Deterministic Basis

~~SEE DETAILED FILE~~

The deterministic basis will be an item by item response to the NRC's Content Guide with respect to how it is met by the tested configuration and where it interfaces with RoverD.

Risk-Informed Basis

~~**SEE ROVERD DESCRIPTION IN DETAILED FILE**~~

Primary Changes to RoverD:

Added CASA and Thermal Hydraulics descriptions

Changed the FIDOE sensitivities to address the two train case (from audit) and added sensitivity for in-core for BAP.

Added IOZ to the break size tables for 10D ZOI.

Safety Margin [IN PROCESS]

The safety margin evaluation identifies margins and conservatisms in the design, analysis and construction that show that the actual probability of core damage due to strainer blockage, given a break at one of the 45 identified locations, is ~~much~~ likely to be smaller than the values calculated in the RoverD analysis. The evaluation credits very low susceptibility of the welds to degradation mechanisms that could lead to a LOCA, expected smaller actual amounts of debris that would be generated and transported to the sumps, little or no actual contribution to head loss from chemical effects, and margin in head loss evaluation.

1-4.2.1 Design Calculation Conservatisms

Non-Debris Head Loss Conservatisms

Sump Temperature

Sump Water Level

Pump Flow Rates

Clean Strainer Head Loss

1-4.2.2 Testing Conservatisms

1-4.2.2.1 Debris Source Term – Amount of Debris

Unqualified Coatings

100% Failure

Quantity in Containment

Marinite

1-4.2.2.2 Debris Source Term – Timing of Debris Arrival

1-4.2.2.3 Chemical Effects

STP Plant-Specific Test Results

1-4.2.3 In-Vessel Effects Conservatisms

Quantity of Debris

Thermal Hydraulic Analyses

1-4.2.4 Conclusions – Cumulative Effect of Safety Margins

Particulate Debris Conclusion from draft Alion particulate margin assessment. STP would include the assessment in the supplement since it addresses questions in the amount of particulate in the testing and the IOZ ZOI question.

Particulate debris that were added to the July 2008 STP head loss test in deficient or extra amounts were identified and compared in this report. The July 2008 tested unqualified epoxy and Microtherm® additions were found to be deficient due to use of methods not approved by guidance and due to the use of values from a draft report respectively. Tested IOZ and Marinite® debris amounts were assessed as extra source terms due to refined analysis and plant removal of insulation respectively. Unqualified epoxy and IOZ were qualitatively compared as typical debris types, defined as debris types that have reliable measurements for surface area to volume ratio; which is a parameter indicative of drag in measured or calculated head loss. A conservative margin of 453 lbm was found for the typical particulate debris types assessed. Microtherm® and Marinite® were qualitatively compared as problematic debris types, defined as debris types that have high and unreliable measurements for surface area to volume ratio because of their microporous geometry. A conservative margin of 153.4 lbm was found for the problematic debris types assessed. The large conservative margin of microporous marinate debris qualitatively can be equivocated to a much larger amount of typical particulate debris that is not quantitatively estimated in this report.

Chemical Effects Conclusion from draft Alion assessment of chemical effects margin. STP plans to include this assessment in the supplement.

The 2008 strainer test design basis chemical load was much larger than the worst case chemical loads expected to exist under STP worst case conditions. The chemical loads examined using risk informed conditions determined that the 2008 strainer design basis chemical load could be reduced by up to 94%. The 2008 strainer data was used to determine a reduction of CHL reflective of the reduced chemical inventory. The CHL demonstrated reduction was as high as 67% resulting in a 38% reduction in peak head loss. While the reduction in precipitate load, CHL and peak head loss was significant, the results are conservative because the CHL was reflective of AlOOH precipitate loading.

Conclusions (from draft Alion best-estimate analysis)

The results from the best-estimate CASA Grande risk analysis illustrate that there is little risk (8.59E-09 per reactor year) associated with GSI-191 phenomenon for STP.

Technical Specification Page Markups

~~(SEE DRAFT)~~

EMERGENCY CORE COOLING SYSTEMS

3/4.5.2 ECCS SUBSYSTEMS - T_{AVG} GREATER THAN OR EQUAL TO 350°F

LIMITING CONDITION FOR OPERATION

3.5.2 Three independent Emergency Core Cooling System (ECCS) subsystems shall be OPERABLE with each subsystem comprised of:

a. One OPERABLE High Head Safety Injection pump,

b. One OPERABLE Low Head Safety Injection pump,

c. One OPERABLE RHR heat exchanger, and

d. An OPERABLE flow path capable of taking suction from the refueling water storage tank on a Safety Injection signal and automatically transferring suction to the containment sump during the recirculation phase of operation through a High Head Safety Injection pump and into the Reactor Coolant System and through a Low Head Safety Injection pump and its respective RHR heat exchanger into the Reactor Coolant System.

e. An OPERABLE Reactor Containment Building emergency sump with respect to effects of LOCA debris by limiting the containment debris quantities to less than or equal to the STP debris analysis assumptions.

APPLICABILITY: MODES 1, 2, and 3.*

ACTION:

a. With less than the above subsystems OPERABLE, but with at least two High Head Safety Injection pumps in an OPERABLE status, two Low Head Safety Injection pumps and associated RHR heat exchangers in an OPERABLE status, and sufficient flow paths to accommodate these OPERABLE Safety Injection pumps and RHR heat exchangers,** within 7 days restore the inoperable subsystem(s) to OPERABLE status or apply the requirements of the CRMP, or be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.

b. With less than two of the required subsystems OPERABLE, within 1 hour restore at least two subsystems to OPERABLE status or apply the requirements of the CRMP, or be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.

c. With less than the required ECC Systems OPERABLE due to potential effects of debris (LCO e), perform the following:

4. Immediately initiate action to implement compensatory actions,

AND

5. Within 90 days restore the affected system(s) to OPERABLE status,

OR

Be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours

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* Entry into MODE 3 is permitted for the Safety Injection pumps declared inoperable pursuant to Specification 4.5.3.1.2 provided that the Safety Injection pumps are restored to OPERABLE status within 4 hours or prior to the temperature of one or more of the RCS cold legs exceeding 375°F, whichever comes first.

** Verify required pumps, heat exchangers and flow paths OPERABLE every 48 hours.

CONTAINMENT SYSTEMS

3/4.6.2 DEPRESSURIZATION AND COOLING SYSTEMS

CONTAINMENT SPRAY SYSTEM

LIMITING CONDITION FOR OPERATION

3.6.2.1

a. Three independent Containment Spray Systems shall be OPERABLE with each Spray system capable of taking suction from the RWST and transferring suction to the containment sump.

b. The Reactor Containment Building emergency sumps shall be OPERABLE with respect to effects of LOCA debris by limiting the containment debris quantities to less than or equal to the STP debris analysis assumptions.

