act as deceleration devices. Deceleration devices are mechanisms which serve to dissipate a substantial amount of energy during a fall arrest or otherwise limit the energy imposed on a person during a fall arrest.

LANYARD

Lanyards are used to connect the harness to the anchor point. They come in a variety of materials and lengths to accommodate the task being performed. They may include an energy-absorber and connecting device. Lanyards used for fall arrest systems will include a deceleration device designed to limit the maximum arresting force on the user to 1800 lbs. (816 kg).

Fig. 33 Example of a Lanyard

SHOCK-ABSORBING LANYARD

This is a fixed length lanyard with a built-in shock-absorber. The shock-absorber protects the employee by minimizing the force transferred to the body in the event of a fall. The length of these lanyards can vary between two and four feet. Best practice for this lanyard is to use the shortest available option that allows you to complete the job.

Fig. 34 Example of a Shock-Absorbing Lanyard

Y LANYARD

Similar to a shock-absorbing lanyard, this is a fixed length lanyard that allows you to connect to two anchor points simultaneously. The Y lanyard has the ability to allow greater employee movement while still remaining anchored 100% of the time. Both anchor connections do not need to be attached for the lanyard to arrest a fall.

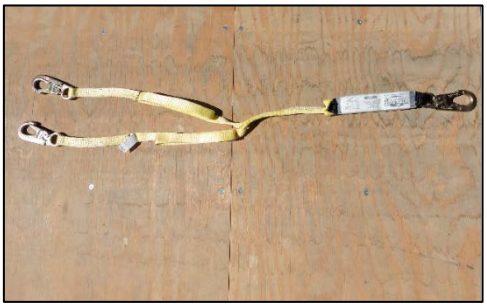


Fig. 35 Example of a Y Lanyard

POSITIONING AND RESTRAINT LANYARD

This can be a rope, webbing, or cable lanyard. It is only used as a position or restraint device. These lanyards do not contain a shock-absorbing component and should never be used in a fall arrest system. Employees have been severely injured when using this type of lanyard during a fall event.

Fig. 36 Example of a Positioning and Restraint Lanyard

SELF-RETRACTING LANYARD / LIFELINE (SRL)

An SRL is a variable length lanyard that employs a locking mechanism similar to that of a car seat belt. There are four components to an SRL: housing, cable or webbing, connector, and impact indicator. In the event of a fall, the rapid deployment of the webbing will cause a braking mechanism in the house to engage which will arrest the fall. In an SRL, the retracting line attaches to the D-Ring.

Fig. 37 Example of an SRL

DOUBLE PERSONAL FALL LIMITER (PFL)

Similar to Y Lanyards, double PFLs allow for 100% anchoring and otherwise function the same as a single PFL (some sites call these SRLs). Both anchor points with a double PFL do not need to be engaged for the system to arrest a fall. PFL's are the preferred devices worn when working with an aerial work platform. In a PFL, the retracting line attaches to the anchor.

Fig. 38 Example of a Double PFL

CARABINER AND SNAP HOOK

Snap hooks are self-closing/self-locking connectors used to secure lanyards both to anchor points and harness D-rings. The gate on a snap hook secures automatically. Carabiners are similar in function to snap hooks, but may require you to manually lock the gate once the carabiner is connected. Both of these devices are required to be able to withstand 5000 lbs. of force and 3600 lbs. of force at the gate.

Fig. 39 Example of a Carabiner

D-RING

D-rings are the connection point between your lanyard and your harness. The dorsal (back) D-ring is the proper location for a fall arrest system. Certain harnesses may have D-rings located at the chest or hips. These D-rings are not intended to arrest a free fall. Chest D-rings are most commonly used when ascending/descending ladders, and hip D-rings are for positioning purposes only. Failing to attach to the proper D-ring can result in severe injury or death in the event of a free fall.

Fig. 40 Example of a D-Ring

ROPE GRAB

A rope grab is the mobile anchor point that secures to a lifeline. As an anchor point, a rope grab is intended to secure a lanyard as part of a fall arrest system. A rope grab allows the worker to move either up or down the lifeline while still maintaining fall protection. If the worker should fall while using a rope grab, an internal locking mechanism will engage, and the anchor point will stop moving along the lifeline.

Fig. 41 Example of a Rope Grab

VERTICAL LIFELINE AND HORIZONTAL LIFELINE

A vertical lifeline serves as a pathway for a sliding rope grab. Lifelines come in a variety of materials and widths. The application will dictate which type of lifeline is most appropriate for the job but only one person at a time may be connected. Only lifelines made from wire can be used in a horizontal direction and all must have a minimum breaking strength of 5000lbs (2268 kg).

A horizontal lifeline serves as an anchor point similar to a horizontal I-beam. The lifeline is fixed between two points, and allows for movement by a worker. The worker can attach a lanyard directly to a horizontal lifeline with a variety of connecting devices.

Fig. 42 Example of a Lifeline (Horizontal and Vertical)

FALL RESTRAINT SYSTEMS

A fall restraint system is used to hold the employee at a specific distance from the fall, such as leading edges or open holes. The lanyard does not expand any further. It acts as a leash of sorts that tethers the employee to an exact area and eliminates any possibility of free fall. The anchorage must be able to withstand 1000 lbs. of force. If there is an opportunity to reach an edge and fall any distance, the system will need to be reconfigured or a fall arrest system will need to be used.

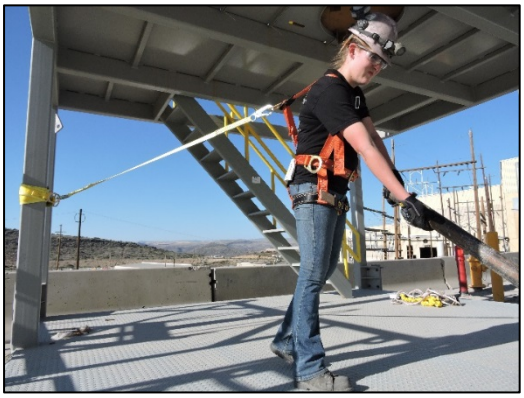


Fig. 43 Using a fall restraint system

LIMITATION OF A FALL RESTRAINT SYSTEM

- Limited work area

FALL POSITIONING SYSTEMS

A fall positioning system allows the employee to conduct their work hands-free. This system is used for work on elevated vertical surfaces, such as welding on the side of a building or working on a power pole. The positioning system must be able to withstand 3000 lbs. of force. The employee is still exposed to the hazards; therefore, this system must be used in conjunction with a fall arrest system.

Fig. 44 Training on a fall positioning system

LIMITATIONS OF A FALL POSITIONING SYSTEM

- Limited work area
- Weak anchor points

FALL ARREST SYSTEMS

A fall arrest system is designed to stop a free fall in a controlled manner once it has started. This system includes the use of a self-retracting lanyard (SRL) or a shock-absorbing lanyard, a full body harness, and an anchor point. The anchorage must be able to support up to 5000 lbs. per person.

Fig. 45 Employee using a fall arrest system

LIMITATIONS OF A PERSONAL FALL ARREST SYSTEM (PFAS)

- Weak anchor points
- Free falling too far
- Insufficient fall clearance
- Not aware of swing falls
- Falling out of a harness, either not properly sized or donned

Learn from Others

On July 9, 2013, a contractor was working on a 793 haul truck and needed to cross from one side of the engine to the other. Since the step mounted to the top of the engine had been removed, he used a lower mounted step. As the employee's weight shifted to the step, the step broke from its mounting causing the contractor to lose his footing and fall approximately 12 feet to the ground. There were no injuries as a result of this fall.

The use of fall prevention could have prevented the employee from falling to the ground. However, no hazard had previously been identified in this area so no fall arrest or fall prevention equipment was being utilized.

Fig. 46 Space employee fell through and location of fall

ACTIVITY 5: NAME THOSE COMPONENTS

Topic: _____

Components of topic

Pros

Cons

Limitations

MODULE 3 QUIZ

Complete the following quiz.

Select the correct answer for each description from the options listed. Write the corresponding letter for that answer in the table below.

1. Sometimes is equipped with an energy-absorber.
2. Only secure around the waist and cannot be used in a fall protection system.
3. Temporary anchorage connector used as an anchor point when working on structural supports.
4. Connection point between your lanyard and your harness.
5. A mobile anchor point that secures to a lifeline.
6. Self-closing or self-locking connectors that are able to withstand 5000 lbs. of force and 3600 lbs. of force at the gate.
7. Designed to distribute the shock evenly throughout the body and keep employee in an upright position once a fall has occurred.

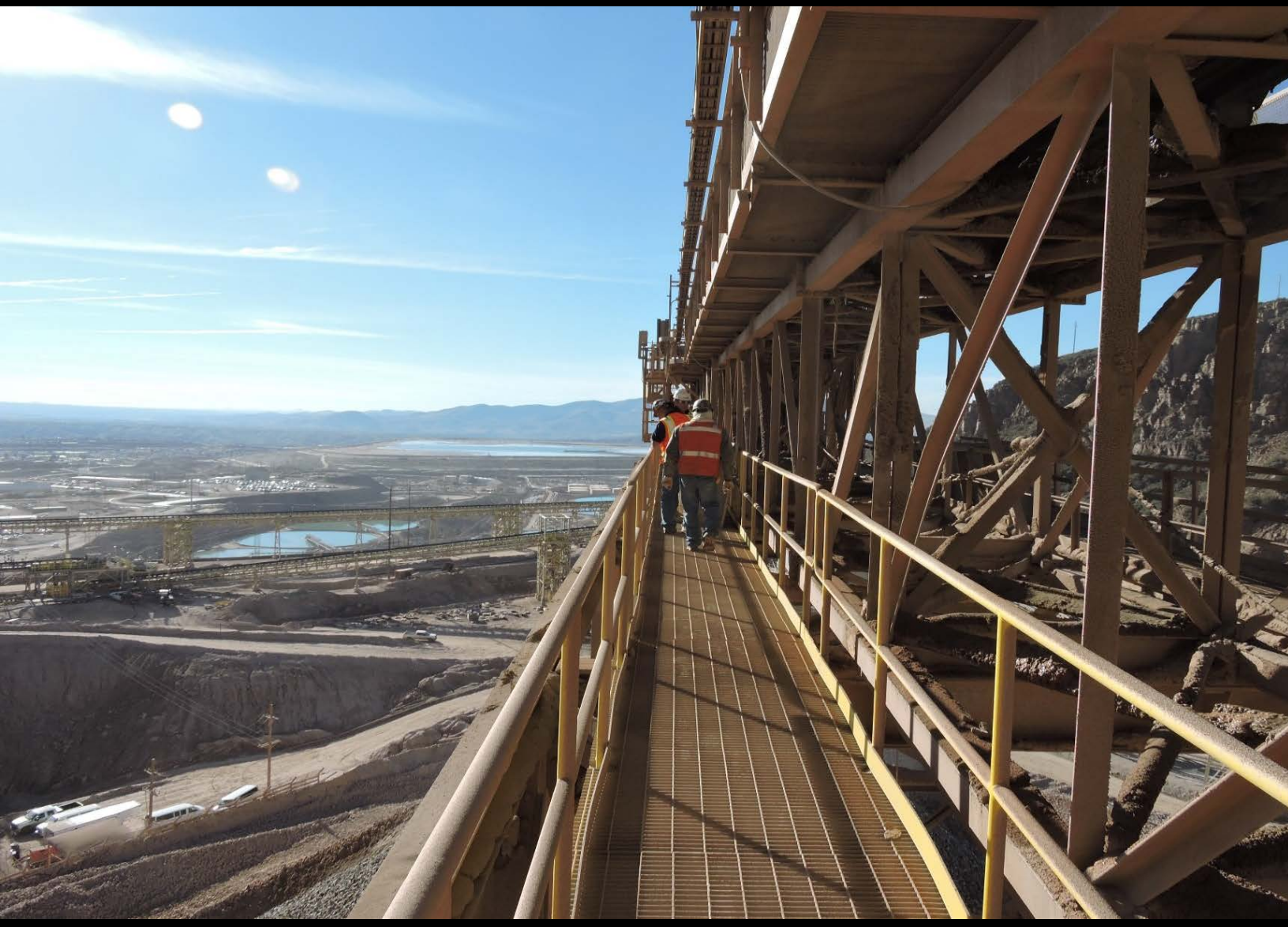
Answers

A. Beam strap
B. Shock-absorbing lanyard
C. Body belt
D. Horizontal lifeline
E. Double SRL
F. Carabiner and/or snap hook
G. Y lanyard
H. Full body harness
I. Lanyard
J. Rope grab
K. I-beam clamp
L. D-ring

1	2	3	4	5	6	7

8. What are the ABCs?
   a. Anchor points, body wear, connecting devices
   b. Anchor points, body armor, communication plan
   c. Anchorage points, body harnesses, company policy
   d. Aerial platforms, body harnesses, connecting devices

Inspection and Storage



MODULE 4

MODULE 4: INSPECTION AND STORAGE

MODULE 4 LEARNING OBJECTIVES

Upon completion of Module 4, the students will be able to:

- Define the different types of inspections.
- Demonstrate a pre-use inspection for a piece of fall protection equipment.

