



NUCLEAR ENERGY INSTITUTE

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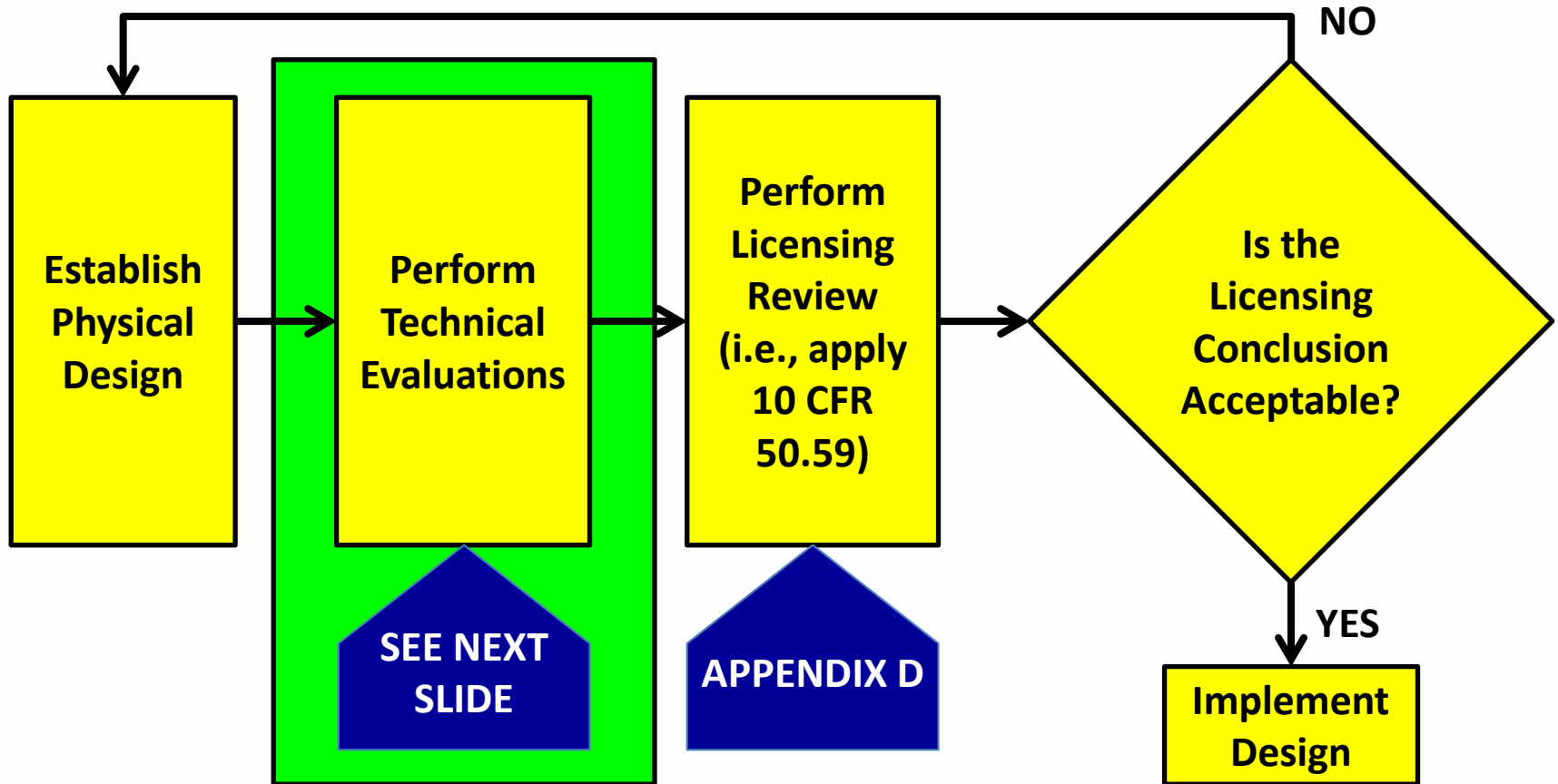
August 1, 2017

