

Wastewater & Drinking Water Operator Certification Training Instructor Guide



Module 30: Safety

This course includes content developed by the Pennsylvania Department of Environmental Protection (Pa. DEP) in cooperation with the following contractors, subcontractors, or grantees:
The Pennsylvania State Association of Township Supervisors (PSATS)
Gannett Fleming, Inc.
Dering Consulting Group
Penn State Harrisburg Environmental Training Center

A Note to the Instructor

Dear Instructor:

The primary purpose of this course, *Safety*, is to provide you with a safety awareness that the participant can take back to the plant and use for identifying safety training and instruction needs. This module has been designed to be completed in approximately 7.5 hours, but the actual course length will depend upon content and/or delivery modifications and results of course dry runs performed by the DEP-approved sponsor. The number of contact hours of credit assigned to this course is based upon the contact hours approved under the DEP course approval process. To help you prepare a personal lesson plan, timeframes have been included in the instructor guide at the Unit level and at the Roman numeral level of the topical outline. You may need to adjust these timeframes as necessary to match course content and delivery modifications made by the sponsor. Please make sure that all teaching points are covered and that the course is delivered as approved by DEP.

Web site URLs and other references are subject to change, and it is the training sponsor's responsibility to keep such references up to date.












Delivery methods to be used for this course include:

<ul style="list-style-type: none"> • Lecture • Discussion questions 	<ul style="list-style-type: none"> • Calculations • Exercises
---	---

To present this module, you will need the following materials:

<ul style="list-style-type: none"> • One workbook per participant • Extra pencils • Flip Chart • Markers 	<ul style="list-style-type: none"> • Laptop (loaded with PowerPoint) and an LCD projector or overheads of presentation and an overhead projector • Screen
--	--

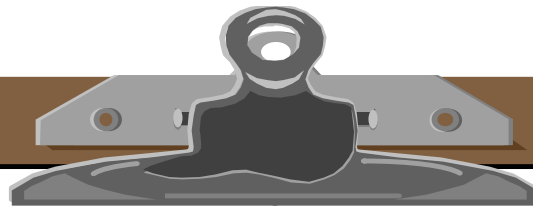
Icons to become familiar with include:

Participant Workbook	Instructor Guide
 Exercise/Activity	Same icons for Participant Workbook apply to the Instructor Guide. Ans: Answer to exercise, case study, discussion, question, etc.
 Case Study	
 Discussion Question	
 Calculation(s)	
 Exercise	
 Key Definition(s)	
 Key Point(s)	
	 PowerPoint Slide
	 Overhead
	 Flip Chart
	 Suggested "Script"

Instructor text that is meant to be general instructions for the instructor are designated by being written in script font and enclosed in brackets. For example:

[Ask participants if they have any questions on how to read the table. Answer any questions participants may have about how to read the table.]

If your module includes the use of a PowerPoint presentation, below are some helpful controls that you may use within the Slide Show.



PowerPoint Slide Show Controls

You can use the following shortcuts while running your slide show in full-screen mode.

To	Press
Advance to the next slide	N, ENTER, or the SPACEBAR (or click the mouse)
Return to the previous slide	P or BACKSPACE
Go to slide <number>	<number>+ENTER
Display a black screen, or return to the slide show from a black screen	B
Display a white screen, or return to the slide show from a white screen	W
Stop or restart an automatic slide show	S
End a slide show	ESC
Return to the first slide	Both mouse buttons for 2 seconds
Change the pointer to a pen	CTRL+P
Change the pen to a pointer	CTRL+A
Hide the pointer and button temporarily	CTRL+H
Hide the pointer and button always	CTRL+L
Display the shortcut menu	SHIFT+F10 (or right-click)
Erase on-screen annotations	E
Go to next hidden slide	H
Set new timings while rehearsing	T
Use original timings while rehearsing	O
Use mouse-click to advance while rehearsing	M

INSTRUCTOR GUIDE

INTRODUCTION OF MODULE: 5 minutes



[Display Slide 1—Module 12: Safety.]

[Welcome participants to “Module 30 – Safety.” Indicate the primary purpose of this course is to provide participants with a safety awareness that the participant can take back to the plant and use for identifying safety training and instruction needs.]

[Introduce yourself.]

[Provide a brief overview of the module.]



This module contains 4 units. On page i, you will see the topical outline for **Unit 1 – Introduction** and **Unit 2 – Chemical Hazards at Treatment Plants**.

[Briefly review outline.]

INSTRUCTOR GUIDE



On this page, you will see the topical outline for **Unit 3 – Other Hazard Sources at Treatment Plants**.

[Continue to briefly review outline.]

INSTRUCTOR GUIDE

*[Continue to review outline for Unit 3 and for **Unit 4 – Preventing and Responding to Safety and Health Issues.**]*

INSTRUCTOR GUIDE

UNIT 1: 50 minutes



[Display Slide 2—Unit 1: Introduction.]



At the end of this unit, you should be able to:

- Define basic safety terms.
- Identify six sources of supplemental safety information.

INSTRUCTOR GUIDE

SAFETY OVERVIEW: 10 minutes

Overview



As you can imagine, there are numerous safety issues in a treatment plant. As a treatment plant operator, you play an important role in ensuring a safe work environment.

[Review information in the workbook.]



[Review the definition of hazard in the workbook.]



[Review the remaining information in the workbook, being sure to cover the four basic factors that cause accidents.]

INSTRUCTOR GUIDE



Preventing accidents is actually quite simple and there are several ways you can stop them from happening at the facility.

[Review the information in the workbook.]

