



**FREEPORT-  
McMoRAN**

## **STUDENT GUIDE**



# **SFT FCX2018C WORKPLACE EXAMINATIONS UNDERGROUND**

JUNE / 2018  
VERSION 1



*“We start with looking after  
our workers’ welfare.”*

***Richard C. Adkerson***  
***President and CEO, Freeport-McMoRan<sup>1</sup>***

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<sup>1</sup> 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 are identified and provided to the students to establish guidance and focus throughout the course.

### MODULE 1: WORKPLACE EXAMINATION COMPLIANCE

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

- Explain the purpose of workplace examinations.
- Describe the qualifications and training necessary to conduct one.

### MODULE 2: UNDERGROUND HAZARD IDENTIFICATION

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

- Conduct a workplace examination by assessing a scenario for general hazards.

### MODULE 3: UNDERGROUND CRITICAL CONTROLS

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

- Describe how critical controls affect the underground environment.

### MODULE 4: CHEMICAL STORAGE

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

- Describe the process for managing chemical identification, storage, and handling.

## FATAL RISKS AND CRITICAL CONTROLS

Fatal Risk Management is a continuation of the Fatality Prevention Program. Focus is centered 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 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.

### EXPOSURE TO HAZARDOUS SUBSTANCES - ACUTE



The Exposure to Hazardous Substances Acute Fatal Risk is defined as workplace exposure to substances that are immediately toxic, asphyxiating or corrosive (e.g., H<sub>2</sub>S gas, NO<sub>x</sub> gas, CO gas, concentrated acids, caustics).

#### Critical Controls

- Access Control
- Alarm Systems
- Engineered Controls
- Handling Requirements
- Loading and Unloading Protection
- Mechanical Integrity of Storage and Distribution
- PPE



## EXPOSURE TO HAZARDOUS SUBSTANCES - CHRONIC



The Exposure to Hazardous Substances Chronic Fatal Risk is defined as workplace exposure to carcinogens and other substances that can cause lethal disease over time (e.g., silica, arsenic, lead, welding fumes, asbestos, acid mist)

### Critical Controls

- Access Control
- Engineered Controls
- Handling Requirements
- PPE

## UNDERGROUND HAZARDOUS ATMOSPHERE



The Underground Hazardous Atmosphere Fatal Risk is defined as exposure to a toxic atmosphere or oxygen deprivation underground.

### Critical Controls

- Refuge Chambers
- Self-Rescuer
- Ventilation Monitoring
- Ventilation System

## UNDERGROUND INRUSH



The Underground Inrush Fatal Risk is defined as exposure to crushing forces or oxygen deprivation caused by the sudden ingress of liquids or solids underground.

### Critical Controls

- Backfill Management and Control
- Draw Point Management and Control
- Entry Point Barriers
- Ore Passes, Chutes, and Raise Controls
- Probe Drilling

## UNDERGROUND ROCK FALL



The Underground Rock Fall Fatal Risk is defined as exposure to rock that falls from the back or sidewalls underground.

### Critical Controls

- Engineered Support Systems
- Geotechnical Inspections and Monitoring Systems
- Ground Control Management Plan Execution
- Scaling

## WORKPLACE EXAMINATIONS INTRODUCTION

Mining is a developing industry with frequently changing factors, such as environment, equipment, personnel, and work areas. It is critical that all employees are alert and aware of any hazard that may affect their own safety, or the safety of others. Safe Production is the ultimate goal. The first step in reinforcing this awareness begins with the employee. Through appropriate training, employees can build the skills necessary to identify, avoid, and mitigate hazards.

A workplace examination is also referred to as an area inspection, pre-shift inspection, work area inspection, and workplace inspection. These procedures or processes are created by each site to identify and immediately control any hazards before beginning and throughout the shift. It is critical to make sure that the workplace is adequate for you to perform your regular job duties. Workplace examinations are the first line of defense in protecting our most valuable asset – you.

The backbone of an effective workplace examination is hazard recognition. Hazards generally fall under one of three categories:

- Chemical (e.g., solvents, Carbon Monoxide, Nitrogen Dioxide)
- Biological (e.g., bacteria, human waste)
- Physical (e.g., noise, radiation, impact injuries)

Depending on your work area, the hazards to which you are exposed can fall under one or all three of these categories. Being skilled at recognizing hazards associated with your work area is a lifelong pursuit.

Never assume that you are automatically aware of all hazards around you. Changing environmental conditions can affect existing workplace hazards. Temperature changes, noise levels, and illumination are factors that can greatly alter your work area and, in turn, the associated hazards.



# Workplace Examination Compliance





## MODULE 1: WORKPLACE EXAMINATION COMPLIANCE

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### MODULE 1 LEARNING OBJECTIVES

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

- Explain the purpose of workplace examinations
- Describe the qualifications and training level necessary to conduct one





## INTRODUCTION

Policies, guidelines, and procedures are typically created as a result of an incident or near miss. Injury or loss of life is often the driving force behind the establishment of the Health and Safety policies under which we work. Performing a job in a safe manner is not only a matter of compliance with regulations, but is your means of returning home safely.

Freeport-McMoRan requires a competent person to perform a workplace examination before work begins or as miners begin work in that area for any conditions that could negatively affect health and safety.



*Fig. 1.1 Remain aware of hazards in any workplace*

## PURPOSE OF INSPECTION

The purpose of an inspection is to bring the employees' attention to hazards in their working area and take immediate action to mitigate or eliminate them. The workplace examination is the first resource available to you to help promote a safer working area. Use this tool to your advantage and keep safety a priority in your actions.

## RESPONSIBLE INDIVIDUALS

As stated previously, Freeport-McMoRan requires that a competent person perform a workplace before work begins or as miners begin work in that area. While some workplace examinations may only be the responsibility of one specified person, such as a Supervisor, this does not lessen your responsibility as it relates to safety.

A competent person means a person having the abilities and experience that fully qualify him/her to perform the duty to which he/she is assigned. A competent person is one who:

- Is designated by Supervision.
- Is well-versed in all operational aspects of the working area.



*Fig. 1.2 Conducting a workplace exam*

Here at Freeport-McMoRan, we feel that increased team involvement in workplace examinations is a key component to increased hazard recognition. Our employees come from various backgrounds and experience levels. Varied experiences can contribute to an increased awareness of hazards and result in a more effective workplace examination. Whether you have been on the job for one month or 25 years, your input is valued. Even though Supervision may not specifically designate you, it is still ultimately your responsibility to maintain a level of awareness of hazards in your workplace or surrounding areas. The Department of Health and Safety (DOHS) team strongly encourages additional workplace examinations whenever environmental conditions change or when you start a new task. While this is not a requirement, it is in line with our best practices and core values.

## RECORD KEEPING

Maintaining and storing records of all workplace examinations may vary depending on your site and department. Regardless of your department-specific handling policies, whenever a workplace examination is performed, it needs to be given to a Supervisor for review.