APPLICABILITY: LCO a. MODES 1, 2, 3, and 4
LCO b. MODES 1, 2, and 3

ACTION:

a. With one Containment Spray System inoperable, within 7 days restore the inoperable Spray System to OPERABLE status or apply the requirements of the CRMP, or be in at least HOT STANDBY within the next 6 hours; restore the inoperable Spray System to OPERABLE status within the next 48 hours or be in COLD SHUTDOWN within the following 30 hours.

b. With more than one Containment Spray System inoperable, within 1 hour restore at least two Spray Systems to OPERABLE status or apply the requirements of the CRMP, or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

c. With less than the required Containment Spray Systems OPERABLE due to potential effects of debris (LCO b), perform the following:

3. immediately initiate action to implement compensatory actions,

AND

4. within 90 days restore the affected system(s) to OPERABLE status,

OR

Be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours

SURVEILLANCE REQUIREMENTS

4.6.2.1 Each Containment Spray System shall be demonstrated OPERABLE:

a. At a frequency in accordance with the Surveillance Frequency Control Program by verifying that each valve (manual, power-operated, or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position;

b. By verifying on a STAGGERED TEST BASIS, that on recirculation flow, each pump develops a differential pressure of greater than or equal to 283 psid when tested pursuant to Specification 4.0.5;

c. At a frequency in accordance with the Surveillance Frequency Control Program during shutdown, by:

1) Verifying that each automatic valve in the flow path actuates to its correct position on a Containment Pressure High 3 test signal, and

2) Verifying that each spray pump starts automatically on a Containment Pressure High 3 test signal coincident with a sequencer start signal.

d. By verifying each spray nozzle is unobstructed following maintenance activities that could result in spray nozzle blockage.

Attachment 3-3

Technical Specifications Bases
Page Markups

(Information Only)

Technical Specifications Bases Page Markups (Information Only)

Add the following to the Bases Section for 3/4.5.2 ECCS Subsystems:

The OPERABILITY of the ECCS Subsystems is assured by the capability of the containment emergency sump to limit entry of high-density particles or floating debris into the sump and recirculating lines. This capability ensures that the flow and net positive suction head requirements of ECCS are satisfied under the most adverse combination of credible occurrence. Assurance that containment debris will not block the sump and render the ECCS Subsystem inoperable on emergency recirculation during design basis accidents is provided by inspection and engineering evaluation. UFSAR Appendix 6A provides a risk-informed approach that addresses the potential of debris blockage concluding that long-term core cooling following a design basis loss of coolant accident is assured with high probability. UFSAR Appendix 6A also provides guidance for assessing the potential impact on Operability due to unexpected material such as loose debris discovered in containment that may contribute to debris loading on the strainers.

Technical Basis:

The effects of debris that are bounded by the plant-specific testing are deterministically mitigated in accordance with NRC-accepted methodology for resolution of GL 2004-02. The STP evaluation shows that the risk associated with debris from pipe breaks that generate quantities of debris that are not bounded by plant-specific prototypical testing is very small, in accordance with the acceptance criteria of RG 1.174.

Thus, the Licensing Basis with regard to effects of debris is that there is a high probability that ECCS and CSS can perform their design basis functions based on successful plant-specific prototypical testing using deterministic NRC-approved assumptions, and that the risk from breaks that could generate debris that is not bounded by the testing is very small in accordance with the criteria of RG 1.174.

STP evaluated the risk associated with the effects on long-term cooling due to debris accumulation on Emergency Core Cooling System (ECCS) and Containment Spray System (CSS) sump strainers in recirculation mode, as well as core flow blockage due to in-vessel effects of debris that bypasses the strainers. A full spectrum of postulated LOCAs is analyzed, including double-ended guillotine breaks (DEGBs) for all pipe sizes up to the largest pipe in the reactor coolant system. The changes to CDF and LERF associated with the effects of debris are quantified by applying the LOCA frequencies published in NUREG-1829, and then compared to RG 1.174 acceptance guidelines. The STP analysis shows that the contribution to risk from the breaks that are not deterministically mitigated is within RG 1.174 Region III

LCO for Strainer Operability:

The affected ECCS and CSS are OPERABLE with respect to the effects of debris when the quantity and characteristics of potential debris in the Reactor Containment Building are bounded by the quantity and characteristics of the debris assumed in the STP debris analysis, and when the expected effects of the debris on the emergency sump strainers are consistent with the analysis. This operability requirement is based on quantity and characteristics of the debris in the RCB being consistent with the debris analysis assumptions. It is fundamentally deterministic and the intent is to not require a risk assessment to make the operability determination. The criterion recognizes that there is margin and conservatism in the debris assumptions used for the deterministic testing and in the debris generation and transport analyses that can be applied to account for previously unidentified debris.

Applicability:

This required action applies only for the potential effects of debris on emergency sump strainer operability or on in-core debris effects. It does not apply for effects other than those caused by debris. Debris effects are conditions caused by transportable debris that could impact the net positive suction head or otherwise degrade pump performance, or cause strainer structural failure by excess accumulation on one of more of the emergency sump strainers. Gaps or other conditions that are a physical degraded or nonconforming condition of the strainer are to be addressed by the system train-specific, non-debris TS actions.

The requirements apply in MODE 1, 2, and 3. In these MODEs, the plant is in normal operating pressure and temperature where generation of design basis quantities of debris can reasonably be postulated. For lower MODEs of operation, there is less energy in the RCS and reduced capability to generate the zones of influence associated with pipe breaks, and the core is at generally lower levels of decay heat generation. Consequently, effects of debris are less likely to cause a condition where ECCS or CSS is inoperable.

Technical Specifications require that all applicable actions must be entered. If concurrent maintenance requirements or a non-debris related degraded or nonconforming condition occurs that would make any system(s) or subsystem(s) inoperable, the non-debris required action for the system(s) or subsystem(s) must be applied. The action from the debris related condition will continue to apply from the time it was initially entered.

Required Action:

The required action to implement compensatory action is based on the very low contribution by LOCA generated debris to the risk of core damage, and is a reasonable response to minimize the potential increase in risk from the debris source. Typical compensatory action would include actions such as:

- Remove the debris or source of debris or take action that would prevent transport of the debris to the emergency sump
- Defer maintenance that would affect availability of the affected systems and strainers
- Increase frequency of RCS leak detection monitoring
- Brief operators on LOCA debris management actions

Completion Time:

The [90 day] completion time is based on the very low contribution to risk from debris. It provides sufficient time to more thoroughly assess the condition and to take corrective action. Operability can be restored by mitigation of the debris such as by removal or making it non-transportable, or by performing a calculation that demonstrates that the Licensing Basis is maintained.

Add the following to the Bases Section 3/4.6.2.1 Containment Spray System:

The OPERABILITY of the Containment Spray System is assured by the capability of the containment emergency sump to limit entry of high-density particles or floating debris into the sump and recirculating lines. This capability ensures that the flow and net positive suction head requirements of Containment Spray System are satisfied under the most adverse combination of credible occurrence. Assurance that containment debris will not block the sump and render the Containment Spray System inoperable on emergency recirculation during design basis accidents is provided by inspection and engineering evaluation. UFSAR Appendix 6A provides a risk-informed approach that addresses the potential of debris blockage concluding that heat removal capability and atmospheric cleanup capability following a design basis loss of coolant accident are assured with high probability. UFSAR Appendix 6A also provides guidance for assessing the potential impact on Operability due to unexpected material such as loose debris discovered in containment that may contribute to debris loading on the strainers.