INTRODUCTION

All equipment, tools, PPE, and barriers (handrails, toe boards, etc.) eventually wear out. Inspections are regularly performed on equipment as a means of lengthening the life and proactively catching any issues before they occur.

Inspections are not the only factor in extending the life of the PPE; storage plays a key role as well. Proper storage guidelines are established for both prolonging the durability, and maintaining the safety of our employees. Adhering to the storage guidelines after each use is as important as cleaning the equipment of dirt, corrosives, and contaminants. If inspection records are maintained on a label affixed to the fall protection component, follow manufacturer's recommendations for the proper type of ink/pen to use.

INSPECTION

It is the employee's responsibility to inspect and maintain his/her equipment according to the guidelines established in the policy and by the manufacturer. Each component or piece of fall protection equipment has its own specific procedure. There are several components involved in a fall protection system. The inspections for each component will vary, but are important all the same. We will look at the general inspection process, but it is important that you check with your site for specifics.

If any sign of damage or unsafe conditions are noticed during an inspection, the item must be immediately removed from service or tagged for further investigation. This includes any equipment that has been involved in a fall, even if this equipment does not show any signs of damage. Follow the life expectancy guidelines of the equipment, according to manufacturer recommendations.

HARNESS: WHAT TO LOOK FOR

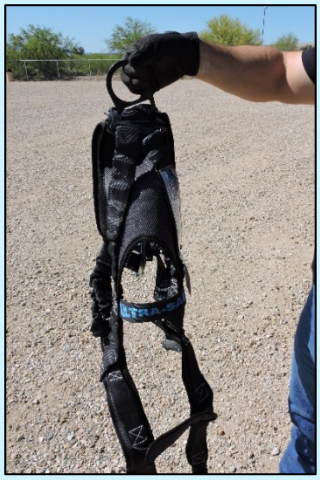
Harnesses are worn around the body of the person. They are typically made of a webbing material. Components of the harness include: hardware, webbing, labels, and stitching.

Component	Inspect for
Harness hardware (buckles, D-rings, back pad, loop keepers)	Damage, broken, distorted, and free from sharp edges, burrs, cracks, worn parts, or corrosion.
Webbing	Frayed, cut or broken fibers. Look for tears, abrasions, mold, burns or discoloration. Check stitching for pulled or cut stitches.
Labels	Location and fully legible.
Stitching	Loose or frayed stitching.

If any part of the harness is defective, partner with your supervisor to remove it from service. It will then be secured until it can be repaired, or destroyed. Always refer to the manufacturer for further inspection recommendations.

HARNESS INSPECTION

1. Hold harness by the D-ring.



2. Inspect for deterioration of webbing or hardware.

3. Is the manufacturer label legible?

4. Inspect straps for twists or knots.

5. Document your inspection.

FULL BODY HARNESS INSPECTION CHECKLIST / LOG

Harness Model: _____ Manufacture Date: _____
Serial Number: _____ Lot Number: _____ Purchase Date: _____
Comments:_____
_____
_____

Component	Pass / Fail	Comments
1. Hardware: (D-rings, buckles, back pad, grommets, loop keepers) Inspect for damage, distortion, sharp edges, burrs, cracks, and corrosion.	☐ Pass ☐ Fail	
2. Webbing: Inspect for cuts, burns, tears, abrasion, frays, excessive soiling, and discoloration.	☐ Pass ☐ Fail	
3. Stitching: Inspect for pulled or cut stitches.	☐ Pass ☐ Fail	
4. Labels: Make sure that all labels are legible and properly secured.	☐ Pass ☐ Fail	
☐ **Pass** ☐ **Fail**	**Inspected By:** _____ **Date:** _____	

LANYARD: WHAT TO LOOK FOR

There are three different types of lanyards available – cable or wire, webbing, and rope. The lanyard is attached to the anchor point and the D-ring. There are many factors that can shorten the life of the lanyard. Carefully inspect for any sign of damage.

Signs of damage to webbing, cable or wire, and rope lanyards	
Heat **Note: Never use above 180 degrees Fahrenheit**	• Nylon becomes brittle to the touch. • Appearance can turn brownish or have a shriveled look. • Fibers easily break when flexed. • Wire rope can melt and fuse.
Chemical	• Appearance can be either a brown smudge or smear. • When belt is bent, cracks may appear which results in loss of elasticity.
Ultraviolet Rays **Note: Do not store in direct sunlight**	• Webbing will appear faded.
Molten Metal or Flame **Note: Nylon will support combustion; webbing will not**	• Appearance may have hard, shiny spots. • Can have a hard, brittle texture.
Paint and Solvents	• Paint can absorb through material and dry results in limited fiber movement. • Solvents are similar to chemical damage. • Wire rope can rust and corrode.

Always refer to the manufacturer for further inspection recommendations.

LANYARD INSPECTION

1. Inspect the connectors (visually and functionally).

2. Inspect the shock absorber and labeling.

3. Inspect the entire length of the webbing.

4. Inspect the connectors on opposite end from the single connector.

LANYARD INSPECTION CHECKLIST / LOG

Lanyard Model: _____ Manufacture Date: _____
Serial Number: _____ Lot Number: _____ Purchase Date: _____
Comments:_____
_____
_____

Component	Pass / Fail	Comments
1. Hardware: (D-rings, buckles, back pad, loop keepers) Inspect for damage, distortion, sharp edges, burrs, cracks, and corrosion	☐ Pass ☐ Fail	
2. Webbing: Inspect for cuts, burns, tears, abrasion, frays, excessive soiling, and discoloration	☐ Pass ☐ Fail	
3. Stitching: Inspect for pulled or cut stitches	☐ Pass ☐ Fail	
4. Labels: Make sure that all labels are legible and properly secured	☐ Pass ☐ Fail	
5. Wire Rope: Inspect for broken wires, corrosion, kinks, and separation of strands.	☐ Pass ☐ Fail	
6. Synthetic Rope: Inspect for cut or pulled yarns, burns, abrasion, knots, excessive soiling and discoloration	☐ Pass ☐ Fail	
7. Energy Absorbing Equipment: Inspect for elongation, tears, and excessive soiling.	☐ Pass ☐ Fail	
☐ **Pass** ☐ **Fail**	**Inspected By:** _____ **Date:** _____	

SELF-RETRACTING LIFELINES (SRL): WHAT TO LOOK FOR

A self-retracting lifeline is a device that is widely used on our properties. An SRL has the ability to physically stop the person immediately, thus reducing one's fall, and minimizing any injuries. The sudden stop that the employee may experience is similar to how a seat belt in a personal vehicle operates. If a sudden motion occurs, the device locks down on the lanyard and halts any further movement.

Components	Inspect for
Exterior	Loose screws and bent or damaged parts.
Housing	Distortion, cracks or other damage.
Lifeline	Full extension and retraction without hesitation or creating a slack line, free of knots. • Cable or wire ropes – cuts, kinks, broken wires, corrosion, welding splatter, chemical burns, or frayed • Web or synthetic rope – wear, frayed strands, broken yarn, burns, cuts, or abrasions
Device	Locking up without slipping when lifeline is jerked suddenly.
Labels	Location and fully legible.
Entire unit	Signs of corrosion, rust, or kinks.
Connecting hooks or carabiners	Damage, corrosion, or working condition.
Reserve lifeline payout	The reserve lifeline has been used by pulling it out of the SRL. • Wire rope – a red line will be visible • Web or synthetic rope – a label is visible
Impact Indicator	Engagement or activation.

Always refer to the manufacturer for further inspection recommendations.

SRL INSPECTION

1. Inspect the connector and SRL housing.

2. Engage mechanism four times.

3. Ensure that shock indicator has not been deployed.

4. Inspect entire length of webbing.

5. Inspect the connector.

SELF-RETRACTING LIFELINES (SRL) INSPECTION CHECKLIST / LOG

SRL Model: _____ Manufacture Date: _____
Serial Number: _____ Lot Number: _____ Purchase Date: _____
Comments: _____
_____
_____

Component	Pass / Fail	Comments
1. Impact Indicator: Inspect indicator for activation (rupture of red stitching, elongated indicator, etc.).	☐ Pass ☐ Fail	
2. Screws/Fasteners: Inspect for damage and make certain all screws and fasteners are tight.	☐ Pass ☐ Fail	
3. Housing: Inspect for distortion, cracks and other damage. Inspect anchoring loop for distortion and damage.	☐ Pass ☐ Fail	
4. Lifeline: Inspect for cuts, burns, tears, abrasions, frays, excessive soiling and discoloration, and broken wires.	☐ Pass ☐ Fail	
5. Locking Action: Inspect for proper lock-up of brake mechanism.	☐ Pass ☐ Fail	
6. Retraction/Extension: Inspect spring tension by pulling lifeline out fully and allowing it to retract fully (no slack).	☐ Pass ☐ Fail	
7. Hooks/Carabiners: Inspect for physical damage, corrosion, proper operation and markings.	☐ Pass ☐ Fail	
8. Reserve Lifeline: Inspect reserve lifeline retention systems for deployment.	☐ Pass ☐ Fail	
9. Labels: Make sure that all labels are legible and properly secured	☐ Pass ☐ Fail	
☐ **Pass** ☐ **Fail**	**Inspected By:** _____ **Date:** _____	

INSPECTION FREQUENCY

Each employee must do inspections prior to using any fall protection device or system. It is a best practice to complete inspections before use, monthly, and annually. Each site determines and communicates the expectation for their inspection criteria.

PRE-USE

A pre-use inspection is completed before each use, and according to manufacturer's specifications. Employees must inspect all components of the system for wear, damage, adequate flexibility, and other signs of deterioration. The inspection process includes the following (where relevant):

- Webbing
- Stitching
- Conditions of grommets, buckles, and hardware
- Presence and legibility of manufacturer's date tag, serial number, and other critical markings
- Cleanliness, broken strands, burns, excessive wear, and dirt
- Fall indicators (see manufacturer's recommendations)
- Wear indicators (see manufacturer's recommendations)

When the systems have not been inspected for a period longer than one month, they will need a documented inspection by a competent person, other than the authorized user.

MONTHLY

In addition to pre-use inspections, there is also a monthly inspection. These inspections should be documented and conducted as per the manufacturer recommendations. A monthly inspection is equally important as a pre-use inspection. Having multiple inspections acts as a safeguard against defective, damaged, or incorrectly maintained equipment.

ANNUALLY

Permanently installed systems, such as horizontal and vertical lifelines, anchors, and trolley systems, will be placed on formal preventative maintenance schedules in accordance with manufacturer's recommendations. These inspections will occur annually.

If any components are determined to be defective, they will be removed from service and either secured until repaired or destroyed. If the manufacturer's label is missing, that component will be removed from service until the label has been replaced per the manufacturer.

STORAGE AND CARE

Following the proper storage and care of equipment is critical for prolonging the durability and quality of the systems and their components. Improperly stored items are at risk for exposure to heat, UV, chemicals, sparks, or slag, which can decrease its effectiveness. The piece of equipment that is not stored properly could be the very one that you or your coworkers are suspended from. Taking a few extra minutes at the end of your day can make all the difference for the next employee who uses it.

Fig. 47 Storing equipment

Would you feel safe using this equipment? How would you feel if your equipment was stored above a chemical storage locker?

CLEANING

Depending on the equipment you are using, there are specific steps for cleaning. Some methods of cleaning and certain products should be avoided as they can decrease the product's effectiveness. The frequency of cleaning these items will vary based on the amount of exposure to certain elements or excessive buildup of materials, for example. Check with your site or the manufacturer for the specific recommended procedure.

