

Lesson Plans for Module AOCFG-17

ABNORMAL OPERATING CONDITIONS – FIELD AND GAS

Module AOCFG-17 describes how field personnel recognize and properly react to abnormal operating conditions (AOCs) that may occur during pipeline operations. Trainees will learn about the federal regulations and agencies governing the operation of gas and liquid pipelines.

Objectives

Learning Objective 1

- Explain how to recognize abnormal operating conditions for both gas and liquid pipelines.
 - a. Explain how to recognize abnormal pipeline facility conditions.
 - b. Explain how to recognize the activation of a safety device.
 - c. Explain how to recognize a communications failure and a control system failure.
 - d. Explain how to recognize power interruptions.
 - e. Explain how to recognize a fire, explosion, and natural disaster occurring in the vicinity of the pipeline.
 - f. Explain how to recognize the unexpected release of hazardous liquid or gas.
 - g. Explain how to recognize unexplained pressure/flow rate changes.

Learning Objective 2

- Describe the proper reaction to abnormal operating conditions for both gas and liquid pipelines.
 - a. Describe the proper reaction to abnormal pipeline facility conditions.
 - b. Describe the proper reaction to the activation of a safety device.
 - c. Describe the proper reaction to a communications failure and a control system failure.
 - d. Describe the proper reaction to power interruptions.
 - e. Describe the proper reaction to a fire, explosion, and natural disaster occurring in the vicinity of the pipeline.
 - f. Describe the proper reaction to the unexpected release of hazardous liquid or gas.
 - g. Describe the proper reaction to unexplained pressure/flow rate changes.

Performance Tasks

- This is a knowledge-based module; there are no performance tasks.

Teaching Time: 5 hours

(Two 2.5-Hour Classroom Sessions)

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the PowerPoint presentations from www.nccerirc.com. For information and updates about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER's Registry is 70 percent or above for the Module Examination.



Safety Considerations

This module does not include Performance Tasks, and as such, no PPE is required for completion of this module. However, trainees should consistently be reminded of all dangers presented by abnormal operating conditions in pipeline work. It should also be stressed that personnel safety is a priority.

Classroom Equipment and Materials

Whiteboard/chalkboard

Markers/chalk

Pencils and paper

PowerPoint® Presentation Slides

Computer

Copies of the Module Examination

Vendor-supplied videos/DVDs showing abnormal operating conditions (*optional*)

TV/DVD player

Additional Resources

The following recommended resources can provide additional helpful information related to the requirements for this covered task:

Code of Federal Regulations 49, Parts 192 and 195

OSHA Occupational Safety and Health Standards 1910, Subpart L, Standard 1910.157.

There are a number of online resources available for trainees who would like more information on abnormal operating conditions. A search for additional information may be assigned as homework to interested trainees.

Lesson Plans for Module CT1_1-17

Measure Structure-to-Soil Potentials

Module CT1_1-17 describes how cathodic protection systems are used to minimize corrosion on a pipeline system. It presents the requirements and general procedures used to measure structure-to-soil potentials as a way of testing the integrity of the CP system.

Objectives

Learning Objective 1

1. Describe cathodic protection systems and fundamental aspects of measuring structure-to-soil potentials.
 - a. Describe cathodic protection system types, standards, and planning.
 - b. Describe fundamental aspects of taking structure-to-soil readings.

Learning Objective 2

2. Describe how to measure structure-to-soil potentials (CT1_1-17).
 - a. Identify the prerequisites, competencies, and abnormal operating conditions associated with taking structure-to-soil readings.
 - b. Describe the procedure for measuring structure-to-soil potentials.

Performance Task

Performance Task 1 (Learning Objective 2)

1. Measure structure-to-soil potentials (CT1_1-17).
 - Identify potential abnormal operating conditions that may occur during performance of this CT, and know the appropriate actions to take in response to them.
 - Utilize the appropriate personal protective equipment according to relevant company procedures.
 - Select the instrumentation to be used.
 - Identify the correct test point locations where measurements will be taken.
 - Correctly connect the test leads to the voltage meter and reference cell.
 - Measure the structure-to-soil potential.
 - Field-analyze readings to ensure they are within the desired range of readings, including a check of the polarity.
 - Complete appropriate documentation as required by operator's procedures.

Teaching Time: 5 hours

(Two 2.5-Hour Sessions)

Session time and quantity may be adjusted to accommodate your class size, schedule, and teaching style.

Before You Begin

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Safety Considerations

This module may require trainees to work in the vicinity of functioning equipment. Electrical and mechanical safety must be emphasized at all times. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and remain aware of any potential abnormal operating conditions. Any deficiencies must be corrected to ensure trainee safety in the future. Work performed on or in the vicinity of functioning equipment must be completed under the direct supervision of the instructor.

Equipment, Materials, and Resources

- Whiteboard and markers
- Pencils and paper
- CT1_1-17 PowerPoint® Presentation
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Module Review answer key
- Module Examinations
- Specific PPE required by the site
- Galvanic anodes
- Impressed current anodes
- One or more pipeline sections showing various coating defects
- Copper sulfate reference electrodes, distilled water, and copper sulfate crystals
- Silver chloride reference electrodes
- Test leads
- Tools for making wiring terminations
- Meters capable of making DC measurements (multimeter or voltmeter/data logger and ammeter)
- Copies of the Performance Profile sheets

Lesson Plans for Module CT1_2-17

Conduct Close Interval Survey

Module CT1_2-17 provides an overview of corrosion and cathodic protection, identifies common types of close interval surveys, and describes the general procedure for safely and effectively conducting a close interval survey on a pipeline.

Objectives

Learning Objective 1

1. Describe cathodic protection systems and identify different types of close interval surveys.
 - a. Describe how cathodic protection systems minimize corrosion.
 - b. Identify different types of close interval surveys.

