



# Vogtle Risk-Informed GL 2004-02 Pre-Submittal NRC Meeting


May 2020





## Meeting Purpose and Agenda

- The purpose for this meeting is to discuss the content of the Vogtle risk-informed GSI-191 licensing submittal with the goal of identifying any areas that may require additional documentation or justification
- This meeting will cover the following topics:
  - Updates from November 2019 Public Meeting
  - Request for exemption (Enclosure 1)
  - License amendment request:
    - Implementation of a risk-informed approach for addressing GSI-191 (Enclosure 2)
    - Proposed changes to the Technical Specifications (Enclosure 3)
    - Regulatory evaluation and environmental consideration (Enclosure 4)
  - Responses to conditions and limitations from NRC Staff Evaluation



# **Updates from November 2019 Public Meeting**



## Background

- Vogtle's July 2018 submittal (ML18193B163 and ML18193B165) summarized the risk-informed approach to resolve GSI-191, and supplemented Vogtle's previous responses to GL 2004-02
- The NRC issued a staff evaluation in September 2019 (ML19120A469)
  - Concluded that the July 2018 submittal was acceptable for Vogtle to use in a licensing application, subject to nine Conditions and Limitations
- SNC held public meeting with NRC on November 4, 2019 to discuss planned submittal
- Changes from the proposed content and format discussed in the November 4, 2019 public meeting are discussed on the next few slides

## Changes in Proposed Submittal Content and Format from November Meeting



- SNC no longer requesting reduced refueling water storage tank (RWST) level for 7 days after Mode 4 entry (SNC still evaluating as a separate, independent license amendment request (LAR))
- SNC only requesting exemption to requirements in 10 CFR 50.46(a)(1), not to the General Design Criteria (GDCs)
- SNC not intending to provide final response to GL 2004-02 with this submittal
  - SNC understanding is that NRC would prefer final response after ALL required actions have been completed (e.g. LAR & exemption request approved, strainer mods complete)
- Guidance for evaluating debris operability revised; will be discussed later in presentation
- Overall organization of the LAR submittal enclosures changed

## Changes in Proposed Submittal Content and Format from November Meeting



- Enclosure 1: Request for exemption from requirements of 10 CFR 50.46(a)(1)
- Proposed LAR includes three separate Enclosures:
  - Enclosure 2: Implementation of a Risk-Informed Approach for Addressing GSI-191
    - “Type 1” LAR format per NEI 06-02 Rev. 6 (Summary Description, Detailed Description, and Technical Evaluation only)
    - Includes the following Attachments:
      - Proposed FSAR Changes (Mark-Up) for Information Only
      - Guidance for Supporting Operability Evaluations for Information Only
      - Updated Evaluation for In-Vessel Effects and Coatings
  - Enclosure 3: Proposed Changes to the Technical Specifications (TSTF-567)
    - “Type 3” LAR format per NEI 06-02 Rev. 6 (Description, Assessment, References only)
    - Includes the following Attachments:
      - Proposed Technical Specification Changes (Mark-Up)
      - Revised Technical Specification Pages
      - Proposed Technical Specification Bases Changes (Mark-Up) for Information Only
  - Enclosure 4: Regulatory Evaluation and Environmental Consideration



## Other Items

- Containment RHR sump strainer modifications planned for fall 2021 (Unit 1) and spring 2022 (Unit 2)
  - Will achieve full submergence of the RHR strainers for an increased number of LOCA scenarios
  - Reduces the risk associated with debris related failures, as described in Enclosure 3 of the July 2018 submittal
- TS Changes and risk-informed methodology cannot be implemented until after modifications are complete
  - Vogtle has one TS and one FSAR for both units
  - Instead of “staggered implementation,” Vogtle would like to implement the change after the modifications for both units are complete



# **Exemption Request (Enclosure 1)**





## Enclosure 1 Content

- 1.0 GENERAL
  - 1.1 Introduction
  - 1.2 Background and Overview
- 2.0 EXEMPTION REQUEST
- 3.0 REGULATORY REQUIREMENTS INVOLVED
- 4.0 BASIS FOR THE EXEMPTION REQUEST
  - 4.1 Applicability of 10 CFR 50.12(a)(1)
  - 4.2 Applicability of 10 CFR 50.12(a)(2)
  - 4.3 Environmental Consideration
- 5.0 TECHNICAL JUSTIFICATION FOR THE EXEMPTION
- 6.0 CONCLUSION



## Exemption Request

- An exemption is requested from certain requirements of 10 CFR 50.46(a)(1), “other properties,” as it relates to using deterministic methodology to evaluate the effects of debris on long-term core cooling
- The request for exemption under 10 CFR 50.12 supports the Vogtle risk-informed approach to GL 2004-02 closure as an alternative to the current deterministic evaluation required by 10 CFR 50.46(a)(1)
  - The exemption will apply only to the effects of debris as described in Enclosures 2 and 3 of the July 2018 submittal
  - The exemption will apply to any breaks that can generate and transport debris that is not bounded by Vogtle analyzed limits, provided that the  $\Delta$ CDF and  $\Delta$ LERF remain in RG 1.174 Region III



## Evaluation for Exemption Request

- The requested exemption was evaluated against the conditions in 10 CFR 50.12(a)
  - The request meets the requirements in 10 CFR 50.12(a)(1) for granting an exemption from the regulation
  - Special circumstances in 10 CFR 50.12(a)(2)(ii) and (iii) are present
- The exemption was reviewed for environmental impacts and was determined to be eligible for categorical exclusion per 10 CFR 51.22(c)(9)
- The July 2018 submittal showed that the risk associated with post-accident debris effects is within RG 1.174 Region III, “Very Small Change”
- The requested exemption to allow use of the risk-informed method is consistent with the key principle in RG 1.174: the proposed change is required to meet current regulations unless explicitly related to a requested exemption

# **License Amendment Request**

**Implementation of a Risk-Informed Approach  
for Addressing GSI-191 (Enclosure 2)**



## Enclosure 2 Content

- 1.0 SUMMARY DESCRIPTION
- 2.0 DETAILED DESCRIPTION
  - 2.1 System Design and Operation
  - 2.2 Current Licensing Basis Requirements
  - 2.3 Reason for the Proposed Change
  - 2.4 Description of the Proposed Change
- 3.0 TECHNICAL EVALUATION
  - 3.1 Engineering Analysis Overview
  - 3.2 Resolution of Limitations and Conditions\*
  - 3.3 Technical Evaluation Conclusion

Attachment 1: Proposed FSAR Changes (Mark-Up) for Information Only

Attachment 2: Guidance for Supporting Operability Evaluations for Information Only