Technical Basis:

The effects of debris that are bounded by the plant-specific testing are deterministically mitigated in accordance with NRC-accepted methodology for resolution of GL 2004-02. The STP evaluation shows that the risk associated with debris from pipe breaks that generate quantities of debris that are not bounded by plant-specific prototypical testing is very small, in accordance with the acceptance criteria of RG 1.174.

Thus, the Licensing Basis with regard to effects of debris is that there is a high probability that ECCS and CSS can perform their design basis functions based on successful plant-specific prototypical testing using deterministic NRC-approved assumptions, and that the risk from breaks that could generate debris that is not bounded by the testing is very small in accordance with the criteria of RG 1.174.

STP evaluated the risk associated with the effects on long-term cooling due to debris accumulation on Emergency Core Cooling System (ECCS) and Containment Spray System (CSS) sump strainers in recirculation mode, as well as core flow blockage due to in-vessel effects of debris that bypasses the strainers. A full spectrum of postulated LOCAs is analyzed, including double-ended guillotine breaks (DEGBs) for all pipe sizes up to the largest pipe in the reactor coolant system. The changes to CDF and LERF associated with the effects of debris are quantified by applying the LOCA frequencies published in NUREG-1829, and then compared to RG 1.174 acceptance guidelines. The STP analysis shows that the contribution to risk from the breaks that are not deterministically mitigated is within RG 1.174 Region III

LCO for Strainer Operability:

The affected ECCS and CSS are OPERABLE with respect to the effects of debris when the quantity and characteristics of potential debris in the Reactor Containment Building are bounded by the quantity and characteristics of the debris assumed in the STP debris analysis, and when the expected effects of the debris on the emergency sump strainers are consistent with the analysis. This operability requirement is based on quantity and characteristics of the debris in the RCB being consistent with the debris analysis assumptions. It is fundamentally deterministic and the intent is to not require a risk assessment to make the operability determination. The criterion recognizes that there is margin and conservatism in the debris assumptions used for the deterministic testing and in the debris generation and transport analyses that can be applied to account for previously unidentified debris.

Applicability:

This required action applies only for the potential effects of debris on emergency sump strainer operability or on in-core debris effects. It does not apply for effects other than those caused by debris. Debris effects are conditions caused by transportable debris that could impact the net positive suction head or otherwise degrade pump performance, or cause strainer structural failure by excess accumulation on one of more of the emergency sump strainers. Gaps or other conditions that are a physical degraded or nonconforming condition of the strainer are to be addressed by the system train-specific, non-debris TS actions.

The requirements apply in MODE 1, 2, and 3. In these MODEs, the plant is in normal operating pressure and temperature where generation of design basis quantities of debris can reasonably be postulated. For lower MODEs of operation, there is less energy in the RCS and reduced capability to generate the zones of influence associated with pipe breaks, and the core is at generally lower levels of decay heat generation. Consequently, effects of debris are less likely to cause a condition where ECCS or CSS is inoperable.

Technical Specifications require that all applicable actions must be entered. If concurrent maintenance requirements or a non-debris related degraded or nonconforming condition occurs that would make any system(s) or subsystem(s) inoperable, the non-debris required action for the system(s) or subsystem(s) must be applied. The action from the debris related condition will continue to apply from the time it was initially entered.

Required Action:

The required action to implement compensatory action is based on the very low contribution by LOCA generated debris to the risk of core damage, and is a reasonable response to minimize the potential increase in risk from the debris source. Typical compensatory action would include actions such as:

- Remove the debris or source of debris or take action that would prevent transport of the debris to the emergency sump
- Defer maintenance that would affect availability of the affected systems and strainers
- Increase frequency of RCS leak detection monitoring
- Brief operators on LOCA debris management actions

Completion Time:

The [90 day] completion time is based on the very low contribution to risk from debris. It provides sufficient time to more thoroughly assess the condition and to take corrective action. Operability can be restored by mitigation of the debris such as by removal or making it non-transportable, or by performing a calculation that demonstrates that the Licensing Basis is maintained.

UFSAR Markups

[DEVELOPMENT STILL IN-PROCESS, PRIMARILY FOR APP. 6A]

STPEGS UFSAR Page Markups

The changes to the South Texas Project Electric Generating Station (STPEGS) Updated Final Safety Analysis Report (UFSAR) are provided for NRC review and approval for the purpose of addressing Generic Safety Issue (GSI)-191, “Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance” and closing GL2004-02 for STP Units 1 and 2. The risk-informed approach following the guidance of RG 1.174 provided as justification for the changes. Future changes to the revised parts of the UFSAR will be done in accordance with 10CFR50.59 since the criteria of 10CFR50.59 are still the relevant and appropriate change criteria.

The design and licensing basis descriptions of accidents requiring ECCS operation, including analysis methods, assumptions, and results provided in UFSAR Chapters 6 and 15 remain unchanged. The performance evaluations for accidents requiring ECCS operation described in Chapters 6 and 15, based on the South Texas Project Units 1 and 2 Appendix K Large-Break Loss-of-Coolant Accident (LBLOCA) analysis, demonstrate that for breaks up to and including the double-ended guillotine break of a reactor coolant pipe, the ECCS will limit the clad temperature to below the limit specified in 10CFR50.46, and assure that the core will remain in place and substantially intact with its essential heat transfer geometry preserved.

The results of the risk-informed method determine acceptable containment sump design and performance with regard to mitigation of the effects of LOCA debris and amend the licensing bases for the supported ECCS and CSS specified functions required during recirculation mode following postulated LOCAs, for the purpose of addressing GSI-191 and closing GL2004-02.

Changes to the UFSAR are shown on the following pages.

3.1.2.4.6.1 Evaluation Against Criterion 35 – The ECCS is provided to cope with any LOCA in the plant design basis. Abundant cooling water is available in an emergency to transfer heat from the core at a rate sufficient to maintain the core in a coolable geometry and to assure that clad metal/water reaction is limited to less than 1 percent. Except for the effects of debris, adequate design provisions are made to assure performance of the required safety functions even with a single failure. The STP Risk over Deterministic (RoverD) methodology was used to evaluate the effects of debris. RoverD relegates break sizes that generate and transport debris that is not bounded by deterministic testing to failure (core damage). It then applies the NUREG 1829 pipe break frequency for the smallest unbounded breaks to determine the increase in core damage frequency. The increase is compared to the criteria in RG 1.174. The analysis shows that the risk from the unbounded breaks is very small, as defined by RG 1.174. An exemption to GDC 35 has been approved to allow application of the risk-informed analysis instead of the single failure assumption required by GDC 35. The exemption applies to the scope of breaks that generate and transport debris not bounded by the deterministic testing. Details of the conditions for the exemption are included in Appendix 6A.

Details of the capability of the systems are included in Section 6.3. An evaluation of the adequacy of the system functions is included in Chapter 15. Performance evaluations have been conducted in accordance with 10CFR50.46 and 10CFR50 Appendix K.