MAPPING DISCUSSION: ILLUSTRATING HOW DRAFT NEI 96-07 APP D CAN UTILIZE INFO FROM DRAFT NEI 16-16

PURPOSE

- Identify the Appendix D terminology that can be “mapped” to NEI 16-16.
- Describe the difference between Appendix D terminology and NEI 16-16 terminology.
- For the Appendix D terminology that can be “mapped” to NEI 16-16, illustrate how Appendix D utilizes the technical information from NEI 16-16 to respond to Evaluation Questions 1, 2, 5 and 6.
- Discuss “Beyond Design Basis” Terminology

TYPICAL DESIGN CHANGE PROCESS



TYPICAL TECHNICAL EVALUATIONS

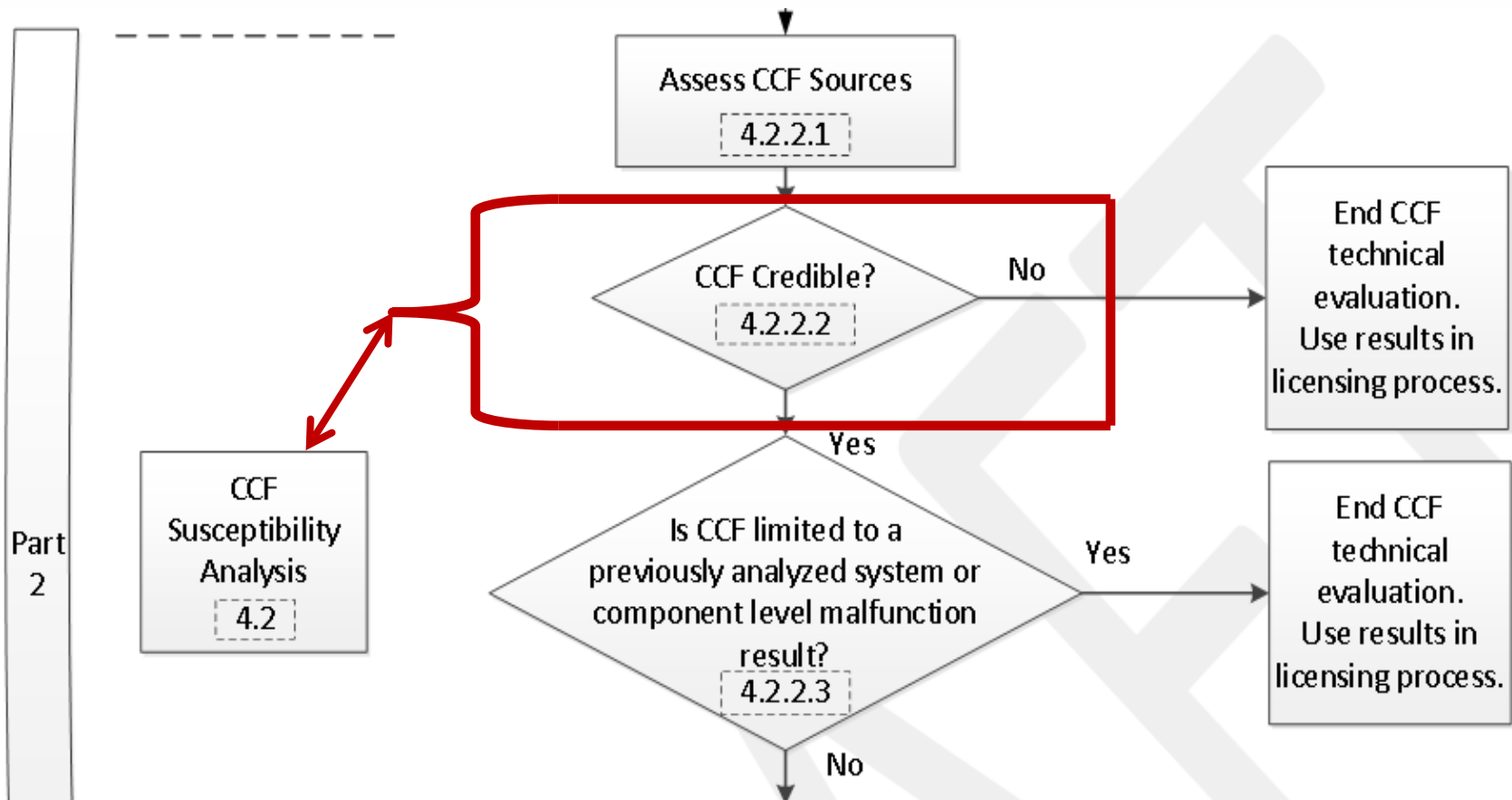
(Appendix B, Criterion III)

