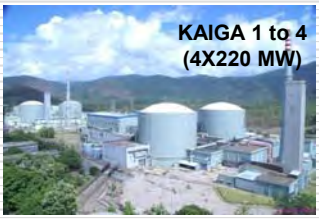
Nuclear Power Corporation of India Ltd.

- Formed on September 17, 1987 as a PSE of DAE
- Fully owned by the Government of India
- AAA rated, Profit making, dividend paying company
- Assets (31st March 2018) : Rs. 73,222 crore

Core competence in PHWR technology

NUCLEAR POWER CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

Operating PHWRs in India



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PHWR projects under construction

PHWR projects sanctioned

- KAIGA-5&6
- Gorakhpur Haryana Anu Vidyut Pariyojana-3&4 (GHAVP-3&4)
- Chutka Madhya Pradesh Atomic Power Project-1&2 (CMPAPP-1&2)
- Mahi Banswara Rajasthan Atomic Power Project-1 to 4 (MBRAPP-1 to 4)

700 MWe PHWRs in FLEET Mode

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Nuclear Power Plants in India (NPCIL)

	TOTAL		PHWRs	
	Nos.	Capacity (MWe)	Nos.	Capacity (MWe)
Operating	22*	6780	18	4460
Projects under construction	8	6200	6	4200
Projects sanctioned	12	9000	10	7000

* *RAPS-1 (100 MWe) reactor owned by DAE*

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Continuous Commercial Operation of Nuclear Power Plants- Worldwide						
Rank	Name of Reactor	Country	Type of Reactor	Continuous days of Operation	From	To
1.	KGS -1	India	PHWR	962 Days	13-05-2016	31-12-2018
2.	Heysham II-8	UK	AGR	940 Days	18-02-2014	15-09-2016
3.	Pickering-7 (Ontario)	Canada	PHWR	894 Days	26-04-1992	07-10-1994
4.	Torness-1	Scotland	AGR	859 Days	17-07-2014	22-11-2016
5.	Torness-2	Scotland	AGR	825 Days	04-08-1997	07-11-1999
6.	RAPS-3	India	PHWR	777 Days	28-08-2016	14-10-2018
7.	RAPS-5	India	PHWR	765 Days	02-08-2012	06-09-2014

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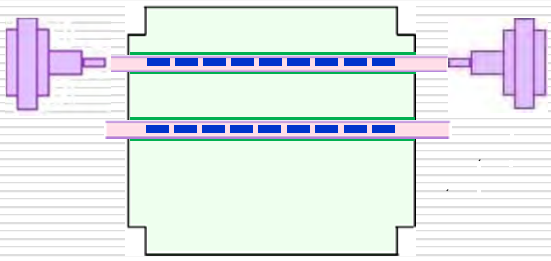
Pressurised Heavy Water Reactor (PHWR) Technology

Conceptual Development

- Making a power reactor with natural uranium- best fissile utilisation per ton of mined uranium
- Heavy water moderator
- Channel type reactor
- Continuous bi-directional fuelling
- Versatility for use of different fuel cycle



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Fuel Bundle
NUCLEAR POWER CORPORATION OF INDIA LIMITED
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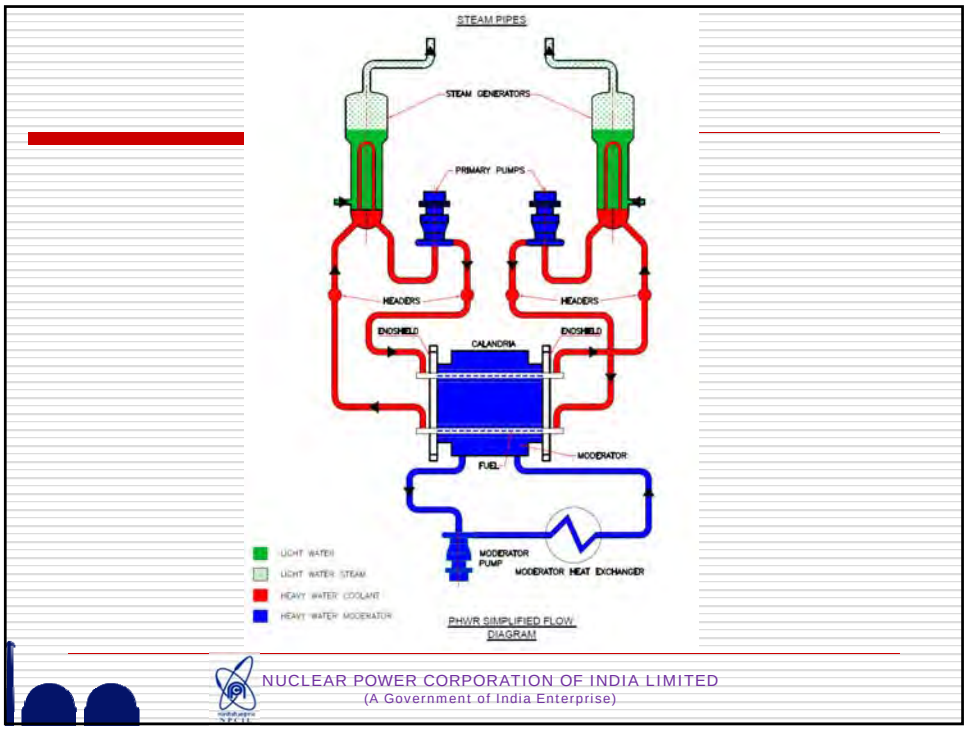
STEAM PIPES
STEAM GENERATORS
PRIMARY PUMPS
HEADERS
HEADERS
ENDSHIELD
ENDSHIELD
CALANDRIA
MODERATOR
FUEL
MODERATOR PUMP
MODERATOR HEAT EXCHANGER
LIGHT WATER
LIGHT WATER STEAM
HEAVY WATER COOLANT
HEAVY WATER MODERATOR
PHWR SIMPLIFIED FLOW DIAGRAM
NUCLEAR POWER CORPORATION OF INDIA LIMITED
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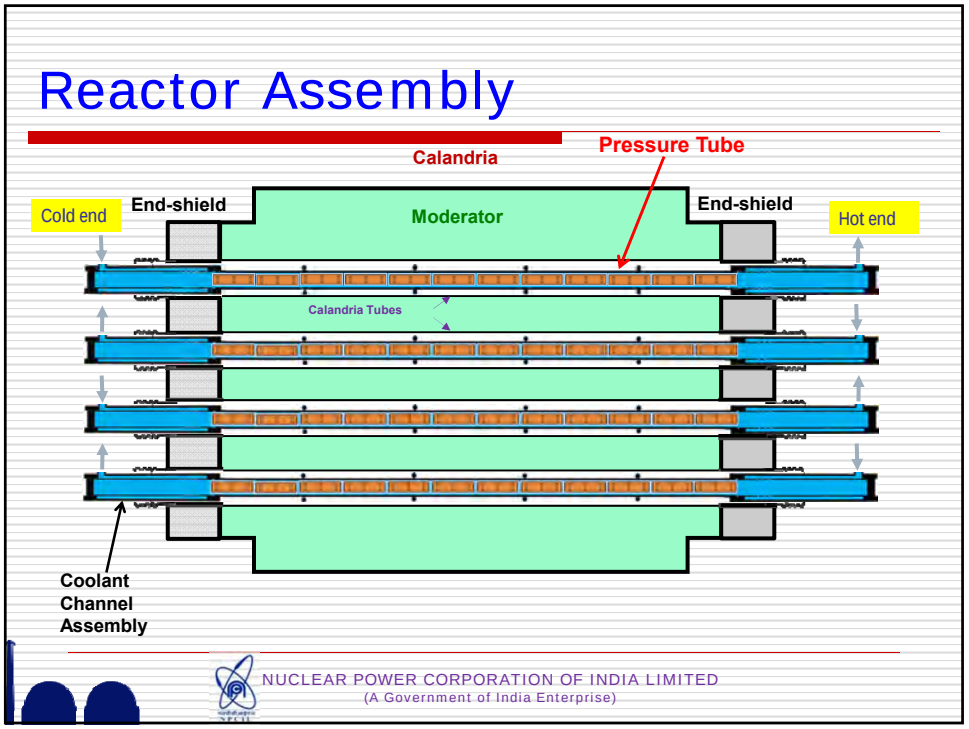
Reactor Assembly
Calandria
Pressure Tube
Cold end
End-shield
Moderator
End-shield
Hot end
Calandria Tubes
Coolant
Channel
Assembly
NUCLEAR POWER CORPORATION OF INDIA LIMITED
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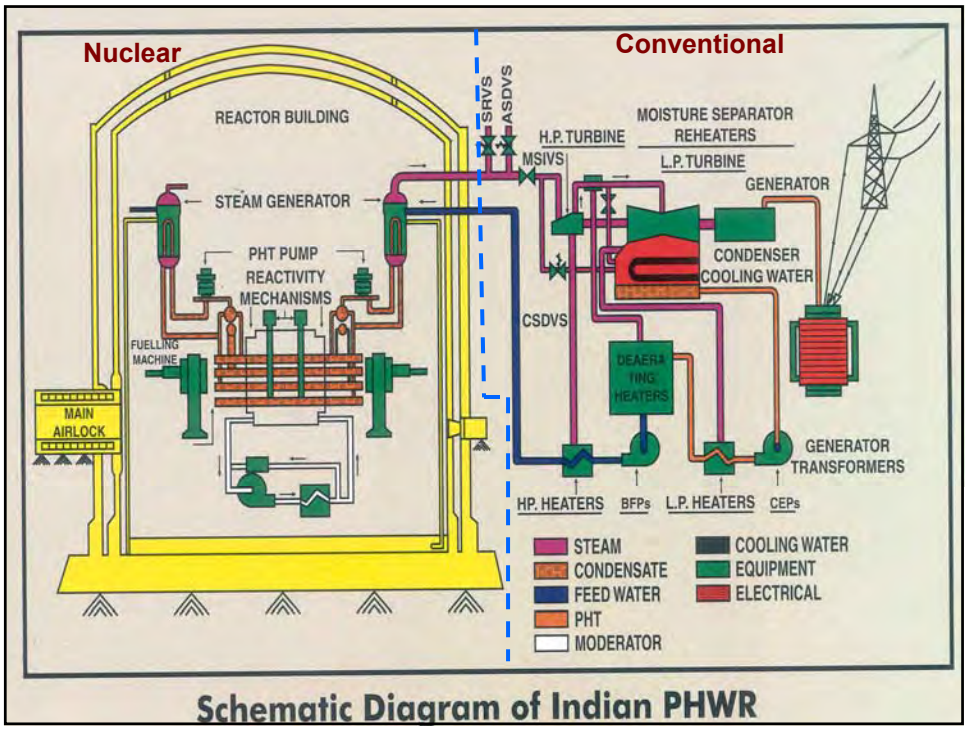
Nuclear
Conventional
REACTOR BUILDING
STEAM GENERATOR
PHT PUMP
REACTIVITY
MECHANISMS
FUELLING
MACHINE
MAIN
AIRLOCK
SRVS
ASDVS
MSIVS
H.P. TURBINE
MOISTURE SEPARATOR
REHEATERS
L.P. TURBINE
GENERATOR
CONDENSER
COOLING WATER
CSDVS
DEAERATING
HEATERS
GENERATOR
TRANSFORMERS
HP. HEATERS
BFPs
L.P. HEATERS
CEPs
STEAM
CONDENSATE
FEED WATER
PHT
MODERATOR
COOLING WATER
EQUIPMENT
ELECTRICAL
Schematic Diagram of Indian PHWR

Indian PHWRs

- 220 MWe
  - Evolution of Technology
  - Standardisation
- 540 MWe
  - Scaling up
  - First of a kind systems
- 700 MWe
  - First of a kind systems
  - Integrated Engineering Environment

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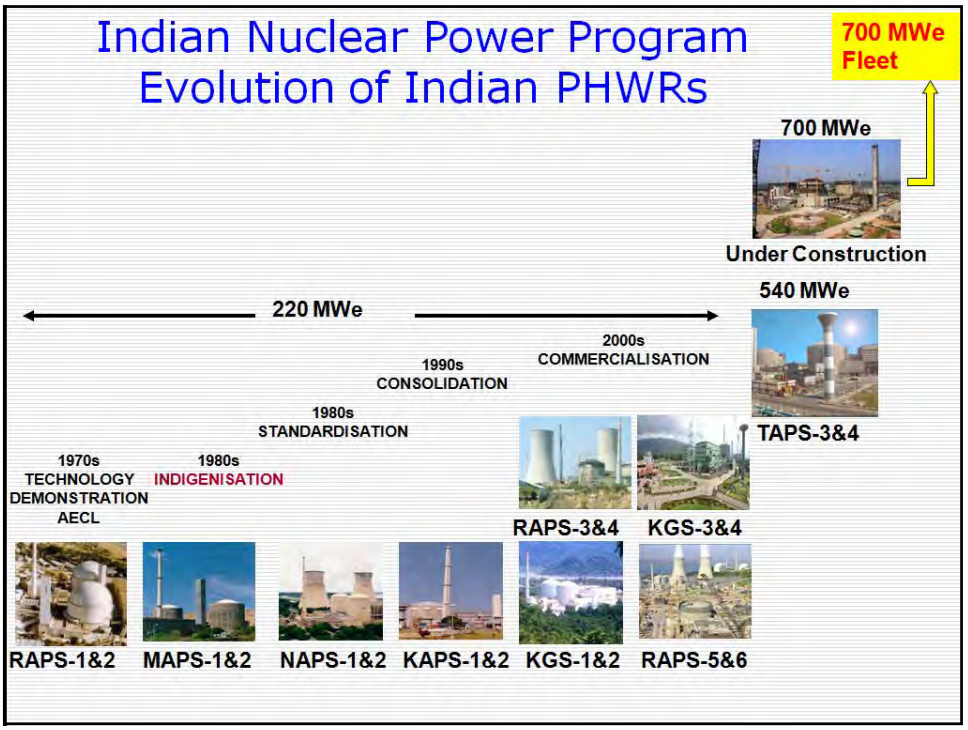
Indian Nuclear Power Program
Evolution of Indian PHWRs



PHWRs - Evolution to maturity

- Design & Analysis capabilities
  - Reactor Core
  - Process systems
  - Structural & Seismic
  - Control & Instrumentation …….
- Research & Development
- Operational feedback
- Indigenous industrial capability
- Development of codes & guides (Design & Regulatory)
- International development & experience sharing

→ ***Mastery of PHWR Technology***

Defence-in-Depth

- **Level 1** – Prevent deviation from normal operation
  [Conservative design, high quality const. & opn.]
- **Level 2** – Detect and intercept deviations from normal operational states to prevent AOOs from escalating to accident conditions
  [Control, limiting & protection system, other surveillance features]
- **Level 3** – Control accidents within the design basis
  [Engineered Safety Features, maintaining at least one barrier for confinement, accident procedures]
- **Level 4** – Prevention of core melt **(additional safety features)**
  Mitigation of core melt **(Complementary measures)**
- **Level 5** – Mitigate radiological consequences
  [on-site and off-site emergency response]

DiD Level-1

Level 1 – Prevent deviation from normal operation.

- Design
- Material
- Manufacture
- Construction
- Operation

Requirements for NPP Components

Requirements for NPP components are formulated to ensure a robust DiD Level-1

Graded approach based on safety functions

Requirements for a component

- Probability that the function will be required
- Probability that the function would not be achieved, when required
- Consequences of failure of the required function

Product of these factors must be acceptably low.

Safety Classification

- **Safety Class 1**

  The SSCs required to perform the safety functions necessary to prevent the release of a substantial fraction of core fission product inventory to the containment/environment are classified as safety class 1.

- **Safety Class 2**

  The SSCs that perform the safety function necessary to mitigate the consequences of an accident which would otherwise lead to release of substantial fraction of the core fission product inventory or activation product inventory into the environment are classified as safety class 2.

Safety Classification

- **Safety Class 3**

  SSCs required to perform a support role to safety functions in safety classes 1 and 2 are classified as safety class 3.

- **Safety Class 4**

  The SSCs which incorporate safety functions that do not fall within safety classes 1, 2 or 3.

Ref. AERB/NPP-PHWR/SG/D-1

Typical List of Codes for Mechanical Structures, Systems And Components

SL. NO.	DESCRIPTION	CODE
1	Safety Class-1	**ASME Section III NB**
2	Safety Class-2	**ASME Section III NC**
3	Safety Class-3	**ASME Section III ND**
4	Safety Class 1,2,3 (Equipment, valves, piping) supports	**ASME Section III NF**
5	Containment sealing bellows, embedded parts	**ASME Section III NE**
6	Safety Class-4 (Safety Pressure vessels)	**ASME Section VIII, DIV.-1**
7	Safety Class-4 (piping)	**B 31.1**

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Major Equipment

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Design & Safety

POSTULATED INITIATING EVENT (PIE) → NPP → NPP RESPONSE TO PIE → SAFETY FUNCTION → NO IMPACT ON PUBLIC DOMAIN

1. ROBUST DESIGN
2. DEFENSE-IN-DEPTH
3. QUALITY IN MANUFACTURE & CONSTRUCTION
4. GOOD OPERATION
5. SAFETY CULTURE

SAFETY ANALYSIS

1. REACTIVITY CONTROL
2. CORE COOLING
3. CONFINEMENT

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Standardisation of Design

- 700 MWe design is being standardised for the fleet mode
- Focus on
  - Time (Schedules)
  - Cost (Unit energy cost)
- 3D engineering having seamless interface with analysis tools

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Standardisation of Design

- Nuclear island is a standard block, qualification required for site specific seismic input
- Turbine island is vendor specific, standardisation possible
- Site specific engineering needs to be done

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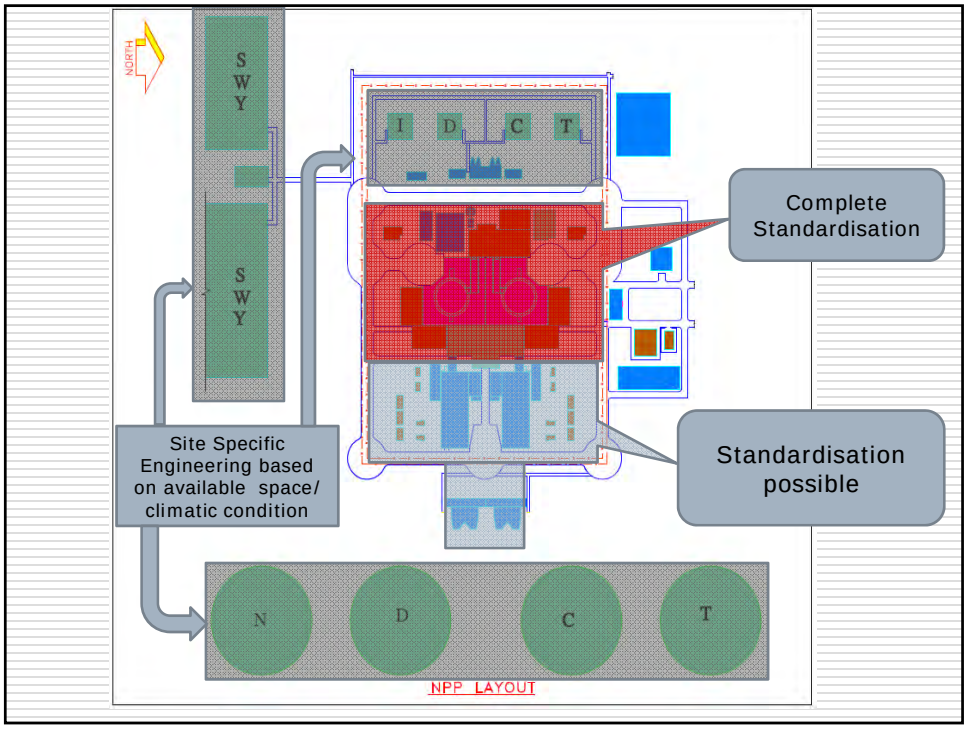
NORTH
SWY
SWY
I
D
C
T
Complete Standardisation
Site Specific Engineering based on available space/ climatic condition
Standardisation possible
N
D
C
T
NPP LAYOUT


Thank You
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Overview of ASME Section III and Updates to the Standard (Section III)

Edward (Ed) L. Pleins
BPV IIII I-IWG Liaison
Westinghouse Electric Company LLC, Inc.