INSTRUCTOR GUIDE

SAFETY TRAINING/INSTRUCTIONS: 5 minutes

Training and Instructions



"Safety" is a very broad topic that encompasses many specific issues and topics. Due to the time limitations of this training module, we cannot expect to cover all of those topics in depth. You should be aware that there are many other types of safety training available. As a treatment plant operator, you may be required to participate in some of those training programs.

[Review the information in the workbook.]

INSTRUCTOR GUIDE

DEFINITIONS: 20 minutes



There are a multitude of safety related terms and definitions you should familiarize yourself with. We will begin reviewing them now. Can anyone tell me what "ACGIH" means?



*[Review definition of **ACGIH** in the workbook if participant answers question incorrectly or no participants answer the question.]*



*[Review the definition of **acute** in the workbook.]*



We will talk about acute exposures and acute health effects when we get to Unit 2 of this module.



*[Review the definition of **action level** in the workbook.]*



What does "AIHA" mean?



*[Review the definition of **AIHA** in the workbook if participant answers question incorrectly or no participants answer the question.]*



*[Review the definition of **ASSE** in the workbook.]*



*[Review the definition of **breathing zone** in the workbook.]*



*[Review the definition of **chronic** in the workbook.]*



Chronic exposure and chronic health effects will be discussed in more detail when we get to Unit 2 of this module.



*[Review the definition of **decibel** in the workbook.]*



*[Review the definition of **flash point** in the workbook.]*



*[Review the definition of **IDLH** in the workbook.]*



*[Review the definition of **Lower Explosive Limit** in the workbook.]*



Who can tell me what "NIOSH" is?



*[Review the definition of **NIOSH** in the workbook if participant answers question incorrectly or no participants answer the question.]*



*[Review the definition of **nonsparking tools** in the workbook.]*

INSTRUCTOR GUIDE



This next term is one that most of you are probably familiar with already.



*[Review the definition of **OSHA** in the workbook.]*



*[Review the definition of **Permissible Exposure Limit** in the workbook.]*



*[Review the definition of **Recommended Exposure Limit** in the workbook.]*



*[Review the definition of **Threshold Limit Value** in the workbook.]*



*[Review the definition of **Time Weighted Average** in the workbook.]*



*[Review the definition of **Upper Explosive Limit** in the workbook.]*



This wraps up our discussion on common safety terms and definitions. Before we move on to the topic of sources of information, can I answer any questions about the terms we have just discussed?

INSTRUCTOR GUIDE

SOURCES OF SUPPLEMENTAL INFORMATION: 15 minutes

Resources



The topic of safety is one that is important to many types of companies and organizations. Because it is a topic that is relevant in virtually every industry, resources that provide safety and health information are fairly easy to locate and access.

[Review the information listed in the workbook on supplemental sources.]



Some of you may be aware of other resources that supply safety and health related information. Take a few minutes and list a few of the resources that you are aware of. Then we will share them with the rest of the class.



List other sources of supplemental information that you are aware of.

[Allow participants 2-3 minutes to jot notes in their workbook.]



Now that you have had a few minutes to think about some of the resources you know about, let's share the information with the rest of the group. Who will share with us another resource that they are familiar with?



[As participants share their answers, write them on a flipchart.]

INSTRUCTOR GUIDE

[Review information listed in the workbook.]

INSTRUCTOR GUIDE

[Point out that references are listed on this page.]



This concludes our introductory unit for the module. By now you should be aware of your role in ensuring workplace safety, you should be familiar with some basic safety terms and definitions and you should be able to identify sources of supplemental safety and health information. Are there any questions before we move on to the next unit?

INSTRUCTOR GUIDE

UNIT 2: 140 minutes



[Display Slide 3—Unit 2: Chemical Hazards at Treatment Plants.]



At the end of this unit, you should be able to:

- For each of the eleven examples of chemicals used at treatment plants:
 - Describe the chemical.
 - Explain its properties.
 - Explain the health hazards and symptoms associated with the chemical.
 - Identify the exposure limits for the chemical.
 - Explain the hazard control requirements for the chemical.



[Display Slide 4—Unit 2: Chemical Hazards at Treatment Plants.]



The next two learning objectives for this unit are:

- List four categories of chemicals associated with laboratory reagents and explain their potential hazards.
- List four sources of chemical hazards associated with maintenance of a Treatment Plant and explain their potential hazards.



[Display Slide 5—Unit 2: Chemical Hazards at Treatment Plants.]



And the next list of learning objectives are:

- Identify the potential chemical generated by chemical reactions.
- List and describe four types of injuries/illnesses associated with chemicals.
- Identify a Material Safety Data Sheet (MSDS), its major components, and explain its importance.



[Display Slide 6—Unit 2: Chemical Hazards at Treatment Plants.]



And the remaining two learning objectives are:

- Describe three means of chemical hazard control.
- List and describe four categories of protective equipment used when working with hazardous chemicals.

INSTRUCTOR GUIDE

INJURIES AND ILLNESSES ASSOCIATED WITH CHEMICALS: 20 minutes



Treatment plant operators work with and around a variety of chemicals that have the potential to pose physical and health hazards if not handled properly. Chemical use in treatment plants is prevalent during the treatment process, laboratory activities and maintenance operations. Knowledge about those chemicals, their potential hazards, proper handling procedures and hazard controls is essential for safe chemical use. This unit provides an overview of the potential injuries and illnesses associated with chemicals, basic hazard control, Hazard Communication and Material Safety Data Sheets (MSDS) and specific chemicals used during treatment plant operations.