Once your workplace examination has been reviewed by your Supervisor, you should use it as a working document throughout your shift. Any new hazards found during the work shift should be documented on the form and submitted to your Supervisor.

Records of each workplace examination will be maintained according to Freeport-McMoRan's record retention policy. These records are maintained in either hardcopy or electronic form and made available for inspection or copy upon request by MSHA or a miners' representative. These records must include:

- The date of the examination
- The examiner's name
- The work areas examined
- Any safety-related conditions found
- Any corrective measures take
- Description of each adverse condition not corrected promptly



*Fig. 1.3 Completing the document*

When an adverse condition that was not promptly corrected is subsequently correct, the record needs to include or be supplemented to include the date of the corrective action.

## COMMUNICATION OF HAZARDS

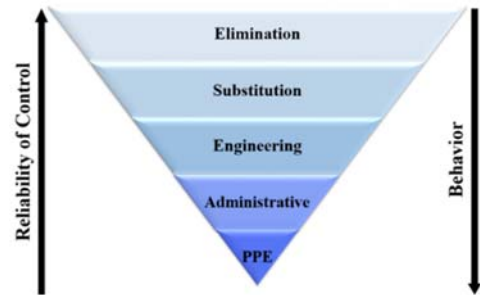
Effective communication of hazards is very important. This can be in the form of signs and other administrative controls. Ensure you are aware of the different forms of communication when working underground. Promptly notify miners in the affected area.

## MITIGATION OF FINDINGS

If a hazardous condition is found while performing an examination, take immediate action to resolve the issue. If a hazard is discovered that poses an immediate risk to personnel (depending on the level or risk to personnel), work activities will be halted until the appropriate controls are in place. A spotter may also need to be posted until proper flagging/ribboning or barricading can occur.

Due to the variety of work performed at our sites, specific steps required to initiate hazard control can vary. Nonetheless, it should always include preventing access to the hazard and contacting your Supervisor or Health and Safety Professional. Only secure or isolate a hazard to the appropriate level of your training.

When attempting to control a hazard, always refer back to the Hierarchy of Controls outlined in Fatality Prevention. Remember that elimination, substitution, and engineering controls are almost always more effective than administrative controls and PPE. Whenever possible, apply the controls that keep the employee as safe as possible.



*Fig. 1.4 Hierarchy of Controls*

## LEARN FROM OTHERS

*On June 11, 2009, an employee backed a buggy (tractor used as an underground personnel transport) into an open ore pass that was under construction. The employee was backing the buggy from the 728 drift into the 77W drift for work related to the construction of the ore pass. The ore pass consisted of two legs: a straight bore of several hundred feet that was completely filled with muck, and a short leg of approximately 30 feet that was open almost to the intersect with the straight bore. He knew that there was an open hole in the drift, but did not know its precise location.*

*The buggy came to rest with the front bumper about two feet below the road level; the ore pass was open an additional ten feet below the buggy. The employee was able to climb out without assistance and had only minor injuries.*



*Fig. 1.5 Buggy in the ore pass*



*Fig. 1.6 View from outside of the ore pass*

## MODULE 1 QUIZ

Complete the following quiz.

1. In accordance with FCX requirements, how often should a workplace examination occur?
  - a. Once per hour
  - b. At the end of each shift
  - c. Before work begins or as miners begin work in that area
  
2. Why is it important to conduct a workplace examination?
  - a. To avoid MSHA fines
  - b. To ensure the previous shift was productive
  - c. To recognize hazards and ensure critical controls are in place prior to starting work
  - d. None of the above
  
3. What defines someone as competent to conduct a workplace examination? (Circle all that apply)
  - a. Assigned by a co-worker
  - b. Designated by Supervision
  - c. Understanding of operations in that work area



# Underground Hazard Identification







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### MODULE 2 LEARNING OBJECTIVES

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

- Conduct a workplace examination by assessing a scenario for general hazards



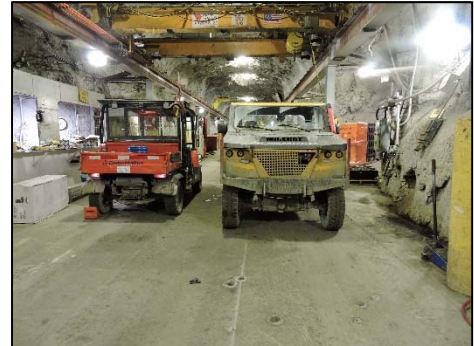
## INTRODUCTION

The keys to an effective workplace examination are strong hazard recognition skills along with personal accountability to the task. While the workplace examination is the first line of defense against hazards, it is only as effective as the person conducting it. Someone may be well-versed in the hazards of a job, but if they do not take the time to perform a proper examination, then the workplace exam becomes ineffective.

The following guidelines are necessary for performing an effective workplace examination:

- Talk through the tasks being performed in the defined work area during a tailgate and identify any relevant or potential fatal risks for these tasks.
- Ensure the appropriate form is being used. Different tasks/departments at your site may require the use of a different form.
- If possible, include more than one person.
- Begin by defining the boundaries of your work area.
- Survey the work area from a distance.
  - Large hazards can be identified such as an open-hole, a suspended load, or moving equipment.
  - This may be easier from an elevated vantage point.
- Survey the work area from a closer point of view. Look for housekeeping issues, tripping hazards, electrical issues, etc.
- Examine specific pieces of equipment relative to your job.

This module will provide examples of common hazards that exist on Freeport-McMoRan's properties. It is important to note this is not an all-encompassing list of hazards you can expect to find in your work area. Refer to your Supervisor or Health and Safety Professional for further clarification.



*Fig. 2.1 Underground Truck Shop*

## AIR AND WATER LEAKS

Throughout the underground mine, you will hear many different noises. Equipment and processes generate most of the noises. Air leaks, unlike water leaks, will be detected audibly. Report the air or water leak to the correct qualified person. Never try to resolve or mitigate an issue that is beyond your skill level or training.

## BLASTING AND EXPLOSIVES

Using explosives to blast rock is a necessary function of mining, especially in an underground mine. As you conduct a workplace examination, check your work area for misfires or leftover explosives. Immediately barricade the area, if any are found. It is important to remain observant even in areas where work is no longer being performed, as misfires can be present or explosives might have dropped in the drift.

All vehicles that transport explosives must have all explosives removed when not actively blasting. They should be cleaned and inspected prior to going into the shop/lube bay.