Mumbai, India
January 5, 2019

Overview

I. ASME Boiler and Pressure Vessel Code Overview
II. ASME Section III Codes and Standards
III. ASME Section III Subsection NCA and Division 1 Overview
IV. 2017 / 2019 Editions – Section III Major Revisions

Objective Summary

ASME Code:
Is **Dynamic** – evolves and changes to reflect industry needs executed through a consensus process

Is **Comprehensive** - provides rules for materials, design, fabrication, examination, inspection, testing, certification, and pressure relief

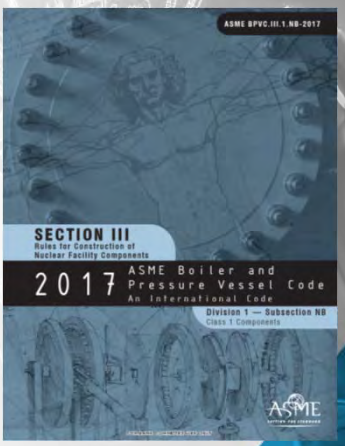
> *Construction (as used in Division 1).* An all-inclusive term comprising materials, design, fabrication, examination, testing, inspection, and certification required in the manufacture and installation of an item.

Is **Integrated** – materials, design, fabrication, inspection and testing rules are integrated – a change in one area may require a change in another

I. ASME Boiler and Pressure Vessel Code Overview

ASME Boiler Pressure Vessel Code (BPVC)

- ASME BPVC establishes rules of safety relating only to **pressure integrity**, which governs the **construction** of boilers, pressure vessels, transport tanks, nuclear components **and their supports**.



Boiler and Pressure Vessel Code

Section I	Power Boilers
Section II	Materials
Section III	Rules for Construction of Nuclear Facility Components (Presentation Focus)
Section IV	Heating Boilers
Section V	Nondestructive Examination
Section VI	Recommended Rules for the Care and Operation of Heating Boilers
Section VII	Recommended Guidelines for the Care of Power Boilers

Boiler and Pressure Vessel Code

Section VIII	Pressure Vessels
Section IX	Welding and Brazing Qualifications
Section X	Fiber-Reinforced Plastic Pressure Vessels
Section XI	Rules for Inservice Inspection of Nuclear Power Plant Components (Yesterday)
Section XII	Rules for the Construction and Continued Service of Transport Tanks
Section XIII	Over Pressure Protection (Does not address Section III)

Boiler and Pressure Vessel Code

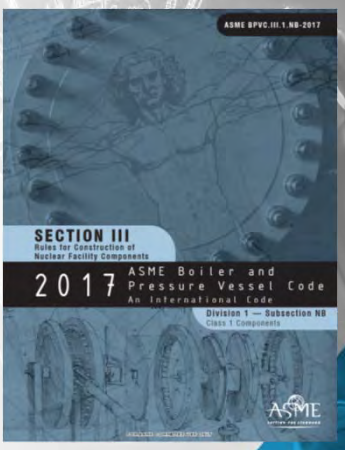
2017 Edition:
12 Sections
31 Volumes
~16,5000 pages
Updated every 2 years

II. ASME Section III Codes and Standards

ASME BPVC Section III

Rules for Construction of Nuclear Facility Components

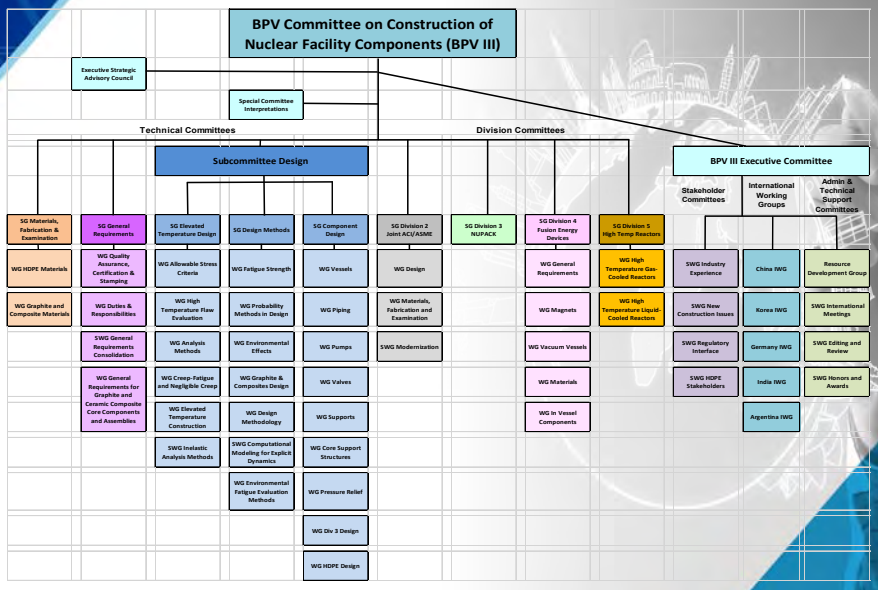
- Section III establishes rules of safety relating only to **pressure integrity**, which governs the **construction** of **components and their supports**.
- *component*: a vessel, concrete containment, pump, pressure relief valve, line valve, storage tank, piping system, or core support structure that is designed, constructed and stamped in accordance with the rules of this Section



ASME Section III Subgroups

- Subgroup on General Requirements
- Subgroup on Materials, Fabrication and Examination
- Subcommittee on Design
  - Subgroup on Component Design
  - Subgroup on Design Methods
  - Subgroup on Elevated Temperature Design
- Joint ACI-ASME Committee on Concrete
- Subgroup on Containment Systems for Spent Nuclear Fuel and High-Level Radioactive Material
- Subgroup on Fusion Energy Devices
- Subgroup on High Temperature Reactors
- Argentina International Working Group
- China International Working Group
- Germany International Working Group
- India International Working Group (IWG)
- Korea International Working Group

BPV III Committee Organization



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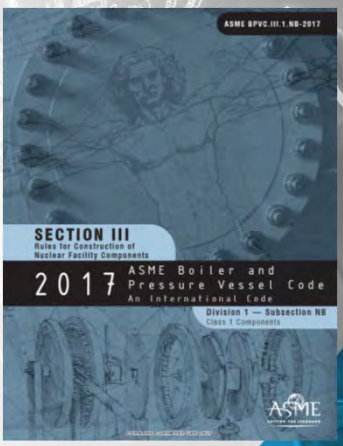
ASME BPVC Section III

Rules for Construction of Nuclear Facility Components

- **Division 1:** Metallic vessels, heat exchangers, storage tanks, piping systems, pumps, valves, core support structures, supports, and similar items. **(addressed in Part III, including Subsection NCA)**
- **Division 2**: Code for Concrete Containments
- **Division 3:** Containment Systems for Transportation and Storage of Spent Nuclear Fuel and High-Level Radioactive Material
- **Division 4:** Fusion Energy Devices
- **Division 5:** High Temperature Reactors (including gas and liquid cooled reactors)
- **Section III Appendices**



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Subsection NCA

General Requirements for Divisions 1 & 2

- Referenced by and is an integral part of Division 1, Subsections NB through NG, and Division 2 of Section III
- Covers quality assurance requirements, ASME product certification marks, and authorized inspection for Class 1, 2, 3, MC, CS, and CC construction
- Includes a Glossary which defines selected terms used in this Section.
  - The definitions in this glossary prevail should a conflict exist elsewhere in this Section or in other documents referenced in this Section.
- While Subsection NCA does not apply to Section III Divisions 3, or 5, the "General Requirements" for those divisions are based on Subsection NCA, with modifications to reflect the practices and roles of organizations that produce items within the scope of those divisions.

Section III, Division 2

Code for Concrete Containments (Subsection CC)

- Joint effort with the American Concrete Institute
  - Dual Standard, ACI-359/ASME BPVC III, Division 2
- Establishes rules for material, design, fabrication, construction, examination, testing, marking, stamping, and preparation of reports for prestressed and reinforced concrete containments.
- The containments covered by this Subsection include the following:
  - structural concrete pressure resisting shells and shell components
  - shell metallic liners
  - penetration liners extending the containment liner through the surrounding shell concrete

Section III, Division 3

Containment Systems for Transportation and Storage of Spent Nuclear Fuel and High Level Radioactive Material

Contains the requirements for construction of individual components and parts that comprise containment systems used for the transportation and/or storage of spent nuclear fuel and high-level radioactive material.

- **Subsection WA** addresses general requirements for Division 3 Containments
- **Subsection WB** addresses requirements for Transportation Containments, Class TC
- **Subsection WC** addresses requirements for Storage Containments, Class SC
- **Subsection WD (NEW)** addresses requirements for Internal Support Structures, Class ISS

Section III, Division 4

Fusion Energy Devices

- **Subsection FA — General Requirements**
  - Subpart A — Fusion Devices
  - Subpart B — Magnetic Confinement
  - Subpart C — Inertial Confinement
- **Subsection FB — Pressure Boundary Components**
  - Subpart A — Magnets
  - Subpart B — Vacuum Vessel (TBD)
  - Subpart C — Target Chamber (TBD)
- **Subsection FC — In Vessel Components (TBD)**
- **Subsection FD — Materials (TBD)**
- **Subsection FE — Support Structures (TBD)**
- **Subsection FF — Balance of Plant (TBD)**
- **Subsection FG — Appendices (TBD)**

Section III, Division 5

High Temperature Reactors

- **Subsection HA — General Requirements**
  - Subpart A — Metallic Materials
  - Subpart B — Graphite Materials
  - Subpart C — Composite Materials
- **Subsection HB — Class A Metallic Pressure Boundary Components**
  - Subpart A — Low Temperature Service (<700°F - 800°F)
  - Subpart B — Elevated Temperature Service (>700°F - 800°F)
- **Subsection HC — Class B Metallic Pressure Boundary Components**
  - Subpart A — Low Temperature Service
  - Subpart B — Elevated Temperature Service
- **Subsection HF — Class A and B Metallic Supports**
  - Subpart A — Low Temperature Service
- **Subsection HG — Class A Metallic Core Support Structures**
  - Subpart A — Low Temperature Service
  - Subpart B — Elevated Temperature Service
- **Subsection HH — Class A Nonmetallic Core Support Structures**
  - Subpart A — Graphite Materials
  - Subpart B — Composite Materials

Section III Appendices

- Mandatory and Non-mandatory appendices referenced in all divisions of Section III.
  - 20 Mandatory Appendices that provide additional **requirements** for various topics, such as:
    - Appendix I, Design Fatigue Curves
    - Appendix II, Experimental Stress Analysis
    - Appendix V, Certificate Holder Data Report Forms
    - Appendix XIII, Design Based on Stress Analysis
    - Appendix XXIII, Qualifications and Duties of Certifying Engineers Performing Certification Activities
    - Appendix XXVI, Rules for Construction of Class 3 Buried Polyethylene Pressure Piping
  - 29 Non-mandatory Appendices that provide **guidance** for topics such as:
    - Appendix B, Owner's Design Specifications
    - Appendix C, Certificate Holder's Design Report
    - Appendix G , Fracture Toughness Dynamic Analysis Methods
    - Appendix W, Environmental Effects on Components
    - Appendix Z, Interruption of Code Work

III. ASME Section III Subsection NCA and Division 1 Overview

Subsection NCA Overview

- Article NCA-1000 – Scope of Section III
- Article NCA-2000 – Classification of Components and Supports
- Article NCA-3000 – Responsibilities and Duties
- Article NCA-4000 – Quality Assurance Requirements
- Article NCA-5000 – Authorized Inspection
- Article NCA-7000 – Reference Standards
- Article NCA-8000 – Certificates, Nameplates, Certification Mark, and Data Reports
- Article NCA-9000 – Glossary

NCA-1000 – Scope of Section III

- NCA-1000 defines the rules of this Section constitute requirements for the design, construction, stamping, and overpressure protection of items used in nuclear power plants and other nuclear facilities.
- NCA-1000 provides several specific inclusions and exclusions beyond the provided scope. For example:
  - Section III requirements address consideration of mechanical and thermal stresses due to cyclic operation.
  - Environmental effects are not directly addressed, however they shall be taken into account for realizing the design or the specified life of the component.
  - The rules of this Section do not apply to instruments, or permanently sealed fluid filled tubing systems furnished with instruments, but do apply to instrument, control, and sampling piping when specified in Design Specifications.

NCA-2000 – Classification of Components and Supports

- NCA Article 2000 addresses the classification of components.
- Section III does not provide guidance for assigning a specific classification to a component.
- Instead, guidance is derived from systems safety criteria for specific types of nuclear power systems. It may also be found in engineering standards or in regulatory requirements.*
- The Owner of a nuclear power plant is responsible for applying system safety criteria to classify the equipment in the plant.
- Classification shall be included in the Design Specification.

* For example, the U.S. NRC Regulatory Guide 1.26 describes quality group classifications.

NCA-3000 – Responsibilities and Duties

- NCA Article 3000 addresses the responsibilities and duties of the various parties identified in Section III, such as:
  - Owner Responsibilities
  - Responsibilities of a Designer (Division 2)
  - Responsibilities of a N Certificate Holder (Division 2)
  - Responsibilities of a N Certificate Holder (Division 1)
  - Responsibilities of NPT, NS, and NA Certificate Holders
  - Metallic Material Organizations
  - Nonmetallic Material Manufacturers and Suppliers

Note: Roles to be discussed in Application of ASME Codes presentation

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NCA-4000 – Quality Assurance

- NCA-4000 provides requirements for N-Type Certificate Holder's Quality Assurance Programs.
  - N Type Certificate Holders shall comply with the requirements of ASME NQA-1, *Quality Assurance Requirements for Nuclear Facility Applications, Part I.*
  - These programs are intended to control the quality of Code activities and the rules for evaluating of such programs leading to the issuance of N-type Certificates.
- The Quality Assurance requirements for Material Organizations (Metallic, Non-Metallic, and Polyethylene) are **now** contained in NCA-4200, -4300 and -4400.

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NCA-5000 – Authorized Inspection

- Article NCA-5000 describes the Authorized Inspection Agency, Authorized Nuclear Inspector and Authorized Nuclear Inspector.
- The Authorized Inspection Agency (AIA) is certified by ASME in accordance with ASME QAI-1, *Qualification for Authorized Inspection*.
- As described in NCA-3000, the Owner and various N-Type Certificate Holders are required to obtain an agreement with an AIA, and NCA-5000 describes the roles and duties required in fulfillment of that agreement.
- The AIA shall notify ASME and when it enters into, or terminates, an agreement with an Owner or a Certificate Holder.
- For agreements with an Owner, the AIA shall also notify the "enforcement authority" (such as the regulatory body in the relevant jurisdiction).

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NCA-7000 – Reference Standards

Article NCA-7000 consists mainly of three tables:

- **Table NCA-7100-1** lists the Dimensional Standards, with their applicable edition year, that are referenced in Divisions 1 and 2.
- **Table NCA-7100-2** lists the Standards and Specifications, and their applicable edition year, referenced in Division 1.
- **Table NCA-7100-3** lists the Standards and Specifications, and their applicable edition year, referenced in Division 2.

Although Section III contains many references to the other Sections of the ASME Boiler and Pressure Vessel Code, those references are not included in the above tables.

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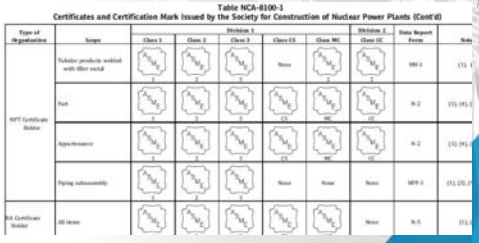
NCA-8000 – Certificates, Nameplates, Certification Mark, and Data Reports

- Article NCA-8000 describes ASME's Certification Mark, nameplates, stamping and application of the Certification Mark, Data Reports and the authorization to perform Code activities as assigned by a Certificate of Authorization.
- The Certification Mark shall not be applied until completion of the required examination and testing.
- The completed Code Data Report Form indicates that the Inspector has inspected the item and authorized the application of the Certification Mark.

Figure NCA-8212-1
Form of Stamping With Certification Mark

Table NCA-8100-1
Certificates and Certification Mark Issued by the Society for Construction of Nuclear Power Plants (Cont'd)



NCA-9000 – GLOSSARY

- Article NCA-9000 provides a glossary of terms used in Section III.

Authorized Inspection Agency: an organization that is empowered by an enforcement authority to provide inspection personnel and services as required by this Section.

Certificate Holder: an organization holding a Certificate of Authorization, Certificate of Authorization (Corporate), or Quality Assurance Program Certificate issued by the Society. This does not include the holder of a Quality System Certificate or Owner's Certificate.

component: a vessel, concrete containment, pump, pressure relief valve, line valve, storage tank, piping system, or core support structure that is designed, constructed and stamped in accordance with the rules of this Section.

Construction (as used in Division 1). An all-inclusive term comprising materials, design, fabrication, examination, testing, inspection, and certification required in the manufacture and installation of an item.

Design Specification (Division 1): a document prepared by the Owner or Owner's designee that provides a complete basis for construction in accordance with this Section

Design Report: the design document that shows that the allowable limits stated in this Section are not exceeded for the loadings specified in the Design Specification.

Owner: the organization legally responsible for the construction and/or operation of a nuclear facility including but not limited to one who has applied for, or has been granted, a construction permit or operating license by the regulatory authority having lawful jurisdiction.

Division 1

- Metallic vessels, heat exchangers, storage tanks, piping systems, pumps, valves, core support structures, supports, and similar items.
- 6 Subsections
  - **Subsection NB:** Class 1 Components
  - **Subsection NC:** Class 2 Components
  - **Subsection ND:** Class 3 Components
  - **Subsection NE:** Class MC Components
  - **Subsection NF:** Supports
  - **Subsection NG:** Core Support Structures

Division 1, Subsections NB, NC & ND

- **Subsection NB** addresses items which are intended to conform to the requirements for Class 1 construction
  - Components that are part of the primary core cooling system
- **Subsection NC** addresses items which are intended to conform to the requirements for Class 2 construction
  - Components that are part of various important-to-safety emergency core cooling systems
- **Subsection ND** addresses items which are intended to conform to the requirements for Class 3 construction
  - Components that are part of the various systems needed for plant operation

Division 1, Subsections NE, NF & NG

- **Subsection NE** addresses items which are intended to conform to the requirements for Class MC or metal containment construction
- **Subsection NF** addresses supports which are intended to conform to the requirements for Classes 1, 2, 3, and MC construction
- **Subsection NG** addresses structures which are designed to provide direct support or restraint of the core (fuel & blanket assemblies) within the reactor pressure vessel

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Structure of Section III, Division 1 Subsections

Article NX-1000: Introduction
Article NX-2000: Material
Article NX-3000: Design
Article NX-4000: Fabrication and Installation
Article NX-5000: Examination (NDE)
Article NX-6000: Testing
Article NX-7000: Overpressure Protection
Article NX-8000: Nameplates, Stamping & Reports

"X" in "NX" above = B, C, D, E, F, G

The following slides will focus on Subsection NB.