Attachment 3: Updated Evaluation for In-Vessel Effects and Coatings

\* Resolution of the limitations and conditions is detailed later in this presentation



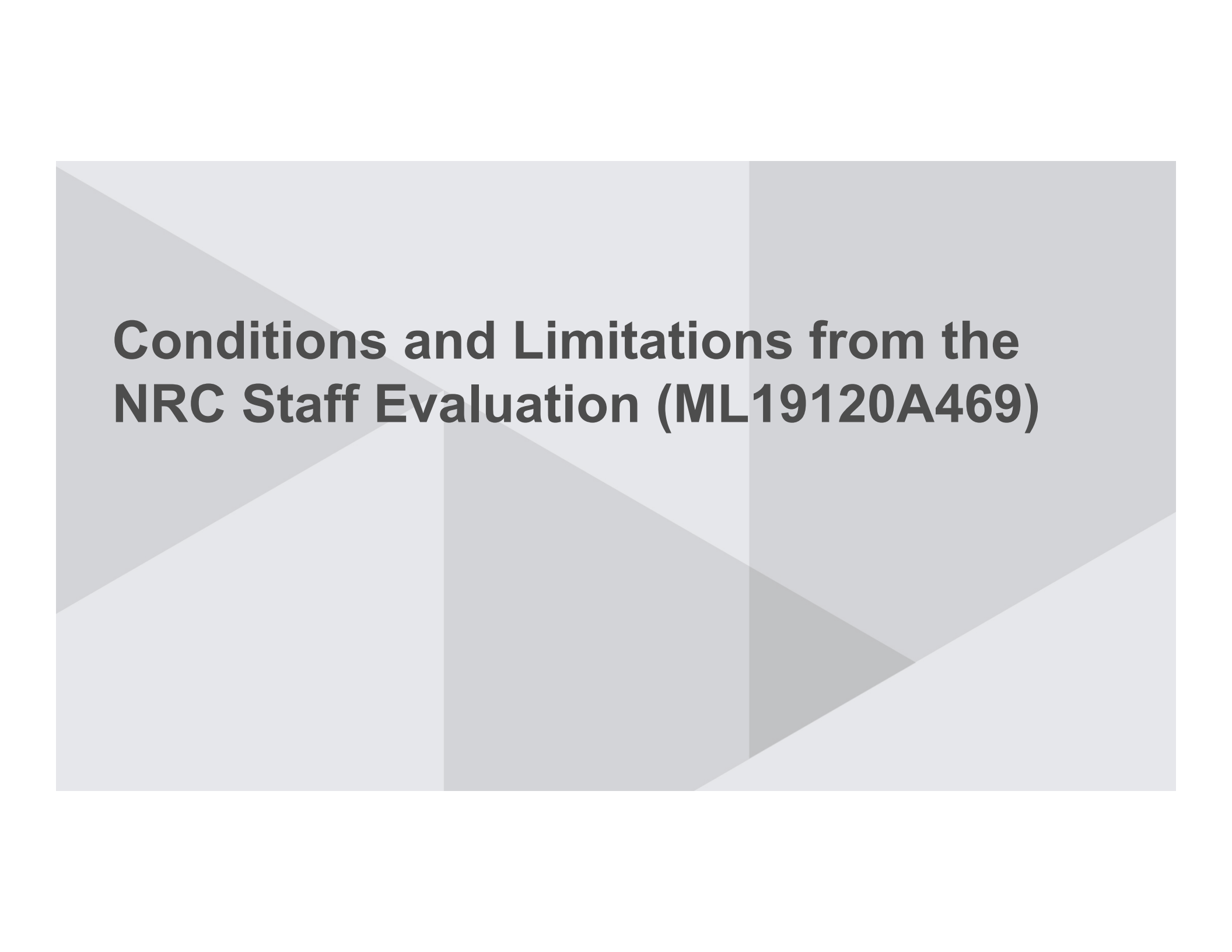
## Overview of Technical Evaluation

- The proposed licensing changes in this submittal are based on the July 2018 submittal and the NRC staff evaluation with no deviations
- Approval of the proposed change would allow Vogtle to use a risk-informed approach to address the effects of accident-generated debris on the containment sumps
- Vogtle's technical evaluation using the risk-informed approach was described in Enclosure 3 of the July 2018 submittal
  - Evaluated LOCAs up to double ended guillotine breaks (DEGBs) on the largest reactor coolant systems (RCS) piping
  - Used break-specific analysis to identify break scenarios that fail any GSI-191 acceptance criteria
  - Quantified change in core damage frequency ( $\Delta$ CDF) and in large early release frequency ( $\Delta$ LERF) using the plant PRA model
  - Showed that the risk associated with post-accident debris is "very small" as defined by Region III of RG 1.174



## Overview of Engineering Analysis

- Approval of the LAR does not change the design and licensing basis descriptions of accidents requiring ECCS and containment spray system (CSS) operation, including analysis methods, assumptions, and results provided in FSAR Chapters 6 and 15
- The functionality of the ECCS and CSS during design basis accidents will still be confirmed because safety margin and defense-in-depth (DID) are maintained with high probability
- The substantial DID and safety margin provide a high level of confidence that the calculated risk is conservative and that the actual risk is likely much lower, as documented in Enclosure 4 of the July 2018 submittal



# **Conditions and Limitations from the NRC Staff Evaluation (ML19120A469)**





## Conditions and Limitations from the NRC SE

1. The applicability of the NRC's acceptance is limited to the structures, systems, and components; plant configurations; and operations described in Enclosures 2, 3, and 4 of SNC's letter dated July 10, 2018 and the strainer design described in the Section entitled, "16-Disk ECCS Suction Strainer Summary," of Enclosure 2.