Excessive exposure to hazardous chemicals can produce a number of health effects, illnesses and physical injuries. Chemicals compounds can come in the form of dusts, gas vapors, fumes, aerosols and liquids, which can act on or react with the body by inhalation, ingestion, direct contact and/or injection or skin absorption. The effects may be localized to only those areas where chemical contact occurs or systemic in which the chemical exposure affects a body system such as the respiratory or nervous systems.

[Review the information in the workbook.]



*[Review the definition of **dose** in the workbook.]*



[Display Slide 7—Standard Dose Response Relationship.]



This graph shows that the dose makes the poison. As the dose increases, the response, or effects, will also increase.

Chronic vs. Acute

[Review the information in the workbook.]



*[Review the definition of **acute exposures** in the workbook.]*

[Review the information in the workbook.]



*[Review the definition of **chronic exposure** in the workbook.]*

[Review the information in the workbook.]

Respiratory



The human respiratory system consists of the mouth, nose, larynx, trachea, lungs and the associated nerves and blood supply. Inhalation of vapors, fumes and dusts can produce a number of respiratory system affects that range from simple lung irritation to lung cancer.

[Review the information in the workbook.]

Dermal



Occupational skin disease is a leading cause of days lost from work as a result of chemical exposure. The costs of occupational skin disease are high not only to the workers but also in terms of lost workdays, medical costs and workers compensation costs.

[Review the information in the workbook.]

Physical



Chemicals also pose potential physical affects.

[Review the information in the workbook.]



[Review the defintions listed in the workbook.]

INSTRUCTOR GUIDE



[Review the definitions listed in the workbook.]

[Review the information in the workbook.]

INSTRUCTOR GUIDE

HAZARD CONTROL HIERARCHY: 30 minutes



Chemical safety at treatment plants is dependent upon controlling the identified hazards posed by the chemicals.

[Review the information in the workbook.]

Engineering Controls



Engineering controls are the most desirable method of hazard control because the potential hazard is “engineered out” or eliminated without relying on or modifying human behavior.

[Review the information in the workbook.]

Design Phase Safety Review

[Review the information in the workbook.]

Substitution

[Review the information in the workbook.]

Isolation

[Review the information in the workbook.]

Ventilation

[Review the information in the workbook.]

Administrative Controls



Administrative controls are the second approach in the hazard control hierarchy.

[Review the information in the workbook.]

Housekeeping

[Review the information in the workbook.]

Hazardous Materials or Transfer Procedure

[Review the information in the workbook.]

Leak Detection Programs

[Review the information in the workbook.]

INSTRUCTOR GUIDE

Training

[Review the information in the workbook.]

Work Schedule Modification

[Review the information in the workbook.]

Personal Hygiene

[Review the information in the workbook.]

Medical Surveillance

[Review the information in the workbook.]

Personal Protective Equipment



PPE is the last line of defense in the hazard control hierarchy and should only be used when engineering and administrative controls are not feasible, do not completely control the hazard or until such time that they can be fully implemented.

[Review the information in the workbook.]

Respiratory Protection

[Review the information in the workbook.]

Protective Clothing

[Review the information in the workbook.]

Head, Eye, Hand and Foot Protection

[Review the information in the workbook.]



Exercise

1. The three principal approaches to hazard control are: engineering controls, administrative controls and **personal protective equipment**.
2. An individual inhales a high concentration of chlorine gas and develops an irritation of the eyes, nose, and throat, followed by coughing, wheezing, and chest pain. This is an example of **acute** exposure.

HAZARD COMMUNICATION AND MATERIAL SAFETY DATA SHEETS (MSDS): 30 minutes



Over the past 20 years there has been a national and state emphasis on hazardous materials safety and ensuring that workers and the community are aware of chemical hazards and how to control them. Each year thousands of new chemicals are developed and used in the workplace and frequently the long-term effects of these chemicals are unknown. Therefore, federal and state laws have been enacted to establish minimum requirements to control the handling and use of hazardous materials. You, as the treatment plant operator, are affected by these laws since you work with a number of hazardous materials, such as chlorine, acids and solvents at your plant.

The purpose of this section is to familiarize you with the general elements of the Federal Haz Com Standard (and state variations) so that you can perform your job in a manner that reduces risks to you and your coworkers, as well as in accordance with applicable laws. This section will provide the basic elements of a hazard communication program, as required by the Federal Haz Com Standard, which is essential for your facility to maintain compliance and protect workers from hazardous materials.

[Review the information in the workbook.]

Identifying and Inventorying Hazardous Material

[Review the information in the workbook.]

Obtaining Information and Determining Potential Hazards


[Review the information in the workbook.]



*[Review the definition of **MSDS** in the workbook.]*

[Review the information in the workbook.]

[Continue to review information in the workbook.]

 In Appendix A, you will see the the generic MSDS. It includes information about the manufacturer, the hazardous ingredients and physical/chemical characteristics of the chemical. The physical/chemical characteristics section continues on the following page. Also included on that page of the MSDS is fire and explosion hazard information, reactivity data and health hazard data.

On the last page of the Appendix A you will see the section for precautions for safe handling and use as well as the section on control measures. Although MSDS's may vary in their appearance, they are all similar with regards to the type of information found in the MSDS.

Labeling Hazardous Materials



For the next few minutes, we will talk about labeling hazardous materials.

[Review the information in the workbook.]

INSTRUCTOR GUIDE



[Display Slide 8—Hazardous Materials Information System Label.]



This label is an example of a Hazardous Materials Information System Label. The top of the label is where the chemical name and number appear. Below that is an area to indicate the type of hazard. Below that you see a section that indicates the type of PPE needed for the specific chemical. The bottom of the label contains space for additional information about the chemical.