- Power System Load Analysis Calculation
- HVAC Loading Calculation
- Cable Voltage Drop Calculation
- Breaker/Fuse Coordination
- Fault Current Analysis
- Instrument Uncertainty/Setpoint Calculation
- Seismic Analysis/Qualification
- EMI/RFI Analysis/Qualification
- Failure Modes and Effects Analysis
- Single Point Vulnerability Analysis

- ***Common Cause Failure (CCF) Analysis*** ← **NEI 16-16**



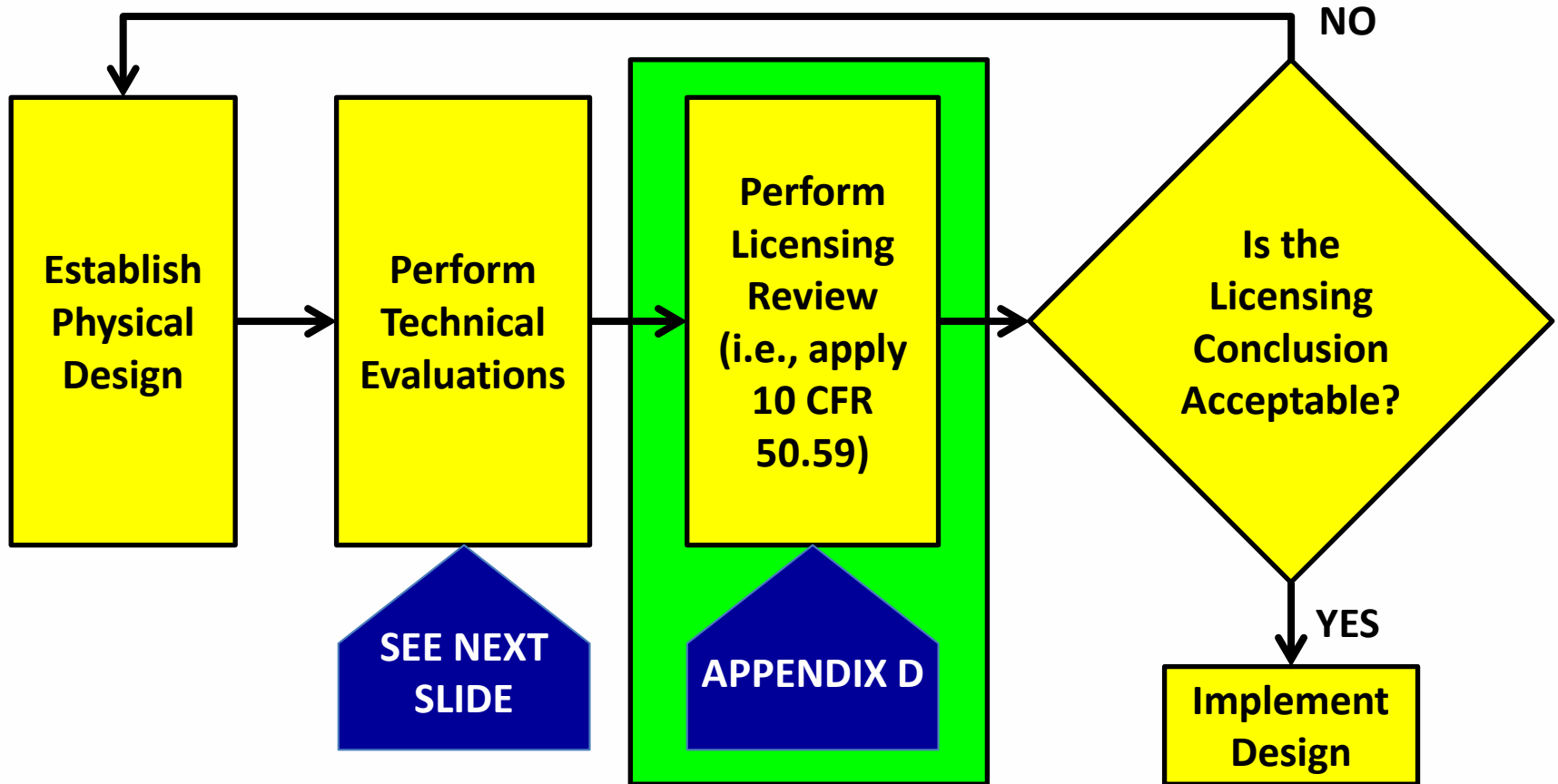
EXCERPT FROM NEI 16-16



USES OF TECHNICAL ANALYSES

- Establish new design requirements and/or verify existing design requirements
- Provide the technical justification for the implementation of the new design
- Support 10 CFR 50.59 conclusions
(See NEI 96-07, Rev. 1, repeated references to “technical/engineering information.”)

TYPICAL DESIGN CHANGE PROCESS



APPENDIX D MAPPING TO NEI 16-16

Terminology to be Mapped

EVALUATION QUESTION(S)	NEI 96-07, R1 / APPENDIX D TERMINOLOGY TO BE "MAPPED"	LICENSING TERMINOLOGY ONLY?	NEI 16-16 TERMINOLOGY	NOTES
1 & 2	ATTRIBUTABLE	YES	N/A	NO EQUIVALENT TECHNICAL TERM IN NEI 16-16
	NEGLIGIBLE/DISCERNABLE	NO	<i>ASSOCIATED</i> TERMINOLOGY EXISTS	ADDRESSED IN PRESENTATION
5	AS LIKELY TO HAPPEN AS THOSE PREVIOUSLY EVALUATED IN THE UFSAR	NO	<i>ASSOCIATED</i> TERMINOLOGY EXISTS	ADDRESSED IN PRESENTATION
	BOUNDED	NO	<i>SIMILAR</i> TERMINOLOGY EXISTS	ADDRESSED IN PRESENTATION
	RELATED	YES	N/A	NO EQUIVALENT TECHNICAL TERM IN NEI 16-16
6	AS LIKELY TO HAPPEN AS THOSE DESCRIBED IN THE UFSAR	NO	<i>ASSOCIATED</i> TERMINOLOGY EXISTS	ADDRESSED IN PRESENTATION
	BOUNDED	NO	<i>SIMILAR</i> TERMINOLOGY EXISTS	ADDRESSED IN PRESENTATION



NOTES

- **NEI 16-16** → Guidance and definitions are extracted from Draft 2, dated May 2017, and NRC comments on NEI 16-16 will not be addressed during this presentation.
- **Appendix D** → Based on NRC Staff feedback and draft comments, some terminology used in this presentation is NOT the same as that contained in the May 16, 2017 version of Appendix D.
