



South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

November 13, 2013  
NOC-AE-13003043  
10 CFR 50.12  
10 CFR 50.90

U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, DC 20555-0001

South Texas Project  
Units 1 and 2  
Docket Nos. STN 50-498 and STN 50-499  
Supplement 1 to Revised STP Pilot Submittal and  
Requests for Exemptions and License Amendment for a  
Risk-Informed Approach to Resolving Generic Safety Issue (GSI)-191  
(TAC NOS. MF0613, MF0614, MF2400, MF2401, MF2402, MF2403, MF2404, MF2405,  
MF2406, MF2407, MF2408, AND MF2409)

References:

1. Letter, John W. Crenshaw, STPNOC to NRC Document Control Desk, "STP Pilot Submittal and Request for Exemption for a Risk-Informed Approach to Resolve Generic Safety Issue (GSI)-191," January 31, 2013, NOC-AE-13002954 (ML13043A013)
2. Letter, Balwant K. Singal, NRC, Dennis L. Koehl, STPNOC, "South Texas Project, Units 1 and 2 – Supplemental Information Needed for Acceptance of Requested Licensing Action Re: Request for Exemption for a Risk-Informed Approach to Resolve Generic Safety Issue 191 (TAC Nos. MF0613 and MF0614)," April 1, 2013, AE-NOC-13002417 (ML13066A519)
3. Letter, D. W. Rencurrel, STPNOC, to NRC Document Control Desk, "Revised STP Pilot Submittal and Requests for Exemptions and License Amendment for a Risk-Informed Approach to Resolving Generic Safety Issue (GSI)-191," June 19, 2013, NOC-AE-13002986 (ML131750250)
4. Letter, Balwant Singal, NRC, to Dennis Koehl, STPNOC, "South Texas Project, Units 1 and 2 - Acceptance of Requests for Exemptions and License Amendment Request for Approval of a Risk-Informed Approach to Resolve Generic Safety Issue GSI-191," August 13, 2013, AE-NOC-1300245 (ML13214A031)
5. Letter, D. W. Rencurrel, STPNOC, to NRC Document Control Desk, "Corrections to Information Provided in Revised STP Pilot Submittal and Requests for Exemptions and License Amendment for a Risk-Informed Approach to Resolving Generic Safety Issue (GSI)-191," October 3, 2013, NOC-AE-13003039 (ML13295A222)

This submittal supplements the Reference 3 licensing application to incorporate revisions resulting from the review described in Reference 5.

A002  
MPK

STI 33766981

In Reference 3 and again in this supplement, STP Nuclear Operating Company (STPNOC) requests exemptions from certain requirements of 10 CFR 50.46(b)(5), "Long-term cooling", and Appendix A to 10 CFR Part 50 General Design Criteria (GDC) 35, "Emergency Core Cooling", GDC 38, "Containment Heat Removal", and GDC 41, "Containment Atmosphere Cleanup" and requests an amendment to South Texas Project (STP) Operating Licenses NPF-76 and NPF-80, to revise the STP Units 1 and 2 licensing basis.

In Reference 4, the NRC staff accepted Reference 3 for review.

In Reference 5, STPNOC identified errors in Reference 3, described actions that STPNOC was taking to address the errors, and committed to supplement Reference 3 with corrected information. This submittal is that supplement. STPNOC identified no errors in Reference 3 other than those addressed in this submittal.

The corrections and associated changes that affect the sections of Reference 3 are identified in the affected sections and listed in Enclosure 6. For ease of review, all the sections submitted in Reference 3 are included and the supplement may be used as a "stand alone" document.

The corrections do not affect the conclusions or the regulatory assessment proposed in Reference 3. The revisions in this supplement result in an increase to the change in core damage frequency (CDF) and large early release frequency (LERF) from 1.09E-08/yr to 2.88E-08/yr and from 8.6E-12/yr to 1.40E-11/yr, respectively. The changes in CDF and LERF remain very small and within Region III of Regulatory Guide 1.174.

#### Description of Submittal Content:

The requested licensing actions are for approval of a risk-informed approach for resolving GSI-191 for STP Units 1 and 2 as the pilot plants for other licensees pursuing a similar approach. The results of the reviews will also support closure of Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors," for STP Units 1 and 2.