Learning Objective 2

2. Describe how to conduct a close interval survey (CT1_2-17).
 - a. Identify the prerequisites, competencies, and abnormal operating conditions associated with conducting close interval surveys.
 - b. Describe the procedure for conducting a close interval survey.

Performance Task

Performance Task 1 (Learning Objective 2)

1. Conduct a close interval survey (CT1_2-17).
 - Identify potential abnormal operating conditions that may occur during performance of this CT, and know the appropriate actions to take in response to them.
 - Utilize the appropriate personal protective equipment according to relevant company procedures.
 - Identify the test point locations where connections will be made.
 - Correctly connect the test leads, the voltage meter or data logger, and reference cell.
 - Verify that current sources are operational (on for "On"/interrupted surveys and turned off/disconnected for depolarized survey).
 - Place the reference cell directly above the pipeline being surveyed.
 - Select the instrumentation to be used (survey wire, voltmeter, data logger, reference electrodes, etc.).
 - For interrupted surveys, install current interrupters at all identified current sources. They should be set at the operator-determined time cycle and synchronized.
 - Measure the structure-to-soil potential according to the desired intervals for this survey.
 - Verify data is recorded.
 - Complete appropriate documentation as required by operator's procedures.

Teaching Time: 5 hours

(Two 2.5-Hour Sessions)

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Equipment, Materials, and Resources

- Whiteboard and markers
- Pencils and paper
- CT1_2-17 PowerPoint® Presentation
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Module Review answer key
- Module Examinations
- Specific PPE required by the site
- Copper sulfate reference electrodes
- Silver chloride reference electrodes
- Test leads
- Tools for making wiring terminations
- Reference electrodes as required
- Meters capable of making DC measurements (multimeter or voltmeter/data logger and ammeter)
- Copies of the Performance Profile sheets

Lesson Plans for Module CT1_3-17

Test and Detect Interference

Module CT1_3-17 provides an overview of corrosion and cathodic protection, identifies foreign structures that can cause interference, and describes the basic procedure used for conducting an interference test.

Objectives

Learning Objective 1

1. Describe cathodic protection systems and identify foreign structures that can cause interference.
 - a. Describe how cathodic protection systems minimize corrosion.
 - b. Identify foreign structures that can cause interference.

Learning Objective 2

2. Describe testing to detect interference (CT1_3-17).
 - a. Identify the prerequisites, competencies, and abnormal operating conditions associated with testing for interference.
 - b. Describe the procedure for testing to detect interference.

Performance Task

Performance Task 1 (Learning Objective 2)

1. Test to detect interference (CT1_3-17).
 - Identify potential abnormal operating conditions that may occur during performance of this CT, and know the appropriate actions to take in response to them.
 - Utilize the appropriate personal protective equipment according to relevant company procedures.
 - Notify appropriate personnel of interference problems.
 - Select the proper instrumentation, test leads, and reference electrode and be prepared to use them correctly.
 - Assess the area for other cathodic protection systems or sources of electrical interference.
 - Measure the structure-to-soil potential.
 - Field-analyze the readings to ensure they are within the desired range.
 - Interrupt rectifiers to determine if interference exists.
 - If interference is found, take corrective action. This may involve making required notifications.
 - Complete appropriate documentation as required by operator's procedures.

Teaching Time: 5 hours

(Two 2.5-Hour Sessions)

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Before You Begin

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Safety Considerations

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Equipment, Materials, and Resources

- Whiteboard and markers
- Pencils and paper
- CT1_3-17 PowerPoint® Presentation Slides
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Module Review answer key
- Module Examinations
- Specific PPE required by the site
- Copper sulfate reference electrodes
- Silver chloride reference electrodes
- Test leads
- Tools for making wiring terminations
- Meters capable of making DC measurements (multimeter or voltmeter/data logger and ammeter)
- Copies of the Performance Profile sheets

Lesson Plans for Module CT1_4-17

Inspect and Perform Electrical Test of Bonds

Module CT1_4-17 identifies common foreign structures that can cause interference, describes instruments that can be used to measure electrical resistance, and explains the basic procedure used for conducting a bond test.

Objectives

Learning Objective 1

1. Identify foreign structures that can cause interference and describe test instruments used to measure electrical resistance.
 - a. Identify foreign structures that can cause interference.
 - b. Identify and describe resistance test instruments.

Learning Objective 2

2. Describe how to inspect and perform electrical testing of bonds (CT1_4-17).
 - a. Identify the prerequisites, competencies, and abnormal operating conditions associated with inspecting and performing electrical testing of bonds.
 - b. Describe the procedure for conducting a bond test.

Performance Task

Performance Task 1 (Learning Objective 2)

1. Inspect and perform electrical testing of bonds (CT1_4-17).
 - Identify potential abnormal operating conditions that may occur during performance of this CT, and know the appropriate actions to take in response to them.
 - Utilize the appropriate personal protective equipment according to relevant company procedures.
 - Identify the bond locations where measurements will be taken.
 - Conduct a visual inspection of the bond test station for physical damage to the bond station, a damaged shunt, loose connections, disconnected wires, arcing across terminals, etc.
 - Select the correct instrumentation (volt-ohmmeter, ammeter, test leads, reference cell) and be prepared to use it properly.
 - Make connections with the test equipment to take and record readings.
 - Measure the potentials for each of the structures at the bond location.
 - Identify the shunt type and size.
 - Measure the direction and magnitude of current flow between the structures.
 - Field-analyze the readings to ensure they are within a desired range, including a check of the polarity.
 - Complete appropriate documentation as required by operator's procedures.

Teaching Time: 5 hours

(Two 2.5-Hour Sessions)

Session time and quantity may be adjusted to accommodate your class size, schedule, and teaching style.

Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

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Safety Considerations

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Equipment, Materials, and Resources

- Whiteboard and markers
- Pencils and paper
- CT1_4-17 PowerPoint® Presentation
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Module Review answer key
- Module Examinations
- Specific PPE required by the site
- Test leads
- Tools for making wiring terminations
- Test instruments for making electrical resistance measurements, which can include:
 - Megohmmeter
 - Multimeter
 - Soil resistance meter
- Test instrument accessories needed to complete the Wenner (four-pin) soil resistance test method, which can include:
 - Stainless steel soil pins
 - Soil box
- Copies of the Performance Profile sheets

Lesson Plans for Module CT1_5-17

Inspect and Test Electrical Isolation

Module CT1_5-17 examines components used to isolate and ground pipeline systems as part of corrosion control, and describes the basic procedure for inspecting and testing electrical isolation.

Objectives

Learning Objective 1

1. Identify and describe components used to electrically isolate and ground a pipeline.
 - a. Describe insulated flanges and explain how they can be tested and repaired.
 - b. Identify devices used to ground and protect insulated flanges.

Learning Objective 2

2. Describe how to inspect and test electrical isolation (CT1_5-17).
 - a. Identify the prerequisites, competencies, and abnormal operating conditions associated with inspecting and testing electrical isolation.
 - b. Describe the procedure for conducting an electrical isolation test.

Performance Task

Performance Task 1 (Learning Objective 2)

1. Inspect and test electrical isolation (CT1_5-17).
 - Identify potential abnormal operating conditions that may occur during performance of this CT, and know the appropriate actions to take in response to them.
 - Utilize the appropriate personal protective equipment according to relevant company procedures.
 - Identify the isolation locations and isolation device where measurements will be taken.
 - Conduct a visual inspection of the isolation location; check for physical damage to the test station, a damaged shunt, loose connections, disconnected wires, arcing across a terminal, etc.
 - Select the instrumentation (voltmeter, isolation/flange tester, test leads, reference cell).
 - Make connections with the test equipment to take and record readings.
 - If using a reference cell, measure the potential for each of the structures. The reference cell should remain in the same location during the measurements.
 - Check for continuity on flanges using an isolation/flange tester.
 - Complete appropriate documentation as required by operator's procedures.

Teaching Time: 5 hours

(Two 2.5-Hour Sessions)

Session time and quantity may be adjusted to accommodate your class size, schedule, and teaching style.

Before You Begin

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Safety Considerations

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Equipment, Materials, and Resources

- Whiteboard and markers
- Pencils and paper
- CT1_5-17 PowerPoint® Presentation
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Module Review answer key
- Module Examinations
- Specific PPE required by the site
- An insulated flange or a flange insulating kit
- An insulation tester
- A radio frequency tester
- Examples of protective devices, which can include:
 - Grounding cells
 - Isolation surge protectors (ISPs)
 - Polarization cell replacements (PCRs)
 - Solid-state decouplers (SSDs)
 - Polarization cells
- Test leads
- Tools for making wiring terminations
- Test instruments for making electrical resistance measurements, which can include:
 - Voltmeter
 - Isolation/flange tester
 - Radio frequency tester
 - Soil resistance meter
- Copies of the Performance Profile sheets

Lesson Plans for Module CT8_1-17

Measure Pit Depth with Pit Gauge

Module CT8_1-17 describes common types of pit depth gauges and explains how to prepare and use these instruments to measure pit depth on corroded areas of exposed pipe.

Objectives

Learning Objective 1

1. Describe types of pit gauges and how to use them, and explain how to gather additional piping wall data after measurements have been taken.
 - a. Identify common types of pit gauges and explain how to use them.
 - b. Describe how to gather remaining wall strength data.

Learning Objective 2

2. Describe how to measure pit depth using a pit gauge (CT8_1-17).
 - a. Identify the prerequisites, competencies, and abnormal operating conditions associated with preparing and using pit gauges.
 - b. Describe how to operate a pit gauge.
 - b. Describe the procedures used to measure pit depth.

Performance Task

Performance Task 1 (Learning Objective 2)

1. Measure pit depth using a pit gauge (CT8_1-17).
 - Identify potential abnormal operating conditions that may occur during performance of this CT, and know the appropriate actions to take in response to them.
 - Utilize the appropriate personal protective equipment according to relevant company procedures.
 - Perform a visual inspection of the exposed pipe. Look for integrity issues such as evidence of a release or significant metal deformation. If unsafe integrity issues are encountered, discontinue the task and make immediate notifications.
 - Clean and remove debris from the area to be measured.
 - Verify that the gauge is working properly. Calibrate the gauge if necessary.
 - Position the gauge flush and longitudinally across the area to be measured. Hold it firmly against the surface, making sure it is supported on non-corroded surfaces.
 - Move the depth indicator until it contacts the deepest part of the wall loss.
 - Read and record the depth and longitudinal length measurements. Repeat several measurements to verify the deepest area of wall loss.
 - Complete appropriate documentation as required by operator's procedures.

Teaching Time: 5 hours

(Two 2.5-Hour Sessions)

Session time and quantity may be adjusted to accommodate your class size, schedule, and teaching style.

Before You Begin

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Safety Considerations

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Equipment, Materials, and Resources

- Whiteboard and markers
- Pencils and paper
- CT8_1-17 PowerPoint® Presentation
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Module Review answer key
- Module Examinations
- Specific PPE required by the site
- Sections of corroded pipe
- Mechanical, dial-type, and micrometer pit gauges
- Mechanical pit gauges with worn points
- Bridging bar for measuring uneven surfaces
- Copies of a pipeline inspection form/field corrosion report
- Copies of the Performance Profile sheets

Lesson Plans for Module CT8_2-17

Ultrasonic Thickness Meters

Module CT8_2-17 describes ultrasonic thickness (UT) meter operation and explains how a UT meter is used to measure pipe wall thickness.