[Display Slide 9—National Fire Protection Association Label.]



This is an example of a National Fire Protection Association Label. It uses a scale of 0 through 4 for three different elements: health, flammability and reactivity. On this particular label, you see that the health rating is a 3, meaning the material is extremely dangerous and full protective clothing is required. The hazardous material is rated 4 for flammability, meaning it is extremely flammable. For reactivity, the hazardous material is rated 3, indicating strong shock or heat may detonate.

Training Employees

[Review the information in the workbook.]

INSTRUCTOR GUIDE

[Continue to review the information in the workbook.]

SOURCES OF CHEMICAL HAZARDS: 30 minutes



Treatment plants use a variety of chemicals during daily operation. These chemicals are associated primarily with the treatment process, laboratory activities and maintenance operations, all of which pose potential hazards to plant employees and contractors. This section will summarize the common chemical hazards associated with each of the three categories and provide basic information relative to each chemical's characteristics, potential health hazards and symptoms of exposure, recommended exposure limits and hazard controls.

Chemicals Used in Treatment

[Point out the Chemical Table in the Appendix B.]



The Chemical Table lists common chemicals used in a treatment plant, such as chlorine, sodium hypochlorite, aluminum sulfate and ozone. For each chemical, the table includes information regarding the use and characteristics of the chemical as well as hazards and symptoms of exposure and the exposure limits. We are not going to review each chemical in detail, but you will use the table shortly to answer some questions and it will be a useful reference tool for you in the plant. Now we will take a few minutes to use the table to answer some questions.



Exercise

1. What is aluminum sulfate used for?

Ans: As a coagulant.

2. How is sulfur dioxide usually shipped?

Ans: As a liquefied compressed gas.

3. What are the hazards and symptoms of exposure for sodium hypochlorite?

Ans: It causes irritation of the eyes, skin, mouth and lungs. Prolonged exposure can burn the skin and cause permanent eye and lung damage.

[Review the information in the workbook.]



[Be sure to cover the key point in the workbook.]

Laboratory Reagents



Laboratory operations, although usually on a small scale, use a number of hazardous materials that if handled improperly can create significant problems. Typical laboratories at treatment plants will use various acids, bases, heavy metals (lead, mercury, cadmium) and oxidizing/reducing agents.

[Review the information in the workbook.]

Chemicals Used in Maintenance



Maintenance operations use a variety of hazardous materials that often are taken for granted because they are so readily available and used not only on the job but at home as well. Treatment plant maintenance chemicals include: pipe grouts, paints and coatings, welding and cutting materials, lubricants and fuels. We will discuss these chemicals in more detail now, starting with pipe grouts.

Pipe Grouts

[Review the information in the workbook.]

INSTRUCTOR GUIDE

Paints and Coatings

[Review the information in the workbook.]

Welding and Cutting

[Review the information in the workbook.]

INSTRUCTOR GUIDE



As just mentioned, UV radiation, nitrogen dioxide, mild steel and stainless steel are all hazards presented by welding. We will not review these in detail at this time, however, on this page of your workbook, there are details listed about each of these hazards for your reference.

INSTRUCTOR GUIDE



On this page, you will find details on the two remaining welding hazards, galvanized steel and flux coatings, for your reference.

Fuels



The last chemical used for maintenance that we will discuss are fuels.

[Review the information in the workbook.]

PROTECTIVE EQUIPMENT: 30 minutes



As discussed earlier in this unit, PPE should be the last consideration in implementing hazard control, as it is a personal, physical barrier between you and the hazard. Sometimes engineering and administrative controls are not feasible, not sufficient, or are in the process of being implemented and therefore the use of PPE becomes necessary. As an operator, you should be familiar with the types of PPE that are required during your work activities and the proper use and limitations of each. PPE can be classified into two general categories: respiratory protection and body protection. Body protection is further broken down into eye, face, hand, foot and skin protection. The most complicated is respiratory protection, which we will review now.

Respiratory Protection Equipment

[Review the information in the workbook.]

Air Purifying Respirators



Air purifying respirators (APRs) come in many forms, from a simple nuisance dust mask (surgical-type mask) to a Powered Air Purifying Respirator (PAPR) and each has specific uses and limitations.

Nuisance Dust Masks

[Review the information in the workbook.]



[Display Slide 10—Nuisance Dust Mask.]



This slide shows an example of a nuisance dust mask. As we discussed, it looks very similar to a surgical mask.

Air Purifying Respirators (APRs)



Now we will review APRs. Your workbook contains a great deal of information about APRs. We will review a limited amount of this information; however, the rest of it is available for your review and reference.

[Review only the first four bullet items in the workbook and then move on to the next topic.]



[Display Slide 11—Air Purifying Respirators.]



This slide shows some examples of air purifying respirators. As you can see, these are not quite as simple as the nuisance dust mask we saw a few minutes ago due to the cartridge or canister on the front of the mask.

Air Supplied Respirators



Air supplied respirators are another category of respiratory protection. Let's talk about what an air supplied respirator is.

[Review the information in the workbook.]

Airline Respirators



Airline respirators are the first type of air supplied respirator we will review.

[Review the information in the workbook.]



[Display Slide 12—Airline Respirators.]



Here is an example of an airline respirator. As you can see, it looks very much like the APR, but there is an airline attached to the mask.

SCBAs



SCBAs are the next type of air supplied respirator.

[Review the information in the workbook.]