Employees trained to handle explosives are responsible for the storage of them. Per Freeport-McMoRan, there are specific requirements for storage of explosives, such as:

- Must be on stable or supported ground so that a fire or explosion will not prevent escape from the mine or cause detonation of the contents of another storage facility
- Out of the line of blasts and protected from vehicular traffic
- At least 200 feet from work places or shafts
- At least 50 feet from electric substations
- At least 25 feet from detonator storage facilities
- Posted with warning signs that indicate the contents and are visible from any approach
- Provided with unobstructed ventilation openings

## ELECTRICAL

The majority of the equipment you find at Freeport-McMoRan sites is powered by electricity. Electrical-related citations from MSHA are also some of the most common. For the 2016 year, three of the top ten MSHA violations pertained to electrical violations:

- Electrical conductors: Not of sufficient size or current-carrying capacity and/or conductors exposed to mechanical damage
- Identification of the power switches: Cover plates missing on electrical equipment or junction boxes
- Correction of dangerous conditions: Failure to provide proper records of resistance measurements and continuity checks

All three types of violations should be covered in a comprehensive workplace examination.



*Fig. 2.2 Electrical panels*

## MISSING KNOCKOUT PLUGS

Electrical boxes are designed to allow for either single or multiple conduits. The conduit is attached to the electrical box at small pre-cut holes. These holes are covered with small knockout plugs that are intended to be broken away when the conduit is attached. Whenever an electrical box is modified in a manner that eliminates the need for a conduit, the remaining hole cannot be left open. A new knockout plug is used to mitigate this hazard. This is to ensure that no open holes exist in the electrical box.

As you perform your workplace inspection, be sure to examine all electrical boxes for broken or missing knockout plugs. You also want to ensure that all electrical box access doors are working and can be properly secured. Electrical boxes should be free from any unused knockout plugs. Never access an electrical box through a knockout plug.



*Fig. 2.3 Missing knockout plug*

## BROKEN OR DAMAGED CONDUITS/CORDS

Electrical conduits house live electrical lines. They are intended to prevent personnel from coming into direct contact with live systems. Broken conduits can lead to exposed wiring, which is a shock/electrocution hazard. While conducting your workplace examination, inspect any sections of conduit to which you have access. Pay close attention to any junctions or access points along the conduit, as these sections are where wire exposure can commonly occur.

Check cords and prongs on power tools and extension cords for damage, including cracks, frays, missing prongs, or loosened connections. Take any damaged cords out of service. Extension cords cannot be used for permanent use.



*Fig. 2.4 Exposed wiring on a conduit*

## ELECTRICAL PANELS

Proper labeling of all electrical panels is critical to the safety of personnel. Improper or nonexistent labeling can contribute to major injuries or death during maintenance or emergency situations.

When inspecting the labeling of electrical panels, verify that all operational fuses are legibly marked appropriately and accurately. If labels are damaged, missing, or not legible, the appropriate personnel needs to be notified so immediate corrective action can be taken. Only authorized and qualified individuals should open any panels. Additionally, note whether or not adequate lighting is in place to read all labeling. Any items labeled “spare” or something similar must remain in the open/off position. If doors to the electrical panel are left open, notify an electrician for further assistance.



*Fig. 2.5 Panel is difficult to read*

Important questions to ask yourself when looking at electrical panels are:

- Is it difficult to read these labels?
- If so, is that due to legibility or something obstructing the view?



*Figs. 2.6 and 2.7 Labeling on panels*



## GROUND CHECKS/GFCI

Electrical equipment requires a ground check upon installation, after repairs or modifications, and annually thereafter. These checks are to test the continuity and resistance of the grounding system.

Some properties use a specific color-coded tape system to allow employees to determine at a glance if the equipment has been inspected or is out of compliance.

Ground Fault Circuit Interrupters (GFCIs) protect people by detecting current flowing outside the normal path or circuit. All 120-volt outlets at Henderson must be GFCI protected. Always test the outlet before use by pushing the “test” button, which should de-energize the outlet. If it does not trip or will not reset, do not use the outlet. Tag the outlet as “BO” and get a work order generated to replace the outlet.



*Fig. 2.8 Labeled GFCI outlet*

## EMERGENCY PREPAREDNESS

In emergency situations, timing is critical. Procedures are in place and should be understood by all employees in a working area. While signs are posted directing employees to emergency routes, eyewash stations, and safety equipment, there are proactive measures that need to be routinely performed to further aid in these situations. Familiarize yourself with the expectations of your site and your workplace. Refer to your site-specific Supervisor or Health and Safety Professional for further clarification.



*Fig. 2.9 Emergency station*

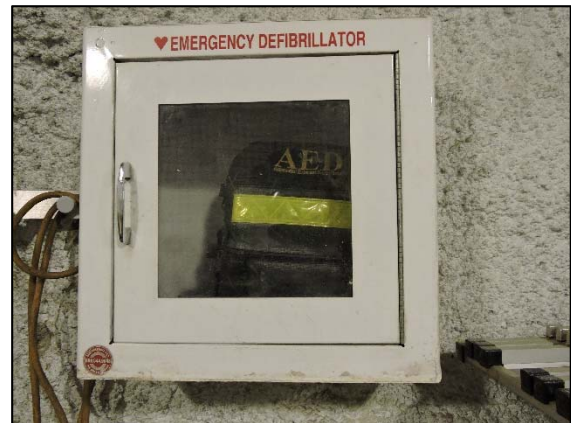
## FIRE EXTINGUISHERS/FIRST-AID KITS/AEDS

Knowing how to use a fire extinguisher is an important skill in the event of a fire. Unfortunately, this skill set is of little use if you do not know where fire extinguishers are located or if they are not in proper working order. When performing your workplace examination, note the location of all fire extinguishers and check the tag and sticker for the dates of the last inspection. Additionally, ensure that signs are posted above each extinguisher and the area three feet around the extinguisher is free of obstructions. All extinguishers identified in the workplace examination need to be inspected to ensure proper working order. Ensure the correct type of fire extinguisher for the work being performed is readily available. If the fire extinguisher needs to be replaced, do so immediately.

When working with fire extinguishers, ask yourself:

- Is there any damage to the handle, nozzle, or hose?
- Is the safety pin correctly in place?
- Does the needle in the pressure gauge fall within the green range, and not above or below this area? That would indicate an over or under pressurized extinguisher.
- Is the annual and monthly inspection tag current?

First-aid kits and automated external defibrillators (AEDs) can be extremely important during a health emergency. During your workplace inspection, pay attention to the location of all first-aid kits and AEDs. Ensure first-aid supplies with an expiration date, such as eyewash solution and AED pads, are current. Verify AED is charged and operational by visually confirming with the display screen or flashing green light, if applicable.



*Fig. 2.10 AED in the workplace*



## EMERGENCY EYEWASH STATIONS AND SHOWERS

Emergency eyewash stations and showers are often the difference between life-altering exposure events and a recoverable injury. Your eyes are especially susceptible to injury. In situations where contamination of the eye has occurred, the longer you wait for treatment the worse off your condition may become. While skin is much more resistant to damage than eyes, there are still certain exposures that will require immediate treatment.

