October 30, 2024 Docket No. 052-050

U.S. Nuclear Regulatory Commission
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SUBJECT: NuScale Power, LLC Submittal of Presentation Material Entitled "ACRS Subcommittee Meeting (Open Session) Chapters 3, 8, and 14 (including Part 8)," PM-175101, Revision 0

The purpose of this submittal is to provide the presentation materials for use during the upcoming Advisory Committee on Reactor Safeguards (ACRS) NuScale Subcommittee Meeting on November 5, 2024. The materials support NuScale's presentation of the subject chapters of the US460 Standard Design Approval Application.

The enclosure to this letter is the nonproprietary presentation entitled "ACRS Subcommittee Meeting (Open Session) Chapters 3, 8, and 14 (including Part 8)," PM-175101, Revision 0.

This letter makes no regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions, please contact Jim Osborn at 541-360-0693 or at josborn@nuscalepower.com.

Sincerely,

Mark W. Shaver
Director, Regulatory Affairs
NuScale Power, LLC

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Enclosure 1: "ACRS Subcommittee Meeting (Open Session) Chapters 3, 8, and 14 (including Part 8)," PM-175101, Revision 0

Enclosure 1:

"ACRS Subcommittee Meeting (Open Session) Chapters 3, 8, and 14 (including Part 8)," PM-175101, Revision 0

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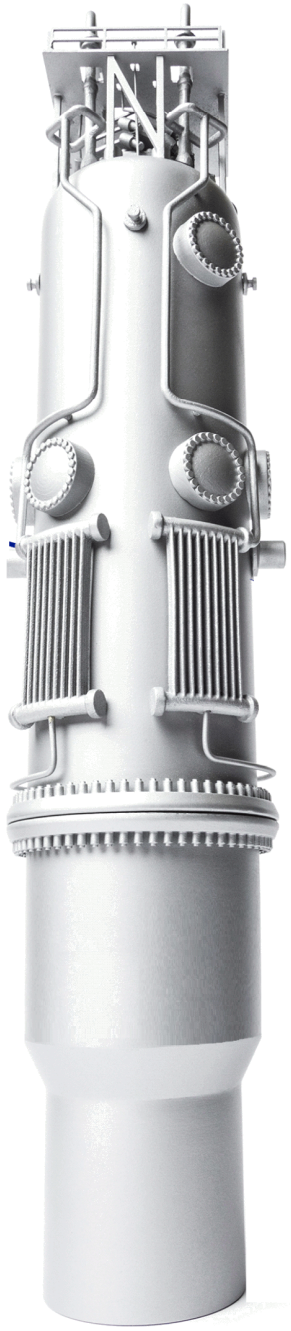


ACRS Subcommittee Meeting

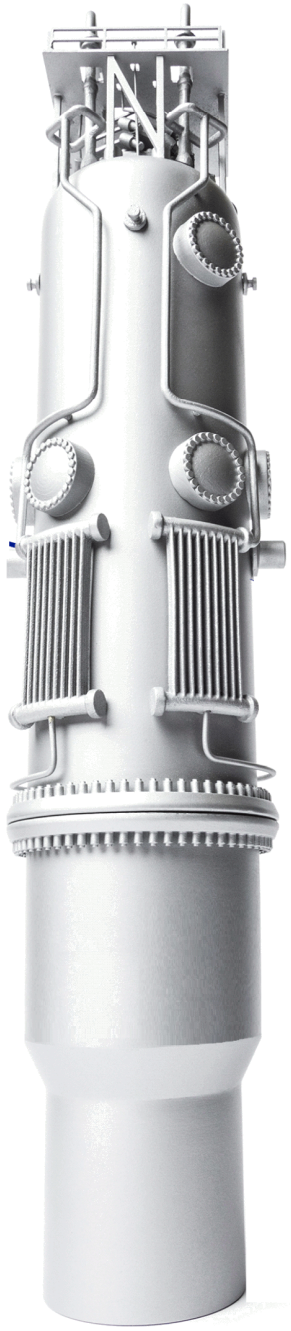
(Open Session)

November 5, 2024

Chapters 3, 8, and 14 (including Part 8)

Acknowledgement and Disclaimer

This material is based upon work supported by the Department of Energy under Award Number DE-NE0008928.