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NB-1000 – Scope of Subsection NB

- NB-1000 defines Subsection NB cover the requirements for strength and pressure integrity of items, the failure of which would violate the pressure-retaining boundary.
  - The rules cover initial construction requirements, but do not cover deterioration which may occur in service as a result of corrosion, radiation effects, or instability of material.
- NB-1000 defines the boundary of jurisdiction applicable to the this subsection.

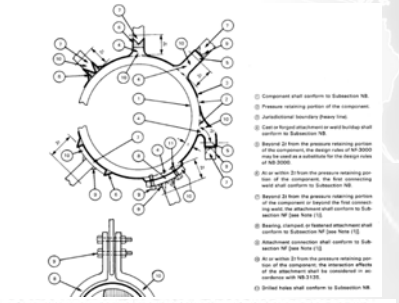

FIG. NB-1132.2-2 ATTACHMENTS THAT DO NOT PERFORM A PRESSURE-RETAINING FUNCTION AND ARE NOT IN THE COMPONENT SUPPORT LOAD PATH (NONSTRUCTURAL ATTACHMENTS)

NB-2000 – Material

- NB-2100 General Requirements for Material
  - Pressure-retaining material shall conform to the requirements of one of the specifications for material given in Section II, Part D, Subpart 1, Tables 2A and 2B, including all applicable footnotes in the table, and to all of the requirements of this Article which apply to the product form in which the material is used.
- NB-2200 Material Test Coupons and Specimens for Ferritic Steel Material
- NB-2300 Fracture Toughness Requirements for Material
- NB-2400 Welding and Brazing Material
- NB-2500 Examination and Repair of Pressure Retaining Material
- NB-2600 Material Manufacturers' Quality System Program
- NB-2700 Dimensional Standards

NB-3000 – Design

- NB-3100 General Design
  - The loadings that shall be taken into account in designing a component
- NB-3200 Design by Analysis
  - Stress Limits for Components
    - Design Condition Limits
    - Level A Service Condition Limits (Normal)
    - Level B Service Condition Limits (Upset)
    - Level C Service Condition Limits (Emergency)
    - Level D Service Condition Limits (Faulted)
- NB-3300 Vessel Design
- NB-3400 Pump Design
- NB-3500 Valve Design
- NB-3600 Piping Design

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NB-4000 – Fabrication and Installation

- NB-4100 General Requirements
  - Components, and parts, shall be fabricated and installed in accordance with the requirements of this Article and shall be manufactured from materials which meet the requirements of Article NB-2000.
- NB-4200 Forming, Fitting and Aligning
- NB-4300 Welding Qualifications
- NB-4400 Rules Governing Making, Examining and Repairing Welds
- NB-4500 Brazing
- NB-4600 Heat Treatment
- NB-4700 Mechanical Joints

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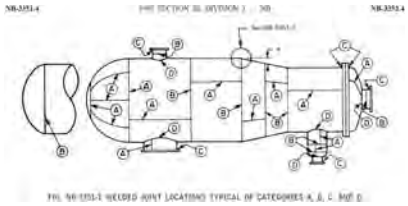
NB-5000 – Examination

- NB-5100 General Requirements for Examination
  - Nondestructive examinations shall be conducted in accordance with the examination methods of Section V, except as they may be modified by the requirements of this Article.
- NB-5200 Required Examination of Welds



- NB-5300 Acceptance Standards
- NB-5400 Final Examination of Vessels
- NB-5500 Qualifications and Certification of Nondestructive Examination Personnel

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NB-6000 – Testing

- NB-6100 General Requirements
  - All pressure-retaining components, appurtenances, and completed systems shall be pressure tested. The preferred method shall be a hydrostatic test using water as the test medium. Bolts, studs, nuts, washers, and gaskets are exempted from the pressure test.
- NB-6200 Hydrostatic Tests

NB-6220 HYDROSTATIC TEST PRESSURE REQUIREMENTS

NB-6221 Minimum Hydrostatic Test Pressure

(a) The installed system shall be hydrostatically tested at not less than 1.25 times the lowest Design Pressure of any component within the boundary protected by the overpressure protection devices which satisfy the requirements of NB-7000.

(b) Valves shall be hydrostatically tested in accordance with the rules of NB-3500.

(c) Components shall be hydrostatically tested at not less than 1.25 times their Design Pressure.

- NB-6300 Pneumatic Tests
- NB-6400 Pressure Test Gages
- NB-6600 Special Test Pressure Situations

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NB-7000 – Overpressure Protection

- NB-7100 General Requirements
  - A system shall be protected from the consequences arising from the application of conditions of pressure and coincident temperature that would cause either the Design Pressure or the Service Limits specified in the Design Specification to be exceeded.
  - Pressure relief devices are required when the operating conditions considered in the Overpressure Protection Report would cause the Service Limits specified in the Design Specification to be exceeded.
- NB-7200 Overpressure Protection Report
- NB-7300 Relieving Capacity Requirements
- NB-7400 Set Pressures of Pressure Relief Devices
- NB-7500 Operating Design Requirements for Pressure Relief Valves
- NB-7600 Requirements for Non-reclosing Pressure Relief Devices
- NB-7700 Certification Requirements
- NB-7800 Marking, Stamping and Data Reports

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IV. 2017 / 2019 Editions – Section III Major Revisions

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Section III 2017 Edition Major Revisions

Subsection NCA and Appendices:

- Revised all designations of the individual tasked with certifying design documents on behalf of the Owner and N-Certificate Holder from "Registered Professional Engineer" to "Certifying Engineer."
- Revised Appendix XXIII - Qualifications and Duties of Certifying Engineers Performing Certification Activities
  - Three available means of initial qualification for the Certifying Engineer:
    - Retained the Registered Professional Engineer credential
      - Currently permitted in Section III
    - Chartered Engineer
    - Licensed Engineer
  - Specified means for maintenance of the Certifying Engineer qualification.

Section III 2017 Edition Major Revisions (Continued)

Subsection NCA:

- Quality assurance system requirements moved to NCA-4000 without significant changes other than renumbering into NCA-4200, 4300 and 4400 that includes:
  - Part of a (ongoing) effort to consolidate General Requirements
  - Move NCA-3850 through NCA-3859.2 to NCA-4200 (Metallic Quality System Requirements)
  - Move NCA-3950 through NCA-3963 to NCA-4300 (Nonmetallic Material Manufacturer's and Constituent Supplier's Quality System Program Requirements)
  - Move NCA-3970 through NCA-3973 to NCA-4400 (Polyethylene Material Organization's Quality System Program)

Section III 2017 Edition
Major Revisions (Continued)

Section III Division 1 and Appendices:

- Appendix XIII – Design Based on Stress Analysis
  - Major rewrite to consolidate, simplify, and modernize the design based on analysis rules in Section III.
  - Incorporated much of NB-3200 (Design By Analysis) and all of Appendix XIV (Design Based on Fatigue Analysis)
    - Appendix XIV deleted as part of this effort.
- New Mandatory Appendix XXVII – Design by Analysis for Service Level D
  - Existing Non-Mandatory Appendix F was converted to a mandatory appendix, with some editorial and minor technical updates
  - Component design rules that were previously in Appendix F were moved to the corresponding subsections
  - Appendix F - Non-mandatory Appendix remained in the Code for one revision cycle, but is planned for deletion in the 2019 Edition.
  - All cross references to this Appendix, in all Division 1 Subsections, have been updated to reference Appendix XXVII.

Section III 2017 Edition
Major Revisions (Continued)

Subsection NH – Rules for Construction of Class 1 Components in Elevated Temperature Service:

- No longer to be published.
- Subsection NH content was incorporated into BPV III, Division 5, HBB (Class A Metallic Pressure Boundary Components , Elevated Temperature Service) in the 2015 Edition.
- The deletion of this subsection, which was also approved for the 2015, was delayed.

Division 3:

- New Subsection WD – Internal Support Structures, Class ISS
  - Added a new subsection to provide requirements for Internal Support Structures (Baskets) Internals to Transportation Containments (Subsection WB) and Storage Containments (Subsection WC).
  - Revisions throughout Division 3 relating to the new Subsection WD were also executed.

General:

- Endnotes
  - Throughout all Divisions and Subsections Endnotes were reviewed and in many cases incorporated into the Code body.
  - If all instances of the Endnotes were incorporated into the Code body, Endnote references were deleted from the back of the Code book.

BPVC-III-2019 – Approved Items to be Published

Total Approved Actions – 195

Code Revisions – 136*

- NCA – 19
- Division 1 – 60
- Division 2 – 16
- Division 3 – 15
- Division 4 – 0
- Division 5 – 8
- Appendices – 28

Editorial / Errata Actions – 41

New/Revised Code Cases – 18

*Note: Some revisions affect more than one subsection/division.

Major Revisions for 2019 – Subsection NCA

- Several updates to Tables NCA-7100-1, -7100-2 and 7100-3 to include new reference standards and updated editions of existing referenced standards
- Revisions to support use of "Certifying Engineers" in Appendix XXIII, which was introduced in the 2017 Edition
- Clarified requirements for the Certified Design Report Summary including adding a definition in NCA-9000
- Introduced a method to certify the design of Appurtenances and applicable revisions to Appendix V data report forms.

Major Revisions for 2019 – Division 1

- Major alignment effort for Class 2 and Class 3 components
  - Comparisons were made between corresponding paragraphs in Subsections NB and NC in order to align them in areas of divergence so that the two subsections might eventually be consolidated into one book

Major Revisions for 2019 – Division 2

- Revised requirements for the use of ASTM A615 Grades 75 and 80 and ASTM A706 Grade 80 reinforcement for containment structure construction.
- Revised code requirements for water content to align with American Concrete Institute (ACI 318)
- Added code requirements to address self compacting (consolidating) concrete
- Revised Article CC-2000, regarding prestressing materials and post-tensioning activities
- Added requirements for slip testing and acceptance criteria for mechanical reinforcing bars.

Major Revisions for 2019 – Division 3

- Revisions to WB-3252.3, WB-3252.3 (c), WB-4243 (a), WB-4243 (c) and Figure WB-4243-2 to clarify design and fabrication requirements for forged flanges with hubs to shells versus flat heads with hubs (16-2761)
- New Nonmandatory Appendix that provides guidance for developing Division 3 Design Specifications and Fabrication Specifications.
- Multiple editorial revisions for consistency

Major Revisions for 2019 – Division 4

- The proposed rules being drafted for this division for **Fusion Energy Devices** have been issued as a Draft Standard for Trial Use, FE.1-2018 as of November 30, 2018 with a 3-year comment period.
- The purpose of its issuance as a draft standard for trial use is to allow:
  - the global fusion community an opportunity to work with these proposed rules
  - provide needed input and revisions to the future development of this document as the evolution of fusion power with its new technologies and experiences continues in its development
- The draft standard is **NOT** part of the BPVC at this time.

Major Revisions for 2019 – Division 5

- Subsection HA Subpart B - General Requirements for Graphite Materials was revised to include Ceramic Composite Materials and relocate HAB-3850 to HAB-4550.
- New Subsection HH Subpart B for Class SN (formerly Class A) Nonmetallic Core Components
  - This Subpart establishes rules for Composite Core Components, where Composite Core Components are defined as components manufactured from carbon or ceramic fiber composites that are installed to form a Core Assembly within a reactor pressure vessel of a high temperature, graphite-moderated, fission reactor
- Elevated temperature allowable stress values for Grade 91 were updated and extended from 300,000hr to 500,000hr

Major Revisions for 2019 – Appendices

- Revised Mandatory Appendices II, XI, and XII and Nonmandatory Appendices L and Q to expand their use to Divisions 3 and 5 where applicable
- Revised Appendix XXVI - Rules for Construction of Class 3 Buried Polyethylene Pressure Piping - to clarify flange adapter requirements, remove redundant test requirement, resolve regulator condition, clarify data acquisition requirements, correct error in electrofusion qualification requirements.
- 2 New Nonmandatory Appendices that provides guidance for developing Division 3 and Division 5 Design Specifications and Fabrication Specifications.

Major Revisions for 2019 – Code Cases

N-879	Use of Micro-Alloyed Carbon Steel Bar in Patented Mechanical Joints and Fittings
N-881	Exempting SA-508 Grade 1A From PWHT Based on Measurement of Residual Stress in Class 1 Applications
N-883	Construction of Items Prior to the Establishment of a Section III, Division Owner
N-884	Procedure to Determine Strain Rate for Use With the Environmental Fatigue Design Curve Method and the Environmental Fatigue Correction Factor (Fen) Method as Part of an Environmental Fatigue Evaluation for Components Analyzed per the NB-3200 Rules
N-886	Use of Polyethylene Pipe for Class 3
N-887	Alternatives to the Requirements of NB-4424.2(a), Figure NB-4250-2 and Figure NB-4250-3, Section III, Division 1

Objective Summary

ASME Code:
Is **Dynamic** – evolves and changes to reflect industry needs executed through a consensus process

Is **Comprehensive** - provides rules for materials, design, fabrication, examination, inspection, testing, certification, and pressure relief

> *Construction (as used in Division 1).* An all-inclusive term comprising materials, design, fabrication, examination, testing, inspection, and certification required in the manufacture and installation of an item.

Is **Integrated** – materials, design, fabrication, inspection and testing rules are integrated – a change in one area may require a change in another

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Questions
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Application of ASME Codes in Nuclear Class 1 Component (Equipment)

Edward (Ed) L. Pleins
BPV IIII I-IWG Liaison
Westinghouse Electric Company LLC, Inc.

Mumbai, India
January 5, 2019

Overview

I. Owner / Owner Designee Overview

II. N Certificate Holder Overview

III. NA / NPT Certificate Holder Overview

IV. Metallic Material Organization Overview

V. Piping System N Certification (Stamping) Overview

Objective Summary

After completion of this course you will be able to understand and describe :

- Overview of general process Section III Division 1 steps delineating the different roles for Piping System N Certification (Stamping)
  - Owner / Owner Designee
  - N Certificate Holder
  - NPT Certificate Holder
  - NA Certificate Holder
- Authorized Inspection Agency (AIA) interface discussed as part of the application roles described above.
- Material Organization role and interface discussed as part of the roles described above.

NCA-9000 – Key Glossary Terms

Owner: the organization legally responsible for the construction and/or operation of a nuclear facility including but not limited to one who has applied for, or has been granted, a construction permit or operating license by the regulatory authority having lawful jurisdiction.

Construction (as used in Division 1). An **all-inclusive term** comprising materials, design, fabrication, examination, testing, inspection, and certification required in the manufacture and installation of an item.

Design Specification (Division 1): a document prepared by the **Owner or Owner's designee** that provides a **complete basis for construction** in accordance with this Section

Component: a vessel, concrete containment, pump, pressure relief valve, line valve, storage tank, piping system, or core support structure that is designed, constructed and stamped in accordance with the rules of this Section.

Design Report: the design document that shows that the allowable limits stated in this Section are not exceeded for the loadings specified in the Design Specification.

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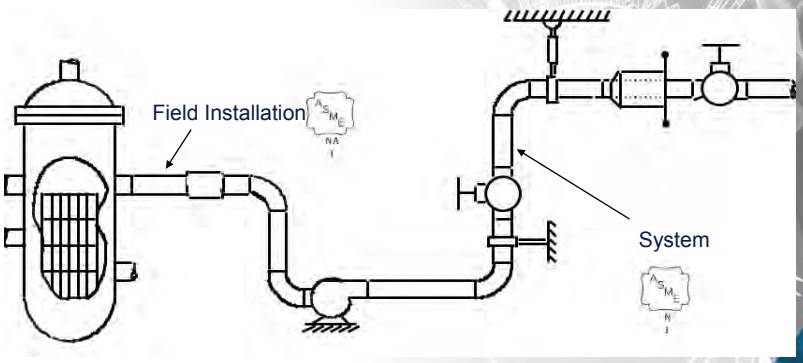
Piping System N Certification (Stamping) and Data Report Application



- Installation requires and NA Certification (Stamp) and an N-5 Data Report
- Complete piping system requires N Certification (Stamp) and an N-5 Data Report

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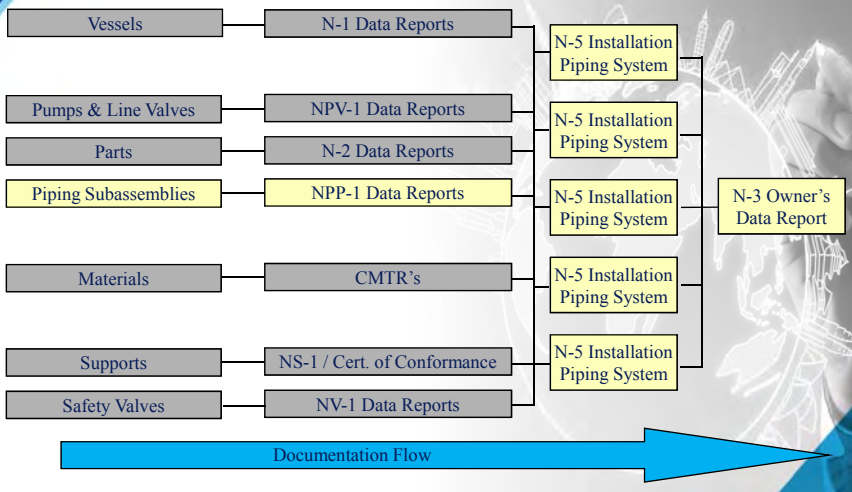
Code Documentation



Serves to indicate that each item assembled into the nuclear power plant and the installation meet the requirements of ASME Section III and the Design Specification.

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I. Owner (Owner Designee) Overview

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NCA-3220 – Owner's Responsibilities

NCA-3220 CATEGORIES OF THE OWNER'S RESPONSIBILITIES

NCA-3220 provides a list of activities which are the responsibility of the Owner, including:

- Obtaining an Owner's Certificate
- Documenting a Quality Assurance Program
- Obtaining a written agreement with an Authorized Inspection Agency (AIA)
- Filing the Overpressure Protection Report (NCA-3270) required for the nuclear power system(s)
- Certifying and filing of Owner's N-3 Data Report.

The above activities shall must be performed by the Owner (cannot be delegated to the Owner' Designee)

NCA-3220 – Owner's Responsibilities

NCA-3220 provides a list of activities which are the responsibility of the Owner, including:

- Establishing the Code Editions, Addenda, and Code Cases to be used in Design Specifications
  - o Determining that they are acceptable to the regulatory and enforcement authorities having jurisdiction at the nuclear power plant site (NCA-1140)
- Verifying through a review of the required documentation that the Code Editions, Addenda, and Code Cases used for completed components and supports, and materials satisfy NCA-1140 and are acceptable to the regulatory and enforcement authorities
- Classifying equipment (NCA-2110 and NCA-3253)
- Providing adequate structures, foundations, and auxiliary systems for the items covered by both Divisions of this Section (NCA-3240)
- Providing and correlating Design Specifications, including establishment of component and system boundaries (NCA-3252)
- Certifying Design Specifications (NCA-3255)
- Reviewing Design Reports (NCA-3260)

The above activities can be delegated to the Owner' Designee.