 - “CCF Credible/Not Credible” will no longer be used.
 - Assessment of Evaluation questions 1, 2, 5 and 6 will be based on CCF Likelihood “Sufficiently Low” or CCF Likelihood “Not Sufficiently Low.”

[See next slide]



NOTES (CONTINUED)

Discussion of “Sufficiently Low”

“**Sufficiently low** means much lower than the likelihood of failures that are considered in the UFSAR (e.g., single failures) and comparable to other common cause failures that are not considered in the UFSAR (e.g., design flaws, maintenance errors, calibration errors).”

[Reference: NEI 01-01, Section 4.4.6, Page 4-20 (to be incorporated into Appendix D)]

EVALUATION QUESTIONS 1 & 2

Terminology to be Mapped

EVALUATION QUESTION(S)	NEI 96-07, R1 / APPENDIX D TERMINOLOGY TO BE "MAPPED"	LICENSING TERMINOLOGY ONLY?	NEI 16-16 TERMINOLOGY	NOTES
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	NEGLIGIBLE/DISCERNABLE	NO	ASSOCIATED TERMINOLOGY EXISTS	ADDRESSED IN PRESENTATION
5	AS LIKELY TO HAPPEN AS THOSE PREVIOUSLY EVALUATED IN THE UFSAR	NO	ASSOCIATED TERMINOLOGY EXISTS	ADDRESSED IN PRESENTATION
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	BOUNDED	NO	SIMILAR TERMINOLOGY EXISTS	ADDRESSED IN PRESENTATION



EVALUATION QUESTIONS 1 & 2

FACTORS TO CONSIDER

- Use of Software
- Use of Digital Components
- Creation of Software CCF (SCCF)*
- Intended Benefits
- Design Attributes/Features

***Only this factor will be addressed.**

EVALUATION QUESTIONS 1 & 2

- 50.59 Term: “Attributable”
 - Licensing terminology only [Reference: NEI 96-07, Rev. 1, Sections 4.3.1 and 4.3.2]
 - Used as part of the qualitative assessment to determine if an impact on the **accident frequency/malfunction likelihood** is due to the activity itself and not “something else”
- Mapping to NEI 16-16 → No associated or equivalent terminology exists in NEI 16-16.