Chapter 3

Design of Structures, Systems, Components, and Equipment

(Excluding Sections 3.7, 3.8, and 3.9.2)

November 5, 2024

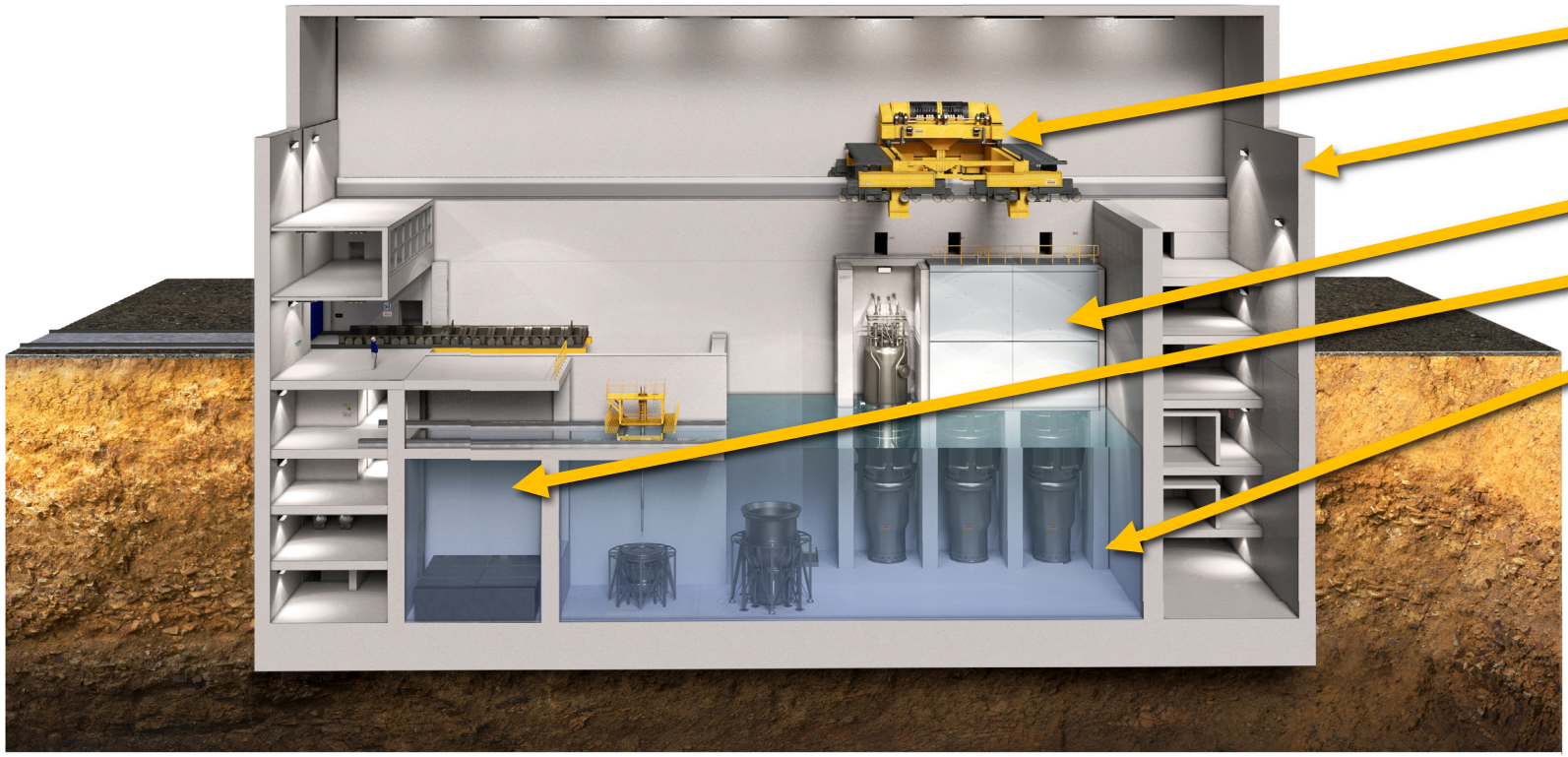
Presenters:

Peter Shaw, Andrea Mota, Daniel Diefendorf, and Gene Eckholt

Chapter 3 Overview

- Chapter 3 describes the methodologies for design of structures, systems, and components
- SDAA is a derivative of the DCA design
- Presentation will focus on high level design and methodology changes and important audit questions and RAIs
- SDAA structures reflect 6 modules (from 12 modules in the DCA) and necessitates updated civil analysis with unchanged design basis
- SDAA design adopted the 2017 ASME BPV Code and 2017 ASME OM Code requirements

US460 Reactor Building Overview



Overhead Heavy Load Handling System

Reactor Building Walls

Bioshield

Spent Fuel Pool

Ultimate Heat Sink

Chapter 3 - Design of Structures, Systems, Components and Equipment

- Section 3.1 – Conformance with U.S. Nuclear Regulatory Commission General Design Criteria
- Section 3.2 – Classification of Structures, Systems, and Components
- Section 3.3 – Wind and Tornado Loadings
- Section 3.4 – Water Level (Flood) Design
- Section 3.5 – Missile Protection
- Section 3.6 – Protection against Dynamic Effects Associated with Postulated Rupture of Piping
- Section 3.9 – Mechanical Systems and Components (excluding 3.9.2)
- Section 3.10 – Seismic and Dynamic Qualifications of Mechanical and Electrical Equipment
- Section 3.11 – Environmental Qualification of Mechanical and Electrical Equipment
- Section 3.12 – ASME Code Class 1, 2, and 3 Piping Systems, Piping Components and Associated Supports
- Section 3.13 – Threaded Fasteners (ASME Code Class 1, 2, and 3)
- Appendix 3C – Methodology for Environmental Qualification of Electrical and Mechanical Equipment