WEB MATERIALS

Method	Procedure
Hand wash	• Can be soaked in warm water/cleaning solution prior to wash. • Using a bleach-free, gentle solution, lightly scrub material. • Fully rinse in clean water. • Hang dry out of direct sunlight.
Machine wash	• Place in a mesh bag to prevent tangling. • It should go through a full wash and rinse. • Hang dry out of direct sunlight.

CARABINERS AND HOOKS

Component	Procedure
Carabiners and Hooks	• Clean with a mild detergent • Locking mechanisms may need lubrication after cleaning (Refer to manufacturer's recommendations for specific procedure for lubrication)

SRLS

Description	Procedure
Exterior	• Clean with water and mild soap, allowing excess water to drain. • Clean labels, as needed.
Lifeline	• Clean with water and mild soap. • Rinse and thoroughly air dry.

STORAGE

Storing equipment is important in maintaining the integrity of those items. The storage location should be clean, dry, and free from flammable materials or direct sunlight. If there is an opportunity to lock your personal equipment, you may want to consider that option. Allowing another person to use your harness could impact your safety. Chances are they are not the same height or weight as you. When the harness is returned, you will need to check the fit and make adjustments, as necessary.

Check with your site for specific storage guidelines.

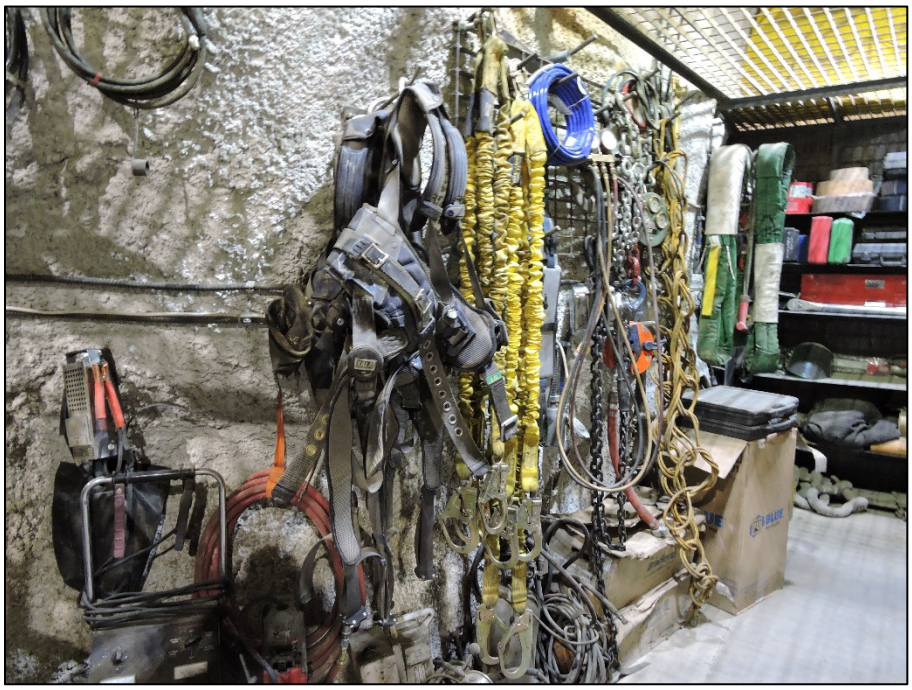


Fig. 48 Proper storage of equipment

ACTIVITY 6: IS THERE AN ISSUE?

Using the images below, decide if the equipment should pass inspection or is stored properly. Check either the "yes" or "no" box. If yes, explain the issue.

1. Is there a storage issue?

□ **Yes** □ **No**

Explain

2. Is there a storage issue?

□ **Yes** □ **No**

Explain

3. Is there a storage issue?

□ **Yes** □ **No**

Explain

4. Is there a storage issue?

□ **Yes** □ **No**

Explain

5. Is there an inspection issue?

□ **Yes** □ **No**

Explain

6. Is there an inspection issue?

□ **Yes** □ **No**

Explain

7. Is there an inspection issue?

□ **Yes** □ **No**

Explain

8. Is there an inspection issue?

□ **Yes** □ **No**

Explain

MODULE 4 QUIZ

Complete the following quiz.

1. Name the three types (frequencies) of inspections.

   _____

   _____

   _____

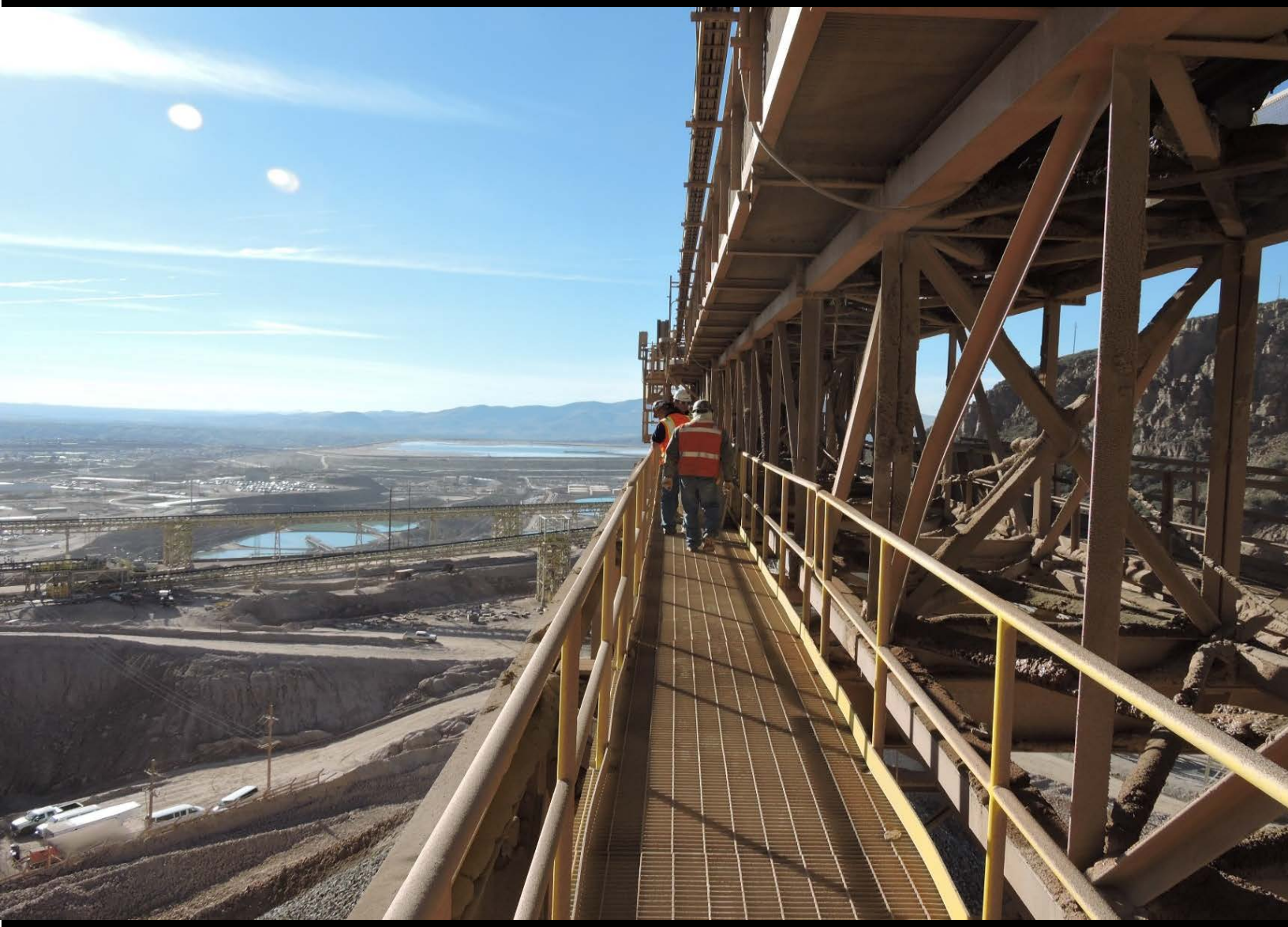
2. After reading each sentence, decide if you would consider this defective by marking a yes or no in the boxes provided.

Inspection Scenario	Would you consider this defective?	
	Yes	No
The SRL does not fully extend.		
The body harness has not been used in 3 months.		
The lanyard was left on the shop floor all night.		
The shock indicator is visible.		

3. Carabiners do not need to be cleaned.
   a. True
   b. False

4. You should store equipment in a clean and dry location.
   a. True
   b. False

Fall Dynamics



MODULE 5

MODULE 5: FALL DYNAMICS

MODULE 5 LEARNING OBJECTIVES

Upon completion of Module 5, the students will be able to:

- Calculate the fall clearance for a given scenario.
- Evaluate a situation and select the appropriate system to use.

INTRODUCTION

Fall dynamics is ***the sum of events that occur during a fall***. It includes the fall protection system in use, the horizontal distance from the employee to the anchor, and the height of the anchor, to name a few.

In order to complete a task safely and efficiently, there are certain choices that impact how it is performed. The employee will typically calculate fall clearance and free fall distance, but they must also take into consideration the swing fall, or pendulum effect.

Ask yourself if the task can be completed in a manner that eliminates the hazard. If eliminating the fall hazard is not possible, and engineering controls are not possible, what anchor point do you intend to use? Once the anchor point has been selected, what type of lanyard is best suited for the task? In order to answer these last two questions, there are two simple calculations that need to be made. The first is your free fall distance, and the second is your fall clearance distance. Lastly, you must take into consideration the swing fall, or pendulum effect.

We will discuss each aspect of fall dynamics in the following pages.

FREE FALL DISTANCE

Free fall distance is the distance a person falls before either reaching the next level (or ground) or before his/her fall arrest equipment engages.[5] According to FCX-HS02, the maximum allowable free fall distance is 6 feet. **Any distance greater than six feet could potentially result in overloading the system and/or injuring the employee.**

Free fall distance also determines the speed at which the employee will fall. This will greatly impact the force that is placed on the system. The location of the anchor point and the length of the lanyard affects the free fall. If the anchor point is high and the lanyard is short, the employee will have less distance to fall when compared to a longer lanyard and lower anchor point. When possible, minimize the free fall distance and keep it as small as practically possible.[6]

[5] J. Nigel Ellis Ph.D., CSP, , Introduction to Fall Protection (4th Edition, 2012), 188
[6] Unknown author, Fall Protection (Competent Person Course, Capital Safety, 2011), 2

When calculating free fall distance, there are three variables that need to be determined first. They are:

- Lanyard length (LL)
- Height of the anchor point (HA)
- Height of the D-ring (HD)

These variables will be inserted into one of the three equations below.

In order to determine which of the above equations is appropriate, you have to ask yourself where the anchor point is in relation to the D-ring of the harness. There are 3 possible answers to this question.

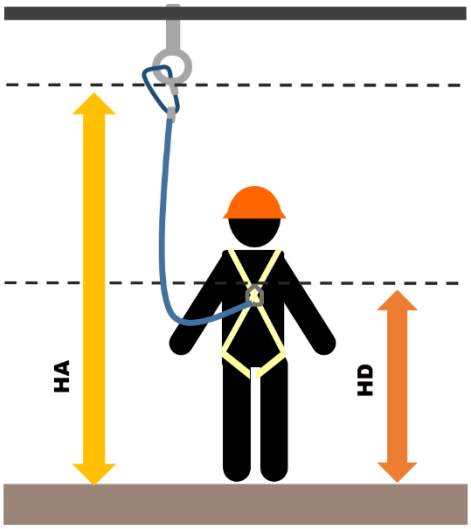
- The anchor is ABOVE the D-ring
- The anchor is BELOW the D-ring
- The anchor is LEVEL with the D-ring

The answer to this question will determine which of the following equations will be used to calculate your free fall distance.

	Formulas	Use when anchor is
EQ 1	$Free\ Fall\ Distance = LL - (HA - HD)$	Above D-ring
EQ 2	$Free\ Fall\ Distance = LL + (HD - HA)$	Below D-ring
EQ 3	$Free\ Fall\ Distance = LL$	Level with D-ring

EXAMPLE 1 – ABOVE (EQ 1)

The employee's D-ring is 5 ft. above the working platform, and is attached to an anchor point 9 ft. above the working platform. The lanyard length is 6 ft. Since the anchor point is located above the D-ring, EQ 1 will be used to calculate this example. If the employee was to fall from the working platform, there would be 2 ft. of free fall.



$$\boldsymbol{Free\ Fall\ Distance = LL - (HA - HD)}$$

$$Free\ Fall\ Distance = 6\ ft. - (9\ ft. - 5\ ft.)$$

$$Free\ Fall\ Distance = 6\ ft. - (4\ ft.) = 2\ ft.$$

Due to the free fall distance being less than 6 ft., this is an ideal working situation.