EVALUATION QUESTIONS 1 & 2

- 50.59 Term: “Negligible/Discernable”
 - Licensing terminology [Reference: NEI 96-07, Rev. 1, Sections 4.3.1 and 4.3.2], with associated technical terminology in NEI 16-16
 - Used as part of the qualitative assessment to assess the magnitude of an impact on the **accident frequency/malfunction likelihood** due to the activity
- Mapping to NEI 16-16
 - CCF Not Credible (Definition 2.5)
 - CCF Susceptibility Analysis (Section 4.2.2.2)



EVALUATION QUESTIONS 1 & 2

ASSESSMENT OF “NEGLIGIBLE/DISCERNABLE”

- Identify the “likelihood of a CCF” outcome from NEI 16-16.
- Assess the impact of the “likelihood of a CCF” on the **accident frequency/malfunction likelihood**.

EVALUATION QUESTIONS 1 & 2

- From the CCF Susceptibility Analysis, identify the “likelihood of a CCF” **outcome** (NEI 16-16, Section 4.2.2.2)
 - **NOT CREDIBLE** (Definition 2.5) → “A CCF can be considered not credible only if the likelihood of a CCF caused by an I&C failure source is no greater than the likelihood of a CCF caused by other failure sources that are not considered in a deterministic safety analysis described in the [U]FSAR.”

EVALUATION QUESTIONS 1 & 2

- If the NEI 16-16, Section 4.2.2.2 outcome is **NOT CREDIBLE**, then for Appendix D, the magnitude of an impact on the **accident frequency/ malfunction likelihood** due to the Creation of a SCCF factor is **sufficiently low**.
- With an Appendix D assessment of **sufficiently low**, the conclusion regarding the increase in magnitude due to the Creation of a SCCF factor is **negligible**.

[NOTE: Assessment of the other four *factors* still needs to be performed to determine of overall qualitative impact on **accident frequency/malfunction likelihood**.]



EVALUATION QUESTIONS 1 & 2

- If the NEI 16-16, Section 4.2.2.2 outcome is **CREDIBLE**, then for Appendix D, the magnitude of an impact on the **accident frequency/ malfunction likelihood** due to the Creation of a SCCF factor is **NOT sufficiently low**.
- With an Appendix D assessment of **NOT sufficiently low**, the conclusion regarding the increase in magnitude due to the Creation of a SCCF factor needs to be assessed using the **discernable** criterion.

[NOTE: Assessment of the other four *factors* still needs to be performed to determine of overall qualitative impact on **accident frequency/malfunction likelihood**.]



EVALUATION QUESTION 5

Terminology to be Mapped

EVALUATION QUESTION(S)	NEI 96-07, R1 / APPENDIX D TERMINOLOGY TO BE "MAPPED"	LICENSING TERMINOLOGY ONLY?	NEI 16-16 TERMINOLOGY	NOTES
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	NEGLIGIBLE/DISCERNABLE	NO	<i>ASSOCIATED</i> TERMINOLOGY EXISTS	ADDRESSED IN PRESENTATION
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EVALUATION QUESTION 5

- 50.59 Term: “As likely to happen as...”
 - Licensing terminology, with associated technical terminology in NEI 16-16
 - Used as part of the assessment to determine if the possibility for an accident of a different type has been created
- Mapping to NEI 16-16
 - CCF Not Credible (Definition 2.5)
 - CCF Susceptibility Analysis (Section 4.2.2.2)



EVALUATION QUESTION 5

- To Assess “As likely to happen as...”
 - Identify the “likelihood of a CCF” outcome from NEI 16-16
 - Assess the impact of the “likelihood of a CCF” on the creation of a possible accident of a different type
- The scope of possible accidents must be “*credible in the sense of having been created within the range of assumptions previously considered in the licensing basis (e.g., random single failure, loss of off-site power, etc.)*.”