Proper Use of Respiratory Equipment



OSHA has established standards for the proper use of respiratory equipment. There are many guidelines that need to be followed if respirators are used at your facility. Your workbook contains information on what some of those guidelines are, however, we will not review them at this time.

We will now move on to the next category of protective equipment, which is gloves.

Gloves



Table 2.1 lists the different types of materials that are most suitable for gloves depending on the type of material they will be used for. For example, if you will be working with chlorine or chlorine dioxide, you will want to ensure you are using a glove constructed of neoprene, butyl rubber, nitrile rubber or Teflon. If you look at the table, you will see that some materials work well for several types of chemicals. This table will be a useful reference tool for you when you return to your facility.

INSTRUCTOR GUIDE



In addition to material construction, there are some other characteristics that are important to consider when selecting gloves. Those characteristics include: permeation, breakthrough time, permeation rate, degradation and penetration.



[Review the definitions in the workbook.]

[Review the information in the workbook.]

Footwear



Special footwear may also be required when working at your facility. Let's discuss this type of PPE now.

[Review the information in the workbook.]

Body Protection



Our final category of protective equipment is body protection.

[Review the introductory statement in the workbook.]

[Review the first bullet item in the workbook.]

[Only review the first two sentences in the second bullet.]

[Only review the first two sentences in the third bullet.]

INSTRUCTOR GUIDE

[Point out that references are listed on this page.]



We have now reached the end of Unit 2. We have learned about the sources of chemicals at a treatment plant, injuries and illnesses associated with chemicals, the MSDS, hazard control hierarchy and various types of protective equipment. In our next unit, we will learn about other hazards at a water plant.

INSTRUCTOR GUIDE

UNIT 3: 195 minutes



[Display Slide 13—Unit 3: Other Hazard Sources at Treatment Plants.]



At the end of this unit, you should be able to:

- List and explain the sources of mechanical hazards and electrical hazards at a Treatment Plant.
- Describe the Lockout/Tagout Program and eye protection requirements as they relate to mechanical hazards in a Treatment Plant.



[Display Slide 14—Unit 3: Other Hazard Sources at Treatment Plants.]



The next two learning objectives for this unit are:

- Describe the sources and exposure limits for noise in a Treatment Plant and explain the role of a hearing conservation program, noise reduction and hearing protection.
- Name four sources of slip, trip and fall hazards in a Treatment Plant and explain what can be done to minimize or prevent those hazards.



[Display Slide 15—Unit 3: Other Hazard Sources at Treatment Plants.]



Our next set of learning objectives are:

- List six safety considerations when excavating.
- Explain the importance of inspections in regards to excavations.
- Explain the protective systems used for excavations.
- List and explain four soil classifications.



[Display Slide 16—Unit 3: Other Hazard Sources at Treatment Plants.]



This slide contains the next two learning objectives, which are:

- Describe the characteristics of a Permit-Required Confined Space and the elements of a Confined Space Entry Program.
- List four classes of fire and describe the proper methods for storing and handling flammable material.

Continued



[Display Slide 17—Unit 3: Other Hazard Sources at Treatment Plants.]



Next we have:

- Describe a typical Fire Response Plan and list three sources of reference information related to fire hazard prevention.
- Explain manual lifting limits, proper lifting procedure and the NIOSH lifting equation.
- Describe the Pennsylvania requirements for traffic safety and work zone isolation.

INSTRUCTOR GUIDE

MECHANICAL HAZARDS: 30 minutes



Treatment plant operators are exposed to a variety of physical hazards during normal plant operation and maintenance, which may include slippery surfaces, mechanical and electrical hazards, noise, falls, excavation hazards and lifting. The most common physical injuries are cuts, bruises, strains and sprains (primarily back injury). Most of these injuries can be avoided by following established safety procedures and using the appropriate tools and safety equipment. This unit will cover some of the potential physical hazards associated with treatment plant operation as well as some common procedures used to minimize or eliminate these hazards.

We will begin by discussing the mechanical hazards that are posed by rotating equipment and by the potential for crushing. Hazards posed by mechanical equipment usually result in an employee being caught-in or struck-by a piece of equipment particularly during maintenance activities.

Rotating Equipment



Rotating equipment is a common hazard found throughout treatment plants and they should be effectively guarded against accidental contact.

Guarding

[Review the information in the workbook.]

Centrifugal Force

[Review the information in the workbook.]

Crushing



Crushing hazards are also prevalent in treatment plants

Conveyor Rollers

[Review the information in the workbook.]

Equipment Movement

[Review the information in the workbook.]

Lockout/Tagout Program



Now that we have learned about potential mechanical hazards in the plant, we will turn our attention to safety procedures that are designed to prevent mechanical hazards. Specifically, we will focus on lockout/tagout programs and energy control. Your plant should establish standard operating procedures for the safe shutdown and deenergization of each piece of equipment whenever equipment must be shut down for repairs.

Purpose

[Review the information in the workbook.]

INSTRUCTOR GUIDE

[Review the information in the workbook.]



[Display Slide 18—Lockout Device for Circuit Breakers.]



This slide shows a lockout device on a circuit breaker. As you can see, the lock prevents the switches from being moved.



[Display Slide 19—Typical Lockout Device.]



This slide shows another example of a type of lockout device.

INSTRUCTOR GUIDE

[Review the information in the workbook.]



*[Be sure to review the definition of **tagout device** in the workbook.]*



[Display Slide 20—Warning Tags.]



This slide shows some examples of the warning tags we just discussed. They are all labeled “Danger” and use the color red. Color coding will be discussed further in Unit 4. You will also notice that the warning tags in the slide contain some of the phrases we just reviewed, such as “Do Not Operate.”