Two plant modifications were described in the July 2018 submittal:

- Modification to operating procedure to inject additional RWST water for breaks that don't initiate containment sprays has been implemented
- Modification to remove top two disks on RHR strainers scheduled for implementation during Fall 2021 refueling outage for Unit 1 (V1R23) and Spring 2022 refueling outage for Unit 2 (V2R22)



## Conditions and Limitations from the NRC SE

2. The applicability of the NRC's acceptance is limited to the Vogtle assessment of risk attributable to debris described in Enclosures 1 and 3 of SNC's letter dated July 10, 2018.
  - Requested exemption (Enclosure 1) and license amendment (Enclosures 2-4) are based on NRC-accepted risk assessment
  - Minor changes to the risk assessment were made to correct the coatings error (Enclosure 2, Attachment 3)



## Conditions and Limitations from the NRC SE

3. Describe in-vessel analysis, establish in-vessel acceptance criteria, and demonstrate the criteria are met.
  - SNC followed the NRC review guidance and PWROG guidance to resolve in-vessel effects (Enclosure 2, Attachment 3)
  - The approach is consistent with that discussed with the NRC staff during the November 2019 public meeting
  - All Vogtle parameters were bounded by those used in the WCAP-17788 analyses except for core inlet fiber load
    - The in-vessel fiber load was analyzed using Vogtle-specific fiber penetration model without crediting any flow diversion from the core inlet ( $m_{split}$ )
    - The core inlet fiber load exceeds the core inlet fiber limit but is less than the total in-core fiber limit presented in WCAP-17788; will not challenge long-term core cooling due to non-uniform debris distribution at the core inlet, as discussed during previous public meeting



## Conditions and Limitations from the NRC SE

4. Address Key Principle 1 (i.e., the proposed licensing basis change meets the current regulations unless it is explicitly related to a requested exemption) and Key Principle 5 (i.e., the impact of the proposed licensing basis change should be monitored using performance measurement strategies) in RG 1.174, Revision 3.
  - Key Principle 1 is addressed with the included request for exemption to certain 10 CFR 50.46(a)(1) requirements in Enclosure 1
  - Vogtle procedures and programs for monitoring, controlling, and assessing changes to the plant that could impact plant performance related to GSI-191 concerns are summarized in Enclosure 2
    - Technical requirements manual (TRM) Surveillance requires visual inspections of all accessible areas of the containment and containment sumps for loose debris
    - The engineering guidance procedure augmented to manage potential debris sources inside containment and effects on recirculation flow paths and downstream components



## Conditions and Limitations from the NRC SE

- A 10 CFR 50.59 screening or evaluation is required for all design changes
- The coatings program ensures that coatings inside containment are procured, applied, and maintained to meet regulatory requirements
- The condition reporting process requires condition reports be written for adverse conditions identified during containment inspections or surveillances of the containment emergency sumps and strainers
- The Maintenance Rule program monitors functions associated with ECCS and CSS to ensure continued availability for performing required functions
- The on-line configuration risk management procedure has administrative controls for performing on-line maintenance of SSCs to enhance overall plant safety and reliability
- The proposed licensing change does not impact any ASME Section XI inspection programs or mitigation strategies for early detection and mitigation of weld and material degradation in Class I piping applications



## Conditions and Limitations from the NRC SE

5. Identify key elements of the risk-informed analysis (e.g., methods, approaches, and data) that will be described in the Vogtle UFSAR.

Key elements of the risk-informed analysis summarized in FSAR Appendix 6A

- The methodology used to quantify the amount of debris generated at each break location, including the assumed zone of influence (ZOI) size and shape
- The methodology for evaluating debris transport to the RHR and CSS strainers
- The methodology for quantifying chemical precipitates, including refinements to WCAP-16530-P-A, application of the solubility correlation, and application of the WCAP-17788-P autoclave testing
- The strainer debris limits to be added to TS Bases Table B 3.6.7-1
- The methodology and acceptance criteria for ex-vessel downstream effects
- The methodology used to assess in-vessel downstream effects
- The methodology used to quantify conditional failure probabilities (CFPs), change in core damage frequency ( $\Delta$ CDF) and change in large early release frequency ( $\Delta$ LERF)



## Conditions and Limitations from the NRC SE

6. Identify key elements of the risk-informed analysis and corresponding methods, approaches, and data that, if changed, would constitute a departure from the method used in the safety analysis as defined by 10 CFR 50.59.
  - Changes to the key elements of the risk-informed analysis, as identified in the response to Condition and Limitation 5, will be evaluated as a potential “departure from a method of evaluation described in the FSAR” in accordance with 10CFR50.59(c)(2)(viii)
  - Procedural controls establish limits on the introduction of new debris sources into containment, particularly fiber or particulate debris sources, to ensure that the risk associated with the effects of debris remains within RG 1.174 Region III (Reference 2).



## Conditions and Limitations from the NRC SE

7. Identify the relevant elements of the risk-informed assessment that may need to be periodically updated. The licensee must describe the program or controls that will be used to ensure relevant elements of the risk-informed assessment are periodically updated.

Periodic updates to the risk-informed evaluation will include the following elements:

- Addition, removal, or replacement of materials in containment that affect debris quantities
- Physical or procedural modifications that affect inputs to the NARWHAL model including pump flow rates, sump water level, sump pH, sump temperature, etc.
- Changes to PRA inputs including LOCA frequencies and success criteria



## Conditions and Limitations from the NRC SE



8. Describe a reporting and corrective action strategy for addressing situations in which an update to the risk-informed assessment reveals that the acceptance guidelines described in Section 2.4 of RG 1.174, Revision 3, have been exceeded.
  - Non-conforming conditions will be addressed in accordance with the VEGP corrective action program
  - Nonconforming conditions that make the containment sump(s) inoperable for longer than the required TS completion time will meet the 10 CFR 50.73 reporting criteria for a condition prohibited by TS
  - Conditions that cause the containment sump(s) to be inoperable and result in the debris-related  $\Delta$ CDF or  $\Delta$ LERF to be greater than the RG 1.174 Region III acceptance guidelines are to be reported in accordance with 10 CFR 50.72 and 10 CFR 50.73, as applicable
  - Enclosure 2 describes a process for supporting a prompt operability evaluation for conditions related to post-accident containment sump operability (as detailed later in this presentation)

## Conditions and Limitations from the NRC SE



9. Correct the error concerning the evaluation of transported coatings debris loads described in SNC's letter dated December 4, 2018. Specifically, provide corrected coating debris volumes and describe how coating debris loads on the strainers are determined. In addition:
  - a. Verify that the use of the corrected coating debris volumes has a limited impact on strainer head loss and the head loss is acceptable. Also, the licensee must describe the method of verification.
  - b. Verify that the use of the corrected coating debris volumes has a limited impact on CDF and does not result in exceeding the acceptance guidelines for very small change in risk, as described in Section 2.4 of RG 1.174, Revision 3. Also, the licensee must describe the method of verification.