NCA-3220 – Owner's Responsibilities

NCA-3220 provides a list of activities which are the responsibility of the Owner, including:

- Designating the overpressure protection requirements for each component or system, including the Class of overpressure protection rules assigned to each component or system and the location of the overpressure protection devices
- Providing the Overpressure Protection Report (NCA-3270) required for the nuclear power system
- Making available to the Inspector the documents specified by this Section and those requested by the Inspector to ensure compliance with Code requirements (NCA-5242)
- Providing for the design and arrangement of components to permit accessibility in accordance with Section XI
- Designating the preservice inspection requirements [NCA-3252(c)]
- Designating records to be maintained and providing for their maintenance (NCA-3290)
- Performing other duties as defined throughout Section III

The above activities can be delegated to the Owner' Designee.

NCA-3252 – Contents of Design Specifications (Division 1)

Design Specification (Division 1): a document prepared by the **Owner or Owner's designee** that provides a **complete basis** for construction in accordance with this Section

NCA-3252 describes the information required for Division 1 Design Specification, which includes:

- Functions and boundaries of the items covered (NCA-3254)
- Design requirements [NCA-2110(a) and NCA-2110(b) and NCA-2140] including all required overpressure protection requirements [NCA-3220(m)]
- Environmental conditions, including radiation
- Code classification of the items covered (Article NCA-2000)
- Material requirements including impact test requirements
- Additional fracture mechanics data for base metal, weld metal, and heat-affected zone
- When operability of a component is a requirement, the Design Specification shall make reference to other appropriate documents that specify the operating requirements
- Effective Code Edition, Addenda, and Code Cases to be used for construction
- Identify those components and/or parts that require a preservice examination

NCA-2000 – Classification of Components and Supports

NCA-2120 PURPOSE OF CLASSIFYING ITEMS OF A NUCLEAR POWER PLANT

- NCA-2120 describes Code Classes 1, 2, 3, CS, MC, and CC.
- This classification system recognizes the different levels of importance associated with the function of each item as related to the safe operation of the nuclear power plant.
- The Code classes allow a choice of rules that provide assurance of structural integrity and quality commensurate with the relative importance assigned to individual items.

NCA-2000 – Classification of Components and Supports

NCA-2142 Establishment of Design, Service, and Test Loadings and Limits

- NCA-2142 Requires the Design, Service, and Test Loadings, and loading combinations to be identified in the Design Specification, and the appropriate Design, Service, and Test Limits must be established for each component or support.
- The Owner must consider all plant or system operating and test conditions anticipated over the intended service life of the item.

II. N Certificate Holder Overview

NCA-3000 – Responsibilities and Duties

NCA-3520 Categories of the N Certificate Holder's Responsibilities

Program responsibilities of the N Certificate Holder (Division 1) include:

- Obtaining an N Certificate (NCA-3530)
- Establishing, maintaining, and documenting a Quality Assurance Program (NCA-3560, NCA-3562)
- Filing the Quality Assurance Manual with the Authorized Inspection Agency (AIA) (NCA-3563)
- Obtaining an agreement with an AIA (NCA-8130)

NCA-3000 – Responsibilities and Duties

NCA-3520 Categories of the N Certificate Holder's Responsibilities

Responsibilities of the N Certificate Holder (Division 1) during execution of activities include:

- Compliance with this Section (NCA-3540)
- Achievement of structural integrity (NCA-3540)
- Qualification of Material Organizations and suppliers of subcontracted services (NCA-3561)
- Making available to the Inspector the documents specified by this Section and those requested by him to assure compliance with Code requirements
- Review of Certified Material Test Reports and Certificates of Compliance for materials (NCA-1220) used by him
- Preparation, accumulation, control, and protection of required records while in his custody (NCA-4134.17)
- Documentation of review and approval of material used by him as permitted by NCA-1140(e)
- Subcontracting (NCA-3125) for materials, design, fabrication, installation, examination, testing, and inspection.
- The N Certificate Holder shall retain overall responsibility, including certification and stamping

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NCA-3000 – Responsibilities and Duties

NCA-3125 Subcontracted Services

- Subcontracting of services is permitted, however activities which require certificates shall only be subcontracted to Certificate Holders.
- N Certificate Holders may subcontract stress analysis or complete design of a component, however the N Certificate Holder remains responsible for the design and for the design output documents.
- The Quality Assurance Manual shall describe the manner in which the Certificate Holder controls and accepts the responsibility for the subcontracted activities.

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NCA-3000 – Responsibilities and Duties

NCA-3520 Categories of the N Certificate Holder's Responsibilities

The N Certificate Holder (Division 1) is also responsible for providing a Design Report. Content of the Design Report includes:

- Stress analysis of parts (NCA-3552)
- Reconciliation of Design Drawing changes with Design Report (NCA-3554)
- Certification of Design Report (NCA-3555)
- Availability of Design Report and its documentation of review to Inspector (NCA-3557)
- Provision of Design Report to Owner or his designees for review, and documentation of review (NCA-3556)
- Fling at the site of installation the Design Report

NCA-3000 – Responsibilities and Duties

NCA-3555 Certification of Design Report

- NCA-3555 describes various components for which the Design Report must be certified by one or more Certifying Engineers.
- The Design Report shall be certified only after all design requirements of this Section have been met.
- Certifying Engineers shall be other than the individual certifying the Design Specification.
- The N Certificate Holder retains responsibility for the structural integrity of the component.

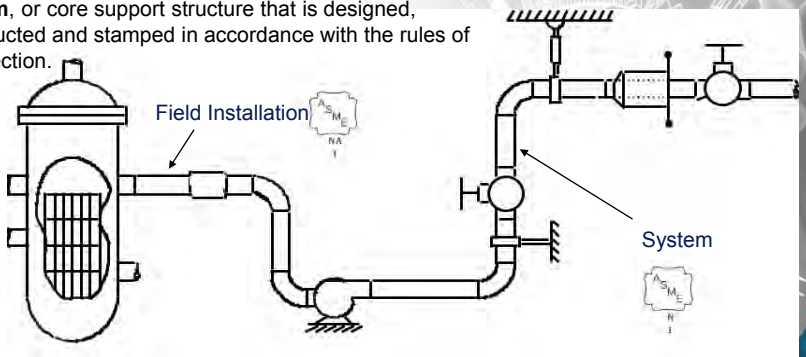
NCA-3000 – Responsibilities and Duties

NCA-3570 DATA REPORT

- The N Certificate Holder shall certify compliance with Section III by signing the appropriate Data Report, including stamping with an ASME Certification Mark with N Designator (NCA-8000)
- Further discussed in Piping System N Certification (Stamp) Overview

Piping System N Certification (Stamping) and Data Report Application

Component: a **vessel**, concrete containment, **pump**, **pressure relief valve**, **line valve**, storage tank, **piping system**, or core support structure that is designed, constructed and stamped in accordance with the rules of this Section.



- Installation requires and NA Certification (Stamp) and an N-5 Data Report
- Complete piping system requires N Certification (Stamp) and an N-5 Data Report

III. NPT / NA Certificate Holder Overview

NCA-3000 – Responsibilities and Duties

- *fabrication*: those actions required to manufacture components, parts, supports, and appurtenances. These actions may include forming, machining, assembling, welding, brazing, heat treating, examination, testing, inspection, and certification. Fabrication does not include design.
- *piping subassembly*: a section of piping system consisting of fittings and pipes or tubes that are fabricated as subassemblies in a shop or in the field before being installed in a nuclear power system.

NCA-3620 Categories of the NPT Certificate Holder's Responsibilities

Program responsibilities of the NPT Certificate Holder include:

- Obtaining an NPT Certificate (NCA-3630),
- Establishing, maintaining, and documenting a Quality Assurance Program (NCA-3660, NCA-3662)
- Filing the Quality Assurance Manual with the Authorized Inspection Agency (AIA) (NCA-3663)
- Obtaining an agreement with an Authorized Inspection Agency (NCA-8130)

NCA-3000 – Responsibilities and Duties

NCA-3620 Categories of the NPT Certificate Holder's responsibilities

Responsibilities of the NPT Certificate Holder during execution of activities include:

- Compliance with this Section (NCA-3630)
- Fabricating parts assigned to him in accordance with Design Drawings and this Section
- Qualification of Material Organizations and suppliers of subcontracted services (NCA-3661)
- Making available to the Inspector the documents specified by this Section and those requested by him to assure compliance with Code requirements
- Review of Certified Material Test Reports and Certificates of Compliance for materials (NCA-1220) used by him
- Preparation, accumulation, control, and protection of required records while in his custody (NCA-4134.17)
- Documentation of review and approval of material used by him as permitted by NCA-1140(e)

NCA-3000 – Responsibilities and Duties

NCA-3670 DATA REPORT

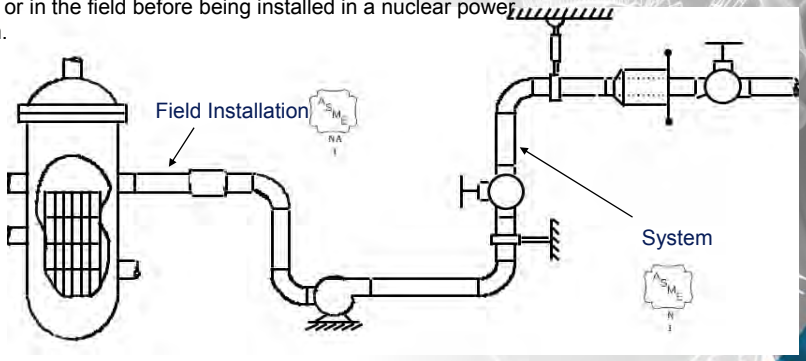
The NPT Certificate Holder shall certify compliance with Section III by signing the appropriate Data Report and applying the appropriate ASME Certification Mark with NPT Designator.

		1	2	3		2	2		
NPT Certificate Holder	Part	NPT 1	NPT 2	NPT 3	NPT CS	NPT MC	NPT CC	N-2	(1), (4), (8), (9)
	Appurtenance	NPT 1	NPT 2	NPT 3	NPT CS	NPT MC	NPT CC	N-2	(1), (4), (8), (9)
	Piping subassembly	NPT 1	NPT 2	NPT 3	None	None	None	NPP-1	(1), (3), (9), (10)

ASME BPVCIII-NCA-2017

Piping System N Certification (Stamping) and Data Report Application

piping subassembly: a section of piping system consisting of fittings and pipes or tubes that are fabricated as subassemblies in a shop or in the field before being installed in a nuclear power system.



- Installation requires and NA Certification (Stamp) and an N-5 Data Report
- Complete piping system requires N Certification (Stamp) and an N-5 Data Report

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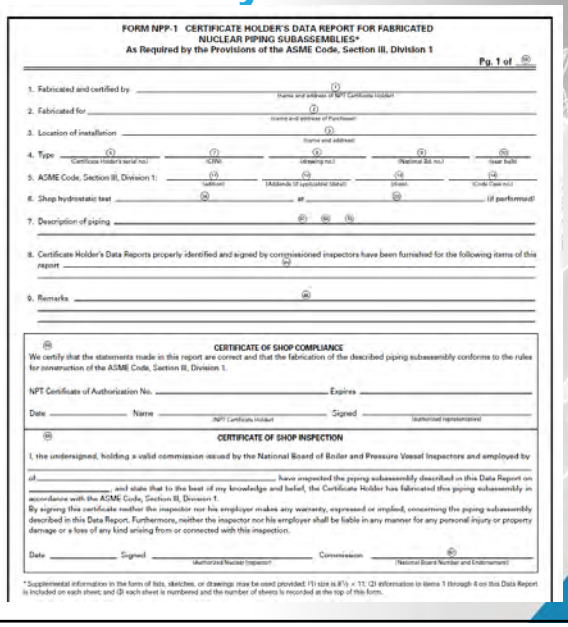
Piping Subassembly NPP-1 Data Report



FORM NPP-1 CERTIFICATE HOLDER'S DATA REPORT FOR FABRICATED NUCLEAR PIPING SUBASSEMBLIES*
As Required by the Provisions of the ASME Code, Section III, Division 1

Pg. 1 of

1. Fabricated and certified by
2. Fabricated for
3. Location of installation
4. Type
5. ASME Code, Section III, Division 1:
6. Shop hydrostatic test
7. Description of piping
8. Certificate Holder's Data Reports properly identified and signed by commissioned inspectors have been furnished for the following items of this report
9. Remarks

CERTIFICATE OF SHOP COMPLIANCE
We certify that the statements made in this report are correct and that the fabrication of the described piping subassembly conforms to the rules for construction of the ASME Code, Section III, Division 1.

NPT Certificate of Authorization No. Expires
Date Name Signed

CERTIFICATE OF SHOP INSPECTION
I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and employed by
of have inspected the piping subassembly described in this Data Report on and state that to the best of my knowledge and belief, the Certificate Holder has fabricated this piping subassembly in accordance with the ASME Code, Section III, Division 1.
By signing this certificate neither the inspector nor his employer makes any warranty, expressed or implied, concerning the piping subassembly described in this Data Report. Furthermore, neither the inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.
Date Signed Commission

* Supplemental information in the form of lists, sketches, or drawings may be used provided: (1) size is 8½ x 11; (2) information in items 1 through 6 on this Data Report is included on each sheet; and (3) each sheet is numbered and the number of sheets is recorded at the top of this form.

NCA-3000 – Responsibilities and Duties

- *installation*: those actions required to place and attach components to their supports and join items of a nuclear power system by welding or mechanical means.

NCA-3720 Categories of the NA Certificate Holder's Responsibilities

Program responsibilities of the NA Certificate Holder include:

- Obtaining an NA Certificate (NCA-3730)
- Establishing, maintaining, and documenting a Quality Assurance Program (NCA-3760, NCA-3762)
- Filing the Quality Assurance Manual (NCA-3763) with the AIA
- Obtaining an agreement with an Authorized Inspection Agency (NCA-8130)

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NCA-3000 – Responsibilities and Duties

NCA-3720 Categories of the NA Certificate Holder's responsibilities

Responsibilities of the NA Certificate Holder during execution of activities include:

- Compliance with this Section (NCA-3740)
- Qualification of Material Organizations and suppliers of subcontracted services (NCA-3761)
- Making available to the Inspector the documents specified by this Section and those requested by him to assure compliance with Code requirements
- Review of Certified Material Test Reports and Certificates of Compliance for materials (NCA-1220) used by him
- Preparation, accumulation, control, and protection of required records while in his custody (NCA-4134.17)
- Documentation of review and approval of material used by him as permitted by NCA-1140(e)

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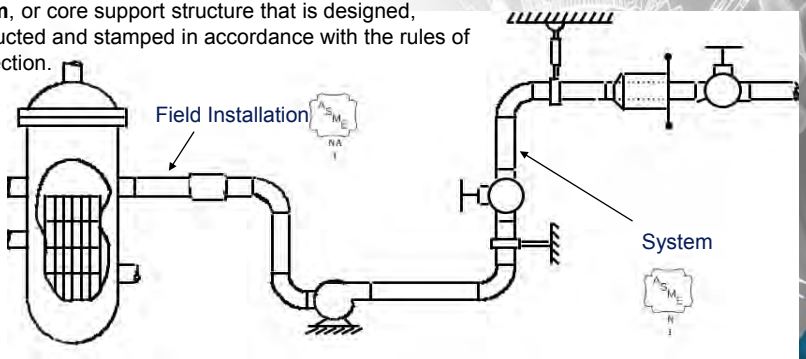
NCA-3000 – Responsibilities and Duties

NCA-3770 DATA REPORT

- The NA Certificate Holder shall certify compliance with Section III by signing the appropriate Data Report, including stamping with an ASME Certification Mark with N Designator(NCA-8000)
- Further discussed in Piping System N Certification (Stamp) Overview

Piping System N Certification (Stamping) and Data Report Application

Component: a **vessel**, concrete containment, **pump**, **pressure relief valve**, **line valve**, storage tank, **piping system**, or core support structure that is designed, constructed and stamped in accordance with the rules of this Section.



- Installation requires and NA Certification (Stamp) and an N-5 Data Report
- Complete piping system requires N Certification (Stamp) and an N-5 Data Report

IV. Metallic Material Organization Overview

NCA-3000 – Responsibilities and Duties

NCA-3800 METALLIC MATERIAL ORGANIZATION'S QUALITY SYSTEM PROGRAM

- NCA-3800 provides for the operations, processes, and services performed by Certificate Holders, Material Organizations, and approved suppliers to procure, manufacture, and supply material, source material, and unqualified source material.

NCA-3000 – Responsibilities and Duties

NCA-3820 CERTIFICATION OR QUALIFICATION OF MATERIAL ORGANIZATIONS

- Material Organizations must be certified by obtaining a Quality System Certificate (QSC) issued by ASME, verifying the adequacy of their Quality System Program.
- Alternatively, the (N-type) Certificate Holder or the certified Material Organization may qualify a Material Organization that is not certified by ASME by evaluating its Quality System Program.
- Also, a Certificate Holder may furnish material when such activity is included in the scope of its certificate.

NCA-3000 – Responsibilities and Duties

NCA-3830 RESPONSIBILITIES OF MATERIAL ORGANIZATIONS

Some of the responsibilities of a Material Organization include:

- Establishing, documenting, implementing, and maintaining a Quality System Program in accordance with Section III
- Controlling quality during manufacture, including control of testing, examination, repair, and treatment of the material or source material
- Establishing and maintaining measures for the traceability of material while under its control
- Approving and controlling operations performed by suppliers of source material and subcontracted services

NCA-3000 – Responsibilities and Duties

NCA-3861 Certification Requirements for Material Organizations

- When furnishing material, a Material Organization (whose responsibilities are described in NCA-3830) shall also provide Certified Material Test Reports (CMTR) or Certificate of Compliances (CoC), as applicable.

NCA-3862.1 Material Certification

- The CMTR shall include the actual results of all required chemical analyses, tests, and examinations.
- CMTR shall also include a report of all weld repairs performed on the material
- CoC may be provided in lieu of a CMTR for material furnished in product forms under certain specified sizes.
- CoC furnished with the material specification must specify the material's grade, class, and heat treated condition.

V. Piping System N Certification (Stamping) Overview

NCA-5000 – Authorized Inspection

NCA-5200 DUTIES OF INSPECTOR

NCA-5210 GENERAL INSPECTION DUTIES

- The Authorized Nuclear Inspector (ANI) must witness or otherwise verify all examinations and make all inspections required by Section III.
- The ANI must also make any other inspections and witness or verify any other Code activities the ANI judges necessary to ascertain the construction of an item is in compliance with Section III.

NCA-5000 – Authorized Inspection

NCA-5200 DUTIES OF INSPECTOR

NCA-5220 CATEGORIES OF INSPECTOR'S DUTIES

Duties of the ANI include:

- Verifying the scope of work, Design Specifications, and Design Reports
- Reviewing Certificate Holder's qualification records (NCA-5260)
- Verifying materials (NCA-5260)
- Witnessing or verifying in-process fabrication, non-destructive examination and tests (NCA-5270)
- Witnessing final pressure tests (NCA-5280)
- Verifying all preservice examinations have been completed to Section XI Edition specified
- Reviewing and signing Data Reports (NCA-5290)

NCA-3260 – Review of Design Report

- NCA-3260 requires the Owner (Owner Designee) to review the Design Report provided by the Certificate Holder, and confirm the evaluation of all Design and Service Loadings as stated in the Design Specification.
- The responsibility for the method of analysis and the accuracy of the Design Report remains with the Certificate Holder.
- ANI shall ensure that this review has been completed prior to endorsing the signature of the Component's Code Data Report

NCA-8000 – Certificates, Nameplates, Certification Mark, and Data Reports

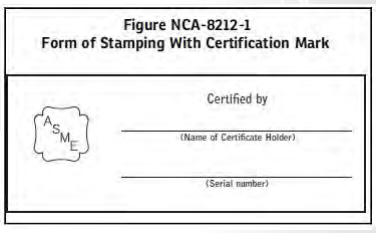
NCA-8212 Stamping With Certification Mark

The Certification Mark shall not be applied until completion of the required examination and testing.

