

Principles of Servicing Diagnostic X-Ray Systems (Phase I)



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

Day 2

- 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
 - Patient Positioning
 - Introduction to troubleshooting the X-ray system
 - Minimum Configuration for R/F suites
 - Isolation of major areas
- 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
- Lab Activities

- Learn safety rules in working with radiation

Day 3

- 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
- Lab Activities
 - Main component identification
 - X-ray tube warmup
 - Radiographic overtable operation & CR operation
 - Diagnostic workstation operation

Day 4

- The production of X-rays (*cont'd*)
 - H.V. cables and terminations
 - Composition and conductors
 - Federal terminations
 - H.V. transformers (single phase, 3 phase, high frequency)
 - R/F changeover
 - Full wave/half wave rectification
 - Circuit failure and cause
 - Generation of three phase
 - Wye and delta
 - Six and twelve-pulse generation
 - Line-to-neutral versus line-to-line voltage
 - Relationship of input to output voltages
 - High frequency inverter technology
- Lab Activities
 - Reference mAs
 - Effects:
 - mA/time changes

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- kV
- SID
- Grids

Day 5

- The production of X-rays (*cont*)
 - The X-ray generator
 - High frequency functional diagram
 - kV circuitry
 - Time/logic circuits
 - mA control
 - Troubleshooting

Day 6

- Formation of the X-ray image
 - Control of the X-ray image
 - Techniques
 - Technique charts
 - Inverse square law
 - Control & production of secondary and scatter radiation
 - Photoelectric effect
 - Compton effect
 - Grids
 - Intensifying screens
 - Effect on quantity and quality
 - Measuring quantity and quality of the X-ray beam
 - Ionization chambers
 - Half-value layer
- Lab Activities
 - X-ray tube
 - Collimator removal
 - Anode rotation verification
 - Filament check
 - Stator type
 - Greasing federal terminations
 - Focal spot size and resolution

Day 7

- X-ray beam control
 - Collimators
 - Resolving capabilities
 - Care and handling
 - X-ray to light field alignment
 - Central ray alignment

- Image receptor technology
 - X-ray film and effects on radiographic quality
 - Construction of X-ray film
 - Formation of a latent image
 - Sensitometric properties
 - H & D Curve and its relationship to digital imaging
 - Speed, contrast, latitude & base fog
 - Lab Activities
 - Film characteristics
 - Non-invasive test equipment
 - HVL

Day 8

- Image receptor technology
 - Computed Radiography
 - CR Imaging Plates
 - PSPs
 - IP Scanners
 - Image post processing
 - S numbers
 - Exposure Index
 - Direct Radiography
 - Flat Panel Construction
 - Direct VS Indirect detectors
 - A to D conversion
 - Quantization
 - Digital Image Properties
 - Detector matrix
 - File sizes
 - Detector Calibrations
 - Gain Calibration
 - Bad Pixel Calibration
 - Dark Offset
 - Dose Calibration
 - Display Performance
 - Image Enhancement
 - Lookup Tables
 - Image Management
 - Lab Activities
 - Light field to X-ray field alignment
 - Central ray alignment
 - DR operation

- AEC

Day 9

- PACS troubleshooting basics
 - Data Representation
 - Network Topology
 - Network troubleshooting
 - DICOM basics
 - AE titles
 - DICOM configuration
 - DICOM PING
 - DICOM ECHO
- Network Interfaces
- Network Hardware
 - Hubs
 - Switches
 - Routers
- Network Protocols
- Protocol Data Units
- Data Storage
- The eye and what it sees
 - Visual acuity
 - Intensity discrimination
- Image Intensifiers
- First Visit Action Items
- Lab Activities
 - DICOM output configuration
 - DICOM troubleshooting
 - Fluoroscopic imaging
 - Room evaluation

Day 10

- System review
- Final exam
- Course evaluation