## Correction of Errors in Coatings Evaluation

- SNC had previously investigated the error and determined that washdown transport fractions were incorrectly applied for unqualified coatings debris in the NARWHAL runs for risk quantification and sensitivity and uncertainty analyses (ML18338A497)
- The error resulted in non-conservative transported particulate debris loads
- SNC has corrected the error and revisions are provided in the current LAR submittal for affected tables from the July 2018 submittal
- The correction has a limited impact and does not change the conclusions of the risk quantification or sensitivity and uncertainty analyses

# **Proposed FSAR Changes**

**Enclosure 2, Attachment 1**



## FSAR Markup

- Attachment 1 in Enclosure 2 of the submittal includes FSAR markup pages for information only
- Revision of applicable FSAR safety system and design bases descriptions that take credit for the risk-informed evaluation
  - Design bases for the ECCS and CSS
  - Analysis of residual heat removal (RHR) and CS pump NPSH margin
- A new Appendix 6A is added to the FSAR to summarize the risk-informed approach used to demonstrate that the ECCS and CSS will operate with a high probability following a LOCA when considering the impacts of accident-generated debris
  - Stated the new licensing basis with respects to debris effects
  - Discussed the exemption from certain requirements of 10 CFR 50.46(a)(1)
  - Listed LOCA scenarios and failure criteria considered in the risk-informed analysis
  - Summarized methodology of risk quantification



## FSAR Markup Cont'd

- Summarized methodology used in key elements of the risk-informed analysis, as stated in the response to Condition and Limitation #5
  - Debris Generation
  - Debris Transport to Sump Strainers
  - Chemical Effects
  - Sump Strainer Evaluations (strainer head loss, submergence, vortexing, void fraction, flashing, and structural limit, and pump NPSH)
  - Ex-Vessel Downstream Effects
  - In-Vessel Downstream Effects
- Discussed how debris limits are derived based on analysis of strainer head loss, and in-vessel and ex-vessel downstream effects
- Summarized how the debris limits should be used for operability assessment

# **Debris Limits and How to Address Future Operability Issues**

**Enclosure 2, Attachment 2**



## Debris Limits and How to Address Future Operability Issues

- The approach is consistent with that discussed with the NRC staff during the November 2019 public meeting
- With approval of the risk-informed GSI-191 license amendment request, the new design basis for Vogtle will be that the risk increase due to GSI-191 failures is within RG 1.174 Region III (i.e., a  $\Delta$ CDF less than  $1\text{E-}06 \text{ yr}^{-1}$ )
- Debris limits are defined that will ensure that the plant stays within its design basis; these debris limits can be used for operability determinations
- It is not necessary to consider potential breaks larger than 10 inches for operability assessment
  - Must consider breaks  $\leq 10$  inches for 2 RHR train operation
  - Must consider breaks  $\leq 6$  inches for 1 RHR train operation
- Strainer debris limits are defined based on strainer testing
- Derivation of the debris limits and guidance for operability evaluation are summarized in Attachment 2 of Enclosure 2.



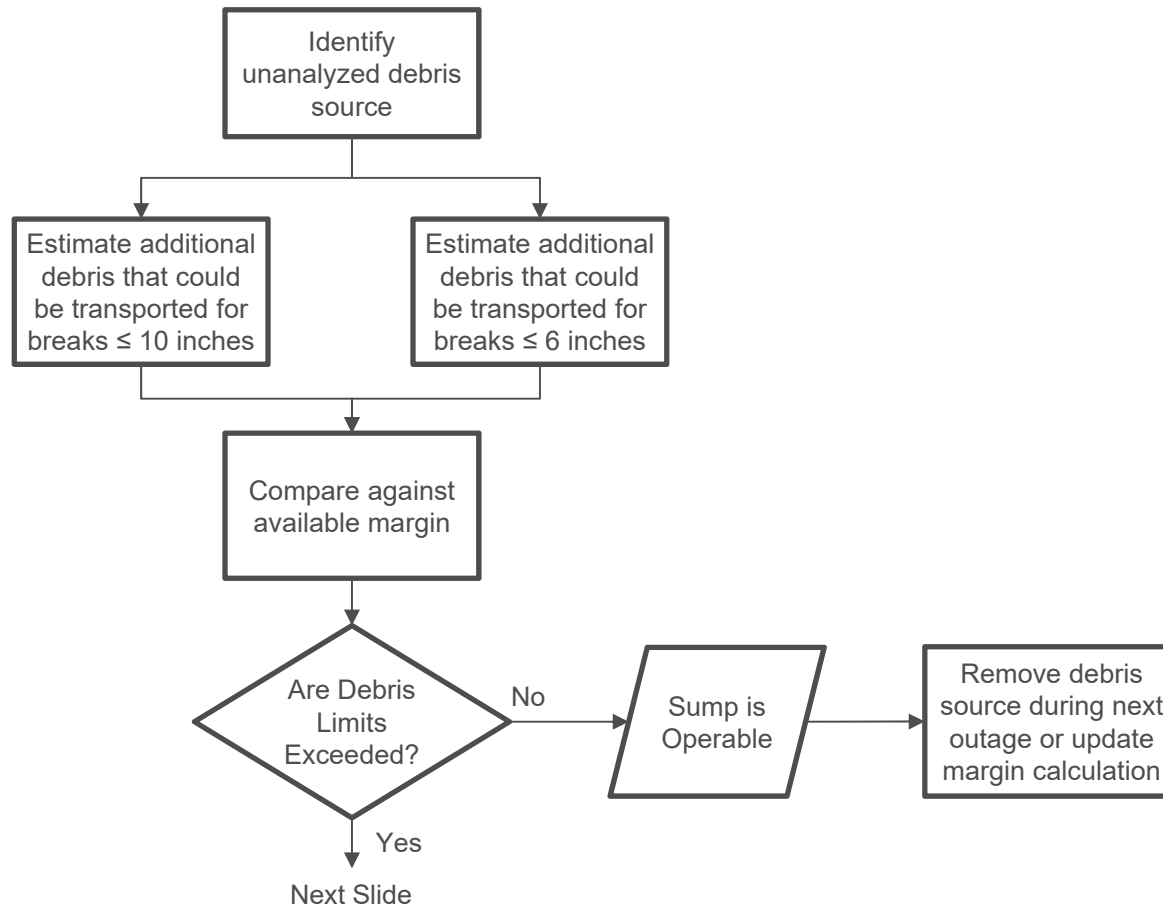
## Debris Limits and How to Address Future Operability Issues