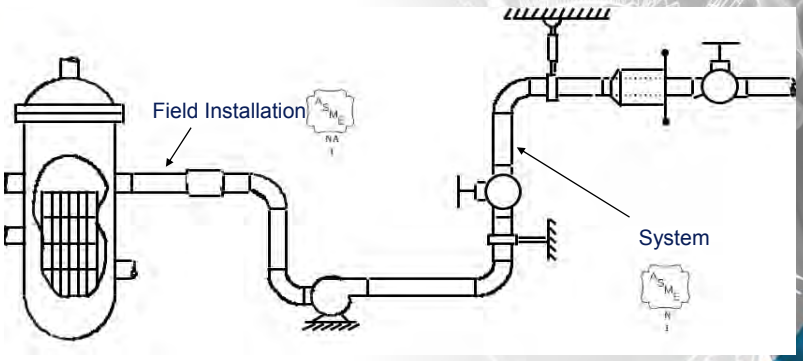
The completed Code Data Report Form indicates that the ANI has inspected the item and authorized the application of the Certification Mark.

Fig. NCA-8212-1 shows the information and arrangement of the markings.

Figure NCA-8212-1
Form of Stamping With Certification Mark



Piping System N Certification (Stamping) and Data Report Application



- Installation requires and NA Certification (Stamp) and an N-5 Data Report
- Complete Piping system requires and N Stamp and an N-5 Data Report

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Piping System N-5 Data Report

FORM N-5 CERTIFICATE HOLDER'S DATA REPORT FOR INSTALLATION OR SHOP ASSEMBLY OF NUCLEAR POWER PLANT COMPONENTS, SUPPORTS, AND APPURTENANCES*
As Required by the Provisions of the ASME Code, Section III, Division 1

Pg. 1 of

1. Installed and certified by
2. Installed for
3. Location of installation
4. System identification
5. ASME Code, Section III, Division 1
6. N Certificate Holder having overall responsibility
7. Nuclear components, parts, appurtenances, and supports installed: (List each item and attach copies of N Certificate Holders' Data Reports and NPT Certificate Holder's Data Reports.)

Components

(a) Comp. or Appurt.	(b) Name of Certificate Holder	(c) Serial No.	(d) CRN No.	(e) National Bd. No.	(f) Year Built

Piping and part installation

(a) Piping or Part Subassembly	(b) Name of Certificate Holder	(c) Serial No.	(d) CRN No.	(e) National Bd. No.	(f) Year Built—Parts Only

Support installation

(a) Support No.	(b) Name of Certificate Holder	(c) Serial No.	(d) Design Rept./Load Capac. Data Sheet	(e) CRN No.	(f) National Bd. No.	(g) Year Built

Additional material excluding welding material

(a) Name of Manufacturer	(b) Material Spec. No.	(c) Dimensions—Overall

8. Installation in accordance with
Procedure or Drawing No. Prepared by
9. Hydrostatic test pressure at temp. System design pressure at temp.
10. Remarks

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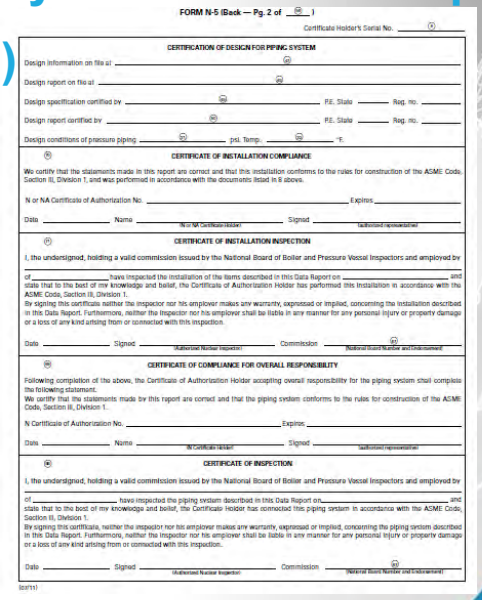
Piping System N-5 Data Report (Continued)



FORM N-5 (Back — Pg. 2 of ___)

Certificate Holder's Serial No. ___

CERTIFICATION OF DESIGN FOR PIPING SYSTEM

Design information on file at ___

Design report on file at ___

Design specification certified by ___ P.E. State ___ Reg. no. ___

Design report certified by ___ P.E. State ___ Reg. no. ___

Design conditions of pressure piping ___ psi, Temp. ___ °F

CERTIFICATE OF INSTALLATION COMPLIANCE

We certify that the statements made in this report are correct and that this installation conforms to the rules for construction of the ASME Code, Section III, Division 1, and was performed in accordance with the documents listed in 6 above.

N or NA Certificate of Authorization No. ___ Expires ___

Date ___ Name ___ (N or NA Certificate Holder) Signed ___ (authorized representative)

CERTIFICATE OF INSTALLATION INSPECTION

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and employed by ___ of ___ have inspected the installation of the items described in this Data Report on ___ and state that to the best of my knowledge and belief, the Certificate of Authorization Holder has performed this installation in accordance with the ASME Code, Section III, Division 1.

By signing this certificate neither the inspector nor his employer makes any warranty, expressed or implied, concerning the installation described in this Data Report. Furthermore, neither the inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date ___ Signed ___ (Authorized Nuclear Inspector) Commission ___ (National Board Number and Endorsement)

CERTIFICATE OF COMPLIANCE FOR OVERALL RESPONSIBILITY

Following completion of the above, the Certificate of Authorization Holder accepting overall responsibility for the piping system shall complete the following statement.

We certify that the statements made by this report are correct and that the piping system conforms to the rules for construction of the ASME Code, Section III, Division 1.

N Certificate of Authorization No. ___ Expires ___

Date ___ Name ___ (N Certificate Holder) Signed ___ (authorized representative)

CERTIFICATE OF INSPECTION

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and employed by ___ of ___ have inspected the piping system described in this Data Report on ___ and state that to the best of my knowledge and belief, the Certificate Holder has constructed this piping system in accordance with the ASME Code, Section III, Division 1.

By signing this certificate, neither the inspector nor his employer makes any warranty, expressed or implied, concerning the piping system described in this Data Report. Furthermore, neither the inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date ___ Signed ___ (Authorized Nuclear Inspector) Commission ___ (National Board Number and Endorsement)

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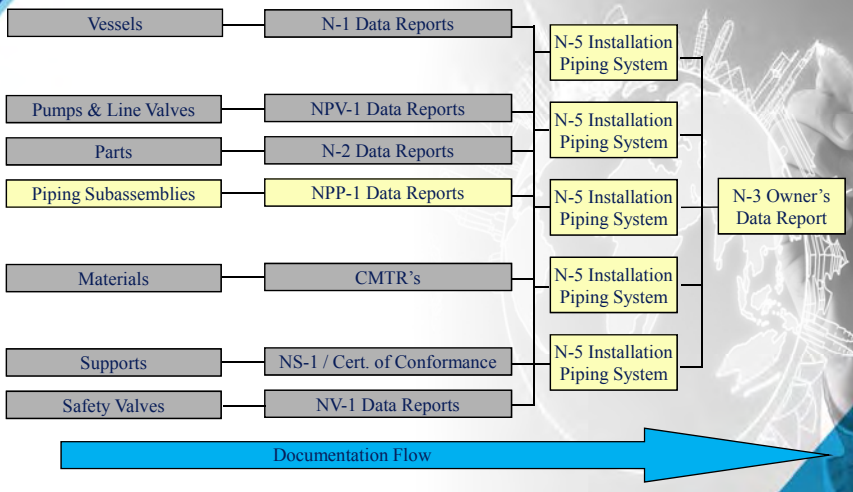
Code Documentation



Serves to indicate that each item assembled into the nuclear power plant and the installation meet the requirements of ASME Section III and the Design Specification.

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NCA-3000 – Responsibilities and Duties

NCA-3270 OVERPRESSURE PROTECTION REPORT

- NCA-3270 requires the Owner to provide an Overpressure Protection Report for each component or system (NB-7200, NC-7200, ND-7200, or NE-7200).
- Owner is responsible for filing the Overpressure Protection Report (NCA-3270) required for the nuclear power system prior to certifying and filing of Owner's N-3 Data Report.

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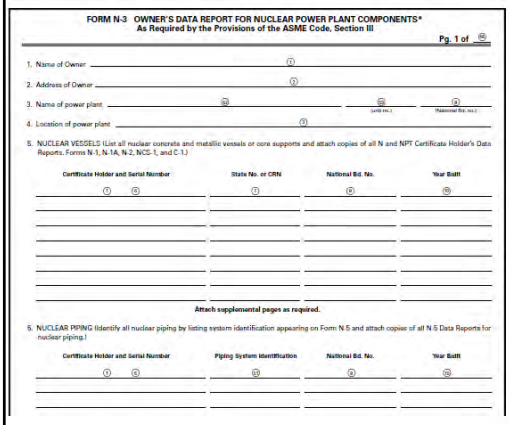
N-3 Owner's Data Report



FORM N-3 OWNER'S DATA REPORT FOR NUCLEAR POWER PLANT COMPONENTS*
As Required by the Provisions of the ASME Code, Section III

Pg. 1 of

1. Name of Owner
2. Address of Owner
3. Name of power plant
4. Location of power plant
5. NUCLEAR VESSELS (List all nuclear concrete and metallic vessels or core supports and attach copies of all N and NPT Certificate Holder's Data Reports. Forms N-1, N-1A, N-2, NCS-1, and C-1.)

Certificate Holder and Serial Number	State No. or CRN	National Bd. No.	Year Built

Attach supplemental pages as required.

6. NUCLEAR PIPING (Identify all nuclear piping by listing system identification appearing on Form N-5 and attach copies of all N-5 Data Reports for nuclear piping.)

Certificate Holder and Serial Number	Piping System Identification	National Bd. No.	Year Built

OWNER'S CERTIFICATE OF COMPLETED INSTALLATION

CERTIFICATE OF INSPECTION

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Objective Summary

After completion of this course you will be able to understand and describe :

- Overview of general process Section III Division 1 steps delineating the different roles for Piping System N Certification (Stamping)
  - Owner / Owner Designee
  - N Certificate Holder
  - NPT Certificate Holder
  - NA Certificate Holder
- Authorized Inspection Agency (AIA) interface discussed as part of the application roles described above.
- Material Organization role and interface discussed as part of the roles described above.

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Questions

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ASME-III BPVC

Nuclear Code uses in India

R N Sen
Chair, ASME India International Working Group, Section-III
and
Head, ALWRD, BARC

ASME Code

- The ASME Boiler and Pressure Vessel Code (BPVC) is a ***standard*** that provides **rules** for the **design, fabrication** and **inspection** of boilers and pressure vessels
- A pressure component designed and fabricated as per ASME, **will have** a long, useful service life that ensures the protection of human life and property
- ASME codes
  - ✓ Does not **guarantee** a safe and useful design life
  - ✓ But a **guidance** document
  - ✓ **Engineering judgement** of the users is **most important**
- Written by **volunteers**, who are nominated to its committees based on their **technical expertise** and on their ability to contribute to the writing, revising, interpreting and administering of the document

2

ASME Code

- Following the invention of the steam engine in the late 18th century, there were thousands of boiler explosions in the United States and Europe, which resulted in many deaths and lasted throughout the 19th century
- ***THE IDEA FOR THE BPVC AROSE IN 1911 OUT OF THE NEED FOR PUBLIC SAFETY***
- The first *Boiler and Pressure Vessel Code* (1914 edition) was **published in 1915**; it was one book, 114 pages long
- Today there are **32 books**, including **13 dedicated to the construction and inspection of NPP components** and two Code Case books
- The latest edition of the *Boiler and Pressure Vessel Code* is **more than 16,5000 pages**. The 32 books are either standards that provide the rules for fabricating a component or they are support documents, such as *Materials* (Section II, Parts A through D), *Non-destructive Examination* (Section V), and *Welding and Brazing Qualifications* (Section IX). Code Cases provide rules that *permit the use of materials and alternative methods of construction* that are not covered by existing BPVC rules
- Internationally, the BPVC is recognized **in more than 100 countries**. The record of the BPVC is a testament to its success. The safety record of pressure containing components manufactured in accordance with the rules of the BPVC is outstanding

3

ASME Section-III Code

Before 1963, all Pressure Vessels were designed using **a systematic Design by Formula Approach** which was based on experience and simple mechanics. What was mostly described was **how to keep hoop stress low with respect to yield** and **how to use ductile material to accommodate local peak stresses**

In the Design by formula, the vessel geometry and major dimensions such as radius, length, etc. are specified and the required **thickness** is then calculated for a given load using equations and graphical data

$$\ln\frac{t}{l} = -1.26177 - 4.55246\left(\frac{r}{D}\right) + 28.9133\left(\frac{r}{D}\right)^2 + \left[0.66299 - 2.24709\left(\frac{r}{D}\right)^2\right] + \left[0.66299 - 2.24709\left(\frac{r}{D}\right) + 15.62899\left(\frac{r}{D}\right)^2\right]\ln\frac{P}{S} + \left[0.26879 \times 10^{-4} - 0.44262\left(\frac{r}{D}\right) + 1.88783\left(\frac{r}{D}\right)^2\right]\left(\ln\frac{P}{S}\right)^2$$

where L = crown radius, r = knuckle radius, D = diameter of the shell to which the head is attached, and S = allowable stress.

- With the development of the nuclear technology in the 1950s, pressure vessel design requirements needed to be improved in order to permit the use of *higher allowable stresses* without reduction in Safety
- Needed change in the philosophy of Code design *by formula*. Advances in mechanics theory and analysis methods provided **new and more scientific methods** for PV design

4

ASME Section-III Code

- In 1956, a Committee was established for ASME Pressure Vessel Code for Nuclear Age
- In **1963**, ASME published the B&PV Code Section III: Nuclear Vessels based on the ***principles of limit analysis*** (Shakedown analysis, Fatigue Analysis) and Stress Analysis was used to determine **higher allowable loads and more consistent margins of safety**
- This improvement in the code permitted two approaches for design:
  - Improved design by formula, providing more accurate formulae for sizing common components and higher allowable stresses, was intended for standard configurations
  - Design by Analysis, in which designer performs stress analysis and evaluates results against code limits, was intended for configurations not covered by the Design By Formula
- These design rules utilized **Design Stress Intensities** based on the **Maximum Shear Stress Theory of Failure (the Tresca Criterion)** and the design values were based on a design factor of the Tensile Strength and of the Yield Strength
- The Code rules assure that violation of the pressure boundary will not occur if the Design Specification satisfactorily addresses all those issues necessary for Code compliance. This assurance is provided in the following two ways:
  - **protection against catastrophic failure**, and
  - **protection against initiation and propagation of a crack** or **propagation of a Section III acceptable flaw through the pressure boundary**

5

Section III – Rules for Construction of Nuclear Facility Components

Provides general requirements which address the material, design, fabrication, examination, testing and overpressure protection of the items specified within each respective Subsection, ***assuring their structural integrity***

Division 1, Subsection NCA : Subsection NCA, which is referenced by and is an integral part of Division 1, Subsections NB through NG, and Division 2 of Section III, covers quality assurance requirements, ASME product-certification marks, and authorized inspection for Class 1, 2, 3, MC, CS, and CC construction

Division 1, Subsections

- Subsection **NB** addresses items which are intended to conform to the requirements for **Class 1 construction**
- Subsection **NC** addresses items which are intended to conform to the requirements for **Class 2 construction**
- Subsection **ND** addresses items which are intended to conform to the requirements for **Class 3 construction**
- Subsection **NE** addresses items which are intended to conform to the requirements for **Class MC construction**
- Subsection **NF** addresses **supports** which are intended to conform to the requirements for Classes 1, 2, 3, and MC construction

6

Section III – Rules for Construction of Nuclear Facility Components

Division 1, Subsections

- Subsection **NG** addresses **structures** which are designed to provide direct support or restraint of the **core** (fuel & blanket assemblies) within the reactor pressure vessel
- Subsection **NH** addresses **Class 1 components**, parts, and appurtenances which are expected to function even when **metal temperatures exceed** those covered by the rules and stress limits of Subsection NB and Tables 2A, 2B, and 4 of Section II, Part D, Subpart 1
- Subsection **APP** contains appendices, both **mandatory** and **non-mandatory** for Section III, Division 1 (Subsections NCA through NG), Division 2 and Division 3, including a listing of design and design analysis methods and information, plus Data Report Forms. These appendices are referenced by, and are **an integral part of**, Subsections NCA through NG, Division 2 and Division 3

Division 2 addresses **concrete containment structures**, pre-stressed or reinforced. These requirements are applicable only to those components that are designed to provide a **pressure retaining** or **containing barrier**

Division 3 addresses the design and construction of the **containment system** of a nuclear **spent fuel or high level radioactive waste transport packaging**

Division 4 – Fusion Energy Components

The all-new **Division 5** provides construction rules for **high-temperature reactors**, including both high-temperature, gas-cooled reactors (HTGRs) and liquid metal reactors (LMRs)

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ASME Section-III Code Uses

- Presently, half of the world's nuclear power plants incorporate all or portions of ASME nuclear codes and standards in their construction, operation, and / or maintenance
- Sixty nations generally recognize and apply the BPVC, while 30 of the 44 nuclear nations purchase their nuclear components to specifications contained within ASME's nuclear codes and standards
- The nuclear sections of the BPVC reflect the best-practices of industry, while contributing to a full half-century (plant life) of safety for the general public
- The major advantage of using ASME-III, is protection against failure of Nuclear components, thereby assurance against release of radioactivity from the plant. This is of prime requirement for safety and protection of Human beings, Livestock, the Nature and also the plant

8

Design of Nuclear Components

- **Requirements**
  - Fail Safe design
  - Defense-in-Depth
  - Redundancy for Reliability
  - High Durability
  - Maintenance Free or less Maintenance
- **Essentials**
  - Meeting norms for '**Safety First**'
  - Detail Stress and Failure Analysis
  - Compliance to Codes & Standards
  - Documentation
  - Design Review System
- **Revolutionary Changes Resulted From**
  - Governmental Regulations
  - Wide Acceptance of Codes & Standards
  - Public Liability Laws

9

Chronology of Reducing FOS in the ASME Code

Year of change	FOS on UTS	Section of Code	Initiator for change	Compensator
1925	5	VIII Div1	(First Publication)	
1945	4	VIII Div1	To help conserve steel having severe shortage during World War-II	Use of better materials, restricted fabrication details, & improved NDE techniques
1963 1968	3 3	III VIII Div2	Emerging requirements of significantly higher design pressures	Use of Stress Analysis, Rules for fracture & fatigue, limited materials, extensive NDE
1999	3.5	VIII Div1	To reduce the cost of construction to be more consistent with European Designs	All improvements in the Code since 1960s
2007	2.4	VIII Div2	More cost-effective designs	Major changes in design philosophy, design techniques, fabrication & testing requirements