Section 3.1 – Conformance with U.S. Nuclear Regulatory Commission General Design Criteria

- Differences from DCA
  - General design criteria conformance is unchanged from DCA with the following exceptions:
    - GDC 27 conformance simplified for SDA with emergency core cooling system supplemental boron
      - Further discussion in Chapters 4, 6, and 15
    - GDC 32 lower RPV changed to stainless steel so no material surveillance required, Exemption 6 requested
      - Further discussion in Chapter 5
    - GDC 41, PDC 41 updated with passive autocatalytic recombiner maintaining inert atmosphere
      - Further discussion in Chapter 6
      - Similar update to GDC 42 and GDC 43

- Audit Results
  - No audit questions

- RAI Results
  - No RAI questions

Section 3.2 – Classification of Structures, Systems, and Components

- Differences from DCA
  - DCA Table 3.2-1 split to align with guidance for Regulatory Guide (RG) 1.26 and 1.29
    - SDAA Table 3.2-1 lists seismic classification of buildings
    - SDAA Table 3.2-2 lists Seismic Category I pressure retaining mechanical systems and components
  - Specific component classifications moved to system chapters
  - COL Item 3.2-1 removed, no applicants expected to add components to these tables in a COL application

- Audit Results
  - No audit questions

- RAI Results
  - No RAI questions

Section 3.3 – Wind and Tornado Loadings

- Differences from DCA
  - SDAA uses more conservative wind loads than required by regulatory guidance to consolidate analysis
- Audit Results
  - Eight audit questions resolved
  - Clarifications in the FSAR to specify which codes inform wind speeds and importance factors
- RAI Results
  - No RAI questions

Section 3.4 – Water Level (Flood) Design

- Differences from DCA
  - SDAA evaluates flood zones instead of rooms
  - COL Items removed for clarification, and to reflect removal of the personnel access tunnel from Reactor Building to Control Building (CRB)

- Audit Results
  - 17 audit questions resolved

- RAI Results
  - RAI 10167 (Question 3.4.1-3)
    - Updated considerations and assumptions used in the flooding analyses
    - Added tables for flooding sources and flooding zones
    - COL Item 3.4-2 updated to clarify the on-site program will be consistent with Section 3.4.1 methodology and flood levels

Section 3.5 – Missile Protection

- Differences from DCA
  - No essential equipment and no turbine missile evaluation for CRB

- Audit Results
  - 12 audit questions resolved
  - Added FSAR clarification regarding CRB and no essential equipment, therefore no turbine missile evaluation required
  - Added inputs used in the turbine analysis and a table for turbine missile parameters
  - Added a table identifying essential structures, systems, components and their locations
  - Added missile parameters for RW-IIa structures

- RAI Results
  - No RAI questions

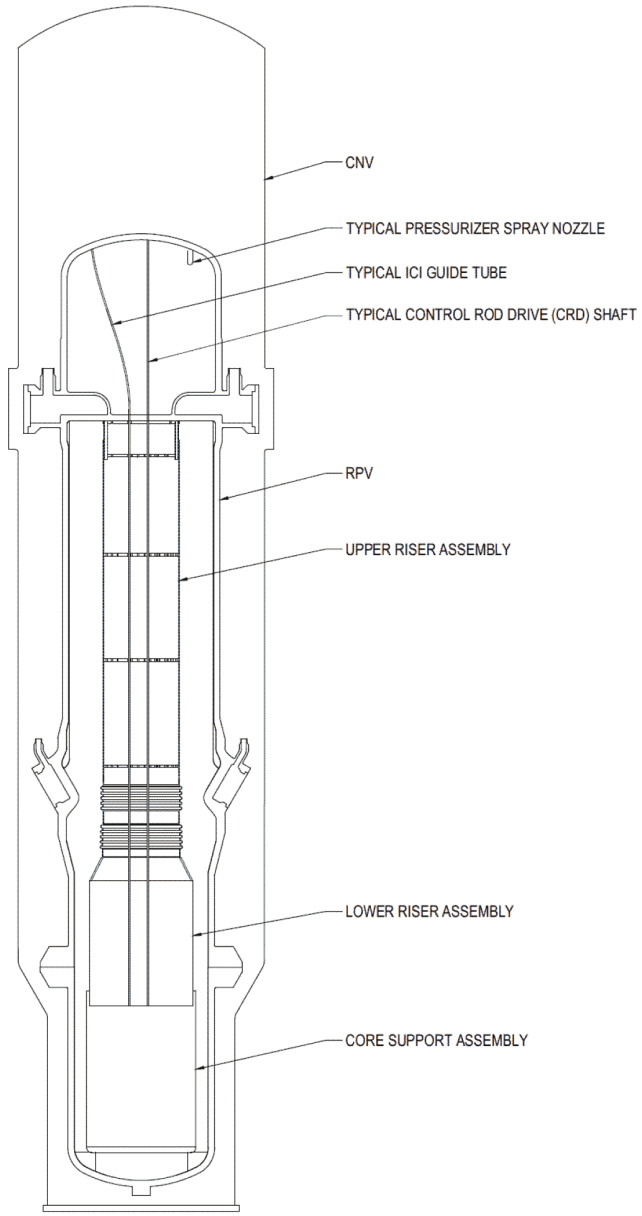
Section 3.6 – Protection against Dynamic Effects Associated with Postulated Rupture of Piping

