FREEPORT-
MCMORAN

FACILITATOR GUIDE

SFT FCX1025C
Control of Hazardous Energy

September / 2019
VERSION 1

TABLE OF CONTENTS

COURSE OVERVIEW

The following sections give basic information about this course.

COURSE DESCRIPTION

Through this course, employees will be trained, qualified, and able to follow the appropriate requirements of the Freeport-McMoRan Control of Hazardous Energy Policy (FCX-HS04). Each employee must have an understanding of the overall hazardous energy control procedures and the elements of the energy control procedures that are directly related to his/her duties.

COURSE OBJECTIVES

Upon completion of this course, students will be able to:

- Module 1: Sources of Energy
  - Identify sources of energy, given a scenario or image
- Module 2: Control of Energy Sources
  - Select the correct energy control device/type, given a scenario
- Module 3: Roles and Responsibilities
  - Determine the responsibilities of each individual, given a simple or complex lockout job
- Module 4: Processes
  - Demonstrate the actions to stay safe, given a scenario
- Module 5: Energy Control in Practice
  - Demonstrate the application of hazardous energy control principles to various sources, given different examples

COURSE PRE-REQUISITES

There are no pre-requisites for this course.

COURSE LENGTH

This course takes approximately 8 hours to complete.

CLASS SIZE

This course is designed for a maximum of 20 students. Class size may be more or less depending on each site's needs and the students' skills and experience levels.

TARGET AUDIENCE

This training is intended to satisfy the minimum Control of Hazardous Energy training requirements for Energy Control Coordinators (ECC), Authorized/Qualified Individuals, and Affect Individuals.

FACILITATOR QUALIFICATIONS

Facilitators should be well versed in the Freeport-McMoRan Control of Hazardous Energy Policy (FCX-HS04).

REGULATIONS/POLICIES/PROCEDURES

The Freeport-McMoRan Control of Hazardous Energy Policy (FCX-HS04) intends to address the practices and procedures necessary to disable machinery or equipment and to prevent the release of hazardous energy while employees perform service and maintenance activities. The Control of Hazardous Energy Policy (FCX-HS04) establishes minimum, acceptable requirements to protect employees and contractors from injury. The policy requires that each site establish a written program for hazardous energy control. Additionally, the policy specifies minimum requirements for identifying and developing controls for all hazardous energy types.

FACILITATOR PREPARATION

The following information helps the facilitator prepare course facilitation.

ABOUT THIS GUIDE

The Facilitator Guide (FG) gives the facilitator a general outline for the flow of the course. It assists the facilitator in presenting content, conducting classroom activities, and managing time to meet the learning objectives. Use the FG in conjunction with the Student Guide (SG) and the PowerPoint (PPT). The guide belongs to the facilitator to make notes and write in as much as needed.

SAFETY

Safety must remain a fundamental component of this course. Students must adhere to safety information in the SG and from the facilitator, and maintain focus on safety procedures throughout the training. Students may not operate equipment without facilitator authorization.

ACTIVITIES

Students participate in many hands-on activities that give students time to practice the knowledge learned throughout the course. They also provide the facilitator with opportunities to give immediate feedback on what each student does/does not do well. Facilitators must review each activity's directions in the FG before guiding students through the learning activities.

GENERAL MATERIALS

Courses consistently need the following materials. Gather the necessary items and verify all equipment functions before starting class.

- Attendance sign-in sheets
- Name cards – 1 per student
- Pens or pencils
- Push pins or tape such as painter's tape
- Sticky notes
- Easel
- Flipchart
- Markers of various colors
- Student Guide (SG) – 1 per student
- Projector and sound system for course PPT and videos
- Laptop with access to the internet
- Assessments
- Course Evaluations (Found in the back of SG and FG)
- Appropriate Personal Protective Equipment (PPE)

ACTIVITY MATERIALS

Gather the following materials specific to the activities in each module.

Module	Materials
Introduction	• Activity 1: Icebreaker o Gather the appropriate materials depending on the icebreaker chosen

Module 1: Sources of Energy	• Activity 2: Energy in the Workplace
	  o **4 posters depicting various types and sources of energy (each site needs to take 4 photos that each depict various energy sources)**
	  o Several sticky notes for each group
	• Activity 3: Identifying Sources of Energy
	  o Flip chart paper
	  o Markers
	  o Student Guide
	  o Pens/Pencils

Module 2: Control of Energy Sources	• Activity 4: Identifying Energy Control Devices/Types
	  o Infographic posters from Activity 3
	  o Markers
	  o Student Guide
	  o Pens/Pencils

Module 3: Roles and Responsibilities	• Activity 5: Who is Who
	  o **4 role signs (tear out from FG or make copies);** pin or tape one sign in each corner of the room
	  o 4 role descriptions as presented in the PPT

Module	Materials

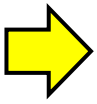
Module 4: Processes	• Activity 6: Lockout Simulation
	  o **Lockout Simulator (each site needs to develop a simulator)**
	  o **Copies of lockout SOPs (developed by your site to correlate with simulator**
	• Activity 7: Creating a Plan
	  o Infographic posters from Activity 3
	  o Student Guide
	  o Pen/Pencils

Module 5: Energy Control in Practice	• Activity 8: Preventing Incidents
	  o Student Guide
	  o Pens/pencils

Conclusion	• **Knowledge Assessment** (one copy per student) • **Performance Assessment** (one copy per student)

FACILITATOR GUIDE CUES

Facilitators quickly identify slides that have unusual but important features by recognizing the cues used throughout the FG. Reference the table below to understand the purpose of each symbol. On each slide that has a cue, the corresponding talking points are **bolded**.

Description	Symbol	Purpose
Audio Link		The speaker icon indicates when a PPT slide links to an audio file.
Video Link		The director's clapboard indicates when a PPT slide links to a video file.
Animated Slide		The star indicates when an animation appears on a PPT slide and requires more than one click to view all slide content.
Note		The notepad indicates the PPT slide or FG include a note relating to the slide but not necessarily found in the SG.
Incidents		The first aid symbol indicates when the PPT slide or FG addresses a PFE, testimonial, or other safety-related incidents.
Flipchart		The marker indicates when a facilitator writes down responses given by students on a flipchart or whiteboard.
Discussion		The question mark indicates when students need to participate in a discussion either as a class or in small groups.
Example		The hand indicates when the facilitator holds up an item or passes an example around the class.
Facilitation Tip		The podium indicates a facilitation technique used by the facilitator to enhance the presentation. The tip is included beneath a red heading at the end of the slide's talking points.
Site Specific		The yellow arrow indicates a place where the facilitator needs to prepare and add site-specific information before class starts.

LAWS OF LEARNING

Implementing the Six Laws of Learning can produce a more effective learning experience for both students and facilitators. Refer to the Instructor Fundamentals SG for more information.

Readiness: Students learn when they are ready, and learn little when they are not ready. Motivate students to prepare for learning and participate by setting a purpose, clearly stating objectives, and giving logical reasons for learning at the start of training.
Exercise: Content repeated is remembered. Every time a concept is practiced, learning is reinforced. Exercise includes recall, review, restatement, drills, and physical application.
Effect: People learn better in a favorable situation. Strengthen learning with pleasant motivational feelings. Constant negative motivation stifles the learning process.
Intensity: Students learn more from the real-life applications than from substitutes. Increase intensity, the power of the learning, through performance activities such as demonstrations, skits, audio/video clips, and models.
Primacy: What a student learns first stays. Teach the correct information the first time. Re-teaching may not work immediately and requires more time and practice with the student.
Recency: The most recent learning idea is the easiest to recall. Practice this law with restating, summaries, and conclusions.

FACILITATION REMINDERS

Incorporating feedback and eye contact, while eliminating semantic barriers can produce a more effective learning experience for both students and facilitators.

Feedback: Feedback in the classroom is evaluative or corrective information about a student's performance given by a facilitator to a student. Feedback guides students toward attaining the course objectives.
Eye contact**:** Eye contact means looking directly into the eyes of the students and at each student equally, not just at a few. It is communication that lets students know the facilitator is interested, allows for nonverbal feedback from students as the facilitator reads their expression, and enhances facilitator credibility as students can view facilitators with more eye contact as being more confident and competent.
Semantic Barriers**:** One word can confuse what the facilitator says and what the audience interprets. Avoid the overuse of jargon, symbolism, abbreviations, acronyms, and slang. Using clear and concrete words eliminates misunderstandings and helps students receive the message without misinterpretations.

QUESTIONING TECHNIQUES

Questions help the facilitator gauge the amount of understanding or student learning taking place.

TYPES OF QUESTIONS

Three types of questions can be used based on the type of response desired.

Rhetorical: No answer from a student is required, but it can be used throughout a lesson to gain attention.

Direct: Questions directed to one specific individual.

Overhead: Questions directed to an entire audience or class and can be answered by anyone.

When a facilitator seeks verbal responses, use response questions that engage and stimulate deeper thinking by the students rather than giving answers to the students.

Reverse: A question asked by student, then redirected back to the same student. Be sure there is a reasonable chance the student can answer it, and give assistance if needed.

Relay: A question asked by student, then redirected to another student. As with a reverse question, be sure there is a reasonable chance the student can answer it.

TYPES OF QUESTIONS TO AVOID

Avoid these types of questions:

Dead end: Simple yes or no answers do nothing to promote thinking or discussions. If used, follow up with, “Why / How / When / Where?” to encourage students to explain their answers.

Foggy: Questions that are unclear or vague in nature and, therefore, hard to answer. Think about the answer desired before asking a question.

Multiple questions: Several questions at the same time. This technique is confusing for students. Allow them to focus on one question at a time. If you have several questions, wait for an answer to one before asking another one.

USING THE PPT PRESENTATION

When preparing to facilitate the course, there are several ways to integrate the PPT with the FG.

1. The facilitator can project the PPT and carry the paper copy of the FG as he/she walks around the room.
2. The facilitator can begin the PPT in presentation mode on his/her computer. This displays only the current slide to the class on the projection screen, but shows the facilitator a different view on his/her computer. The facilitator's screen shows a notes screen that has the same information for the slide that is included in the FG. This view also shows the next slide and lets the facilitator see the marker tools to write on the slides and emphasize talking points.
3. The facilitator can also choose to do both, which is the **preferred** method. Moving around the room helps the facilitator engage more participants and keeps the students' brains stimulated, thus promoting learning.

Facilitation Tip: The facilitator is the presentation. The PPT is an aid. Know the required talking points in the PPT notes or FG and engage the class by maintaining eye contact as much as possible and not directly reading from the slides or pages.

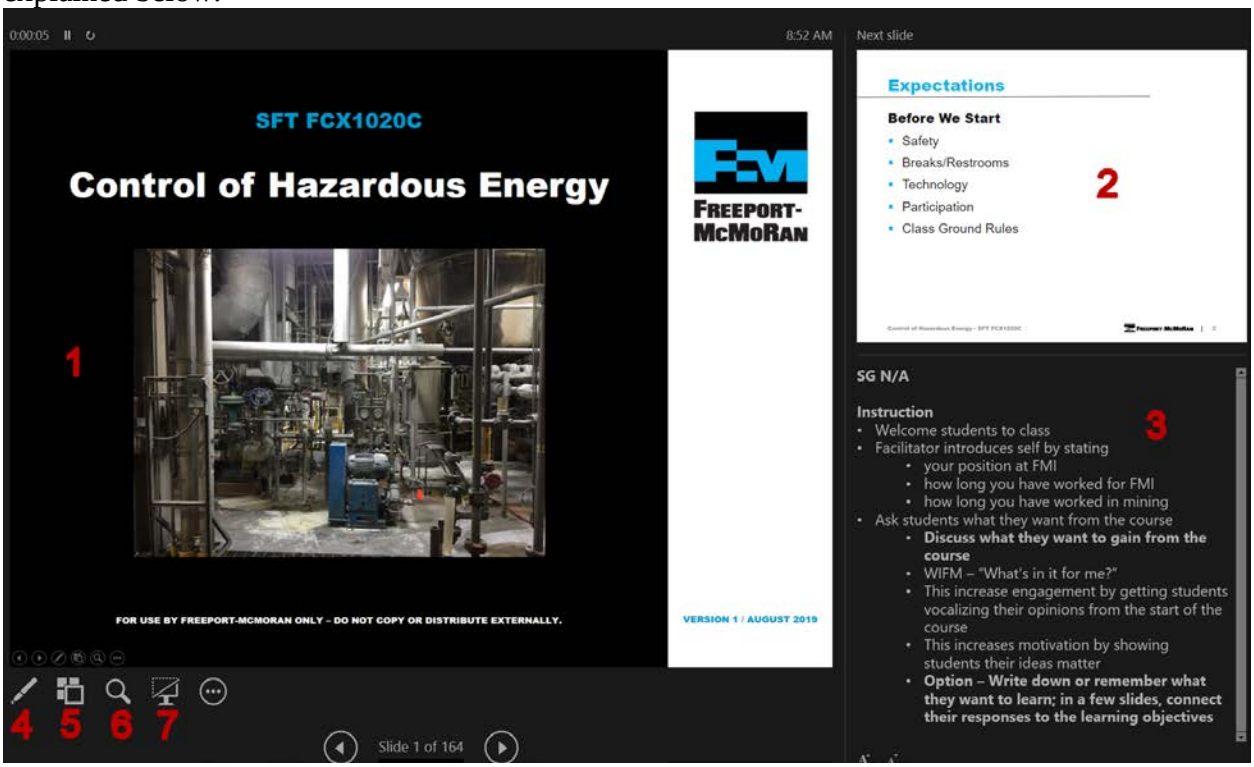
SETTING THE PRESENTATION MODE

To initiate the presentation mode, do the following.

Step	Action
1	Open the PPT presentation.
2	Find the colored bar at the bottom of the screen. The look and color vary depending on the PPT version used.
3	Select the icon circled in the image below and often found in the bottom right-hand corner of the PPT screen. 

PRESENTATION MODE FEATURES

When in presentation mode, the students only see the slide displayed, but the facilitator sees the layout below. Some of the commonly used features available from this view are numbered and explained below.



1. **Current slide** – This is the slide students see on the projection screen.
2. **Next slide** – Shows a visual preview of the next slide.
3. **Notes** – Shows the same talking points available in the FG. The notes shown correspond to the current slide projected to the students.
4. **Pens** – This icon gives the user access to a laser pointer, pen, highlighter, ink color, and arrow options. The tool shows on the facilitator's screen and the students' projection screen. Facilitators use the tools to emphasize specific points on the PPT and customize the presentation to suit the needs of the site and students better.
5. **All slides** – This shows small slide images together on the facilitator's screen.
6. **Zoom** – This icon lets the facilitator zoom in on specific aspects of the PPT.
7. **Black screen** – If the facilitator wants to explain content further but feels the PPT slide shown on the screen distracts from the learning, black out the screen to help focus the students.

INTRODUCTION

The introduction sets the tone for the course by introducing the facilitator, setting class expectations, welcoming the students, presenting the course learning objectives, setting safety as a priority, and introducing the Freeport-McMoRan Control of Hazardous Energy Policy (FCX-HS04). This policy addresses the practices and procedures necessary to disable machinery or equipment and to prevent the release of hazardous energy while employees perform service and maintenance activities. It establishes minimum, acceptable requirements to protect employees and contractors from injury and requires that each site establish a written program for hazardous energy control. The policy specifies minimum requirements for identifying and developing controls for all hazardous energy types.

ACTIVITIES

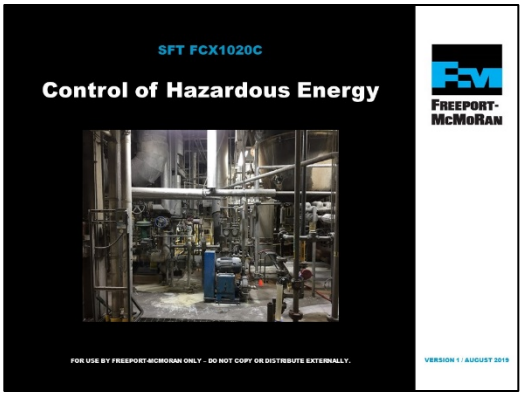
Activity 1: Icebreaker

For further details, refer to *Activity Materials* under *Facilitator Preparation* on page 6.

TOTAL TEACHING TIME

The introduction takes approximately 20 minutes to complete.

PPT slide 1, SG page N/A



Instruction

- Welcome students to class
- Facilitator introduces self by stating
  - your position at FMI
  - how long you have worked for FMI
  - how long you have worked in mining
- Ask students what they want from the course
  - **Discuss what they want to gain from the course**
  - WIFM – "What's in it for me?"
  - This increase engagement by getting students vocalizing their opinions from the start of the course
  - This increases motivation by showing students their ideas matter
  - **Option – Write down or remember what they want to learn; in a few slides, connect their responses to the learning objectives**

Facilitation Tip

- Create a pleasant and welcoming atmosphere at the start of the class to increase learning (Law of Effect)
- Learn more in the Facilitator Preparation Section at the start of the FG

PPT slide 2, SG page N/A

Instruction

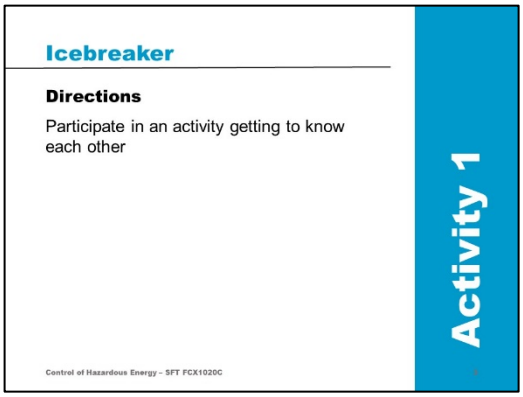
- Discuss administrative/classroom guidelines
- Safety: Identify the appropriate evacuation procedures, gathering areas, and emergency exits and fire extinguisher locations, etc.
- Breaks and Restrooms
    - Establish and announce a break schedule to the class. Ten minute breaks are included throughout the FG and occur approximately every 50 minutes so students can relax, refocus, and re-engage
    - Identify the location of restrooms and smoking areas
- Technology policy: Review your expectations on cell phone and laptop use during the training
- Participation
    - This course requires significant participation
    - Students should be prepared for discussions and small group activities
- Evaluations
    - Direct students to the course evaluation at the end of the SG
    - Students should fill in the evaluation as the class progresses rather than completing all at once at the end of the class
- Set the class ground rules by verbalizing your expectations; some suggestions are provided below
    - Participate
    - Be on time
    - Stay on task
    - Listen when others talk
    - Respect the opinions and attitudes of others

Facilitation Tip

Letting students help create class rules empowers them, creates buy-in, builds trust with the facilitator, and helps maintain control as students hold each other accountable

ACTIVITY 1: ICEBREAKER

PPT slide 3, SG page N/A



Time
Approximately 10 minutes

Materials
Choose an icebreaker and gather appropriate materials

Purpose

- Successful icebreakers promote a safe learning environment, which can reduce stress and increase retention
- They also encourage students to contribute their ideas and experiences thus increasing motivation and engagement in the class
- Below is an assortment of icebreakers the facilitator can incorporate at the beginning of the course as well as after breaks

Icebreaker	Instructions
The Pocket/Purse Game *(5-10 minutes)*	1. Give students one minute to find an item with significance they carry on them in their pocket, purse, backpack, etc. 2. Students introduce themselves by showing the item, telling about it and explaining why they chose it
Three of Anything *(10-15 minutes)*	1. Divide the class into groups of four to five students 2. Give students one minute each to share their three favorite (or least favorite) movies, children's books, vacations, etc. 3. Ask a volunteer from each group to share anything that was common between any of the students
Phrases that Fit *(10-15 minutes)*	1. Give students two minutes to think about a slogan, commercial, poem, song, etc. that describes his or her life 2. Students introduce themselves to the class by sharing the slogan and explaining why they chose it

Continued on next page

Icebreaker	Instructions
Stranded on an Island *(10-15 minutes)*	1. Divide the class into groups of three to five students 2. Students think of three items to take with them if they knew they would be stranded on an island 3. Students take turns sharing their items with the group explaining why they chose each item *NOTE: With a larger group, have students choose less items*
Coin Picker *(5-10 minutes)*	1. Students take a coin out of their pocket or borrow one from somebody 2. Students introduce themselves by stating their name, the year on the coin, and something that happened that year *NOTE: If students do not have coins, assign them a year*

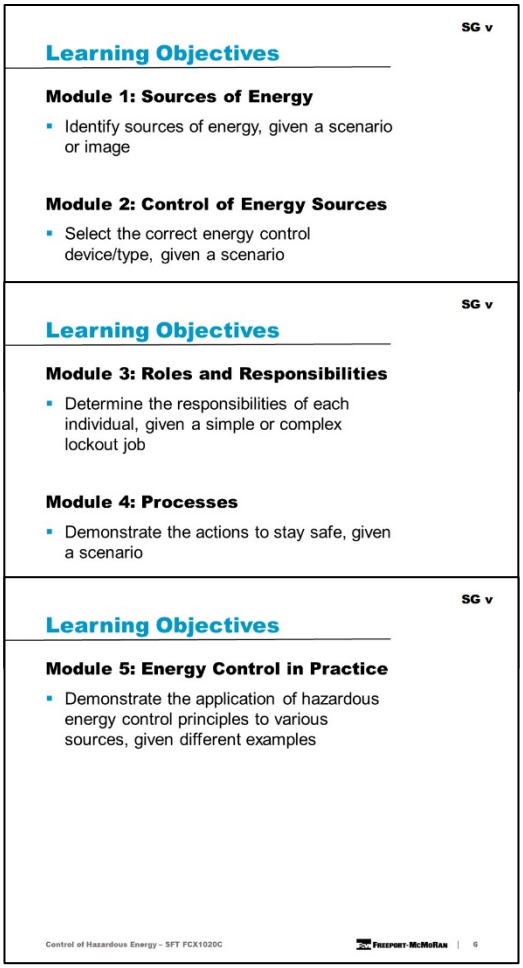
PPT slides 4-6, SG page v

Instruction

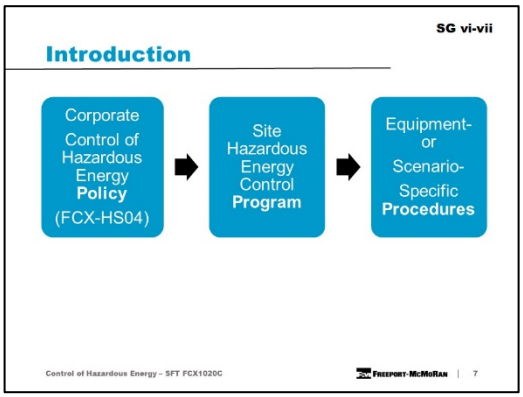
- State objective(s) for each module
- Learning objectives are also located at the beginning of each module
- Option
    - If you wrote down or remember the student's ideas of what they want to learn in the course, connect each response they gave to an objective (even if it is a vague connection)
    - This increases motivation by showing students their ideas matter

Facilitation Tip

- Reviewing objectives before teaching, prepares students for learning (Law of Readiness)
- Learn more in the Facilitator Preparation Section at the start of the FG



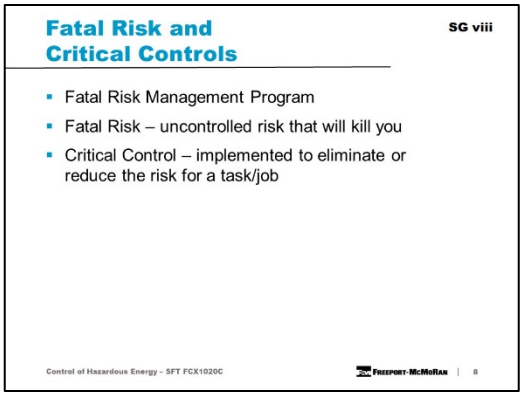
PPT slide 7, SG pages vi-vii



Instruction

- Freeport-McMoRan Control of Hazardous Energy Policy (FCX-HS04):
    - Addresses the practices and procedures necessary to disable machinery or equipment and to prevent the release of hazardous energy while employees perform service and maintenance activities
    - Establishes minimum, acceptable requirements to protect employees and contractors from injury
    - Requires that each site establish a written program for hazardous energy control
    - Specifies minimum requirements for identifying and developing controls for all hazardous energy types
- Differences between policy, program, and procedures
    - Policy – broad and all-encompassing foundation; outlines minimum requirements as specified by Freeport-McMoRan
    - Program – somewhat broad in scope; outlines specific guidelines for how a policy is implemented at a specific site to meet the site's unique needs
    - Procedures – very detailed; outline specific energy control steps to perform when working on specific equipment; ensure compliance with policy