STPNOC seeks NRC approval based on a determination that the STP risk-informed approach and the risk associated with the postulated failure mechanisms due to GSI-191 concerns meets the guidance, key principles for risk-informed decision-making, and the acceptance guidelines in RG 1.174.

The STP piloted risk-informed approach to resolving GSI-191 applies the STP Probabilistic Risk Assessment (PRA) model to quantify the risk associated with GSI-191 concerns by calculating the difference in risk for two cases:

- The actual plant configuration for STP Units 1 and 2, with failures due to GSI-191 concerns, and
- The same plant configuration for STP Units 1 and 2, except for the assumption that there are no failures due to GSI-191 concerns.

The risk associated with GSI-191 concerns includes 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, following loss of coolant accidents (LOCAs). 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. To inform the PRA with risk insights, the physical processes are modeled as realistically as possible, using results from industry and plant-specific testing, and applying conservatism, where appropriate. The changes to CDF and LERF associated with GSI-191 concerns are then compared to RG 1.174 acceptance guidelines.

Enclosure 1 provides the generic methodology for the proposed risk-informed approach to resolving GSI-191, consistent with RG 1.174 guidance. This enclosure describes the required inputs to the PRA model, the basic structure for appropriately modeling the inputs, and performance criteria used to calculate the risk.

Enclosure 2 provides an introduction and background to the proposed exemptions from certain regulatory requirements in accordance with the provisions of § 50.12. The requests for exemptions address regulatory requirements that concern the ECCS and CSS functions for emergency core cooling, containment heat removal, and containment atmosphere cleanup following postulated LOCAs:

- Enclosure 2-1, 10 CFR 50.46(b)(5), *Long-term cooling*
- Enclosure 2-2, GDC 35 – *Emergency core cooling*
- Enclosure 2-3, GDC 38 – *Containment heat removal*
- Enclosure 2-4, GDC 41 – *Containment atmosphere cleanup*

Approval for the requests for exemptions is based on a risk-informed approach demonstrating that the calculated risk associated with GSI-191 concerns for STP Units 1 and 2 is far less than the threshold for Region III, "Very Small Changes," of RG 1.174 acceptance guidelines.

Enclosure 3 provides the License Amendment Request, pursuant to 10 CFR 50.90, for approval of the proposed changes to the STP Units 1 and 2 licensing basis including page markups for the Updated Final Safety Analysis Report (UFSAR). The LAR is contingent upon approval of the requested exemptions. The LAR includes technical and regulatory evaluations for the proposed change, a no significant hazards consideration determination pursuant to § 50.92, and an environmental considerations review. The Plant Operations Review Committee has approved the proposed change. In accordance with 10 CFR 50.91(b), STPNOC has notified the State of Texas by transmitting a copy of this letter and enclosure to the State of Texas Official. Changes to the STP UFSAR are to be implemented pursuant to NRC approval of LAR.

Enclosure 4 provides an introduction and overview of the supporting documentation. Enclosures 4-1, 4-2 and 4-3 support the application by providing summary level and detailed descriptions of the supporting engineering analysis and PRA information. Enclosure 4-1 follows the structure, content and documentation requirements of RG 1.174, and provides references to other supporting documentation. Enclosure 4-1 also provides the details of how the STP piloted approach meets the guidance and conforms to the risk-informed principles in RG 1.174.

Enclosure 5 (renamed from "Attachment" in Reference 3) provides information and references responsive to each item identified in Reference 2. In Reference 2, the NRC notified STPNOC that the initial GSI-191 pilot submittal (Reference 1) did not provide technical information in sufficient detail, and did not provide adequate discussion of or justification for the requested exemptions. Reference 3 and this supplement replace Reference 1 in its entirety.

As noted above, Enclosure 6 identifies the changes to Reference 3.

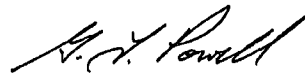
To support the completion of work and resolution schedule for closure of GSI-191, STPNOC requests approval of the proposed exemption requests and license amendment request by June 2015.

Upon approval of the requested licensing actions, changes to the STP UFSAR will be made as shown in Attachment 2 to Enclosure 3. The licensing commitment for updating the UFSAR is provided as Attachment 1 to Enclosure 3. A 90-day implementation period is requested to provide time to revise the applicable STP licensing documents. There are no other commitments in this letter.

