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SMR-300 CRDS Testing Plans

October 1, 2024

Presented by: Clark Shurtleff

SMR, LLC, A Holtec International Company
Krishna P. Singh Technology Campus
One Holtec Boulevard
Camden, NJ 08104, USA

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Meeting Agenda

- Introductions
- Purpose & Outcome
- SRP 3.9.4 Expectations
- Discussion of Testing Program
- Overview of SMR-300 CRDS Design
- Open Forum

Purpose & Outcome

- Purpose:
  - ✔ Describe the approach to meet SRP 3.9.4 Acceptance Criteria
  - ✔ Describe the CRDS design

- Outcome:
  - ✔ Align on plan for CRDS Operability Assurance Program: SMR-300 design will reference existing testing and operating experience (OE)
    - Identify essential parameters necessary to demonstrate applicability of existing testing and OE
    - Identify information necessary to be submitted to support review

SRP 3.9.4 Review Areas

1. Descriptive information on design and operation

   Describe design and operation in SAR

2. Design codes, specifications, GDCs, guidance applied

   Describe applicable codes, GDCs, etc. in SAR

3. Design loads, load combinations, and associated limits

   Meet ASME Code requirements for pressure boundary
   Meet specified requirements for other components

4. Operability assurance program or reference to prior test programs

   Focus of this meeting

Operability Assurance Program

From SRP 3.9.4:

The operability assurance program is reviewed to ascertain coverage of the following:

A. Life cycle test program, including acceptance criteria for testing
B. Proper service environment imposed during testing
C. Mechanism functional tests
D. Program results

Operability Assurance Program

- SMR asked what “Operability Assurance Program” means during Sept 2022 meeting (ML22252A194)
- NRC Response:

“With respect to the NRC’s definition of operability assurance as it relates to the overall control rod drive mechanism and CRDS function, the NRC staff responded that the reactor should be able to be shut down and safely kept shut down in all postulated conditions over the entire life of the plant.”

- SMR understanding:
  Operability Assurance = Life cycle testing +
  Factory acceptance testing +
  Startup testing + In-service testing

Operability Assurance Program

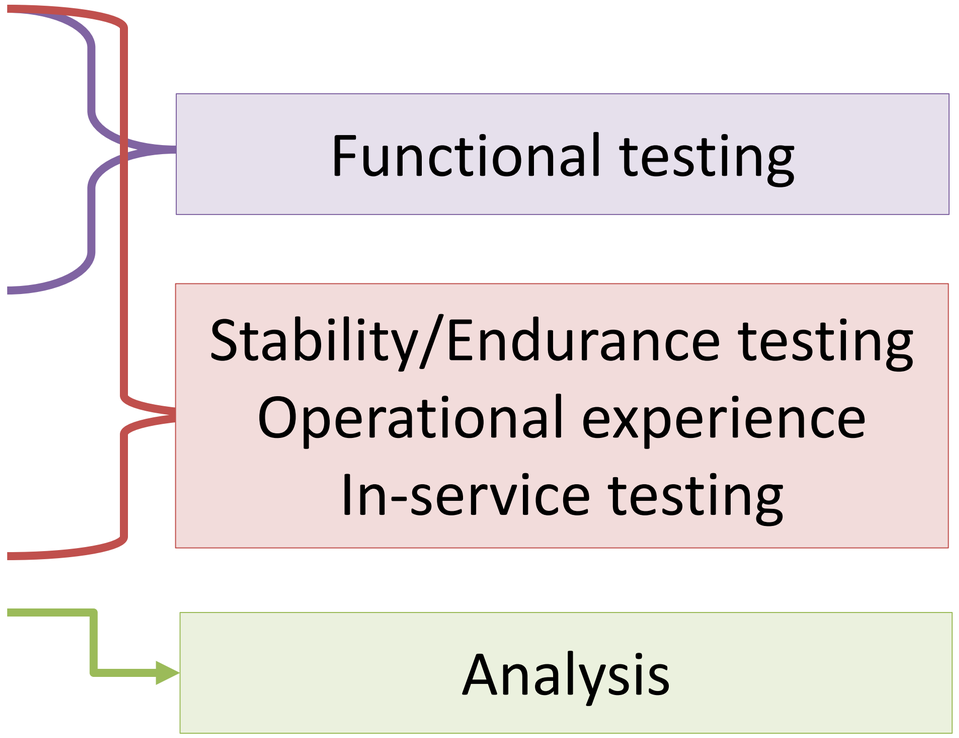
- Two main options:

1) Conduct a new testing program
2) Reference previous test programs and/or OE on similar apparatus

- SMR is pursuing Option #2
  - ✔ Need to demonstrate applicability of previous test programs/OE
  - ✔ Pre-service testing for SMR-300 CRDS will be limited:
    - Factory acceptance testing
    - Pre-operational/startup testing (once installed)

Purpose of Operational Assurance

- Demonstrate key performance metrics:
  - Insertion and withdrawal times
  - Latching operation
  - Scram operation and time
  - Wear
  - Stability of attributes over time
  - Ability to overcome stuck rod



See SRP 3.9.4, III. REVIEW PROCEDURES, #4

Purpose of Operational Assurance

- Key performance metrics inform SMR-300 safety analysis:
  - Insertion and withdrawal times
    - Normal operations (startup, shutdown)
    - Ch 15 - Uncontrolled RCCA Withdrawal
    - Ch 15 - Control Rod Misoperation
  - Rod drop time

SMR's plan to demonstrate that key performance metrics will be met in SMR-300

- Demonstrate applicability of prior testing/OE
- Compare essential parameters in three major areas:

- Equipment design
  - ✓ CRDM
  - ✓ *Upper internals*
  - ✓ RCCA
  - ✓ Fuel Assembly

- Operating conditions
  - ✓ Temperature
  - ✓ Pressure
  - ✓ Flow
  - ✓ Chemistry
  - ✓ Design lifetime

- Mechanical response:
  - ✓ Deflection of CRGA
  - ✓ Deflection of CRDM pressure housing
- Influenced by:
  - ✓ Loading (e.g., seismic, LOCA)

Question for NRC Staff:

- Are there any essential parameters that are not listed that the NRC staff is interested in seeing evaluated?

- Equipment design
  - CRDM
  - *Upper internals*
  - RCCA
  - Fuel Assembly
- Operating conditions
  - Temperature
  - Pressure
  - Flow
  - Chemistry
  - Design lifetime
- Mechanical response:
  - Deflection of CRGA
  - Deflection of CRDM pressure housing
- Influenced by:
  - Loading (e.g., seismic, LOCA)

SMR will compare essential parameters to those used in prior test programs and operating plants

- SMR-300 Qualification Summary Report will justify applicability of testing and OE:
  - Equipment design
    - Compare SMR-300 to tested and operating configurations
  - Operating conditions
    - Compare SMR-300 to test conditions and operating plants
  - Mechanical response
    - Compare SMR-300 deflections to tested deflections

Question for NRC Staff:

- Is there any documentation that is <u>not listed</u> that the NRC staff would want in order to evaluate the CRDS?

- SAR content:
  - ✔ SSC design description
  - ✔ Operating conditions
  - ✔ Mechanical response
    - (PSAR) Analysis methods and acceptance criteria
    - (FSAR) Analysis results
  - ✔ Reference Qualification Summary Report

- Qualification Summary Report:
  - ✔ Summarize existing testing and OE
  - ✔ Justify applicability to SMR-300 design

SMR-300 CRDS Design

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CRDM Design – [[Framatome L106A]]

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Upper Internals

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RCCAs

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Fuel

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Operating Conditions

	SMR-300	[[ ]]
Normal Operating Temperature	[[ ]]	[[ ]]
Normal Operating Pressure	[[ ]]	[[ ]]
Average Coolant Flow Velocity Through Core	[[ ]]	[[ ]]
Chemistry	[[ ]]	[[ ]]

Conclusion – SMR plans to:

- Meet SRP 3.9.4 guidance for Operability Assurance by referencing existing test programs and operating experience
- Utilize key performance metrics from prior testing/OE to as inputs to safety analysis
- Demonstrate applicability by comparing essential parameters to previous test programs and operating plants

Next steps

- Possible future preapplication meetings
  - Additional detail on essential parameters:
    - Changes to CRDS design to address OE
    - Details of upper internals design
    - Anticipated deflections
  - Planned timelines for completion of design and analysis

Open Forum