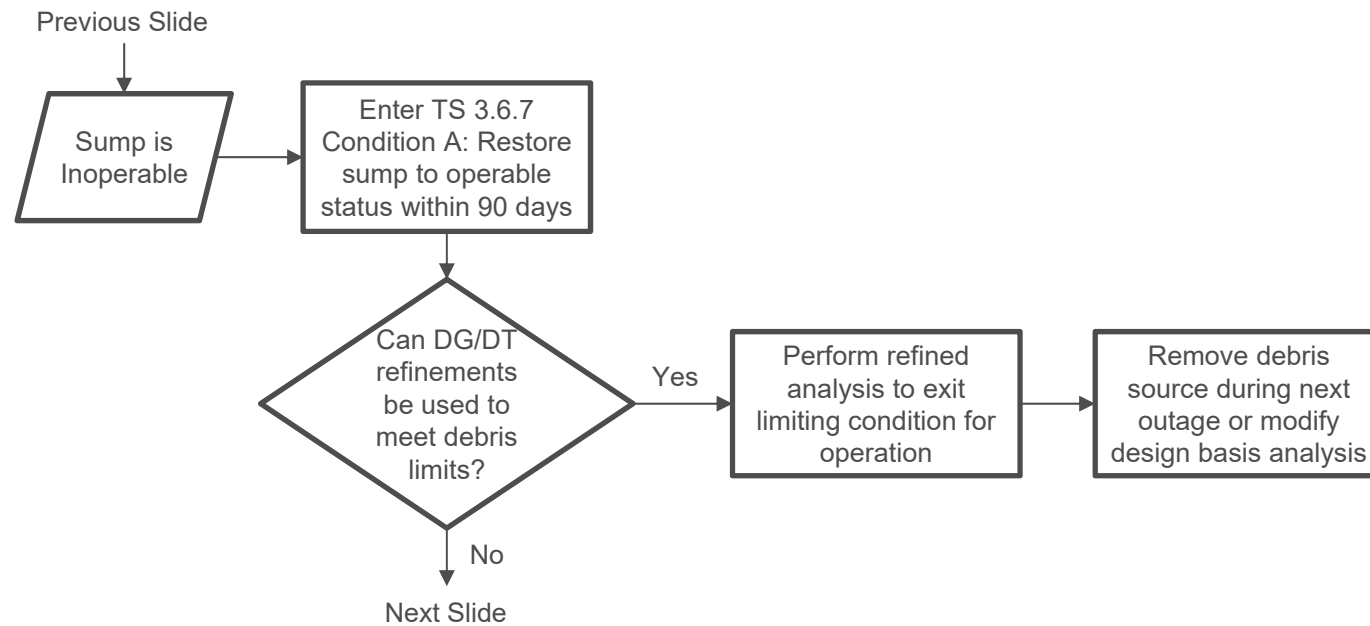
Debris Type	Current Quantity	Limit	Available Margin
Fiber Insulation Debris	5.3 ft <sup>3</sup>	95.2 ft <sup>3</sup>	89.9 ft <sup>3</sup>
Qualified and Unqualified Coatings Debris	15.3 ft <sup>3</sup>	16.8 ft <sup>3</sup>	1.5 ft <sup>3</sup>
Fire Barrier Debris	0 lbm	284.7 lbm	284.7 lbm
Latent Debris	60 lbm	200 lbm	140 lbm
Miscellaneous Debris	2 ft <sup>2</sup>	50 ft <sup>2</sup>	48 ft <sup>2</sup>



## Debris Limits and How to Address Future Operability Issues

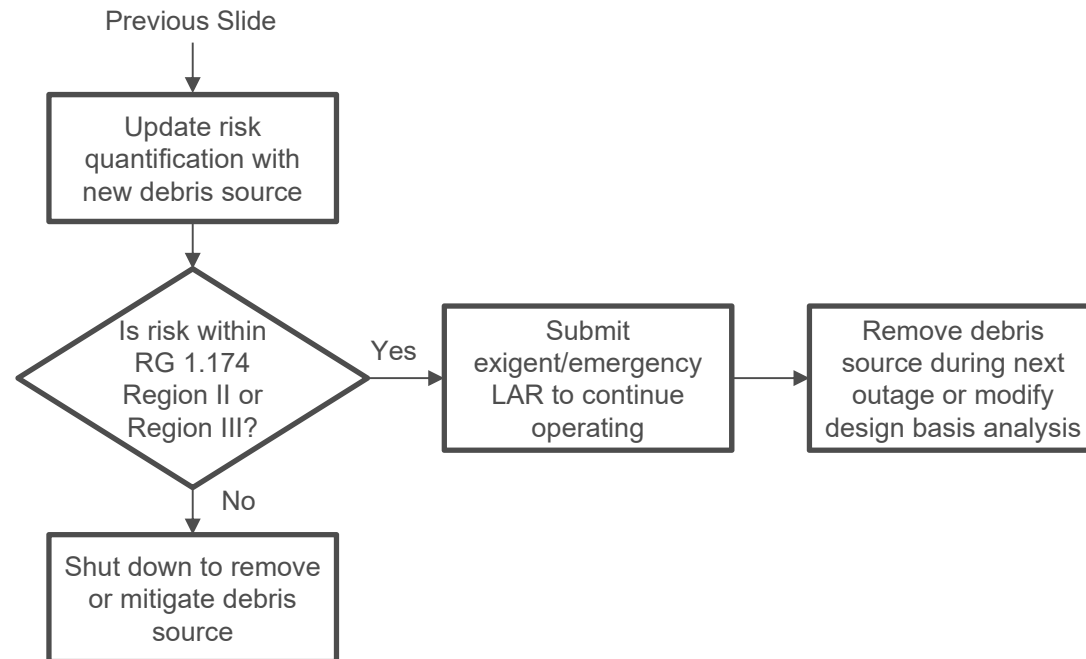


## Debris Limits and How to Address Future Operability Issues





## Debris Limits and How to Address Future Operability Issues



# **License Amendment Request**

**Proposed Changes to the Technical  
Specifications (Enclosure 3)**



## Enclosure 3 Content

- 1.0 DESCRIPTION
- 2.0 ASSESSMENT
  - 2.1 Applicability of Safety Evaluation
  - 2.2 Variations
- 3.0 REFERENCES

Attachment 1: Proposed Technical Specification Changes (Mark-Up)

Attachment 2: Revised Technical Specification Pages

Attachment 3: Proposed Technical Specification Bases Changes (Mark-Up) for  
Information Only

- The TS changes follow the model application in TSTF-567, Revision 1
- SNC has reviewed TSTF-567 and the NRC's SE and concluded that the justifications presented in TSTF-567 and the SE are applicable to Vogtle



## Variations from TS Changes in TSTF-567

- The proposed Condition B for the new Vogtle containment sump specification requires declaring the affected ECCS and CSS trains inoperable immediately
  - TSTF-567 Revision 1 requires restoring the containment sump to operable status within a specific completion time and entry into the ECCS and CSS TS actions
  - The Condition C for the new containment sump specification is unnecessary because the required actions of Condition B to “declare” affected trains inoperable are immediate
- The containment sump debris limits are provided in TS Bases instead of the FSAR
- Administrative differences in numbering between the Vogtle TS and Standard TS on which TSTF-567 was based