Energy Control

[Review the information in the workbook.]

Training

[Review the information in the workbook.]

Sample Lockout/Tagout Procedure



Let's take a look at what a lockout/tagout procedure may look like.

[Review the information in the workbook.]

INSTRUCTOR GUIDE

[Allow a five to ten minute discussion of the following question:]



How does the lockout/tagout procedure at your plant differ from the sample procedure above?

Outside Contractors



It is common for outside contractors to be present at a treatment plant, so they deserve some mention here.

[Review the information in the workbook.]



[Emphasize the key point in the workbook.]

Eye Protection



Eye protection is imperative when working around equipment, machinery or tools.

Requirements

[Review the information in the workbook.]

Welding Lens Shades



Welding and cutting, which are common operations at a water plant, have additional eye protection requirements.

[Review the information in the workbook.]

INSTRUCTOR GUIDE

ELECTRICAL HAZARDS: 40 minutes



In addition to mechanical hazards, which we have just discussed, electrical hazards are also prevalent in a treatment plant. In this section, we will talk about issues that are related to preventing electrical hazards.

[Review the information in the workbook.]



[Be sure to review the key point in the workbook.]

[Review the remainder of the information in the workbook.]

Electrical Hazard Control



Let's talk about controlling electrical hazards.

[Review the information in the workbook.]

INSTRUCTOR GUIDE



There are several means of controlling electrical hazards that we are going to discuss: insulation, guarding, grounding, electrical protective devices, safe work practices, deenergizing electrical equipment, tools, overhead/underground power lines, protective equipment and good judgment.

[Review the information in the workbook.]

INSTRUCTOR GUIDE

[Review the information in the workbook.]

INSTRUCTOR GUIDE

NOISE HAZARDS: 20 minutes



An additional hazard source at a treatment plant is noise. Let's spend some time talking about noise hazards, beginning with the sources of noise hazards.

Sources

[Review the information in the workbook.]

Exposure Limits



In order to prevent or minimize the impact of noise hazards, noise exposure limits have been established.

[Review the information in the workbook.]

Monitoring



Monitoring for noise hazards is an essential prevention element.

[Review the information in the workbook.]

Hearing Conservation Program



A hearing conservation program also helps to prevent or minimize the effects of noise hazards.

[Review the information in the workbook.]

Noise Reduction and Hearing Protection



In this section we will talk about noise reduction and hearing protection. Let's begin by talking about some ways to reduce or eliminate noise.

[Review the information in the workbook.]



Now that we have discussed how to calculate noise reduction, try the calculation in your workbook.



Calculation

A motor produces a sound level of 93 dBA and you have been provided with earplugs with an NRR of 25. What would the effective noise reduction from the earplugs be?

Ans: $25 \text{ (NRR)} - 7\text{dBA} = 18 \text{ dBA (NRR)}$
 $93 \text{ dBA} - 18 \text{ dBA} = 75 \text{ dBA effective NRR}$



We get the answer by taking the noise reduction provided by the earplugs, which is 25 NRR, and subtract 7 dBA from it. This gives us 18 dBA. Next, we take this number and subtract it from the measured noise exposure, which is 93 dBA, and we get an effective noise reduction of 75dBA. Remember that reducing your noise exposure is important not only to prevent permanent hearing loss but also to ensure that you can hear desired sounds such as speech and warning signals.

INSTRUCTOR GUIDE

SLIP, TRIP AND FALL HAZARDS: 20 minutes



So far we have talked about mechanical, electrical and noise hazards. In this section, we are going to talk about slip, trip and fall hazards. Let's start by talking about walking and working on surfaces.

Walking/Working Surfaces

[Review the information in the workbook.]

Stairs, Ladders and Scaffolds



Stairs, ladders and scaffolds present specific slip, trip and fall hazards.

[Review the information in the workbook.]

Working at Elevations



Working at elevations obviously presents a host of potential hazards. Let's talk about some things that can be done to make working at elevations safer.

[Review the information in the workbook.]

Working Above 4 Feet or Adjacent to Water or Hazardous Equipment



Working above four feet or working adjacent to water or hazardous equipment requires some specific safety considerations. We will talk about some of those now.

INSTRUCTOR GUIDE

[Review the remaining information in the workbook.]

INSTRUCTOR GUIDE

EXCAVATIONS: 30 minutes



Occasionally it becomes necessary for plant personnel to excavate a sewer line, electrical conduit or other subsurface item. Excavations pose a serious safety hazard to personnel working in and around excavations in the form of cave ins, undermining of adjacent structures, breaking underground utilities and accidental falls. Therefore, it is important for you to become familiar with the fundamentals of excavation safety.

[Review the information in the workbook.]



[Display Slide 21—PA One Call System.]



This slide shows the uniform color code for underground utilities. As you can see, red is used to designate electric power lines, cables, conduit and lighting cables, while yellow is used to indicate gas, oil, steam, petroleum or gaseous materials. Other colors are used to indicate communication cables, water lines, sewer and drain lines, temporary survey markings and proposed excavations.

Considerations



There are a number of things that need to be considered when excavating. Let's review those now.

[Review the information in the workbook.]

Inspections



Because of the inherent dangers involved in excavations, it is necessary for numerous inspections to be done.

[Review the information in the workbook.]

Soil Classifications



Prior to designing an excavation protective system the soil must be classified by a properly trained competent person as either stable rock, Type A, Type B or Type C.

[Review the information in the workbook.]

Stable Rock

[Review the information in the workbook.]

Type A

[Review the information in the workbook.]

