

## **MODULE OVERVIEW**

This module provides specific training for certified SNT-TC-1A Level II radiographic technicians who perform radiographic testing of pipeline welds in accordance with the requirements of *API 1104*. It gives an overview of X-ray and gamma ray theory, reviews radiation safety procedures, and covers the exposure, processing, and interpretation of radiographic film.

## **PREREQUISITES**

Prior to training with this module, it is recommended that the trainee shall have successfully completed the following:

Core Curriculum; Pipeline Core, Modules 66101-02 and 66102-02

## **OBJECTIVES**

Upon completion of this module, the trainee will be able to:

1. Describe how X-ray and gamma ray techniques are used in the examination of pipe welds.
2. List the safety procedures and identify the detection devices used to ensure the safety of persons working with or near radiographic testing.
3. Describe in detail the exposure techniques used in radiographic testing.
4. Explain the equipment and methods used in processing radiographic film.
5. List the main requirements for radiographic testing defined in *API 1104*.
6. Demonstrate to the satisfaction of the instructor the ability to expose and process radiographic film. (CT 38.4)
7. Demonstrate to the satisfaction of the instructor the ability to recognize and identify weld conditions by examining radiographic film of pipe welds. (CT 38.4)

## **PERFORMANCE TASKS**

Under the supervision of the instructor, the trainee should be able to:

1. Demonstrate to the satisfaction of the instructor the ability to expose and process radiographic film. (CT 38.4)
2. Demonstrate to the satisfaction of the instructor the ability to recognize and identify weld conditions by examining radiographic film of pipe welds. (CT 38.4)

## MATERIALS AND EQUIPMENT LIST

Transparencies	Alarming rate meter
Markers/chalk	Ion chamber survey meter
Blank acetate sheets	Geiger Mueller (GM) rate meter
Transparency pens	Area alarm monitor
Pencils and scratch paper	Exposure calculator
Overhead projector and screen	Exposure charts
Whiteboard/chalkboard	Radiographic film in different packaging
Appropriate personal protective equipment	Flexible, semi-rigid, and rigid film cassettes
Copies of <i>API Standard 1104, Welding of Pipelines and Related Facilities</i>	Hole-type and wire-type penetrameters
Copies of your company policy and procedures manual	Selection of welded pipe sections
Manual film processing equipment	Intensifying screens
Automatic film processing equipment	Module Examinations*
Film badge	Performance Profile Sheets*
Thermoluminescent dosimeter (TLD)	<i>Radiographer's Weld Interpretation Reference**</i>
OSL dosimeter	Copies of the Performance Verification for Covered Task 38.4**

\* Located in the Test Booklet.

\*\*Available for download at [www.nccer.org](http://www.nccer.org).

## SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment.

## ADDITIONAL RESOURCES

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.

*Annual Book of ASTM Standards, Volume 03.03, Nondestructive Testing.* American Society for Testing and Materials, Philadelphia, PA.

*Industrial Radiography/Holography.* Agfa-Gaevert, Ridgefield Park, NJ.

*Working Safely in Gamma Radiography.* NUREG/BR-0024, McGuire and Peabody, US Government Printing Office, Washington, DC.

*Radiography in Modern Industry.* Eastman Kodak, Rochester, NY.

*Industrial Radiography.* Agfa-Gaevert NV, Mortsels, Belgium.

*Radiographic Interpretation.* Charles Hellier and Sam Wenk, American Society for Nondestructive Testing, Columbus, OH.

## TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 25 hours are suggested to cover *Radiographic Testing of Pipeline Welds*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
<b>Session I. Introduction to Radiography and Radiographic Testing Procedures</b>	
A. Introduction to Radiography	_____
B. Review of Radiographic Testing Procedures	_____
1. Characteristics of Radiation	_____
2. Radiation Source Selection and Energy Levels	_____
3. Radiation Measurements	_____
4. X-Rays	_____
5. Gamma Rays	_____
<b>Session II. Radiation Safety Review</b>	
A. Personal Protective Equipment for Detecting and Measuring Exposure to Radiation	_____
B. Site Safety Equipment	_____
C. U.S. Nuclear Regulatory Commission Regulations	_____
D. Time, Distance, and Shielding	_____
E. Inverse Square Law	_____
<b>Session III. Radiation Safety Practice</b>	
A. Radiation Safety Practice – Trainees calculate exposure risks and safe distances.	_____
<b>Session IV. Specimen Exposure Techniques</b>	
A. Setup	_____
B. Exposure Variables	_____
C. Image Quality Indicators (Penetrameters)	_____
<b>Session V. Radiographic Film Processing</b>	
A. Processing Room	_____
B. Film Processing Systems	_____
C. Radiographic Films	_____
D. Film Packaging	_____
E. Film Cassettes	_____
F. Intensifying Screens	_____
<b>Session VI. API Standard 1104 – Radiographic Procedures and Techniques, Part One</b>	
A. API Standard 1104 – Radiographic Procedures and Techniques	_____
B. API Standard 1104 – Requirements Associated with Radiography	_____
<b>Session VII. API Standard 1104 – Radiographic Procedures and Techniques, Part Two</b>	
A. API Standard 1104 – Radiographic Indications and Interpretation	_____
1. Accumulation of Discontinuities/ Imperfections	_____
2. Base Metal Discontinuities/ Imperfections	_____
B. Laboratory – Trainees expose, process, and interpret radiographic film in accordance with API 1104. This laboratory corresponds to Performance Tasks 1 and 2.	_____

- C. Laboratory – Trainees identify weld imperfections on radiographic film.  
This laboratory corresponds to Performance Task 2.

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**Sessions VIII and IX. Laboratories, Continued**

- A. Laboratory – Trainees expose, process, and interpret radiographic film in accordance with *API 1104*. This laboratory corresponds to Performance Tasks 1 and 2.
- B. Laboratory – Trainees identify weld imperfections on radiographic film.  
This laboratory corresponds to Performance Task 2.

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**Session X. Review, Module Examination, and Performance Testing**

- A. Review
- B. Module Examination
  - 1. Trainees must score 70% or higher to receive recognition from the NCCER.
  - 2. Record the testing results on Craft Training Report Form 200 and submit the results to the Training Program Sponsor.
- C. Performance Testing
  - 1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from the NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
  - 2. Record the testing results on Craft Training Report Form 200 and submit the results to the Training Program Sponsor.

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