Module 6: ASME Section III, Section VIII, and ASME NCA 3800 and N-Stamp requirements

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Learning Objectives

1. **Recognize the purposes of ASME Section III, VIII, and NCA requirements**
   - Understand NRC endorsement of ASME codes
   - Understand safety-related impacts of codes
   - Understand differences and application of Section III and Section VIII

2. **Understand the N stamp holder requirement and roles of ASME inspector**

Objective 1: Recognize the purposes of ASME Section III, Section VIII and NCA Requirements

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ASME Section III – Rules of Construction of Nuclear Facility Components: Overview

10CFR 50.55a, Codes and Standards, endorses the use of **ASME Sections III and XI** for safety-related systems and components of boiling and pressurized water-cooled nuclear power reactors. **The ASME Code is incorporated by reference into 10 CFR 50.55a.**

ASME Section III covers many nuclear components including:

- Pressure vessels, piping, pumps, valves,
- Supports and core support structures,
- pressure relief

Regulation Guide 1.84 "Design, Fabrication, and Materials Code Case Acceptability, ASEM Section III" identifies the **Code Cases** that have been **determined by the NRC to be acceptable alternatives to applicable parts of Section III.**

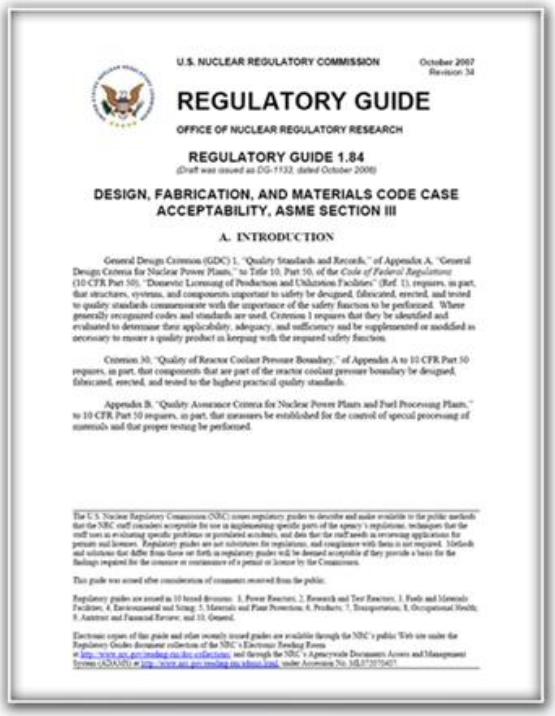
This permits the use of alternatives to the Code requirements referenced in 10 CFR 50.55(a) provided that

- The proposed alternatives result in an acceptable level of quality and safety, and
- That their use is authorized by the Director of the Office of Nuclear Reactors Regulation.

ASME Section III – Rules of Construction of Nuclear Facility Components: NRC Endorsement

Regulation Guide 1.84 "Design, Fabrication, and Materials **Code Case Acceptability**, ASME Section III" endorses ASME Section III indicating that this standard:

- Is **used globally**, and ASME Code symbols are universally recognized
- Will see applications at foreign vendor facilities
- Contains **rules for construction** of nuclear facility components (reactor vessel, steam generator, nuclear steam piping (NSSS)
- Provides for **special welding requirements** and qualification of welders
- Provides for NDE
- Very important to understand the **interfaces with the qualified nuclear inspectors** (ANI) **authorized nuclear inspector supervisor** (ANIS)



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REGULATORY GUIDE

OFFICE OF NUCLEAR REGULATORY RESEARCH

REGULATORY GUIDE 1.84

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DESIGN, FABRICATION, AND MATERIALS CODE CASE ACCEPTABILITY, ASME SECTION III

A. INTRODUCTION

General Design Criterion (GDC) 1, "Quality Standards and Records," of Appendix A, "General Design Criteria for Nuclear Power Plants," to Title 10, Part 50, of the *Code of Federal Regulations* (10 CFR Part 50), "Domestic Licensing of Production and Utilization Facilities" (Ref. 1), requires, in part, that structures, systems, and components important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed. Where generally recognized codes and standards are used, Criterion 1 requires that they be identified and evaluated to determine their applicability, adequacy, and sufficiency and be supplemented or modified as necessary to ensure a quality product in keeping with the required safety function.

Criterion 30, "Quality of Reactor Coolant Pressure Boundary," of Appendix A to 10 CFR Part 50 requires, in part, that components that are part of the reactor coolant pressure boundary be designed, fabricated, erected, and tested to the highest practical quality standards.

Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Processing Plants," to 10 CFR Part 50 requires, in part, that measures be established for the control of special processing of materials and that proper testing be performed.