If there are questions regarding this submittal, please contact Ken Taplett at 361-972-8416, or me at 361-972-7566.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 11-13-2013



G. T. Powell  
Site Vice President

awh

Enclosures:

1. STP Piloted Risk-Informed Approach to Closure for GSI-191
2. Requests for Exemptions for STP Piloted Risk-Informed Approach to Closure for GSI-191
  - 2-1 Request for Exemption from 10 CFR 50.46(b)(5)
  - 2-2 Request for Exemption from General Design Criterion 35
  - 2-3 Request for Exemption from General Design Criterion 38
  - 2-4 Request for Exemption from General Design Criterion 41
3. License Amendment Request for STP Piloted Risk-Informed Approach to Closure for GSI-191
  - Attachment 1: List of Commitments
  - Attachment 2: STPEGS UFSAR Page Markups
  - Attachment 3: Technical Specifications Bases Page Markups (Information Only)
4. Risk-Informed Closure of GSI-191 Supporting Engineering Analysis and PRA – Introduction and Overview
  - 4-1 Risk-Informed Closure of GSI-191, Volume 1, Project Summary
  - 4-2 Risk-Informed Closure of GSI-191, Volume 2, Probabilistic Risk Analysis
  - 4-3 Risk-Informed Closure of GSI-191, Volume 3, Engineering (CASA Grande) Analysis
5. Response to NRC Supplemental Information Items
6. Changes to June 19, 2013 Submittal

cc: w/o enclosures except\*

(paper copy)

Regional Administrator, Region IV  
U. S. Nuclear Regulatory Commission  
1600 East Lamar Boulevard  
Arlington, TX 76011-4511

\*Balwant K. Singal  
Senior Project Manager  
U.S. Nuclear Regulatory Commission  
One White Flint North (MS 8 B1)  
11555 Rockville Pike  
Rockville, MD 20852

NRC Resident Inspector  
U. S. Nuclear Regulatory Commission  
P. O. Box 289, Mail Code: MN116  
Wadsworth, TX 77483

Jim Collins  
City of Austin  
Electric Utility Department  
721 Barton Springs Road  
Austin, TX 78704

(electronic copy)

Steven P. Frantz, Esquire  
\*A. H. Gutterman, Esquire  
Morgan, Lewis & Bockius LLP

Balwant K. Singal  
Michael Markley  
John Stang  
U. S. Nuclear Regulatory Commission

John Ragan  
Chris O'Hara  
Jim von Suskil  
NRG South Texas LP

Kevin Pollo  
Richard Peña  
City Public Service

Peter Nemeth  
Crain Caton & James, P.C.

C. Mele  
City of Austin

Richard A. Ratliff  
Robert Free  
Texas Department of State Health Services

## ENCLOSURE 1

STP Piloted Risk-Informed Approach to  
Closure for GSI-191

## **STP Piloted Risk-Informed Approach to Closure for GSI-191**

### **I. Introduction**

This enclosure provides a generic methodology for licensees planning to use a risk-informed approach to resolving Generic Safety Issue (GSI)-191, as discussed in SECY Paper, "Closure Options for Generic Safety Issue - 191, Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance" (Reference 1). The South Texas Project (STP) risk-informed approach is intended to be applied to STP Units 1 and 2 as pilot plants.

The risk-informed approach is consistent with the guidance in Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis" (Reference 2). The risk associated with GSI-191, which includes the modeling of the containment sumps and sump strainers, is determined using a plant-specific, Probabilistic Risk Assessment (PRA) model, and the results are compared to the acceptance guidelines in RG 1.174. Based on meeting the acceptance guidelines, the sump design is determined to be acceptable, thereby reconstituting the licensing basis for the supported Emergency Core Cooling System (ECCS) and Containment Spray System (CSS).

The generic methodology for the STP risk-informed approach, consisting of the required inputs to the plant-specific PRA, the basic structure for modeling the inputs, and the performance criteria used, are described below.

Implementation for STP Units 1 and 2 is documented in Enclosure 4-1, "Volume 1 Project Summary," Enclosure 4-2, "Volume 2 Probabilistic Risk Analysis," and Enclosure 4-3, "Volume 3 Engineering (CASA Grande) Analysis," to this letter. These enclosures provide more detailed descriptions and explanations for the approach.