INSTRUCTOR GUIDE

Type B

[Review the information in the workbook.]

Type C

[Review the information in the workbook.]

Protective Systems



There are several types of protective systems that need to be used for excavations. We will spend the remainder of this section discussing those.

Sloping and Benching



The first type of protective systems is sloping and benching.

[Review the information in the workbook.]

INSTRUCTOR GUIDE



[Display Slide 22—OSHA Slope Tables.]



Once you have identified the type of soil, the tables in this graphic can be used to determine the minimum-allowable slopes and benches for the type of soil.

Shoring



Shoring is another type of protective system used during excavations.

[Review the information in the workbook.]

Shielding



Shielding is the final type of protective system used in excavations that we will discuss.

[Review the information in the workbook.]

INSTRUCTOR GUIDE

CONFINED SPACE: 20 minutes



Confined space entry is a necessary part of plant operation. Often workers are required to work in manholes, sewers, pump stations, metering pits, tanks, wet wells or vaults to perform repairs or make inspections. Confined spaces pose a number of serious safety and health hazards that range from exposure to oxygen deficient or toxic atmospheres to physical injuries associated with mechanical equipment.



[Be sure to review the key point in the workbook.]



Let's talk about exactly what qualifies something as a confined space.

[Review the information in the workbook.]

Characteristics of a Permit-Required Confined Space



A confined space is considered either a permit-required confined space or a non-permit required confined space. Let's talk about the difference between the two of them.



*[Review the definition of **permit-required confined space**.]*



*[Review the definition of **non-permit required confined space**.]*

Atmospheric Testing



Confined spaces pose specific atmospheric hazards, which we will discuss now.

[Review the information in the workbook.]

INSTRUCTOR GUIDE

Monitoring



Because of the various atmospheric hazards present in a confined space, it is necessary to monitor the atmospheric conditions.

[Review the information in the workbook.]

Ventilation



The presence of various contaminants in the confined space necessitates certain ventilation requirements, which we will now review.

INSTRUCTOR GUIDE

[Review the remaining information on ventilation in the workbook.]

Controls



As with any type of hazard, controlling the hazard is imperative. Let's spend a few minutes talking about controls as they relate to confined spaces.

[Review the information in the workbook.]

Confined Space Entry Program



Now let's talk about confined space entry programs.

[Review the information in the workbook.]

INSTRUCTOR GUIDE

FIRE: 20 minutes



Another type of hazard that you may encounter at a treatment plant is fire.

[Review the information in the workbook.]



[Present the following discussion to the participants and record their answers on a flipchart. Possible answers are listed below.]



There are also some less obvious consequences of fire. What do you think some of those consequences are?

Ans: Loss of production, destruction of business records, costs of reconstruction or clean-up, direct costs for losses not covered by insurance, increased insurance premiums and water and smoke damage to equipment and property.

[Review the information in the workbook.]

Classes of Fire



There are four classes of fire based on the type of material involved each of which requires a unique method of extinguishment.

Class A

[Review the information in the workbook.]

Class B

[Review the information in the workbook.]

Class C

[Review the information in the workbook.]

Class D

[Review the information in the workbook.]

Storage and Handling of Flammable Material



There are many types of flammable materials present at a treatment plant. Obviously, this presents potential safety hazards; therefore, there are some specific requirements for storing and handling flammable materials.

[Review the information in the workbook.]

Fire Response Plan



A fire response plan will go a long way towards minimizing or eliminating fire hazards at the plant. Let's talk further about what should be included in a fire response plan.

[Review the information in the workbook.]

Supplemental Reference Information



This page lists some additional sources of information you may want or need to consult regarding fire hazards. We will not review it in detail; however, it is provided in your workbook for your reference.

LIFTING HAZARDS: 10 minutes



Lifting materials and equipment is a frequent occurrence at treatment plants, which often result in painful and costly back, neck, hand and finger injuries. These types of injuries are quite common but easily preventable by establishing and following a few basic lifting procedures and techniques.

Manual Lifting

[Review the information in the workbook.]

Proper Lifting Procedure

[Review the information in the workbook.]

NIOSH Lifting Equation

[Review the information in the workbook.]

INSTRUCTOR GUIDE

TRAFFIC HAZARDS: 5 minutes



Work performed in a street, parking lot or other traffic area exposes you to vehicular traffic hazards.

Pennsylvania Requirements

[Review the information in the workbook.]

INSTRUCTOR GUIDE

[Point out that references are listed on this page.]



Now that we have reached the end of this unit, you should be aware of the various types of hazards you will encounter at a treatment plant: these include mechanical, electrical, noise and slip, trip and fall hazards. We also discussed hazards associated with excavations and confined spaces, as well as fire, lifting and traffic hazards. In the next unit, we will learn about preventing and responding to safety and health issues.

INSTRUCTOR GUIDE

UNIT 4: 65 minutes



[Display Slide 23—Unit 4: Preventing and Responding to Safety and Health Issues.]



At the end of this unit, you should be able to:

- Explain the role of signage in preventing safety and health problems.
- Explain the essential elements of a safety and health program and describe the purpose of a safety policy statement.



[Display Slide 24—Unit 4: Preventing and Responding to Safety and Health Issues.]



The next three learning objectives are:

- Explain how a safety committee should be organized and what its objectives and responsibilities are.
- Describe the important policies, programs and rules found in a safety and health manual.
- Explain two methods of safety promotion.



[Display Slide 25—Unit 4: Preventing and Responding to Safety and Health Issues.]



And the next two learning objectives are:

- Explain two options for staffing and implementation of a safety program.
- Explain four key components of managing a safety program and monitoring safety performance.