PRACTICE

The employee's D-ring is 4 ft. above the working platform, and is attached to an anchor point 8 ft. above the working platform. The lanyard length is 6 ft. Since the anchor point is located above the D-ring, EQ 1 will be used to calculate this example. If the employee was to fall from the working platform, what is his/her free fall distance?

LL = _____

HA = _____

HD = _____

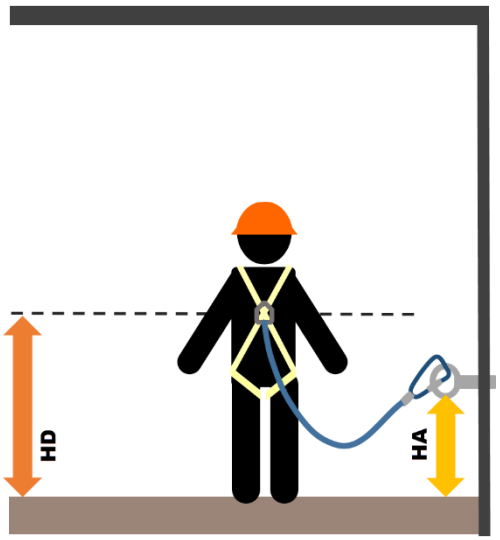
$$\boldsymbol{Free\ Fall\ Distance = LL - (HA - HD)}$$

Free Fall Distance = _____ *ft.* – (_____*ft.* - _____ *ft.)*

Free Fall Distance = _____ *ft.* – (_____ *ft.)* = _____ *ft.*

EXAMPLE 2 – BELOW (EQ 2)

The employee's D-ring is 5 ft. above the working platform, and is attached to an anchor point 3 ft. above the working platform. The lanyard length is 6 ft. Since the anchor point is located below the D-ring, **EQ 2** will be used to calculate this example. If the employee was to fall from the working platform, what is his/her free fall distance?



$$\boldsymbol{Free\ Fall\ Distance = LL + (HD - HA)}$$

$$Free\ Fall\ Distance = 6\ ft. + (5\ ft. - 3\ ft.)$$

$$Free\ Fall\ Distance = 6\ ft. + (2\ ft.) = 8\ ft.$$

Due to the free fall distance being greater than 6 ft., this is not an acceptable practice. Changes will need to be made in order to work safely.

PRACTICE

The employee's D-ring is 4 ft. above the working platform, and is attached to an anchor point 2 ft. above the working platform. The lanyard length is 6 ft. Since the anchor point is located above the D-ring, **EQ 2** will be used to calculate this example. If the employee was to fall from the working platform, what is his/her free fall distance?

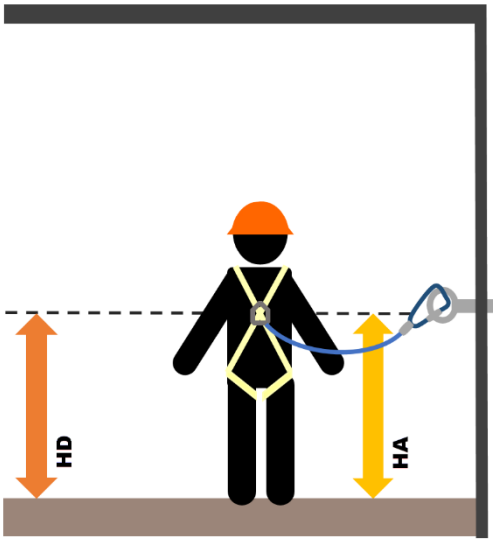
$$\boldsymbol{Free\ Fall\ Distance = LL + (HD - HA)}$$

Free Fall Distance = _____ *ft. + (*_____*ft. -* _____ *ft.)*

Free Fall Distance = _____ *ft. + (*_____ *ft.) =* _____ *ft.*

EXAMPLE 3 – LEVEL (EQ 3)

The employee's D-ring is 5 ft. above the working platform, and is attached to an anchor point that is also 5 ft. above the working platform. The lanyard length is 6 ft. Since the anchor point is level with the D-ring, **EQ 3** will be used to calculate this example. If the employee was to fall from the working platform, what is his/her free fall distance?



$$\boldsymbol{Free\ Fall\ Distance = LL}$$

$$Free\ Fall\ Distance = 6\ ft.$$

Due to the free fall distance being 6 ft., this is considered acceptable; however, not as ideal as Example 1.

When the anchor point is level with the D-ring, the free fall distance is equal to the lanyard length.

As stated previously, the maximum free fall distance allowed is six feet. When using a six foot lanyard, you need to make sure that you do not attach to an anchor point that is below the D-ring of your harness.

There are some situations where it is not feasible to find an anchor point that is level with or above your D-ring. When it is not possible to limit the free fall distance to 6 feet with a fixed lanyard, check with your Health and Safety Professional or Supervisor to determine a better practice.

FALL CLEARANCE DISTANCE

Fall clearance distance is the sum of four factors that impact the distance you travel once you fall. Fall clearance distance needs to be calculated prior to beginning a job. This ensures the anchor point is high enough to prevent contact with the lower level given the available PPE.

The four variables used to determine fall clearance distance when using any lanyard with a shock absorber are:

- Lanyard length (LL)
- Deceleration distance (DD)
- Height of the suspended worker (HW)*
- Safety factor (SF)**

**For the purposes of calculating fall clearance distances, using the worker's height accounts for D-ring slide.*

***A minimum safety factor of 2 ft. is required for all fall clearance calculations.*

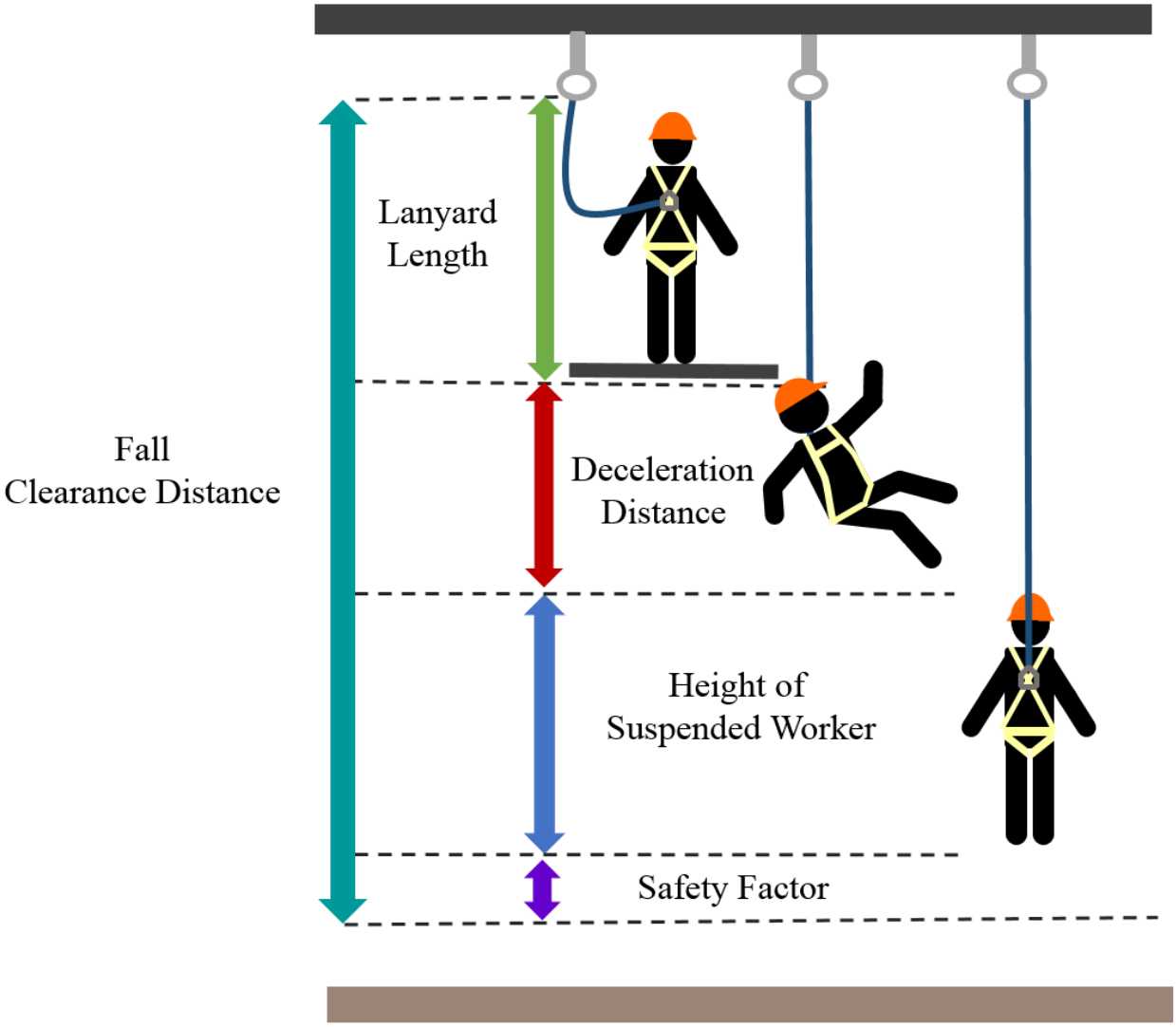
	Formula
EQ 4	$Fall\ Clearance\ Distance = LL + DD + HW + SF$

Once you have calculated you fall clearance distance, you will need to compare that value to the distance from the lower level to your proposed anchor point. If the calculated fall clearance distance is **LESS** than the distance between the anchor point and the lower level (total fall distance or TFD), your fall arrest system will prevent you from making contact with the lower level, should a fall occur. If the calculated fall clearance distance is greater than the distance between the anchor point and the lower level, then you are not protected.

Keep in mind that the deceleration distance is the length that your lanyard's shock-absorbing device will expand. While this distance is commonly 3.5 feet, the actual deceleration distance of your equipment may vary. Be sure to check your lanyard's specifications for the correct deceleration distance.

It is a commonly held belief that there is no deceleration distance associated with the use of an SRL. This is not the case. When using an SRL as opposed to a fixed length lanyard, be aware that there is a deceleration distance that needs to be included in your calculation. The specific deceleration distance designed into your SRL will vary depending on equipment and manufacturer.

The illustration below shows the different variables used to calculate fall clearance distance.



EXAMPLE 4 – FALL CLEARANCE ON A LANYARD

You are using a 6 ft. fixed length lanyard with a shock absorber. The shock absorbing unit has a decelerating distance of 3.5 ft. The worker is 6 ft. tall, and a 2 ft. safety factor is being used. The distance between the anchor point and the lower level is 15 ft. What is the fall clearance distance in this scenario, and is the equipment being used sufficient in maintaining a safe working condition?

$$\boldsymbol{Fall\ Clearance\ Distance = LL + DD + HW + SF}$$

$$Fall\ Clearance\ Distance = 6\ ft. + 3.5\ ft. + 6\ ft. + 2\ ft.$$

$$Fall\ Clearance\ Distance = 17.5\ ft.$$

Since 17.5 ft. is greater than 15 ft., this is not a safe working condition.

PRACTICE

You will be performing a task that requires fall protection. You will anchor to a point 20 ft. above the next lower level. You will use a 6 ft. shock-absorbing lanyard that has a deceleration distance of 3.5 ft. You are 5 ft. tall, and will use a safety factor of 2 ft. Calculate your fall clearance distance, and decide if the fall arrest system is appropriate for this task.

$$\boldsymbol{Fall\ Clearance\ Distance = LL + DD + HW + SF}$$

Distance from anchor point to lower level = _____ ft.

$$Fall\ Clearance\ Distance = \_\_\_\_ ft. + \_\_\_\_ ft. + \_\_\_\_ ft. + \_\_\_\_ ft.$$

$$Fall\ Clearance\ Distance = \_\_\_\_\_ ft.$$

SWING FALL

Swing fall, or pendulum effect, occurs when the employee is working at a location away from the anchor point. Should the employee fall, they will swing like a pendulum until the movement has stopped. Always work directly beneath your anchor point. The further away from the anchor point you are, the greater swing you will experience. This could lead to serious injuries if you should hit existing structures that are in your swing path.