Waiting for an event that requires the use of either an emergency eyewash station or shower is not the time to learn where they are located or if they are operational. As you enter your workplace, locate all emergency eyewash stations and showers. Inspect them to ensure they are functioning, clean, and free from debris. In addition, eyewashes and showers must have signage near them and the area around them must be clear of obstruction. Eyewash water streams should cross when turned on.



Fig. 2.11 Eyewash station



Fig. 2.12 Eyewash shower

## EMERGENCY LIGHTING, EXIT SIGNS, AND EXIT ACCESS

Each work area has a detailed evacuation plan. Success of this plan in an emergency is partially dependent upon minimal emergency lighting, exit signs, and clear access to all exit routes. Prior to working underground, familiarize yourself with your primary and secondary routes of escape and nearest refuge chamber.

Part of the workplace examination will include locating and testing the emergency lighting, locating all exit signs, and ensuring that access to all exits are free of obstructions. Emergency lighting can be tested by pressing the “Test” button or simply unplugging it.

Ensure exit signs are clean and legible.



Fig. 2.13 Exit sign

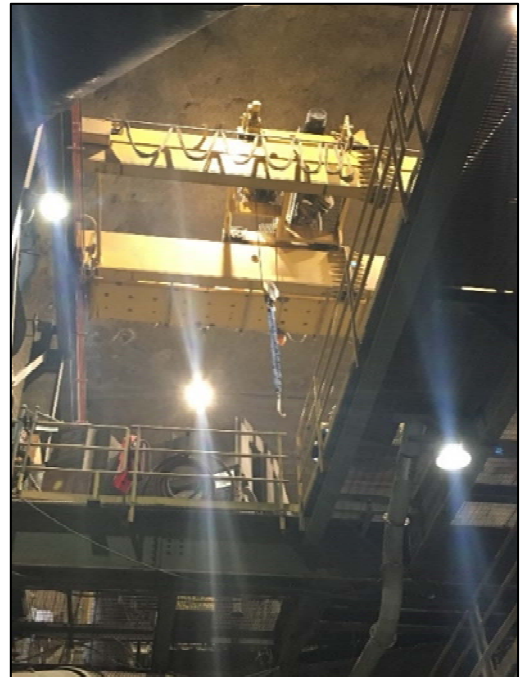
## EQUIPMENT AND TOOLS

A wide variety of equipment is used on our properties. Equipment can be stationary or mobile and will have many uses. This course will focus on common or general hazards within the following three general categories:

- Lifting equipment
- Fabrication equipment
- Grinding equipment

### LIFTING EQUIPMENT

If lifting equipment is in your work area, note the travel path of the equipment and if it may cross your travel path at any time during your shift. Check for proper flagging/ribboning and tagging in the work area. Look for the operator's position in relation to the travel path of the equipment, and whether the operator will be able to see if a pedestrian were to cross the route.



*Fig.2.14 Lifting equipment in use*

## FABRICATION EQUIPMENT

Oftentimes many of our maintenance practices require welding. Welding is the process of fusing two or more metal pieces by bringing them to their melting point. Be aware of your surroundings and watch for indicators of welding in your work area.

Important questions to ask yourself when working in an area where welding or fabrication is occurring are:

- Is the welding equipment mobile or in a fixed location?
- If welding is scheduled to be performed during your shift, is there a likelihood of being exposed to spatter?
- Are all materials (stinger, bottles, or lines) stored/secured properly? Are clamshells in place on all valves?
- Are there any flammable materials stored near the welding equipment?
- Is the welder utilizing a flash screen?
- Is a Hot Work Permit required?



*Fig. 2.15 Welding on the job*

If the welding equipment is mobile, be sure to apply these questions to any location where welding could occur.

## GRINDING EQUIPMENT

In many workshops or work areas you will come across grinders. It is important to know the hazards associated working with or near grinders.

If grinders are in your work area, ask yourself:

- Is use of the grinder going to produce noise levels that could impact other people in the area?
- Are any generated sparks likely to affect a travelway?
- Are you using any flammable materials that may come into contact with sparks from the grinder?



*Fig. 2.16 Using a hand-held grinder*

If you are working with grinders, ask yourself:

- Has a Hot Work permit been completed (if required)?
- Are you turning off the grinder when not in use?
- Is there a 1/8" gap between the tool rest and grinding wheel and is the tongue guard in place?
- Is the grinding wheel rpm rated for the grinder?
- Is the peripheral hood capable of withstanding a bursting wheel and enclosing not less than 270°?



*Fig. 2.17 Using a stationary grinder*

## GROUND CONTROL/SUPPORT

Maintaining awareness of your surroundings underground is critical for both employees and equipment. Freeport-McMoRan mandates that ground conditions underground be inspected at least once per shift. These inspections are part of a workplace examination. This type of examination is performed by either a Supervisor or a qualified individual assigned by Supervision. Even though you may not be the person conducting this examination, you still have a responsibility to examine ground conditions as you travel through underground areas.

Regardless of the type of equipment you are operating underground, visual examinations will commonly include looking for these hazards:

- Cracks.
- Raveling.
- Spalling.
- New water seepage.
- Shotcrete damage.

It is just as important to be aware of conditions that may lead to the above mentioned hazards. Some of these conditions from seismic activity include, but are not limited to:

- Blasting.
- Vehicle movement/impact.
- Earthquakes.

As a best practice, follow these guidelines:

- Working under unsupported ground is prohibited.
- Perform ground inspections.
- Do take action in reporting altered ground conditions and/or mitigate the issue to the best of your skill level or training.
- Maintain communication about changing ground conditions.
- Loose rock needs to be barred or scaled down.

When an unsafe condition is noted and cannot be safely mitigated, stop work activities immediately and contact your Supervisor or Health and Safety Professional.



## GUARDS

Guarding is intended to prevent access into a hazardous area. Some forms of guarding are intended to prevent whole person access, while other forms only eliminate access into smaller areas. All forms of guarding should be maintained at all times.

When performing a workplace examination, note all areas where guarding should be installed. This can include, but is not limited to, machinery with exposed moving parts, shielding to protect against chemical contact, heat shielding, and fan silencing. If guarding deficiencies are discovered through a workplace examination, stop working until the guarding is repaired or reinstalled. These unguarded areas should be barricaded, flagged/ribboned, and/or include a spotter until the hazard can be mitigated or eliminated. If the workplace examination reveals areas where guarding was never installed, but should have been, contact your Supervisor or Health and Safety Professional to begin the process.



*Fig. 2.18 Proper guarding*



*Fig. 2.19 Improper guarding*

## UNDERGROUND HAZARDOUS ATMOSPHERE

Critical controls are in place to maintain a safe working environment. Without these controls in place and in operating order, the atmosphere can become hazardous with high levels of carbon monoxide and nitrogen dioxide. It is critical that workplace examinations include checking on the functionality of these controls.

Questions to ask yourself:

- Are the fans on before entering the drift?
- Are the fixed monitors operating? Fixed monitors are located throughout the underground mine.
- After a blast, has enough time passed (minimum 30 minutes) before employees are allowed to enter the area?
- Are oxygen levels safe to begin or resume work?