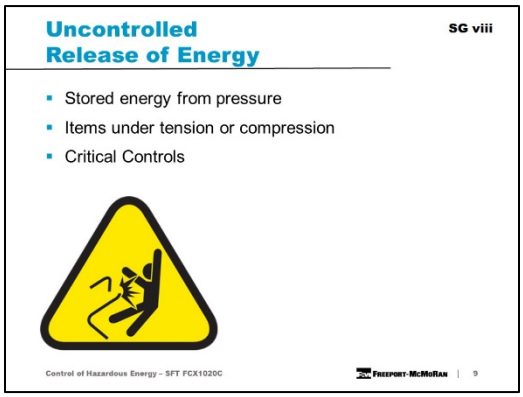
PPT slide 8, SG page viii



Instruction

- Fatal Risk Management
  - Continuation of the Fatality Prevention Program
  - Focus is placed on identifying Fatal Risks and Critical Controls in an attempt to safeguard all employees
  - Standardizes communication for twenty-three Fatal Risks by implementing icons, definitions, and Critical Controls
- Fatal Risks are based on safety issues that have resulted in catastrophic events such as severe injury or death
- For each identified Fatal Risk a list of necessary Critical Controls was developed to prevent or mitigate the most serious consequences of these risks
- Once the Fatal Risk is identified, applying the most effective Critical Control is crucial
- A Critical Control is a device, system, or process implemented to eliminate or reduce the risk for a task/job, and if missing or overlooked has the potential to lead to catastrophic outcomes such as serious injury or death
  - These Critical Controls are considered the most impactful on preventing a fatality or injury and have been previously established based on data
  - The absence or failure of a Critical Control significantly increases the risk of severe injury or death despite the existence of other controls
- The Fatal Risk(s) and Critical Controls relevant to this course are provided next

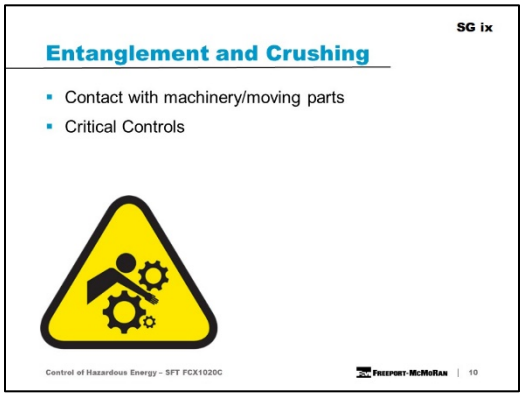
PPT slide 9, SG page viii



Instruction

- The Uncontrolled Release of Energy Fatal Risk is defined as exposure to stored energy from pressure (e.g., pneumatic systems, hydraulic systems, steam, tires, etc.); Items under tension or compression (e.g., mooring lines, springs, counterweights, etc.)
- **Discuss the Critical Controls**
    - Energy Isolation/LOTOTO
    - Guards, Barriers, and Barricades
    - Hose Coupling Lock System
    - Pipe Management
    - Piping Hoses and Equipment Mechanical Integrity
    - Relief Valves
    - Tensioned Lines Management
    - Tire Management

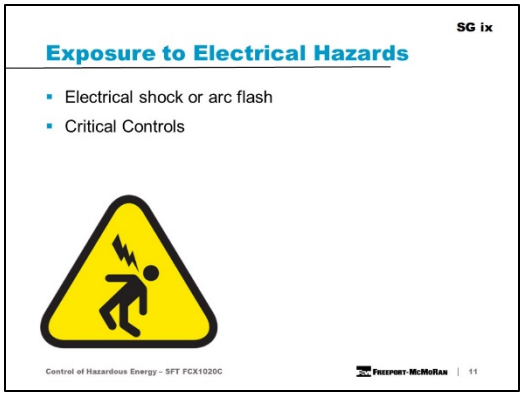
PPT slide 10, SG page ix



Instruction

- The Entanglement and Crushing Fatal Risk is defined as contact with machinery/moving parts (entanglement, crushing, pinching, penetrating and cutting forces)
- **Discuss the Critical Controls**
    - Blocking for Maintenance Work
    - Energy Isolation/LOTOTO
    - Guards, Barriers, and Barricades

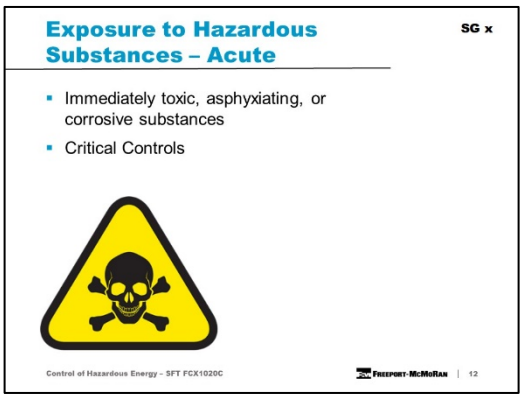
PPT slide 11, SG page ix



Instruction

- The Contact with Electricity Fatal Risk is defined as exposure to electrical shock or arc flash
- **Discuss the Critical Controls**
  - Access Control
  - Barriers and Segregation
  - Drawings and Labels
  - Electrical PPE
  - Energized Electrical Work Permit Execution
  - Energy Isolation/LOTOTO

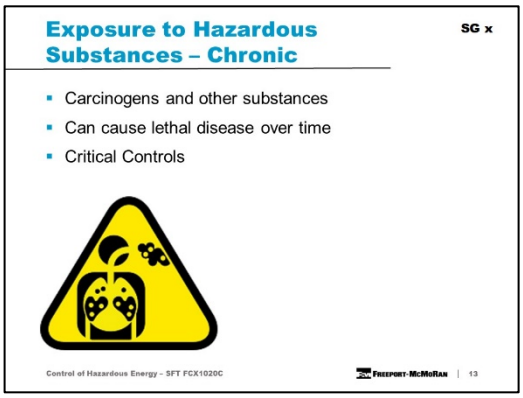
PPT slide 12, SG page x



Instruction

- 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_2S gas, NO_x gas, CO gas, concentrated acids, caustics, etc.)
- **Discuss the Critical Controls**
  - Access Control
  - Alarm Systems
  - Engineered Controls
  - Handling Requirements
  - Loading and Unloading Protection
  - Mechanical Integrity of Storage and Distribution
  - PPE

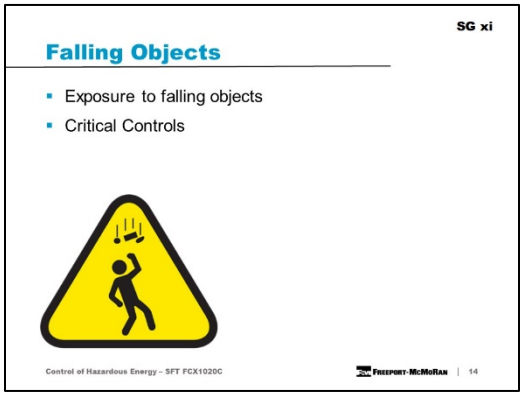
PPT slide 13, SG page x



Instruction

- 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, etc.)
- **Discuss the Critical Controls**
  - Access Control
  - Engineered Controls
  - Handling Requirements
  - PPE

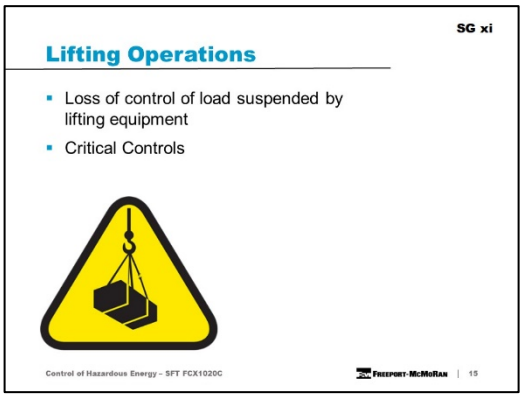
PPT slide 14, SG page xi



Instruction

- The Falling Objects Fatal Risk is defined as exposure to falling objects (e.g. tools, material, equipment, structures, etc.)
- **Discuss the Critical Controls**
  - Barriers and Segregation
  - Integrity of Overhead Structures and Equipment
  - Securing Devices
  - Work Area Management

PPT slide 15, SG page xi



Instruction

- The Lifting Operations Fatal Risk is defined as exposure to loss of control of a load suspended by a crane (fixed or mobile), hoist, forklift, boom or other lifting equipment
- **Discuss the Critical Controls**
  - Barriers and Segregation
  - Lifting Execution
  - Mechanical Integrity of Lifting Equipment

MODULE 1: SOURCES OF ENERGY

This module contains information about the different sources of hazardous energy employees may encounter in the work areas.

LEARNING OBJECTIVES

Upon completion of this module, students will be able to identify sources of energy, given a scenario or image.

ACTIVITIES

- Activity 2: Energy in the Workplace
- Activity 3: Identifying Sources of Energy

For further details, refer to *Activity Materials* under *Facilitator Preparation* on page 6.

TOTAL TEACHING TIME

This module takes approximately 1 hour to complete.

PPT slide 16, SG pages 3 and 5

Instruction

- Review learning objectives for the module
- Upon completion of this module, students will be able to identify sources of energy, given a scenario or image
- Most of the hazards in the work areas come from some form of energy
- This module begins by describing some of the energy types that may be present in the work environment and then discusses how to identify the sources of energy

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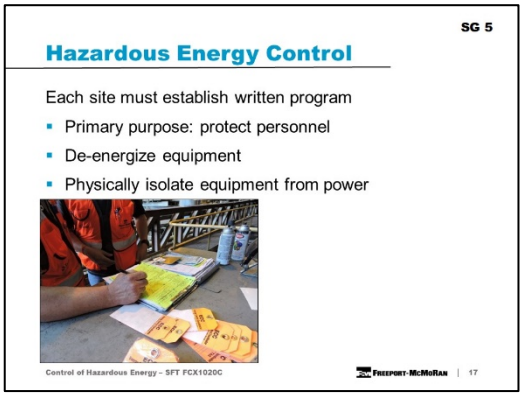
PPT slide 17, SG page 5



Instruction

- Maintenance or repair work may expose workers to hazardous energy sources
- Each site must establish a written program (per Freeport-McMoRan Policy Administration Requirements (FCX-HS01))
- Primary purpose of a Hazardous Energy Control Program: to protect personnel from injury
- Hazardous Energy Control Program requires workers to do the following:
    - De-energize equipment
    - Physically isolate the equipment from power sources to avoid accidental re-energization or unexpected start up while performing work
- Remind students to check with their Supervisor or Health and Safety Representative for their site's specific Hazardous Energy Control Program

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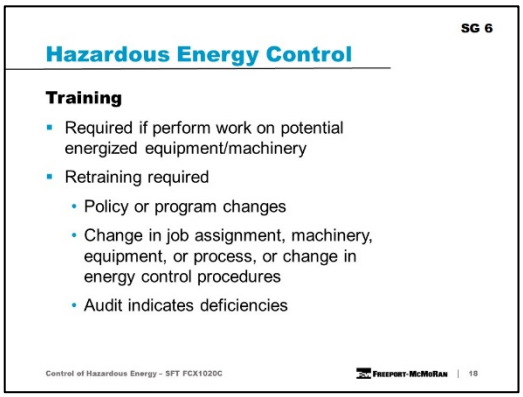
PPT slide 18, SG page 6



Instruction

- Initial and annual refresher training required for all employees who may perform work on potential energized equipment/machinery
  - This course
  - Specific equipment, machinery, or process assigned to the individual at appropriate level according to his/her duties and responsibilities
- Sites will provide retraining to all employees when one of the following occurs:
  - When policy or program changes
  - When there is a change in job assignment, a change in machinery, equipment, or process that presents a new hazard, or a change in energy control procedures
  - If auditing indicates that there are deficiencies in the application of hazardous energy control or a lack of employee understanding of the program

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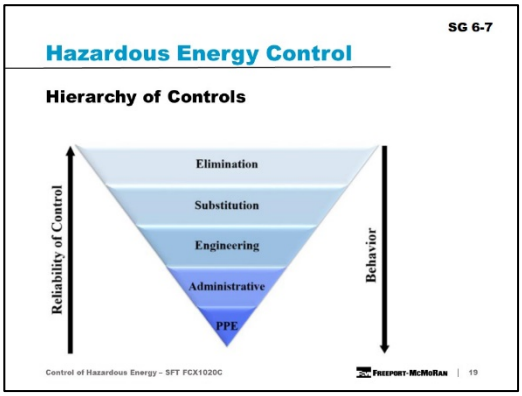
PPT slide 19, SG page 6

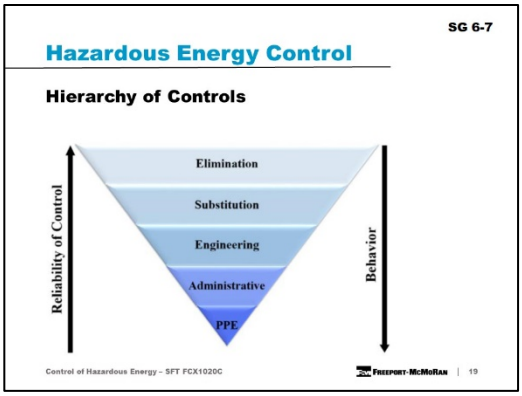


Instruction

- Hierarchy of Controls: tool to determine type of control to use
  - Consider the effectiveness of each level
  - Most effective control: when they do not rely on individual worker behaviors as behaviors may vary from worker to worker
  - Controls at the bottom (such as PPE and Administrative) are less reliable because worker behaviors play a larger role than the controls at the top.
- The diagram shows the five types in order from most effective (elimination) to least effective (PPE).
  - Elimination – physically removing the hazard from the workplace
  - Substitution – replace a chemical, substance, material, or practice with something less hazardous
  - Engineering – blocks an employee's access to a hazard with a barrier so the employee cannot contact the hazard
  - Administrative – implementing rules that change the way employees do their job
  - Personal Protective Equipment (PPE) – offers the body a layer of protection from hazards

Continued on next page

PPT slide 19, SG page 7



Instruction

- Most of the hazards in our work areas come from some form of energy
  - Stored energy (suspended loads, pressurized lines, etc.)
  - Energy in motion (moving machine parts, vehicles, etc.)
  - Thermal energy (furnaces, boilers, roasters, etc.)
  - Electrical energy or others
- All have one thing in common
- If workers can identify a potential hazard, then workers can control it

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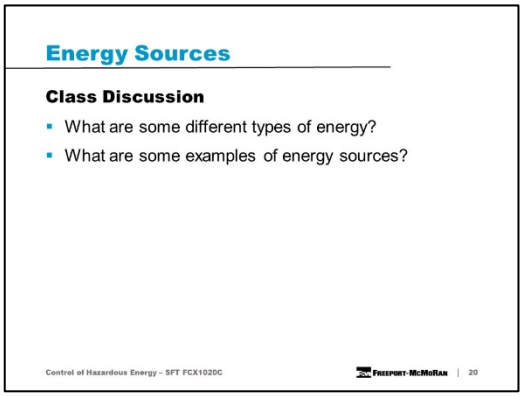
PPT slide 20, SG page N/A



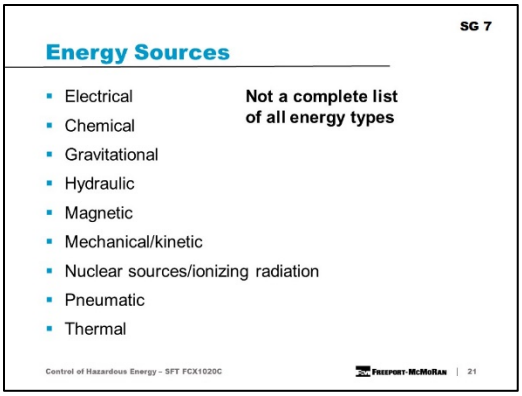
Instruction

- **Ask students what they know about types and sources of energy by asking the questions on the slide**
- **Record student answers on a flipchart**

Facilitation Tip

- Questions are key to learning and can be used to clarify and stimulate thinking
- Use different questioning techniques to enhance the overall student experience
- See examples in the Facilitator Preparation Section at the start of the FG

PPT slide 21, SG page 7



Instruction

- Identify any energy that could energize, startup, or release before work begins so that personnel can lock or block them out
- Types of energy prevalent at most of Freeport-McMoRan's operations: electrical, chemical, gravitational, hydraulic, magnetic, mechanical/kinetic, nuclear/radiation, pneumatic, and thermal

Note: Emphasize that this is not a complete list of all energy types

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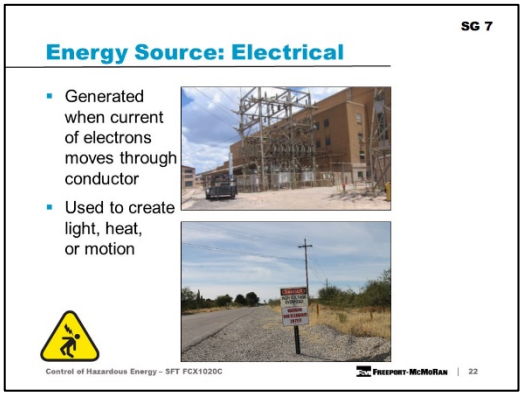
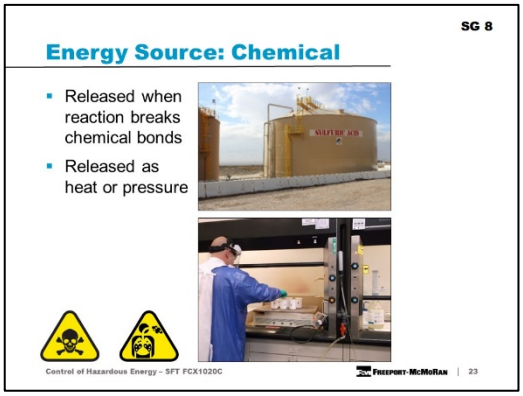
PPT slide 22, SG page 7



Instruction

- Generated when a current of electrons moves through a conductor
- Used to create light, heat, or motion
- **Ask students for any examples of electrical energy** (possible answers: images are a substation and overhead power lines)
- **Ask students what are some potential hazards of electrical energy** (possible answers: arc flash, electric shock, burns, fires/explosions)
- **Ask students to name the Fatal Risk associated with electrical energy source** (Answer: Exposure to Electrical Hazards)
- **Ask students to name the critical controls** (Answer: Access Control, Barriers and Segregation, Drawings and Labels, Electrical PPE, Energized Electrical Work, Permit Execution, Energy Isolation/LOTOTO)

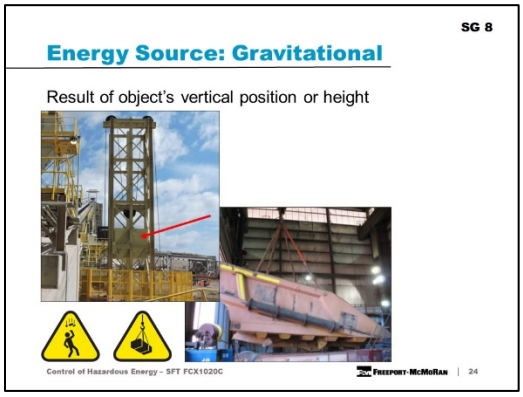
PPT slide 23, SG page 8



Instruction

- Energy released when a reaction breaks the chemical bonds
- Released as heat or other forms such as pressure
- **Ask students for any examples of chemical energy** (possible answers: images are a sulfuric acid tank and perchloric acid added to samples)
- **Ask students what are some potential hazards of chemical energy** (possible answers: fires/explosions, toxic, corrosive)
- **Ask students to name the Fatal Risks associated with chemical energy source** (Answer: Exposure to Hazardous Substances (Acute and Chronic))
- **Ask students to name the critical controls**
    - Answer: Exposure to Hazardous Substances (Acute) – Access Control, Alarm Systems, Engineered Controls, Handling Requirements, Loading and Unloading Protection, Mechanical Integrity of Storage and Distribution, PPE
    - Exposure to Hazardous Substance (Chronic) – Access Control, Engineered Controls, Handling Requirements, PPE

PPT slide 24, SG page 8



Instruction

- Result of object's vertical position or height
- **Ask students for any examples of gravitational energy** (possible answers: images are a crane suspending a haul truck bed and a counterweight)
- **Ask students what are some potential hazards of gravitational energy** (possible answers: falling object)
- **Ask students to name the Fatal Risks associated with gravitational energy source** (Answer: Falling Objects and Lifting Operations)
- **Ask students to name the critical controls**
    - Answer: Falling Objects – Barriers and Segregation, Integrity of Overhead Structures and Equipment, Securing Devices, Work Area Management
    - Lifting Operations – Barriers and Segregation, Lifting Execution, Mechanical Integrity of Lifting Equipment

Note: Whether suspended or not, objects still have hazardous energy

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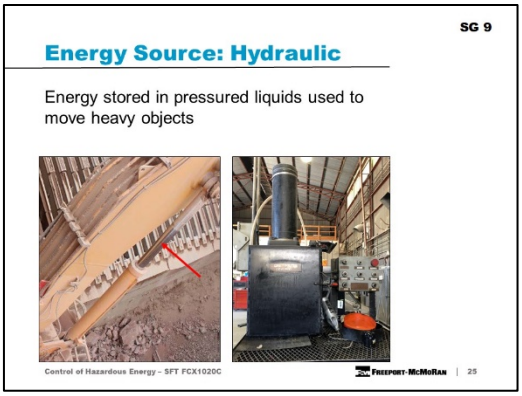
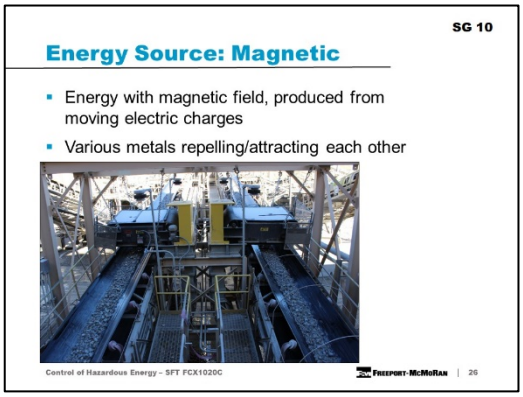
PPT slide 25, SG page 9



Instruction

- Energy stored in pressurized liquids frequently used to move heavy objects
- **Ask students for any examples of hydraulic energy** (possible answers: images are a hydraulic cylinder and hydraulic filter press)
- **Ask students what are some potential hazards of hydraulic energy** (possible answers: unexpected discharge of liquids)

PPT slide 26, SG page 10



Instruction

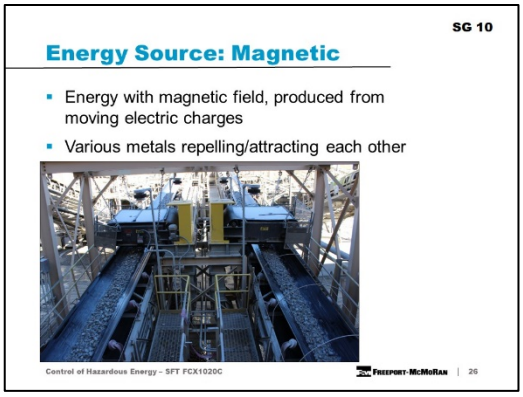
- Energy within a magnetic field produced from moving electric charges
- Various metals repelling or attracting each other
- Individuals with pacemakers and implantable cardioverter defibrillators (ICDs): should avoid areas with high-powered magnets as these magnets may interfere with the function of the devices
- **Ask students for any examples of magnetic energy** (possible answers: image is a metal detector on a conveyor belt)
- **Ask students what are some potential hazards of magnetic energy** (possible answers: struck by moving objects)

Note: Additional information about magnets

- Metal detector – an electronic instrument that senses the presence of metal on a belt conveyor but does not retrieve the metal
    - Any refined metal (magnetic or nonmagnetic) on belt contains higher conductivity than ore in conveyer belt
    - Metal detector transmits an electromagnetic signal from above the belt to the receiver below the belt
    - Presence of metal on the moving belt
        - Causes a change in this electromagnetic signal
        - Provides a signal to the control system to activate an alarm and, in most cases, to shut down the belt conveyor automatically

Continued on next page

PPT slide 26, SG page 10



Instruction

- Tramp metal magnet – a powerful magnetic separator suspended over a belt conveyor
    - Removes magnetic iron (shovel teeth, drill bits, nuts, bolts, etc.) from the ore stream
    - Magnet has an iron core wound with wire
    - Alternating current passed through the windings generates a powerful magnetic field
    - Force of this magnetic field pulls the magnetic material in the ore off the conveyor belt and up to the electromagnet, where the magnet holds the metal in place until the operator decides to release it
    - Magnet typically hangs from a hoist or trolley, and the operator manually pushes it to the side of the conveyor and leaves it suspended over a bin before clearing the tramp metal
    - Workers de-energize the magnet, which breaks the magnetic force field and causes the tramp metal to fall into the bin

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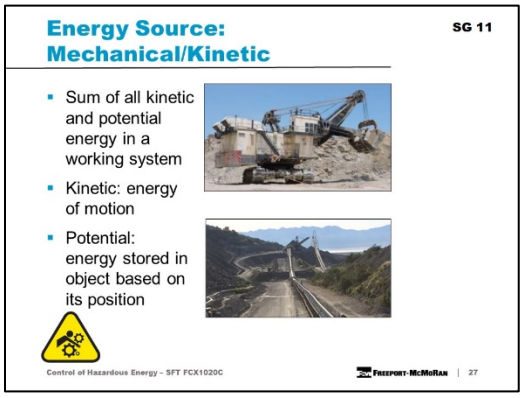
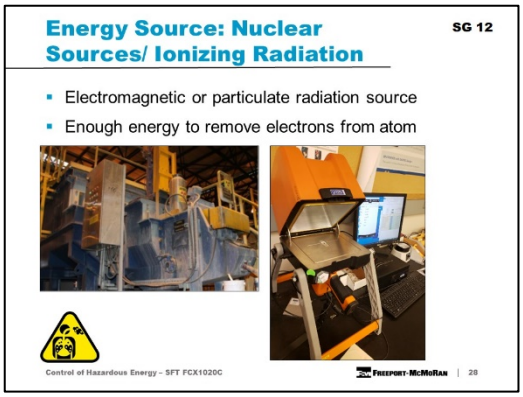
PPT slide 27, SG page 11



