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Environmental Qualification Program SMR-300

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Meeting Agenda

- Introductions
- Purpose & Outcome
- Overview of Environmental Qualification Program
- Regulatory Compliance
- Scope of Equipment
- Qualification Methodology
- Conformance with RG 1.89 Rev.2
- Open Forum

Purpose & Outcome

- Purpose

  To provide a high-level overview of Holtec's approach and methodology for the SMR-300 Environmental Qualification (EQ) Program for Safety Related Mechanical, Electrical, and Instrumentation and Control (I&C) Equipment.

- Outcome

  To obtain feedback from the NRC staff on Holtec's approach and methodology of the SMR-300 EQ Program.

Overview of Environmental Qualification Program

- Demonstrates with reasonable assurance that equipment important to safety, within the scope of 10 CFR 50.49, can perform its function(s) without experiencing a common-cause failure before, during, and after for design basis events (DBE) as applicable.

Regulatory Compliance

- Requirements
  - 10 CFR 50.49, Equipment Qualification Rule
  - 10 CFR 50 Appendix A (GDC) 1, 2, 4, and 23
  - 10 CFR 50 Appendix B, Quality Assurance Criteria III, XI, XVII
- Regulatory Guidance
  - Regulatory Guide 1.89 Rev 2, Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants
  - Standard Review Plan 3.11 Rev 3 (and Draft Rev 4), Environmental Qualification of Electric and Mechanical Equipment
- Related Regulatory Guidance
  - Regulatory Guide 1.100 Rev 4, Seismic Qualification of Electric and Mechanical Equipment for Nuclear Power Plants
  - Standard Review Plan 3.10 Rev 4, Seismic & Dynamic Qualification of Electric and Mechanical Equipment

Industry Standards Endorsed for Qualification

- IEEE Standards
  - IEC/IEEE 60780/323-2016, Qualification of Class 1E Equipment
  - Several IEEE -323 daughter standards for specific components: cables, MOVs, etc.
  - IEEE 344-2013, Seismic Qualification of Class 1E Equipment

Procedure & Controls

- Program Document
- Procedural Controls
  - Measures for managing EQ Program
  - Procedures for evaluating qualification test results
  - Requirements for evaluating and establishing qualification for equipment
  - Procurement specifications and procedures
  - Measures to identify and control design changes
  - Maintenance procedures to preserve qualified life
  - Measures to review of EQ operating experience and implement appropriate actions

Scope Of Equipment in 10 CFR 50.49

- Category of Equipment in Harsh Environment
  - (1) Safety-related electric equipment.
    - (i) This equipment is that relied upon to remain functional during and following design basis events to ensure

      (A) The integrity of the reactor coolant pressure boundary.

      (B) The capability to shut down the reactor and maintain it in a safe shutdown condition; or

      (C) The capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guidelines in § 50.34(a)(1), § 50.67(b)(2), or § 100.11 as applicable.
    - (ii) Design basis events are defined as conditions of normal operation, including anticipated operational occurrences, design basis accidents, external events, and natural phenomena for which the plant must be designed to ensure functions (b)(1)(i) (A) through (C),
  - (2) Nonsafety-related electric equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions specified in subparagraphs (b)(1) (i) (A) through (C) of paragraph (b)(1) of this section by the safety-related equipment.
  - (3) Certain post-accident monitoring equipment.

Scope of Equipment Continued

- The SMR-300 is designed with passive core cooling capability, therefore, there are only very limited number of components that perform safety functions
  - One time actuation of valves for ESF functions
  - Pressure, temperature, level monitoring sensors that provide signals to the safety systems
  - Post-accident monitoring instrumentation that are required to function during and after design basis events and severe accident events

Qualification Methodology

- The majority of SMR-300 equipment requiring EQ falls within environmental conditions that have existing commercial EQ test data.
- Environmental conditions during limiting design basis events may necessitate new EQ testing for a select amount of equipment
  - ~50°F higher peak than the common EQ test profiles
  - Considering options to lessen limiting environmental conditions

Conformance with RG 1.89 Revision 2 (4/2023)

- Purpose paragraph states, “This RG also provides guidance for addressing environmental stressors affecting long-term reliability of electric equipment.”
  - Appears to expand scope for EQ and meeting 10 CFR 50.49 compared to RG 1.89 Revision 1
  - No precedence for implementation

- Proposed SMR-300 approach to conformance with long-term reliability:
  - Not considered within the scope of EQ program or performing aging analysis and qualification program; instead rely on the following for equipment located in mild environment (where 10CFR50.49 does not apply):
    - Operating Experience (*endorsed Std IEC/IEEE 60780-323 Clause 6.1.2*)
    - Generic Aging Lessons Learned (*mentioned in RG 1.89 Section C.1.f.*)
    - Condition Monitoring (*mentioned in RG 1.89 Background (3) and C.1.g*)
    - Mean Time Before Failure

Open Forum