- Differences from DCA
  - Postulated pipe rupture hazards analysis updated for the SDA design
  - Leak-before-break methodology replaced with Branch Technical Position (BTP) 3-4 B.1(ii) methodology
- Five Audit questions resolved
- RAI results
  - RAI 10134 (Question 3.6.3-1)
    - Provided clarification on methodology change from leak-before-break to BTP 3-4 B.1 (ii)
    - Resulted in no changes to the SDA
  - RAI 10135 (Question 3.6.2.7-2)
    - Provided clarification on the leakage detection system in regards to RG 1.45
    - Resulted in no changes to the SDA
  - RAI 10177 (Question 3.6.2-2)
    - Demonstrated compliance with BTP 3-4 requirements
    - Emphasized margin to demonstrate robustness of the design
    - Weld examinations clarified in the FSAR

Section 3.9.1 – Special Topics for Mechanical Components

- Differences from DCA
  - Additional transients: density wave oscillations, loss of feedwater, initial test program, secondary leakage tests, control rod drive system piping failure
  - Removed transients: hydrogen detonation and hydrogen detonation with deflagration-to-detonation transition
  - Transients with cycle changes: containment flooding and drain, power ascent from hot shutdown, and turbine trip without bypass
- Audit Results
  - Three audit questions resolved
- RAI Results
  - No RAI questions

Detail from FSAR Figure 3.9-1



Section 3.9.2 – Dynamic Testing and Analysis of Systems, Components, and Equipment

- To be presented at a later ACRS meeting

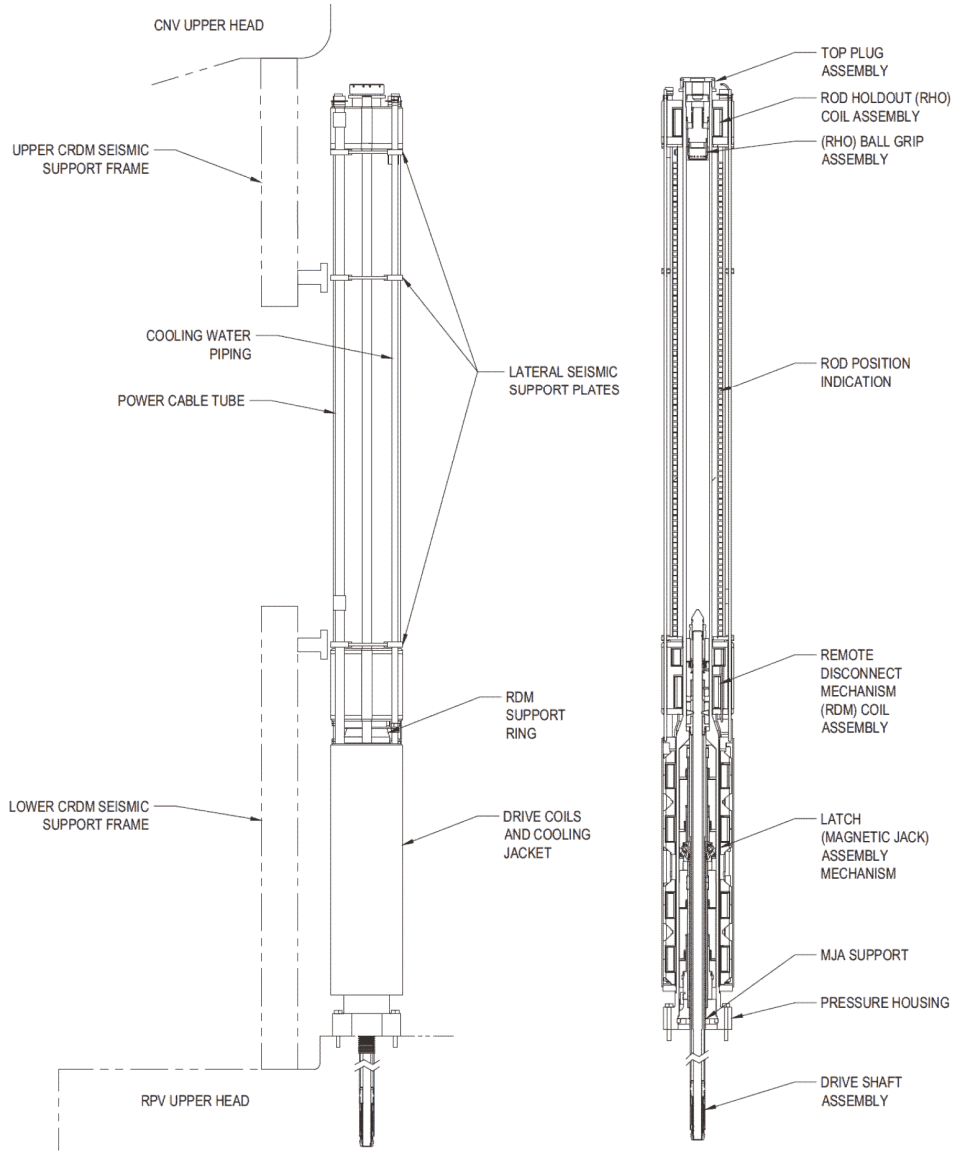
Section 3.9.3 – ASME Code Class 1, 2, 3 and Non-Code Components, Component Supports, and Core Support Structures