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Design & Analysis of Unfired PVs using the ASME Boiler & PV Code

- **Sec. VIII Div-1 → Most widely used**
  - → Design by Formulae & Rules
  - → Based on Max. Principal Stress Theory
  - → Uses higher FOS
  - → **No guidelines for thermal loads, fatigue, fracture**
- **Sec. VIII Div-2 & Sec. III → Provisions for DBA**
  - → Require detailed stress analysis
  - → Based on Tresca theory (*From 2007 Edition, Division 2 uses Von Mises*)
  - → Use lower FOS
  - → **Give guidelines for thermal loads, fatigue, fracture & other failure modes**

DBA especially useful in cases such as:
- → Design check for thermal loads
- → Local stress evaluation for Fatigue assessment
- → Design check for failure modes like ratcheting, fracture etc.
- → Design check for non-standard features
- → Design optimization

*Thinner Sec.III and VIII-Div.2 vessels **retain safety factors that are comparable** to thicker VIII-Div.1 vessels by incorporating more extensive engineering analysis and design requirements*

11

Stress Significance in Design

- The key point to the professional design approach is, **"Not Every Stress is Equally Significant"**
- It is important to realize that it is not just the *magnitude*, but the *nature, location and distribution* of a stress that govern the behaviour of a structure under that stress, and the potential of that stress to cause failure
- ***Therefore, it is unreasonable to have a single limit or acceptance value for every type of stress, because, it would result in over-conservative designs***
- **Ductile** materials under steady loads, fail by **gross yielding**. Locally high stress would cause local yielding & redistribution of stresses to a more favourable state
- Fatigue however, initiates locally, so local stress is important even in case of ductile materials
- For brittle materials, redistribution of stress is limited & local stress could cause brittle fracture

12

Types of Stresses w.r.t. Stress Significance

- ***Based on Nature of Loading:***
  - → **Primary stresses** are developed in a structure as a response to force controlled loads. These stresses must satisfy the static force and moment equilibrium with the applied loads
  - → **Secondary stresses** are are developed in a structure for satisfying imposed deformation controlled loads. These are self limiting in nature. Thermal stresses are also secondary in nature
- ***Based on Distribution:***
  - → Stress uniformly distributed over full section thickness is called **membrane stress**. For e.g., stress in a bar under tensile pull is a membrane stress
  - → Stress that varies linearly through the section thickness with maximum magnitudes at the outer surfaces and zero at the neutral plane is called **bending stress**. For e.g., the stress in a rectangular beam under bending moment is a bending stress
  - → Highly localized stress that develops due to stress concentration effects is called **peak stress**

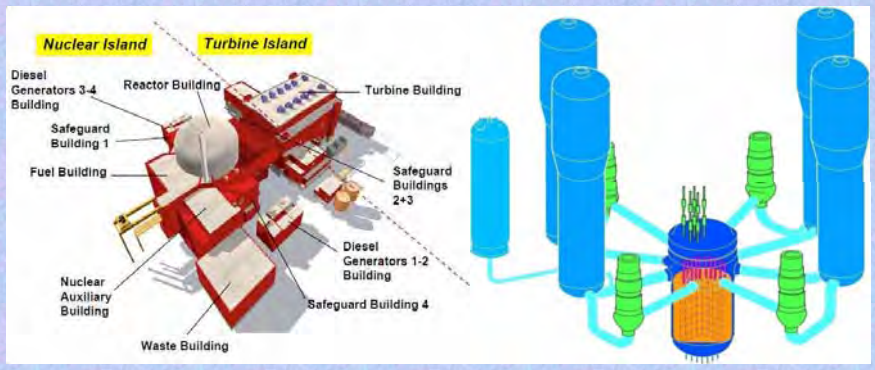
13

Design By Analysis Approach

- Used in **Sec.III**, Sec.VIII Div-2 & 3
- Requires a detailed *Linear Elastic Stress Analysis*
- Basic dimensioning for stress analysis may be done by formulae / experience
- Stresses *categorized* in to various classes defined by the Code
- The design qualifies if the stresses developed in the structure *satisfy the limits for all stress categories* at all locations of the structure
- Expertise in modelling, analysis, post processing of results needed for complex geometries in 3D stress fields
- Code also permits to do an *elastic-plastic analysis*, in which case, the elastic stress limits of the code need not be satisfied and qualification is based upon collapse load of the structure

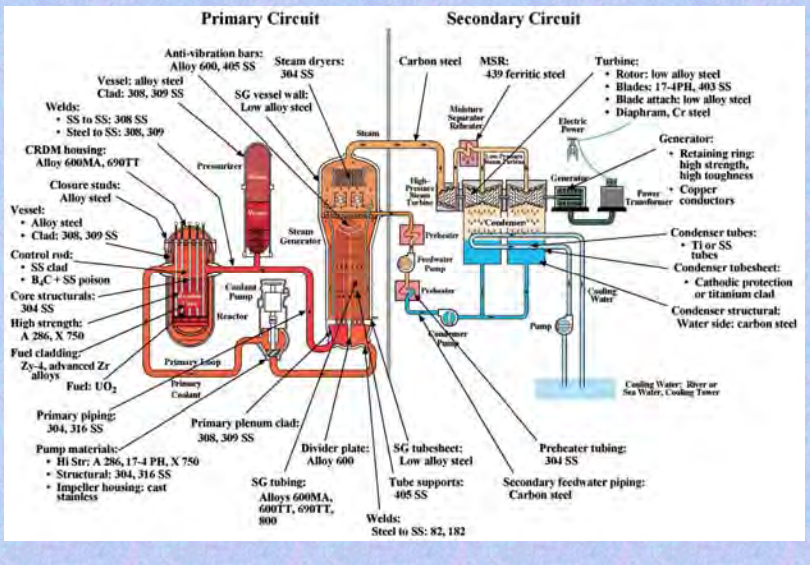
14

ASME Section-III Code Uses



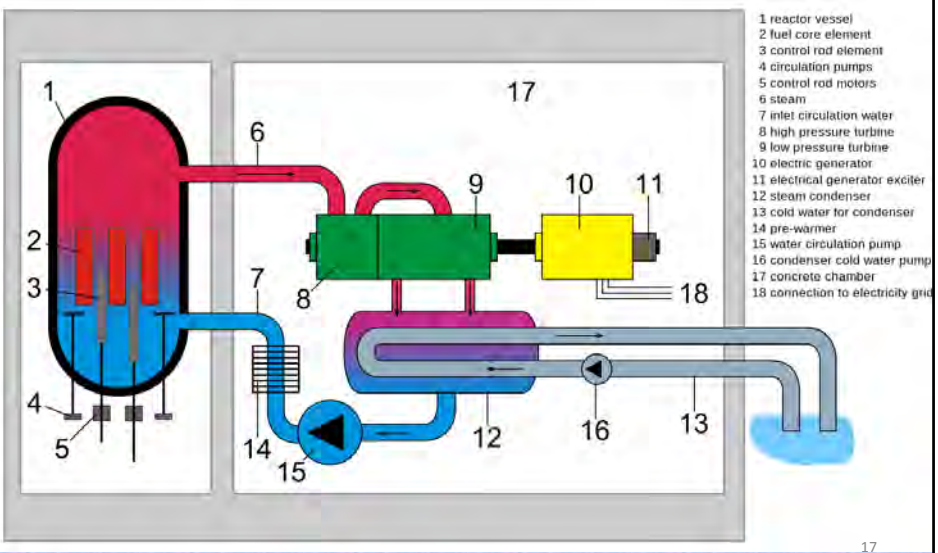
15

ASME Section-III Code Uses



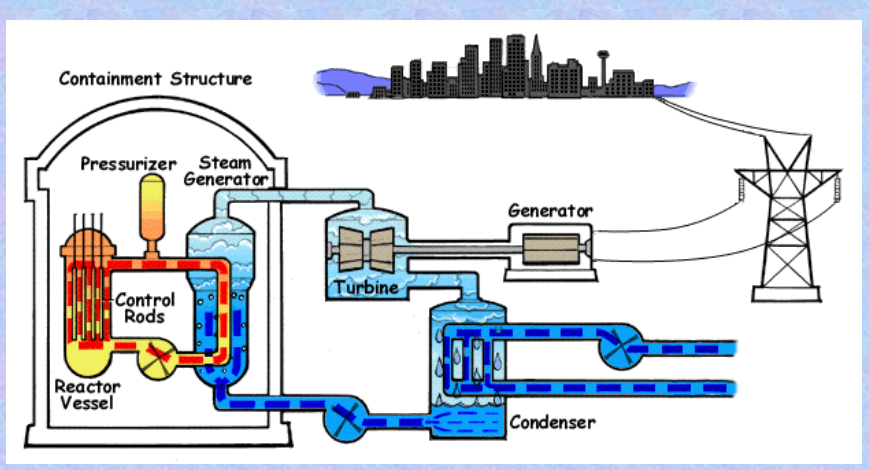
16

BWR


1 reactor vessel
2 fuel core element
3 control rod element
4 circulation pumps
5 control rod motors
6 steam
7 inlet circulation water
8 high pressure turbine
9 low pressure turbine
10 electric generator
11 electrical generator exciter
12 steam condenser
13 cold water for condenser
14 pre-warmer
15 water circulation pump
16 condenser cold water pump
17 concrete chamber
18 connection to electricity grid

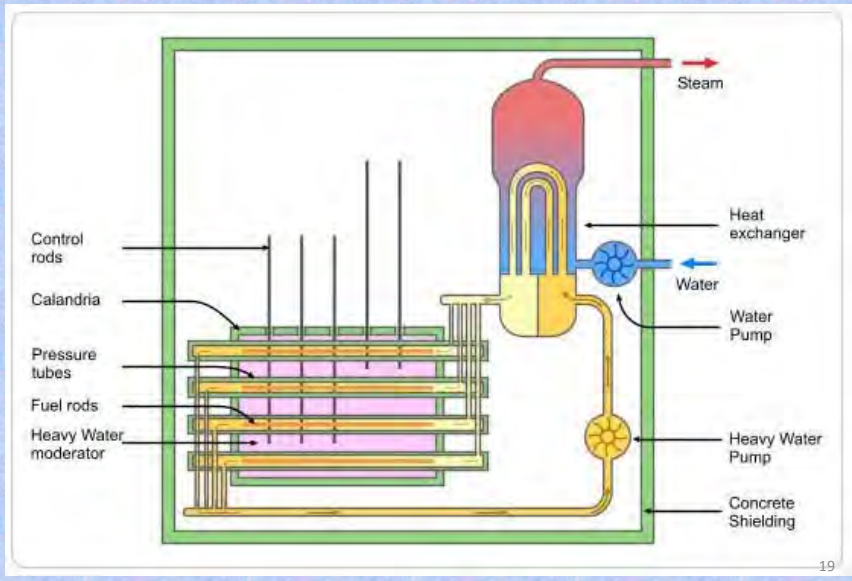
17

PWR


Containment Structure
Pressurizer
Steam Generator
Control Rods
Reactor Vessel
Generator
Turbine
Condenser

18

PHWR



ASME Section-III Code Uses in India

- **India has a largely indigenous nuclear power program**
- **Committed to increase capacity as part of massive infrastructure development program**

- Power reactors operating 22 units - 6780 MWe
- Power reactors under construction 7 units - 5400 MWe
- Power reactors planned 14 units - 10,500 MWe

ASME Section-III Code Uses in India

- Therefore, there exists a number of equipment and vessels to be designed to meet ASME-III requirements
- Indian regulator (AERB) require conformance of ASME-III for design, fabrication, qualification of all critical equipment and systems before issue of license of NPP to be operated in the country

Subsection NB Class 1 components (Those components that are part of the fluid-retaining pressure boundary of the reactor coolant system. Failure of this pressure boundary would violate the integrity of the reactor coolant pressure boundary) for (**LWRs**) -

- Reactor Pressure Vessel
- Steam Generators (for PWR)
- Reactor Coolant Pumps
- Reactor Coolant Piping
- Pressurizer Vessel
- Line Valves
- Safety Valves

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ASME Section-III Code Uses in India

Subsection NC Class 2 components (Those components that are not part of the reactor coolant pressure boundary, but are important for reactor shutdown, emergency core cooling, post-accident containment heat removal, or post-accident fission product removal)

- Emergency Core Cooling
- Post Accident Heat Removal
- Post Accident Fission Product Removal
- Includes Vessels, Pumps, Valves, Piping, Storage Tanks, and Supports

Subsection ND Class 3 components (Those components that are not part of class 1 or 2 but are important to safety)

- Cooling Water Systems
- Auxiliary Feedwater Systems
- Includes Vessels, Pumps, Valves, Piping, Storage Tanks, and Supports

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ASME Section-III Code Uses in India

Subsection NE Class MC supports

- Containment Vessel
- Penetration Assemblies (Does not include piping, pumps and valves which if passing through the containment must be class 1 or class 2)

Subsection NF Supports

- Plate and Shell Type
- Linear Type
- Standard Supports

(Support Class is the class of the Component Supported)

Subsection NG Core Support Structures (class CS)

- Core Support Structures
- Reactor Vessel Internals

and Appendices

23

ASME Section-III Code Uses in India

Similarly for **PHWRs**, Subsection NB Class 1 components & systems are -

- All components in PHT main circuit, including headers, feeders, piping including first isolation valve penetrating the containment
- Coolant Channel assembly
- Components of Reactor Shutdown system
- Primary side of Steam Generators
- Pressure and Relief system up to bleed condenser control valves and relief valves
- Primary Coolant Pumps
- Fueling Machine head and fueling machine D_2O system upto first isolation valve

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ASME Section-III Code Uses in India

Subsection NC Class 2 components & systems for **PHWRs**

- Calandria tubes and garter springs
- Instrument supply line from PHT main circuit upto the first isolation valve
- Shutdown cooling system
- Emergency Core Cooling system
- Secondary side of Steam Generator upto including main steam line isolation valve, and feed water line upto including first isolation valve
- Auxiliary feed water system
- Primary containment & ventilation interfaces/isolation dampers, primary containment cleanup & controlled discharge system,
- Secondary containment airlocks/isolation systems, secondary containment cleanup & purge system,
- Suppression pool system
- Reactor building emergency coolers and associated ducting
- Spent fuel transfer D_2O / H_2O system, spent fuel dry transfer system

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ASME Section-III Code Uses in India

Subsection ND Class 3 components & systems for **PHWRs**

- Calandria including nozzle attachments, tubesheets and diaphragm plates
- End Shield
- Bellow for annulus space between calandria and pressure tubes
- Reactor regulating system
- PHT purification / sampling / inventory control / leakage collection / header level control / filling / draining systems
- PCP gland supply system, Fueling machine supply and return circuit
- Moderator systems including purification / poison addition / adjuster rod cooling / filling / draining / leakage collection / sampling
- End Shield & Calandria vault Cooling Systems
- Spent fuel storage bay cooling System
- Process water system catering to safety related equipments
- Service/process water cooling system catering to safety related process water system
- Fire water system for safety related areas
- Compressed air supply to safety related areas
- Fueling machine drive system
- DG oil system

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ASME Code Knowledge-base in India

- *Codes, Literature, International Journals, Softwares*
  - Library at BARC, NPCIL HQ, Plant sites
  - Advance FEM & CFD softwares, CAD softwares
  - Internet
- *Manpower development*
  - Engineering and Science recruits – 1 year training on Nuclear Science & Engineering
  - On job training post recruitment
  - Training and certification to individuals carrying out specific activities of inspection, operation, maintenance, etc.
  - INS course on advance design, fabrication & qualification of Nuclear equipment
  - Interactive inhouse discussions & short-term courses
  - Various Seminars, workshops, etc.

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ASME Nuclear Code Uses in India

- Nuclear Power Plants
  - PHWRs
  - BWRs
  - PWRs
  - FBRs
- Research Reactors
- Spent Fuel Handling Facilities
- Waste Management Facilities
- Heavy Water Plants

Both DAE and the Industry uses ASME Nuclear Codes

28

ASME Nuclear Code Uses in India

- ***ASME Section-III, especially NB, is extensively used across the nuclear code users in India***
- *Section-III Appendix-G for protection against brittle failure is mandatorily used for assuring integrity before regulatory clearance*
- *Section-XI is used for proving 'Fitness for Service' during lifetime operation*
- *Section-V is used for Non-Destructive Examination, Section-III para-5000 for acceptance standards*
- *Section-II is used for specification of materials and their product forms for selecting various materials in design/fabrication of Nuclear equipments*
- *Section-IX is used for welding and welding qualifications*

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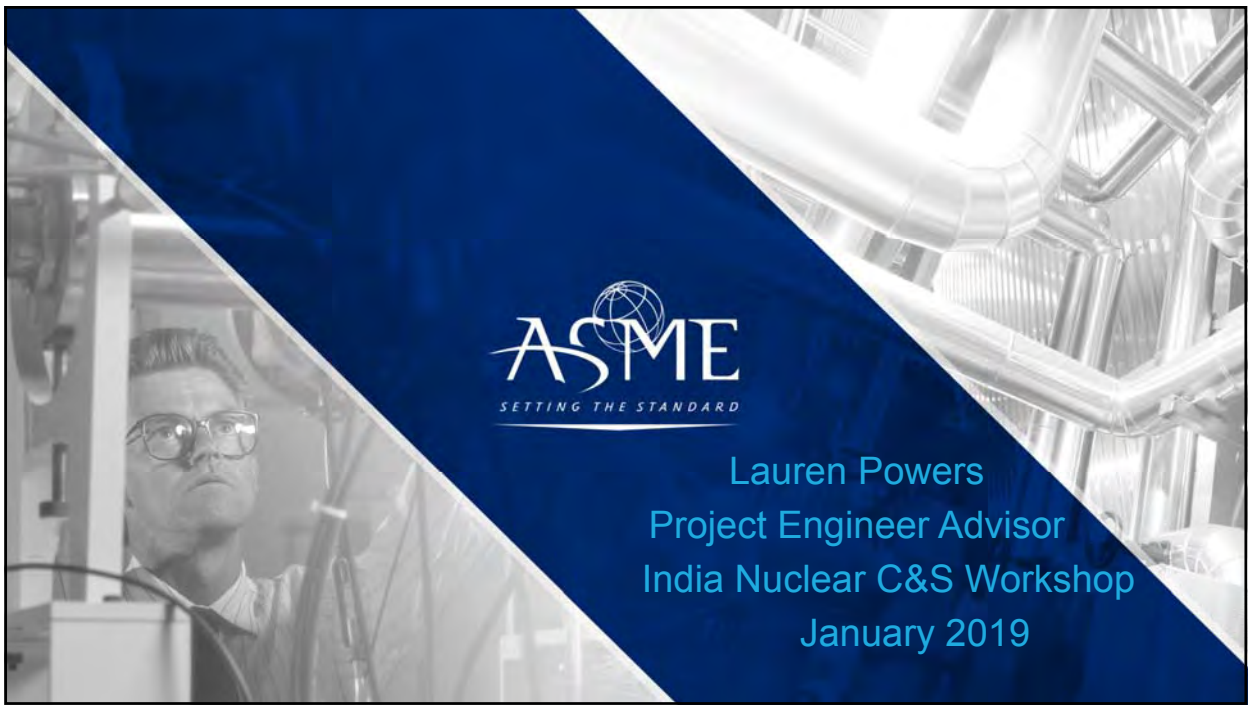
Conclusion

- ASME-III is *widely used* for design, construction, operation of NPPs in the country
- *Conformance* to ASME-III is a mandatory Regulatory requirement
- Well *experienced trained* manpower exist who are *conversant* to ASME-III requirements
- Modern software tools are *extensively used* to finalize design of NPP components through *'Design by Analysis'* Approach
- A robust multi-tier review and safety mechanism in force with effort of Utility and Regulatory in design, construction, operation, maintenance and In-Service Inspection program; which resulted in about 493 reactor years of *safe, reliable and accident-free operation*
- Industry partnering with DAE in building NPPs are also well *experienced* with Section-III and its quality requirements
- The joint effort of DAE and Indian Industries has made the indigenous nuclear power program a *successful* achievement

30

Thank You

31


ASME
SETTING THE STANDARD
Lauren Powers
Project Engineer Advisor
India Nuclear C&S Workshop
January 2019


NQA-1 Standard
Quality Assurance Requirements for Nuclear Facility Applications

NQA-1 Purpose

NQA-1 ensures the quality, and thereby safety of nuclear facilities through establishment of clear and proven requirements implemented via a documented set of processes (i.e., QA Program or Management System).