Instruction

- Sum of all kinetic and potential energy in a working system
    - Kinetic: energy of motion
    - Potential: energy stored in an object based on its position
- **Ask students for any examples of mechanical/kinetic energy** (possible answers: kinetic – images are electric shovel and conveyor belt; potential – ball mill, rotating equipment, or a tensioned spring/line)
- **Ask students what are some potential hazards of mechanical/kinetic energy** (possible answers: kinetic – people crushed or struck by moving object; potential – when released, becomes kinetic energy and has same potential hazards)
- **Ask students to name the Fatal Risk associated with mechanical/kinetic energy source** (Answer: Entanglement and Crushing)
- **Ask students to name the critical controls** (Answer: Blocking for Maintenance Work, Energy Isolation/LOTOTO, Guards, Barriers and Barricades)

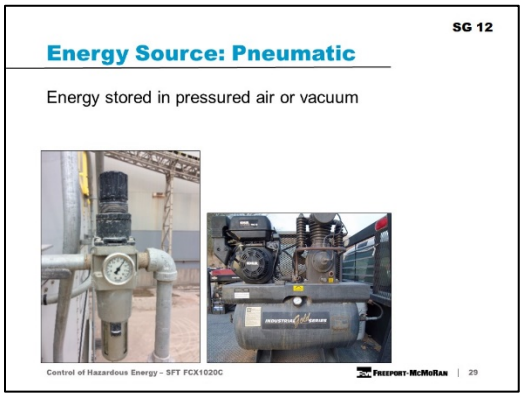
PPT slide 28, SG page 12



Instruction

- Any electromagnetic or particulate radiation source with enough energy to remove electrons from an atom
- **Ask students for any examples of nuclear sources/ionizing radiation energy** (possible answers: images are an X-Ray Fluorescence (XRF) machine and an On-Stream Analyzer (OSA))
- **Ask students what are some potential hazards of nuclear sources/ionizing radiation energy** (possible answers: radiation)
- **Ask students to name the Fatal Risk associated with nuclear sources/ionizing radiation energy source** (Answer: Exposure to Hazardous Substances – Chronic)
- **Ask students to name the critical controls** (Answer: Access Control, Engineered Controls, Handling Requirements, PPE)

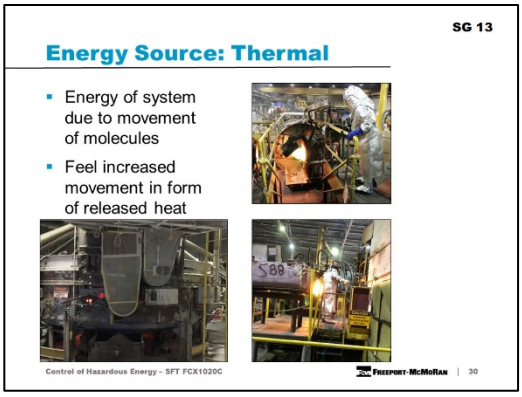
PPT slide 29, SG page 12



Instruction

- Energy stored in pressured air as well as stored in a vacuum
- **Ask students for any examples of pneumatic energy** (possible answers: images are a stationary compressed airline and an air compressor)
- **Ask students what are some potential hazards of pneumatic energy** (possible answers: unexpected discharge of pressurized air)

PPT slide 30, SG page 13



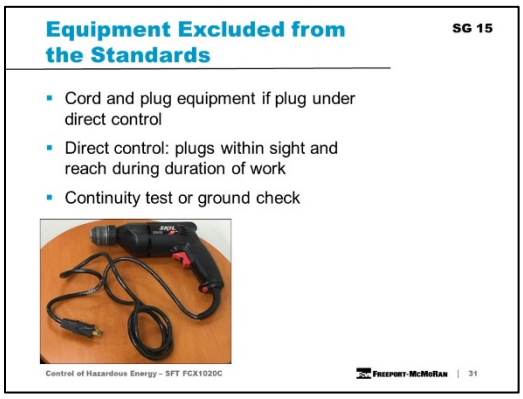
Instruction

- Energy of a system due to movement of molecules
- Greater amount of energy, faster the molecules move
- Feel increased movement in form of released heat
- **Ask students for any examples of thermal energy** (possible answers: images are a furnace/skim basin, roaster, and rod mill)
    - High levels of thermal energy: heat felt from an electrical cord, hot liquids or steam, or the surface of a motor
    - Low levels of thermal energy: ice, liquid propane, liquid oxygen, and liquid nitrogen
- **Ask students what are some potential hazards of thermal energy**
    - Combustion, radiant heat applied by an outside force such as the sun, or friction between two moving objects in contact with each other
    - Burns to a person or damage a piece of equipment that can harm a person in the event of a failure

Note: Tell students that the table on page 14 provides a quick summary of various sources of energy

- Can be used as a quick reference guide
- Not an all-encompassing list of energy sources
- **Optional: have students take turns reading aloud the table for review**

PPT slide 31, SG page 15



Instruction

- Includes cord and plug equipment if the plug is under the direct control of the employee
- "Direct control": plugs that are within sight and reach during the duration of the work
- Example – some sites use a mill inch drive, in which the operator has direct control using a remote control device
- Continuity test or ground check – remind students to not use electrical equipment until it has been checked
- Always check with site Health and Safety or leadership before performing work using this type of equipment

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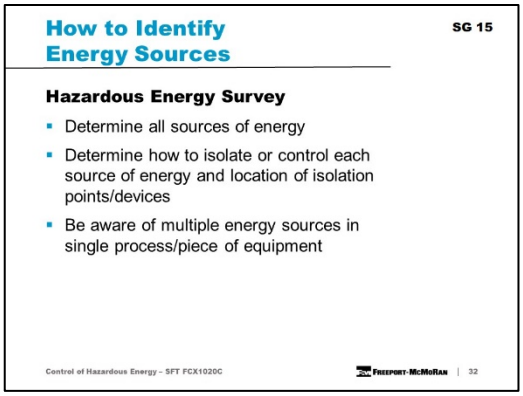
PPT slide 32, SG page 15



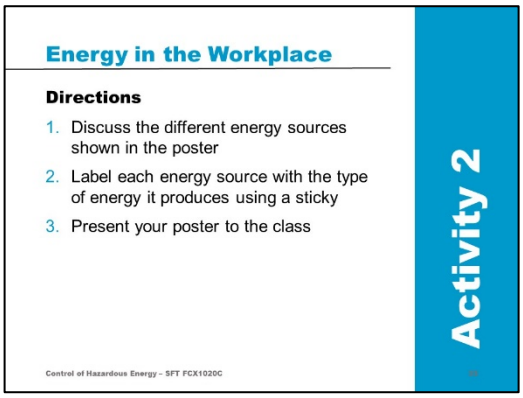
Instruction

- Each Freeport-McMoRan site conducts a Hazardous Energy Survey
- Serves two main functions:
  - Determine all sources of energy that service or maintenance activities may expose to an employee
    - Include all sources of electrical, chemical, gravitational, hydraulic, magnetic, mechanical/kinetic, nuclear/radiation, pneumatic, and thermal energy
    - Consider internal energy sources such as charged capacitors, batteries, wound springs, and raised loads
    - **Notes: Emphasize the importance of identifying all the energy sources as the first step of the process before beginning any work**
      - **Most Job Safety Analysis (JSA) asks you to identify the sources of energy**
      - **Some sites develop a switching plan as part of this planning before a shutdown**
  - Determine how workers can isolate or control each source of energy and the location of the isolation points or devices (be aware of multiple energy sources in single process/piece of equipment)

ACTIVITY 2: ENERGY IN THE WORKPLACE

PPT slide 33, SG page N/A

Time
Approximately 10 minutes



Materials

- 4 posters depicting various types and sources of energy
- Several sticky notes for each group

Purpose
This activity gives students the opportunity to apply their knowledge of energy sources by identifying all of the energy sources they can find in a workplace photo

Instruction

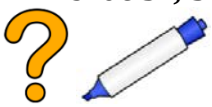
1. Give each group several sticky notes
2. Give each group a different poster
3. Allow the groups 2-3 minutes to identify various energy sources
4. Discuss and label the type of energy each source produces
5. **Have each group present their poster to the class**

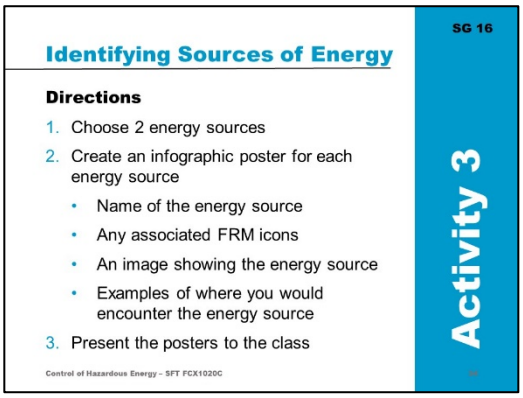
Facilitation Tip

- Module activities increase learning through repetition (Law of Exercise)
- Learn more in the Facilitator Preparation Section at the start of the FG

ACTIVITY 3: IDENTIFYING SOURCES OF ENERGY

PPT slide 34, SG page 16





Time
Approximately 30 minutes

Materials

- Flip chart paper
- Markers
- Student Guide
- Pens/Pencils

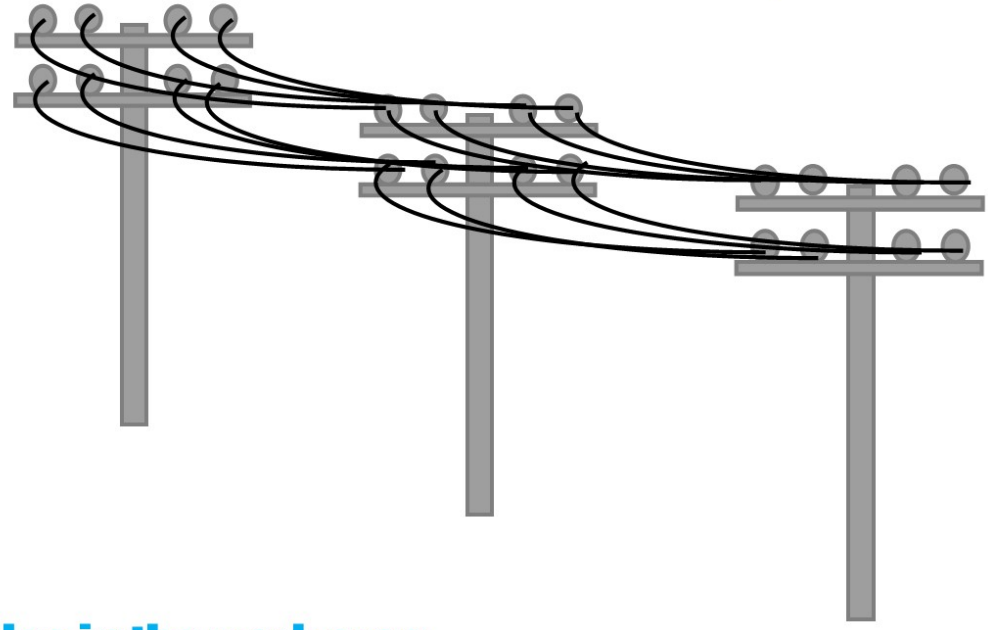
Purpose
This activity gives students the opportunity to summarize sources of energy that they may encounter in their work area

Instruction

1. **Create an example infographic poster using the Electrical energy source**
    a. Create the infographic poster on a piece of flip chart poster
    b. Use the example on the next page to create the poster – you can organize the information however you want
    c. Include the following information:
        - Name of the energy source
        - Any associated FRM icons
        - An image showing the energy source
        - Examples of where you would encounter the energy source
          *This is not an all-inclusive list – always follow site procedures
2. Give each group flip chart paper and markers
3. Groups can choose 2 energy sources (not Electrical)
4. Allow the groups 20 minutes to create an infographic for each energy source with the following information
5. **Remind groups that they can use the Student Guide for reference**
6. **Allow 10 minutes for each group to present their posters – for each energy source, ask students what are some potential hazards for the energy source**

Example of Electrical infographic poster

Electrical



Examples in the work area

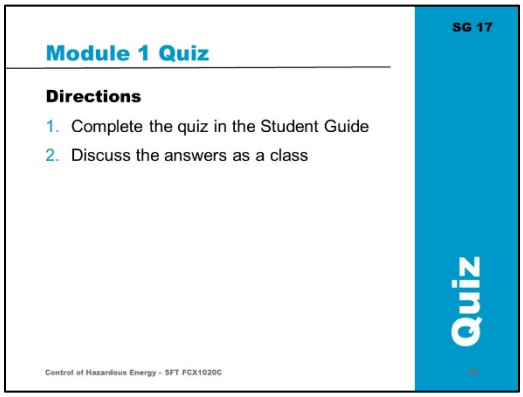
- In the mill
- Administration building
- In the pit
- In Crush/Convey
- In the Lab
- In the Rod Plant

MODULE 1 QUIZ

PPT slides 35-40, SG page 17

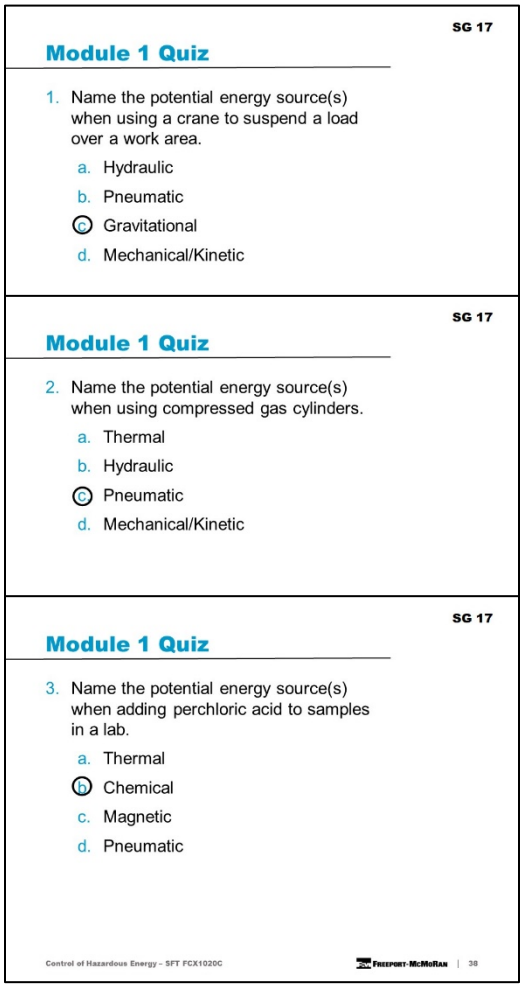
Instruction

- Students write answers to the quiz questions in the SG
- Tell students that some questions may have more than one answer
- Review the answers as a class
- **Click to view circled answer**



Quiz Answers

Question	Answer
1	C, Gravitational, SG Page 8
2	C, Pneumatic, SG Page 12
3	B, Chemical, SG Page 8



Facilitation Tip

- Module quiz questions increase learning through repetition (Law of Exercise)
- Learn more in the Facilitator Preparation Section at the start of the FG

Continued on next page

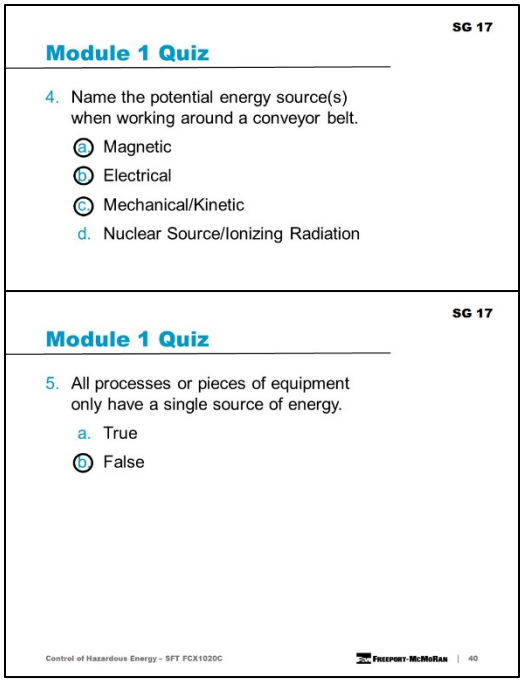
PPT slides 35-40, SG page 17

Instruction

- Students write answers to the quiz questions in the SG
- Review the answers as a class
- **Click to view circled answer**

Quiz Answers

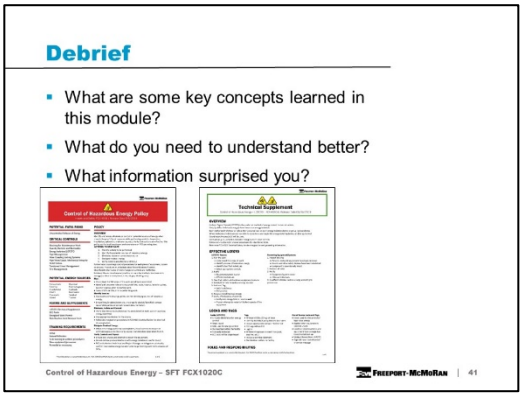
Question	Answer
4	A, Magnetic, SG Page 10 B, Electrical, SG Page 7 C, Mechanical/Kinetic, SG Page 11
5	B, False, SG Page 15



PPT slide 41, SG page N/A

Instruction

- **Discuss the questions on the slide**
- **Note: Ask students to turn to page 104 in the Resources section of the SG – tell students that much of the information we will cover is from the policy and its technical supplement and to use these documents as references**



Facilitation Tip

- Debriefs help summarize, review, refresh, retain, and clarify previously covered content, which increases learning (Law of Recency)
- Learn more in the Facilitator Preparation Section at the start of the FG
- Add debriefs before or after breaks, and at the beginning or end of a day to gauge student understanding and prepare them to learn more

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Break

- Take a 5 to 10 minute break after this module
- Clearly communicate what time you expect students to return

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MODULE 2: CONTROL OF ENERGY SOURCES

This module contains information about the process of controlling hazardous energy. After identifying the source of hazardous energy, select and apply controls to isolate or eliminate those sources. Then, verify the effectiveness of controls. This module discusses various types of controls used at Freeport-McMoRan properties and the verification process.

LEARNING OBJECTIVES

Upon completion of this module, students will be able to select the correct energy control device/type, given a scenario.

ACTIVITIES

Activity 4: Identifying Energy Control Devices/Types

For further details, refer to *Activity Materials* under *Facilitator Preparation* on page 6.

TOTAL TEACHING TIME

This module takes approximately 1 hour to complete.

PPT slide 42, SG pages 22 and 23

Instruction

- Review learning objectives for the module
- Upon completion of this module, students will be able to select the correct energy control device/type, given a scenario
- Control of hazardous energy process
    - Identify and isolate potential sources of energy when there is the possibility of exposure while performing work
    - Eliminate or control the sources of energy
    - Verify that controls are effective
- This module discusses the various types of controls used at Freeport-McMoRan properties and the verification process

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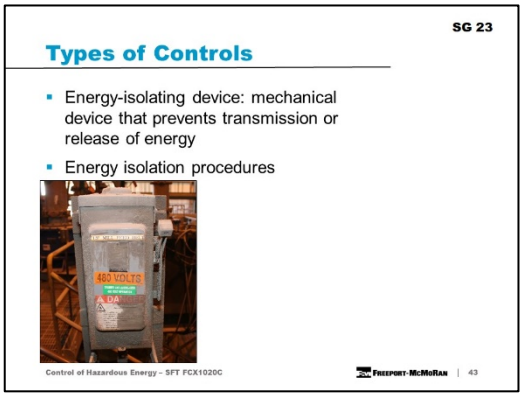
PPT slide 43, SG page 23



Instruction

- Energy-isolating device: a mechanical device that prevents the transmission or release of energy
- Examples: circuit breakers, disconnect switches, line valves, and blocks
- Each site must develop and document detailed energy isolation procedures for each unique piece of equipment, system, or process during service and maintenance activities
    - Clearly outline the requirements for energy isolation for machines, equipment, or processes
    - Include the following:
        - Identification of the machine, equipment, or process
        - Listing of all energy isolation devices and their locations
        - Specific procedural steps for shutting down, isolating, blocking, securing, and relieving stored or residual energy
        - Specific procedural steps for placement and removal of energy isolation devices
        - Specific procedural steps for verifying isolation and if a device has been properly de-energized

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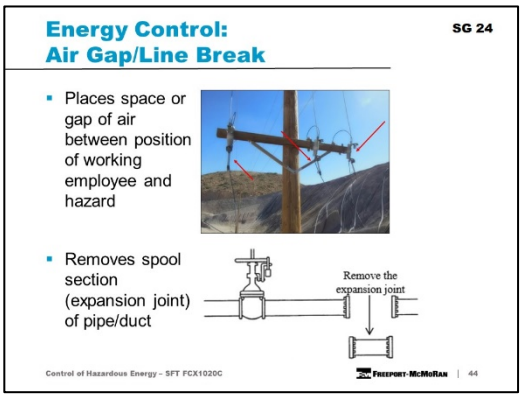
PPT slide 44, SG page 24



Instruction

- After identifying potential sources of hazardous energy, use appropriate methods and devices for controlling the energy source
- Next several slides describe the use of procedures, techniques, designs, and methods to protect personnel from injury from the unplanned release of energy
- Air gap/line break: puts a space or gap in the system carrying the energy (e.g., wires, lines, or pipes)
- Examples: removing a section of pipe or completely removing the fuses out of a power line system
- Line breaking: removes a spool section (an expansion joint) of a pipe/duct
    - Close and lock all upstream valves – ensure that the material does not flow into whatever the line was attached to, such as a tank or pump
    - Place a lock through a bolt hole to prevent accidental re-sectioning – ensures that this control functions properly

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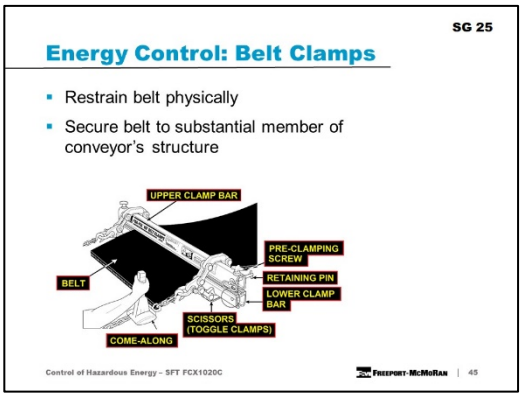
PPT slide 45, SG page 25



Instruction

- Belt clamps and ratchet lever hoists: physically restrain the belt by securing it to a substantial member of the conveyor's structure
- Belt may move in either direction based on the conditions present at the time of the work and that conditions can and do change as the work progresses
- Potential for accidents or fatalities even if properly locking out and tagging out the belt conveyor

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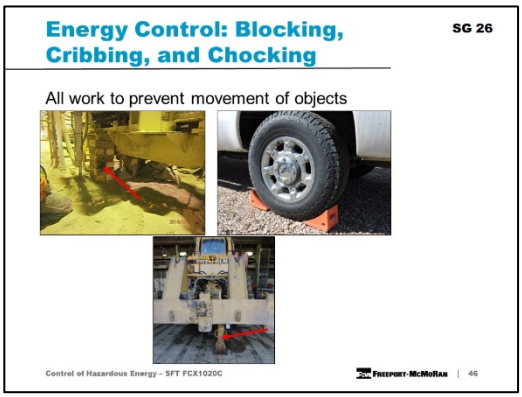
PPT slide 46, SG page 26



Instruction

- Blocking, cribbing, and chocking: all work to prevent movement of objects
- Cribbing: when workers stack material (normally wood) for stability, which helps to prevent movement
- Blocking: protects the worker from potential energy inadvertently becoming kinetic energy
- Chocking: prevents vehicles, rail cars, and rolling stock from moving unexpectedly

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PPT slide 47, SG page 27

Instruction

- Clam shells, chains, and valve locks: prevent valve movement after de-energizing a system
- Valve lockout device: allows the placement of a personal lock and tag on a valve handle after de-energizing a system
    - Use wide variety of valves on Freeport-McMoRan properties
    - Use a lockout device that does not allow the valve to be moved or reopened without removal of the personal lock and tag – if the lockout device allows for valve movement, danger still exists

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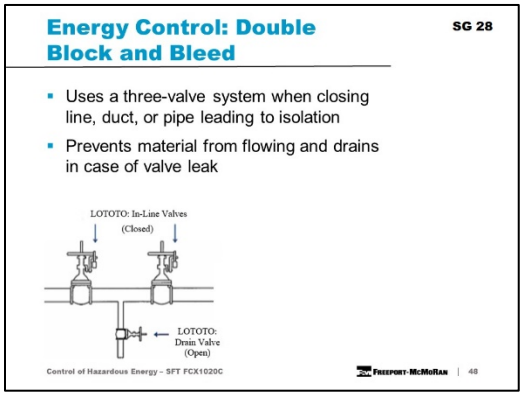
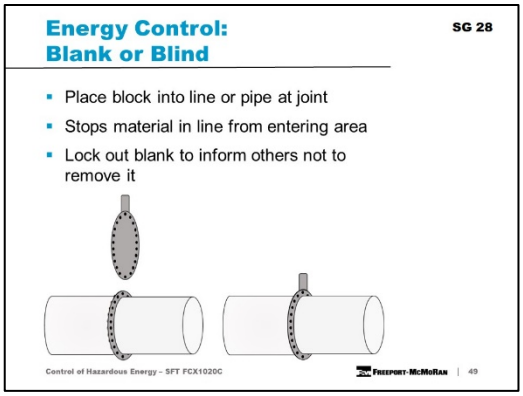
PPT slide 48, SG page 28



