

Tabletop of NEI 96-07, Appendix D, Section 5.5, Example 4: *Chiller Controls Replacement*

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Application of Guidance Contained in Appendix D of NEI 96-07
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TODAY'S OBJECTIVES

- Illustrate how the guidance in NEI 96-07, Appendix D is applied, using Example 4 in Section 5.5 (Chiller Controls Replacement)
- Explain the approaches used in performing the 10 CFR 50.59 Screen and Evaluation
- Solicit feedback and invite questions from the NRC Staff regarding the application of the guidance in NEI 96-07, Appendix D

“GROUND RULES” & “EXPECTATIONS”

- Ground Rules
 - No purely technical discussions
 - Assumption of knowledge of basic 50.59 definitions, concepts and guidance (from NEI 96-07, Rev. 1)
 - Focus on supplemental guidance (i.e., Appendix D)
- Expectations
 - Identify any discrepancies between the guidance in the body of Appendix D and the Example
 - Identify the appropriate amount of technical information and/or references needed to ensure fully supported responses

APPENDIX D GUIDANCE TO BE EXAMINED

- Screen Guidance
 - Combination of Components and/or Functions (Appendix D, Section 3.2.1.2)
 - Dependability (Appendix D, Section 3.2.1.4)

NOTE: No coping analyses were performed. Therefore, Appendix D, Section 3.2.1.3 is not applicable.

- Evaluation Guidance
 - Malfunction Likelihood (Criterion #2)
 - Creation of New Accidents (Criterion #5)
 - Malfunction Results (Criterion #6)

SCREEN

Proposed Activity Description

- Design Comparison (Activity #1)
 - Current Design: Two **analog** control systems, *one per train*
 - Proposed Design: Two **digital** control systems, *one per train*
- Design Scope (Activity #2)
 - Current Design: **Separate** components and **separate** functions, *within each train*
 - Proposed Design: **Combined** components and functions, *within each train*

SCREEN

Design Function Identification

- Activity #1 (Analog-to-Digital)
 - There are no UFSAR descriptions related to the specific type of equipment (i.e., analog vs. digital) being modified.
 - UFSAR descriptions DO exist that relate to the design requirements of the system (i.e., the expectation that the system can withstand a single failure / redundancy).
- Activity #2 (Combination)
 - There are no UFSAR descriptions related to the specific components or specific functions (of the components).
 - UFSAR descriptions exist regarding the performance requirements of the individual components and functions within the system (e.g., “...maintain temperature and humidity...”).

SCREEN

Screen Consideration #1: Facility (SSC) Response

Combination of Components/Functions: Activity #1 - Analog-to-Digital

- Layers of Design
 - *Independence* is **NOT** maintained: **ADVERSE, because the same software exists in both channels, creating a commonality that did not previously exist. [More on the next slide.]**
 - *Separation* is maintained: **NOT adverse (two physical locations)**
 - *Redundancy* is maintained: **NOT adverse (two physical systems)**
- Variety (N/A - None described in the UFSAR)

SCREEN

Screen Consideration #1: Facility (SSC) Response

“Direction” vs. “Magnitude”

- Screens consider the “direction” of the impact on the Licensing Basis as described in the UFSAR.
- In this case, the creation of a *possible* new malfunction (i.e., SCCF) adds a type of malfunction not previously considered, causing the ADVERSE impact on the UFSAR description regarding the single failure requirement.
- NOTE: The Evaluation will determine if the “magnitude” of the adverse impact (i.e., the likelihood of the malfunction) is acceptable.

SCREEN

Screen Consideration #1: Facility (SSC) Response

Combination of Components/Functions: Activity #2 - Combination

- Layers of Design
 - *Independence* between channels is maintained (i.e., channels are not combined): **NOT adverse**
 - *Separation* between channels is maintained: **NOT adverse**
 - *Redundancy* between channels is maintained: **NOT adverse**
- Variety (N/A - None described in the UFSAR)

SCREEN

Screen Consideration #1: Facility (SSC) Response

Dependability:

Both Activities

- Digital design performs the same functions as the analog design
- Commercial Grade Dedication performed
- Technical Basis for the **NOT adverse** conclusion is contained in the “CGD Report”

SCREEN

Screen Consideration #2: Procedure Response

- Physical Interface Considerations
 - Physical Interaction
 - Number and/or Type of Parameters
 - Information Presentation
- Conclusion: **NOT adverse**
- Justification: Proposed activity does not involve aspects affecting the Physical Interface

SCREEN

Summary

- **ADVERSE** impact: Addition of a type of malfunction not previously considered
- **No adverse** impacts on *dependability* of performing a design function or *how a design function is performed or controlled*

EVALUATION

Eight 10 CFR 50.59(c)(2) Criteria

4.1 – Accident Frequency

4.2 – Malfunction Likelihood

4.3 – Accident Dose

4.4 – Malfunction Dose

4.5 – Accident of a Different Type

4.6 – Different Result from any Malfunction

4.7 – Design Basis Limits for Fission Product Barriers

4.8 – Methods of Evaluation

EVALUATION

Criterion #2: Malfunction Likelihood

- Level of Detail
 - Control system is NOT described
 - Chiller system IS described
- “System” Malfunctions Previously Described
 - Chiller *fails to start*
 - Chiller *stops*
- Malfunctions Initiators
 - Electrical failures
 - Mechanical failures

EVALUATION

Criterion #2: Malfunction Likelihood (continued)

- Non-CCF Considerations (Hazard Analysis : No single failure modes affecting electrical or mechanical failures already considered.)
- CCF Considerations
 - Hardware
 - *Environmental factors review*
 - *Design development process review*
 - Conclusion: CCF Unlikely (Technical Basis contained in the CDR and FMEA)
 - Software
 - *100% software review* ⇒ Conclusion: CCF Unlikely (Technical Basis contained in the CDR, SRS, SDD, SVVR, Hazard Analysis and FMEA)
 - *CCF source review* (the only plausible source is a single design defect) ⇒ Conclusion: CCF Unlikely due to likelihood being lower than failures already considered in the licensing basis (Technical Basis contained in the CCF Susceptibility Analysis)

EVALUATION

Criterion #5: Accident of a Different Type

- CCF Considerations
 - Hardware Initiator: CCF unlikely = New initiator **NOT** credible \Rightarrow *accident of a different type not possible*
 - Software Initiator: CCF unlikely = New initiator **NOT** credible \Rightarrow *accident of a different type not possible*
- Non-CCF Considerations
 - Chiller design basis: Accident mitigator
 - No credible scenario in which the accident mitigator could become an accident *initiator*
- Technical Basis contained in the CCF Susceptibility Analysis

EVALUATION

Criterion #6: Different Result

- Level of Detail (same as in Criterion #2)
- CCF Considerations (same as in Criterion #2)
- Malfunction **RESULT** previously described: the standby chiller will start (if one of the redundant chillers malfunctions; i.e., fails to start)

EVALUATION

Criterion #6: Different Result

- CCF Considerations
 - Hardware Initiator: CCF unlikely = New initiator **NOT** credible \Rightarrow *new malfunction not possible \Rightarrow different result not possible*
 - Software Initiator: CCF unlikely = New initiator **NOT** credible \Rightarrow *new malfunction not possible \Rightarrow different result not possible*
- Conclusion: The standby chiller will still start.
- Technical Basis contained in the CCF Susceptibility Analysis

QUESTIONS / COMMENTS / FEEDBACK