Objectives

Learning Objective 1

1. Describe the basic operation and calibration of an ultrasonic thickness (UT) meter.
 - a. Describe the basic operation of a UT meter.
 - b. Describe the calibration of a UT meter.

Learning Objective 2

2. Describe how to measure pipe wall thickness using a UT meter (CT8_2-17).
 - a. Identify the prerequisites, competencies, and abnormal operating conditions associated with measuring pipe wall thickness using a UT meter.
 - b. Describe the procedures used to measure pipe wall thickness using a UT meter.

Performance Task

Performance Task 1 (Learning Objective 2)

1. Measure wall thickness using an ultrasonic meter (CT8_2-17).
 - Identify potential abnormal operating conditions that may occur during performance of this CT, and know the appropriate actions to take in response to them.
 - Utilize the appropriate personal protective equipment according to relevant company procedures.
 - Perform a visual inspection of the exposed pipe. Look for integrity issues such as evidence of a release or significant metal deformation. If unsafe integrity issues are encountered, discontinue the task and make immediate notifications.
 - Assemble, check, and calibrate an ultrasonic thickness (UT) meter. Ensure it is ready for operation.
 - Clean and remove debris from the area to be measured.
 - Apply an acceptable couplant.
 - Place the transducer in contact with the couplant/surface, ensuring it is oriented to the pipe surface according to the manufacturer's instructions.
 - Observe the wall thickness measurement on the meter display.
 - Repeat several measurements to confirm the nominal wall thickness.
 - Complete appropriate documentation as required by operator's procedures.

Teaching Time: 5 hours

(Two 2.5-Hour Sessions)

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Before You Begin

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Equipment, Materials, and Resources

- Whiteboard and markers
- Pencils and paper
- CT8_2-17 PowerPoint® Presentation
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Module Review answer key
- Module Examinations
- Sections of corroded pipe
- Ultrasonic thickness meter
- Several types of couplant
- Copies of a pipeline inspection form/field corrosion report
- Copies of the Performance Profile sheets

Lesson Plans for Module CT8_3-17

Measure Corroded Area

Module CT8_3-17 describes procedures involved in measuring corroded areas of piping and documenting the extent and location of corrosion damage.

Objectives

Learning Objective 1

1. Explain the need to determine defect length and the extent and location of damage.
 - a. Describe how the interaction rule is used to determine defect length.
 - b. Describe how to document the extent and location of damage.

Learning Objective 2

2. Describe how to measure a corroded area (CT8_3-17).
 - a. Identify the prerequisites, competencies, and abnormal operating conditions associated with measuring a corroded area.
 - b. Describe the procedures used to measure a corroded area.

Performance Task

Performance Task 1 (Learning Objective 2)

1. Measure a corroded area (CT8_3-17).
 - Identify potential abnormal operating conditions that may occur during performance of this CT, and know the appropriate actions to take in response to them.
 - Utilize the appropriate personal protective equipment according to relevant company procedures.
 - Perform a visual inspection of the exposed pipe. Look for integrity issues such as evidence of a release or significant metal deformation. If unsafe integrity issues are encountered, discontinue the task and make immediate notifications.
 - Gather the necessary tools and materials.
 - Clean and remove debris from the area to be measured.
 - Create a representation of the pipe surface to be inspected so that corroded areas on the pipeline can be accurately represented. Identify the long seam and the nearest girth weld as reference points and identify corrosion in proximity.
 - Overlay a grid on each area of localized corrosion.
 - Measure the longitudinal length and circumferential width of each area of localized corrosion.
 - Measure the distance between each area of localized corrosion.
 - Obtain profile measurements of the corrosion region (CT8_1-17 and/or CT8_2-17).
 - Obtain and determine the nominal wall thickness (CT8_2-17).
 - Identify the areas of greatest wall loss within each area of localized corrosion and obtain pit depth measurements (CT8_1-17 and/or CT8_2-17).
 - Denote all areas of localized corrosion, distances between those areas and pit depth readings on the representation.
 - Complete appropriate documentation as required by operator's procedures.

Teaching Time: 5 hours

(Two 2.5-Hour Sessions)

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Equipment, Materials, and Resources

- Whiteboard and markers
- Pencils and paper
- CT8_3-17 PowerPoint® presentation
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Module Review answer key
- Module Examinations
- Sections of corroded pipe
- Ruler
- Tape measure
- Copies of a pipeline inspection form/field corrosion report
- Copies of the Performance Profile sheets

Lesson Plans for Module CT9_1-17

Install Bonds

Module CT9_1-17 explains how stray current interference affects cathodic protection, and it describes the procedures used to install bonds to eliminate stray current interference.

Objectives

Learning Objective 1

1. Describe stray current interference and methods for reducing or eliminating it.
 - a. Identify types of stray current and describe how they affect cathodic protection.
 - b. Identify and describe methods used to reduce or eliminate stray current interference.

Learning Objective 2

2. Describe how to install bonds (CT9_1-17).
 - a. Identify the prerequisites, competencies, and abnormal operating conditions associated with installing bonds.
 - b. Describe the procedure for installing bonds.

Performance Task

Performance Task 1 (Learning Objective 2)

1. Install bonds (CT9_1-17).
 - Identify potential abnormal operating conditions that may occur during performance of this CT, and know the appropriate actions to take in response to them.
 - Utilize the appropriate personal protective equipment according to relevant company procedures
 - Identify the structures to be connected.
 - Install the test leads and bond cables/wires on both structures at the location of current discharge.
 - Attach the test leads and bond cables/wires by exothermic (thermite) weld, pin brazing, or other method which will yield a permanent, low-resistance connection.
 - Terminate the test leads and bond cables/wires inside of the test box/station that is accessible to both structures.
 - Install shunts for the measurement of current flow and resistance inside of the test box/station.
 - Install blocking diodes as required.
 - Conduct tests to determine the effectiveness of the installed interference bond.
 - Complete appropriate documentation as required by operator's procedures.
-

Teaching Time: 5 hours

(Two 2.5-Hour Sessions)

Session time and quantity may be adjusted to accommodate your class size, schedule, and teaching style.

Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Performance Profile Sheets from www.nccerirc.com. For information and updates about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER's Registry is 70% or above for the Module Examination; performance testing is graded pass or fail.

Safety Considerations

This module may require trainees to work in the vicinity of functioning equipment. Electrical and mechanical safety must be emphasized at all times. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and remain aware of any potential abnormal operating conditions. Any work performed on or in the vicinity of functioning equipment must be completed under your direct supervision.

Equipment, Materials, and Resources

- Whiteboard and markers
- Pencils and paper
- CT9_1-17 PowerPoint® Presentation Slides
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Module Review answer key
- Module Examinations
- Specific PPE required by the site
- Copper sulfate reference electrode
- Test leads
- Hand tools for making connections/terminations
- Bond cables
- Blocking diodes
- Shunts
- Multimeter
- Copies of field data sheets for recording measurements
- Copies of the Performance Profile sheets

Lesson Plans for Module CT9_2-17

Install Galvanic Anodes

Module CT9_2-17 describes how stray current interference affects cathodic protection. It presents the steps for the general procedures used to install galvanic anodes for stray current mitigation.

Objectives

Learning Objective 1

1. Describe stray current interference and methods for reducing or eliminating it.
 - a. Identify types of stray current and describe how they affect cathodic protection.
 - b. Identify and describe methods used to reduce or eliminate stray current interference.

Learning Objective 2

2. Describe how to install galvanic anodes (CT9_2-17).
 - a. Identify the prerequisites, competencies, and abnormal operating conditions associated with installing galvanic anodes.
 - b. Describe the procedure for installing galvanic anodes.

Performance Task

Performance Task 1 (Learning Objective 2)

1. Install galvanic anodes (CT9_2-17).
 - Identify potential abnormal operating conditions that may occur during performance of this CT, and know the appropriate actions to take in response to them.
 - Utilize the appropriate personal protective equipment according to relevant company procedures.
 - Verify the location for anode installation. Ensure that the electrolytic environment is moist. Horizontal anodes may require backhoe excavation.
 - Install the anode into an augered hole or horizontal excavation. Wet down the anode prior to backfilling or before placing it in the ground.
 - Uncoil the anode lead and extend it fully. Do not damage or kink the wire.
 - If the design is for direct connection, connect the test lead directly to the pipe. Install shunts for measurement of current flow and resistance inside of the test station.
 - Backfill carefully with approved soil backfill. Use rock-free backfill to pad the anode and the anode lead wire.
 - Complete appropriate documentation as required by operator's procedures.

Teaching Time: 5 hours

(Two 2.5-Hour Sessions)

Session time and quantity may be adjusted to accommodate your class size, schedule, and teaching style.

Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the presentation), and these lesson plans, and to gather the required equipment and materials. Consider the time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Performance Profile Sheets from www.nccerirc.com. For information and updates about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER's Registry is 70% or above for the Module Examination; performance testing is graded pass or fail.

Safety Considerations

This module may require trainees to work in the vicinity of functioning equipment. Electrical and mechanical safety must be emphasized at all times. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and remain aware of any potential abnormal operating conditions. Any deficiencies must be corrected to ensure trainee safety in the future. Work performed on or in the vicinity of functioning equipment must be completed under the direct supervision of the instructor.

Equipment, Materials, and Resources

- Whiteboard and markers
- Pencils and paper
- CT9_2-17 PowerPoint® Presentation
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Module Review answer key
- Module Examinations
- Specific PPE required by the site
- Copies of field data sheets for recording measurements
- Test leads
- Hand tools for making connections/terminations
- Magnesium anodes
- Ribbon (strip) anodes
- Vertical anodes
- Horizontal anodes
- Header cables
- Copies of the Performance Profile sheets

Lesson Plans for Module CT9_3-17

Install Rectifiers

Module CT9_3-17 describes how stray current interference affects cathodic protection. It presents the steps for the general procedures used to install rectifiers for stray current mitigation.

Objectives

Learning Objective 1

1. Describe stray current interference and methods for mitigating it.
 - a. Describe types of stray current and how they affect cathodic protection.
 - b. Describe methods used to mitigate stray current interference.

Learning Objective 2

2. Describe how to install rectifiers (CT9_3-17).
 - a. Identify the prerequisites, competencies, and abnormal operating conditions associated with installing rectifiers.
 - b. Describe the procedure for installing a rectifier.

Performance Task

Performance Task 1 (Learning Objective 2)

1. Install rectifiers (CT9_3-17).
 - Identify potential abnormal operating conditions that may occur during performance of this CT, and know the appropriate actions to take in response to them.
 - Utilize the appropriate personal protective equipment according to relevant company procedures.
 - Verify the rectifier required for the location and service.
 - Mount the rectifier at the designated location (pole, post, wall, etc.), making sure that it is securely fastened.
 - Connect the AC power feed wires through an appropriately sized conduit according to the *National Electric Code (NEC®)*, the *National Electric Safety Code*, and local electric and building codes.
 - Terminate the AC feed wires at terminals on circuit breaker or AC input connection wires.
 - Connect the DC conduits to the rectifier.
 - Install the DC cables from the anode groundbed and the structure in their respective conduits, and terminate on their respective terminals.
 - Test and verify that cables are correctly installed.
 - Complete appropriate documentation as required by operator's procedures.
-

Teaching Time: 5 hours

(Two 2.5-Hour Sessions)

Session time and quantity may be adjusted to accommodate your class size, schedule, and teaching style.

Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the presentation), and these lesson plans, and to gather the required equipment and materials. Consider the time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Performance Profile Sheets from www.nccerirc.com. For information and updates about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER's Registry is 70% or above for the Module Examination; performance testing is graded pass or fail.

Safety Considerations

This module may require trainees to work in the vicinity of functioning equipment. Electrical and mechanical safety must be emphasized at all times. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and remain aware of any potential abnormal operating conditions. Any deficiencies must be corrected to ensure trainee safety in the future. Work performed on or in the vicinity of functioning equipment must be completed under the direct supervision of the instructor.

Equipment, Materials, and Resources

- Whiteboard and markers
- Pencils and paper
- CT9_3-17 PowerPoint® Presentation Slides
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Module Review answer key
- Module Examinations
- Specific PPE required by the site
- Test leads
- Hand tools for making connections/terminations
- Junction boxes
- AC power feed wires
- Conduit and tools/fittings required for conduit connections
- Copies of field data sheets for recording measurements
- Copies of the Performance Profile sheets

Lesson Plans for Module CT9_4-17

Install Impressed Current Groundbeds

Module CT9_4-17 explains how stray current interference affects cathodic protection. It describes the general procedures for installing impressed current groundbeds to mitigate stray current interference.

Objectives

Learning Objective 1

1. Describe stray current interference and methods for mitigating it.
 - a. Describe types of stray current and how they affect cathodic protection.
 - b. Describe methods used to mitigate stray current interference.

Learning Objective 2

2. Describe how to install impressed current groundbeds (CT9_4-17).
 - a. Identify the prerequisites, competencies, and abnormal operating conditions associated with installing impressed current groundbeds.
 - b. Describe procedures for installing impressed current groundbeds.

Performance Task

Performance Task 1 (Learning Objective 2)

1. Install impressed current groundbeds (CT9_4-17).
 - Identify potential abnormal operating conditions that may occur during performance of this CT, and know the appropriate actions to take in response to them.
 - Utilize the appropriate personal protective equipment according to relevant company procedures.
 - Confirm that the location and materials meet the requirements of the design criteria.
 - Lay out the number, spacing, and configuration of the anodes according to the design criteria.
 - Excavate a vertical hole or horizontal ditch.
 - Install an anode in the excavated hole, being careful to avoid damage.
 - Install the anode header cable between the groundbed and the rectifier.
 - Backfill the hole or ditch with appropriate backfill material.
 - Complete appropriate documentation as required by operator's procedures.

Teaching Time: 5 hours

(Two 2.5-Hour Sessions)

Session time and quantity may be adjusted to accommodate your class size, schedule, and teaching style.

Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Performance Profile Sheets from www.nccerirc.com. For information and updates about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER's Registry is 70% or above for the Module Examination; performance testing is graded pass or fail.

Safety Considerations

This module may require trainees to work in the vicinity of functioning equipment. Electrical and mechanical safety must be emphasized at all times. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and remain aware of any potential abnormal operating conditions. Any deficiencies must be corrected to ensure trainee safety in the future. Work performed on or in the vicinity of functioning equipment must be completed under the direct supervision of the instructor.

Equipment, Materials, and Resources

- Whiteboard and markers
- Pencils and paper
- CT9_4-17 PowerPoint® Presentation
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Module Review answer key
- Module Examinations
- Specific PPE required by the site
- Test leads
- Hand tools for making connections/terminations
- Magnesium anodes
- Ribbon (strip) anodes
- Vertical anodes
- Horizontal anodes
- Header cables
- Junction boxes
- Copies of field data sheets for recording measurements
- Copies of the Performance Profile sheets

Lesson Plans for Module CT9_5-17

Repair Shorted Casings

Module CT9_5-17 explains how shorted casings can compromise the cathodic protection of a pipeline. It describes how to test for shorted casings, and presents the general procedures for clearing, filling, repairing, monitoring, and replacing a shorted casing.

Objectives

Learning Objective 1

1. Describe the use of electrical isolation in CP systems.
 - a. Describe the purpose of electrical insulation/isolation in CP systems.
 - b. Describe how to test for shorted casings.

Learning Objective 2

2. Describe how to take corrective actions for a shorted casing (CT9_5-17).
 - a. Identify the prerequisites, competencies, and abnormal operating conditions associated with repairing shorted casings.
 - b. Describe the procedures for repairing shorted casings.

Performance Task

Performance Task 1 (Learning Objective 2)

1. Repair shorted casings (CT9_5-17).
 - Identify potential abnormal operating conditions that may occur during performance of this CT, and know the appropriate actions to take in response to them.
 - Utilize the appropriate personal protective equipment according to relevant company procedures.
 - Clear a workable area and support the pipeline as needed.
 - Remove the end seal.
 - Visually inspect the ends of the carrier pipe and casing for metallic contact.
 - If the pipe has settled, center the carrier pipe within the casing, if possible.
 - If the pipeline is coated, ensure the coating is bonded to the carrier pipe (CT5_3-17).
 - Install casing insulator and centering cradle while providing adequate support.
 - If no metallic contact is found, an electrolyte condition may be the cause of elevated potentials on the casing. This may require removal of the electrolyte material in the casing, if possible, while the end seals are removed.
 - Replace the end seal.
 - Install the test leads as required (CT1_1-17 and CT2_4-17).
 - Conduct a pipe-to-casing potential difference test to determine that the pipe and casing are isolated.
 - Complete appropriate documentation as required by operator's procedures.

Teaching Time: 5 hours

(Two 2.5-Hour Sessions)

Session time and quantity may be adjusted to accommodate your class size, schedule, and teaching style.

Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Performance Profile Sheets from www.nccerirc.com. For information and updates about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER's Registry is 70% or above for the Module Examination; performance testing is graded pass or fail.