- Differences from DCA
  - Updated to the 2017 Edition of ASME BPVC
- Audit Results
  - 12 audit questions resolved
- RAI Results
  - RAI 10150 (Question 3.9.3-11) response submitted
    - Provided additional information for the RPV flange bolted connections
    - Resulted in no changes to SDAA

Section 3.9.4 – Control Rod Drive System

- Differences from DCA
  - Change from welded connection to bolted connection
- Audit Results
  - Seven audit questions resolved
- RAI Results
  - RAI 10131 (Question 3.9.4-8)
    - Provided additional information for steam generator set screws
    - Added additional augmented visual examinations
  - RAI 10131 (Question 3.9.4-9)
    - Provided additional information for the control rod drive mechanism housings and associated connections
    - Resulted in no changes to the SDAA

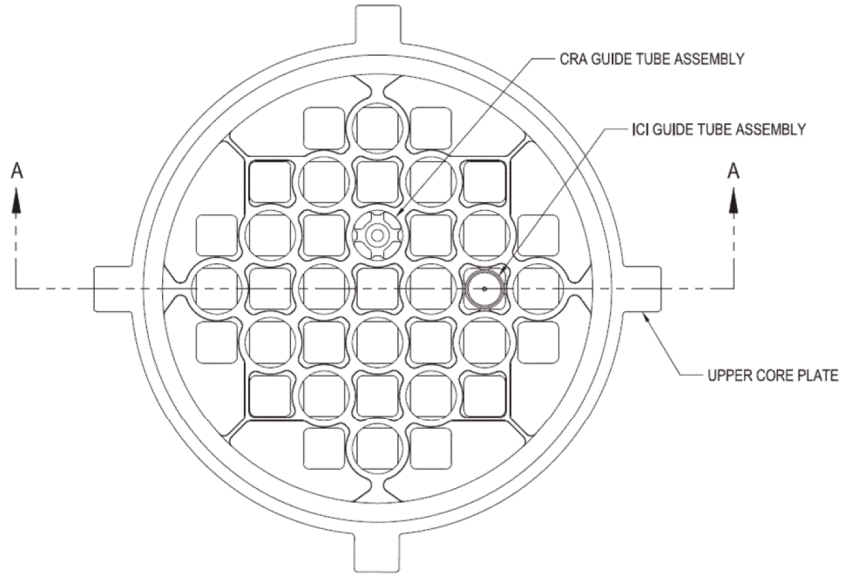
Detail from FSAR Figure 4.6-2

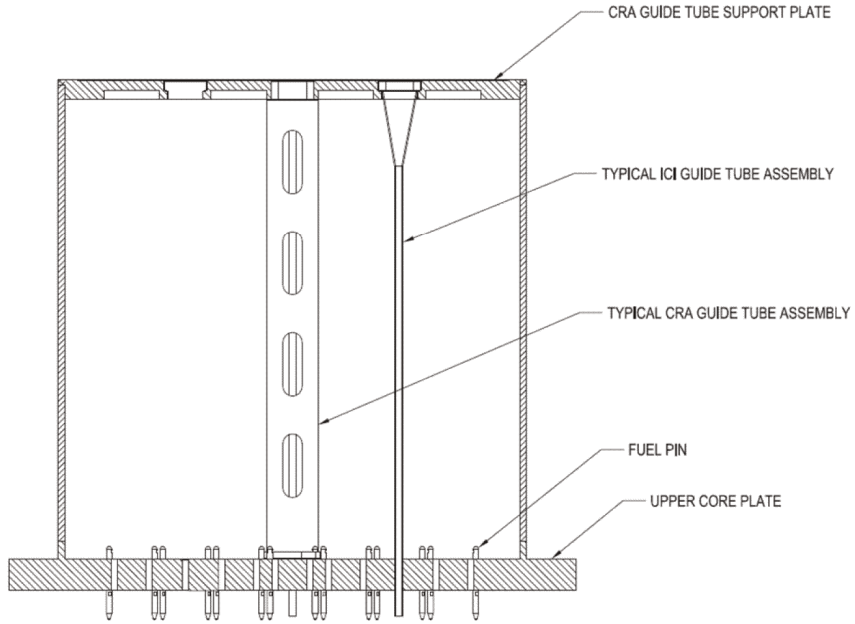


Section 3.9.5 – Reactor Vessel Internals

- Differences from DCA
  - Upper Steam Generator Support – Reclassified from internal structure to a Class 1 Support
- Audit Results
  - No audit questions
- RAI Results
  - No RAI questions

Detail from FSAR Figure 3.9-3





Section 3.9.6 – Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints

- Differences from DCA
  - Updated requirements from ASME OM Code, 2012 Edition to ASME OM Code, 2017 Edition
  - Updated to ASME QME-1-2017
  - Updated requirements from 10 CFR 50.55a for New Reactors

- Audit Results
  - 16 audit questions resolved
- RAI Results
  - No RAI questions

Section 3.10 – Seismic and Dynamic Qualifications of Mechanical and Electrical Equipment

- Differences from DCA
  - Newer versions of regulatory guidance and industry standards adopted
  - Three COL Items related to administration of qualification program removed
