

# Principles of Servicing Diagnostic X-Ray Systems (Phase 1) - eLearning Week 1



RADIOLOGICAL SERVICE TRAINING INSTITUTE

## Introduction

Principles of Servicing Diagnostic X-Ray Systems is a skills development program that teaches the new service professional the cognitive skills necessary to understand the X-ray system and its applications in the medical community. The program is divided into six major learning units:

- Introduction to radiography
- Radiation safety
- The production of X-rays
- Formation of the X-ray image
- Image receptor technologies
- PACS troubleshooting basics

The course contains lecture, demonstration, and hands-on training, which teach participants proper operation, radiation safety, image quality assessment, and global understanding of the X-ray system.

Upon completion of the course, the student will be able to perform first level service on the radiographic system.

## Prerequisites

To attend this course, the service professional must have a two-year associate degree in electronics or equivalent service experience.

## Objectives

At the conclusion of this course, participants will be able to:

- Have a thorough understanding of X-rays and X-ray production
- Follow safety procedures for patients, physicians, and individuals
- Describe the criteria for high quality radiographs
- Understand overtable radiographic, fluoroscopic, and special procedures system operation
- Describe the parameters of all current image receptor technologies
- Have a basic understanding of PACS and DICOM

## Course Outline

### Day 1

- Introduction to radiography
  - Welcome to E-RSTI!
    - Meet your instructor
    - Technology Overview
    - What is Moodle/The LMS?
    - Getting Logged In
    - Moodle Screen Layout
    - Moodle Course/Navigation
    - Moodle Assessments
    - Assessment Question Types
    - Grades and Grading
  - Zoom Controls
  - Virtual Tour
  - X-rays: An overview
    - A brief history
    - What they are
    - How they are produced
    - What they do
  - The radiographic system, an overview
  - The radiograph, an overview
  - Image receptor types
  - Measurements of beam quality and quantity
  - Half Value Layer

### Day 2

- Factors that measure radiographic quality
  - Density
  - Contrast
  - Sharpness
  - Magnification
  - Distortion
- Operation of the overtable system
- Operation of the undertable system
- Patient positioning

### Day 3

- Introduction to radiography (*cont'd*)
- Factors that affect radiographic quality
- Basic single purpose radiographic system
  - Computed Radiography
  - Direct Radiography
  - Film Screen Radiography
- Radiographic studies
  - Common non-contrast media
  - Common contrast media
- Special radiographic studies

### Day 4

- Radiation safety, principles, and practices
- Radiation and its biological effects
  - Atom
  - X-ray beam
  - Compton effect
  - Photoelectric effect
- Radiation safety, working with radiation
  - Rules governing working with radiation
  - Time, distance, and shielding
  - Radiation protective devices

### Day 5

- The production of X-rays
  - How X-rays are produced
    - Where X-rays are produced
    - How X-rays are controlled
    - Bremsstrahlung radiation theory
    - Characteristic radiation Theory
  - The X-ray tube
    - X-ray tube construction
    - Functions of basic elements
    - Electrical and mechanical requirements
    - Tube protection
    - Understanding Tube Charts
    - Problems and cures
    - Installation and evaluation

# Principles of Servicing Diagnostic X-Ray Systems (Phase 1) - eLearning Week 2



RADIOLOGICAL SERVICE TRAINING INSTITUTE

## Introduction

Principles of Servicing Diagnostic X-Ray Systems is a skills development program that teaches the new service professional the cognitive skills necessary to understand the X-ray system and its applications in the medical community. This is the outline for the second week, in house portion of the program. The course contains lecture, demonstration, and hands-on training, which teaches participants global understanding of the X-ray system. Upon completion of the course, the student will be able to perform first level service on the radiographic system.

## Prerequisites

To attend this course, the service professional must attend eLearning week one.

## Objectives

At the conclusion of this course, participants will be able to:

- Have a thorough understanding of X-rays and X-ray production
- Follow safety procedures for patients, physicians, and individuals
- Describe the criteria for high quality radiographs
- Understand overtable radiographic, fluoroscopic, and special procedures system operation
- Describe the parameters of all current image receptor technologies
- Develop a basic understanding of PACS and DICOM

## Course Outline

### Day 1

- Introduction to radiography
  - Welcome to E-RSTI!
    - Meet your instructor
    - Technology Overview
    - Moodle/The LMS?
    - Getting Logged In
  - Building Tour
    - Review of eLearning Week 1
  - The radiographic system, an overview

- The radiograph, an overview
- Image receptor types
- Factors that measure radiographic quality
  - Density
  - Contrast
  - Sharpness
- Operation of the overtable system
- Operation of the undertable system
- H.V. cables and terminations
- Lab Activities
  - Main component identification
  - X-ray tube warmup
  - Radiographic overtable & CR operation
  - Diagnostic workstation operation
  - Reference mAs
  - Effects on image quality

### Day 2

- H.V. transformers (1 $\phi$ , 3 $\phi$ , high frequency)
  - R/F changeover
  - Full wave/half wave rectification
- Generation of three phase
  - Wye and delta
- The X-ray generator
  - High frequency functional diagram
  - kV circuitry
  - Time/logic circuits
  - mA control

### Day 3

- Formation of the X-ray image
  - Control of the X-ray image
  - Control & production of secondary and scatter radiation
    - Photoelectric effect
    - Compton effect
    - Grids
  - Measuring X-ray beam quantity & quality
    - Half-value layer
- X-ray beam control
  - Collimators
  - Resolving capabilities
  - Care and handling
  - X-ray to light field alignment

- Lab Activities
  - X-ray tube
    - Collimator removal
    - Anode rotation verification
    - Filament check
    - Stator type
    - Greasing federal terminations
    - Focal spot size and resolution
    - Central ray alignment
  - Lab Activities
    - Non-invasive test equipment
    - HVL

### Day 4

- PACS troubleshooting basics
  - Data Representation
  - Network Topology
  - Network troubleshooting
  - DICOM basics
    - AE titles
    - DICOM configuration
    - DICOM ECHO
  - Network Interfaces
  - Network Hardware
  - Network Protocols
  - Protocol Data Units
  - Data Storage
  - The eye and what it sees
    - Visual acuity
    - Intensity discrimination
  - First Visit Action Items
  - Lab Activities
    - Light field to X-ray field alignment
    - Central ray alignment
    - DR operation
    - AEC
    - DICOM output configuration
    - DICOM troubleshooting
    - Fluoroscopic imaging

### Day 5

- System review
- Final exam
- Course evaluation