Instruction

- "Double block and bleed"
    - Uses a three-valve system when closing a line, duct, or pipe leading to the isolation
    - Prevents the material from flowing and drains in case of a valve leak
- Close and lock the two in-line valves, then open and lock the drain valve in between the two closed valves
- Lock out the valves, either opened or closed

PPT slide 49, SG page 28



Instruction

- Blank or blind: the block put into the line or pipe at a joint
- Stops whatever material is in the line from entering the area
    - Bleed the pipeline to relieve any pressure
    - Remove the flange bolts to separate the pipes
    - Insert the blank or slip blind between the two pipes and bolt the blank – ensure that the blanks fit tightly with all bolts in place
    - Lock out valve – make sure it does not move more than a one-quarter turn (tryout)
- Lock out the blank to inform other workers not to remove it – clearly mark to indicate the presence of the blank or blind

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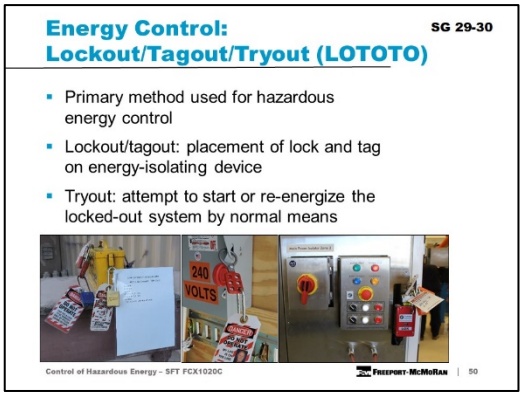
PPT slide 50, SG pages 29-30



Instruction

- Lockout/Tagout/Tryout (LOTOTO): primary method used for hazardous energy control at Freeport-McMoRan
- Required when performing service, maintenance, modification, or installation work
- Lockout/Tagout: placement of a lock and tag on an energy-isolating device
    - Place the lock to prevent others from restarting the piece of equipment while workers perform the work
    - Use a tag in combination with a lockout device to identify the person who placed the lock and to warn others of the hazards of attempting to energize the equipment/machinery
- Tryout: before beginning work, release or dissipate any stored energy and try out the machine or equipment
    - Ensure that all energy sources were effectively isolated
    - Attempt to start or re-energize the locked-out system by normal means to accomplish this verification

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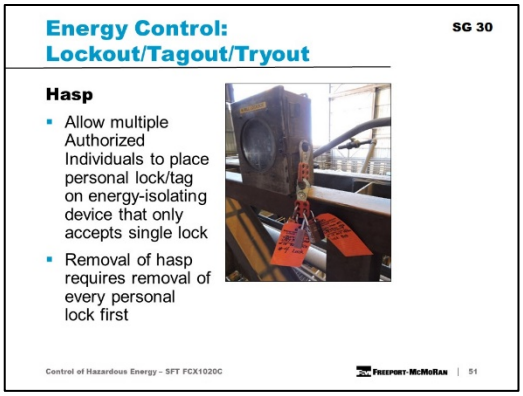
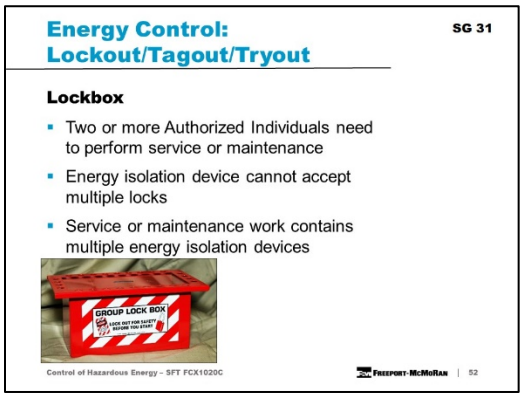
PPT slide 51, SG page 30



Instruction

- **Show your site specific hasp**
- Lockout hasps: allow multiple Authorized Individuals to place a personal lock and tag on an energy-isolating device that can only accept a single lock
- Each Authorized Individual places his/her personal lock on one of the lock points on the hasp
- Removal of the hasp requires the removal of every personal lock first
- **Note: additional hasp for installing more locks is permitted for lockout**

PPT slide 52, SG page 31



Instruction

- **Show your site specific lockbox**
- Lockbox: used for the following situations
  - Two or more Authorized Individuals need to perform service or maintenance
  - Energy isolation devices cannot accept multiple locks
  - Service or maintenance work contains multiple energy isolation devices
- Comes in different sizes and varieties including portable, heavy-duty, and wall mountable
- Holds multiple keys securely
  - Place lock(s) on the energy isolation device, then place the key(s) inside the lockbox
  - Place personal locks and tags on lockbox by all Authorized Individuals working in the affected area
- Ensures that others cannot re-energize the energy isolation device until the removal of the final personal lock from the lockbox
  - Only way to remove the keys contained inside the box is if each worker removes his/her personal lock from the lockbox
  - Once the final worker removes his/her personal lock, the key inside becomes available to unlock the energy isolation device

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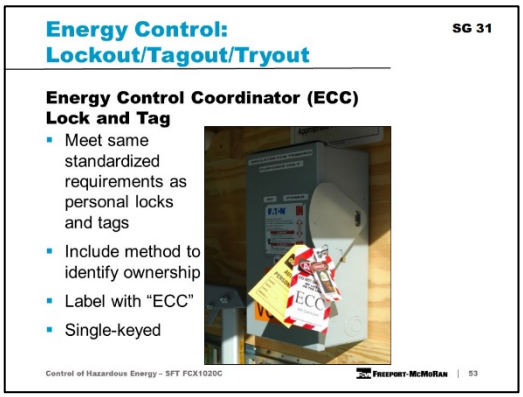
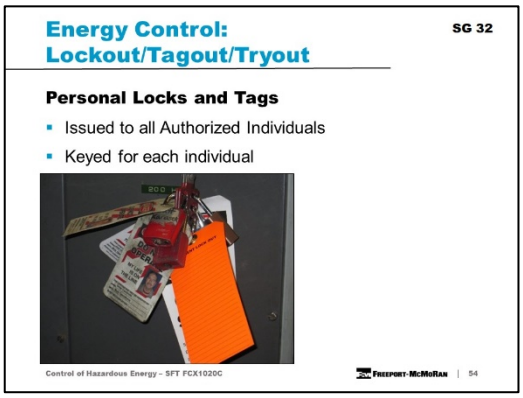
PPT slide 53, SG page 31



Instruction

- **Show your site specific ECC locks and tags**
- Energy Control Coordinator's locks and tags: meet the same standardized requirements as personal locks and tags
- Includes a method to identify ownership and has an ECC label
- Are single-keyed

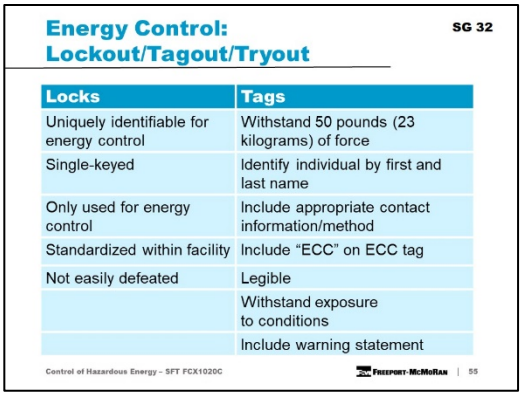
PPT slide 54, SG page 32



Instruction

- **Show your site specific personal locks and tags**
- Personal locks and tags
  - Issued to all Authorized Individuals
  - Standardized by facilities based on the needs of their facility
- Personal lock:
  - Keyed for each individual
  - Only one key exists that can unlock a personal lock
  - Single key unlocks all multiple personal locks keyed alike
  - Single key under the exclusive control of the employee performing the service or maintenance
  - Only the owner of the personal lock can place and remove the lock
- Personal tag:
  - Accompanies each lock
  - Includes a method of identifying the individual who placed the lockout device
  - Standardized (across sites) in color, shape, size, or specific markings, as well as print and format
  - Include a means of attachment that is substantial enough for the following:
    - Prevent inadvertent or accidental removal
    - Withstands 50 pounds of pulling force
    - Withstands the surrounding environment

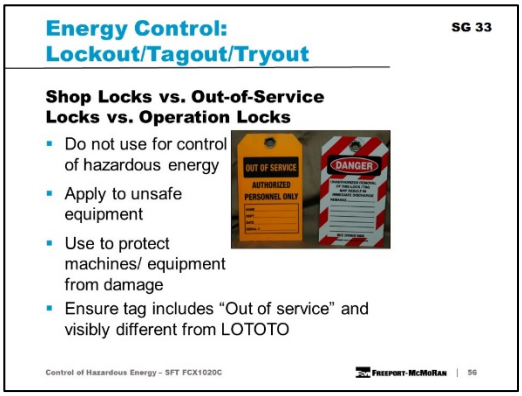
PPT slide 55, SG page 32



Instruction

- Go over the table for requirements for locks and tags
- **Ask what does "Uniquely identifiable for energy control" mean** (Answer: does not look like other locks)
- Examples of conditions are acid, weather, etc.

PPT slide 56, SG page 33



Instruction

- May see these locks on Freeport properties
- Do not use these locks these locks during Lockout/Tagout/Tryout applications – only Authorized Individuals using personal locks and tags may perform LOTOTO
- Never use out-of-service locks and tags for the control of hazardous energy
- Apply to unsafe equipment
- Use to protect the machines and equipment from damage due to accidental start-up
- Ensure that the tag includes "Out of service" or a similar message and that they are visibly different from LOTOTO locks and tags

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PPT slide 57, SG page 34

Instruction

- Use appropriate controls to eliminate the exposure to the energy source when unable to control the hazardous energy source completely
- Chicken switches: remotely operated devices that can operate various electrical switches using a control motor operator externally applied to the switch; provides distance from operating switch
- Remote racking: system used to remotely rack in a breaker; eliminates exposure to the breaker due to distance

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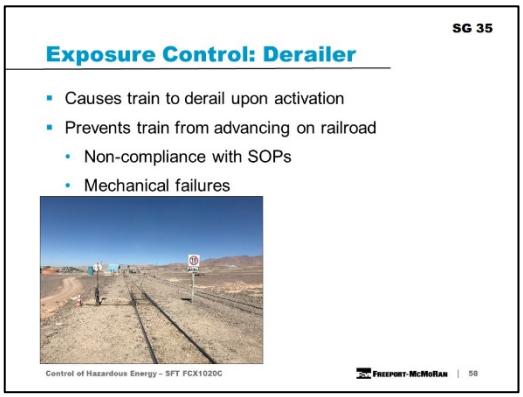
PPT slide 58, SG page 35



Instruction

- Derailer: device installed on railroad tracks
  - Causes the train to derail upon activation
  - Prevents the train from advancing on the railroad
- Used to stop advancement of train
  - Non-compliance (e.g., an uncontrolled engine without authorization) with the site's Standard Operating Procedures (SOPs)
  - Any mechanical failures in the derailer or train machinery

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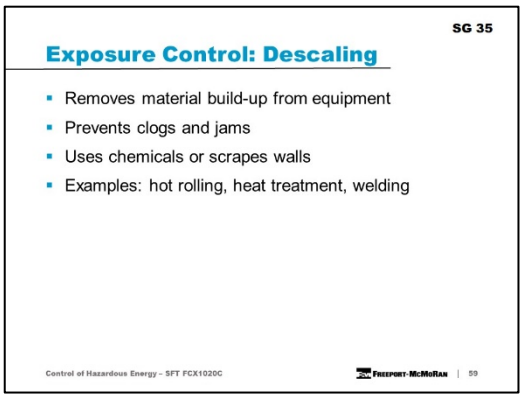
PPT slide 59, SG page 35



Instruction

- Descaling: removes material build-up from equipment
  - Boilers and heat exchangers: accumulation of layers of calcium on the surface; hinders function
  - Chutes: material build-up collects on walls
- Remove material to prevent clogs and jams that not only can damage the machinery, but also could pose a hazard to employees who enter into the spaces for cleaning purposes
- Descale equipment chemically or mechanically by scraping the walls of chutes
- Example: remove tightly adhered layers of oxide formed by hot rolling, heat treatment, welding, and other high-temperature operations; remove layers by using sulfuric, nitric, and hydrofluoric acid

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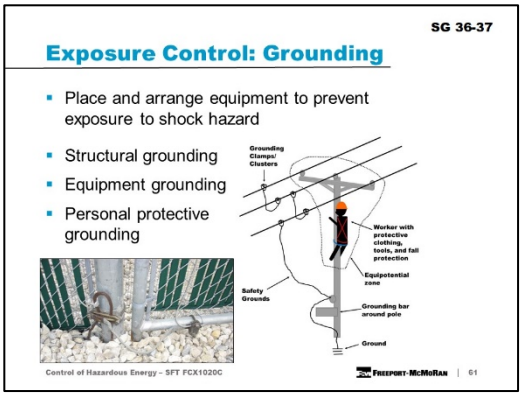
PPT slide 60, SG page 36

Instruction

- Flagging and Barricading: used to safeguard an area (e.g., mark an unsafe area or prepare for a task)
- Install in conjunction with proper communication to any affected parties, including your supervisor, health and safety professional, and any groups working in the area
- Consult your site specific SOP for further details

PPT slide 61, SG pages 36-37



Instruction

- Grounding: place and arrange grounding equipment in a manner to prevent employees from exposure to a shock hazard
- Three types of grounding:
    1. Structural grounding: installs ground bonds to buildings, conveyors, fences, and other structures to provide a safe path to ground for residual electrical energy
    2. Equipment grounding: installs ground bonds to equipment like welding machines, generators, or portable light plants to provide a safe path to ground for residual electrical energy
    3. Personal protective grounding: install on equipment such as grounding clusters when working on electrical power systems that have a chance of inducing energy onto wire or while working on an electrical bus
        - Example: Working on power lines – install grounding clusters to remove any chance of induced energy
        - Example: Working on Motor Control Center (MCC) bus where there are energized electrical sources near the work area – grounding removes any stored energy and prevents any induced energy from injuring an employee working

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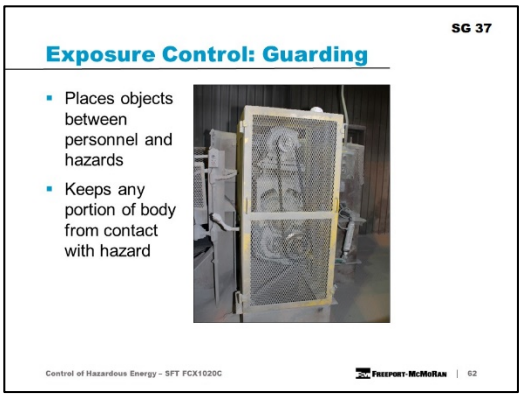
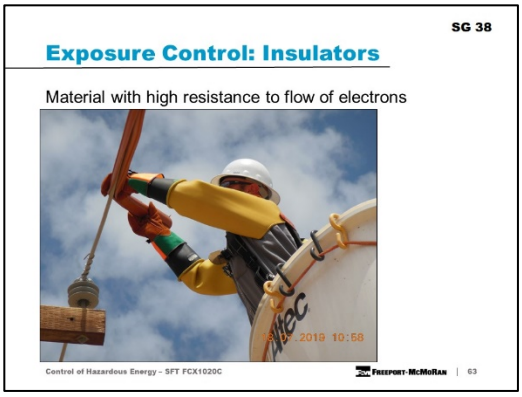
PPT slide 62, SG page 37



Instruction

- Guards: objects placed between personnel and hazards
- Keeps any portion of the body from contact (intentional or inadvertent) with a hazard
- Design examples: shielding, fencing, or enclosing hazards with covers, casings, shields, troughs, spillways, or railings
- Examples of guarding methods: guarding by location (positioning hazards so they are inaccessible to employees) and point of operation guarding (using barrier guards, electronic safety devices, or other such devices)

PPT slide 63, SG page 38



Instruction

- Insulator: material that has a very high resistance to the flow of electrons and is non-absorbing
- Not good conductors of electricity
- Do not allow insulators to touch other objects
- Example: using an insulating blanket when working near energized power line

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PPT slide 64, SG page 38

Instruction

Maintenance switches: take power away from whatever type of load they are currently controlling

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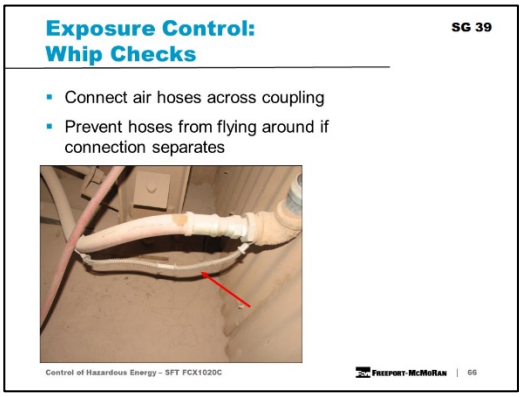
PPT slide 65, SG page 39

Instruction

- Personal Protective Equipment (PPE): help protect workers from items or situations that could cause bodily harm during their job performance
- Inspect or test all PPE before use according to that equipment's specific requirements, such as specific requirements for Cal suits or inspecting face shields, gloves, etc. for hot work.
- Use only serviceable PPE that is free from modifications

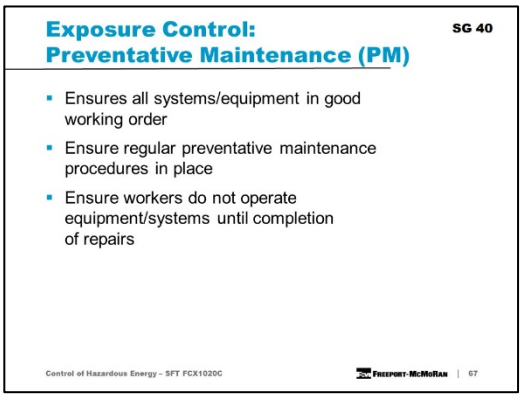
PPT slide 66, SG page 39



Instruction

- Whip checks: connect air hoses across the coupling to prevent the hoses from flying around if the connection inadvertently separates
- Required for air hoses ¾ inches (2 centimeters) or larger

PPT slide 67, SG page 40



Instruction

- Preventative Maintenance (PM): ensures that all systems and equipment are in good working order and that regular preventative maintenance procedures are in place
- Ensures that systems and equipment meet and follow all manufacturer recommendations and engineering requirements
- Ensures that workers do not operate the equipment and systems until completion of repairs when a defect or equipment issue does not allow safe operation
- Troubleshooting: systematic way of problem-solving that looks at data, signs, and symptoms to determine what is happening to processes or equipment
- Make changes based on the analysis to remedy any problems or constraints in the processes or equipment

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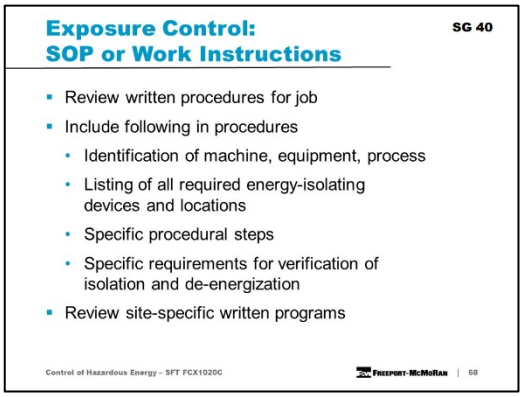
PPT slide 68, SG page 40

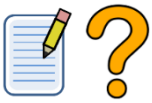


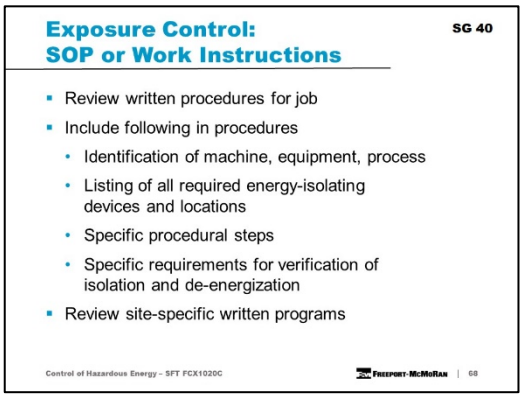
Instruction

- Review any written procedures for the job before performing a hazardous energy control job
- Review any written procedures and amend the procedures as necessary for the job when installing or upgrading new processes or systems
- Include the following in procedures:
    - Identification of the machine, equipment, or process,
    - Listing of all required energy-isolating devices and their locations
    - Specific procedural steps for shutting down, isolating, blocking, securing, and relieving stored or residual energy
    - Specific procedural steps for the placement and removal of lockout devices
    - Specific requirements for verifying the accomplishment of isolation and de-energization
- Review site written programs that detail the requirements for Lockout/Tagout/Tryout
    - Survey all hazardous energy sources
    - Identify complex or multiple source energy-isolating devices

Continued on next page

PPT slide 68, SG page 40



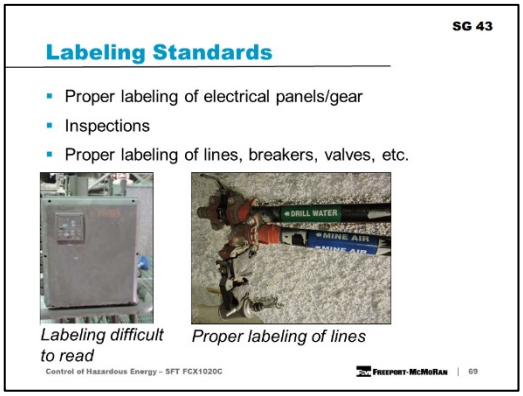


Instruction

Note: Tell students that the tables on pages 41-42 provide a quick summary of energy controls and exposure controls

- Can be used as a quick reference guide
- Not an all-encompassing list of examples/controls
- **Optional: have students take turns reading aloud the table for review**

PPT slide 69, SG page 43



Instruction

- Label all electrical panels properly
  - Critical to the safety of personnel
  - Improper or nonexistent labeling – can contribute to major injuries or death during maintenance or emergencies
- Inspect the labeling of electrical panels
  - Verify that all operational fuses are marked appropriately and accurately
  - Notify appropriate personnel of damaged, missing, or illegible labels
  - Do not open panels unless you are an authorized or qualified individual
  - Note whether adequate lighting is in place to read all labeling
  - Leave any items labeled “spare” or something similar in the open position
- Label electrical gear (breakers, cabinets, switches, panels, etc.) with the following:
  - Voltage
  - Equipment being powered or fed
- Label and identify all lines, breakers, valves, etc. properly
  - Contact responsible parties or consult the relevant documentation for more information if needed
  - Labeling includes contents, direction of flow, and rate of flow/pressure if necessary

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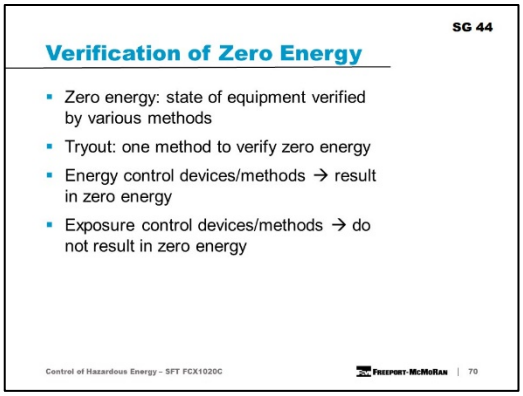
PPT slide 70, SG page 44



Instruction

- Before starting maintenance work:
  - Ensure that there is zero energy and attempt to restart the equipment
  - Do not confuse process interlocks with energy isolation or use for a tryout
- Zero energy: refers to the state of equipment verified by various methods
  - Equipment does not have any hazardous energy
  - Employees may begin to perform service on the equipment safely
- Tryout: one method to verify that there is zero energy
  - Employees attempt to restart the equipment
  - When the equipment does not restart, this verifies zero energy in the equipment
- Energy control devices or methods result in zero energy of the equipment, exposure control devices or methods do not result in zero energy

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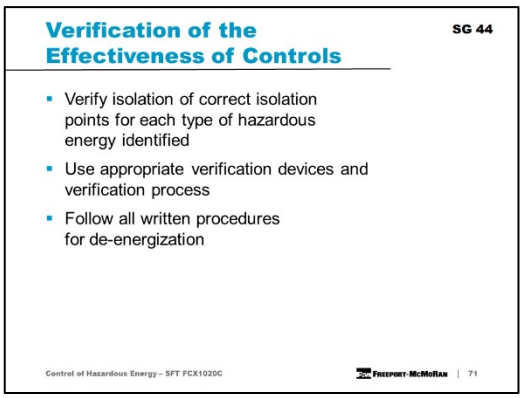
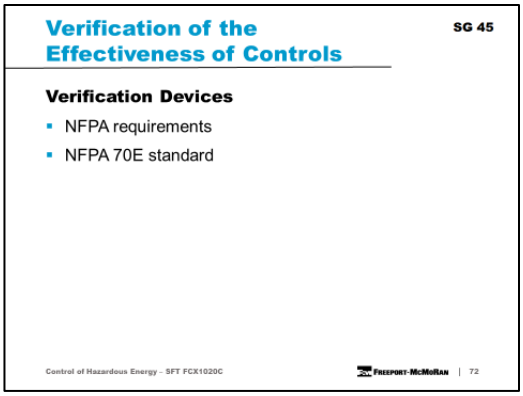
PPT slide 71, SG page 44