    - A COL Application will incorporate the seismic and dynamic qualification program described in the SDA by reference
- Audit Results
  - One audit question resolved
- RAI Results
  - No RAI questions

Section 3.11 – Environmental Qualification of Mechanical and Electrical Equipment

- Differences from DCA
  - List of environmentally qualified equipment updated to reflect US460 design

- 11 audit questions resolved
  - Created new equipment qualification zones for control building and for harsh environments with electronic equipment
  - Clarified application of industry standards
  - Evaluated design-basis accident dose contributions for the limiting collapsed liquid level event

- RAI Results
  - No RAI questions

Appendix 3C – Methodology for Environmental Qualification of Electrical and Mechanical Equipment

- Differences from DCA
  - Updated to reflect US460 design
    - Environmental qualification zones
    - Harsh/Mild environment areas
    - Post-accident operating times
    - Normal operating conditions
    - Design-basis event environment conditions
    - Limiting design-basis accident environmental qualification radiation dose
- Audit Results
  - One audit question resolved
- RAI Results
  - No RAI questions

Section 3.12 – ASME Code Class 1, 2, and 3 Piping Systems, Piping Components and Associated Supports

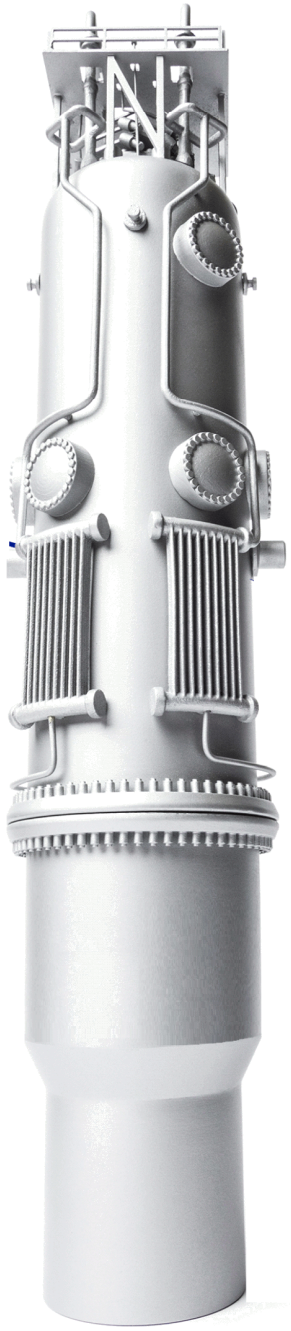
- Differences from DCA
  - Removed reference to NUREG-1367, “Functional Capability of Piping Systems”
- Audit Results
  - 12 audit questions resolved
    - Clarified how the functional capability guidance of NUREG-1367 is addressed by NuScale
- RAI Results
  - No RAI questions

Section 3.13 –Threaded Fasteners (ASME Code Class 1, 2, and 3)

- Differences from DCA
  - Containment vessel pressure retaining threaded fasteners are examined in accordance with ASME BPVC, Section XI, Subsection IWE.