Safety Considerations

This module may require trainees to work in the vicinity of functioning equipment. Electrical and mechanical safety must be emphasized at all times. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and remain aware of any potential abnormal operating conditions. Any deficiencies must be corrected to ensure trainee safety in the future. Work performed on or in the vicinity of functioning equipment must be completed under the direct supervision of the instructor.

Equipment, Materials, and Resources

- Whiteboard and markers
- Pencils and paper
- CT9_5-17 PowerPoint® Presentation
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Module Review answer key
- Module Examinations
- Specific PPE required by the site
- High dielectric material to fill shorted casing
- Casing end seals
- Casing vents
- Casing insulators
- Center cradles
- Test leads
- Copper sulfate reference electrode
- Shunt
- Switch
- Battery
- Variable resistor
- Multimeter
- Copies of field data sheets for recording measurements
- Copies of the Performance Profile sheets

Lesson Plans for Module CT9_6-17

Install Electrical Insulating Device

Module CT9_6-17 describes how electrical insulation/isolation is used in cathodic protection (CP) systems. It explains how to test for electrical isolation and describes procedures for installing various electrical insulating devices.

Objectives

Learning Objective 1

1. Describe the use of electrical isolation in CP systems.
 - a. Describe the purpose of, and methods used for, electrical insulation/isolation in CP systems.
 - b. Describe how to test for electrical isolation.

Learning Objective 2

2. Describe how to install electrical insulating devices (CT9_6-17).
 - a. Identify the prerequisites, competencies, and abnormal operating conditions associated with installing electrical insulating devices.
 - b. Describe procedures for installing various electrical insulating devices.

Performance Task

Performance Task 1 (Learning Objective 2)

1. Install electrical insulating devices (CT9_6-17).
 - Identify potential abnormal operating conditions that may occur during performance of this CT, and know the appropriate actions to take in response to them.
 - Utilize the appropriate personal protective equipment according to relevant company procedures.
 - Verify the location where the isolation device is needed.
 - Verify the appropriate kit materials.
 - Verify proper flange alignment prior to installation of insulation kit.
 - Install the flange kit and/or dielectric unions according to the manufacturer's specifications. Use precautions to prevent any moisture, soil, or other foreign matter from contacting any portion of the insulating joint prior to its being sealed.
 - Verify isolation using the appropriate insulation tester.
 - Complete appropriate documentation as required by operator's procedures.

Teaching Time: 5 hours

(Two 2.5-Hour Sessions)

Session time and quantity may be adjusted to accommodate your class size, schedule, and teaching style.

Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Performance Profile Sheets from www.nccerirc.com. For information and updates about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER's Registry is 70% or above for the Module Examination; performance testing is graded pass or fail.

Safety Considerations

This module may require trainees to work in the vicinity of functioning equipment. Electrical and mechanical safety must be emphasized at all times. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and remain aware of any potential abnormal operating conditions. Any deficiencies must be corrected to ensure trainee safety in the future. Work performed on or in the vicinity of functioning equipment must be completed under the direct supervision of the instructor.

Equipment, Materials, and Resources

- Whiteboard and markers
- Pencils and paper
- CT9_6-17 PowerPoint® Presentation
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Module Review answer key
- Module Examinations
- Specific PPE required by the site
- Pipe section prepared for installation of one of the following methods of electrical insulation/isolation:
 - Insulated flange or dielectric union
 - Isolation joint
 - Lightning and ground fault protection
 - Electrical isolation from electrical grounding
 - Aboveground piping isolation from other buried structures
 - Casing isolation/insulation
- Electrical insulating device/ installation kit for the chosen method of electrical insulation/isolation
- Hand and/or power tools required for installing the chosen electrical insulating device
- An appropriate isolation tester for installing the chosen electrical insulating device
- Copies of field data sheets for recording measurements
- Copies of the Performance Profile sheets

Lesson Plans for Module CT10_1-17

Insert and Remove Coupons

Module CT10_1-17 covers the applications and use of corrosion coupons and describes the procedure for installing and removing coupons.

Objectives

Learning Objective 1

1. Describe the use of coupons to monitor corrosion.
 - a. Understand the factors affecting internal corrosion.
 - b. Describe how coupons are used for corrosion monitoring.

Learning Objective 2

2. Describe how to insert and remove corrosion coupons (CT10_1-17).
 - a. Identify the prerequisites, competencies, and abnormal operating conditions associated with using corrosion coupons.
 - b. Describe the procedure used to insert and remove corrosion coupons.

Performance Task

Performance Task 1 (Learning Objective 2)

1. Insert and remove corrosion coupons (CT10_1-17).
 - Identify potential abnormal operating conditions that may occur during performance of this CT, and know the appropriate actions to take in response to them.
 - Utilize the appropriate personal protective equipment according to relevant company procedures.
 - Retract coupon according to manufacturer and company procedures. Perform this function slowly, monitoring for any leaks or change in pressure.
 - Close isolation valve. Follow company procedures to isolate coupon.
 - Package and label coupon. Document the coupon's visual characteristics. Confirm that the coupon is placed in its original shipping envelope.
 - Prepare new coupon. Properly record the new coupon's information. Thoroughly clean and prepare the coupon holder and ancillary equipment for coupon installation.
 - Install the new coupon on insulating assembly. Install coupon holder according to manufacturer and company procedures. Perform this function slowly to prevent damage to the coupon and plug assembly.
 - Open the isolation valve after the coupon holder assembly is properly installed on the valve.
 - Reinsert the coupon.
 - Perform the necessary notifications upon completion of the inspection.
 - Complete appropriate documentation as required by operator's procedures.

Teaching Time: 5 hours

(Two 2.5-Hour Sessions)

Session time and quantity may be adjusted to accommodate your class size, schedule, and teaching style.

Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

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Safety Considerations

This module may require trainees to work in the vicinity of functioning equipment. Electrical and mechanical safety must be emphasized at all times. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and remain aware of any potential abnormal operating conditions. Any work performed on or in the vicinity of functioning equipment must be completed under your direct supervision.

Equipment, Materials, and Resources

- Whiteboard and markers
- Pencils and paper
- CT10_1-17 PowerPoint® Presentation
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Module Review answer key
- Module Examinations
- A variety of weight loss and scale coupons and associated mounting devices
- Anti-seize compound
- Copies of the Performance Profile sheets

Lesson Plans for Module CT10_2-17

Monitor Probes (Online)

Module CT10_2-17 describes various probes used to monitor conditions in a pipeline system, and provides a typical procedure for probe insertion and retrieval.

Objectives

Learning Objective 1

1. Describe the function of online probes.
 - a. Understand the factors affecting internal corrosion.
 - b. Identify various probes and their applications.

Learning Objective 2

2. Describe how to read a probe (CT10_2-17).
 - a. Identify the prerequisites, competencies, and abnormal operating conditions associated with reading probes.
 - b. Describe the procedure used to read a probe.

Performance Task

Performance Task 1 (Learning Objective 2)

1. Monitor online probes (CT10_2-17).
 - Identify potential abnormal operating conditions that may occur during performance of this CT, and know the appropriate actions to take in response to them.
 - Utilize the appropriate personal protective equipment according to relevant company procedures.
 - Locate the probe site and remove any secondary containment covers to gain access to the probe.
 - Confirm the probe terminals are acceptable for use.
 - Connect the data cords from the data logger to the appropriate terminal of the probe.
 - Turn the data logger on and obtain the reading (follow the manufacturer's operating procedures).
 - Document the reading.
 - Disconnect the data logger leads from the probe.
 - Dress the secondary container cover with anti-seize compound and place the cap back on probe adapter.
 - Confirm data logger readings are appropriate (the data logger is functioning properly).
 - Complete appropriate documentation as required by operator's procedures.
-

Teaching Time: 5 hours

(Two 2.5-Hour Sessions)

Session time and quantity may be adjusted to accommodate your class size, schedule, and teaching style.

Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Performance Profile Sheets from www.nccerirc.com. For information and updates about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER's Registry is 70% or above for the Module Examination; performance testing is graded pass or fail.

Safety Considerations

This module may require trainees to work in the vicinity of functioning equipment. Electrical and mechanical safety must be emphasized at all times. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and remain aware of any potential abnormal operating conditions. Any work performed on or in the vicinity of functioning equipment must be completed under your direct supervision.

Equipment, Materials, and Resources

- Whiteboard and markers
- Pencils and paper
- CT10_2-17 PowerPoint® presentation
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Module Review answer key
- Module Examinations
- One or more probes (electrical resistance, linear polarization resistance, galvanic, hydrogen, and biological) with associated data logger(s)
- Anti-seize compound
- Access to a pipeline to monitor probes
- Copies of the Performance Profile sheets

Lesson Plans for Module CT11_0-17

Monitoring and Controlling the Injection Rate of the Corrosion Inhibitor

Module CT11_0-17 describes chemical injection systems used to inject corrosion inhibitors into a pipeline system, and it explains the general procedures for monitoring and adjusting the inhibitor injection rates.

Objectives

Learning Objective 1

1. Identify the components of a typical chemical injection system, and describe how to monitor and adjust the inhibitor injection rates.
 - a. Identify the components of a typical chemical injection system.
 - b. Describe how to monitor and adjust the inhibitor injection rates.

Learning Objective 2

2. Describe how to monitor and control the injection rate of the corrosion inhibitor (CT11_0-17).
 - a. Identify the prerequisites, competencies, and abnormal operating conditions associated with monitoring and controlling the injection rate of the corrosion inhibitor.
 - b. Describe procedures for monitoring and controlling the injection rate of the corrosion inhibitor.

Performance Task

Performance Task 1 (Learning Objective 2)

1. Monitor and control the injection rate of the corrosion inhibitor (CT 11_0-17).
 - Identify potential abnormal operating conditions that may occur during performance of this CT, and know the appropriate actions to take in response to them.
 - Utilize the appropriate personal protective equipment according to relevant company procedures.
 - Visually inspect the tank and injection system to verify that the injection system is operating. Check for indications of leakage.
 - Ensure that the volume of inhibitor is sufficient to last until the next inspection.
 - Monitor the flow rate of the inhibitor to determine if it is correct to the established flow rate.
 - Adjust the injection rate to meet the established flow rate, if necessary.
 - Complete appropriate documentation as required by operator's procedures.

Teaching Time: 5 hours

(Two 2.5-Hour Sessions)

Session time and quantity may be adjusted to accommodate your class size, schedule, and teaching style.

Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Performance Profile Sheets from www.nccerirc.com. For information and updates about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER's Registry is 70% or above for the Module Examination; performance testing is graded pass or fail.

Safety Considerations

This module may require trainees to work in the vicinity of functioning equipment. Electrical and mechanical safety must be emphasized at all times. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and remain aware of any potential abnormal operating conditions. Any deficiencies must be corrected to ensure trainee safety in the future. Work performed on or in the vicinity of functioning equipment must be completed under the direct supervision of the instructor.

Equipment, Materials, and Resources

- Whiteboard and markers
- Pencils and paper
- CT11_0-17 PowerPoint® Presentation
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Module Review answer key
- Module Examinations
- Specific PPE required by the site
- Copies of an inhibitor safety data sheet
- Access to a chemical injection system for monitoring and adjustment
- Various tubing terminations (atomizer, open, nipple, quill)
- Copies of an injection system inspection checklist
- Copies of the Performance Profile sheets