Instruction

- Verify isolation of correct isolation points for each type of hazardous energy identified
- Use appropriate verification devices and the verification process to maintain safe working conditions; list below is not all encompassing
  - Single line drawings
  - Process diagrams
  - Piping and Instrumentation Drawings (P&IDs)
  - Pressure gauges
  - Flow meters/indicators
  - OHM/volt meter readings
  - Temperature
  - Tank levels
  - Atmospheric monitoring
  - Tryout
- Follow all written procedures for de-energization

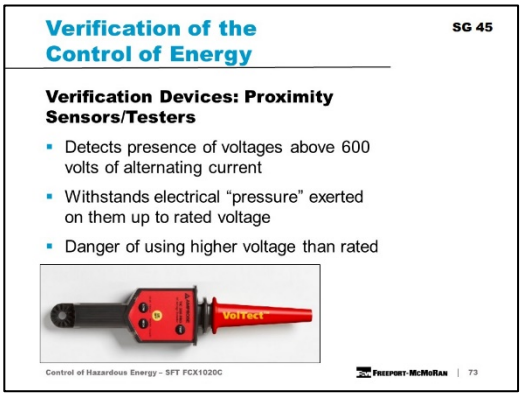
PPT slide 72, SG page 45



Instruction

- Verify effectiveness of energy control – important action to stay safe while working around potential energy hazards
- Use appropriate verification devices and the verification process to maintain safe working conditions
- National Fire Protection Association (NFPA)
  - Requires the verification of zero-energy state
  - Requires voltage measurements of both phase-to-phase and phase-to-ground to ensure the removal of all power from the circuit
- NFPA 70E standard – gives no voltage range for when this requirement starts or stops
- Freeport-McMoRan compliance with NFPA 70E standards requires sites to use devices to verify zero-energy state
- **Note: Freeport-McMoRan follows NFPA 70E Standards**
  - **Cannot always test for zero voltage (for example, with local disconnects)**
  - **Can test for zero energy with live-dead-live tests (described in the Electrical Safety Policy, FCX-HS03)**

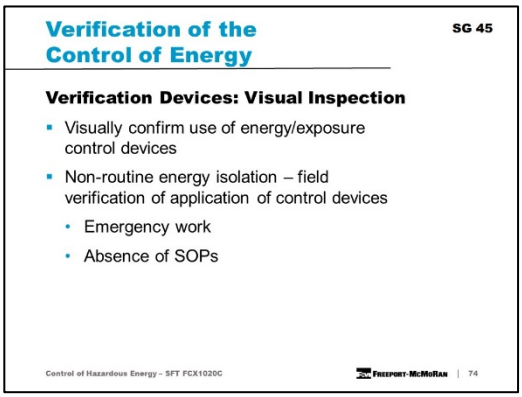
PPT slide 73, SG page 45



Instruction

- Proximity detectors: industry-accepted method for detecting the presence of voltages above 600 volts (electrical pressure) of alternating current (VAC)
- Designed to withstand the electrical "pressure" exerted on them up to the rated voltage
  - Higher voltages cause damage
  - High enough voltage level cause catastrophic failure, resulting in possible worker injury or death
- **Note: proximity sensors work for Low Voltage (LV) and Medium voltage levels**
  - **Only use for rated voltage**
  - **Only trained employees (e.g., electricians) use these**
  - **For non-electrical personnel – try out the equipment to see if it turns on after turning it off at the system switch**

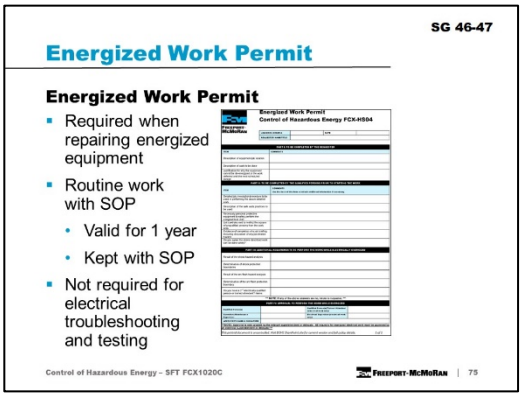
PPT slide 74, SG page 45



Instruction

- Visually confirm the use of energy or exposure control devices after isolating the energy source and before beginning work
- For non-routine energy isolation – complete a field verification of the application of the control devices before performing work in these situations:
    - Non-routine energy isolation
    - Absence of Standard Operating Procedures (SOPs)
- **Note: remind students about the importance of verifying the control of energy – this is where they check to make sure the controls are effective**

PPT slide 75, SG pages 46-67

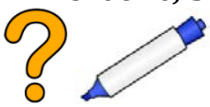


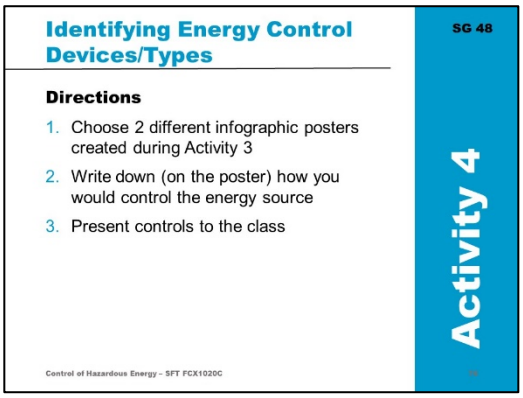
Instruction

- When de-energizing circuit is not possible when performing work
    - **Ask for examples of energized work (possible answer: battery banks)**
    - Require appropriate justifications
    - Must follow the processes and procedures defined in the Electrical Safety Policy – Energized Electrical Work Technical Supplement (FCX-HS03) document
- Complete an Energized Work Permit: when possible exposure to hazardous energy exists and the equipment must remain energized to perform work
- Routine work and where Standard Operating Procedure (SOP) exists:
    - Energized Work Permit valid for one year
    - Kept with the SOP as part of the record – review the SOP prior to performing work
- Electrical troubleshooting and testing does not require a permit – refer to the Electrical Safety Policy Technical Supplement for Energized Electrical work
- If there is no Superintendent on site, the delegate may authorize the work in his/her place
- **Have students look over the Energized Work Permit in their SG and ask them if they have any questions about the information requested**

ACTIVITY 4: IDENTIFYING ENERGY CONTROL DEVICES/TYPES

PPT slide 76, SG page 48





Time
Approximately 20 minutes

Materials

- Infographic posters from Activity 3
- Markers
- Student Guide
- Pens/Pencils

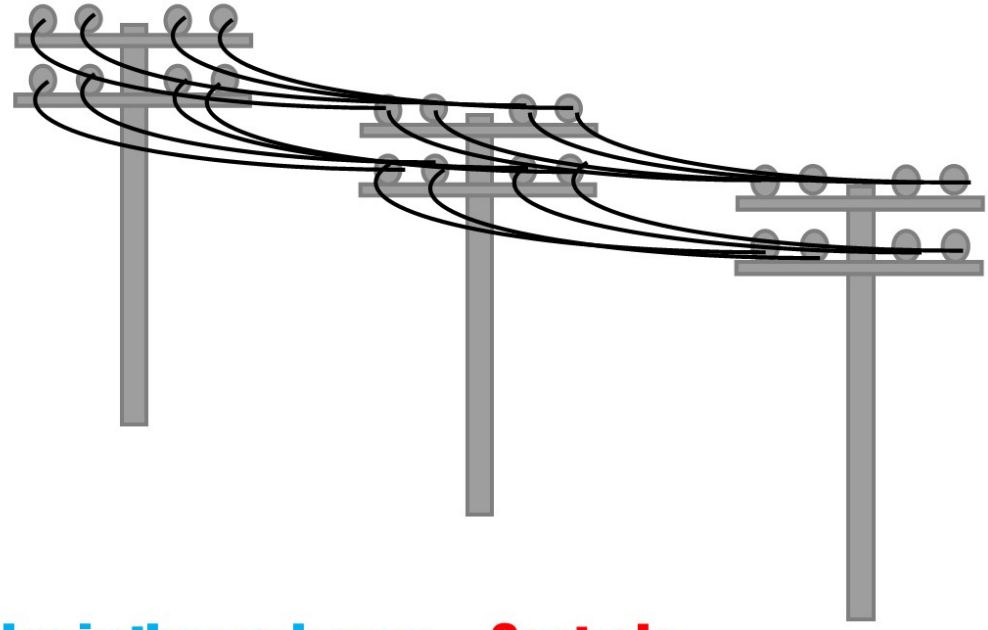
Purpose
This activity gives students the opportunity to select the correct energy control device/type

Instruction

1. **Ask students what are methods to control an Electrical energy source**
    - **Write these answers on the Electrical example poster created during Activity 3 – some examples are given on the next page**
    - **Remind students that controls may be site-specific and/or task-specific**
2. Have groups rotate so that they are working with different energy sources
3. Allow groups 10 minutes to discuss and write down (on the poster) controls for each energy source
4. **Allow groups 5 minutes to present the controls for each energy source**

Example of Electrical infographic poster

Electrical



Examples in the work area

- In the mill
- Administration building
- In the pit
- In Crush/Convey
- In the Lab
- In the Rod Plant

Controls

- LOTOTO
- Air Gapping
- Energy Isolation Device
- Flagging and Barricading
- Grounding
- Insulators
- PPE
- SOPs

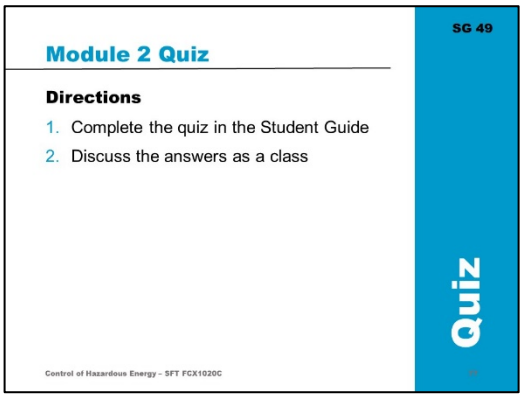
PPT slides 77-82, SG page 49

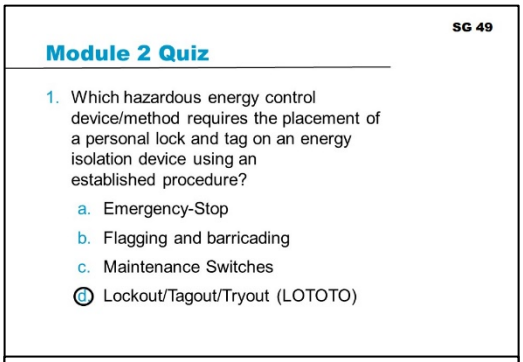
Instruction

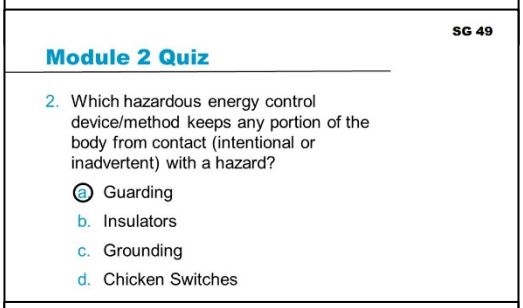
- Students write answers to the quiz questions in the SG
- Review the answers as a class
- **Click to view circled answer**

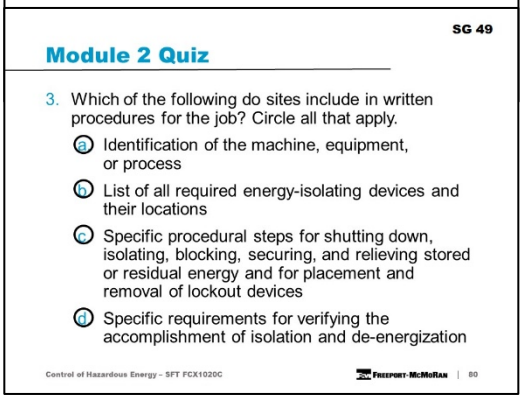
Quiz Answers

Question	Answer
1	D, Lockout/Tagout/Tryout (LOTOTO), SG Page 29
2	A, Guarding, SG Page 37
3	A, B, C, D, SG Page 40









Continued on next page

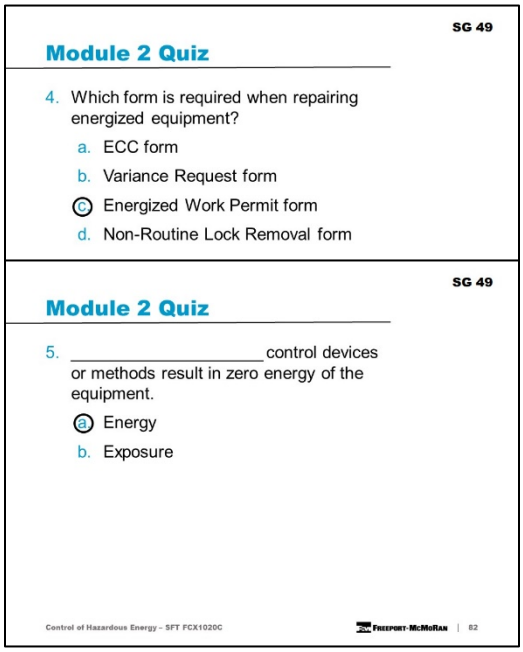
PPT slides 77-82, SG page 49

Instruction

- Students write answers to the quiz questions in the SG
- Review the answers as a class
- **Click to view circled answer**

Quiz Answers

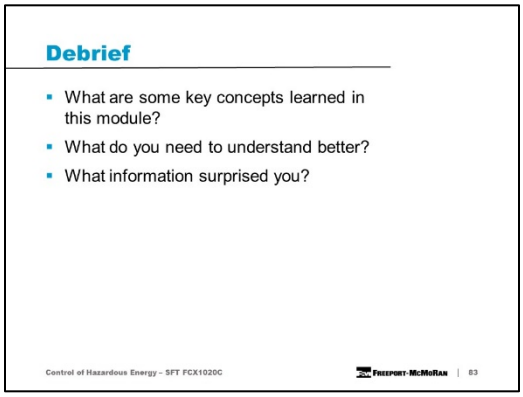
Question	Answer
4	C, Energized Work Permit form, SG Page 46
5	A, Energy, SG Page 44



PPT slide 83, SG page N/A

Instruction

- **Discuss the questions on the slide**
- **Remind students to always refer back to the policy and technical supplements (located on page 104 in the Resources section of the SG)**



Break

- Take a 5 to 10 minute break after this module
- Clearly communicate what time you expect students to return

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MODULE 3: ROLES AND RESPONSIBILITIES

This module contains information about the various roles and responsibilities involved with controlling hazardous energy during a lockout situation.

LEARNING OBJECTIVES

Upon completion of this module, students will be able to determine the responsibilities of each individual, given a simple or complex lockout job.

ACTIVITIES

Activity 5: Who is Who?

For further details, refer to *Activity Materials* under *Facilitator Preparation* on page 6.

TOTAL TEACHING TIME

This module takes approximately 30 minutes to complete.

PPT slide 84, SG pages 53 and 55

Instruction

- Review learning objectives for the module
- Upon completion of this module, students will be able to determine the responsibilities of each individual, given a simple or complex lockout job
- Various roles and responsibilities that come with controlling hazardous energy
- Role determines responsibilities during the job
- This module discusses the various roles and responsibilities of individuals involved with the job

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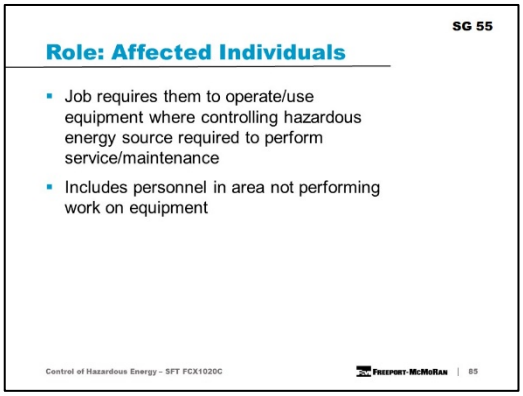
PPT slide 85, SG page 55



Instruction

- When controlling hazardous energy, the following roles may apply to the job or task
- Affected Individuals: an employee whose job requires them to operate or use a machine or piece of equipment where controlling a hazardous energy source is required to perform service or maintenance
- Includes personnel in the area who are not performing work on the equipment

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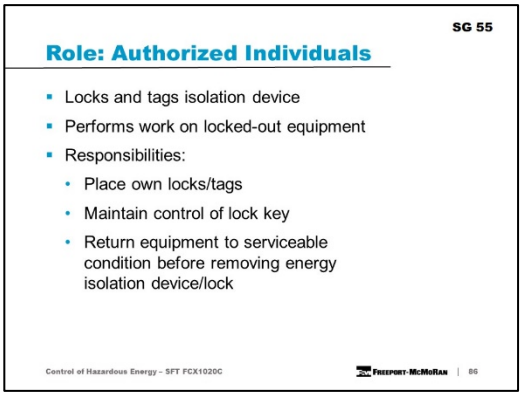
PPT slide 86, SG page 55



Instruction

- Authorized Individual: locks and tags the isolation device for equipment to perform service or maintenance
- Performs work on the locked-out equipment
- Must place their own locks and tags and must maintain control of the key to their lock
- Responsible for returning the equipment to the serviceable condition before removing any energy isolation device or lock
- **Ask students what is the difference between an Affected Individual and an Authorized Individual**
    - Possible answers: Affected Individual
        - Does not directly perform servicing or maintenance work
        - Does not implement lockout procedures or other hazardous energy controls
        - Have jobs that require them to perform tasks such as operating, cleaning, setting up, adjusting, monitoring, or otherwise interacting with or directly around systems and equipment that are under hazardous energy control
    - If performing maintenance is the responsibility of the Affected Individual, then that person becomes the Authorized Individual and he/she must place a personal lock and tag on the energy-isolating device or use an appropriate alternative device to control the energy source

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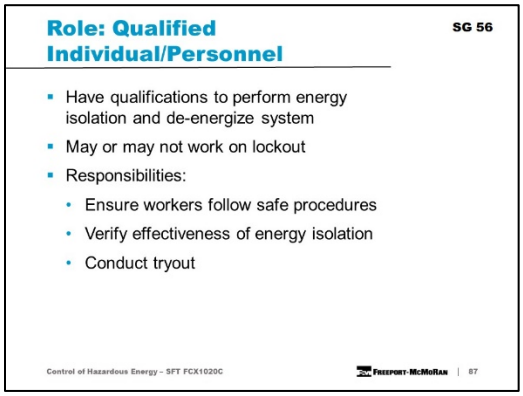
PPT slide 87, SG page 56



Instruction

- Qualified Individuals/Personnel: have the qualifications to perform energy isolation to de-energize the specific system, but they may or may not work on the lockout
- Ensure workers follow safe procedures for the shutdown, isolation, and energy release
- Responsible for verifying the effectiveness of energy isolation and conducting tryout
- Example: electrician that operates a switchgear to de-energize a piece of equipment for mechanics to perform service

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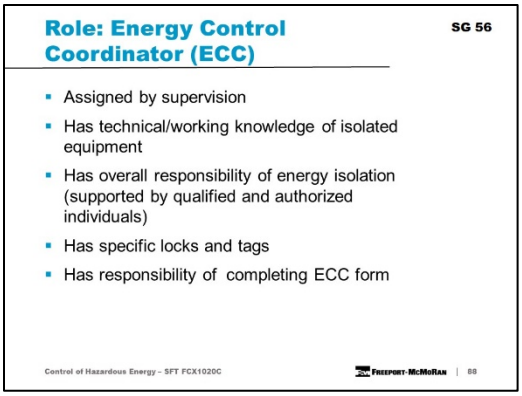
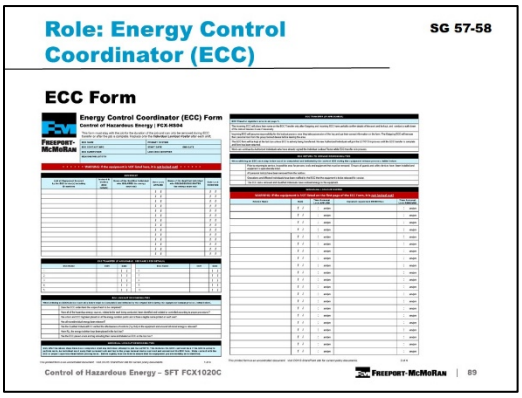
PPT slide 88, SG page 56



Instruction

- Energy Control Coordinator (ECC): assigned by supervision when one of the following occurs:
    - Authorized Individual is unable to place his/her lock and tag directly on the energy-isolating device(s) or is unable to use another control device directly
    - Use of multiple energy-isolating devices
    - Involvement of multiple Authorized Individuals
    - Extension of the period of energy isolation
    - Relatively inaccessible energy-isolating device(s)
    - Dependently connected multiple system components
- Has technical and working knowledge of the equipment needing energy isolation
- Has overall responsibility (with support of qualified and authorized individuals) of the energy isolation to ensure the identification, control, and tryout of energy sources from start to finish
- Have their own specific and distinguishable locks and tags

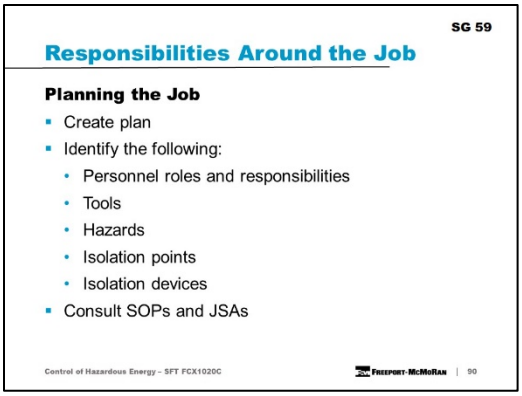
PPT slide 89, SG pages 57-58



Instruction

- Keep ECC form with the lockbox unless there is an active transfer of the ECC
- **Have students look over the ECC form in their SG and ask them if they have any questions about the information requested**

PPT slide 90, SG page 59



Instruction

- Create a plan for the job or task before beginning any work – understand the full scope of the work and all associated tasks
- Identify all personnel roles and responsibilities, tools, hazards, isolation points, and isolation devices
- Consult relevant Standard Operating Procedures (SOPs) and Job Safety Analyses (JSAs) before performing work

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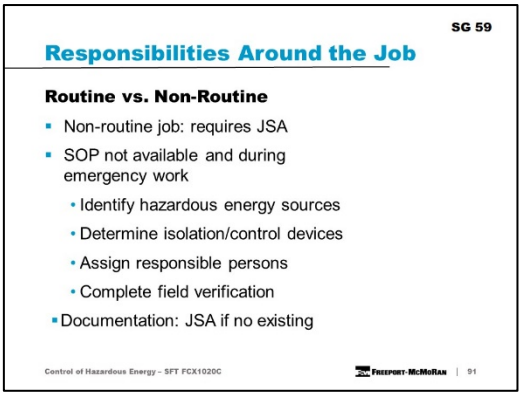
PPT slide 91, SG page 59



Instruction

- **Note: both routine and non-routine jobs follow the Actions to Stay Safe outlined in policy**
  - **Discussed in Module 4**
  - **Refer to policy in Resources section of SG (page 104)**
- Non-routine job: requires a Job Safety Analysis (JSA)
  - Allows the team to think forward
  - Identifies any potential hazards along with the critical controls to assist in completing work safely
- Standard Operating Procedure (SOP) not available and during emergency work, planning for the energy control must include the following:
  - An inventory of identified hazardous energy sources
  - Determination of isolation/control devices
  - Assignment of responsible persons, including Qualified Individuals and ECC if necessary
  - Field verification of the application of the control devices
- Document this information and evidence of the verification
- No existing documentation in place, document this information by using a JSA completed before starting the job

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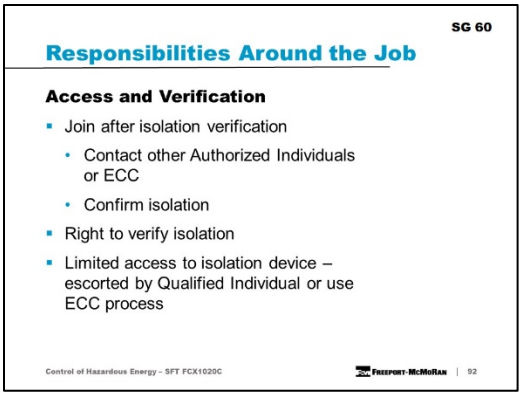
PPT slide 92, SG page 60



Instruction

- If Authorized Individual joins after verification of isolation has taken place
  - Contact the other Authorized Individuals or the ECC (if used)
  - Confirm isolation of equipment and completion of verification/testing
- Retain the right to verify isolation by clearing the area and attempting to start the equipment
- Limited access to isolation devices (e.g., inside a restricted area): Qualified Individual escorts the Authorized Individuals or use the ECC process

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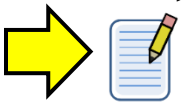
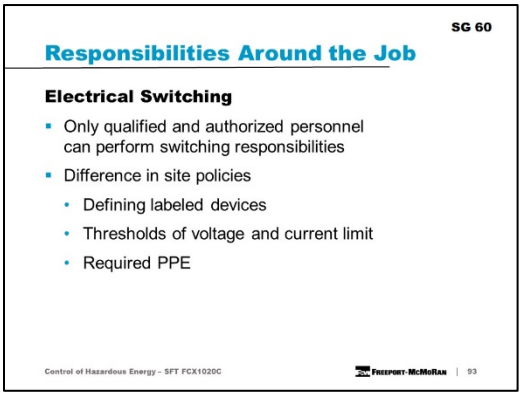
PPT slide 93, SG page 60