- Audit Results
  - Three audit questions resolved

- RAI Results
  - RAI 10133 (Question 3.13-1) response submitted
    - Added augmented visual examination requirements for ASME Class 1 threaded inserts and seal welds



Chapter 8
Electric Power

November 5, 2024

Presenter: David Rickenbach

Chapter 8 Overview

- Section 8.1 – Overview
- Section 8.2 – Offsite Power Systems
- Section 8.3 – Onsite Power Systems
- Section 8.4 – Station Blackout (SBO)

- SDAA changes from DCA :
  - Conforming changes in SDAA reflect US460 standard design, which is functionally equivalent to the DCA
  - DCA included six COL items, none in the SDAA
  - FSAR content optimized from the US600 DCA
    - Example: Removed specific wattage of plant loads from FSAR tables

- 14 audit questions resolved

Overview of Design Changes

- AC power
  - Common load AC power provided by redundant transformers
  - High voltage AC electrical distribution configuration
  - Backup power supply system configuration
- DC power
  - Single battery string for each augmented DC power system (EDAS) power channel
  - EDAS divisions are physically separated in independent rooms
  - EDAS includes power channel cross-connects

Section 8.1 – Overview

- High-level overview of onsite and offsite power sources
- Technical content reflects US460 plant systems instead of US600 plant systems
- GDC conformance is unchanged from US600 DCA

- Audit Results
  - FSAR Table 8.1-1 revised to include more information for the US460 standard plant design, such as the IEEE standards applicable to EDAS
- RAI Results
  - No RAI questions

Section 8.2 – Offsite Power Systems

- Technical content is generally unchanged
- COL items removed in SDAA:
  - Removed COL Item 8.2-1, description of the site-specific plant switchyard
  - Removed COL Item 8.2-2, description of the site-specific offsite power (grid study)
  - Removed COL Item 8.2-3, description of required testing
  - With GDC 17 and 18 exemption, site does not rely on offsite power
    - DCA COL items were unnecessary

- Audit Results
  - No audit questions
- RAI Results
  - No RAI questions

Section 8.3 – Onsite Power Systems

- Technical content is revised to reflect design on US460 electric power systems
- COL items removed in SDAA:
  - Removed COL Item 8.3-1, as the US460 design does not have AAPS
  - Removed COL Item 8.3-2, no electrical heat tracing system: not required for a safety finding in DCA
  - Removed COL Item 8.3-3, site-specific information was not needed to demonstrate compliance with RG 1.204 in DCA
    - US460 standard design maintains conformance with RG 1.204

- Audit Results
  - Addition of Table 8.3-3 to describe EDAS augmented system design, qualification, and quality assurance provisions

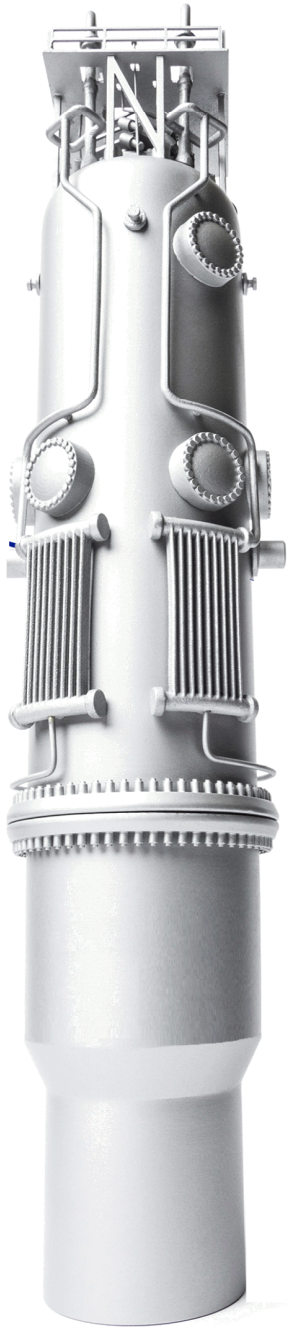
- RAI Results
  - No RAI questions

Section 8.4 – Station Blackout

- The US460 SBO is similar to the DCA.
- An SBO does not does not pose a significant challenge to the plant, because the plant does not rely on AC power for performing safety functions. A safe and stable shutdown is automatically achieved and maintained for 72 hours without operator actions.

Reliability and Availability of EDAS

- EDAS batteries are environmentally qualified per IEEE 323
- Portions of the nonsafety-related EDAS supplying DC power to ECCS valves are augmented:
  - SC-I components
  - Protected from natural phenomena (GDC 2)
  - Protected from environmental conditions (GDC 4)
  - Not shared between modules (GDC 5)
  - Protected from fire per RG 1.189 (GDC 3)
  - Include physical independence per RG 1.75
  - Separated into redundant load groups
  - Designed to be single-failure proof per RG 1.53
- Validated EDAS is within the scope of the Maintenance Rule Program
- Included EDAS in owner-controlled requirements manual



Chapter 14 (including Part 8) Initial Test Program and ITAAC

November 5, 2024

Presenter: Tyler Beck

Chapter 14 Overview

- Section 14.0 – Verification Program (overview)
  - Section 14.0 is unchanged from the DCA
- Section 14.1 – Specific Information to be Addressed for the Initial Plant Test Program (describes relevant regulations)
  - Section 14.1 is unchanged from the DCA
- Section 14.2 – Initial Plant Test Program (ITP)
- Section 14.3 – Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC), including the ITAAC selection methodology
- Part 8 includes the ITAAC for the US460 standard plant design
- Changes from the DCA generally reflect system design changes to the US460
- 22 audit items directly in Chapter 14 or Part 8
  - Several additional audit items tied to ITP or ITAAC originate through other chapters