[Display Slide 26—Unit 4: Preventing and Responding to Safety and Health Issues.]



And the last two learning objectives are:

- Explain the value of safety and health training; describe the recommended and the required training, the training process and the recordkeeping requirements.
- List and explain three essential elements in regards to first aid and emergency response.

INSTRUCTOR GUIDE

SIGNAGE: 10 minutes



Signs and tags warning employees of physical and chemical hazards are essential to workplace safety and health programs. In this section, we will talk about signage in further detail.

[Review the information in the workbook.]

Proper Identification of Hazard



Color coding is used to identify various types of hazards.

Safety Color Coded for Marking Physical Hazards

[Review the information in the workbook.]

Uniform Style



In addition to consistent color coding, the style of signage needs to be consistent as well. Let's talk about some of the elements of uniform sign style.

Specific Sign Classification and Design

[Review the first bullet item in the workbook.]



Figure 4.1 is an example of a danger sign.

INSTRUCTOR GUIDE

[Review the remaining bullet items in the workbook.]

SAFETY AND HEALTH PROGRAM DEVELOPMENT: 40 minutes

Essential Elements of Program



A systematic safety and health program goes a long way towards preventing and responding to safety and health issues. In this section, we will summarize the basic elements necessary to implement a proactive safety program.

Management Commitment and Employee Involvement



The success of a facility safety and health program is dependant on the level of management commitment and employee involvement.

[Review the information in the workbook.]

Worksite Analysis of Hazards



Analysis of worksite hazards is another essential element of a safety and health program.

[Review the information in the workbook.]

Hazard Prevention and Control



Once facility hazards have been identified and analyzed the next step is to control the hazard. This is where the hierarchy of hazard control comes into play.

[Review the information in the workbook.]

Safety and Health Training



Safety and health training is extremely important for workers to be able to perform their jobs in a safe manner.

[Review the information in the workbook.]

Safety Policy Statement



The starting point for establishing management commitment to safety and health is the development and dissemination of a clearly defined facility safety and health policy that is endorsed by top management.

[Review the information in the workbook.]

Safety Committee



A safety and health committee should be established in order to assist and advise management and coworkers on safety and health issues relative to the plant.

[Review the information in the workbook.]


Safety and Health Manual



A safety and health manual is another important aspect of a safety and health program. How many of you have a safety and health manual in your plant?

[Review the information in the workbook.]

Safety and Health Manual Section Outline

 On this page, you will see an outline for what a typical safety and health manual might look like. Typically, it should include an introduction, an overview section, a section on the administrative procedures for the program, a section that contains the safety and health rules and policies and a section that lists resources that are available. The sample outline in your workbook contains additional details about each of these sections; however, due to time restraints, we will not review them now.

Safety Rules



As we just mentioned in our sample safety program outline, safety and health rules are a common part of any safety and health program. Let's talk about safety rules in more detail now.

[Review the information in the workbook.]

Safety Promotion



Promotion of the safety and health program is essential in maintaining a successful level of safety performance and interest in safety and health in the workplace.

[Review the information in the workbook.]

Direct Promotion

[Review the information in the workbook.]

INSTRUCTOR GUIDE

Indirect Promotion

[Review the information in the workbook.]

[Allow approximately five minutes to discuss the following question:]



What are some other examples of indirect promotion?



[Write participant answers on a flipchart.]

Possible answers can include:

Safety contests.

Incentive programs or reward programs.

Promotional items such as jackets, hats, t-shirts for good safety performance.

Monetary bonuses.

Large item prizes.

Lottery drawings or "safety Bingo" contests based on performance.



Sometimes indirect approaches have a negative impact in the form of not reporting or underreporting of accidents, which requires consideration when implementing an incentive or reward program.

Implementation



Safety staffing will be dependent upon the size of your facility and the resources available.

[Review the information in the workbook.]

Management of Program

[Review the information in the workbook.]

Organizational Structure



Organizational structure relative to safety and health must come from the top down as far as commitment and responsibility.

[Review the information in the workbook.]

Plant Manager

[Review the information in the workbook.]

Supervisors

[Review the information in the workbook.]

Safety Coordinator

[Review the information in the workbook.]

Employees

[Review the information in the workbook.]

Recordkeeping



As you can imagine, a recordkeeping system is an important aspect of a safety and health program.

Monitoring Safety Performance



Safety performance must be monitored frequently to ensure that program elements are being implemented and enforced; safety goals and objectives are being met; and that the safety rules, procedures and programs are up to date and applicable to current plant conditions and operations.

Inspections, Audits and Observations

[Review the information in the workbook.]

Statistics

[Review the information in the workbook.]

Safety and Health Training



Training is an essential element of an effective safety and health program.

[Review the information in the workbook.]

Value

[Review the information in the workbook.]

Recordkeeping

[Review the information in the workbook.]

INSTRUCTOR GUIDE

FIRST AID AND EMERGENCY RESPONSE: 10 minutes



First aid and emergency response play important roles in treatment plant operations since they are the first response actions taken in the event of an employee injury/illness or facility emergency.

Qualified Individuals and Medical Evaluation

[Review the information in the workbook.]

Emergency Response Plan



An emergency response plan must be established and posted at the facility.

[Review the information in the workbook.]

INSTRUCTOR GUIDE

[Point out that the references are listed on this page.]



We have now completed the entire module. You should now be familiar with some common safety terms and their definitions; you should be aware of the various hazards present in a treatment plant and what safety procedures should be used when dealing with those hazards; and you should also understand how to prevent and respond to various safety and health issues. Are there any questions?