



# NRC Perspective on Establishing Similarity To Previously Qualified Equipment

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# Presentation Overview

- Equipment Qualification (EQ) Regulatory Basis and Process Overview
- Similarity Importance In EQ
- Similarity Importance in Supply Chain Scenarios
- Supplier Oversight's Role In Establishing Qualification
- Challenges When Trying To Qualify Commercial Grade Equipment
- Similarity Issues Identified During Recent NRC Inspections
- Questions

# Why Is Equipment Qualification (EQ) Required

- Protects against risk significant common cause failures
- Provides a basis for ensuring design requirements have been met
- Allows for proactive replacement of components prior to failures that could challenge the plant

# EQ Regulatory Basis

- Design Validation is required by Criterion III of Appendix B to 10CFR Part 50
- Equipment qualification is a subset of design validation and is performed to ensure that equipment (e.g. components) will be capable of performing their safety functions under all design basis conditions
  - Environmental
  - Seismic
  - EMI/RFI
  - Functional

# EQ Process Overview

- Equipment Qualification Usually Involves:
  - Identifying design requirements including design envelope
  - Verifying through a combination of analysis or testing that the above design requirements have been achieved
  - Defining critical parameters that need to be controlled during manufacture (and establishing acceptance criteria)
    - Materials
    - Manufacturing processes
    - Tolerances

# Similarity Importance In EQ

- Establishes validity of type testing and analysis to production components
- Allows use of previous testing as part of dedication process
- Is specifically discussed in certain equipment qualification standards

# Example of Similarity Analysis Requirements

- 10CFR50.49 states in part that, “Each item of electric equipment important to safety must be qualified by one of the following methods:
  - (1) Testing an identical item of equipment under identical conditions or under similar conditions with a supporting analysis to show that the equipment to be qualified is acceptable.
  - (2) Testing a similar item of equipment with a supporting analysis to show that the equipment to be qualified is acceptable.
  - (3) Experience with identical or similar equipment under similar conditions with a supporting analysis to show that the equipment to be qualified is acceptable.
  - (4) Analysis in combination with partial type test data that supports the analytical assumptions and conclusions.”

# Maintaining Similarity

Generally requires

- Design control
- Manufacturing control
- Material control
- Control of special processes

OR

- Testing to verify critical characteristics of each item



# Overview of EQ Interfaces

Proper definition and control of EQ Interfaces is critical to establishing and maintaining an effective EQ program.

- Reactor Designer/Vendors
- Reactor Designer/Operators
- Vendors/Sub-vendors
- Vendors/Test Facilities
- Reactor Designer/Test Facilities

# Similarity Importance in Supply Chain Scenarios

- OEM commissions test program to qualify specific component
  - Design and manufacturing controls required to maintain similarity between tested and production components
  - Need to ensure controls are in place to evaluate and account for any modifications made to test specimens during testing
- OEM commissions test program to qualify family of components
  - Design and manufacturing controls required to maintain similarity between tested and production components
  - Justification of similarity required for establishing family group
    - For example, see IEEE 382 for establishing safety related actuator family groups

# Similarity Importance in Supply Chain Scenarios (cont.)

- Licensee or third party commissions test program to qualify components purchased as safety related
  - Justification of similarity required between tested and production components
  - Need to verify no changes made to design or to materials that could impact qualification
- Licensee or third party commissions test program to qualify commercial grade components
  - Justification of similarity required between tested and production components
  - Need to verify no changes made to design, materials, subcomponents, or manufacturing methods that could impact qualification
    - Typically done by inspection/testing/analysis
    - Part number verification or statements from OEM/distributors alone are not sufficient

# Supplier Oversight's Role In Establishing Qualification

- When purchasing EQ components from suppliers with nuclear quality assurance programs
  - Need to verify supplier has sufficient programs in place to control design or has alternate methods of verifying similarity to previously tested devices
  - Typically only OEM has access to design control and manufacturing information
- When purchasing EQ components from commercial suppliers
  - Need to verify basis of any certifications relied upon as part of qualification/dedication process
  - Certifications provided by non-audited commercial grade suppliers or distributors can not be relied upon without performing additional inspection, analysis or testing

# Challenges When Trying To Qualify Commercial Grade Components

- Authorized distributors may not have traceability back to the OEM
- Typically no access to design/manufacturing information
- Requires extensive knowledge of potential failure modes and effects
- Certain critical characteristics can not be verified by testing
  - May have to rely on commercial OEM testing and traceability
- Need to justify lot formulation for commercial grade procurements

# Similarity Issues Identified During Recent NRC Inspections

- Circuit breakers – traceability to OEM, basis for interrupting rating
- Relays – basis for ensuring no design changes were made that could impact seismic qualification
- Electrical panels – maintaining similarity/controlling modifications made to test specimens
- Squib valves – ensuring similarity between production and test specimens is maintained

# Questions

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