3.1.2.4.9.1 Evaluation Against Criterion 38 – The CHRS consists of the CSS, the Reactor Containment Fan Cooler (RCFC) Subsystem and the residual heat removal (RHR) heat exchangers. The CHRS acts in conjunction with the Safety Injection System to remove heat from the Containment. The CHRS is designed to accomplish the following functions in the unlikely event of a LOCA: to rapidly condense the steam within the Containment in order to prevent over pressurization during blowdown of the RCS; and to provide long-term continuous heat removal from the Containment.

Initially, the CSS and the high-and low-head safety injection (HHSI and LHSI) pumps take suction from the refueling water storage tank (RWST). During the recirculation phase, the CSS and the HHSI and LHSI pumps take suction from the Containment emergency sumps. The CHRS is divided into three trains. Each train is sized to remove 50 percent of the system design heat load at the start of recirculation. Each train of the CHRS is supplied power from a separate independent Class 1E bus. The redundancy and capability of the Offsite and Emergency Power Systems are presented in the evaluation against Criterion 17. Redundant system trains and emergency diesel power supplies provide assurance that system safety functions can be accomplished. An exemption to GDC 38 has been approved to allow application of a risk-informed analysis instead of the single failure assumption required by GDC 38, to address the effects of debris. The STP Risk over Deterministic (RoverD) methodology was used to evaluate the effects of debris. RoverD relegates break sizes that generate and transport debris that is not bounded by deterministic testing to failure (core damage). It then applies the NUREG 1829 pipe break frequency for the smallest unbounded breaks to determine the increase in core damage frequency. The increase is compared to the criteria in RG 1.174. The analysis shows that the risk from the unbounded breaks is very small, as defined by RG 1.174. The exemption applies to the scope of breaks that generate and transport debris not bounded by the deterministic testing. Details of the conditions for the exemption are included in Appendix 6A.

For further discussion, see the following sections of the UFSAR:

Residual Heat Removal System	5.4.7
Design for Debris Effects	App. 6A
Containment Systems	6.2
Engineered Safety Features Actuation System	7.3
Onsite Power System	8.3
Accident Analysis	15.0

3.1.2.4.12.1 Evaluation Against Criterion 41 – The CSS is provided to reduce the concentration and quantity of fission products in the Containment atmosphere following a LOCA. Per 10CFR50.44, hydrogen recombiners are no longer required for design basis accidents.

The equilibrium sump pH is maintained by trisodium phosphate (TSP) contained in baskets on the containment floor. The initial CSS water and spilled RCS water dissolves the TSP into the containment sump allowing recirculation of the alkaline fluid. Each unit is equipped with three 50- percent spray trains taking suction from the Containment sump. Each Containment spray train is supplied power from a separate bus. Each bus is connected to both the Offsite and the Standby Power Supply Systems. This assures that for Onsite or for Offsite Electrical Power System failure, their safety function (except for the consideration of debris effects) can be accomplished, assuming a single failure. An exemption to GDC 41 has been approved to allow application of a risk-informed analysis instead of the single failure assumption required by GDC 41, to address the effects of debris on the CSS function. The STP Risk over Deterministic (RoverD) methodology was used to evaluate the effects of debris. RoverD relegates break sizes that generate and transport debris that is not bounded by deterministic testing to failure (core damage). It then applies the NUREG 1829 pipe break frequency for the unbounded breaks to determine the increase in core damage frequency. The increase is compared to the criteria in RG 1.174. The analysis shows that the risk from the unbounded breaks is very small, as defined by RG 1.174. The exemption applies to the scope of breaks that generate and transport debris not bounded by the deterministic testing. Details of the conditions for the exemption are included in Appendix 6A.

Post-accident combustible gas control is assured by the use of the Supplementary Containment Purge Subsystem.

For further discussion, see the following sections of the UFSAR:

Containment Systems	6.2
Containment Spray System – Iodine Removal	6.5.2
Design for Debris Effects	App. 6A
Containment Hydrogen Sampling System	7.6.5
Containment HVAC System	9.4.5

TABLE 3.12-1
REGULATORY GUIDE MATRIX

ABBREVIATIONS:

A Conform to guide

No.	Regulatory Guide Title	UFSAR Reference	Revision Status On STPEGS	STPEGS Position
1.82	Sumps for Emergency Core Cooling and Containment Spray Systems	6.2.2.1.2 6.2.2.2.3 6.3.4.1	Proposed Rev 1 (5/83)	A See Note 103

NOTES

103 NRC Generic Letter 2004-02 (GL 04-02) "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," required licensees to evaluate the ECCS and CSS recirculation functions based on the potential susceptibility of sump screens to debris blockage during design basis accidents. Refer to Section 6.2.2.1.2.

6.2.2.1.2 Containment Emergency Sump Design Bases:

The Containment emergency sump meets the following design bases:

1. Sufficient capacity and redundancy to satisfy the single-failure criteria. To achieve this, each CSS/ECCS train draws water from a separate Containment emergency sump.

2. Capable of satisfying the flow and net positive suction head (NPSH) requirements of the ECCS and the CSS under the most adverse combination of credible occurrences. This includes minimizing the possibility of vortexing in the sump.

3. Minimizes entry of high-density particles (specific gravity of 1.05 or more) or floating debris into the sump and recirculating lines.

4. Sumps are designed in accordance with RG 1.82, proposed revision 1, May 1983 with consideration of the debris effects addressed by Generic Letter 2004-02, as described in ~~NOC-AE-08002372~~ Appendix 6A.

6.2.2.2.3 Containment Emergency Sump Description:

At the beginning of the recirculation phase, the minimum water level above the Containment floor is adequate to provide the required NPSH for the ECCS and CSS pumps. The sumps are designed to RG 1.82, proposed revision 1, May 1983 and with consideration of the debris effects identified in Generic Letter 2004-02, as described in ~~NOC-AE-08002372~~ Appendix 6A. The sump structures are designed to limit approach flow velocities to less than 0.009 ft/sec permitting high-density particles to settle out on the floor and minimize the possibility of clogging the strainers. The risk-informed methodology applied to evaluate the risk associated with effects of debris shows that the increase in risk associated with debris that would exceed the design limits of the sump structures is very small, in accordance with the acceptance criteria of Regulatory Guide 1.174.

6.3 EMERGENCY CORE COOLING SYSTEM
6.3.1 Design Basis

Insert:

The Licensing Basis for ECCS with regard to effects of debris on emergency sump strainers to the extent that the strainers support the ECCS element of the core cooling function, is a risk-informed analysis that shows there is a high probability that ECCS can perform its design basis functions based on plant-specific prototypical testing using deterministic assumptions that provide safety margin and defense-in-depth and that the risk from breaks that could generate debris that is not bounded by the testing is very small in accordance with the criteria of RG 1.174.

The STP Risk over Deterministic (RoverD) methodology was used to evaluate the effects of debris. RoverD relegates break sizes that generate and transport debris that is not bounded by deterministic testing to failure (core damage). It then applies the NUREG 1829 pipe break frequency for the smallest unbounded breaks to determine the increase in core damage frequency. The increase is compared to the criteria in RG 1.174. The analysis shows that the risk from the unbounded breaks is very small, as defined by RG 1.174. An exemption to GDC 35 has been approved to allow application of the risk-informed analysis instead of the single failure assumption required by GDC 35. The exemption applies to the scope of breaks that generate and transport debris not bounded by the deterministic testing.