## HOUSEKEEPING

Housekeeping is more than just picking up after yourself. Trash, debris, spills, and miscellaneous equipment/tools become a safety hazard when they obstruct walkways or working surfaces. Fine materials such as sawdust and silica, along with biological hazards such as improperly stored food or human waste, can create a wide array of health hazards. Ensure common areas are kept clean, such as microwaves, refrigerators, and lunch tables. Verify that trash cans are not overfilled. Establish housekeeping habits by cleaning your area routinely and encourage others to do the same.



*Fig. 2.20 Proper Housekeeping*

## TRASH/CLUTTER

Trash and clutter can result in injuries/health issues, if not removed from a work area. This can be a tripping hazard and, depending on the material, can cause cuts and scrapes. If the trash happens to be food waste, biological hazards may also be present. Trash and clutter can block escape routes, in the event of an emergency or evacuation. In the event of a fire, excess trash can provide an additional fuel source allowing the fire to spread quickly and easily.



*Fig. 2.21 Trash and debris*



*Fig. 2.22 Improper storage of hoses*

## DRAINAGE

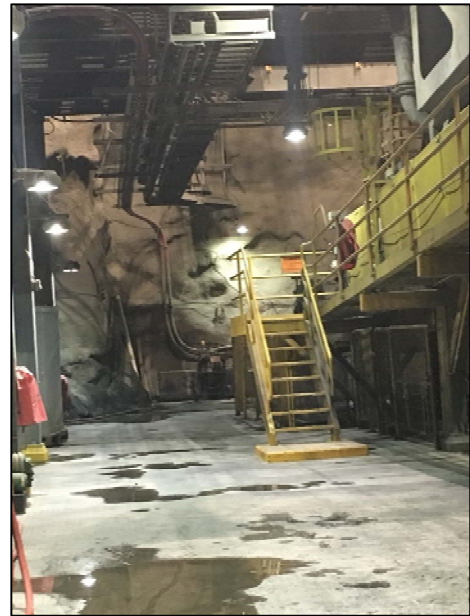
While inspecting the drainage areas underground, it is important to observe the water level. If the drain is not properly emptying, utilize a scaling bar to loosen the material to restart the flow.

## SLIPPING/TRIPPING HAZARDS

Slips and trips can be caused by a wide variety of conditions. Some of these may include standing liquids, uneven surfaces, hoses, electrical cords, or stairs and ladders. If you happen to see standing liquids or puddles, and cannot avoid walking through it, make sure to shuffle your feet. Once you establish appropriate barricading, contact your Supervisor or Health and Safety Professional.

Questions to ask yourself:

- What is my travel path in this area?
- Are there any conditions that might lead to a slip or trip?



*Fig. 2.23 Excess water leads to slipping incidents*

## SIGNAGE

According to the Hierarchy of Controls, signs are classified as administrative controls. When immediate, potential health, or not easily recognized safety hazards exist in a work area, warning signs must be posted at all approaches. Recognizing these signs enables you to easily understand the hazards and adhere to proper precautions while working. Pay attention to signs in your work area as they are intended to:

- Direct
- Warn
- Inform

Some of the signs encountered are:

- **Danger:** Indicates a hazardous situation that, if not avoided, will result in death or serious injury. The signal word "DANGER" is to be limited to the most extreme situations. DANGER [signs] should not be used for property damage hazards unless personal injury risk appropriate to these levels is also involved. Shall be used in major hazard situations where an immediate hazard presents a threat of death or serious injury to employees. Danger tags shall be used only in these situations.
- **Warning:** Indicates a hazardous situation that, if not avoided, could result in death or serious injury. WARNING [signs] should not be used for property damage hazards unless personal injury risk appropriate to this level is also involved.
- **Caution:** Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury. Shall be used in minor hazard situations where a non-immediate or potential hazard or unsafe practice presents a lesser threat of employee injury.



All signs must be in good health, meaning they must be properly anchored, legible, and visible. If you notice signs that are falling or are not easily visible, either resolve the issue or notify your Supervisor to take further action.

For a sign to be effective in a working area, it must be positioned in an obvious location, be clean and legible, posted in the common language for that property, and oriented properly. During an emergency situation, you do not want to lose time by having to stop and focus on a sign that does not meet these standards. If during a workplace examination it is noted that there are signs that do not meet these standards, take the time to correct the problem, or notify Supervision so that the issue can be resolved. Remember, signage is designed to notify you of a hazard; it is understanding and adhering to the information that will protect you.



*Fig. 2.24 Signs should be legible*

## LIGHTING

In areas where lights are installed, such as shops, warehouses, substations, or lunchrooms, lighting must be maintained and working. Portable construction lights that are equipped with guards must have the guards installed on them and in working order. Emergency lighting, where applicable, must be functional. High visibility lamps are part of the required PPE for entrants underground and must be fully functional.

## SHAFTS AND CAGES

Shafts and cages are not commonplace in most employees' workplace examinations. There is a formal process for inspecting these areas using specially trained crews; however, ensure the entrance is clear of debris and tripping hazards.

## SHOP AREA

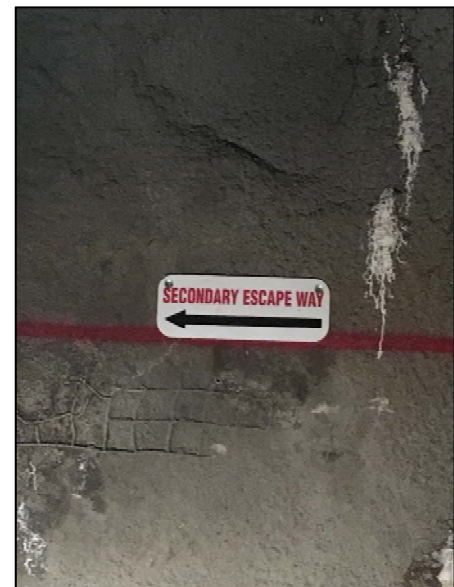
Shop areas are painted white in an effort to brighten the area. Illumination is found most often in these work areas. Some of the shops are designated “safe areas” for hot work and do not require a permit. Ensure all materials are properly stored in appropriate areas within the shop area; this includes flammables, combustibles, hazardous waste, trash, and universal waste. Clear any tripping hazards. Confirm that all signage is not only clean and legible but also current, valid, and adequate.

## TRAVELWAYS/ESCAPEWAYS

While travelways and escapeways come in a wide variety, their purpose is ultimately the same: to allow employees on foot or equipment to travel from one area to another. They may be traveled frequently or rarely, but it is important that they remain a safe route for all employees at all times. Always be aware of your primary and secondary escapeway, as well as the nearest refuge chamber.