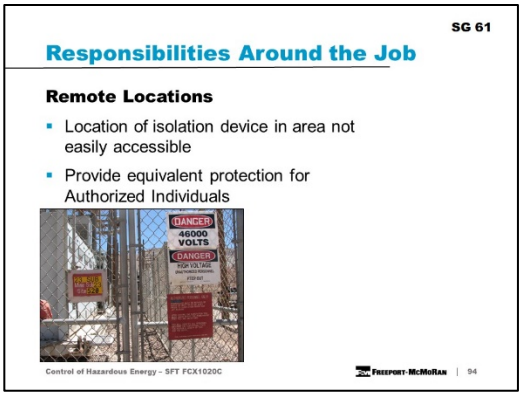




Instruction

- Most site policies: only qualified and authorized personnel can perform switching responsibilities
  - Must receive electrical safety training
  - Must receive task training
- **Note: non-electricians can only switch disconnect switches approved under 1000 volts (see Technical Supplement Switch for Non-Electrical Personnel)**
- **Go over your site policies for defining labeled devices (e.g., switches, disconnects, breakers, etc.), the thresholds of voltage and current limit, and required PPE**

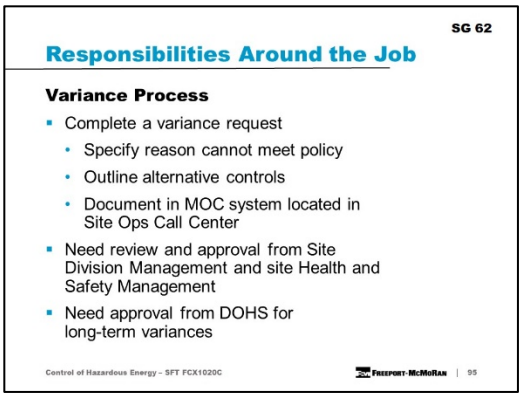
PPT slide 94, SG page 61



Instruction

- Remote areas: location of isolation devices in areas that are not easily accessible
- Example: equipment located miles from the energy isolation device
- Provide equivalent protection for any Authorized Individual as he/she had placed his/her personal lock and tag under LOTOTO
- Follow these steps:
    - ECC at remote location of an energy isolation device has a Qualified Individual perform the energy isolation and verify zero energy state of the equipment
    - ECC places ECC lock and tag on the energy isolation device, and ECC places the key to that lock in a group lockbox
    - ECC places representative personal lock and tag on the group lockbox for each Authorized Individual performing service or maintenance on the de-energized equipment – use ECC form
    - Once all Authorized Individuals have a personal lock and tag placed on the group lockbox, they may begin servicing or performing maintenance on the equipment/process
- **Note: Some areas (e.g., substations or Motor Control Center (MCC)) require an escort**

PPT slide 95, SG page 62



Instruction

- Freeport recognizes that due to the diversity of operating conditions at each site, strict compliance with Control of Hazardous Energy policy may not always be feasible
- Process to allow for justifiable variances from the Control of Hazardous Energy Policy
- When workers cannot meet the Control of Hazardous Energy Policy
    - Complete a variance request
    - Need review and approval from site leadership and site Health and Safety
    - Need approval from the Department of Occupational Health and Safety (DOHS) for any long-term variances to ensure acceptable control of the risks
- Variance request requirements:
    - Specify the reason why the work requirements cannot meet the Control of Hazardous Energy Policy
    - Outline the alternative controls that workers will implement to ensure the establishment of an equivalent level of protection for employees or contractors
    - Document the variance in the Management of Change (MOC) system located in the Site Ops Call Center
    - Site Ops Call Center is the archive for the MOC ticket and associated documents

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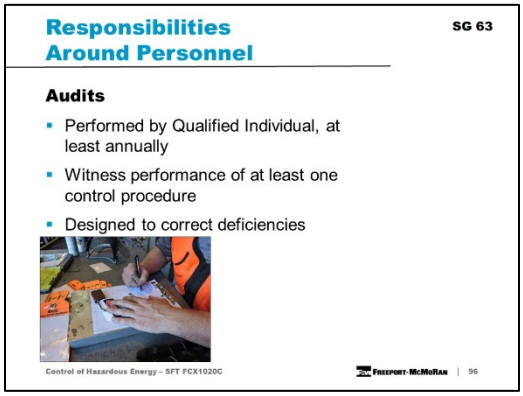
PPT slide 96, SG page 63



Instruction

- Documented audits
    - Performed by a Qualified Individual (determined by site management)
    - Performed at least annually for every control of hazardous energy procedure in use
- Qualified Individual must witness the performance of at least one control of hazardous energy procedure with the procedural details
- Audit designed to correct deficiencies in the established control of hazardous energy procedure or in employee understanding through retraining

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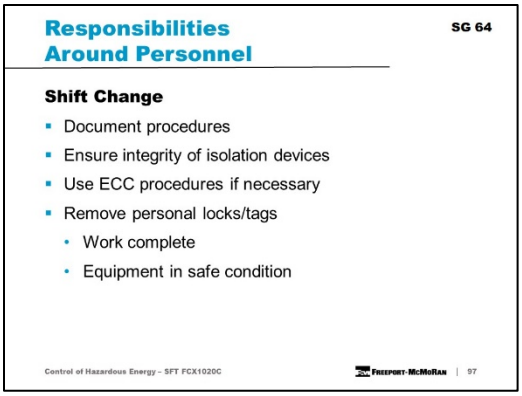
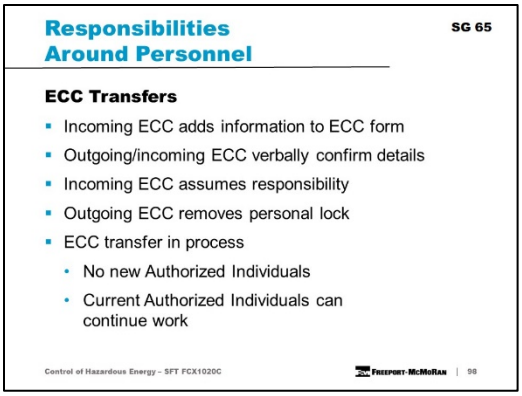
PPT slide 97, SG page 64



Instruction

- Ensure removal of personal locks when the Authorized Individual:
  - Receives another task assignment
  - Leaves at the end of the shift
  - Completes the work
- Exception: when the removal of the lock exposes others to a hazard
- Shift changes include the following procedures:
  - Document the procedures for shift changes
  - Ensure integrity of isolation devices before turnover
  - Use the ECC procedures if necessary
  - Remove personal locks and tags if work is complete and equipment is in a safe condition
- Maintenance of hazardous energy control integrity and orderly shift/personnel transfers include the following examples:
  - On-coming employees apply their personal locks before the off-going employees remove their locks
  - The lockout sequence repeats for the on-coming shift
  - An ECC lock remains on the energy isolation device until completion of the job
  - Transfer of ECC locks or lock custody during shift change
- Before commencing work at the beginning of each shift, each Authorized Individual has the right to verify the effectiveness of the hazardous energy control

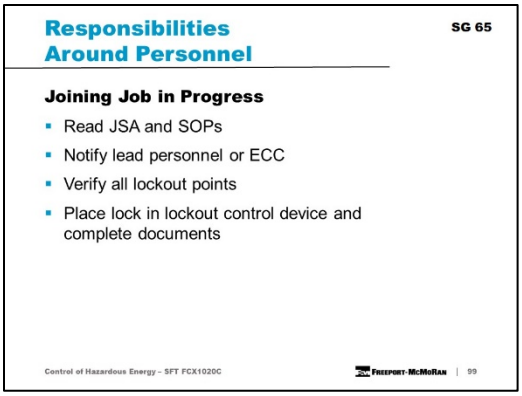
PPT slide 98, SG page 65



Instruction

- For shift change with ECC
  - Incoming ECC adds their information to the ECC form
  - Outgoing and incoming ECC verbally confirms the details of the work and lockout and may visually confirm lockout devices in use
  - Incoming ECC assumes responsibility of the lockout process once they take possession of the key and they put their contact information on the ECC tag
  - Outgoing ECC removes their personal lock from the group lockout device before leaving the area
- Keep ECC form with the lockbox unless there is an active transfer of the ECC
- During the ECC transfer
  - No new Authorized individuals can join the LOTOTO in progress until the completion of the ECC transfer and the return of the form
  - Authorized Individuals who have already signed the Individual Lockout Roster can continue work while the ECC transfer is in process

PPT slide 99, SG page 65



Instruction

- Read the Job Safety Analysis (JSA) and any relevant Standard Operating Procedures (SOPs)
- **Note: remind students about the importance of reviewing provided drawings, prints, and other documentation of what was locked out**
- Notify the lead personnel or ECC
- Remind students that it is an employee's right to verify all lockout points for the potential hazardous energies involved with the job
- Place their lock in the lockout control device and complete necessary documents once completing the verification of all lockout points

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PPT slide 100, SG page 65

Instruction

- Contractors and FCX employees working together on complex lockout jobs
- Contractors must evaluate the full scope of work to ensure job planning adequately covers project specific procedures so that all parties are informed

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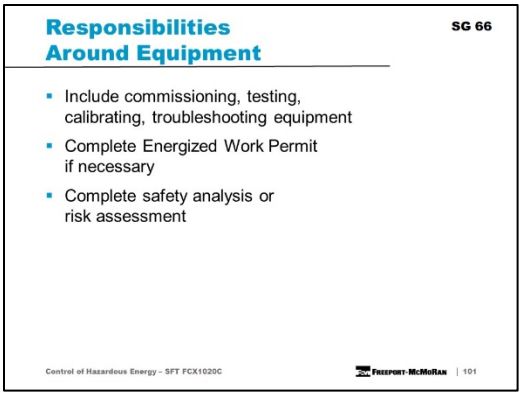
PPT slide 101, SG page 66



Instruction

- Responsibilities around equipment include the commissioning, testing, calibrating, and troubleshooting of equipment
- Complete an Energized Work Permit when possible exposure to hazardous energy exists and the equipment must remain energized to perform work.
- Complete a safety analysis or risk assessment even though hazardous energy control may not apply
    - Understand the process for the start-up of the equipment and the potential for exposure to self and others
    - Develop a communication plan for these activities, evaluate new controls, and verify existing control
    - Keep in mind the following points:
        - When removing guards and barriers (or bypassing interlocks) for troubleshooting/testing and calibration, put in place other controls to prevent exposure
        - When performing work on energized equipment, follow specific documented guidelines and procedures
        - When installing other bypass devices and while performing work on energized equipment, follow specific documented guidelines and procedures for installation, use, and removal of bypass devices

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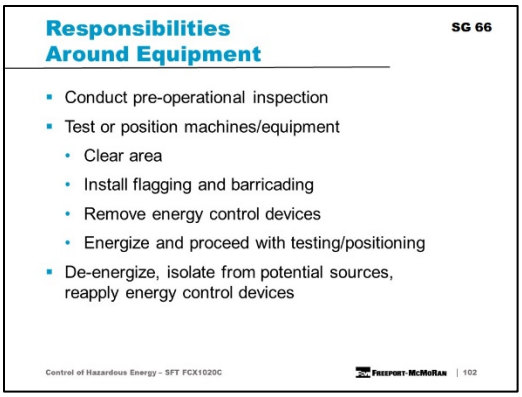
PPT slide 102, SG page 66



Instruction

- Always conduct a pre-operational inspection before starting up the equipment
- Complete the following steps when testing or positioning machines or equipment:
    1. Clear the area of unnecessary personnel, tools, and materials
    2. Install flagging or barricading (refer to FCX-HS19)
    3. Remove energy control devices as specified in procedures
    4. Energize and proceed with testing or positioning
- De-energize, isolate from potential sources, and reapply energy control devices before performing additional maintenance

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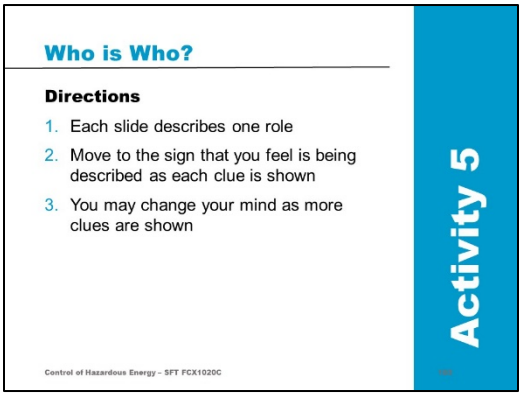
ACTIVITY 5: WHO IS WHO?

PPT slides 103-107, SG page N/A



Time
Approximately 5 minutes

Materials

- 4 role signs (see attachments on following pages); pin or tape one sign in each corner of the room
- 4 role descriptions as presented in the PPT

Purpose
This activity gives students the opportunity to engage with the facilitator actively to ensure understanding of each duty

Instruction

1. Place a role sign in each corner of the room – carefully tear out from the FG or make copies of each role
2. Point out the four role signs located in each corner of the room
3. Explain that you will read one clue for each description at a time from the PPT and they must decide which duty was described
4. As soon as each student believes they have figured out which duty is being described, the student stands near the corresponding sign
5. **Once all students have moved to a sign that they believe is the answer, discuss how they chose each answer**
6. Repeat for each duty description

Note: As an alternative for large class sizes

- Place copies of the four role signs at each table
- Group at table work together to choose the role and hold up the appropriate sign when they believe they have figured out the answer

Authorized Individual

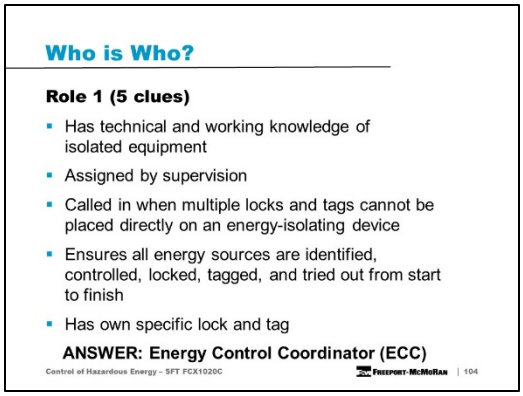
Affected Individual

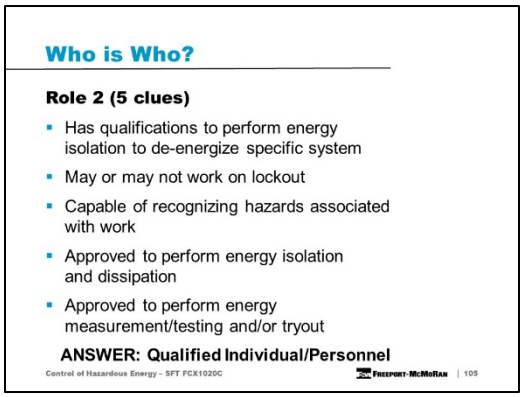
Qualified Individual/ Personnel

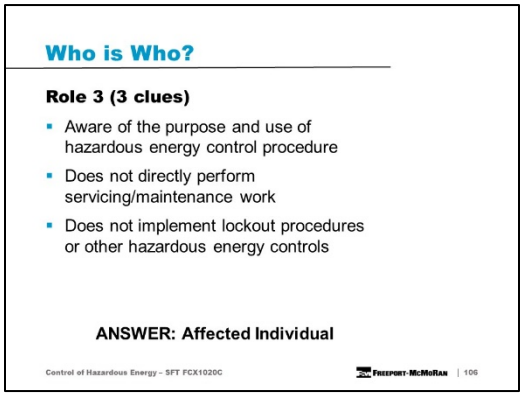
Energy Control Coordinator

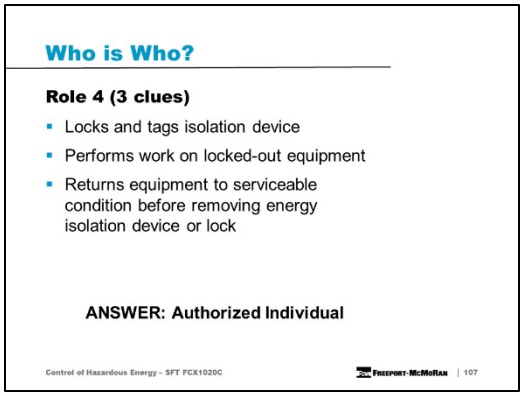
Answer Clarifications

- Role 1: Energy Control Coordinator
  - Assigned by supervision
  - Ensures all energy sources are identified and controlled from start to finish
  - Utilized when multiple Authorized Individuals are used, and the energy isolation device cannot accept multiple locks
- Role 2: Qualified Individual/Personnel
  - Approved to perform energy isolation, dissipation, and measurement
  - Often performs safe de-energization even though they may not be working on the process/equipment
- Role 3: Affected Individual
  - Does not directly perform service/maintenance work
  - Does not implement lockout procedures
- Role 4: Authorized Individual
  - Performs service/maintenance on equipment
  - Locks and tags isolation device









MODULE 3 QUIZ

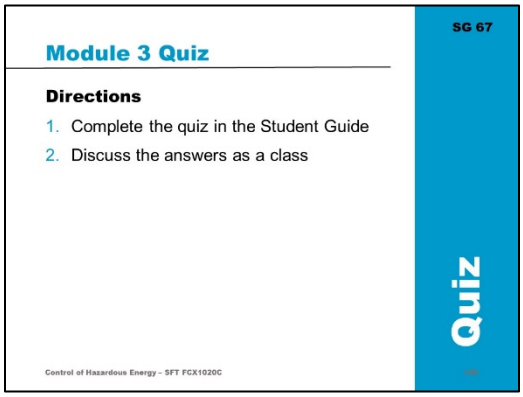
PPT slides 108-113, SG page 67

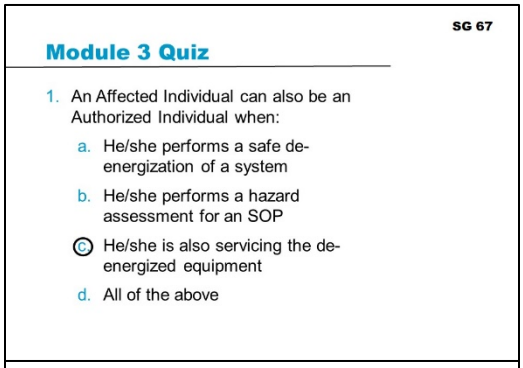
Instruction

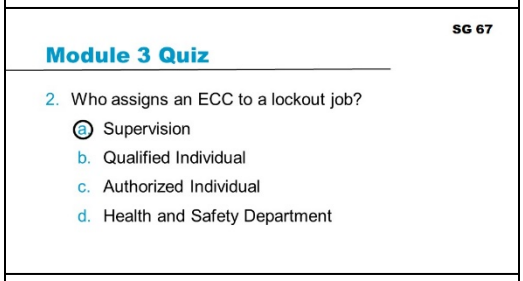
- Students write answers to the quiz questions in the SG
- Review the answers as a class
- **Click to view circled answer**

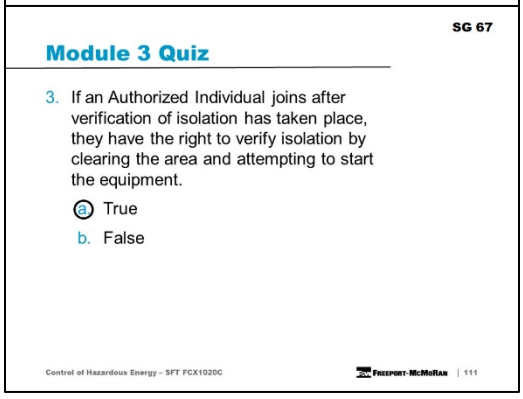
Quiz Answers

Question	Answer
1	C, He/she is also servicing the de-energized equipment, SG Page 55
2	A, Supervision, SG Page 56
3	A, True, SG Page 58









Continued on next page

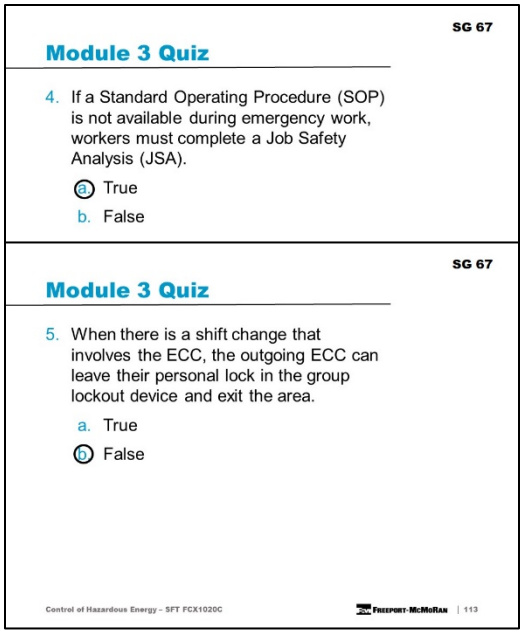
PPT slides 108-113, SG page 67

Instruction

- Students write answers to the quiz questions in the SG
- Review the answers as a class
- **Click to view circled answer**

Quiz Answers

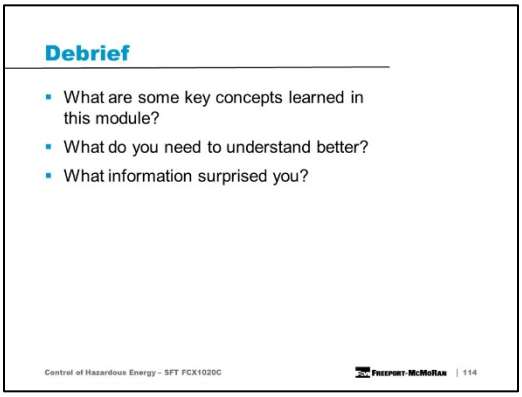
Question	Answer
4	A, True, SG Page 59
5	B, False, SG Page 63



PPT slide 114, SG page N/A

Instruction

Discuss the questions on the slide



MODULE 4: PROCESSES

This module contains information about various processes that help workers to stay safe when performing work that involves potential exposure to hazardous energies.

LEARNING OBJECTIVES

Upon completion of this module, students will be able to demonstrate the actions to stay safe, given a scenario.

ACTIVITIES

- Activity 6: Lockout Simulation
- Activity 7: Creating a Plan

For further details, refer to *Activity Materials* under *Facilitator Preparation* on page 7.

TOTAL TEACHING TIME

This module takes approximately 70 minutes to complete.