The U.S. Nuclear Regulatory Commission (NRC) issues regulatory guides to describe and make available to the public methods that the NRC staff considers acceptable for use in implementing specific parts of the agency's regulations, techniques that the staff uses in evaluating specific problems or postulated accidents, and data that the staff needs in reviewing applications for permits and licenses. Regulatory guides are not substitutes for regulations, and compliance with them is not required. Methods and solutions that differ from those set forth in regulatory guides will be deemed acceptable if they provide a basis for the findings required for the issuance or continuance of a permit or license by the Commission.

This guide was issued after consideration of comments received from the public.

Regulatory guides are issued in 10 broad divisions: 1. Power Reactors; 2. Research and Test Reactors; 3. Fuels and Materials Facilities; 4. Environmental and Siting; 5. Materials and Plant Protection; 6. Products; 7. Transportation; 8. Occupational Health; 9. Antitrust and Financial Review; and 10. General.

Electronic copies of this guide and other recently issued guides are available through the NRC's public Web site under the Regulatory Guides document collection of the NRC's Electronic Reading Room at http://www.nrc.gov/reading-rm/doc-collections/ and through the NRC's Agencywide Documents Access and Management System (ADAMS) at http://www.nrc.gov/reading-rm/adams.html, under Accession No. ML073270407.

ASME Section III – Rules of Construction of Nuclear Facility Components: Scope

Section III of ASME B&PV Code **governs the activities of nuclear power plant construction/life extension**, including:

- **NCA-1000**: Scope of Section III
- **NCA-2000**: Classification of Nuclear Items
- **NCA-3000**:
  - Responsibilities of Owner and "N" Certificate Holder
  - Design Specifications, Design Reports, Load Capacity Data Sheets, and Design Report Summaries
- **NCA-3800:** Metallic Material Organization's Quality System Programs
  - NCA 3800 is a quality management process that ensures certified suppliers follow strict quality standards during production of pipe for nuclear uses. NCA 3800 requirements result in a comprehensive traceable report on processes and testing.
- **NCA-4000** and **NQA-1-1994**: Quality Assurance Programs
- **NCA-5000** and **QAI-1**: AIA, ANIS, and ANI Responsibilities and Duties

ASME Section III – Rules of Construction of Nuclear Facility Components: Scope cont'd

Section III of ASME B&PV Code governs the activities of nuclear power plant construction/life extension, including (cont'd):

- **NCA-8000**: Stamping and Data Reports
- **NX-2000**, **NX-2400**, **NX-4300**, and **NX-4400**: Welding Requirements
- **NX-2000**: Nondestructive Examination (NDE) Requirements
- **NX-2300** and **NX-4335**: Impact Testing
- **NX-5500** and **SNT-TC-1A**: NDE Personnel Qualifications
- **NX-6000**: Pressure Tests
- Fundamentals of radiographic testing (RT) and RT Film Review
- Fundamentals of ultrasonic testing (UT)
- **Section II, Division 2:** Primary Containment
- **Section III, Division 3**: Containment Systems for Storage and Transport Packagings of Spent Nuclear Fuel and High-Level Radioactive Material and Waste

ASME Section III – Rules of Construction of Nuclear Facility Components: Highlights, NC-1000

ASME SECTION III **NC-1000 scope**:

- Contains rules for the:
  - material,
  - design,
  - fabrication,
  - examination,
  - testing,
  - overpressure,
  - relief,
  - marking,
  - stamping, and
  - preparation of reports by the Certificate Holder for items which are intended to conform to the requirements for class 2 construction
- Covers strength and pressure integrity
- NCA 1100 Covers New Construction

ASME Section III – Rules of Construction of Nuclear Facility Components: Highlights, NCA General

ASME SECTION III **NCA 3850** covers Quality System (QS) Program Requirements:

- **NCA/WA-3851.1** - General
  - The Material Organization establishes QS Program for control of quality and traceability of material.
  - The Program includes technical aspects and planning for accomplishment of activities affecting quality.

ASME Section III – Rules of Construction of Nuclear Facility Components: Highlights, NCA Scope and Applicability

The **NCA/WA-3851.2 Scope and Applicability** portion references the following

- Quality Manual defines specific activities included in the scope of work proposed to perform:
  - **Operations**
    - Performed during melting and heat analysis
    - Affecting mechanical properties, conversion of product forms including dimension and certification requirements
  - **Testing, examination, repair or treatments** required by the material specification and certification of the results.
  - **Receipt, Identification, verification, handling, storage, and shipment** of material or source material.
  - Qualification of Material Organization (NCA/WA-3820(b)).
  - **Approval and control of suppliers** of source material or subcontracted services (NCA/WA-3855.3).
  - Use of unqualified source material. (NCA/WA-3855.5)
- Measures to comply with requirements of NCA/WA-3800, to assure compliance with the material requirements of Section III

ASME Section III – Rules of Construction of Nuclear Facility Components: Highlights, NCA Identification of Completed Material