## New TS 3.6.7



### ACTIONS

<i>CONDITION</i>	<i>REQUIRED ACTION</i>	<i>COMPLETION TIME</i>
<i>A. One or more containment sumps inoperable due to containment accident generated and transported debris exceeding the analyzed limits.</i>	<i>A.1 Initiate action to mitigate containment accident generated and transported debris.</i>	<i>Immediately</i>
	<u><i>AND</i></u>	
	<i>A.2 Perform SR 3.4.13.1.</i>	<i>Once per 24 hours</i>
	<u><i>AND</i></u>	
	<i>A.3 Restore the containment sumps to OPERABLE status.</i>	<i>90 days</i>



## New TS 3.6.7



### *ACTIONS (continued)*

<i>CONDITION</i>	<i>REQUIRED ACTION</i>	<i>COMPLETION TIME</i>
<i>B. One or more containment sumps inoperable for reasons other than Condition A.</i>	<i>B.1 Declare affected Emergency Core Cooling System train(s) inoperable.</i>	<i>Immediately</i>
	<i><u>AND</u></i>	
	<i>B.2 Declare affected containment spray train(s) inoperable.</i>	<i>Immediately</i>
<i>C. Required Action and associated Completion Time of Condition A not met.</i>	<i>C.1 Be in MODE 3.</i>	<i>6 hours</i>
	<i><u>AND</u></i>	
	<i>C.2 Be in MODE 5.</i>	<i>36 hours</i>

## New TS 3.6.7



### *SURVEILLANCE REQUIREMENTS*

<i>SURVEILLANCE</i>		<i>FREQUENCY</i>
<i>SR 3.6.7.1</i>	<i>Verify, by visual inspection, the containment sumps do not show structural damage, abnormal corrosion, or debris blockage.</i>	<i>In accordance with the Surveillance Frequency Control Program</i>

# **License Amendment Request**

**Regulatory Evaluation and Environmental  
Consideration (Enclosure 4)**



## Enclosure 4 Content

- 1.0 REGULATORY EVALUATION
  - 1.1 Applicable Regulatory Requirements/Criteria
  - 1.2 Precedent
  - 1.3 No Significant Hazards Consideration
  - 1.4 Conclusions
- 2.0 ENVIRONMENTAL CONSIDERATION



## Regulatory Evaluation

- The proposed license amendment does not involve a significant hazards consideration under the standards in 10 CFR 50.92(c)
- The licensing basis changes are shown to meet the five key principles of RG 1.174
- The PRA model used for the Vogtle risk-informed GSI-191 evaluation complies with RG 1.200 and can be applied in regulatory decision-making



## Precedent

- The proposed licensing changes are very similar to the license amendment and 10 CFR 50.46(a)(1) exemption granted to STP for implementing their risk-informed approach to address GSI-191 concerns
- Key similarities include:
  - Use of RG 1.174 acceptance guidelines and key principles
  - Identification of key methods and approaches in the risk-informed methodology for evaluating potential departure from a method of evaluation in FSAR
  - Associated request for exemption from 10 CFR 50.46(a)(1) “other properties”
  - TS changes that provide for additional time to address the effects of debris on ECCS and CSS operability
- Key differences include:
  - Software used for risk analysis (NARWHAL vs. CASA Grande)
  - Methodology used for risk quantification (CFP approach vs. RoverD approach)
  - STP requested exemption from GDC 35, 38, and 41
  - Vogtle TS changes follow TSTF-567, Revision 1, which was not available to STP



## Environmental Consideration

- Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared for the proposed LAR because it meets the eligibility criterion for categorical exclusion in 10 CFR 51.22(c)(9).
  - The proposed amendment does not involve a significant hazards consideration
  - The proposed amendment does not pose a significant change in the types or a significant increase in the amounts of any effluents that may be released offsite
  - The proposed amendment does not result in a significant increase in individual or cumulative occupational radiation exposure



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# **Backup Slides**



## Resolution of In-Vessel Downstream Effects

- SNC followed the NRC review guidance and PWROG guidance to perform the in-vessel analysis, establish in-vessel acceptance criteria, and demonstrate that the criteria are met in the LAR submittal for Vogtle
- Overall approach is consistent with that discussed during the November 2019 public meeting
- The Vogtle in-vessel fiber load was analyzed using Vogtle-specific fiber penetration model without crediting any flow diversion from the core inlet ( $m_{\text{split}}$ )
- Per the NRC review guidance, various Vogtle parameters were compared with those used in the WCAP-17788 analyses to demonstrate applicability of the methodology



## Comparison of Vogtle Parameters with WCAP-17788

Parameters	Values from WCAP-17788-P, Rev 1	Vogtle Values
Nuclear Steam Supply System (NSSS) Design	Various	Westinghouse 4-loop
Fuel Type	Various	Westinghouse 17 x 17 VANTAGE 5, VANTAGE+ fuel
Barrel/Baffle Configuration	Various	Upflow
Minimum Chemical Precipitation Time	$t_{\text{block}}$ from WCAP-17788: 143 minutes	24 hours
Maximum HLSO Time	N/A	8 hours
Maximum Core Inlet Fiber Load for Hot Leg Break (HLB)	WCAP-17788, Volume 1, Table 6-3	90.61 g/FA
Total In-Vessel Fiber Limit for HLB	WCAP-17788, Volume 1, Section 6.4	N/A
Minimum Sump Switchover (SSO) Time	20 minutes	31.9 minutes
Maximum Rated Thermal Power	3658 MWt	3625.6 MWt
Maximum Alternate Flow Path (AFP) Resistance	WCAP-17788, Volume 4, Table 6-1	WCAP-17788, Volume 4, Table RAI-4.2-24
ECCS Flow per FA	8 – 40 gpm/FA	15.5 gpm/FA



## Comparison of Vogtle Parameters with WCAP-17788

- Chemical precipitation was shown to occur after the latest HLSO time and after the time that complete core inlet blockage can be tolerated ( $t_{\text{block}}$  in WCAP-17788)
- The earliest sump recirculation switchover time for Vogtle is greater than that assumed in the WCAP-17788 analysis
- Vogtle's maximum rated thermal power is less than the analyzed power level in WCAP-17788 for a Westinghouse NSSS with an upflow barrel/baffle design
- The Vogtle reactor AFP resistance is less than that analyzed in WCAP-17788
- The Vogtle ECCS flow rate per fuel assembly is within the range analyzed in WCAP-17788
- The maximum amount of fiber that may arrive at the core inlet for Vogtle exceeds the core inlet fiber limit but is less than the total in-core fiber limit presented in WCAP-17788
  - The Vogtle core inlet fiber load will not challenge long-term core cooling due to the expected non-uniform debris load at the reactor core inlet, as stated in the NRC review guidance