Section 14.2 – Initial Plant Test Program

- The methodology and general content of ITP is unchanged from the DCA
- Revised test abstracts are due to design changes or specific issues from the NRC staff
  - Example: Audit item request resulting in clarification of test objectives for the emergency core cooling system (ECCS) blowdown test (e.g., “Verify ECCS RRVs remain closed above the IAB block threshold differential pressure setpoint”)
- Overhead heavy load handling system interlock tables removed from Section 14.2
  - Interlocks described in Chapter 9
- Test updates to reflect ease of testing and operations (e.g., rearranged testing sequences, improved numbering scheme for test method)

Section 14.3 – Inspections, Tests, Analyses, and Acceptance Criteria

- Section 14.3 presents the ITAAC selection methodology
  - ITAAC selection methodology is unchanged from DCA
  - DCA Section 14.3 reflected ITAAC being included in Tier 1 → there is no Tier 1 for SDAA
  - DCA Section 14.3 included ITAAC discussions and → SDAA includes these in Part 8
- Part 8 presents the SDAA ITAAC and associated ITAAC discussions
  - This information was included in Tier 1 and FSAR Section 14.3 in the DCA

Part 8 – ITAAC

- SDAA ITAAC additions:
  - Passive autocatalytic recombiner
    - ITAAC verifying recombination rate, qualification, functional arrangement
  - ITAAC verifying functional arrangement for ECCS supplemental boron
  - ITAAC verifying containment vessel net free volume (applicable to first NuScale Power Module only)
  - ITAAC verifying automatic system response to new high radiation signals:
    - New automatic high radiation actions in main steam lines, auxiliary boiler system, demineralized water system, radioactive drain waste system, and site cooling water system
  - ITAAC verifying travel limits of the new fuel elevator
  - ITAAC verifying integrated system validation for Human Factors Engineering

Part 8 – ITAAC (continued)

- SDAA ITAAC removal based on design changes:
  - ITAAC verifying leak-before-break (LBB) analysis → no LBB analysis (Section 3.6)
  - ITAAC related to RPV material surveillance specimens → no RPV material surveillance program (Section 5.3)
  - ITAAC verifying ASME design and data reports for Class III chemical and volume control system piping and components → reclassified to ASME B31.1 piping (Section 9.3.4)
  - ITAAC verifying controls for important human actions → no important human actions (Section 18.6)
  - ITAAC verifying the new fuel jib crane travel limits → no travel limits due to single-failure proof design (Section 9.1.4)
  - ITAAC verifying normal main control room lighting → not a top-level design feature (Section 14.3)
  - ITAAC verifying 8-hour battery-pack emergency lighting fixtures → not included in the design (Section 9.5.3)
  - ITAAC verifying automatic system response to high radiation signal in pool surge control system → this automatic system action is not included in the design (Sections 9.1.3 and 11.5)

Part 8 – ITAAC (continued)

- SDAA ITAAC updates:
  - ITAAC verifying inability for drain down of ultimate heat sink → revised to include anti-siphon devices on piping that extends below 49.5 ft pool level (Section 9.1.3)
  - ITAAC verifying single-failure proof overhead heavy load handling system components → revised to one ITAAC
  - ITAAC verifying features of the module lift adapter and module lifting fixture → incorporated into lower block assembly and top support structure (Section 9.1.5)
  - ITAAC verifying Radioactive Waste Building as an RW-IIa structure → revised to reflect only the RW-IIa portions of the building (Section 3.8.4)

Acronyms

ACRS	Advisory Committee on Reactor Safeguards
ASME	American Society of Mechanical Engineers
BDG	Backup Diesel Generator
BTP	Branch Technical Position
BPVC	Boiler and Pressure Vessel Code
COL	Combined Operating License
CRB	Control Building
DCA	Design Certification Application
ECCS	Emergency Core Cooling System
EDAS	Augmented DC Power System
EQ	Environmental Qualification
FSAR	Final Safety Analysis Report
GDC	General Design Criterion
IAB	Inadvertent Actuation Block
IEEE	Institute of Electrical and Electronics Engineers
ITAAC	Inspections, Tests, Analyses, and Acceptance Criteria
ITP	Initial Test Program
NPS	Nominal Pipe Size
NRC	Nuclear Regulatory Commission
OM	Operation and Maintenance
PDC	Principal Design Criteria
RAI	Request for Additional Information
RG	Regulatory Guidance
RPV	Reactor Pressure Vessel
RRV	Reactor Recirculation Valve
RWB	Radioactive Waste Building
SDAA	Standard Design Approval Application
SDA	Standard Design Approval