[Reference: NEI 96-07, Rev. 1, Section 4.3.5]



EVALUATION QUESTION 5

- From the CCF Susceptibility Analysis, identify the “likelihood of a CCF” **outcome** (NEI 16-16, Section 4.2.2.2)
 - **NOT CREDIBLE** (Definition 2.5) → “A CCF can be considered not credible only if the likelihood of a CCF caused by an I&C failure source is no greater than the likelihood of a CCF caused by other failure sources that are not considered in a deterministic safety analysis described in the [U]FSAR.”

EVALUATION QUESTION 5

- If the NEI 16-16, Section 4.2.2.2 outcome is **NOT CREDIBLE**, then for Appendix D, the impact on the creation of a possible accident of a different type is *sufficiently low*.
- With an Appendix D assessment of *sufficiently low*, the conclusion that the creation of a possible accident of a different type due to a CCF is *not as likely to happen as those previously evaluated in the UFSAR (i.e., is not credible)*. [NOTE: The Bounded/Related criteria are not applied in this case.]

EVALUATION QUESTION 5

- If the NEI 16-16, Section 4.2.2.2 outcome is **CREDIBLE**, then for Appendix D, the impact on the creation of a possible accident of a different type is ***NOT sufficiently low***.
- With an Appendix D assessment of ***NOT sufficiently low***, the conclusion that the creation of a possible accident of a different type due to a CCF is ***as likely to happen as those previously evaluated in the UFSAR (i.e., is credible)***.
[NOTE: The *Bounded/Related* criteria are applied in this case.]

EVALUATION QUESTION 5

- 50.59 Term: “Bounded”
 - Licensing terminology [Reference: NEI 96-07, Rev. 1, Section 4.3.5], with similarly-worded technical terminology in NEI 16-16
 - Used as part of the assessment to determine if the possibility for an accident of a different type has been created
- Mapping to NEI 16-16 → Bounded (Definition 2.2)

EVALUATION QUESTION 5

DEFINITIONS

- NEI 16-16, Definition 2.2, BOUNDED
*“A bounded conclusion means that the **plant-level results** of the CCF malfunction are no worse than the **plant-level results** of other malfunctions that have been previously analyzed in the [U]FSAR.”*
- NEI 96-07, Rev. 1, Section 4.3.5
*“Accidents of a different type are credible accidents that the proposed activity could create that are not bounded by UFSAR-evaluated accidents.” (NOTE: Using this excerpt, bounded refers to **accidents currently evaluated in the UFSAR.**)*



Conclusion: NEI 16-16 usage ≠ NEI 96-07 usage

EVALUATION QUESTION 5

- 50.59 Term: “Related”
 - Licensing terminology only [Reference: NEI 96-07, Rev. 1, Section 4.3.5]
 - Used as part of the assessment to determine if the possibility for an accident of a different type has been created
- Mapping to NEI 16-16 → No associated or equivalent terminology exists in NEI 16-16.

EVALUATION QUESTION 6

Terminology to be Mapped

EVALUATION QUESTION(S)	NEI 96-07, R1 / APPENDIX D TERMINOLOGY TO BE "MAPPED"	LICENSING TERMINOLOGY ONLY?	NEI 16-16 TERMINOLOGY	NOTES
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	BOUNDED	NO	<i>SIMILAR</i> TERMINOLOGY EXISTS	ADDRESSED IN PRESENTATION



EVALUATION QUESTION 6

- 50.59 Term: “As likely to happen as...”
 - Licensing terminology, with associated technical terminology in NEI 16-16
 - Used as part of the assessment to determine if the possibility for a malfunction with a different result has been created
- Mapping to NEI 16-16
 - CCF Not Credible (Definition 2.5)
 - CCF Susceptibility Analysis (Section 4.2.2.2)



EVALUATION QUESTION 6

- To Assess “As likely to happen as...”
 - Identify the “likelihood of a CCF” outcome from NEI 16-16
 - Assess the impact of the “likelihood of a CCF” on the creation of a possible malfunction with a different result
- *“The possible malfunctions with a different result are limited to those that are as likely to happen as those described in the UFSAR.”* [Reference: NEI 96-07, Rev. 1, Section 4.3.6]

EVALUATION QUESTION 6

- From the CCF Susceptibility Analysis, identify the “likelihood of a CCF” **outcome** (NEI 16-16, Section 4.2.2.2)
 - **NOT CREDIBLE** (Definition 2.5) → “A CCF can be considered not credible only if the likelihood of a CCF caused by an I&C failure source is no greater than the likelihood of a CCF caused by other failure sources that are not considered in a deterministic safety analysis described in the [U]FSAR.”

