

Radiography Level 1/II Course Outline (40hrs)

1. Introduction

- a. Process of radiography
- b. Types of electromagnetic radiation sources
- c. Electromagnetic spectrum
- d. Penetrating ability or "quality" of X-rays and gamma rays
- e. Spectrum of X-ray tube source
- f. Spectrum of gamma-radioisotope source
- g. X-ray tube - change of mA or kVp effect on "quality" and intensity

2. Basic Principles of Radiography

- a. Geometric exposure principles
 - (1) "Shadow" formation and distortion
 - (2) Shadow enlargement calculation
 - (3) Shadow sharpness
 - (4) Geometric unsharpness
 - (5) Finding discontinuity depth
- b. Radiographic screens
 - (1) Lead intensifying screens
 - (2) Fluorescent intensifying screens
 - (3) Intensifying factors
 - (4) Importance of screen-to-film contact
 - (5) Importance of screen cleanliness and care
 - (6) Techniques for cleaning screens
- c. Radiographic cassettes
- d. Composition of industrial radiographic film
- e. The "heel effect" with X-ray tubes

3. Radiographs

- a. Formation of the latent image on film
- b. Inherent unsharpness
- c. Arithmetic of radiographic exposure
 - (1) Milliampere - distance-time relationship
 - (2) Reciprocity law
 - (3) Photographic density
 - (4) X-ray exposure charts - material thickness, kV, and exposure
 - (5) Gamma-ray exposure chart
 - (6) Inverse-square-law considerations
 - (6) Calculation of exposure time for gamma- and X-ray sources
- d. Characteristic Hurter and Driffield (H&D) curve
- e. Film speed and class descriptions
- f. Selection of film for particular purpose

4. Radiographic Image Quality

- a. Radiographic sensitivity
- b. Radiographic contrast
- c. Film contrast
- d. Subject contrast
- e. Definition
- f. Film graininess and screen mottle effects
- g. Penetrameters or image-quality indicators

5. Film Handling, Loading, and Processing

- a. Safe light and darkroom practices
- b. Loading bench and cleanliness
- c. Opening of film boxes and packets
- d. Loading of film and sealing cassettes
- e. Handling techniques for "green film"
- f. Elements of manual film processing

6. Exposure Techniques - Radiography

- a. Single-wall radiography
- b. Double-wall radiography
 - (1) Viewing two walls simultaneously
 - (2) Offset double-wall exposure single-wall viewing
 - (3) Elliptical techniques
- c. Panoramic radiography
- d. Use of multiple-film loading
- e. Specimen configuration

7. Fluoroscopic Techniques

- a. Dark adaptation and eye sensitivity
- b. Special scattered radiation techniques
- c. Personnel protection
- d. Sensitivity
- e. Limitations
- f. Direct screen viewing
- g. Indirect and remote screen viewing

8. Darkroom Facilities, Techniques, and Processing

- a. Facilities and equipment
 - (1) Automatic film processor vs. manual processing
 - (2) Safe lights
 - (3) Viewer lights
 - (4) Loading bench
 - (5) Miscellaneous equipment
- b. Film loading
 - (1) General rules for handling unprocessed film
 - (2) Types of film packaging
 - (3) Cassette-loading techniques for sheet and roll
- c. Protection of radiographic film in storage
- d. Processing of film - manual
 - (1) Developer and replenishment
 - (2) Stop bath
 - (3) Fixer and replenishment
 - (4) Washing
 - (5) Prevention of water spots
 - (6) Drying
- e. Automatic film processing
- f. Film filing and storage
 - (1) Retention-life measurements
 - (2) Long-term storage
 - (3) Filing and separation techniques
- g. Unsatisfactory radiographs - causes and cures
 - (1) High film density
 - (2) Insufficient film density
 - (3) High contrast
 - (4) Low contrast
 - (5) Poor definition
 - (6) Fog
 - (7) Light leaks
 - (8) Artifacts
- h. Film density
 - (1) Step-wedge comparison film
 - (2) Densitometers

9. Indications, Discontinuities, and Defects

- a. Indications
- b. Discontinuities
 - (1) Inherent
 - (2) Processing
 - (3) Service
- c. Defects

10. Manufacturing Processes and Associated Discontinuities

- a. Casting processes and associated discontinuities
 - (1) Ingots, blooms, and billets
 - (2) Sand casting
 - (3) Centrifugal casting
 - (4) Investment casting
- b. Wrought processes and associated discontinuities
 - (1) Forging
 - (2) Rolled products
 - (3) Extruded products
- c. Welding processes and associated discontinuities
 - (1) Submerged arc welding (SAW)
 - (2) Shielded metal arc welding (SMAW)
 - (3) Gas metal arc welding (GMAW)
 - (4) Flux corded arc welding (FCAW)
 - (5) Gas tungsten arc welding (GTAW)
 - (6) Resistance welding
 - (7) Special welding processes – electron beam, electroslag, electrogas,

11. Radiological Safety Principles Review

- a. Controlling personnel exposure
- b. Time, distance, shielding concepts
- c. ALARA (as low as reasonably achievable) concept
- d. Radiation-detection equipment
- e. Exposure-device operation