

# NON-DESTRUCTIVE TESTING PROCEDURE

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## INSPECTION OBJECTIVES

To determine whether radiographic examination procedures used by the licensee/contractor meet the applicable AWS/ASME Code, regulatory, specification and contract requirements.

To determine through direct observation whether the radiographic examination is being conducted by properly qualified personnel in accordance with qualified procedures and the licensee's/contractors approved QA program.

To review a sample of radiographs, records, and digital radiographic images, if any, to determine whether they are prepared, evaluated, and maintained in accordance with applicable commitments and/or requirements.

## INSPECTION REQUIREMENTS

### Procedure Review.

- a) Review the active radiographic procedure(s) and ascertain whether it has (they have) been issued and approved in accordance with the licensee's/contractor's QA program.
- b) For each radiographic procedure, ascertain whether the examination variables are defined and whether these variables are controlled within the limits specified by the applicable Code and other specification/contract requirements. To accomplish this, determine whether the radiographic examination procedure contains information or references a general radiographic procedure or supplementary instructions sufficient to assure that the following parameters are specified and controlled within the limits permitted by the applicable Code and other additional specification requirements.
  1. Material and weld surface condition requirements (irregularities, Weld ripples, surface finish, etc.).
  2. Types of material to be radiographer.
  3. Material thickness range.
  4. Type of radiation source, effective focal spot or effective source size, X-ray equipment voltage rating and equipment manufacturer, as applicable.
  5. Film brand or type and number of films in cassette.
  6. Minimum source to film distance.
  7. Blocking or masking technique, if used.
  8. Type and thickness of intensifying screens and filters.

9. Exposure conditions for procedure qualification, if applicable.
10. Radiographic film processing requirements.
11. Quality of radiographs - limits on mechanical, chemical or other blemishes, such as fogging, process marks, scratches, finger marks, loss of detail or false indications.
12. Film density limits for single and composite viewing.
13. Use of densitometers for assuring compliance with film density requirements.
14. System of radiograph identification.
15. Use of location markers.
16. Records for showing film and source location with reference to the part being radiographed.
17. Use of intensifying screens.
18. Methods of reducing and testing for backscatter.
19. Description of or reference to the welding procedure.
20. Material type and thickness restrictions for isotoperadiography.
21. Geometrical unhappiness limitations.
22. Selection and use of pentameters including:
  - a) a) Pentameter design
  - b) (b) Selection of essential hole
  - c) (c) Pentameter thickness including special requirements for single and double wall viewing
  - d) (d) Pentameter placement including special requirements for single and double wall viewing
  - e) (e) Number of pentameters
  - f) (f) Shims under penetrameters
23. Radiographic technique requirements for double wall viewing.
24. Qualification of radiographic procedure (radiographs taken to demonstrate procedure capability).
25. Requirements for evaluation and disposition of radiographs.
26. Records requirements.

c. For each digital radiographic image procedure, ascertain that the procedure meets the requirements of the NRC Generic Letter 88-18, "Plant Record Storage on Optical Disks" and ASME Section V, Article 2, Mandatory Appendix, "Digital Image Acquisition, Display, and Storage for Radiography and Radioscopy."

Work Observation.

Observe the performance of a radiographic examination including processing of the film for a randomly selected weld sample of at least three but not more than ten welds and conduct the following reviews:

- a. Determine whether the applicable drawings, instructions, or travelers clearly specify the examination procedure to be used and that a copy of this procedure is available in the area where the examination is being performed.
- b. Identify for subsequent record review the personnel performing radiography and evaluate the examination results to ascertain whether they are qualified to perform the assigned task.
- c. Determine whether the required equipment and materials (as specified in the examination procedures) are available at the work station. Identify materials/equipment serial number(s) for subsequent reviews of calibration records and certifications as required.
- d. Determine whether the specific areas, locations, and extent of examination are clearly defined.
- e. Determine whether the examination attributes (as applicable) are as specified and consistent with the limits or ranges given in paragraph 02.01b.
- f. Determine whether the radiographic film is being processed in accordance with the applicable procedure requirements and that processed film is free of chemical and mechanical blemishes which could interfere with interpretation.