Imagine a ball on one end of a string and the other end of the string is tied to a horizontal bar. If you let the ball hang, it will remain directly below the point where the string is tied to the bar. If you move the ball to the side and let it go, what would happen to the ball? This same situation can be applied to an employee attached to a lanyard. As your work area moves, you should change your anchor points to ensure you are working as directly underneath them as possible.

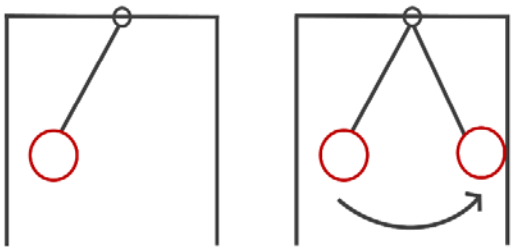


Fig. 49 Simulating swing fall

Swing fall is a factor to be taken into consideration when using an SRL. The swing fall is greatly affected by the working length of your lanyard. The further away from the anchor point, the greater the drop and swing will be on an SRL. This can result in a substantially greater impact force, should you crash into something during your swing. Avoid swing fall events by staying under the anchor point as much as possible.

FALL CLEARANCE DISTANCE, FREE FALL, AND SWING FALL – SRL

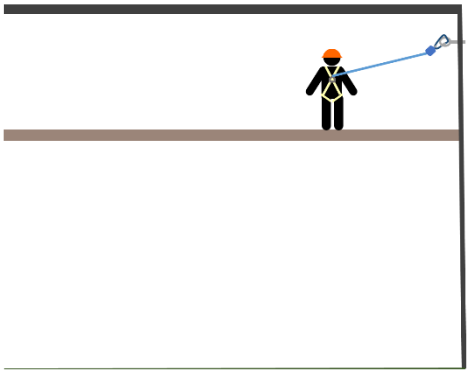
When calculating your free fall distance or your fall clearance distance while using an SRL, only consider the deceleration distance and safety factor. Add these two lengths together and the sum must be shorter than the distance to the next level. That being said, there is one major consideration that needs to be accounted for prior to beginning work: the working length of your SRL.

If the worker is kneeling, **add three (3) additional feet to the calculation due to the need for the worker's body to straighten out in the fall**.

EXAMPLE 5 – ON AN SRL

As an example, if you will be working on an elevated platform that is 15 ft. above the lower level. You have selected an SRL as the appropriate lanyard for the task. The deceleration distance of your SRL is 3.5 ft., and you are using a 2 ft. safety factor.

Deceleration distance + SF = Fall Clearance Distance



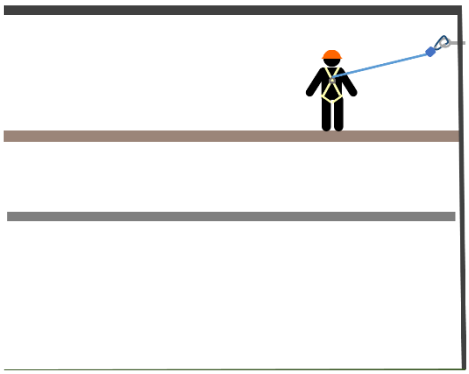
3.5 ft. **+ Deceleration Distance**

2 ft. **+ Safety Factor**

15 ft. **Height of above the next level**

In the above scenario, if your SRL deceleration distance is a length of 3.5 ft. and you add the 2 ft. safety factor, your fall distance is 5.5 ft. Since this number is less than the distance to the lower level (15 ft.), you would be protected.

PRACTICE



_____ **+ Deceleration Distance**

_____ **+ Safety Factor**

_____ **Height above the next level**

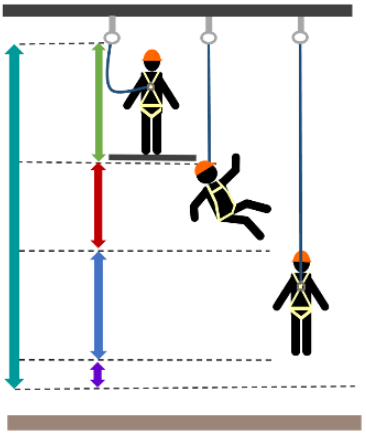
Consider then, what would happen if there were a metal conduit running 5 ft. under the work surface in the same situation. How does this affect your safety?

ACTIVITY 8: CALCULATE THE FALL

Complete the calculations for the scenario provided.

You are assigned a task that must be completed from a work platform 10 feet above the ground. You are six feet tall and your shock-absorbing lanyard is six feet long. The deceleration distance of your lanyard is three and a half feet. The D-ring on your harness is five feet high. Your anchor point is seven feet above the working surface. Calculate the fall clearance distance, free fall distance, and complete the remaining questions.

FALL CLEARANCE DISTANCE



_____: Lanyard Length

_____: Deceleration Distance

_____: Height of Suspended Worker

_____: Safety Factor

_____: Required Fall Clearance Distance

_____: Height of Anchor Point above fall surface

FREE FALL DISTANCE

_____: Height of Anchor Point above Working Surface

_____: Height of D-ring

_____: Free Fall Distance

Are you performing this work in a safe manner? _____

Is your free fall distance less than the maximum allowable distance? _____

What are at least two aspects of this job that you could change in order to better protect yourself?

1. _____
2. _____
3. _____
4. _____

MODULE 5 QUIZ

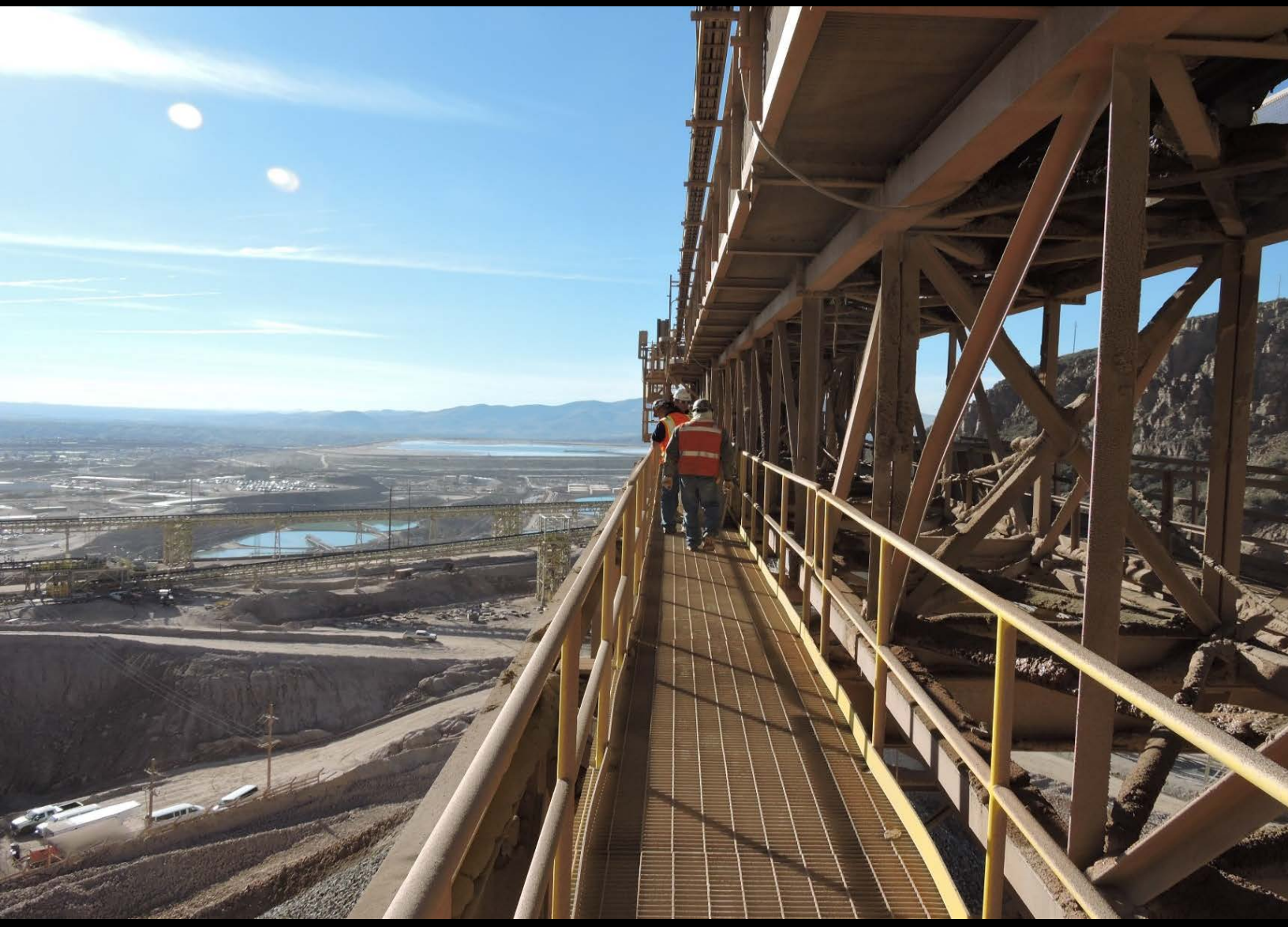
Complete the following quiz.

1. What can cause a swing fall?
   a. There is too much slack in the lanyard
   b. The body harnesses are not worn properly
   c. The anchor points are lower than the employee
   d. The anchor point is not located directly above the employee

2. On a lanyard, how is fall clearance distance calculated?
   a. From the anchor point to the D-ring
   b. From the anchor point to the lower level
   c. From the anchor point to the higher level
   d. From the D-ring to the lower level

3. What is the maximum allowable free fall distance?
   a. 3 feet
   b. 5 feet
   c. 6 feet
   d. 8 feet

Fit, Donning, and Adjustment



MODULE 6

MODULE 6: FIT, DONNING, AND ADJUSTMENT

MODULE 6 LEARNING OBJECTIVES

Upon completion of Module 6, the students will be able to:

- Demonstrate proper fit, donning and adjustment of full body harnesses and lanyards.

INTRODUCTION

Any job that requires you to wear fall protection is a job that carries a certain degree of risk of injury. It is critical that you not only know **what** you need to wear, but also **how** to wear it. Specific training is provided for the equipment you will use. Improper harness fit, an incorrectly positioned D-ring, or a lanyard that is not the correct length, can have major negative consequences in the event of a fall. It is your body and health. This is why it is important to take the proper steps and use the tools that Freeport-McMoRan has provided to you.

FIT

When using a full body harness, it is important that it fits properly. Choose the appropriate size recommended by the manufacturer, as harnesses are not one size fit all. Loose or ill-fitting harnesses provide little to no security should you fall. Most harnesses have a 310 lb. weight limit. Larger or taller employees must be evaluated for appropriate harness size and style.

Fig. 50 Correct fitting

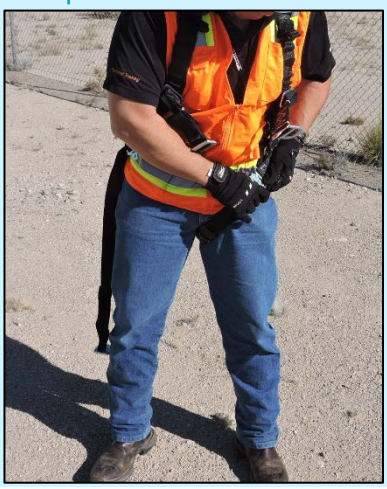
DONNING AND ADJUSTING

1. Empty your pockets. Objects like keys, coins, and small tools can cause major injury in the event of a fall.
2. Hold the harness by the D-ring and straighten all the straps. Inspect the straps for any signs of wear or damage. Inspect the D-ring and any other metal hardware.
3. Undo all buckles.
4. Don the harness beginning with the leg straps. Be sure to adjust the leg and waist straps prior to connecting the chest strap. Make sure that the straps are snug. You should be able to slide a flat hand underneath the straps, but have difficulty sliding a cupped hand underneath the straps.
5. Connect the chest strap. Make sure that the strap is snug.
6. Position the D-ring on your back. The D-ring should be centered with your spine, at the same height as your shoulder blades.
7. Have a co-worker inspect the harness to make sure that it has the proper fit.