## Debris Limits and How to Address Future Operability Issues

- Probability of a single RHR pump failure (due to non-debris related causes) is less than 2%

Equipment Configuration	Functional Failure Probability
No Equipment Failures	91.50%
2 CS Pump Failures	5.31%
1 RHR Pump Failure	1.46%
1 CS Pump Failure	1.26%
1 RHR Pump + 1 CS Pump Failures	0.39%
1 RHR Pump + 2 CS Pump Failures	0.07%
<b>Total</b>	<b>100%</b>

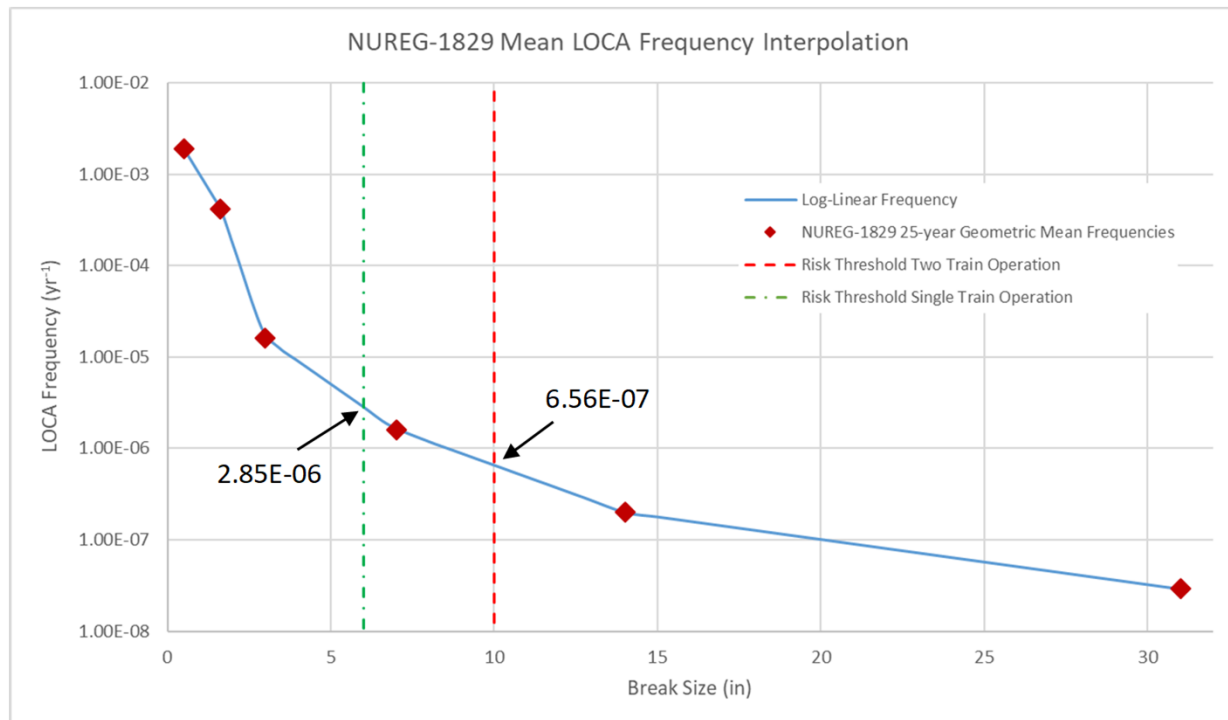
- Conservatively assume that single RHR train operation will be available 5% of the time and two train operation will be available 95% of the time



## Debris Limits and How to Address Future Operability Issues

- Risk will still be in Region III if all breaks larger than 10 inches fail for two train operation and all breaks larger than 6 inches fail for single train operation

$$\Delta CDF = 0.95 \cdot 6.56 \times 10^{-7} \text{yr}^{-1} + 0.05 \cdot 2.85 \times 10^{-6} \text{yr}^{-1} = 7.7 \times 10^{-7} \text{yr}^{-1}$$

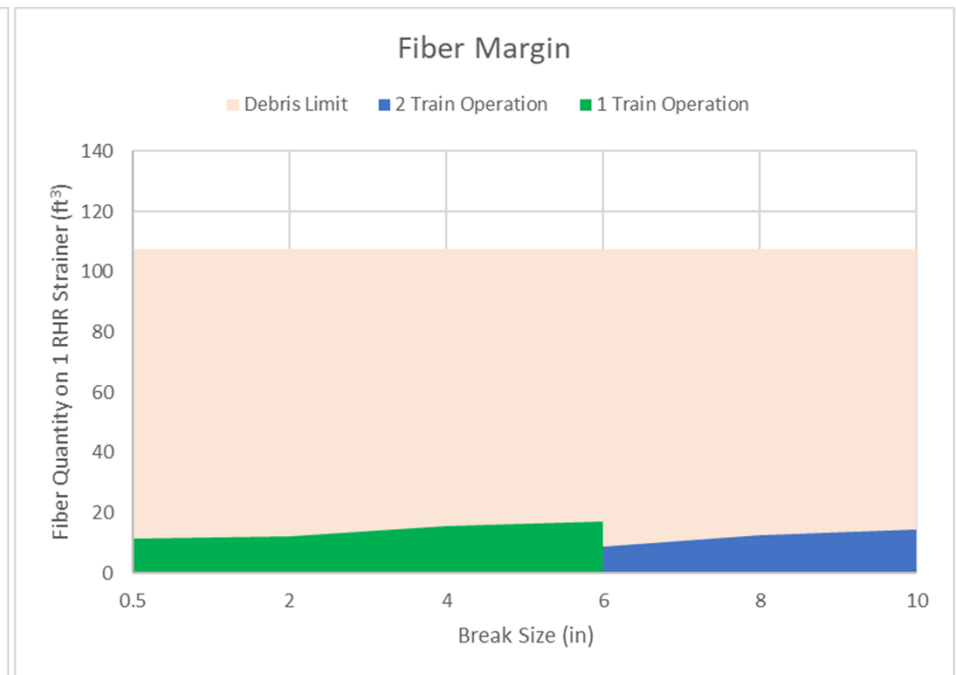
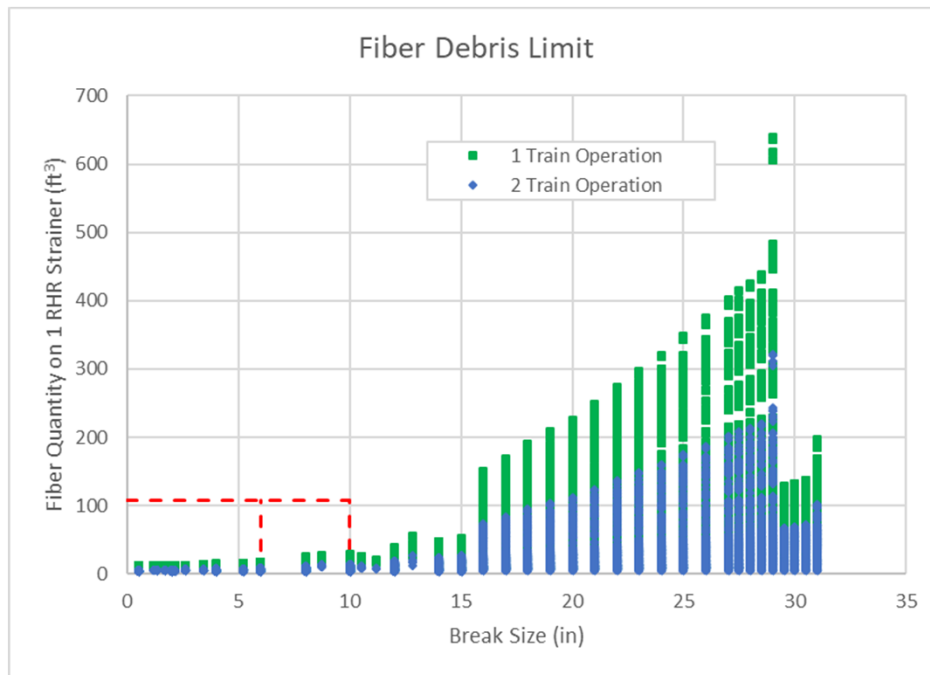