While working underground, ensure you know where the primary and secondary escapeways are located. At Henderson, the primary escapeway is 2 shaft, which is a fresh air intake. The secondary escapeway is the conveyor tunnel, which can only be used in the event 2 shaft is not accessible. Note: the conveyor tunnel is also a fresh air intake.

Safe access along any path that is traveled for work, repair, or maintenance should be kept free of debris or obstruction, and easily accessible. Travelways and escapeways are everyone’s responsibilities and are scaled/barred down accordingly. Inspections should be occurring whether employees travel via equipment or on foot. For example, during the Quarterly Scaling Program at Henderson, each department devotes a day near the end of each quarter to complete additional inspections.



*Figs. 2.25 and 2.26 Signage noting underground escapeways*

## TRAFFIC/PARKING PROCEDURES

With different mobile equipment present underground, there are procedures in place to maintain safe passage.

Follow these procedures whenever you are underground:

- All uphill traffic has the right of way.
- All mobile equipment in your work area must have the emergency brake set and the tires chocked, when not in use.
- All unattended equipment should be turned off.
- Make sure vehicles are not blocking access ways to shafts.



*Fig. 2.27 Parking underground*

## RAILINGS AND TOE BOARDS

Handrails, midrails, and toe boards are provided to protect employees from falling to a lower level or to protect those working or traveling beneath the elevated walkway. As you enter a work area, be aware of either the presence or absence of railing systems along travelways. Where railing systems are installed, look for broken or missing sections. If found, contact your Supervisor or Health and Safety Professional immediately after properly flagging/ribboning and barricading. Along travelways without railing systems, ask yourself if a fall from heights is possible.

When working near or walking through an area with railings and toe boards, ask yourself:

- Are there any missing bolts, hardware, grating, or bent stairs/tread?
- Is there an installed toe board along all areas that have midrails and handrails?
- If a fall hazard exists, do you need to be wearing fall protection?

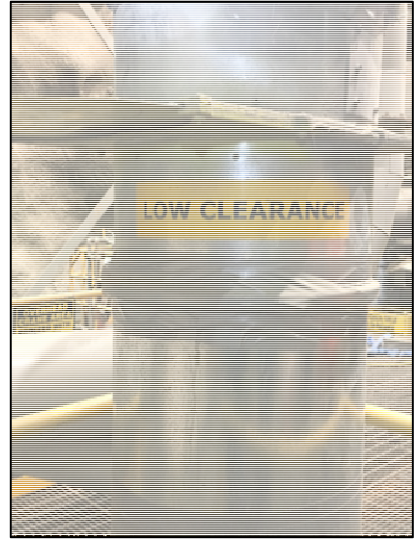


*Fig. 2.28 Railing systems and toe boards in place*

## OVERHEAD CLEARANCE

Overhead clearance is another integral part of safe access along travelways or escapeways. Some of our infrastructures and equipment may require employees to duck as they pass.

The presence of an overhead crane can add another hazard to the workplace when in use. Alarms and lights are used to warn employees of a moving crane. During a workplace exam, be aware of any overhead hazards, as well as any associated warning devices.

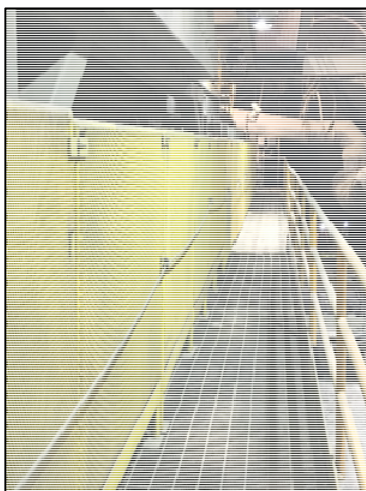


*Fig. 2.29 Overhead clearance*

## CONVEYORS

Conveyors along travelways can present multiple hazards. Material can fall from the conveyor and collect along the travelway. If left uncontrolled, the build-up of material can present a trip hazard, or can completely impede travel along the path. Unguarded conveyors can project material, as well as expose employees to moving machinery.

Also, be aware of conveyance systems overhead. When guards are installed, look carefully for any gaps that may exist in the guarding and build-up of excess material, as it can easily fall and strike workers below.



*Fig. 2.30 Walkway along a conveyor*



## OPEN HOLES

The presence of an unguarded/non-barricaded open-hole, other than ore passes, along any travelway or escape route is considered an imminent danger. In the event a workplace examination reveals an open hole other than an ore pass, work activities should immediately stop, Supervisor or Health and Safety Professional should be notified, and proper barricading must be installed.



*Fig. 2.31 A secured ore pass*

## UNSECURED ORE PASSES/RAISES

All open holes must be marked, and either barricaded or physically guarded at both the collar and bottom. This includes all raises, access in grating floors, manholes and vaults, ladder ways, etc. In inactive areas, all ore passes must be covered or barricaded from access; a single flag/ribbon is not adequate. Any ore passes in operation must have a light or yellow flasher.



*Fig. 2.32 Open holes pose a risk*



## ACTIVITY 2: HAZARDS IN THE WORKPLACE

Conduct a workplace examination by identifying the existing hazard(s) in each photograph and the potential consequence. If there is not one present, write “none.”

1.



Existing Hazard(s) / Potential Consequence

2.



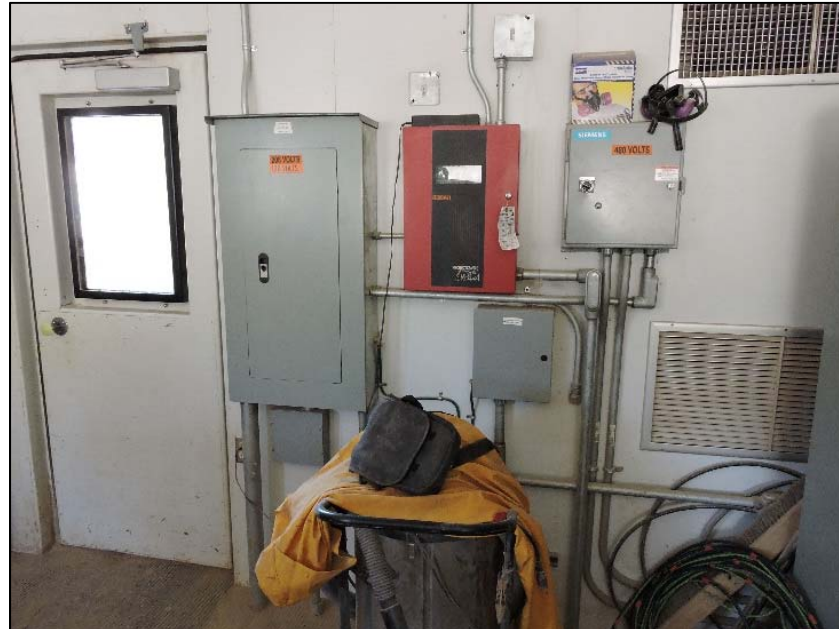
Existing Hazard(s) / Potential Consequence

3.