Details of the design basis for the effects of debris on the function of the emergency sump strainers is provided in UFSAR Appendix 6A.

Insert for Ch 15.6.5.4.1:

The Licensing Basis for ECCS and containment heat removal with regard to effects of debris on emergency sump strainers to the extent that the strainers support the CSS and ECCS element of the core cooling and containment heat removal functions, is a risk-informed analysis that shows there is a high probability that CSS and ECCS can perform their design basis functions based on plant-specific prototypical testing using deterministic assumptions that provide safety margin and defense-in-depth and that the risk from breaks that could generate debris that is not bounded by the testing is very small in accordance with the criteria of RG 1.174.

The STP Risk over Deterministic (RoverD) methodology was used to evaluate the effects of debris. RoverD relegates break sizes that generate and transport debris that is not bounded by deterministic testing to failure (core damage). It then applies the NUREG 1829 pipe break frequency for the smallest unbounded breaks to determine the increase in core damage frequency. The increase is compared to the criteria in RG 1.174. The analysis shows that the risk from the unbounded breaks is very small, as defined by RG 1.174. Exemptions to 10CFR50.46(d), GDC 35 and GDC 38 have been approved to allow application of the risk-informed analysis instead of the single failure assumption required by GDCs. The exemptions apply to the scope of breaks that generate and transport debris not bounded by the deterministic testing.

Details of the design basis for the effects of debris on the function of the emergency sump strainers is provided in UFSAR Appendix 6A.

The following UFSAR changes with respect to NPSH are provided for information. These changes are corrections/clarifications to ECCS and CSS NPSH description and are provided for completeness. STPNOC is not requesting NRC approval of these changes.

UFSAR NPSH Description Change
For Information Only

TABLE 6.3-1

EMERGENCY CORE COOLING SYSTEM
COMPONENT PARAMETERS

Accumulators	
Number	3
Design pressure, psig	700
Design temperature, °F	300
Operating temperature, °F	90
Maximum operating pressure, psig	670
Minimum operating pressure, psig	590
Total volume, ft^3	2,500 each
Nominal water volume, ft^3	1,200
N_2 volume, ft^3	1,300
Boron concentration (as boric acid), ppm	2,700-3,000
Relief valve setpoint, psig	700
High Head Safety Injection Pumps	
Number	3
Design pressure, psig	1,750
Design temperature, °F	300
Design flow rate*, gal/min	800
Design head, ft	2,850
Max. flow rate, gal/min	1,600
Head at max. flow rate, ft	1,000
Differential head at shutoff, ft (max)	3,700
Motor rating, hp	1,000
Required NPSH at max. flow rate, ft (max)	~~16.1~~ 1.1
Available NPSH, ft (From RWST)	~~55.8~~ 41.1
(From RCB Emergency Sump)	~~> 17.8~~ 7.2
Low Head Safety Injection Pumps	
Number	3
Design pressure, psig	495
Design temperature, °F	300
Design flow rate, gal/min	1,900
Design head, ft	560
Max. flow rate, gal/min	2,900
Head at max. flow rate, ft	400
Differential head at shutoff, ft	700
Motor rating, hp	400
Required NPSH, ft (max)	~~16.5~~ 1.5
Available NPSH, ft (From RWST)	~~55.1~~ 40.8
(From RCB Emergency Sump)	~~> 18.0~~ 7.3

* Includes miniflow

NOTE:
-The Available NPSH from RCB excludes any debris head loss and any strainer head loss.

-NPSH values are based upon a reference elevation of the center line of the pump suction nozzle rather than the first stage impeller.

UFSAR NPSH Description Change
For Information Only

STPEGS UFSAR

TABLE 6.2.2-4

CSS PUMP NPSH PARAMETERS

Required NPSH at Max Flow Rate, ft (max)	~~16.4~~ 1.4
Available NPSH, ft (from RWST)	~~56.1~~ 41.4
(From RCB Emergency Sump)	~~>17.6~~ 7.0

NOTE:

The Available NPSH from RCB excludes any debris head loss and any strainer head loss.

NPSH values are based upon a reference elevation of the center line of the pump suction nozzle rather than the first stage impeller.

UFSAR NPSH Description Change
For Information Only

Question 211.37

Provide a discussion of NPSH requirements for the safety injection pumps. Include in this discussion NPSH as required by pump warranty, estimated variability between pumps, and testing inaccuracies. Also provide the assumptions and calculations used to establish available NPSH.

Response

Discussion of the NPSH requirements is given in Section 6.3.2.2, with the values of both required and available NPSH stated in Table 6.3-1.

NOTE: UFSAR change for Appendix 6A shown below consists entirely of new content, therefore gray highlight is not used.

APPENDIX 6A

Resolution of NRC Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," Including Application of a Risk-Informed Approach to Potential Impact Of Debris Blockage on Emergency Recirculation During Design Basis Accidents

1.0 Introduction and Summary

NRC Generic Letter 2004-02 (GL 2004-02) required licensees to perform an evaluation of the ECCS and CSS recirculation functions, and the flowpaths necessary to support those functions, based on the potential susceptibility of sump screens to debris blockage during design basis accidents requiring recirculation operation of ECCS or CSS. This Generic Letter resulted from the Generic Safety Issue (GSI) 191, "Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance." As a result of the evaluation required by GL 2004-02 and to ensure system function, sump design modifications were implemented (refer to Section 6.2.2.2.3).

The plant licensing basis considers long-term core cooling following a LOCA as identified in 10CFR50.46. Long-term cooling is supported by the ECCS, which includes the Containment Spray (CS), the High Head Safety Injection (HHSI), the Low Head Safety Injection (LHSI), and the Residual Heat Removal (RHR) systems. Of these systems, only the CS, HHSI and LHSI are subject to the effects of LOCA debris because they rely on the containment emergency sumps in the recirculation mode. Debris from non-LOCA events (steam line breaks) is not in the scope of the STP GL2004-02 evaluation because those events do not result in ECCS or CS operation in the recirculation mode where debris would become a factor.

STP GL 2004-02 deterministic sump performance evaluation activities, documented in References 6A-1 and 6A-2, included the following:

- Containment walkdowns to identify and quantify sources of debris
- Debris generation and transport analysis
- Calculation of required and available net positive suction head (NPSH) for Emergency Core Cooling and Containment Spray pumps
- ECCS Sump Strainer requirements
- ECCS Sump Strainer structural analyses
- Operations procedures
- Debris effects downstream of the strainers and sumps, including effect on core flow
- Debris effects upstream of the strainers and sumps
- Chemical effects associated with debris
- Plant-specific testing

The deterministic evaluation above does not fully address the full spectrum of LOCAs; therefore, a risk-informed evaluation was implemented to respond to complete the response to GL2004-02 to address the scope of LOCAs not fully addressed in the deterministic evaluation. The evaluation provides high confidence that the sump design supports long-term core cooling following a design basis loss of coolant accident. The evaluation meets the acceptance guidelines for a very small change as defined in Regulatory Guide 1.174 (Reference 6A-3).