## Debris Limits and How to Address Future Operability Issues

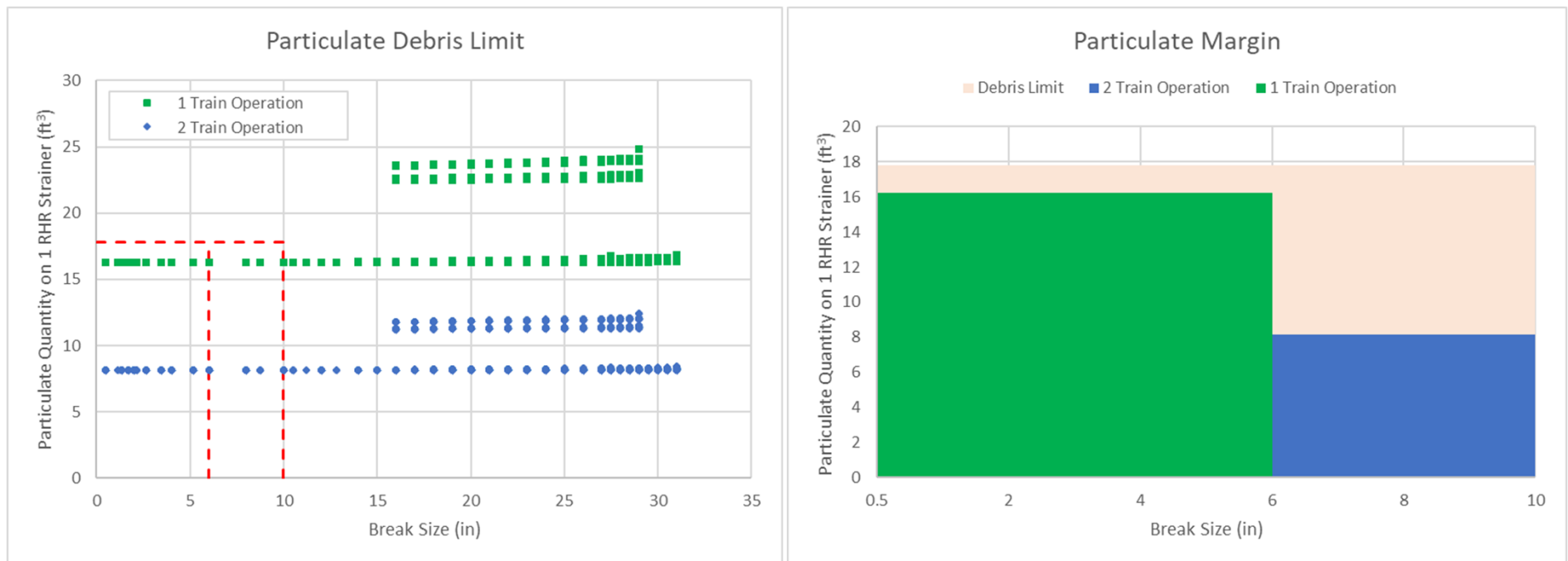
- It is not necessary to consider potential breaks larger than 10 inches for an operability assessment
- Must consider breaks  $\leq 10$  inches for 2 RHR train operation
- Must consider breaks  $\leq 6$  inches for 1 RHR train operation

## Debris Limits and How to Address Future Operability Issues





## Debris Limits and How to Address Future Operability Issues





## Debris Limits and How to Address Future Operability Issues

Debris Type	Acceptable Limit
Insulation Fiber Debris	95.2 ft <sup>3</sup> *
Qualified and Unqualified Coatings Debris	16.8 ft <sup>3</sup> †
Fire Barrier Debris	284.7 lbm
Latent Debris	200 lbm††
Miscellaneous Debris (Tags, Labels, etc.)	50 ft <sup>2</sup>

\*Based on an equivalent test quantity of 107.7 ft<sup>3</sup> fiber minus 12.5 ft<sup>3</sup> of latent fiber, which has a separate limit.

†Based on an equivalent test quantity of 17.8 ft<sup>3</sup> particulate minus 1.0 ft<sup>3</sup> of latent dirt/dust, which has a separate limit.

††Using the NRC accepted split of 85% dirt/dust and 15% fiber, along with the accepted fiber density of 2.4 lbm/ft<sup>3</sup> and dirt/dust density of 169 lbm/ft<sup>3</sup>, this is equivalent to 12.5 ft<sup>3</sup> fiber and 1.0 ft<sup>3</sup> dirt/dust.