Existing Hazard(s) / Potential Consequence

4.



Existing Hazard(s) / Potential Consequence



## ACTIVITY 3: TEACH ME

**Assigned hazard topic:** \_\_\_\_\_

**Hazards to consider:**

*(Use your Student Guide to assist you)*

**Talking points:**

*(What do you want your classmates to understand about this topic? What are some key concepts? How can you apply this topic to your workplace?)*



## MODULE 2 QUIZ

Complete the following quiz.

1. What is the purpose of guarding?
  - a. Prevent access into a hazardous area
  - b. Provide another location to store PPE
  - c. Protect equipment from dust and debris
  
2. What are some examples of good housekeeping? (Circle all that apply)
  - a. Disposing of trash
  - b. Cleaning up oil spills
  - c. Wearing the correct dust mask
  - d. Securing ladders in the tool shop
  
3. What should you include in your workplace examination when working with grinders? (Circle all that apply)
  - a. Drainage
  - b. Hot work permit
  - c. The tongue guard
  - d. The peripheral hood



# Underground Critical Controls





## MODULE 3: UNDERGROUND CRITICAL CONTROLS

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### MODULE 3 LEARNING OBJECTIVES

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

- Describe how critical controls affect the underground environment





## INTRODUCTION

This module addresses some of the critical controls in place for working underground. If you recall, 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.

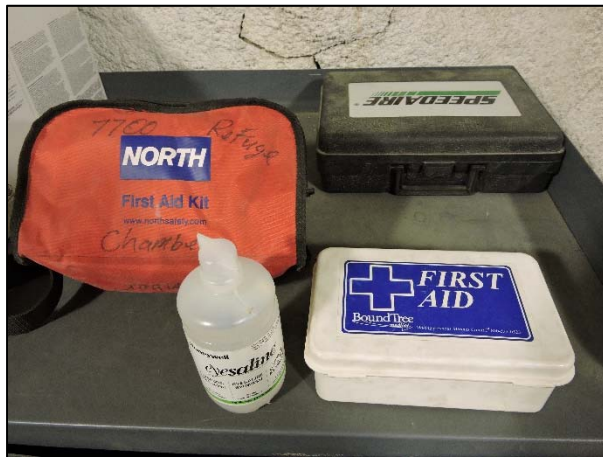
The table below lists the fatal risks relevant to conducting a workplace examination underground. For each fatal risk, there are multiple critical controls identified to prevent injury or death. The bolded critical controls are those that are specific to the underground environment.

Fatal Risks	Critical Controls
Exposure to Hazardous Substances – Acute	<ul style="list-style-type: none"> <li>• <b>Access Control</b></li> <li>• <b>Alarm Systems</b></li> <li>• <b>Engineered Controls</b></li> <li>• Handling Requirements</li> <li>• Loading and Unloading Protection</li> <li>• <b>Mechanical Integrity of Storage and Distribution</b></li> <li>• PPE</li> </ul>
Exposure to Hazardous Substances – Chronic	<ul style="list-style-type: none"> <li>• <b>Access Control</b></li> <li>• <b>Engineered Controls</b></li> <li>• Handling Requirements</li> <li>• PPE</li> </ul>
Underground Hazardous Atmosphere	<ul style="list-style-type: none"> <li>• <b>Refuge Chambers</b></li> <li>• Self-Rescuer</li> <li>• <b>Ventilation Monitoring</b></li> <li>• <b>Ventilation System</b></li> </ul>
Underground Inrush	<ul style="list-style-type: none"> <li>• Backfill Management and Control</li> <li>• Draw Point Management and Control</li> <li>• Entry Point Barriers</li> <li>• <b>Ore Passes, Chutes, and Raise Controls</b></li> <li>• Probe Drilling</li> </ul>
Underground Rock Fall	<ul style="list-style-type: none"> <li>• Engineered Support Systems</li> <li>• <b>Geotechnical Inspections and Monitoring Systems</b></li> <li>• Ground Control Management Plan Execution</li> <li>• <b>Scaling</b></li> </ul>

While there are many critical controls available and/or in place underground, the following examples are critical controls inspected during a workplace examination.

## REFUGE CHAMBERS

In addition to primary and secondary escapeways, refuge chambers are located throughout the underground mine. This critical control is provided for employees who cannot reach the surface within one hour from their working area using either escapeway. The refuge chambers are specifically located so that employees can reach one of them within 30 minutes from leaving their workplace.



*Fig. 3.1 Refuge chamber supplies*

Refuge chambers are designed with fire-resistant construction and can be sealed to be gas-tight. Each chamber is equipped with compressed air lines, waterlines, suitable hand tools, stopping materials, and first aid supplies. Ensure that the proper tools and supplies are maintained and readily available, should an emergency occur. Even though refuge chambers are not active working areas, it is critical to check the integrity of the walls and ceilings (ribs and back).

## VENTILATION

It is critical for airflow to be constantly moving within the underground mine. Maintaining proper airflow within the underground mine is required to introduce fresh air into work areas and reduce hazardous atmospheres to workers. Airflow also controls temperatures, environments, and provides oxygen. With the combination of fresh air intakes and exhaust fans (return airshafts), air has the ability to safely move throughout the various drifts to provide a safe working environment.

There are qualified individuals who are responsible for completing a more in-depth inspection of the ventilation system; however, it is important to inform Supervision or a Health & Safety Professional if you notice a change in the environment, the airflow or defects in the ventilation equipment (e.g. torn vent bag, gap between fan and vent bag).

## AIR DOORS

Throughout the underground mine, air doors are specially designed and placed in areas to control ventilation of the mine between intakes and return airways. The doors create an air-lock. With the use of sensors at Henderson, the doors will automatically open when equipment and/or machinery are detected or in proximity. It is critical that all doors are fully operational and free from obstructions.

## DUST CONTROL

When bulk material is altered or moved by equipment or at transfer station via chutes, dust is generated. Not all dust particulates are visible to the eye, which is why dust suppression measures are critical underground. Dust suppression sprayers in draw points must be fully functional and running. Dust collection systems at transfer points must be free from damage and running. Water trucks are utilized to control dust for main access and travelways. Wash down hoses must be fully functional for dust suppression near exhaust ends. Transfer points on conveyors utilized water sprayer to suppress dust while equipment and machinery are dumping/crushing ore.

Roadways need to be maintained with minimal amounts of water to reduce dust. Look for non-functioning/disabled sprayers. If you notice an excessive amount of dust or an area that needs maintenance, notify Supervision or a Health & Safety professional. Mitigate the issue to the best of your skill level or training.



## MODULE 3 QUIZ

Complete the following quiz.