Note: When not in use, lanyard connections can only be attached to break-away connections.

DONNING A FALL ARREST SYSTEM

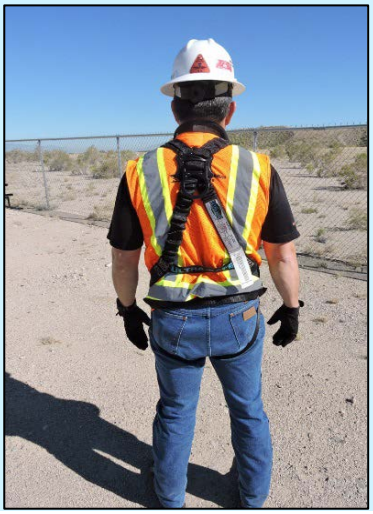
1. Don the harness beginning with the leg straps.



2. Connect the chest strap.

3. Make sure that the straps are snug.

4. Position the D-ring on your back. Have a co-worker inspect your harness.



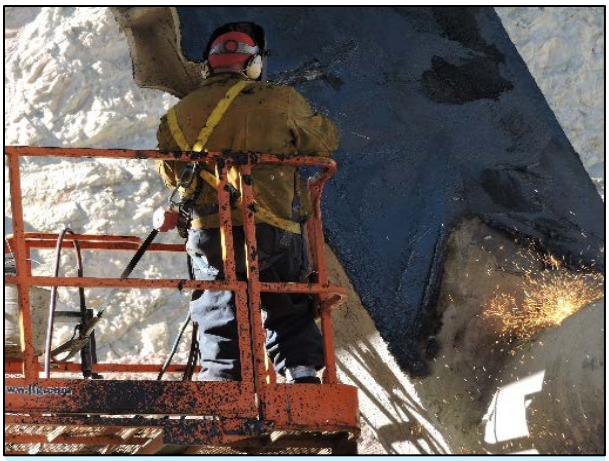
ADJUSTING

Area	How to adjust
Shoulders	• If loose, pull up on the straps • If tight, push down on adjustable buckle
Chest strap	• If loose, pull up on the strap • If tight, push strap through adjustable buckle • To adjust the position, slide keeper up or down on the shoulder strap
D-ring (on back)	• Slide the D-ring and pad up or down along the webbing[7]

[7] Unknown author, *Fall Protection: Competent Person Course*, (Unknown publication location: *Capital Safety*, 2011, 18)

ACTIVITY 9: PROPER FIT

Look at the pictures below. Determine if the fall protection equipment is fitting properly. If not, explain why.



1. Does this fit properly?

□ **Yes** □ No

If not, why?

2. Does this fit properly?

□ Yes □ **No**

If not, why?

3. Does this fit properly?

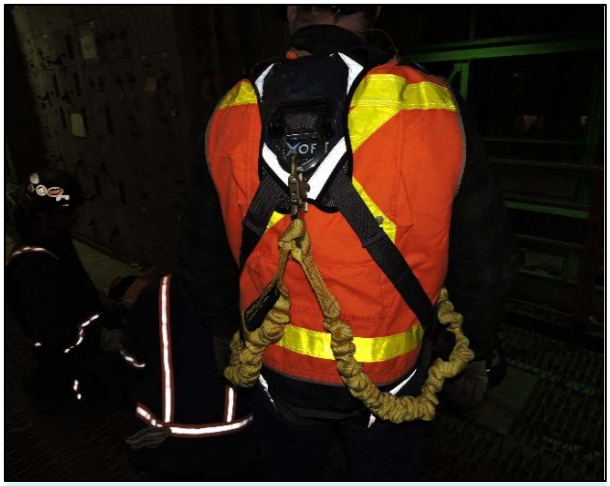
□ Yes □ **No**

If not, why?

4. Does this fit properly?

□ Yes □ No

If not, why?



5. Does this fit properly?

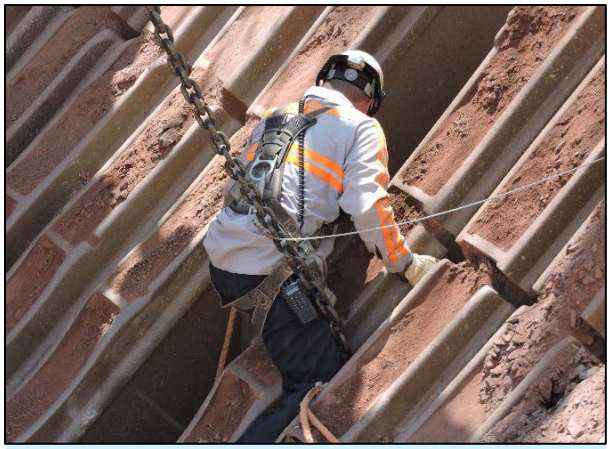
□ **Yes** □ **No**

If not, why?

6. Does this fit properly?

□ **Yes** □ **No**

If not, why?



7. Does this fit properly?

□ **Yes** □ **No**

If not, why?

8. Does this fit properly?

□ Yes □ **No**

If not, why?

MODULE 6 QUIZ

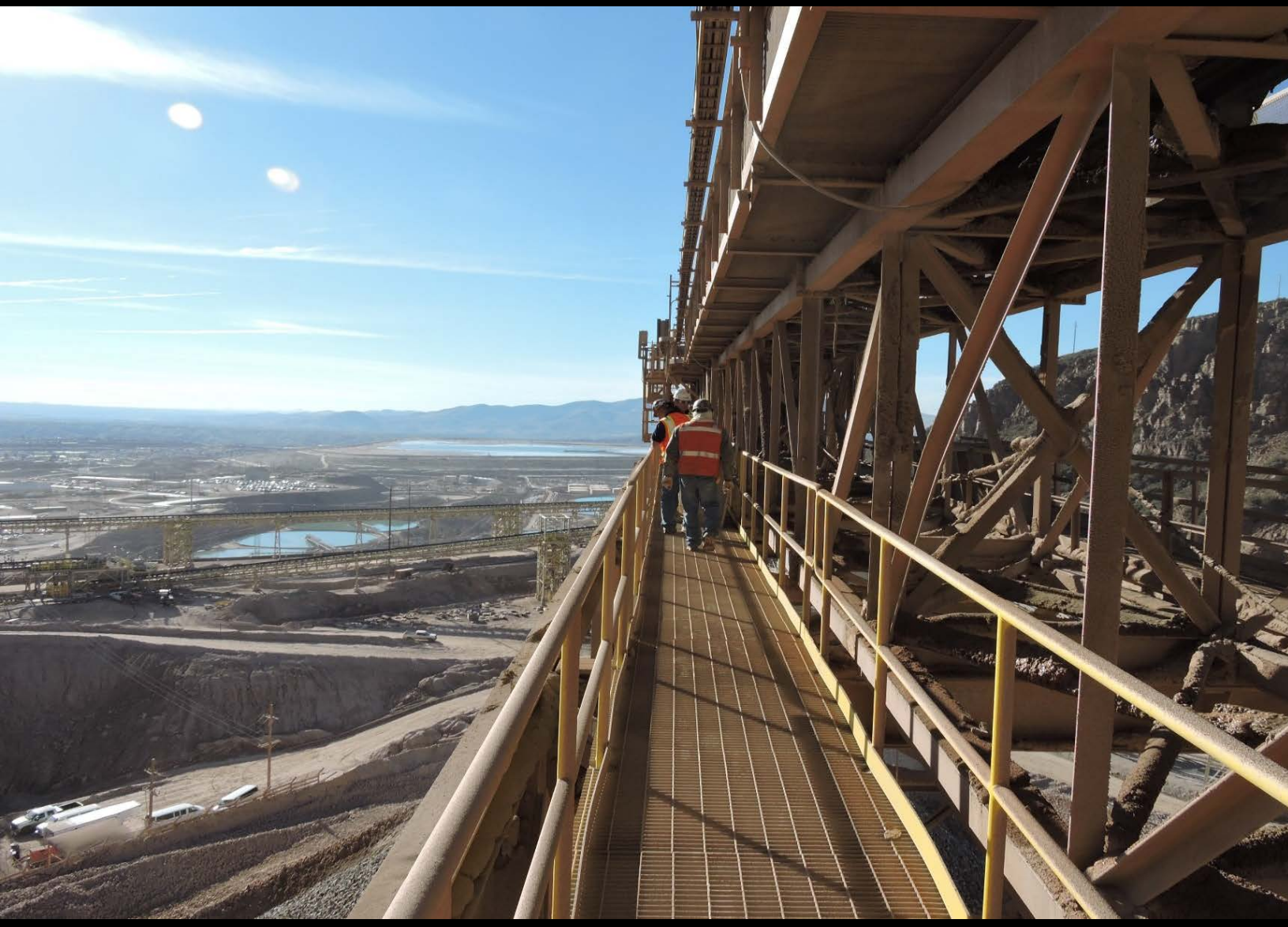
Complete the following quiz.

1. Harnesses are one size fit all.
   a. True
   b. False

2. The straps around the legs should be a snug fit, not too loose or too tight.
   a. True
   b. False

3. When not in use, lanyard connections can be attached to which of the following?
   a. Jean pockets
   b. Unused D-rings
   c. Break-away connections
   d. Around the harness straps

Other Working at Height Systems



MODULE 7

MODULE 7: OTHER WORKING AT HEIGHT SYSTEMS

MODULE 7 LEARNING OBJECTIVES

Upon completion of Module 7, the students will be able to:

- Discuss the other types of equipment used to work at heights.

INTRODUCTION

In addition to the fall protection systems already discussed, there are other pieces of equipment commonly used for tasks performed at heights. Some examples of this include ladders, scissor lifts, scaffolds, and bucket trucks. Elevated work platforms or work surfaces have unique fall hazards and fall protection requirements. It is important to maintain a hazard awareness for any form of fall protection used on the job.

Maintain a safety awareness for any form of fall protection used on the job.

LADDERS

Ladders are often an effective way to gain access to elevated work areas. However, when used improperly, ladders can become unstable and lead to significant falls from heights.

Over the past 10 years, 43% of fatal falls and 81% of falls in the construction industry, involved ladders. [8]

Most ladder-related incidents involve improper use and failure to follow best practices. Some examples of this are:

- Using ladders in a manner for which they were not intended.
- Leaning away from a ladder while working.
- Failing to maintain three points of contact.
- Placing ladders on an uneven surface causing it to become unstable and tip over.
- Failing to barricade or secure the area where the ladder is in use.
- Failing to secure ladders at the top or bottom before using.

SELECTION AND CARE

Ladders should be selected based on the task and environmental conditions present at the time of use. Certain ladder materials such as steel or aluminum, are not be appropriate in environments that are corrosive or have energized sources present. Fiberglass ladders stored outdoors are susceptible to UV degradation and steps should be taken to avoid long-term sunlight exposure during storage. Recent studies also show that ethanol, which is a common additive in gasoline may degrade the chemical bonds of fiberglass over long periods of exposure.[9]

Fig. 51 Storing ladders

[8] Centers for Disease Control and Prevention. Morbidity and Mortality Weekly Report. April, 25, 2014.
[9] Environmental Protection Agency. Biofuels Compendium – Ethanol – Equipment Compatibility. 2015

GENERAL LADDER SAFETY AND BEST PRACTICES

Rules to follow when working with ladders:[10]

Always	Never
• Face the ladder when either ascending or descending. • Maintain three points of contact when ascending or descending. • Use barricades to keep affected individuals and equipment away from the ladder. • Make sure the spreader bars are fully open on a stepladder before mounting. • Inspect ladders prior to use and on a monthly basis (conducted by a competent person). • Make sure the manufacturer labels are legible.	• Use metal ladders around energized sources. • Exceed ladder ratings. Remember to include your weight and the weight of your tools, equipment, etc. • Use a ladder in a manner it was not intended (e.g. as a platform or bridge). • Use an A-frame ladder in a closed position as a single ladder. • Climb on surfaces that are not designated rungs. • Step above the highest rung indicated by the manufacturer. • Paint with opaque coatings. • Leave tools on a ladder. • Welding or cutting from a ladder without a variance.

