Section III Division 2
Code for Concrete Containments

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Background and Overview

• Developed and Maintained by a Joint Committee between ASME and ACI - American Concrete Institute-
• Original Code written in 1971 by ACI-359 Committee
• Originally Included rules for Prestressed Concrete Reactor Vessels
• Industry wanted to benefit by the conformity assessment process of ASME
Scope of Section III Div 2

- Rules for Prestressed and Reinforced Concrete Containments
- Materials
- Design
- Fabrication and Construction
- Construction Testing and Examination
- Structural Integrity Testing
Scope of Section III Div 2

- Includes requirements for the steel liner as well as concrete components
- Penetrations, equipment hatches and other parts not backed by concrete governed by Section III Div 1 NE
- Jurisdictional boundary needs to be very clearly identified for containments integral with the reactor building
Material Issues

- Concrete constituents difficult to fit into ASME material control processes
  - Aggregates
  - Water
  - Fly ash
- Forming and placing of concrete
- Prestressing systems are patented
- Splicing of reinforcing steel requires added control
Design of Concrete Containments

- Loads and Load Combinations are Defined
- A factored load design is used for extreme conditions
- Critical load combination
  - D+1.5P
  - D+1.25P+1.25E₀
  - D+1.0P+1.0E_s
- Primary loads limit section capacity to elastic behavior
Design of Concrete Containments

- Service load conditions are design using an allowable stress approach
- Splicing of reinforcing in tension zone requires welding or a mechanical splice
- Due to thickness of the shell wall creep and shrinkage effects of the concrete must be accounted for in the design
Liner Design Requirements

• No credit allowed for the liner in strength calculations
• Strain limits are established to assure leak tightness
• The liner anchors are designed to a deflection limit
• Detailed to assure anchor failure before liner tear
Fabrication and Construction

- Rules for concrete forming and placing generally follows ACI specifications
- Fabrication, welding, bending and anchoring requirements for the liner plates are provided generally in line with ASME approaches
Construction Testing and Examination

• Enhance frequency of material testing requirements prescribed for concrete constituents
• Qualification of concrete inspection and testing personnel are provided
• Reinforcing steel user testing prescribed
• Prestressing rules are per system supplier but verified by inspector
Structural Integrity Test

- Test to 1.15 times Design Pressure
- Deflection instrumentation required for all concrete containments during the test
- Strain and stress instrumentation is required for prototype concrete containments
- Calculated predicted deflections are compared against actual measured results
- Mapping of cracks in critical areas is required
Application

• Many containment have been build to Section III Div 2 Rules
• Only one containment has been stamped
• NSSS users of concrete containments
  – Areva EPR
  – GE ABWR
  – GE ESWR
  – MHI PWR
• Section III Div 2 in process of a major update
Summary

• Section III Div 2 concrete containment is consistent with format of Division 1 components
• Required the adding:
  – Designer
  – Constructor
• Required developing an ASME approach to handle nonmetallic materials
• Design added load definitions and a factored load design
• Structural integrity testing requires instrumentation