1. What does airflow control? (Circle all that apply)
  - a. Temperature
  - b. Illumination
  - c. Environment
  - d. Oxygen levels
  
2. Refuge chambers are intentionally located how many minutes from each workplace?
  - a. 15 minutes
  - b. 30 minutes
  - c. 45 minutes
  - d. 60 minutes
  
3. Which of the following are critical controls for Underground Hazardous Atmosphere? (Circle all that apply)
  - a. Air doors
  - b. Ventilation
  - c. Refuge chambers
  - d. Dust control systems



# Chemical Storage







## MODULE 4: CHEMICAL STORAGE

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### MODULE 4 LEARNING OBJECTIVES

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

- Describe the process for managing chemical identification, storage, and handling



## INTRODUCTION

This module explains chemical containment for working underground. The process differs slightly for in-pit operations versus underground. When performing a workplace examination, look for spills or leaks. Mitigate the issue only to the best of your skill level or training.

## CHEMICAL CONTAINMENT

Check your work area for any chemicals and liquids. Identify the hazards of each by reading the corresponding SDS for each. If they do not belong in the area, take appropriate action to remove safely or notify your Supervisor or Health and Safety Professional.

All tanks/containers must have clear, legible labels. All oil totes and drums require secondary containment. Totes will most likely be double walled for containment purposes. Examine all totes for proper containment and make sure they are stored in their appropriate areas.

## STORAGE OF COMBUSTIBLE MATERIALS

In areas where combustible materials are stored, signage must be present and legible stating “No Smoking” and “No Open Flame.” All containers must be properly labeled and legible. Containers should be clean and in good condition (no dents, broken caps, or stoppers, unclean, etc.)

Ensure that combustible liquids are stored separately from explosives or blasting agents, shaft stations, and ignition sources. This includes any electric equipment that could create sufficient heat or sparks. This helps minimize the spread of fire. In the event of a combustible liquid spill such as oil or grease, actions must be taken to clean up the spill as quickly and safely as possible. Establish good housekeeping habits and ensure this area is free of debris.

## IMPROPERLY STORED MATERIALS

Similar to trash/clutter, improperly stored materials can become a hazard when obstructing travelways. The risk of this hazard increases dramatically in the event of an emergency. When looking around your work area, note if all materials are stored in accordance with Freeport-McMoRan standards as well as manufacturers’ instructions. While materials may be stored in the proper containers, if their weight exceeds the limits of the shelving system, then they are improperly stored.

If your work area contains liquids stored under pressure, ensure that the vessels are secured properly and that no valves are leaking. If you are storing liquid waste, verify that all containers are properly labeled (describing contents), secured, and free from leaks. If your work area contains various hazardous or reactive chemicals, make sure that there is no possibility of the chemicals mixing.

When storing materials, ensure that you utilize a rated flammable materials safety storage cabinet. All containers stored in the cabinet, regardless of the content, need to be properly labeled. Do not store items in the cabinet such as rags, cardboard containers, paper, or anything else that could become a fuel source, should a fire occur. Keep in mind that some cardboard containers are used for organizational purposes.



Fig. 4.1 Flammable storage cabinet



Fig. 4.2 Improperly stored items

## UNIVERSAL WASTE

Universal waste is considered hazardous and should be handled with care, and in such a manner as to reduce and/or prevent releases to the environment. This waste should be segregated and never stored in a container with an unlike item.

Accumulation areas are located throughout the underground mine for aerosol, battery, lamp/bulb, and electronics. All material must be properly disposed of in a timely manner. For example, empty aerosol cans should be properly stored in containers labeled with the words “Universal Waste Aerosol Cans” while BO batteries should be stored in containers that are appropriately labeled “Universal Waste Batteries” with the leads insulated.



Fig. 4.3 Universal waste container

## USED OIL SPILLAGE/LEAKS

All shops and surface areas are supplied with spill kits. The kit contains absorbent materials and pads. Check each spill kit during your inspection and refill supplies accordingly. If you see a spill, clean it up immediately. Discard oil absorbent pads into the proper disposal container after each use.

## MODULE 4 QUIZ

Complete the following quiz.

1. What document provides hazards, proper handling, and storage information for each chemical?
  - a. JSA
  - b. SDS
  - c. Hot Work Permit
  - d. Workplace Examination
  
2. Combustible materials should always be stored near open flames and smoking areas.
  - a. True
  - b. False
  
3. When storing liquid waste, what should be verified with all containers? (Circle all that apply)
  - a. Secured
  - b. Free from leaks
  - c. Properly stored
  - d. Properly labeled



## WORKPLACE EXAMINATIONS CONCLUSION

The importance of a good workplace examination cannot be understated. This is the first step taken every shift or prior to beginning a new task, which leads to a safe return home. Everyone has worked a job where complacency to hazardous conditions is common. For some, this behavior has resulted in an incident where an injury occurred. For others, perhaps luck was on their side. The mining industry and the work we perform every day does not lend itself to the lucky ones of the group. Safety on a mine site is an actively achieved task and it starts with the workplace examination.

As your career with Freeport-McMoRan progresses, remember that conducting a workplace examination is a continuous process. Good hazard recognition skills along with a strong understanding of how to implement critical controls are the backbone of a successful one. Knowledge of the processes performed in the area plays a significant role as well. Unfortunately, none of this means much if even the most experienced employee does not take the examination seriously.

Begin each day with a focus on safety. By having a proactive approach to your work area or one you are passing through, and taking the time to mitigate hazards, you are creating a safer workplace for you and those around you.







# Resources





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## GLOSSARY

Competent Person	One who has demonstrated the capability of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
Conveyors	A moving belt system that is typically used to relocate items from one location to another.
Electrical	Refers to the use of electricity as a power source.
Guards/Guarding	An object placed between personnel and hazards. Designed to keep any portion of the body from contact (intentional or inadvertent) with a hazard. Shielded, fenced, or enclosed by covers, casings, shields, troughs, spillways or railings, or guarded by position or location. Examples of guarding methods are guarding by location (positioning hazards so they are inaccessible to employees) and point of operation guarding (using barrier guards, two-hand tripping devices, electronic safety devices, or other such devices).
Hierarchy of Controls	A means of evaluating risks and identifying controls. Those controls designated as more conservative and most effective are at the top of the hierarchy, while the less conservative and least effective are at the bottom.
Housekeeping	The act of maintaining cleanliness and order by removing trash/debris, cleaning up spills, putting away equipment/tools, and keeping walkways or working surfaces free from obstructions.
MSHA	Mine Safety and Health Administration
Overhead Clearance	The amount of overhead space a person or piece of equipment needs to avoid impact with infrastructure or equipment.

Travelway

A path that allows employees to travel on foot from one area to another.

Spotter

A qualified person, designated by the supervisor, who performs all the observation duties assigned for the task. This individual may be equipped with an emergency communication device, and be outfitted with PPE as required for the task. It is the sole responsibility of this individual to perform only the observation activities that apply to the task, and no other functions or tasks.

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## STUDENT COURSE EVALUATION

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. <b>What did you find valuable in the course?</b>				

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