Fig. 52 Working safely on a ladder

[10] OSHA Fact Sheet, Reducing Falls in Construction: Safe Use of Stepladders, Publication: OSHA3662

ELIMINATING THE RISK

A maintenance employee at Bagdad recognized the task of accessing the grease fill port on the 4100 shovels as a risk that could be mitigated. This port had to be accessed by climbing onto the shovel tracks which required a ladder and fall protection equipment. While this is an acceptable control, he pushed to find a solution that eliminated the risk. The grease fill port was relocated to the side of the lube room and can now be accessed by the shovel man lift and catwalk eliminating the need for a ladder, fall protection equipment, and climbing onto the shovel tracks.

Fig. 53 Original location

Fig. 54 New location

Discussion Questions:

Based on the Hierarchy of Controls and the critical controls that you have learned about, why would this be considered a major success? What control was implemented? How does this relate to the Hierarchy of Controls? Using your knowledge of working at heights, what additional concerns do you have regarding the original method of accessing the grease fill port?

USING LADDERS WITH FALL PROTECTION

There are times when work can be performed with the use of fall protection equipment. The requirements are specific and need to be followed for the safety of you and your co-workers.

- Are your feet more than four feet from the lower level?
- Is the ladder wet and dirty?
- Is the ladder on an uneven surface?
- Does the work require leaning or reaching away from the ladder?
- Does the work include leaning over corrosive substances or sharp objects?

If you answered "yes" to any of these questions, then you will need fall protection.

Learn from Others

After finishing his work on the roof of a building, a contractor descended through the facility's wooden frame using the framework as a makeshift ladder. A wooden post he was using as a hand hold detached causing him to fall 2.5 meters (approximately 8 feet) to the ground. He suffered five fractured ribs. 20 days of lost time

The employee was wearing a full body harness during his work hours but, since no ladder was made available, he disconnected the harness from the tie off to descend.

Fig. 55 Re-enactment of Incident

EXTENSION LADDERS

When using an extension ladder, be sure to follow the 4:1 rule. The horizontal distance should be ¼ the height of the point of contact. For example, if your ladder is extended 20 feet high, the base should be approximately 5 feet from the wall.

If the extension ladder is used at a height of 20 feet or higher, either a second employee needs to steady the ladder or the top of the ladder needs to be tied off to a sound anchor point.

Extension ladders and fixed ladders should always extend 3 feet above the landing surface, but no more than 4 feet.

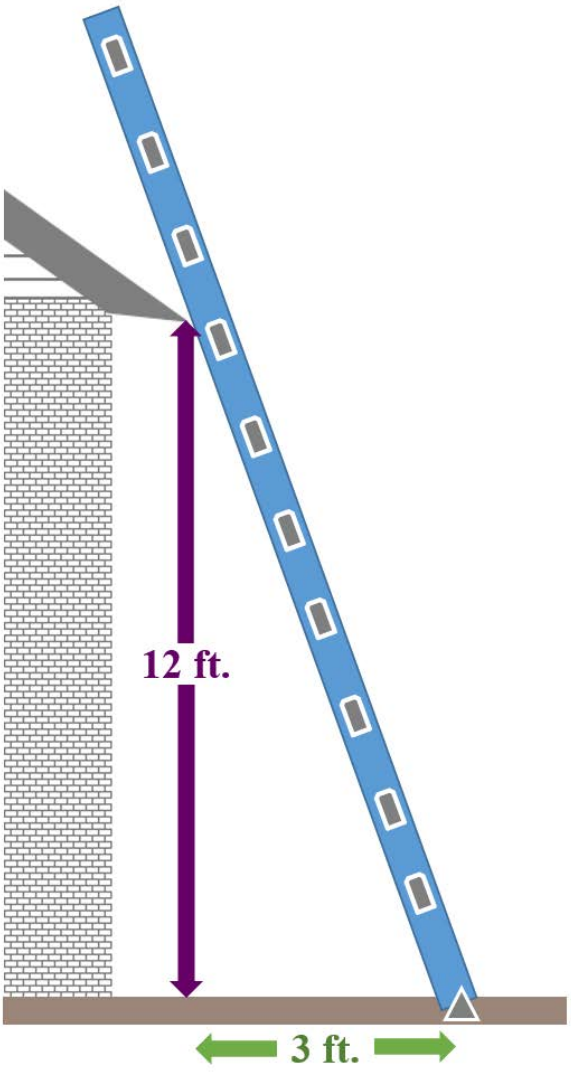


Figure 56 The base of a straight ladder needs to be one foot out for every four feet of height

AERIAL WORK PLATFORMS

Aerial, elevated work platforms are commonly used at many sites. They are defined as having hinged sections that allow the work platform to maneuver in a manner other than a straight vertical motion. Common examples of aerial work platforms are man lifts and bucket trucks.

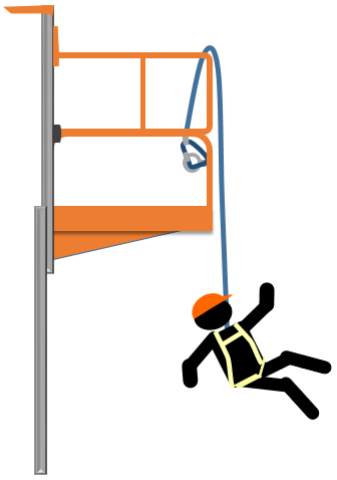
Personal fall protection systems must be utilized when working from aerial lifts and mobile platforms.

It is important to identify appropriate anchorage points on the platform. In most cases, guardrails are not engineered to withstand the forces required to restrain or arrest a fall. Unless specifically indicated by the manufacturer as being a suitable tie-off point, never anchor to a guardrail system.

Fig. 57 Close up of man lift

Fig. 58 Employees working on a man lift

It is also important to select the appropriate lanyard to connect your body harness to the AWP. The location of the anchor point will have a large impact on the appropriate lanyard selection. When determining your fall clearance from inside an AWP, remember that if the anchorage point is below the railing, that the difference in height needs to subtracted from the lanyard length prior to using Equation 4. If you are using a 6 ft. fixed length lanyard, and the anchor point is 2 ft. below the top railing of the AWP, then the effective length of your lanyard is 4 ft. when calculating fall clearance distance.



SCISSOR LIFTS

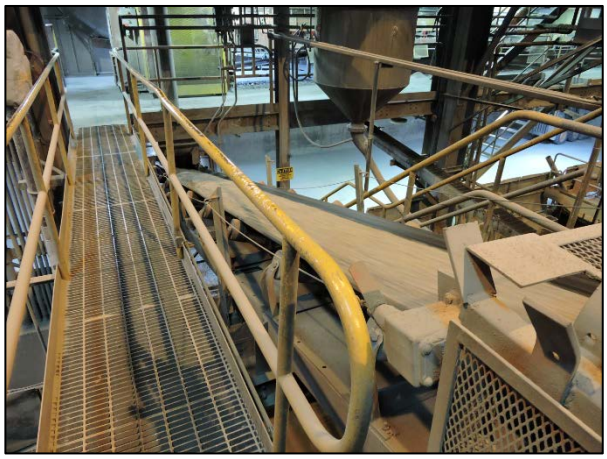
Unlike aerial work platforms, scissor lifts are only capable of elevating employees in a vertical motion. Due to this limitation, scissor lifts are considered a form of mobile scaffolding. Therefore, employees are not required to use fall prevention/protection systems in a scissor lift when the following conditions are met:

- A complete handrail, mid-rail and toe board is present
- The lift is used according to manufacturer's instructions
- Workers' feet never leave the platform
- Some sites require the use of fall protection while working from scissor lifts. Check with your supervisor or safety representative for your site's specific policies.

Fig. 59 Employee working on a scissor lift

HANDRAILS

According to FCX-HS02, handrails (permanent barriers) must be:



- 39-45 inches (99-115 cm) from the working platform
- Mid-rail that supports 200 lbs. (91 kg) of horizontal/lateral force
- Include a standard toe board on all exposed sides with the ability to withstand 75lb (34kg) of force outward, and no more than 1/4in (0.64 cm) gap between surface and lower edge to the top of the rail
- Stair rail systems must be 42in (107cm) from the leading edge of the stair to the top of the rail

ACTIVITY 11: UNDERSTAND YOUR SYSTEM

Break into small groups. The facilitator will assign a system (ladder, aerial work platform, or scissor lift) to each group. Using your knowledge of that system, list the pros, cons, and limitations for the system you have been assigned. Be prepared to share your responses with the class.

System _____

Pros	Cons

Limitations

MODULE 7 QUIZ

Complete the following quiz.

1. When working with ladders, always maintain _____ points of contact when _____ or _____.

2. When working with ladders, never step above the _____ _____ indicated by the manufacturer.

3. What are some examples of aerial work platforms?

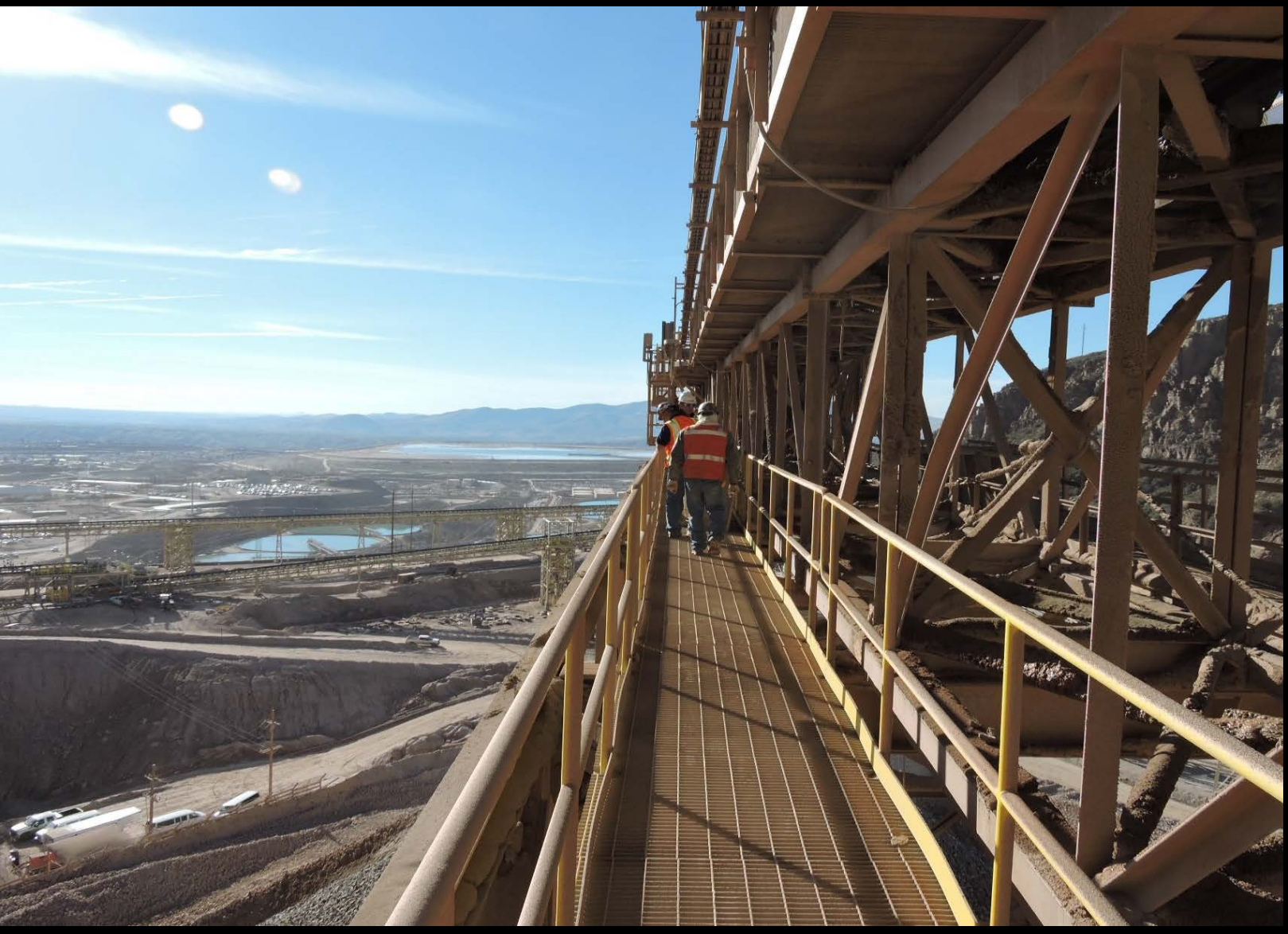
   _____

   _____

4. Employees working in scissor lifts always need to use fall protection.
   a. True
   b. False

5. The 4:1 rule applies to aerial work platforms.
   a. True
   b. False

Rescue



MODULE 8

MODULE 8: RESCUE

MODULE 8 LEARNING OBJECTIVES

Upon completion of Module 8, the students will be able to:

- Describe the components of a rescue plan.
- Demonstrate how to conduct a self-rescue.

