



# Issues Identified In The Procurement of Reverse Engineered Components

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# Presentation Overview

- NRC Vendor Inspection Program Overview
- Reverse Engineering Issues
- Steris IN
- Questions

# NRC Vendor Inspection Program

- Covers manufacturers, test facilities, suppliers, and other service suppliers for both new and operating reactors
- Completed 39 inspections last year
- Provides regulatory oversight of NUPIC/utility effectiveness
- <http://www.nrc.gov/reactors/new-reactors/oversight/quality-assurance/vendor-insp/insp-reports/2015/>

# Typical Purchasing Methods for Replacement Components

- There are several methods for procuring replacement nuclear safety related components
  - Original safety related OEM replacement
  - “Identical” commercial component, dedicated by either a third party or the utility
  - “Similar” component, either safety-related or commercial grade and dedicated (may be considered a design change)
  - Reverse engineered component, purchased from a commercial supplier and dedicated
  - Reverse engineered component, purchased as an Appendix B safety related component

# Reverse Engineered Components

- No real standard definition of what constitutes a reverse engineered component
- Criterion III “Design Control” of Appendix B still applies
- Requires at a minimum an Equivalency Evaluation
- Can not typically be considered equivalent unless:
  - Critical characteristics of the component are understood and documented
  - All relevant interfacing requirements are evaluated
  - Design verification, as required by Criterion III is re-performed
  - Qualification (as required) is re-established either through testing or analysis

# Design Verification

- Design verification testing is different than production testing and is typically more comprehensive
- In order to verify the adequacy of the design of the reverse engineered component (as required by Criterion III of Appendix B to 10 CFR Part 50) the following factors need to be considered:
  - Environmental factors
  - All input and output interface requirements
  - Other design considerations

# Environmental Factors

- Operating and accident temperatures/pressures/humidity/radiation (as applicable) including self heating contributions
- Seismic requirements
- EMI/RFI as applicable

# Input and Output Interface Requirements

- Mechanical/electrical connections
- Input and output operating voltages/currents
- Other electrical and/or mechanical parameters



# Other Design Considerations

- Failure rates
- Design life
- For mechanical components
  - Surface finishes
  - Heat treatment and other special processes
  - Specially selected mating components
  - Mechanical stresses/loads
  - Mechanical fits/tolerances
- For electrical components
  - Voltage/current withstand
  - Introduction of new failure modes(analog vs digital)

# NRC Identified Weaknesses in Reverse Engineered Procurements

- Assuming equivalency without re-verification of design
- Not clearly specifying interface requirements to vendor performing reverse engineering
- Inadequate or incomplete design verification testing
- Taking credit for past qualification without performing a proper similarity analysis

# Steris Information Notice

- Provides a summary of the issue and links to key documents
- Does not provide any new NRC positions
- Reinforces the need to include appropriate margins in the qualification process

# Questions