Acceptable sump design, based on meeting the acceptance guidelines in RG 1.174, demonstrates high probability of successful ECCS and CSS operation in recirculation mode following postulated LOCAs, with consideration of debris effects on the strainers and sumps, and debris effects on flow through the reactor core. This result provides closure for GL2004-02 for STP Units 1 & 2.

The use of a risk-informed method, rather than the deterministic methods prescribed in the regulations required exemptions to 10CFR50.46(d), GDC 35, GDC 38, and GDC 41, which have been granted pursuant to 10CFR50.12.

The detailed description of the STP GL2004-02 closure evaluation is provided in the sections below.

1.1 Deterministic Element

The deterministic element applies STP plant-specific testing performed using accepted guidance to establish an analyzed amount of LOCA debris.

1.1.1 *Deterministic element still in preparation and will summarize the description in the content guide*

1.2 Risk Informed Element – RoverD Summary

The STP piloted risk-informed approach to closing GL2004-02 includes a deterministic element and a risk-informed element (risk over deterministic, or RoverD). The effects of debris that is bounded by the plant-specific testing are deterministically mitigated in accordance with NRC-accepted methodology for resolution of GL 2004-02. Section 1.1 above describes the deterministic evaluation.

The risk-informed element then identifies LOCA break sizes that could exceed the deterministically tested amount of fine fibrous debris. Breaks that can generate and transport fine fibrous debris in excess of the tested amount are conservatively assumed to fail; i.e., go to core damage. The break frequency for the smallest break size (i.e., most likely break) that can generate and transport an amount of fine fibrous debris that exceeds the amount that was tested establishes the upper limit for the ΔCDF in the risk-informed evaluation. STP uses the geometric mean pipe break frequency from NUREG 1829 to determine the ΔCDF and compare it to the CDF in the current STP PRA to determine.

The risk-informed element also evaluates the in-vessel effects to confirm that there are no failures from in-vessel effects for the scope of LOCAs that are satisfactorily addressed in the deterministic element.

1.2.1 RoverD risk quantification process summary

RoverD involves the following steps to assess the risk associated with the effects of LOCA debris:

1. Perform a plant-specific test that has some margin to failure following accepted protocols (deterministic element of RoverD)

   - Note the amount of fine tested (in this case, 191.78 lbm) as well as the configuration (in this case, two ECCS trains). The plant configuration is important to ensure whether the test bounds other plant states. Fine fiber is used because it is the transportable form of the low-density fiberglass (LDFG) debris created in the break scenario
   - Note that the test results must be applied to strainer performance criteria to ensure they are met using deterministic analysis requirements (e.g., vortexing, structural margin, flashing, etc.)

2. In-vessel performance criteria (core cooling, including fiber effects, boric acid precipitation) must be met under the conditions tested

   - A thermal-hydraulic analysis is performed for hot leg breaks to evaluate peak clad temperature with the core bypass completely blocked at the time ECCS recirculation is initiated.
   - For cold leg breaks, a mass balance is performed to assure that debris accumulation in the core is less than 15g/fuel assembly for all deterministic scenarios.
   - For boric acid precipitation, the evaluation shows that hot leg switchover timing is appropriate with debris effects considered.

3. Itemize all break locations, break sizes, and amount of LDFG fines in the sump (including erosion and latent fiber)

4. Compare the amount of fiber fines in each break scenario to the tested amount

   - If the amount is equal to or less than the tested amount, categorize the scenario 'deterministic'.
   - If the amount exceeds the tested amount, categorize the scenario 'risk- informed'

5. Evaluate the risk contribution (including in-vessel) of scenarios in the risk-informed category against the Regulatory Guide 1.174 quantitative criteria for {CDF, ΔCDF}, {LERF, ΔLERF}

   - Assign change in core damage frequency to the geometric mean frequency from NUREG 1829 for the smallest size break that can generate and transport fine fibrous debris in excess of what was tested.
   - Check {CDF,ΔCDF} against the quantitative requirement of Regulatory Guide 1.174, Region III

- Check {LERF,ΔLERF} against the quantitative requirement of Regulatory Guide 1.174, Region III
- Verify other requirements (for example, safety margin, defense in depth) of Regulatory Guide 1.174 are met

6. If all requirements are met for the risk-informed category, the performance is acceptable

1.2.2 Reactor containment building debris generation and transport

Debris Generation

A break size and location define a scenario from which is derived the amount of fibrous fines that arrive in the ECCS sumps. STP applied the CASA Grande computer code to facilitate the calculation of amount of fine fibrous material that could be generated and transported by a given LOCA break size. CASA Grande took input from the detailed STP CAD model that mapped locations of plant equipment and structures and potential target fibrous insulation. Casa Grande used a 17D ZOI at RCS weld locations to identify the smallest equivalent break size at each location that could generate more debris than what was in the plant-specific testing; i.e., more than 191.78 lbm. Each scenario specific break is numerically represented by either a spherical ZOI for double-ended guillotine breaks (DEGB) or by a hemispherical ZOI for partial breaks. The computer evaluation varied the orientation of the break location around the circumference of the weld locations to assure that the maximum debris generation was attained. Credit was taken for shielding by concrete walls.

Debris Transport

Once the amounts and distributions of fiber types are known, a transport logic tree, is used to arrive at the amount of fiber distributed to various areas of the RCB. Only fiber fines generated from the break are analyzed this way, the other two sources of fiber fines, latent fiber and eroded fiber, are transported directly to the sump. The transport fractions are representative of a break in the Steam Generator compartment, which bound transport fractions that would represent other possible break locations in the RCB.

Fiber fines from the ZOI: The majority of fiber fines (98.5%) destroyed from insulation in the ZOI are transported to the containment pool. The other 1.5% of debris not transported to the RCB sump is trapped in inactive cavities during pool fill. The transport modes and their contributing fractions to the RCB sump for ZOI-generated fiber fines are described below.

Blowdown**:** Fiber fines were initially calculated to be blown to upper and lower containment at 30% and 70%, respectively. The percentages blown to upper and lower containment were calculated as volume fractions taken as ratios of the open containment volume in upper containment and lower containment compared to the total open containment volume. This proportion of fibrous fines transport was assumed to be reasonable because fine debris generated by the LOCA jet would be easily entrained and carried with blow down flow.

Wash Down: All (100%) of the fiber fines blown to upper containment is washed down and homogenized in the containment pool. Note that wash down fractions from upper containment were split between the "Inside Secondary Shield Wall" and "Annulus" compartments; because both of these compartments are at the pool level, and because fine debris was assumed homogenized, these fractions are inconsequential except for their combined total which is 100%.

Pool Fill: 5% of the fiber fines transported to lower containment during blow down is trapped in inactive cavities. This pool fill transport fraction of 5% is less than the NEI SER suggested maximum inactive cavity pool fill transport fraction of 15%. Although 6% of the debris blown to lower containment was calculated to arrive on strainers early as a function of initial sheeting flow, this only affects debris arrival timing in a full CASA Grande calculation and does not affect the total fraction that can reach the strainers. The ROVERD methodology depends only on the amount of fine fiber introduced to the containment pool.