Content of NQA-1 Standard

The Standard reflects 50+ years of industry experience and current understanding of the QA requirements necessary to achieve **safe**, **reliable** and **efficient** utilization of nuclear energy

- Focusing on the **achievement of results**,
- Emphasizing the **role and responsibilities** of the individual and line management, and
- Applying the requirements in a **"*graded approach*"** consistent with the **relative importance to safety.**

Content of NQA-1 Standard

- Developed originally from QA requirements that ASME N-certificate holders were required to implement to fabricate ASME Section III components
- Expanded to include QA requirements the U.S. Nuclear Regulatory Commission required of licensees for nuclear power plants and subsequently adopted by regulatory position
- Scope broadened to include all nuclear facilities and activities at all phases, including nuclear generation
- Adopted **internationally** by regulators, facility owners, designers, constructors, suppliers, etc

International Adoption of NQA-1

Nuclear facilities and activities across the globe

U.A.E., Japan, Korea for NPP design, fabrication and construction

International suppliers to the U.S.A. and other countries requiring a rigorous nuclear standard

U.S. Department of Energy – 10 CFR 830 & Order 414.1D

U.S. Nuclear Regulatory Commission – 10 CFR 50, Regulatory Guide 1.28, and others (2008 edition, 2009 addenda)

U.S. Environmental Protection Agency – 40 CFR 194.22 (earlier edition)

ASME Boiler & Pressure Vessel Code Section III

Scope of Standard

Apply to any structure, system, component, activity, or organization that is essential to the safe, reliable, and efficient performance of a nuclear facility and any activities independent of a facility that may affect performance (e.g., transportation of nuclear materials) of those activities.

Extent of application depends upon the specific type of facility, items, or services involved and the nature, scope and relative importance of the activity being performed.

All phases of a nuclear life cycle (e.g., siting, design, construction, operation, and decommissioning).

All types of activities (e.g., training, testing, software development or use).

Scope of Standard

- Apply to activities that could affect the quality of nuclear material applications, structures, systems, and components of nuclear facilities, such as:
  - Power generation
  - Spent fuel storage
  - Waste management
  - Fuel reprocessing
  - Nuclear material reprocessing
  - Nuclear research
- All types of activities – such as:
  - Siting -Developing or using software
  - Designing -Fabricating
  - Procuring -Constructing
  - Erecting -Decommissioning
  - Handling -Shipping, Receiving, Storing

Stakeholders

Any organization involved with nuclear facilities

Utilities
Regulators
DOE Facilities
National Laboratories
NSSS Suppliers
Material and Equipment Suppliers

Regulatory Background

- 10 CFR 50 Appendix A – Criteria 1 required that the licensee have a QA program to assure that items and activities were accomplished in a manner sufficient to give assurance that the necessary quality was achieved

- 10 CFR 50 Appendix B – describing the QA program Appendix A required was necessarily broad enough to cover many approaches and technologies

NQA-1 Part 1

- Contains requirements for developing and implementing a Quality Assurance Program (QAP) or Integrated Management System for nuclear facility applications
- Scope is focused on 10CFR 50 Appendix A (GDC) Criteria 1 (Item centric) as further delineated in Appendix B.
- Scope was expanded to include other facilities but focused on 10CFR830 for DOE Owned and Operated facilities

NQA-1 Part 1 Requirements

Requirement 1 – Organization

- Organization structure and responsibility assignments
- Need senior management to establish expectations
- Quality is achieved and maintained by those assigned responsibility
- Quality is verified by those not directly responsible for performing the work

NQA-1 Part 1 Requirements

Requirement 2 – Quality Assurance Program

- Indoctrination and Training
- Qualification Requirements
  - NDE
  - Inspection and Test
  - Lead Auditor
  - Auditor

Leader Auditor Audit Participation:
303.3(a) independence from the functional areas being assessed

NQA-1 Part 1 Requirements

Requirement 3 – Design Control

- Design shall be defined, controlled, and verified
- Design adequacy shall be verified by individuals other than those who designed the item or computer program
- Design changes control

NQA-1 Part 1 Requirements

Requirement 4 – Procurement Document Control

- Procurement documents shall require Suppliers to have a quality assurance program consistent with the applicable requirements of NQA-1

NQA-1 Part 1 Requirements

Requirement 5 – Instructions, Procedures, and Drawings

- Activities affecting quality and services shall be prescribed by and performed in accordance with documented instructions, procedures, or drawings

NQA-1 Part 1 Requirements

Requirement 6 – Document Control

- Identification of controlled documents
- Specified distribution of controlled documents to responsible individuals and appropriate locations

NQA-1 Part 1 Requirements

Requirement 7 – Control of Purchased Items and Services

- Supplier evaluation and selection
- Control of supplier-generated documents
- Acceptance criteria

NQA-1 Part 1 Requirements

Requirement 8 – Identification and Control of Items

- Identification Methods
- Identification and traceability of items
- Need to monitor limited life items

NQA-1 Part 1 Requirements

Requirement 9 – Control of Special Processes

- Welding
- NDE
- Heat Treatment

NQA-1 Part 1 Requirements

Requirement 10 – Inspection

- Inspection Requirements
- Inspection Hold Points
- Inspection Planning
- In-process Inspection
- Final Inspection
- Periodic Inspection

NQA-1 Part 1 Requirements

Requirement 11 – Test Control

- Test requirements and acceptance criteria shall be provided or approved by the responsible design organization.
- Test procedures shall include or reference the test configuration and test objectives.

NQA-1 Part 1 Requirements

Requirement 12 – Control of Measuring and Test Equipment

- Tools, gages, instruments, and other measuring and test equipment need calibration and control

NQA-1 Part 1 Requirements

Requirement 13 – Handling, Storage, and Shipment

- Handling, storage, cleaning, packaging, shipping, and preservation of items shall be controlled to prevent damage or loss and to minimize deterioration.
- Needs to be work and inspection instructions, drawings, specifications, shipment instructions, or other pertinent documents or procedures

NQA-1 Part 1 Requirements

Requirement 14 – Inspection, Test, and Operating Status

- Status Indicators such as tags, markings, shop travelers, stamps, inspection records, or other suitable means need to be used

NQA-1 Part 1 Requirements

Requirement 15 – Control of Nonconforming Items

- Identification
- Segregation
- Disposition

NQA-1 Part 1 Requirements

Requirement 16 – Corrective Action

- When a deficiency is identified, the root cause of the condition shall be determined and corrective action taken

NQA-1 Part 1 Requirements

Requirement 17 – Quality Assurance Records

- Record control requirements
- Record storage
- Record retention period

NQA-1 Part 1
Requirement 18 – Audits

This is what Appendix B para. XVIII states:

A comprehensive system of planned and periodic audits shall be carried out to verify compliance with all aspects of the quality assurance program and to determine the effectiveness of the program. The audits shall be performed in accordance with the written procedures or check lists by appropriately trained personnel not having direct responsibilities in the areas being audited. Audit results shall be documented and reviewed by management having responsibility in the area audited. Followup action, including reaudit of deficient areas, shall be taken where indicated.

NQA-1 Part 1
Requirement 18 – Audits

- Internal Audit Scheduling
  - Nuclear facility prior to operation – at least once each year or at least once during the life of the activity
  - Nuclear facility after operation – each functional area within a period of 2 yr*
  - Suppliers - at least once each year or at least once during the life of the activity**

NQA-1 Part 1
Requirement 18 – Audits

- External Audits
  - Triennial basis and supplemented by annual evaluations of the Supplier's performance to determine if the regular schedule audit frequency shall be maintained or decreased or if other corrective action is required.

NQA-1 Part 1
Requirement 18 – Audits

Audit Preparation

- Audit Plan
- Audit Personnel including a qualified lead auditor
- Reporting Methods

NQA-1 Part 2
Work Practices

- Contains additional requirements for the planning and conduct of specific work activities under a QAP developed in accordance with Part 1
- Includes additional requirements to address certain unique IAEA and U.S. DOE criteria/regulations

NQA-1 Part 2
Work Practices

Subpart 2.14 Quality Assurance Requirements for Commercial Grade Items and Services

Provides amplified requirements to provide reasonable assurance that a commercial grade item (CGI) or service will perform its safety function

NQA-1 is the ONLY quality standard that addresses dedication

Commercial Grade Item (CGI)

A structure, system, or component, or part thereof, that affects its safety function, that was not designed and manufactured in accordance with the requirements of the NQA-1 Standard

Dedication

An acceptance process performed in accordance with the NQA-1 Standard to provide reasonable assurance that a commercial grade item (or service) will perform its intended safety function and, in this respect, is deemed equivalent to an item or service designed and manufactured or provided under the requirements of this Standard

NUPIC

Nuclear Procurement Issues Corporation

Established in 1989 by a partnership involving all domestic and several international nuclear utilities

The NUPIC program evaluates suppliers furnishing safety-related components and services and commercial-grade items to nuclear utilities

NQA-1 Part 3 Guidance for Implementing Parts I and II Requirements

- Provides acceptable methods of compliance for implementing the requirements of Parts I and II

  "Excellent source of material to support your implementing process development"

- Good practices based on experience
- Not requirements unless by commitment or contract

NQA-1 Part 4
Guidance for Application and Use

- Comparisons with other quality requirements:
  - ISO 9001
  - 10 CFR 830, Subpart A and DOE O414.1
  - 10 CFR 71 and/or 72
  - IAEA GS-R-3
  - ANSI/ANS-15.8
- Applications to:
  - Research and Development in a graded fashion,
  - Electronic Information,
  - Transition from Construction to Operations, and,
  - Decommissioning

NQA-1 vs. ISO

- NQA-1 is a nuclear specific document versus a generic management standard
- NQA-1 provides implementation details versus individual organization development
- NQA-1 has a regular publication schedule
- NQA-1 has a process to answer inquiries

NQA-1
Subpart 4.1.1

Guidance to Modification of an ISO 9001:2015 Quality Management System for Compliance With NQA-1–2015, Part I

It is conceivable that an NQA-1–based quality assurance program could be integrated into an ISO-based (quality) management system framework

(and vice versa)

Table 400-1 NQA-1, Part I, Requirement 1 (Organization) and Corresponding ISO 9001 Clauses

NQA-1–2015	ISO 9001:2015
100 General	4.1 Understanding the Organization and its Context 4.3 Determining the Scope of the Quality Management System 4.4 Quality Management System and its Processes 5.5.1 Leadership — General
200 Structure and Responsibility 201 General 202 Delegation of Work	5.5.1 Leadership — General 5.3 Organizational Roles, Responsibilities, and Authorities 4.4.1 Quality Management System and its Processes
300 Interface Control	4.2 Understanding the Needs and Expectations of Interested Parties 7.4 Communication

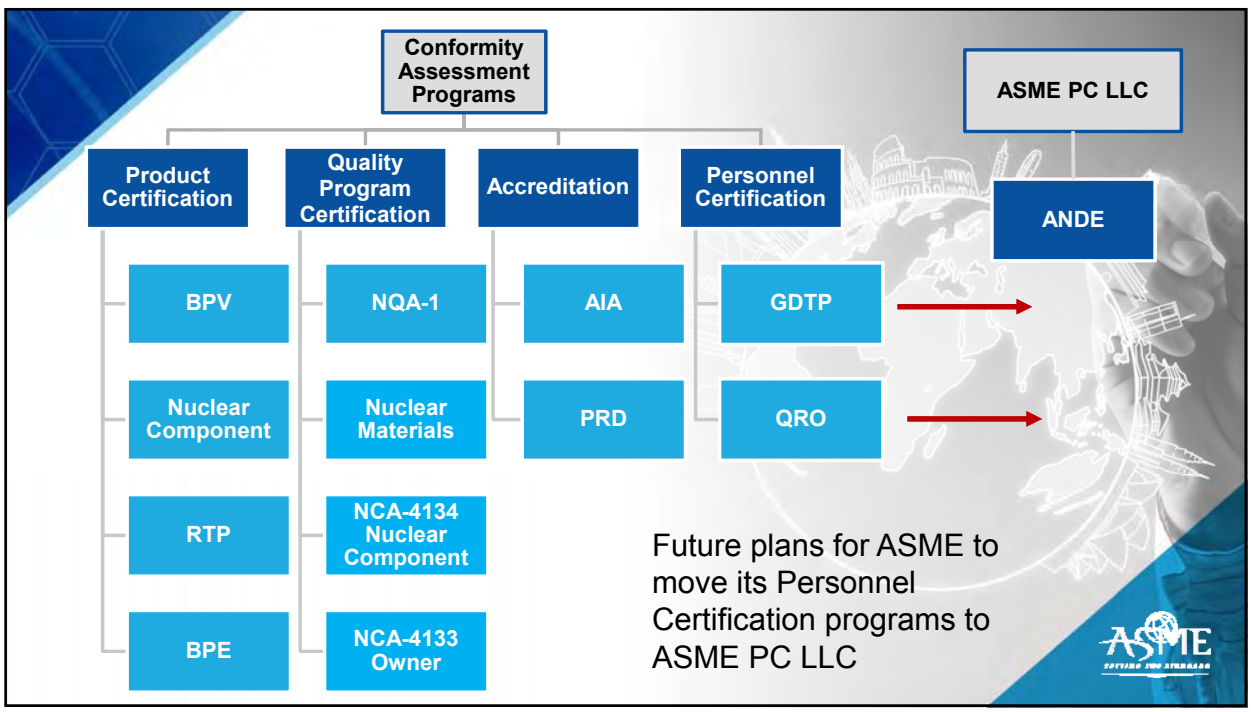
RECOMMENDATIONS: The following topics need to be addressed in more detail in an ISO 9001 management system to meet NQA-1:

(a) The organizational structure shall be documented to reflect functional responsibilities, levels of authority, and lines of communications for activities affecting quality.

(b) The management system shall define those individuals who are responsible for verifying quality achievement and that they have sufficient authority, direct access to management, organizational freedom, and access to the work to perform their function. Those individuals responsible for quality verification shall not be directly responsible for performing the work.

ASME Conformity Assessment Programs

Look for THE MARK
Demand THE MARK



ASME Accreditation Programs

Accreditation is the **act of granting recognition** to organizations that maintain suitable standards. Accreditation is necessary to any person or institution that needs to prove that they meet a general standard of quality.

Authorized Inspection Agencies

Accreditation of an Authorized Inspection Agency (AIAs) to the QAI-1 Standard as a conformity assessment body performing inspections during the manufacturing/fabrication of ASME pressure equipment to verify the product's compliance with the ASME BPV code.

Authorized Inspection Agencies

- Accredited Authorized Inspection Agencies (AIAs) are responsible for performing inspections during the manufacturing/fabrication of ASME pressure equipment for certificate holders.

- Jurisdictional Authorities
- Insurance Companies
- Independent Third-Party Inspection Organizations

Pressure Relief Devices Testing Laboratories Accreditation (PRD)

Accreditation of a laboratory as a conformity assessment organization having the ***technical*** ability and capacity to perform capacity certification tests of pressure relief devices manufactured in accordance with the ASME Boiler and Pressure Vessel Code (BPVC).

ASME Product Certification Programs

Product Certification

Provides companies the ability to apply the ASME Single Certification Mark with designator on their products. Certificate holders may:

- Increase the quality and safety of their products.
- Enable business in the global marketplace.
- Achieve production efficiencies.
- your company grows and develops with industry
- Common language
- Use an ASME Certification Mark on their product.

Boiler & Pressure Vessel (BPV) Certification

Conforms to the rules governing the design, fabrication, assembly, and inspection of boiler and pressure vessel components during construction.

Boiler & Pressure Vessel Certification Offerings

- Section I – Power Boilers
- Section IV – Heating Boilers
- Section VIII – Pressure Vessels
- Section X – Reinforced Plastic Vessels
- Section XII – Transport Tanks

Future Certification– Draft of the new Section XIII – Overpressure Protection, which may encompass a certification program.

Why Boiler & Pressure Vessel (BPV) Certification

"When I interact with others in the field, use of the ASME mark means that we will speak the same language, have the same technical basis, and all points are clearly defined."

Christophe Saul

Head of Design, Körting Hannover AG

GERMANY

Nuclear Component Certification

Conformity Assessment Program recognizing a company's capability to meet and fulfill the specific requirements of Section III of the ASME Boiler and Pressure Vessel Code for items installed in nuclear facilities.

Nuclear Component Certification Scope of Code Activities

N	Construction of vessels, pumps, valves, piping systems, storage tanks, core support structures, concrete containments, and transport packaging
NA	Field installation and shop assembly of parts and components
NPT	Fabrication of parts, appurtenances, welded tubular products, and piping subassemblies
NS	Fabrication of supports
NV	Construction of pressure relief valves
N3	Construction of transportation and storage containments
OWN	Authorization for the owner of a Nuclear Facility to prepare and file the data report on the completed pressure retaining system.

Why Nuclear Component Certification

"The ASME Certificates and Certification Mark provides a recognized level of assurance to customers and regulators that the Quality Assurance Program and products meet an industry standard of excellence."

Lisa Plante Supervisor, Quality Systems,
Westinghouse Electric Company

RTP Certification

- Product Certification Program recognizing a company's capability to meet the requirements of the ASME RTP-1 Standard, "Reinforced Thermoset Plastic Corrosion-Resistant Equipment"
- Construction of stationary fiberglass vessels operating at atmospheric pressure, and holding or processing corrosive substances

Bioprocessing Equipment (BPE) Certification *(Overlay of BPV Code)*

- Product Certification Program recognizing a company's capability to meet the requirements of the BPE Standard
- Construction of components used in bioprocessing, pharmaceutical, and personal care product industries
- Certification current limited to manufacturers of tubing and/or fittings.
- Program will be expanded to include additional components.

Quality Program Certification

A nuclear sector-specific standard to achieve quality.

Certificate holders may:

- Gain entry to the supply chain and/or a competitive edge in the marketplace.
- Save time and money.
- Inspire a culture of safety from within the company and convey confidence to your customer about your commitment to quality.

Nuclear Material Organization Certification

Quality System Certificates (QSC) are issued to recognize a material organization's capability of manufacturing and supplying material to BPV, Section III.

- Bars, fasteners, castings, forgings, plates, fittings, flanges, tubular products
- Wire, rod, billets, ingots
- Welding material
- Concrete reinforcing bars, prestressing components

Quality Assurance Program Certificates

- Issued to an organization that has documented a Quality Assurance Program and whose ability to staff, equip, or otherwise implement the described Quality Assurance Program has been evaluated and accepted by ASME.
- Implementation of the program is not required.
- Can convert to Certificate of Authorization and issued a stamp after a successful implementation audit.