NCA/WA-3856.3 Identification of Completed Material details the following:

- The identification of completed material by **marking the material with the specification and grade of material, the heat number or heat code, and additional marking** required by the applicable Division(s) 1, 2, and/or 3 to facilitate traceability to reports of the results of all tests and examinations.
- A marking symbol or code may be used, provided such code or symbol is explained in the Certified Material Test Report. (NCA/WA-3862.1)

ASME Section III – Rules of Construction of Nuclear Facility Components: Highlights, NCA Welding

NCA/WA-3857.3 Welding elaborates on the following:

- Welding repair of material or source material must be performed in accordance with procedures and by welders or welding operators qualified in accordance with the applicable Division(s) 1, 2, and/or 3 and Section IX.

ASME Section III – Rules of Construction of Nuclear Facility Components: Highlights, NCA Certification Requirements for Material Organizations

NCA/WA-3861 Certification Requirements for Material Organizations provides the following guidance:

The Material Organization whose scope of activities includes NCA/WA-3830 provide a **Certified Material Test Report** (CMTR) or Certificate of Compliance (COC).

- The **certification affirms** that:
  - The **contents of the report are correct and accurate**, and
  - That all test results and operations performed by the Material Organization or its subcontractors are **in compliance with the material specification**

- The **Material Organization must**:
  - Transmit all certifications received from Material Organizations, or approved suppliers, to the purchaser at time of shipment.

- The **Certificate Holder must:**
  - Complete operations not completed by the Material Organization
  - Provide a CMTR for all operations performed by him or his approved suppliers
  - Certify the contents of the report are correct and accurate and test results and operations performed are incompliance with the requirements.

ASME Section III – Rules of Construction of Nuclear Facility Components: Highlights, NCA Certification Requirements for Material Organizations cont'd

Guidance regarding **nuclear valves and piping** includes the following:

- **Nuclear valve and piping manufacturers are accredited to the ASME 'N' code stamp** in accordance with the rules and requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section III, Division I, Nuclear Power Plant Components, and addenda, including referenced codes and standards.
  - ASME Section III Class 1, 2 and 3 nuclear valves to comply with subsections NB, NC and ND respectively – Subsection ND defines the requirements for Class 3 valves, NC for Class 2 valves and B for Class 1 valves - the most stringent.
- The **'N' code symbol stamp** is issued by ASME for qualified and approved manufacturers to identify line valves which the manufacturer certifies to have been **manufactured in compliance with the Code**.
- Advantages of an ASME Certification include:
  - Authorization of manufacturing of Stamped Items
  - Publication in the ASME register of Authorized Manufacturer Competence in using the ASME Code
  - Extensive responsibility as ASME Manufacturer
  - Certified ASME Quality Assurance System
- Verified by Authorized Nuclear Inspector (ANI)

ASME Section III – Rules of Construction of Nuclear Facility Components: Highlights, NCA Qualification of Testing of Valves, etc.

The **qualification of testing of valves, tanks**, etc section indicates the following:

- **Valves and spare parts** essential in preventing the significant release of radioactive material into the environment or essential to maintaining the integrity of the containment requires nuclear qualification **must be tested**
- **Qualification Testing provides additional documentation** to confirm that the equipment will perform its essential function under worst-case environmental and seismic conditions, as well as under normal operating conditions
- **Environmental and seismic conditions** that may be considered include radiation exposure, service life aging, operational cycling, seismic aging and seismic design basis earthquake, and a design basis accident.
- **Actual testing** to verify continued performance of the safety-related function **may be required**. Nuclear Qualification Testing involves the substantiation of a valve's ability to operate under extended normal and adverse conditions by Type Testing
- **Testing is witnessed and approved** by licensee or their representative, vendor QA, and sometimes an ANI.

ASME Section III – Rules of Construction of Nuclear Facility Components: Highlights, NCA Quality Control Considerations

Quality control considerations include the following guidance:

- Quality control is **implemented through a comprehensive set of procedures and instructions** using a quality manual that satisfies the requirements of NCA-3800, or NQA-1 (depending on contractual requirements)
- **Quality is assured through**:
  - Comprehensive, approved and audited controls
  - Witnessed testing at all levels of production
  - Stringent definition and traceability of raw materials, manufacturing process control and procedures
  - Approved non-destructive testing procedures
  - Witnessed testing
  - Special testing
  - Approved and witnessed cleaning procedures of finished valves, prior to witnessed packing and dispatch

ASME Section III – Rules of Construction of Nuclear Facility Components: Highlights, NCA 3800, Metallic Materials Organizations

The **basic requirements of NCA-3800 Metallic Materials Organizations** are:

- Document Quality System Program (QSP)
- Obtain **Certificate of Accreditation** (or alternatively, be qualified by each organization that buys material)
- Quality System Certificate (QSC) Holder **subject to two unannounced audits** between renewal surveys
- **Changes to manual must be approved** by ASME before they are implemented

ASME Section III – Rules of Construction of Nuclear Facility Components: Highlights, NCA 4000, QA Requirements

The **NCA-4000 Quality Assurance** background and requirements include:

- QA Program Required for all organizations
- 10 CFR 50, Appendix B required QA in 1970
- NQA-1-1994 approved by Code in the winter 1982 addenda
- Previous accepted edition Is NQA-1-1994

ASME Section VIII – Pressure Vessels: Overview

ASME SECTION VIII applies to **pressure vessels and components** that are **not used in nuclear safety-related applications**.

- Provides requirements applicable to the:
  - Design
  - Fabrication
  - Inspection
  - Testing, and
  - Certification of pressure vessels operating at either internal or external pressures exceeding 15 psig.
- **Such vessels may be fired or unfired**. Specific requirements apply to several classes of material used in pressure vessel construction, and also to fabrication methods such as welding, forging and brazing
  - This pressure may be obtained from an external source, a process reaction, by the application of heat from a direct or indirect source, or any combination thereof.
  - Division 3 rules cover **vessels intended for a specific service** and installed in a fixed location or relocated from work site to work site between pressurizations. The operation and maintenance control is retained during the useful life of the vessel by the user who prepares or causes to be prepared the design specifications.
  - Contains **mandatory and non-mandatory appendices** detailing supplementary design criteria, nondestructive examination and inspection acceptance standards. Rules pertaining to the **use of the U, UN and UV Code** symbol stamps are also included.

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ASME Section VIII – Pressure Vessels: Overview

ASME Section VIII is organized into **three divisions**:

- Division 1 –Basic Pressure Vessels (Maintenance/Enhancements)
- Division 2 –Engineered Pressure Vessels (New Code)
- Division 3 –High Pressure Vessels (Maintenance/Enhancements

Objective 2: Understand the N-Stamp holder requirements and roles of ASME inspector

ASME N Stamp – Overview

Utilization of the ASME Code Symbol Stamp is a means of complying with the laws and regulations in all 50 U.S. states.

ASME certifies compliance with various N Stamps:

- **N:** Nuclear vessels, pumps, valves, piping systems, storage tanks, core support structures, concrete containments, and transport packaging
- **NA:** Field installation and shop assembly
- **NPT:** Fabrication, with or without design responsibility, for nuclear appurtenances and supports
- **NS:** Nuclear supports
- **NV:** Pressure relief valves
- **N3:** Containment for spent fuel and radioactive waste

ASME N Stamp – ASME N-Stamp Inspectors

Several key aspects to note regarding **ASME N-Stamps and Inspectors**:

- Licensees may face a **challenge in finding qualified suppliers** that are also ASME N-stamp holders.
- Some past suppliers of ASME Code parts and materials are **no longer committed to a quality assurance program** that meets 10 CFR 50, Appendix B, while others have dropped their N-stamp certification.
- Some vendors are willing to furnish ASME Code items to **only the most current Code edition and addenda**.
- Licensees must **resolve issues in a timely and cost-efficient manner** to ensure that the right items are furnished to maintenance organizations when needed.
- Once a Code **stamp is applied**, provisions of the **Code have been satisfied**.

What are options with regards to finding ASME N-stamp holders?

Module 6 Review

For the Module 6 Review, we will conduct a matching activity.

Match each criteria on the left with a corresponding detail on the right. (Hint: There is one extra detail on the right-hand side than there are criteria on the left.)

Each participant will:

- Partner with 1-2 other participant(s)
- Using PowerPoint slides 173-193, match each criterion with the appropriate corresponding detail
- Once you have completed the exercise, let the instructor know.
- The class will then review the correct answers together.

Module 6: Summary

In this section, we have covered:

1. ASME Section III
2. ASME Section VIII
3. ASME NCA requirements
4. ASME N-stamp use

Module 6 - Activity 1: Amazing Race

For this activity, each team will be provided the same task to complete. Upon successful completion of a task, the team will be provided with their next task. READ TASK INSTRUCTIONS CAREFULLY!

The winning team will be the one that has successfully completed all tasks within the race.

Some useful terminology:

A **DETOUR** is a choice between two tasks, each with pros and cons.

A **ROADBLOCK** is a task in which only one member of the Team may participate; non-participants must wait for the participant to accomplish the goal and cannot assist.

This race has a **YIELD** point. Teams must stop at the YIELD to do two things before continuing along the course:

1) They must check to see if they have been YIELDed by another team;

2) If no Team has been YIELDed, they must decide whether to use the YIELD or not. If a Team is YIELDed, they must wait until 2 minutes has elapsed out before they may continue with the race.