PPT slide 115, SG pages 71 and 73

Instruction

- Review learning objectives for the module
- Upon completion of this module, students will be able to demonstrate the actions to stay safe, given a scenario
- This module discusses various processes that help workers to stay safe when performing work that involves potential exposure to hazardous energies

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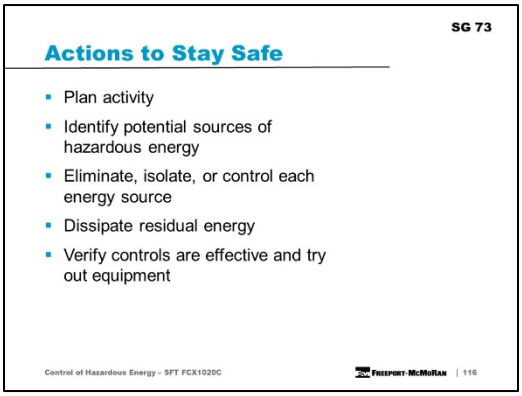
PPT slide 116, SG page 73



Instruction

- Actions to stay safe when there is the possibility of exposure to hazardous energies while performing work
  - Planning the activity
  - Identifying the potential sources of hazardous energy
  - Eliminating, isolating, or controlling each energy source
  - Dissipating residual energy
  - Verifying controls are effective and try out the equipment
- Follow hazardous energy control procedures for each piece of equipment, system, or process
  - Include steps for verification of control
  - Stop the job when the scope of work changes or controls are ineffective
  - Isolate at the source whenever possible, or use other methods to ensure zero energy

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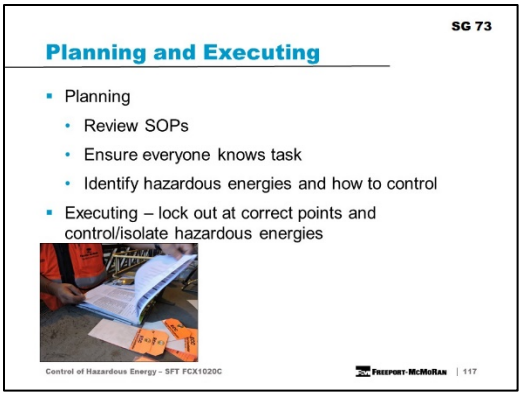
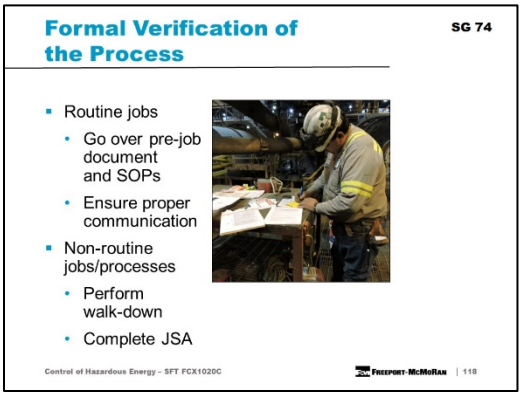
PPT slide 117, SG page 73



Instruction

- Planning for the job
  - Review the appropriate Standard Operating Procedures (SOPs) – all sites must have a written process for energy control for each unique piece of equipment that incorporates equipment lockouts into the process
  - Ensure that everyone knows the task and that individuals have the correct equipment for the task
  - Identify all potential hazardous energies and identify how to control those energies or exposure to those energies
- **Note: Remind students that the Qualified Individual needs to understand the equipment they lock out**
  - **Look at drawings/schematics/Onelines, such as P&IDs or single line drawings – you will receive appropriate field training on these resources**
    - Piping and Instrumentation Drawings (P&IDs) – see the example in the SG Resources section page 108
      - Indicate design intent for controls on the project and are a back check for installed mechanical and electrical equipment
      - Ensure pipes are built and installed correctly while used in tandem with the isometrics and plan designs
      - Used during commissioning to make sure the design intent was achieved during construction
      - Used post construction for the controllers to determine their lockout points and how the site should be controlled
      - Single line drawings – see the example in the SG Resources section page 110
  - **Consult manuals and specifications of equipment**
  - **Walk area around work and identify sources**
- Executing the job: involves locking out at the correct points and controlling or isolating all potential hazardous energies

PPT slide 118, SG page 74



Instruction

- Routine jobs
  - Go over the pre-job document and associated Standard Operating Procedures – identify the potential hazardous energies involved with the job, necessary safety equipment, and all lockout points
  - Ensure proper communication with anyone working in the area
- Non-routine jobs or processes
  - Perform a walk-down of the job
    - Ensure that everyone knows the tasks involved for the job and the work that each person will perform
    - Ensure that each individual understands the potential hazardous energies involved with the job and has the proper training (e.g., working at heights, confined space)
    - Verify the lockout points involved in the job
  - Complete the Job Safety Analysis (JSA) before beginning work

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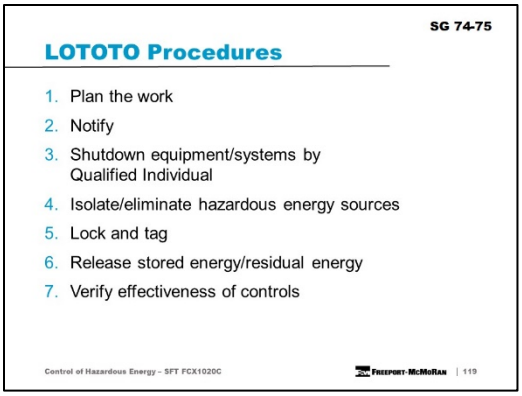
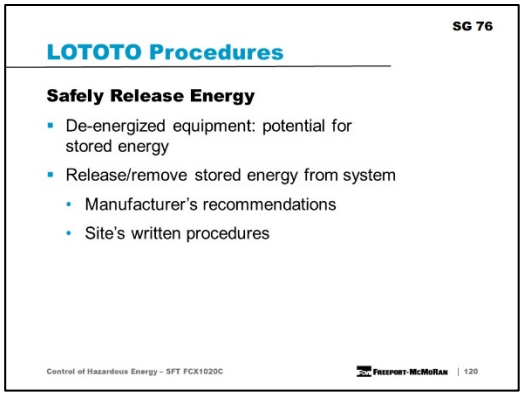
PPT slide 119, SG pages 74-75



Instruction

- All Freeport-McMoRan LOTOTO procedures must address seven critical steps that safeguard employees from the unexpected startup or release of hazardous energy during service or maintenance activities
- Course outlines the MINIMUM requirements for LOTOTO procedures
- Individual properties may have individual requirements, but all procedures include following 7 steps **(as you go through each step, model the step on the lockout simulator)**
    - Plan the work – Authorized Individuals must understand the scope of the work, identify sources of hazardous energy, identify Qualified Individuals, and select appropriate controls
    - Notify – notify the equipment/system owner and individuals affected by a shutdown of a machine, piece of equipment, or process before the application and after the removal of any lockout/tagout devices **(Note: emphasize the importance of ensuring that the area is clear of all personnel)**
    - Shutdown equipment/systems by Qualified Individual – Qualified Individual(s) performs the shutdown of the equipment/systems using the established hazardous energy control procedures
    - Isolate/eliminate hazardous energy sources – Qualified Individual(s) operates the switch, valve, or other energy-isolating devices to disconnect or isolate the energy source(s) from the equipment
    - Lock and tag
        - Each Authorized Individual or Energy Control Coordinator places personal lock and tag on each energy-isolating device that controls the energy source(s) to the area in which the individual is working
        - Approved tag accompanies each lock
    - Release stored/residual energy – relieve, disconnect, restrain, or otherwise control all potentially hazardous stored, residual, or potential energy
    - Verify the effectiveness of controls
        - Authorized Individual or Energy Control Coordinator verifies zero energy from all sources and tryouts the machine or piece of equipment prior to working on a machine, piece of equipment, or process
        - Tryout refers to attempting to restart all locked aspects of the equipment

PPT slide 120, SG page 76



Instruction

- De-energized equipment: still has potential for stored energy including kinetic, pressure, residual, electrical, and fluid that the system has not released
- Follow the manufacturer's recommendations and the site's written procedures to carefully release and remove this stored energy from the system

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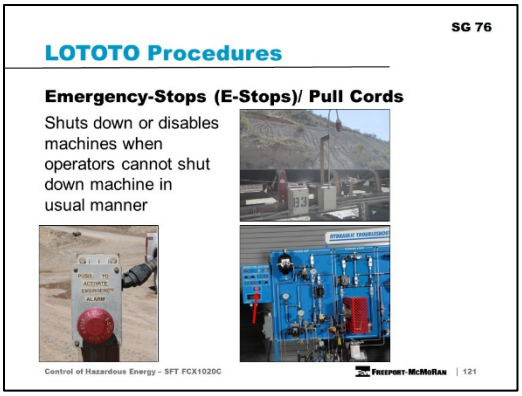
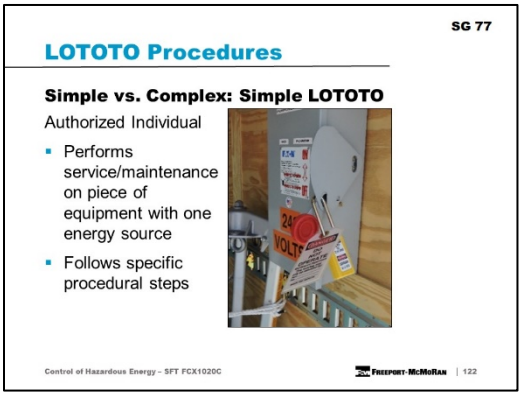
PPT slide 121, SG page 76



Instruction

- Emergency-stops (e-stops), pull cords, or kill switches: safety mechanisms used to shut down or disable machines when operators cannot shut down the machine in the usual manner
- Mounted along both sides of the conveyor
- **Note: Emphasize that these are used to stop equipment in an emergency – these devices are not substitutes for a proper energy isolation**
- Examples: pumps, conveyors, rectifiers, and fuel stations

PPT slide 122, SG page 77



Instruction

- Three types of LOTOTO situations encountered on a routine basis: Simple LOTOTO, Complex LOTOTO, ECC LOTOTO
- Simple LOTOTO: Authorized Individual(s) performing service or maintenance on a piece of equipment having one energy source
- Authorized Individual: responsible for following the specific procedural steps to safely de-energize and isolate the equipment they will be servicing

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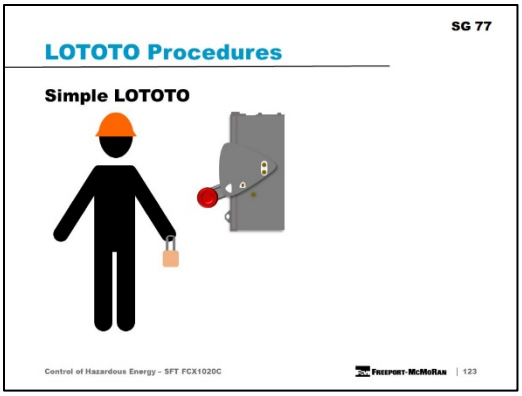
PPT slide 123, SG page 77

Instruction

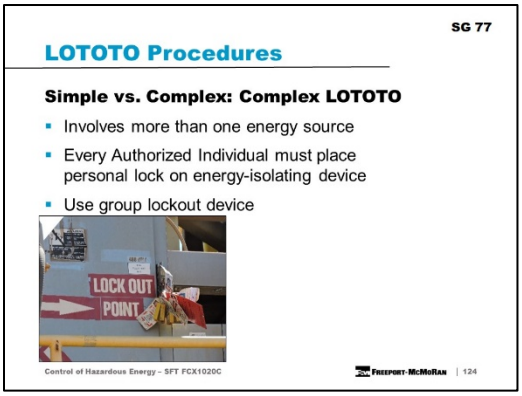
- Simple LOTOTO – In this scenario, an Authorized Individual places a personal lock and tag on a single energy isolation device
- One energy source



PPT slide 124, SG page 77

Instruction

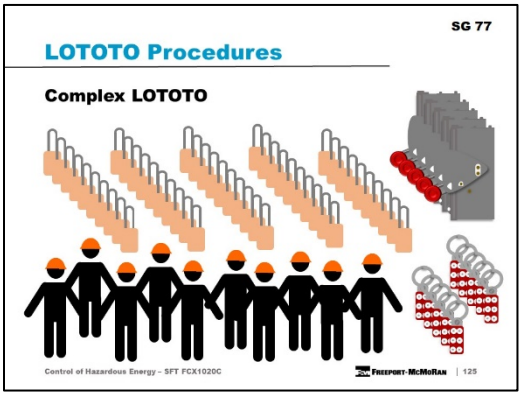
- Group/Complex LOTOTO: any LOTOTO procedure that involves more than one energy source
- Every authorized individual must place his/her personal lock on the energy-isolating device
- Use some form of group lockout device, such as a hasp or lockbox



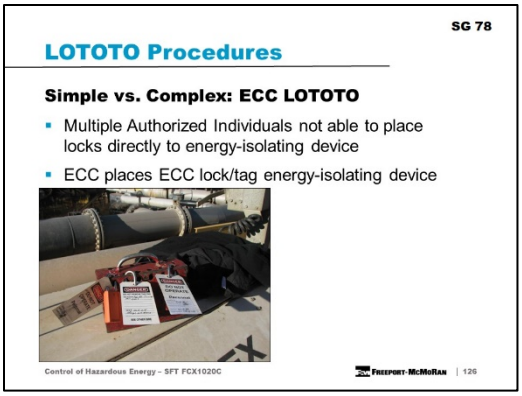
PPT slide 125, SG page 77

Instruction

- Complex LOTOTO – In this scenario, 10 Authorized Individuals need to each place personal locks and tags on 5 different energy isolation devices
- Require 2 hasps to be used with each energy isolation device and a total of 50 personal locks and tags



PPT slide 126, SG page 78



Instruction

- ECC LOTOTO: multiple Authorized Individuals are not able to place their personal locks and tags directly to the energy-isolating device(s)
- ECC places ECC lock and tag on energy-isolating device
    - Provides full protection to all Authorized Individuals working on the same project
    - Stores the ECC lock's key and allows all Authorized Individuals to place a personal lock while conducting work
- ECC use: for complex, large-scale lockout situations, such as jobs that require multiple departments, shifts, or systems

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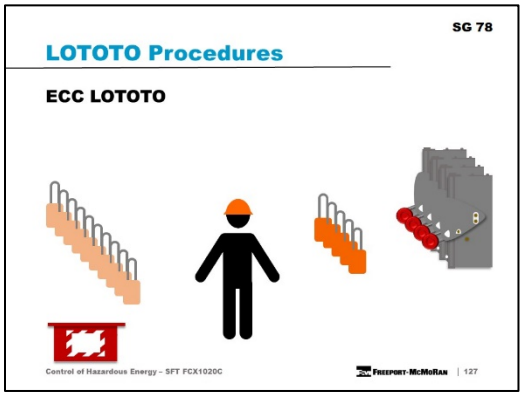
PPT slide 127, SG page 78



Instruction

- ECC LOTOTO – This is the same scenario from the previous slide (10 Authorized Individuals need to each place personal locks and tags on 5 different energy isolation devices)
- Difference: in this scenario, use an ECC
    - ECC places an ECC lock and tag onto each of the five energy isolation devices
    - ECC's places key in a lock box where each of the 10 Authorized Individuals will hand a personal lock and tag
- Repeat that the primary reason for ECC use is to provide protection to all Authorized Individuals working on the same project

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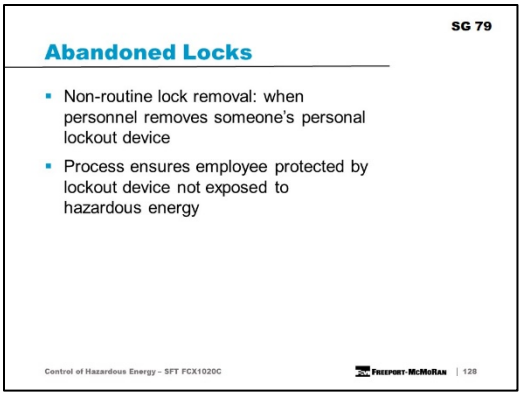
PPT slide 128, SG page 79



Instruction

- Non-routine lock removal
  - When another personnel removes device if Authorized Individual not available to remove a device or personnel unable to identify the owner of a lockout device
  - Only time removal of personal lockout device by another person permitted
  - Ensure that the employee protected by the device is not exposed to hazardous energy once another employee removes the lock
- Non-Routine Lock Removal Process requires all of the following:
  - All reasonable efforts have been made by a member of management to contact the individual of the pending lock removal, and determine why the equipment was locked out
  - If personnel cannot notify or identify the lock's owner, the Area Supervisor, a Qualified Individual, and a Safety Representative must verify the completion of a thorough inspection and certify that the machine or equipment is safe to re-energize
  - Area Supervisor requesting the lock removal completes the Non-Routine Lock Removal Authorization Form
  - Before resuming work at that facility, personnel informs the individual about the removal of his/her lockout/tagout device

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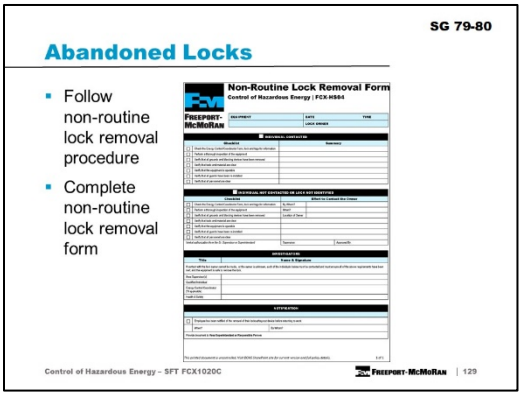
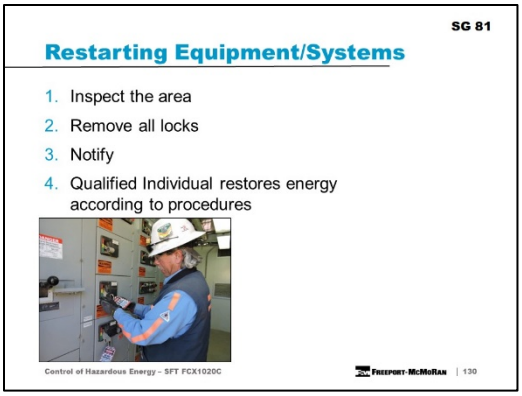
PPT slide 129, SG pages 79-80



Instruction

- For abandoned locks, follow non-routine lock removal procedures and complete the non-routine lock removal form
- **Have students look over the Non-Routine Lock Removal form in their SG and ask them if they have any questions about the information requested**

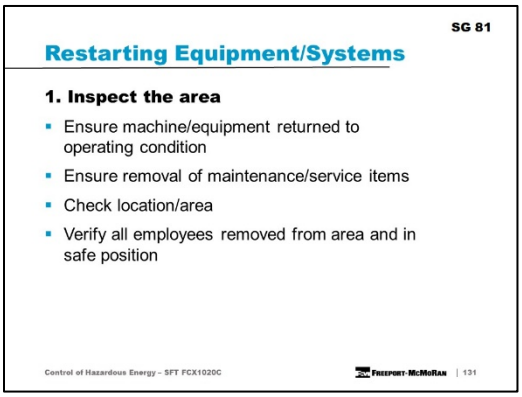
PPT slide 130, SG page 81



Instruction

- Four basic steps to returning equipment to service:
    1. Inspect the area
    2. Remove all locks
    3. Notify
    4. Qualified Individual restores energy according to procedures
- Performed by authorized employees using specific control of hazardous energy procedures before the re-energization of any equipment
- Ensure removal of any maintenance/service items that may impact the operation of equipment
- Ensure that all guarding is in place and secured properly
- **Ask students what do they think is the most important step?** (Answer: Make sure all personnel are accounted for and in a safe location)

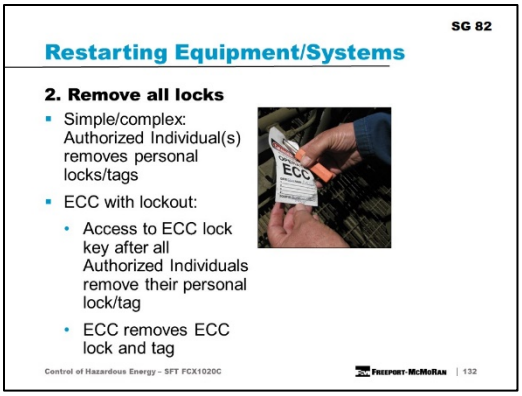
PPT slide 131, SG page 81



Instruction

- Ensure that the workers have returned the machine/equipment to operating condition and that it is safe to re-energize after the maintenance is complete
- Inspect work area prior to returning machine/equipment to service
    - Inspection completed by Authorized Individual or Energy Control Coordinator (ECC)
    - Ensure that workers have removed all maintenance/service items and that the machine, equipment, or process is operationally intact
    - Ensure the proper installation of all safety equipment
- Check the location/area
- Verify that all employees were removed from the area and are in a safe position
- **Model the step on the lockout simulator**

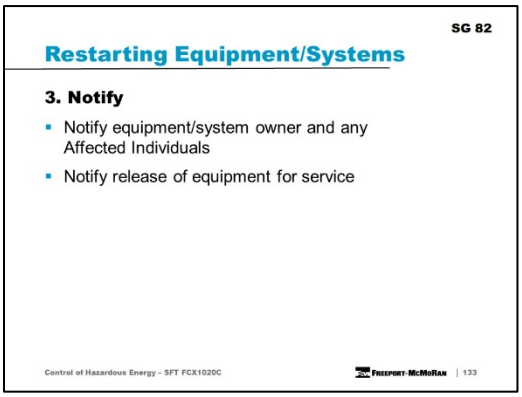
PPT slide 132, SG page 82



Instruction

- Removal of lock/tag/other device by Authorized Individual that applied device
- Simple or complex control of hazardous energy: isolated energy source free to be unlocked once the Authorized Individual(s) has completed the task and the inspection
- ECC situation with the use of a lockbox
    - ECC not able to access the key for the ECC lock before the removal of all Authorized Individuals' personal locks and tags from the lockbox
    - ECC removes the ECC lock and tag from the energy isolation device once the ECC key is accessible
- **Model the step on the lockout simulator**

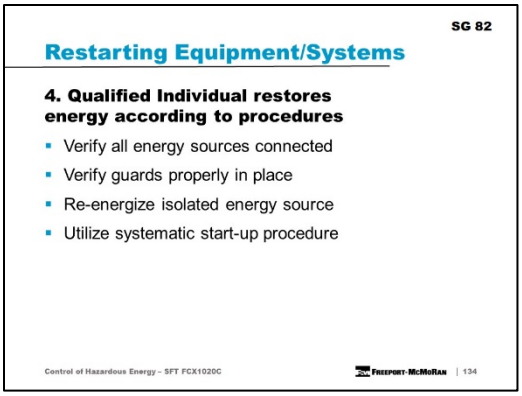
PPT slide 133, SG page 82



Instruction

- Authorized Individual or ECC notifies the equipment/system owner and any Affected Individuals that they have released the equipment for service
- Equipment/process now ready to begin the start-up process using the SOP
- **Model the step on the lockout simulator**

PPT slide 134, SG page 82



Instruction

- Qualified Individual verifies the following:
  - All energy sources are connected to the equipment and no longer isolated before equipment start-up
  - All guards properly in place
- May need to charge pressurized systems to accomplish this
- Qualified Individual re-energizes isolated energy sources
  - Start equipment by using the standard start-up procedures and best management practices
  - Utilize systematic start-up procedure to avoid any additional or increased hazards to employees as a result of the machine or equipment start-up
- **Model the step on the lockout simulator**

Break

- Take a 5 to 10 minute break after this slide
- Clearly communicate what time you expect students to return

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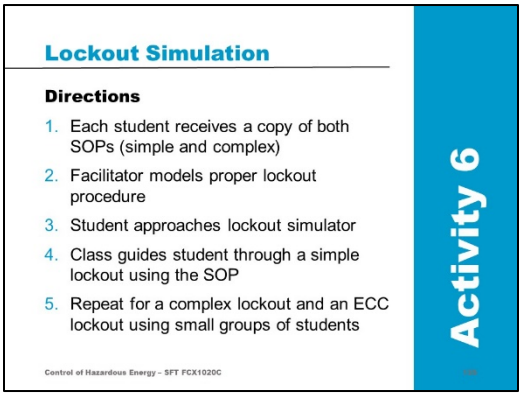
ACTIVITY 6: LOCKOUT SIMULATION

PPT slide 135, SG page N/A



Time
Approximately 30 minutes

Materials
- Lockout Simulator (use your site simulator)
- Copies of lockout SOPs (1 simple and 1 complex)

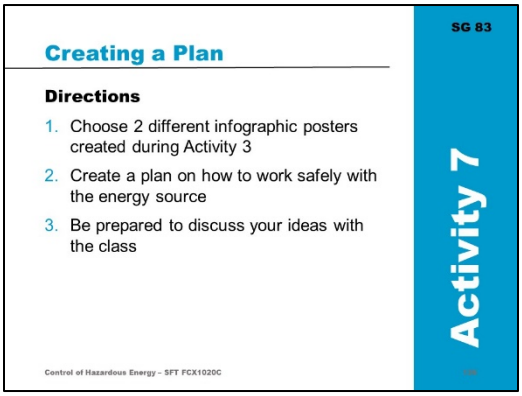
Purpose
This activity gives students the opportunity to demonstrate the actions to stay safe during a lockout procedure

Instruction
1. Give each student a copy of the simple SOP and the complex SOP
2. Facilitator models the lockout procedure and restoring equipment on the simulator as one complete process
3. Clarify that the simulator is a prop and not what would actually be seen in a work setting
4. Role play a simple lockout and restore equipment
    - Set up a brief scenario to orient the students (Example: Work needs to be done on an overhead crane)
    - Have one student go to the simulator
    - The class will guide the student through a simple lockout and restoring equipment to service using the SOP
5. Role play a Complex lockout
    - Set up a brief scenario to orient the students
    - Have a group of 3-4 students go to the simulator and assign each student a role (Authorized, Qualified, ECC, etc.).
    - The class will guide the students through a complex lockout and restoring equipment to service using the SOP
6. Role play an ECC lockout
    - Set up a brief scenario to orient the students
    - Have a group of 3-4 students go to the simulator
    - Identify 1 student as the ECC
    - The class will guide the students through an ECC lockout and restoring equipment to service using the SOP

7. **Summarize and discuss the activity as a class by asking questions such as:**
    - What went wrong?
    - What went right?
    - How does this apply on the job? In your work area?