EVALUATION QUESTION 6

- If the NEI 16-16, Section 4.2.2.2 outcome is **NOT CREDIBLE**, then for Appendix D, the impact on the creation of a possible malfunction with a different result is *sufficiently low*.
- With an Appendix D assessment of *sufficiently low*, the conclusion that the creation of a possible malfunction with a different result due to a CCF is *not as likely to happen as those previously evaluated in the UFSAR (i.e., is not credible)*.
[NOTE: The Bounded criterion is not applied in this case.]

EVALUATION QUESTION 6

- If the NEI 16-16, Section 4.2.2.2 outcome is **CREDIBLE**, then for Appendix D, the impact on the creation of a possible malfunction with a different result is ***NOT sufficiently low***.
- With an Appendix D assessment of ***NOT sufficiently low***, the conclusion that the creation of a possible malfunction with a different result due to a CCF is ***as likely to happen as those previously evaluated in the UFSAR (i.e., is credible)***. [NOTE: The Bounded criterion is applied in this case.]

EVALUATION QUESTION 6

- 50.59 Term: “Bounded”
 - Licensing terminology [Reference: NEI 96-07, Rev. 1, Section 4.3.6], with similarly-worded technical terminology in NEI 16-16
 - Used as part of the assessment to determine if a possible malfunction with a different result has been created
- Mapping to NEI 16-16 → Bounded (Definition 2.2)

EVALUATION QUESTION 6

DEFINITIONS

- NEI 16-16, Definition 2.2, BOUNDED
*“A bounded conclusion means that the **plant-level results** of the CCF malfunction are no worse than the **plant-level results** of other malfunctions that have been previously analyzed in the [U]FSAR.”*
- NEI 96-07, Rev. 1, Section 4.3.6
*“Malfunctions of SSCs are generally postulated as potential single failures to evaluate **plant performance**....” [NOTE: Using this excerpt, bounded refers to **plant performance**, which is the same as “**plant-level result(s)**”.]*



Intent: NEI 16-16 usage = NEI 96-07 usage

“DESIGN BASIS”

- NEI 96-07, Rev. 1, Section 1.2.4

“10 CFR 50.59 controls changes to both 10 CFR 50.2 design bases and supporting design information contained in the UFSAR.”

- NEI 96-07, Rev. 1, Section 4.3.8

“The UFSAR contains design and licensing basis information for a nuclear power facility, including description on how regulatory requirements for design are met and how the facility responds to various design basis accidents and events.”

- Unless required by Regulation (e.g., SBO per 50.63), beyond design basis conditions are not considered in a licensee’s UFSAR.



“BEYOND DESIGN BASIS”

- NEI 16-16, Definition 2.4, CCF BEYOND DESIGN BASIS

“...For this guideline, a CCF *beyond the design basis* conclusion is used *only to determine the method and acceptance criteria for the analysis of a CCF malfunction result*, not to preclude the need for that analysis.”

- NEI 16-16, Definition 2.1, BEST ESTIMATE METHOD

“A method of analysis that can employ realistic/nominal initial plant conditions and equipment performance, relaxed acceptance criteria, no other assumed equipment failures, credit for beneficial control system action as well as credit for operator actions *not described in the [U]FSAR*, and allows conclusions based on qualitative expert judgment or quantitative analysis. Best estimate methods can be applied when a CCF is concluded to be *beyond design basis*.”



(BEYOND) DESIGN BASIS

SUMMARY & CONCLUSION

- NEI 16-16 terminology refers to the **selection of numerical analyses and the assumptions, inputs and acceptance criteria applied to the computational results.**
- NEI 96-07, Rev. 1 terminology refers to the **information contained in the UFSAR to satisfy 10 CFR 50.2.**

NEI 16-16 terminology ≠ NEI 96-07 terminology

QUESTIONS / COMMENTS / FEEDBACK