Personnel Certification Programs

- Certifies personnel in:
  - Preparing and reading engineering drawings
  - Plant Operations
  - Nondestructive Examinations

Geometric Dimensioning and Tolerancing Professionals (GDTP)

- The Y14.5 Standard establishes uniform practices for stating and interpreting dimensioning and tolerancing requirements for use on engineering drawings.
- Certifying engineers, drafters, inspectors, machinists, etc. as GDT Professionals ensures drawings are prepared properly and all can interpret the drawings identically and correctly.

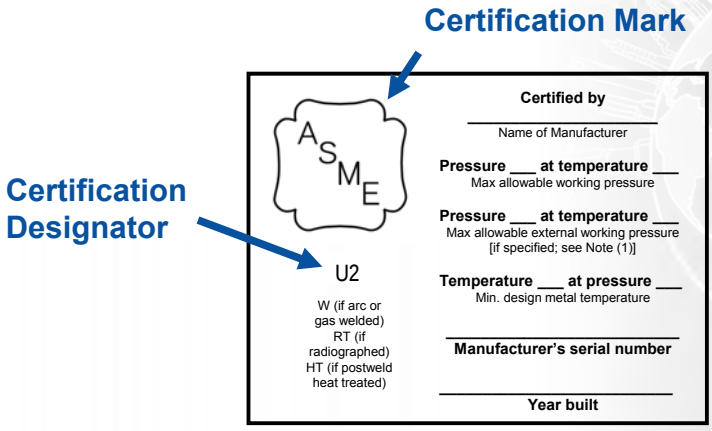
Resource Recovery Facility Operators (QRO)

Personnel certification program recognizing an individual's capability to perform or direct operations of facilities that combust Municipal Solid Waste

ASME Non-Destructive Examination (ANDE)

Personnel certification program recognizing an individual's capability to perform non-destructive examination and quality control inspection in accordance with the ANDE-1 Standard.

The Global Mark of Safety and Quality: What to Look for



Why Become an ASME Certificate Holder?

How the assessment of conformity, and by whom, can have a significant impact on the level of confidence of purchasers and regulators on the results.

ASME Conformity Assessment has done and will continue to provide regulators (jurisdictions) and purchasers of products a high level of confidence that the item meet the requirements of the applicable standard, regardless of where in the world they were manufactured.

*Item – product, component, part, service

Why Become an ASME Certificate Holder?

- ASME is responsible for all assessments
  - Responsible for qualifying & certifying auditors
  - Procedures on conduct & annual training encourages that all assessments are performed in a consistent manner
- Uniform implementation of ASME Conformity Assessment Programs & integrity of ASME brand has resulted in wide acceptance by regulators and industry worldwide

Why Become an ASME Certificate Holder?

- Provides a means of remedy when a problem arises – Due Process and Investigations
- Third party oversight of construction and are members of the ASME team performing the assessment
  - May entail additional program audits if CI performs oversight
- Regulators/National Board are actively involved in ASME's conformity assessment scheme and standards development activities

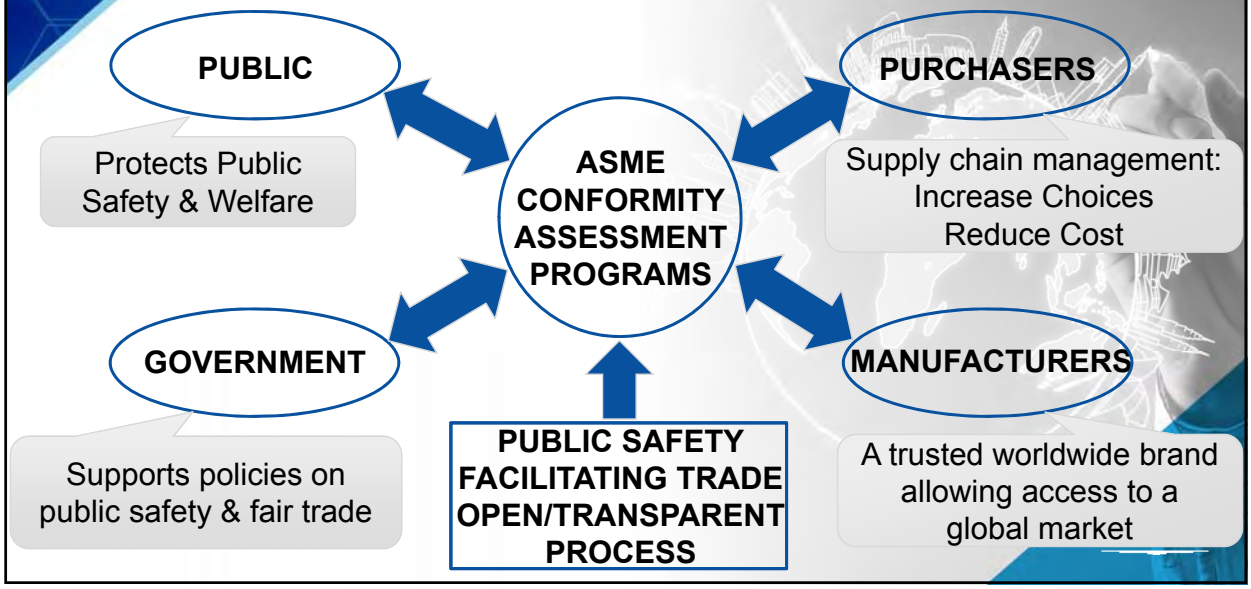
Why Become an ASME Certificate Holder?

- ASME Standards have a proven reliability
- ASME Standards are consensus standards
- Products/Services are supplied to internationally known standards

Why Become an ASME Certificate Holder

- Should not be viewed as a cost burden but rather a tool to:
  - Cut cost through improved processes
  - Aid or facilitate clear understanding of the requirements between Supplier, Purchaser, Government, Public
  - Create a company culture centered around the achievement of quality
  - Demonstrate compliance/conformity to a regulation/standard
  - Advance public safety
  - Access new markets

Benefits ASME Certification



Why Become an ASME Certificate Holder?

- **Demonstrates your commitment** to best practices, efficiency, and sustainability
- **Provides confidence** to owners and suppliers of the quality and safety of your products
- **Achieves universally-recognized** ASME conformity vs. self-declared conformity

Why Conformity Assessment?

Conforming to the Standard	ASME Conformity Assessment
Suppliers Self-Declaration of Conformity	Accreditation and Certification
"We bought the standard and follow it."	*"Our company went through a rigorous certification process designed to validate that we meet the standard."*

NQA-1 Certification

Nuclear Quality Assurance (NQA-1) Certification

The ASME NQA-1 Certification program provides a means for an organization supplying items or services that are safety related to have its Quality Assurance Program recognized by ASME.

The ASME NQA-1 Certification program audits an organizations Quality Assurance Program and is verified to be in conformance with the requirements of the ASME NQA-1 Standard.

Nuclear Quality Assurance (NQA-1) Certification

- Voluntary program
- Certificate valid for 3 years
- 2 interim audits required during the 3-year certification

Benefits

- Fairness and Impartiality
- Provides confidence in the technical integrity of the product or service
- Meets the regulatory and market needs of regions to facilitate international trade

Conformity Assessment Requirements

ASME's Certification Scheme includes the following elements of what has become the *"Industry Standard"* in Certification:

1. Inspection
2. Examination
3. Testing
4. Evaluation
5. Auditing
6. Certification

What is unique about the ASME Scheme is a company must actually demonstrate their Code knowledge and its ability to implement a Quality Assurance Program in accordance with the NQA-1 Standard to produce a product for the supply of items or services that provide a safety function for nuclear facilities.

ASME Certification Process

Nuclear Quality Assurance (NQA-1) Certification

"We have been able to secure millions of dollars in contracts based solely on our company having an NQA-1 Certificate. Recently we were awarded a contract because one of the requirements was to be NQA-1 Certified by ASME."

Doug Sayer
President and Chairman
Premier Technologies
Blackfoot, Idaho


Questions?
Lauren Powers
PowersL@asme.org
(212) 591-7008

Participation in the Nuclear Codes and Standards Process

Kate Hyam
Project Engineering Manager
NCS Asia Liaison

Mumbai, India
January 5, 2019

Ways You Can Participate in the Development of ASME Nuclear Codes and Standards

- Submittal of Technical Inquiries
  - Requests for Revision
  - Interpretation
  - Code Cases
- Committee Participation

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Submittal of Technical Inquiries

- Requests for Revisions, Interpretations and Code Cases.
  - Could result from internal committee sources
  - Could result from external requests from users
  - Inquirers are encouraged to participate in committee discussion when their proposal is on a committee agenda, meetings are open to the public
    - **go.asme.org/inquiry**

NOTE: Additional guidance on submittal of technical inquiries can be found in the front matter of the BPVC.

ASME BPV Code Committees Respond to User Needs

Requests for Revision

- BPV Code committees respond to requests to revise the wording of an existing requirement or to propose a new requirement. (Contact ASME S&C Staff)
- Requests for Code revisions once reviewed by committee and accepted result in new projects assigned to technical committees with an individual volunteer Project Manager

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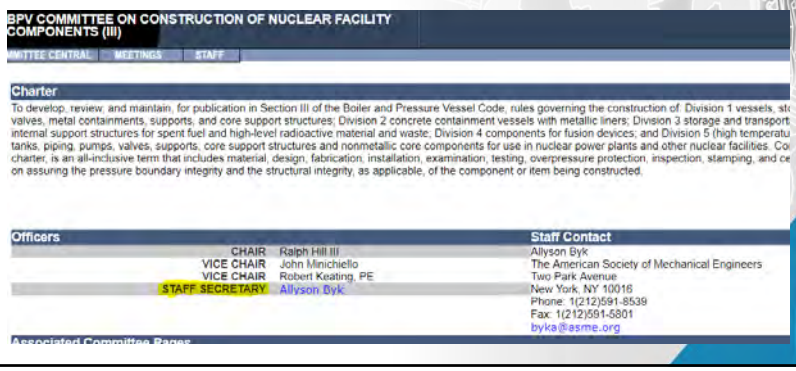
ASME BPV Code Committees Respond to User Needs

- ASME S&C Staff contact info available on C&S Connect committee page and in front matter of code/standard.



BPV COMMITTEE ON CONSTRUCTION OF NUCLEAR FACILITY COMPONENTS (III)

MITTEE CENTRAL | MEETINGS | STAFF

Charter

To develop, review, and maintain, for publication in Section III of the Boiler and Pressure Vessel Code, rules governing the construction of: Division 1 vessels, st valves, metal containments, supports, and core support structures; Division 2 concrete containment vessels with metallic liners; Division 3 storage and transport internal support structures for spent fuel and high-level radioactive material and waste; Division 4 components for fusion devices; and Division 5 (high temperatu tanks, piping, pumps, valves, supports, core support structures and nonmetallic core components for use in nuclear power plants and other nuclear facilities. Co charter, is an all-inclusive term that includes material, design, fabrication, installation, examination, testing, overpressure protection, inspection, stamping, and ce on assuring the pressure boundary integrity and the structural integrity, as applicable, of the component or item being constructed.

Officers		Staff Contact
CHAIR	Ralph Hill III	Allyson Byk
VICE CHAIR	John Minichiello	The American Society of Mechanical Engineers
VICE CHAIR	Robert Keating, PE	Two Park Avenue
STAFF SECRETARY	Allyson Byk	New York, NY 10016
		Phone: 1(212)591-8539
		Fax: 1(212)591-5801
		byka@asme.org

Associated Committee Pages

ASME BPV Code Committees Respond to User Needs

Requests for Interpretation

- BPV Code committees respond to requests to clarify the application of an existing requirement.
- Questions should be formatted such that they can be answered by a Yes or No.
- Intent interpretations are special Interpretation request that result in a need for revision to the standard to clarify conflicting/ambiguous or incorrect wording.

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Steps Prior to Requesting an Interpretation

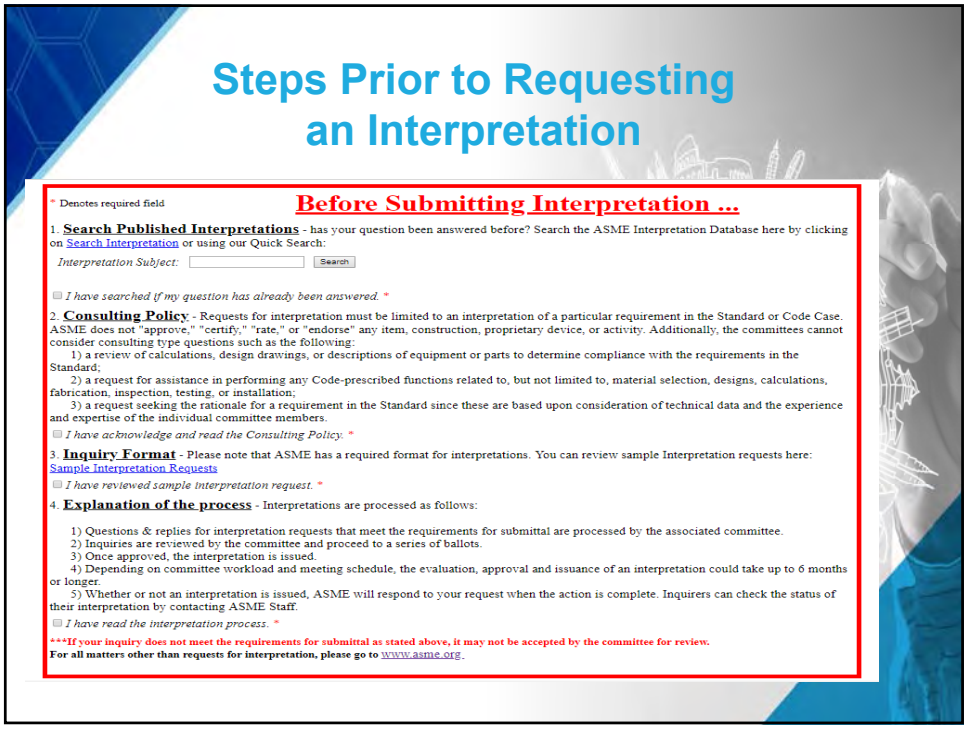
Review Previously Issued Interpretations

- To review issued interpretations (from ~2016 onwards), access the Interpretation Database: https://cstools.asme.org/Interpretation/SearchInterpretation.cfm
- Older issued interpretations were published in the back of codes/standards, and may be accessible on C&S Connect committee page. They are in queue to be migrated to Interpretation Database.

Submitting an Inquiry

- If an interpretation is not available for your inquiry, review the consulting policy and inquiry format detailed on Inquiry Submittal Form prior to submitting an inquiry at: https://cstools.asme.org/Interpretation/InterpretationForm.cfm

Steps Prior to Requesting an Interpretation



* Denotes required field

Before Submitting Interpretation ...

1. **Search Published Interpretations** - has your question been answered before? Search the ASME Interpretation Database here by clicking on Search Interpretation or using our Quick Search:

Interpretation Subject: Search

I have searched if my question has already been answered. *

2. **Consulting Policy** - Requests for interpretation must be limited to an interpretation of a particular requirement in the Standard or Code Case. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity. Additionally, the committees cannot consider consulting type questions such as the following:

1) a review of calculations, design drawings, or descriptions of equipment or parts to determine compliance with the requirements in the Standard;

2) a request for assistance in performing any Code-prescribed functions related to, but not limited to, material selection, designs, calculations, fabrication, inspection, testing, or installation;

3) a request seeking the rationale for a requirement in the Standard since these are based upon consideration of technical data and the experience and expertise of the individual committee members.

I have acknowledge and read the Consulting Policy. *

3. **Inquiry Format** - Please note that ASME has a required format for interpretations. You can review sample Interpretation requests here: Sample Interpretation Requests

I have reviewed sample interpretation request. *

4. **Explanation of the process** - Interpretations are processed as follows:

1) Questions & replies for interpretation requests that meet the requirements for submittal are processed by the associated committee.
2) Inquiries are reviewed by the committee and proceed to a series of ballots.
3) Once approved, the interpretation is issued.
4) Depending on committee workload and meeting schedule, the evaluation, approval and issuance of an interpretation could take up to 6 months or longer.
5) Whether or not an interpretation is issued, ASME will respond to your request when the action is complete. Inquirers can check the status of their interpretation by contacting ASME Staff.

I have read the interpretation process. *

***If your inquiry does not meet the requirements for submittal as stated above, it may not be accepted by the committee for review.**
For all matters other than requests for interpretation, please go to www.asme.org.

Steps Prior to Requesting an Interpretation

Consulting Policy - Requests for interpretation must be limited to an interpretation of a particular requirement in the Standard or Code Case. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity. Additionally, the committees cannot consider consulting type questions such as the following:

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3) a request seeking the rationale for a requirement in the Standard since these are based upon consideration of technical data and the experience and expertise of the individual committee members.

Code Cases

Requests for a Code Case

- Cases represent alternatives or additions to existing rules.
- Can be requested by an inquirer or initiated by a committee.
- The most common applications for Cases are:
  - to permit early implementation of an approved revision based on an urgent need
  - to permit the use of a new material
  - to gain experience with alternative or additional rules prior to incorporation directly into the code or standard.
- https://www.asme.org/about-asme/who-we-are/standards/code-cases-of-the-asme-boiler-and-pressure-vessel

ASME Committee Participation

ASME standards development is truly an open system:

- Full participation by volunteer members based in the U.S. and many countries; all working to improve the ASME Code's technical excellence and global usability.
- Our international volunteer members participate at all levels of standards development - including the highest supervisory committees.
- Many Subcommittee meetings are held via teleconference and are open to the public.

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ASME Committee Participation

As technology development, industry and commerce are increasingly globalized:

- The number and geographic diversity of volunteer participants in ASME's standards development is steadily increasing year-over-year.
- Participation experts based outside North America has also risen consistently.
  - Many participate in a traditional way.
  - Others are members of ***International Working Groups.***

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International Working Groups (IWGs)

- Developed to gain input from international stakeholders who have experience, technical expertise, and distinct perspectives that enhance the global relevance of ASME's standards
- Currently, IWGs are populated by virtue of a common geographic location, rather than a common engineering discipline or expertise (e.g., a working group on "Design").
  - Members provide expertise across a diverse mixture of disciplines (e.g., design, materials, etc.)
- IWGs play a similar roles as subordinate groups in that they should be expected to both develop and review proposed standards actions for subsequent consideration by their respective standards committees
- IWGs typically conduct all of their meetings outside of the U.S. and Canada.

ASME BPV Code International Working Groups

India: BPV Sections I, III, *BPV VIII,* B31.3 and B31.8 and *currently soliciting interested NQA and BPV XI IWG Participants!*

China: BPV Sections II, III, VIII and XI, O&M, QME, NQA, JCNRM

Germany: BPV Sections III and XI

Italy: BPV Section VIII, soon Section III

Korea: BPV Section III and Section XI and NQA are under consideration

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IWG Interested Parties

- Let us know if you are interested!
- Please sign up on the interested parties sheets for NQA, BPV XI or BPV III IWGs
- Details will be sent to you regarding how to apply.
  - Complete a PF-1 Personnel Form. Submit your resume or include your qualifications on the PF-1 form
  - Sign a PAF - Participation Acknowledgement Form. These forms can be downloaded online at: https://www.asme.org/about-asme/get-involved/boards-and-committees/join-a-c-s-committee

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Thank you for your Attention!
Kate Hyam
hyamk@asme.org