#### Record Review

a. Review a randomly selected sample of at least 10 but no more than 30 accepted radiographic films and determine if the radiographic quality is in accordance with the applicable procedure and Code requirements. Specifically, verify the following:

- a. 1. Penetrameter type, size, placement
- b. 2. Penetrameter sensitivity
- c. 3. Film density, density variation
- d. 4. Film identification
- e. 5. Film quality
- f. 6. Weld coverage (overlap)

b. Review qualification records for all RT inspection personnel and ascertain whether the qualification records properly reflect the following:

1. Employer's name
2. Person certified
3. Activity qualified to perform

4. Level of qualification
5. Effective period of certification
6. Signature of employer's designated
7. Basis used for certification
8. Annual visual acuity, color vision examination and periodic recertification

c. Review equipment and material certification and calibration records for materials and equipment (density meter pentameter) identified in paragraph to ascertain whether the documents are retrievable, complete and accurate.

d. Review a randomly selected sample of at least 10 but no more than 30 accepted digital radiographic images and determines whether the digital image quality is in accordance with the applicable procedure requirements.

## INSPECTION GUIDANCE

### General Guidance

- a. The recommended inspection schedule listed below applies to inspection of a nuclear construction site and other long-term inspection efforts. For short-duration projects and vendor inspections, a different schedule may be more practical.

### Inspection May Be Started Must Be Started

### Must Be Completed

1st Inspection after Work is-----Before work is 10% complete.

25% complete.

2nd Inspection After work is before work is before start up 75% complete. 90% complete. Of the plant.

- b. Applicable portions of the SAR should be reviewed to determine licensee commitments relative to nondestructive examination of components and equipment. The applicable Code editions and special requirements will generally be indicated in specification, drawings and/or construction QA manuals. The inspector is responsible for determining the acceptance criteria for each individual application.

c. Inspection of radiographic examination as outlined in this procedure can be described as a three-phase, progressive review: First, a general audit is made of the applicable RT procedure to verify that it is properly prepared, approved and qualified in accordance with the applicable Code and contract requirements. Secondly, the use of the procedure is observed to verify that the work is planned, scheduled and accomplished in accordance with the licensee's/contractor's QA program and that personnel performing the examination are properly qualified. Finally, records are reviewed to verify that they are complete, accurate and retrievable. It is preferable to complete all phases of the procedure during a single inspection. However, this may not be possible since there may be no radiographic examination in progress during a particular inspection. Under such circumstances, completion of a specific phase of the procedure may be deferred and resumed during a subsequent inspection.

d. Findings from this inspection activity should address each element as being satisfactory, being unresolved and requiring resolution, or being in violation and requiring correction. When significant inadequacies are identified indicating possible generic deficiencies, the issue should be addressed at the appropriate level of licensee management.

Specific Guidance.

The specific guidance listed below provides additional information to clarify the inspection requirements listed in paragraph

**Procedure Review.** The radiographic examination method described in Section III or V of the ASME Code is applicable to most conditions encountered during fabrication. However, the Code recognizes that special conditions may be encountered which require modification of these techniques. If modified procedures are used, they must be equivalent or superior to the code techniques. Such special procedures must also be proven by demonstration to be capable of detecting discontinuities to at least the same extent of the applicable Code technique under normal conditions. This applies to all nondestructive examination procedures used to meet Code acceptance criteria

**Work Observation.** The actual number and location of welds to be inspected should be selected by the inspector. The selected number of welds scheduled for observation should be adequate to permit an effective evaluation of the inspected radiographic examination activities.

In addition, the sample selection should include considerations such as number of NDE techniques or contractors performing the work at the manufacturing facility or plant site (construction or modification), combination of systems, weld configurations and difficulties to perform the required NDE.

Qualification of NDE personnel involved in the performance, evaluation or supervision of nondestructive examination should meet the qualification requirements set forth in the applicable Codes and standards referenced in the licensee SAR. Qualification certificates, visual acuity, color vision examination, and periodic recertification should be included in the licensee's or contractor's procedures.

Record Review.

#### RESOURCE ESTIMATE

This inspection should require about 24 hours of direct inspection effort to complete.

NRC INSPECTION MANUALEMCBINSPECTION PROCEDURE 57090NONDESTRUCTIVE EXAMINATION PROCEDURE RADIOGRAPHIC EXAMINATIONPROCEDURE REVIEW/WORK OBSERVATION/RECORD REVIEWPROGRAM APPLICABILITY: 2512, 2515SALP FUNCTIONAL AREA: MAINTENANCE SURVEILLANCE (SOMS) 57090-01INSPECTION OBJECTIVES01.01

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