Recirculation: All fibrous fines were assigned a conservative recirculation transport fraction of 100%. CFD calculations were not used to predict the amount of fines that may settle on the pool floor. One hundred percent transportability exceeds the fine fiber introduced to the containment pool for each analyzed break scenario and the amount of fine fiber introduced by in the deterministic flume test. Credit for realistic settling is an inherent part of the test conditions.

Eroded fines: Three types of erosion were considered for small and large pieces of fibrous debris held up on containment structures:

1. CSS spray flow
2. Break flow
3. Pool recirculation

The percentage of small and large fibrous insulation pieces eroded into fines as a result of CSS flow is assigned the maximum value of 1% as found by Rao et al. (1998). The percentage of small and large pieces eroded into fines by break flow is negligible in the STP RCB since debris is blown away from the break location. Based on Alion Science & Technology (2011) testing that shows a maximum of 7% of small and large fibrous insulation pieces erode to fiber fines in 30 days of testing fibrous erosion by recirculation flow, 7% are eroded to fines. Total fractions of small and large fibrous debris held up on containment structures, their corresponding erosion fractions and resulting total fiber fines transport fractions homogenized in the containment pool have been provided in the table below.

Erosion modes and erosion percentages summary of smalls and large pieces eroded to fines.

Insulation Size	Erosion Mode	Held Up Fraction	Erosion Fraction	Total Fines from Pieces
Small Pieces	Spray	36.5%	1.0%	0.4%
	Recirculation	23.8%	7.0%	1.7%
Large Pieces	Sprayed	100.0%	1.0%	1.0%
	Recirculation	0.0%	7.0%	0.0%

Fiber collection in the ECCS for assessment of in-vessel effects

For cold-leg breaks, a mass balance is performed for the LDFG that includes the ECCS and CSS flow to the RCS, the pool, and the strainer. The core is modeled as the final "sink" for the LDFG mass. If the mass is less than 15 grams of fibrous fines per fuel assembly, the evaluation is considered to be a success. STP's evaluation of both the deterministic and risk-informed scope of breaks identified no cold-leg breaks that resulted in more than 15g/fuel assembly.

1.2.3 LOCA frequencies and results

Determination of Core Damage Frequency

Forty-five (45) weld locations were identified on the pressurizer surge line and RCS main loop piping where a sufficient amount of fibrous debris can be generated and transported to the sump to exceed the amount of fine fibrous debris in the STP plant-specific testing described in Section 1.1. To provide break size perspective, that scope is generally described as breaks larger than approximately 12.8" ID in those locations.

STP has two Cases (Case 1 and Case 2) other than the condition tested that are bounding for fine fiber amounts. The tested deterministic case assumed two of the three STP ECCS strainers in operation (single failure criterion). Case 1 is the most likely case when all three strainers are in operation. In this case, far less fiber will accumulate on each strainer than for the tested case. Therefore, Case 1 is bounded by the tested case.

However, Case 2 corresponds to a case where only one train of the three STP ECCS strainers are in operation. Although this case is beyond design basis, it needs to be considered in the risk analysis since at least twice as much fiber would accumulate on the single strainer than when two or more strainers are in operation. In this case, only 1/2 the tested amount of fine fiber can be assumed to be tolerated.

When all cases are considered, a slightly higher ΔCDF is estimated than when only one strainer is in operation.

The break frequency is obtained from a linear-linear interpolation of the geometric mean break frequencies in NUREG 1829 using a weighted average of the sizes of smallest debris generation exceedance break in each of the 45 locations. The weighting factor is determined by the number and category of welds associated with the break size.

Table 1.2.3 - 1: Data for weld locations in the risk-informed category listing the *i t h weld* number, mass of fiber in the sump for the scenario (lbm), location name (ID), Break size (Size), scenario frequency, f *i* (mean quantile, geometric aggregation), Category, and NUREG 1829 data category

No.	Amount (lbm)	Location	Size (in)	*f i*	NUREG 1829 Cat.
1	207.16	16-RC-1412-NSS-8	12.814	4.37E-07	Cat. 4
2	191.78	29-RC-1101-NSS-RSG-1A-IN-SE	13.922	2.16E-07	Cat. 4
3	191.95	29-RC-1101-NSS-5.1	13.939	2.12E-07	Cat. 4
4	192.23	29-RC-1201-NSS-5.1	14.120	1.99E-07	Cat. 5
5	192.60	29-RC-1201-RSG-1B-IN-SE	14.127	1.99E-07	Cat. 5
6	195.55	29-RC-1301-RSG-1C-IN-SE	14.342	1.97E-07	Cat. 5
7	196.62	29-RC-1301-NSS-5.1	14.405	1.96E-07	Cat. 5
8	196.03	29-RC-1401-NSS-RSG-1D-IN-SE	14.620	1.94E-07	Cat. 5
9	196.51	29-RC-1401-NSS-4.1	14.650	1.93E-07	Cat. 5
10	192.74	29-RC-1101-NSS-4	14.721	1.93E-07	Cat. 5
11	192.05	29-RC-1301-NSS-4	14.948	1.90E-07	Cat. 5
12	191.87	29-RC-1201-NSS-4	14.953	1.90E-07	Cat. 5
13	194.24	29-RC-1401-NSS-3	15.172	1.88E-07	Cat. 5
14	193.97	31-RC-1102-NSS-2	16.525	1.75E-07	Cat. 5
15	194.36	31-RC-1202-NSS-RSG-1B-ON-SE	16.724	1.73E-07	Cat. 5
16	195.82	31-RC-1102-NSS-RSG-1A-ON-SE	16.760	1.72E-07	Cat. 5
17	201.09	31-RC-1202-NSS-2	16.819	1.72E-07	Cat. 5
18	191.78	31-RC-1202-NSS-3	17.020	1.70E-07	Cat. 5
19	192.64	31-RC-1302-NSS-2	17.209	1.68E-07	Cat. 5
20	201.67	31-RC-1202-NSS-1.1	17.279	1.67E-07	Cat. 5
21	194.24	31-RC-1102-NSS-3	17.338	1.66E-07	Cat. 5
22	192.56	31-RC-1302-NSS-1.1	17.593	1.64E-07	Cat. 5
23	193.22	31-RC-1302-NSS-RSG-1C-ON-SE	17.659	1.63E-07	Cat. 5
24	192.46	31-RC-1202-NSS-4	17.665	1.63E-07	Cat. 5
25	193.39	31-RC-1302-NSS-3	17.674	1.63E-07	Cat. 5
26	211.20	31-RC-1102-NSS-1.1	17.793	1.62E-07	Cat. 5
27	193.53	31-RC-1402-NSS-RSG-1D-ON-SE	17.876	1.61E-07	Cat. 5
28	196.61	31-RC-1102-NSS-4	18.126	1.58E-07	Cat. 5
29	197.10	31-RC-1402-NSS-1.1	18.140	1.58E-07	Cat. 5
30	191.86	31-RC-1402-NSS-2	18.233	1.57E-07	Cat. 5
31	192.24	31-RC-1302-NSS-4	18.367	1.56E-07	Cat. 5
32	192.93	31-RC-1402-NSS-3	19.246	1.47E-07	Cat. 5