ACTIVITY 7: CREATING A PLAN

PPT slide 136, SG page 83



Time
Approximately 20 minutes

Materials
- Infographic posters from Activity 3
- Student Guide
- Pens/pencils

Purpose
This activity gives students the opportunity to create a plan to work safely with an energy source that demonstrates the actions to stay safe

Instruction
1. **Ask students how would they work safely with an Electrical energy source** – some suggested answers are below
    a. Job Safety Analysis (JSA) and/or Job Hazard Analysis (JHA)
    b. Workplace Exam (WPE)
    c. LOTOTO
    d. Proximity
    e. Am I trained?
    f. Notify affected individuals
    g. Walk through the job Identify, implement, and verify controls
    h. Review Standard/Safe Operating Procedures (SOP)
2. Have groups rotate so that they are working with different energy sources
3. Allow groups 10 minutes to discuss and write down (in their Student Guide) how they would work safely with that energy source
4. **Allow 10 minutes for whole group discussion on the energy sources – ask the other groups if they can add anything to the individual group's ideas**

MODULE 4 QUIZ

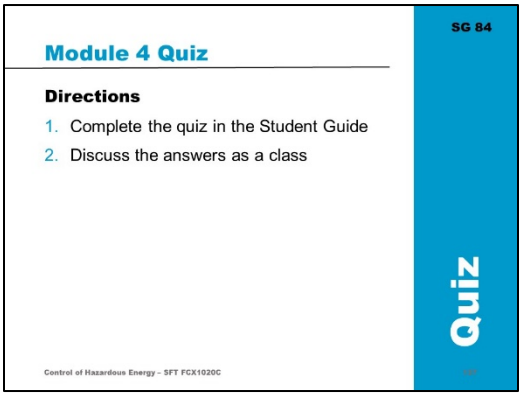
PPT slides 137-142, SG page 84

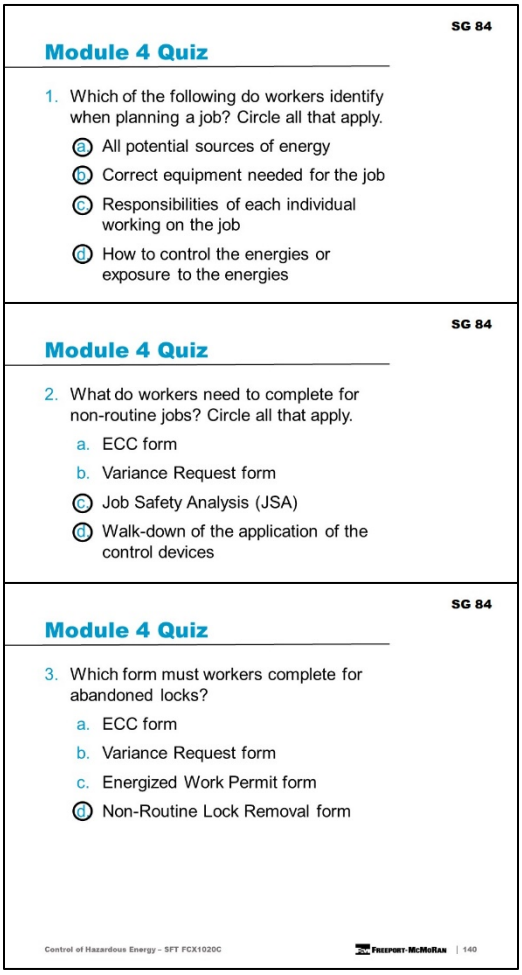
Instruction

- Students write answers to the quiz questions in the SG
- Review the answers as a class
- **Click to view circled answer**

Quiz Answers

Question	Answer
1	A, B, C, D, SG Page 73
2	C, Job Safety Analysis (JSA), SG Page 78 D, Walk-down of the application of the control devices, SG Page 74
3	D, Non-Routine Lock Removal form, SG Page 79





Continued on next page

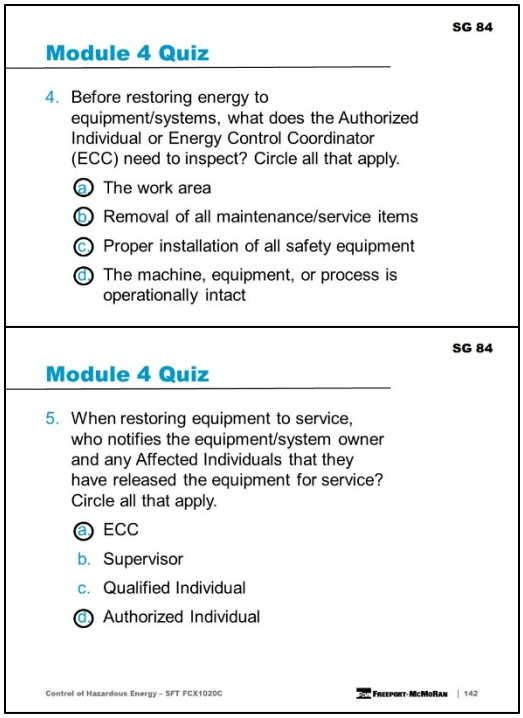
PPT slides 137-142, SG page 84

Instruction

- Students write answers to the quiz questions in the SG
- Review the answers as a class
- **Click to view circled answer**

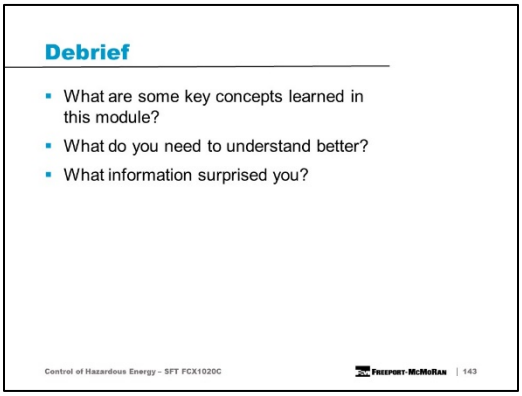
Quiz Answers

Question	Answer
4	A, B, C, D, SG Page 81
5	A, ECC, SG Page 82 D, Authorized Individual, SG Page 82



PPT slide 143, SG page N/A

Instruction
Discuss the questions on the slide



Break

- Take a 5 to 10 minute break after this module
- Clearly communicate what time you expect students to return

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MODULE 5: ENERGY CONTROL IN PRACTICE

This module contains information about an incident where an employee was unable to verify zero energy of the system, resulting in injury to the employee.

LEARNING OBJECTIVES

Upon completion of this module, students will be able to demonstrate the application of hazardous energy control principles to various sources, given different examples.

ACTIVITIES

Activity 8: Preventing Incidents

For further details, refer to *Activity Materials* under *Facilitator Preparation* on page 7.

TOTAL TEACHING TIME

This module takes approximately 30 minutes to complete.

PPT slide 144, SG pages 87 and 89

Instruction

- Review learning objectives for the module
- Upon completion of this module, students will be able to demonstrate the application of hazardous energy control principles to various sources, given different examples
- Module discusses an incident where an employee was unable to verify zero energy of the system, resulting in an injury to the employee
- Verifying zero energy of the equipment or system before tryout is an important step in ensuring the safety of employees when performing work that involves potential exposure to hazardous energies

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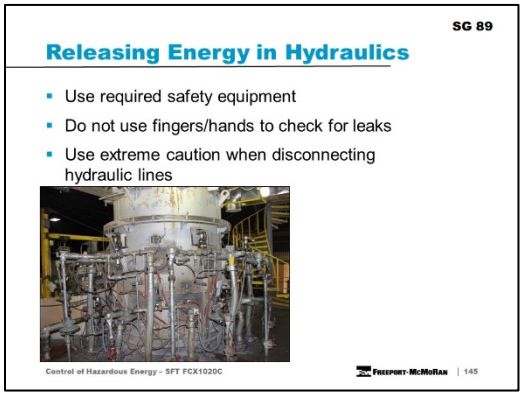
PPT slide 145, SG page 89



Instruction

- Review the equipment manuals and all chemical Safety Data Sheets (SDS) before beginning work on hydraulic systems
- Maintain a clean work area free of slipping hazards and debris
- Use all required safety equipment
- Block, secure, or lower to the ground any components that may move, rotate, or fall
- Use test equipment designed for higher pressures than the system in repair
    - Use of gauges, lines, connectors, or other equipment designed for lower pressures can result in bursting or equipment damage
    - Start with higher gauges and work down (e.g., start with using equipment rated at twice the expectation)
- Do not use fingers or hands to find leaks when relieving system pressures
- Always use safety glasses
- Use extreme caution when disconnecting hydraulic lines
    - Severe burns can result from hot fluids unintentionally released from the lines
    - Avoid heating near pressurized fluid lines
- Clean up any spills immediately, as hydraulic fluid can cause slips or falls and result in injuries
- Do not work under equipment supported by hydraulics – place stops, safety pins, or other safety devices before beginning repairs

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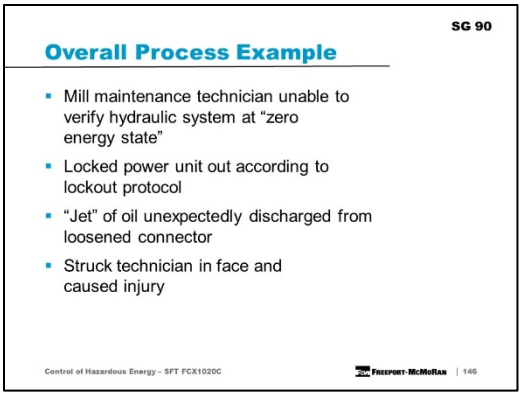
PPT slide 146, SG page 90



Instruction

- Injury occurred when a mill maintenance technician was unable to verify if the hydraulic system he was working on was at "zero energy state"
- Mill maintenance technician removing cylinder from machine to replace gland seals
    - Found the cylinder mounted in the vertical position and the rod-end connected to a relatively heavy structure
    - Started the pump and lowered the load (retracted the cylinder rod) to the rested position to remove the pressure – no means of verifying the depletion of the pressure
    - Locked the power unit out in accordance with his company's lockout protocol
    - Proceeded with the task of removing the cylinder
    - Loosened the connector and a "jet" of oil unexpectedly discharged from the connector, struck him in the face, and caused the injury

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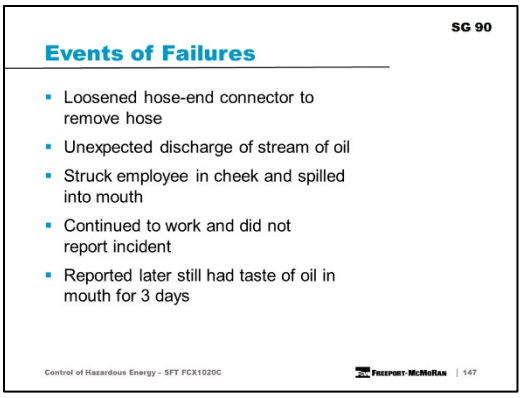
PPT slide 147, SG page 90



Instruction

- Employee in the process of removing a hydraulic cylinder from a production machine to replace leaking gland seals
- Loosened the hose-end connector to remove the hose from the closed-end of the cylinder, a stream of oil unexpectedly discharged from the connector at extreme velocity and struck him in the face
- Oil penetrated his cheek and spilled into his mouth
- Employee continued to work and did not report the incident to his supervisor
- Later reported that the taste of the hydraulic oil remained in his mouth for approximately three days after the accident, as it secreted into his mouth from the pinhole-sized wound in his cheek

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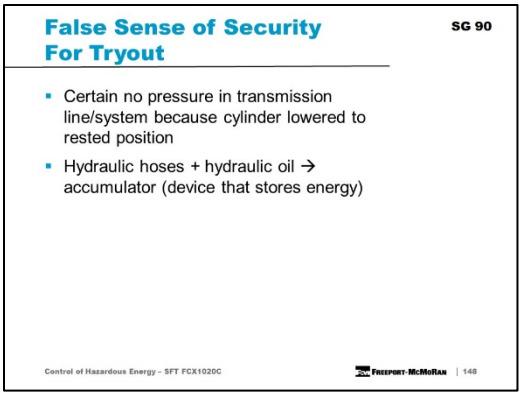
PPT slide 148, SG page 90

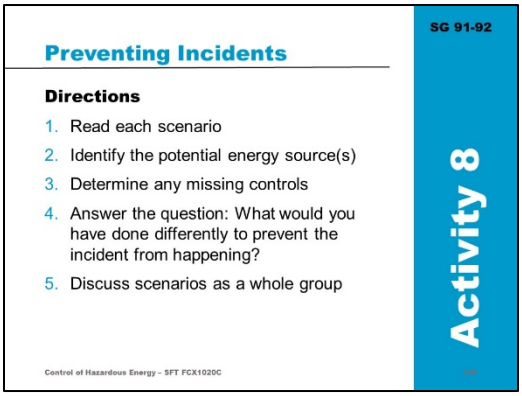


Instruction

- Employee certain that there would be no pressure in the transmission line/system because he had lowered the cylinder to the rested position
- Critical to de-energize and verify in hydraulic system
- Hydraulic hoses – flexible and can expand with pressure
- Hydraulic oil – compressible to a limited degree
- Combining flexible hydraulic hoses with compressible hydraulic oil creates an accumulator or a device that stores energy

ACTIVITY 8: PREVENTING INCIDENTS

PPT slide 149, SG pages 91-92



Time
Approximately 20 minutes

Materials
- Student Guide
- Pens/pencils

Purpose
This activity gives students the opportunity to demonstrate the application of hazardous energy control principles to various sources, given different examples

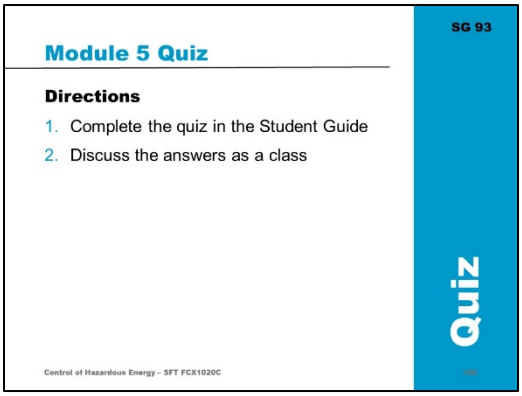
Instruction
1. Have students work in pairs or small groups
2. Go over the directions on the slide
3. **After 15 minutes, go over the scenarios as a group**
    - The Answer Key provides ***suggested*** answers intended to guide student discussions
    - Students may come up with alternative information that would be adequate in answering the question

Answer Key

Incident	Potential energy source(s)	Missing energy control(s)	Done differently to prevent incident from happening
1	Electrical	Lockout procedures	Perform lockout procedures
2	Chemical, Pneumatic	PPE, labeling, JSA, SOP	Wear proper PPE
3	Mechanical/Kinetic, Electrical	PPE	Complete Energized Work Permit Wear proper PPE
4	Mechanical/Kinetic, Electrical	Lockout procedures	Perform lockout procedures to retrieve tool

MODULE 5 QUIZ

PPT slides 150-155, SG page 93

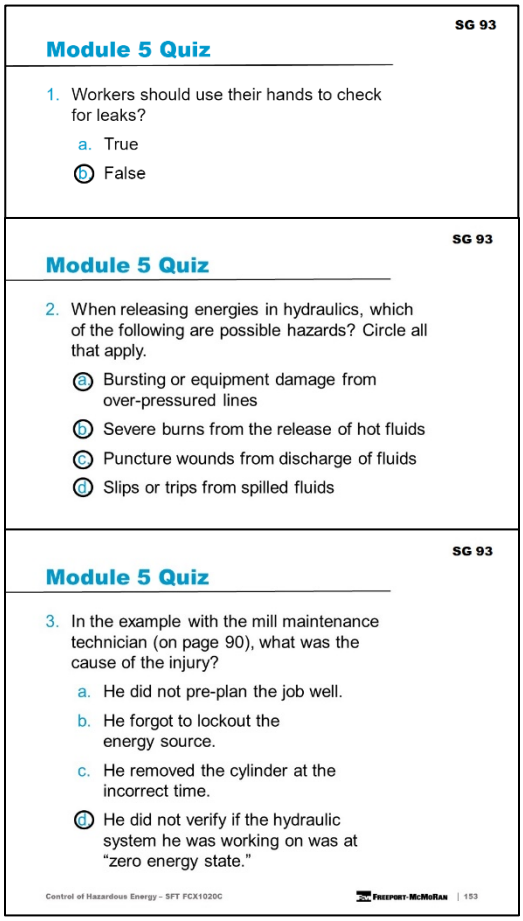


Instruction

- Students write answers to the quiz questions in the SG
- Review the answers as a class
- **Click to view circled answer**

Quiz Answers

Question	Answer
1	B, False, Do not use hands to check for leaks.
2	A, B, C, D, SG Page 89
3	D, He did not verify if the hydraulic system he was working on was at "zero energy state." SG Page 90



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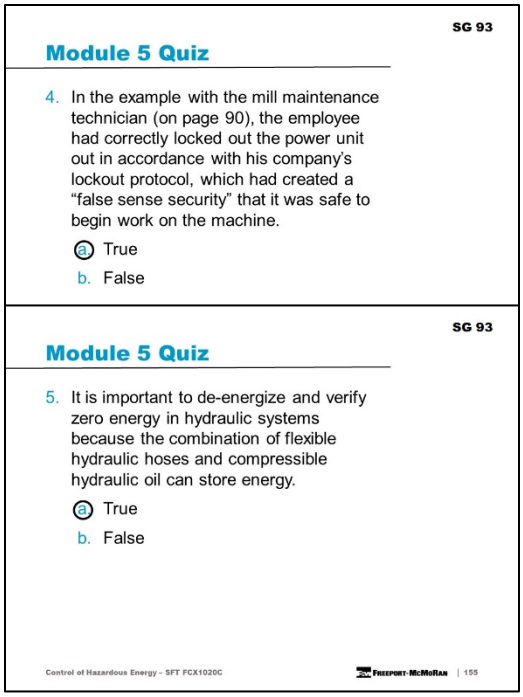
PPT slides 150-155, SG page 93

Instruction

- Students write answers to the quiz questions in the SG
- Review the answers as a class
- **Click to view circled answer**

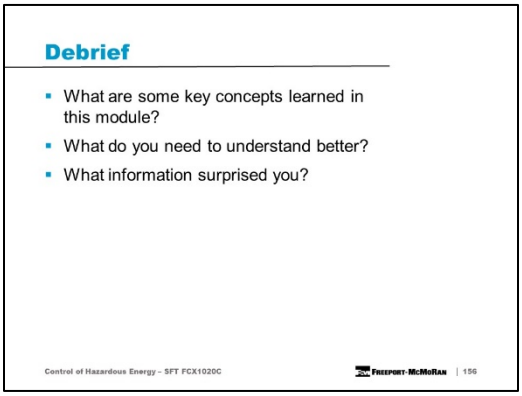
Quiz Answers

Question	Answer
4	A, True, SG Page 90
5	A, True, SG Page 90



PPT slide 156, SG page N/A

Instruction
Discuss the questions on the slide



Break

- Take a 5 to 10 minute break after this module
- Clearly communicate what time you expect students to return

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CONCLUSION

The conclusion contains information about the assessments and evaluations.

ACTIVITIES

- Knowledge Assessment
- Performance Assessment
- Student Course Evaluation (in SG)

For further details, refer to *Activity Materials* under *Facilitator Preparation* on page 7.

TOTAL TEACHING TIME

The conclusion takes approximately 60 minutes to complete.

PPT slide 157, SG page N/A

Instruction

The conclusion covers

- Review
- Assessments
- Student Course Evaluation
- Facilitator Course Evaluation

Facilitation Tip

- Debriefs help summarize, review, refresh, retain, and clarify previously covered content, which increases learning (Law of Recency)
- Learn more in the Facilitator Preparation Section at the start of the FG
- Add debriefs before or after breaks, and at the beginning or end of a day to gauge student understanding and prepare them to learn more

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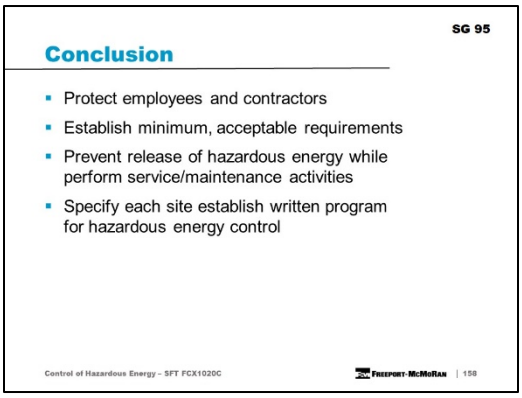
PPT slide 158, SG page 95



Instruction

- There is no shortcut worth your life or the lives of your coworkers
- Freeport-McMoRan designed the rules, regulations, equipment, and guidelines 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
- Control of Hazardous Energy Policy (FCX-HS04)
    - Protect employees and contractors by establishing minimum, acceptable requirements for the practices and procedures necessary to disable machinery or equipment
    - Prevent the release of hazardous energy while employees perform service and maintenance activities
    - Specify that each site establishes a written program for hazardous energy control – written program allows the sites to create guidelines with more detail and to develop guidelines to meet the unique needs of their site and further ensure employee safety
    - **Note: remind students to refer to the policy and technical supplement (located in the SG Resources section page 104) for any questions**

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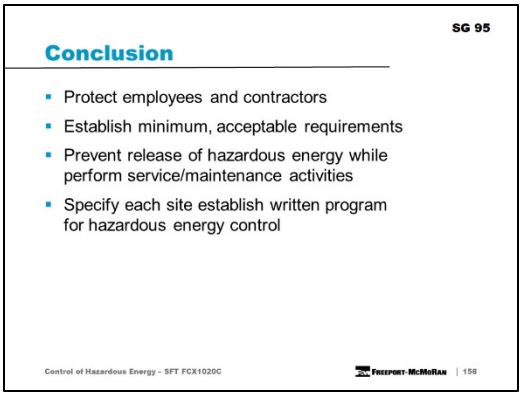
PPT slide 158, SG page 95



Instruction

- You are a valuable asset to this company
  - 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
- Failure to follow regulations can result in termination, but more importantly, it can result in you or your coworker's death
- No production deadline is more important than any one of our lives

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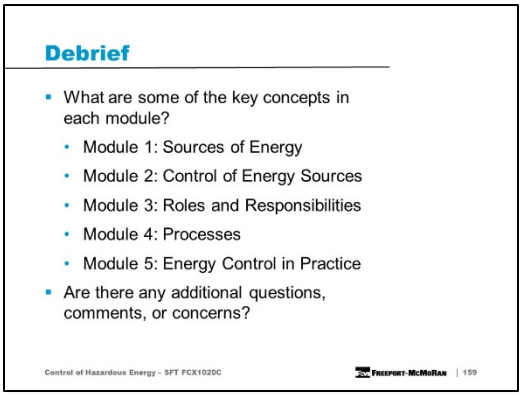
PPT slide 159, SG page N/A



Instruction

- As the objectives for each module are reviewed, **discuss the students' lingering questions, comments, or concerns**
- Module 1: Identify sources of energy, given a scenario or image
- Module 2: Select the correct energy control device/type, given a scenario
- Module 3: Determine the responsibilities of each individual, given a simple or complex lockout job
- Module 4: Demonstrate the actions to stay safe, given a scenario
- Module 5: Demonstrate the application of hazardous energy control principles to various sources, given different examples

Facilitation Tip

- At the end of the day, keep debriefs short and relevant
- Students are prone to be more focused on leaving than what the facilitator says

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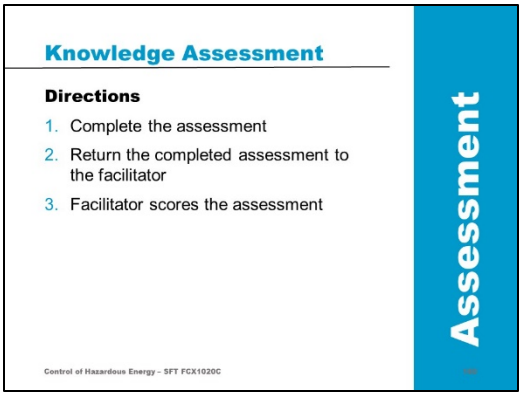
PPT slide 160, SG page N/A

Instruction

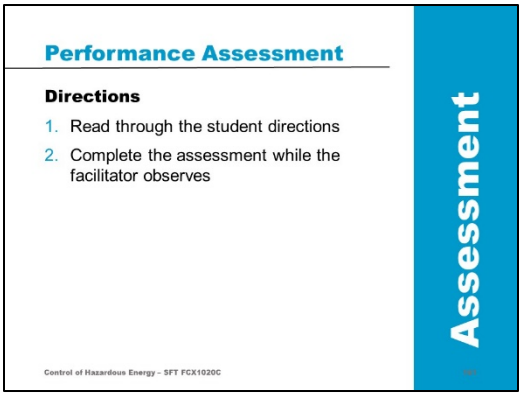
- Students complete the knowledge assessment
- Use the Answer Key to score each assessment



PPT slide 161, SG page N/A

Instruction

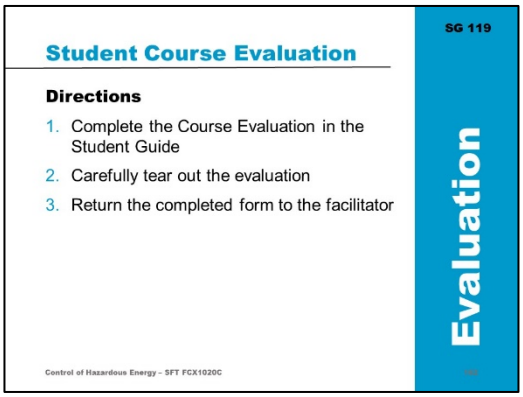
- Students complete the performance assessment according to the directions on the Performance Assessment documents
- Score the performance assessment according to the directions on the Performance Assessment documents



PPT slide 162, SG page 119

Instruction

- Students complete the Student Course Evaluation (in SG)
- Collect and return evaluations (including the Facilitator Course Evaluation in the back of the FG) to the Mine Training Institute according to the directions on the form



FACILITATOR COURSE EVALUATION

Course Name	Control of Hazardous Energy
Facilitator Name	

1. What worked well in the course? Please explain.

2. Were the topics effectively sequenced? If not, please provide suggestions for change.

3. Was the content up-to-date with current processes, equipment, etc.? If not, please provide specific examples.

4. Was the content at the appropriate level of difficulty? If not, please provide examples.

5. What in the course needs improvement? Please provide specific examples.

6. Were the course materials (PPT, FG, etc.) of high quality? If not, please provide examples.

7. Were there any inaccuracies or missing content? If so, please provide examples.

8. Do any of the issues you've identified need to be addressed immediately? If so, please list which ones.

Thank you for taking the time to complete the survey.

Please mail to: Mine Training Institute, Attention: Suzanne Anderson, 18550 S. La Canada Drive, Sahuarita, AZ 85629
Or scan and email to: sanderso2@fmi.com