INTRODUCTION

Fall protection is an effective control for falls from heights. In the event your fall protection becomes engaged, new hazards can arise. While the fall protection may have prevented you from falling to the ground below, you can still be injured. The forces exerted on the body by the engagement of the fall protection can be substantial. In addition, there is a possibility for internal injuries that may not be obvious at the time of the incident.

Chances are that members of your work group will conduct the fastest rescue. Due to the size of some Freeport-McMoRan properties, mine rescue teams and fire department personnel may have a longer response time.

How do you prepare for these circumstances? What should you do if you are suspended from your lanyard? In this module, we will discuss the importance of a well formed rescue plan, and why communication is so important to potentially saving your life or the life of a co-worker.

SUSPENSION TRAUMA AND UNSEEN INJURIES

Once an employee's fall has been arrested by a fall protection system, the threat of injury or death is still present. The forces exerted on the body as a result of the harness arresting the fall can be substantial and can cause unseen internal injuries. If the worker is unconscious after the fall, they will not be able to communicate that something is potentially wrong. The longer that the worker is left suspended, the greater the amount of time prior to receiving medical treatment that could save his or her life.

Even if the worker has not suffered any internal injuries from the fall, remaining suspended in the harness can potentially result in death within 5-30 minutes. As a worker hangs in the harness, blood begins to pool in the legs. This reduces the amount of blood that can reach the lungs and brain. As the brain is deprived of oxygen, the body is essentially suffocating. Additionally, the kidneys are very susceptible to blood oxygen levels. Therefore, even if the worker has not lost consciousness, renal failure may still be a concern. This scenario is known as suspension trauma.

The amount of time that a person can remain suspended in a harness before experiencing suspension trauma can vary greatly depending on the individual. The National Institute for Occupational Safety and Health (NIOSH) estimates that most people in the workforce will experience suspension trauma in less than 30 minutes. This is why an efficient rescue plan needs to be in place prior to any worker attempting to complete a job from height.

RESCUE PLAN

An integral part of a well-developed fall protection program is conducting a successful rescue. The metric by which any rescue plan is judged, is the safe retrieval of the suspended employee without injury, as well as the safety of the rescuer(s). This is a pass/fail evaluation, with little room for mistakes. Communication and training are the foundation for a successful execution of any rescue plan.

Be sure that any rescue plan includes the following:

- Emergency response procedures. These are the steps to be followed during a rescue event.
- General guidelines for methods used during rescue operations.
- Training requirements/competency measurements for rescue team members.

If an incident occurs where a member of your work group requires rescue from his/her fall protection system, be sure to follow all procedures for calling a mayday. The mayday needs to be called regardless of who conducts the rescue. Some injuries are not easily detected; it is important that the appropriate medical personnel evaluate the individual who sustained the fall.

EMERGENCY RESPONSE PROCEDURES

During a rescue plan, the first step is developing emergency response procedures. When developing the procedures, all directions must be specific and detailed. Along with writing the plan down, it should also be verbally conveyed to all personnel involved with the job. Included in the procedures are:

- Sound a Mayday (reporting the location and type of emergency).
- Perform a quick hazard assessment to ensure that rescue personnel are not exposed to unnecessary dangers.
- If you are capable, rescue the suspended worker; this will be accomplished with a full knowledge of:
    - Location and strength of the rescue anchor.
    - Identification of the nearest safe working level.
    - Equipment required to transport the suspended worker to a safe working level.
    - Personnel required to operate the rescue equipment.
- Provide first aid or medical care only to your level of training.

Fig. 60 Sounding a Mayday

Fig. 61 Preparing for an emergency

RESCUE TECHNIQUES

Should a fall occur, there are steps you can take to assist in your own rescue.

There are two types of rescue techniques that can be performed to help the suspended worker. These techniques are referred to as Self-Rescue or Assisted Rescue, and may be used independently or in conjunction with each other depending on the situation.

Remember that once a fall has occurred, time is the enemy. Do not allow a person to remain suspended in a harness for more than 6 minutes, as the lack of blood circulation can lead to severe medical emergencies, including death.

SELF-RESCUE

Self-Rescuing equipment/techniques are vital to ensuring worker safety. The use of self-rescuing devices will help to relieve the pressure that the harness places on the legs. If the pressure exerted by the harness on the legs is not relieved quickly, the worker can lose consciousness due to restricted blood flow.

It is important to engage the self-rescue method available to you as quickly as possible. This is usually a step loop rescue device (such as a suspension straps). If a foot-step rescue device is not available, you may need to perform the self-tied foot loop rescue technique.

If you find yourself in a situation where there is no equipment to perform a self-rescue technique, there are actions you can take in order to reduce the risk of suspension trauma. The first thing that you want to avoid is allowing your legs to remain motionless in the harness. Positioning and the lack of muscle movement is what allows blood to pool in the legs. If you can, try to elevate your legs against a surface. If that is not an option, and your legs can only be positioned freely below you, then you will want to flex your leg muscles as much as possible. If this is the circumstance you find yourself in, make sure that you are flexing all muscles in the lower legs as well as the upper legs. This action will help to push the blood in your legs back towards your heart, while simultaneously preventing the return veins from being constricted by the harness.

Check with your Health and Safety Professional or Supervisor for site-specific devices that are available on your site.

ASSISTED RESCUE

Assisted rescues are performed when the suspended worker cannot correct the situation after a fall. They involve trained rescuers and appropriate equipment. When deciding what equipment is appropriate for an assisted rescue, be sure to keep the following in mind:

- Can you use a forklift with man basket, or an elevating platform to perform an assisted rescue? If not, do you need technical rescue equipment (such as pulley systems and winch systems)?
- Will the equipment be available and ready to use when you need it?
- Can rescuers always reach a suspended worker with the equipment?
- Have rescue personnel been trained on the specific equipment available?

If you answered "no" to any of these questions, then a new rescue plan should be developed prior to beginning the job.

There are advantages and disadvantages to the different types of technical rescue equipment. Educate yourself on the site-specific equipment available to you.

ACTIVITY 12: RESCUE ME

You will be conducting a self-rescue. Feel free to write notes in this section from your observations and experience.

Watch for certain techniques that you will employ. What does it feel like to be suspended? What will be your greatest obstacle to a successful self-rescue? Make sure you capture as many details as possible.

OBSERVATIONS

MODULE 8 QUIZ

Complete the following quiz.

1. What should be included in the written rescue plan?
   a. Response procedures
   b. General guidelines for methods used during rescue operations
   c. Training requirements/competency measurements for team members
   d. All of the above

2. What causes a suspended person to lose consciousness?
   a. Fear of heights
   b. Nerves are pinched
   c. Air flow is restricted
   d. Blood flow is restricted

3. When are assisted rescues necessary?

   _____

COURSE CONCLUSION

There is no shortcut worth your life or the lives of your co-workers. The rules, regulations, equipment, and guidelines at Freeport-McMoRan are designed to keep you safe and ensure that you return home in the same way you reported to work.

Maintaining an awareness of your surroundings, as well as being knowledgeable about current policies and procedures, is an integral part of your job. Through past experiences and collected data, it is clear that falls occur far too often. Understanding how and why falls are occur can reduce the number of instances. While there is an element of risk working from a height, safety is deliberately built into each and every job. It is ultimately up to you to perform your job safely and efficiently.

Applying the Hierarchy of Controls can further aid in the control of hazards. Knowing what hazards are in your immediate work area and effectively controlling them will reduce the amount of incidents. Taking a proactive approach to hazards is one of the best lines of defense.

When the only possible control remaining involves PPE, be sure that you are following company policies for fitting, donning, and inspecting all safety equipment. Taking a few extra minutes each day can be the deciding factor between experiencing a fall or not.

Remember - you are a valuable asset to this Company. As displayed throughout this course, measures exist to protect you and allow you to work with minimal exposure to risk. FCX Department of Occupational Health and Safety policies are available online and in print. Speak with your supervisors and health and safety representatives to ensure you know and understand how these policies apply to you and your work areas.

There may be rare circumstances where FCX-HS02 policy and this training course cannot be followed. If for any reason any aspect of FCX-HS02 cannot be met, a variance must be completed in accordance with FCX-HS21. If a variance is required, make sure that you are in compliance with all appropriate governing regulations.

Failure to follow regulations can result in termination, but more importantly they can result in you or your co-worker’s death. No production deadline is more important than any one of our lives.

Resources

RESOURCES

GLOSSARY

Anchorage	A secure point of attachment for lifelines, lanyards or deceleration devices.
Authorized / Competent Individual	An employee who uses personal fall protection systems and receives specific training on the equipment being used.
Body Belt	A strap with means both for securing it about the waist and for attaching it to a lanyard or lifeline in a fall restraint system or positioning device system.
Body Harness	Straps which may be secured about the person in a manner that will distribute the fall arrest forces over at least the thighs, pelvis, waist, chest and shoulders with a means for attaching it to other components of a personal fall arrest system.
Deceleration Device	Any mechanism, such as a rope grab, rip-stitch lanyard, specially-woven lanyard, tearing or deforming lanyard, automatic self-retracting lifelines/lanyards, etc., which serve to dissipate a substantial amount of energy during a fall arrest or otherwise limit the energy imposed on a person during a fall arrest.
Deceleration Distance	The additional vertical distance a fall person travels, excluding lifeline elongation and free fall distance, before stopping, from the point at which a deceleration device begins to operate. It is measured as the distance between the location of a person's body belt or body harness attachment point at the moment of activation (at the onset of fall arrest forces) of the deceleration device during a fall and the location of that attachment point after the person comes to a full stop.
Free Fall	The act of falling before a personal fall arrest system begins to apply force to arrest the fall.
Free Fall Distance	The vertical displacement of the fall arrest attachment point on the person's body belt of body harness between onset of the fall and just before the system begins to apply force to arrest the fall. This distance excludes deceleration distance and lifeline/lanyard elongation, but includes any deceleration device slide distance or self-retracting lifeline/lanyard extension before they operate and fall arrest forces occur.
Guardrail System	Barrier erected to prevent persons from falling to lower levels.
Lanyard	A flexible line of rope, wire rope or strap which generally has a connector at each end for connecting the body belt or body harness to a deceleration device, lifeline or anchorage.
Lifeline	A component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline) or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline) and which services as a means for connecting other components of a personal fall protection system to the anchorage.

Qualified Individual	One who, by possession of a recognized degree, certificate or professional standing or who by knowledge, training, and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work or the project.
Self-Retracting Lifeline/Lanyard (SRL)	A deceleration device containing a drum-wound line which can be slowly extracted from, or retracted onto, the drum under slight tension during normal person movement and which, after onset of a fall, automatically locks the drum and arrests the fall.
Servicing and/or Maintenance	Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the unexpected energization or startup of the equipment or release of hazardous energy.

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STUDENT END OF COURSE QUESTIONNAIRE

Course Title | Site | Date

Your Name (optional) | Facilitator

Directions: Circle the number that best fits your level of agreement with the statement. Then complete the short answer questions.

	Strongly Disagree	Disagree	Agree	Strongly Agree
1. The course content was relevant to my job.	1	2	3	4
2. The course materials were clear and well written.	1	2	3	4
3. The balance of lecture, discussion, activities, and student questions was appropriate.	1	2	3	4
4. The activities were appropriate for the course.	1	2	3	4
5. The facilitator was knowledgeable about the content.	1	2	3	4
6. The facilitator created an atmosphere that enhanced my learning.	1	2	3	4
7. I am confident I can apply the course content to my job.	1	2	3	4
8. The course met my expectations.	1	2	3	4

9. **What did you find valuable in the course?**

10. **What can be improved in the course?**

11. **Please clarify your responses (questions 1-8) and provide any additional comments.**

Thank you for taking the time to complete this evaluation. We value your feedback.

Mail to: Mine Training Institute, Attn: Suzanne Anderson, 18550 S. La Canada Dr., Sahuarita, AZ 85629
Scan or email to: sanderso2@fmi.com