No.	Amount (lbm)	Location	Size (in)	*f i*	NUREG 1829 Cat.
33	192.77	31-RC-1202-NSS-8	19.297	1.47E-07	Cat. 5
34	191.93	27.5-RC-1103-NSS-1	19.454	1.45E-07	Cat. 5
35	192.02	31-RC-1102-NSS-8	19.547	1.44E-07	Cat. 5
36	192.16	27.5-RC-1203-NSS-1	19.584	1.44E-07	Cat. 5
37	192.23	31-RC-1402-NSS-4	20.225	1.37E-07	Cat. 5
38	192.27	31-RC-1302-NSS-8	20.367	1.36E-07	Cat. 5
39	191.80	27.5-RC-1303-NSS-1	21.007	1.30E-07	Cat. 5
40	192.07	31-RC-1202-NSS-9	21.114	1.28E-07	Cat. 5
41	192.04	31-RC-1102-NSS-9	21.255	1.27E-07	Cat. 5
42	192.16	27.5-RC-1403-NSS-1	22.068	1.19E-07	Cat. 5
43	191.94	31-RC-1402-NSS-8	22.155	1.18E-07	Cat. 5
44	191.79	31-RC-1302-NSS-9	23.040	1.09E-07	Cat. 5
45	191.96	31-RC-1402-NSS-9	25.303	8.63E-08	Cat. 5

For the continuum break model, the mean frequency is 1.22E-07/yr.
For the DEGB-only model, the mean frequency is 5.32E-08/yr.

Considering the CDF of [x.xE-05] in the current STP PRA model, applying the RG 1.174 criteria for acceptable ΔCDF places this in Region III as a very small change.

Determination of Large Early Release Frequency

[Still in progress]

1.2.4 RCS Thermal-hydraulics
1.2.5 Core performance metrics
1.3 Defense-in-Depth and Safety Margin

The risk-informed evaluation meets the RG 1.174 guidance with respect to defense in depth in that the following aspects of the facility design and operation are unaffected:

- Functional requirements and the design configuration of systems
- Existing plant barriers to the release of fission products
- Design provisions for redundancy, diversity, and independence
- Plant's response to transients or other initiating events
- Preventive and mitigative capabilities of plant design features

The STP Units 1 and 2 EOP framework has guidance for monitoring for the loss of emergency sump recirculation capabilities and actions to be taken if this condition occurs. These actions are as described in responses to Bulletin 2003-01 and GL 2004-02, and remain in effect. These actions include the following:

(1) Reducing flow through the strainer(s) by stopping pumps,
(2) Monitoring for proper pump operation, core exit thermocouples, and reactor water level indication,
(3) Refilling the RWST for injection flow,
(4) Using injection flow from alternate sources, and
(5) Transferring to combined hot leg/cold leg injection flow paths.

Thermal-hydraulic evaluation showed that there is safety margin to in-vessel debris effects. The PRA acceptance criteria for in-vessel effects are partially established by conservative sensitivity studies of small, medium, and large breaks in the cold leg and hot leg using the RELAP5 3D vessel, 1D core model following recirculation initiation. These cases assumed that not only is the core completely blocked but also, the bypass is completely blocked even though there are no major blockage opportunities in the core bypass region. Even when medium and large cold leg break scenarios are investigated with open bypass (conservatively ignoring the STP LOCA holes in the baffle walls), such cases go to success.

More realistic scenarios that used the 3D vessel, 3D core model were performed where just the flow area of one fuel assembly maintains core cooling below the failure peak clad temperature (PCT) (800°F). This small flow area would be much less than the flow area of the core baffle bypass flow area and the cases demonstrate that the PCT is insensitive to the open location.

<u>1.4 Exemptions to Regulations</u>

In support of the South Texas Project (STP) risk-informed approach to addressing GSI-191 and response to GL2004-02, STP was granted exemptions under 10CFR50.12 from certain requirements in 10CFR50.46 and 10 CFR Part 50 Appendix A General Design Criteria (GDC). The exemptions complemented a license amendment that revised the UFSAR to add this Appendix 6A and other complementary changes to describe the risk-informed methodology, and Technical Specification changes based on NRC acceptance of the risk-informed method and results.

The specific exemptions pertain to requirements for deterministic analysis of Emergency Core Cooling System (ECCS) and Containment Spray System (CSS) system functions for core cooling, and containment heat removal and atmosphere cleanup following a postulated loss of cooling accident (LOCA), and affect the following requirements:

- 10CFR50.46(d) – the governing requirement in 10CFR50.46 to establish GDC 35 as the technical design basis for ECCS analysis.
- GDC 35, Emergency Core Cooling

- GDC 38, Containment Heat Removal
- GDC 41, Containment Atmosphere Cleanup

The exemptions allow use of the risk-informed methodology described in UFSAR Appendix 6A to account for the probabilities and uncertainties associated with mitigation of the effects of debris following postulated LOCAs instead of using the deterministic analyses required by the regulation or GDC.

The scope of the exemptions applies for all debris effects addressed in the risk-informed element of the STP RoverD methodology described in Appendix 6A, which is associated with LOCA break sizes and locations that potentially generate fine fibrous debris that exceeds the quantity bounded by STP plant-specific testing described in Section 1.1 of Appendix 6A. That scope is generally described as breaks larger than approximately 12.8" ID in locations where a sufficient amount of fibrous debris can be generated and transported to the sump to exceed the amount of fine fibrous debris in the STP plant-specific testing described in Section 1.1. Forty-five (45) weld locations have currently been identified on the pressurizer surge line and RCS main loop piping. To minimize the potential that a later analysis could cause the specific locations to change, the requested exemptions are based on the breaks' ability to generate sufficient transportable debris, as described in RoverD.

The key elements of each of the exemption requests are:

1. It applies only to the effects of debris as described in UFSAR Appendix 6A.
2. It applies only for LOCA breaks that can generate and transport fibrous debris that is not bounded by STP plant-specific testing.
3. It applies to any LOCA break that can generate and transport fibrous debris that is not bounded by STP plant-specific testing and is not limited to the 45 specific break locations noted in this application, provided that the ΔCDF associated with the break size remains in Region III of RG 1.174.

UFSAR Sections 3.1.2.4.6.1, 3.1.2.4.9.1 and 3.1.2.4.12.1 provide additional information on STP's compliance with GDC 35, 38, and 41, respectively.

1.5 Technical Specifications

STP revised the TS for ECCS and for CSS to add a LCO and action statement specific to debris effects. The operability requirement for the LCO is based on the quantity of debris in the STP debris analysis and would involve evaluation of the quantity, nature and transportability of the debris in question to determine if it is within the STP debris analysis. Operability determinations do not involve application of probabilistic risk. The required completion time is based on the very low risk from the effects of debris, as demonstrated in the RoverD evaluation.

Additional information is provided in the Technical Specification Bases for the ECCS and CSS.

REFERENCES