### **Background**

GSI-191 concluded that debris generated during a postulated loss of coolant accident (LOCA) could clog the containment sump strainers in pressurized-water reactors (PWRs), leading to the loss of net positive suction head (NPSH) for the ECCS and CSS pumps. The NRC issued Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors" requesting that licensees address the issues raised by GSI-191. GL 2004-02 was focused on demonstrating compliance with ECCS acceptance criterion 10 CFR 50.46 (b)(5) for long term cooling.

In response, the industry completed plant modifications, such as installing larger sump strainers and replacing fibrous insulation inside containment, and implemented other compensatory measures to reduce the risk of strainer clogging and to mitigate strainer blockage and inadequate core cooling. Sump designs have been previously evaluated, using deterministic methods, to meet the current licensing basis for debris blockage and related effects, complying with the applicable regulatory requirements. Considerable effort has also been made to reduce the uncertainties and conservatism in the standard

models used to evaluate GSI-191 concerns. However, the complexity of the debris effects has challenged the ability to use these methods to fully resolve GSI-191.

### Summary of the STP Risk-Informed Approach

The STP risk-informed approach to resolving GSI-191 uses the plant-specific PRA with realistic modeling to quantify the residual risk associated with GSI-191 and to evaluate for acceptable sump design in support of successful ECCS and CSS operation in recirculation mode following postulated LOCAs with the debris effects discussed in GSI-191. The residual risk associated with GSI-191 for the as-built, as-operated plant represents those issues not previously resolved using the deterministic methods. The approach follows the guidance and meets the key principles of RG 1.174.

A full spectrum of postulated break sizes is analyzed, including double-ended guillotine breaks (DEGBs) for all pipe sizes up to and including the largest in containment. The required inputs to the PRA, the basic structure for modeling the inputs, and performance criteria used to calculate the risk are described. The physical processes are modeled as realistically as possible, using results from industry and plant-specific testing, and applying conservatism, where appropriate. Debris accumulation effects on the containment sumps and core flow are evaluated.

Acceptable sump design in support of long term cooling is based on a high probability that net positive suction head for the pumps is maintained, and that other limits for acceptable sump performance are not exceeded. High probability is confirmed by showing that the residual risk associated with GSI-191 concerns meets the RG 1.174 acceptance guidelines for changes in Core Damage Frequency (CDF) and Large Early Release Frequency (LERF).

This risk-informed approach is expected to be applicable to plants with substantial fibrous insulation, and also may be beneficial to plants with low to medium fibrous insulation. Risk-informed insights into the plant design may also be used to assess and prioritize plant modifications, if required.

## **II. Methodology**

### Define the Proposed Change

The proposed change is to use the risk-informed method, rather than deterministic methods, to evaluate for acceptable sump design based on a quantification of the residual risk associated with GSI-191, and to revise the plant's Updated Final Safety Analysis Report (UFSAR) as appropriate to describe the method and its results. The sump design is required to support ECCS and CSS system functions following postulated LOCAs, including long term cooling, containment heat removal, and containment atmosphere cleanup.

Approval for the proposed change is based on implementation of a risk-informed approach that meets the key principles of RG 1.174, and a determination that the residual risk associated with GSI-191 meets the acceptance guidelines of RG 1.174. If the acceptance guidelines are not met, insights obtained from the model may be used



incrementally to target modifications to the facility that would further reduce risk in order to achieve acceptable results.

The plant licensing basis considers the requirement for ECCS to meet the long term cooling criterion 10 CFR 50.46(b)(5) and requires ECCS to operate with high level of confidence following a postulated LOCA. A determination of acceptable sump design, using the risk-informed method, thereby reconstitutes the long term cooling licensing basis. Acceptable sump design also supports the licensing basis for meeting the Generic Design Criteria (GDC) applicable to ECCS and CSS system design requirements following postulated LOCAs.

#### PRA Model Assessments and Supporting Engineering Analysis

The required inputs to the PRA model and the method for assessing the risk associated with GSI-191 using the PRA model are shown in Table 1 and Table 2 below.

The risk-informed method uses an integrative approach to explicitly provide the probabilities for post-LOCA events. This is accomplished by modeling the underlying physical phenomena of the basic events and by propagating uncertainties in the physical models. These inputs are used to risk-inform the plant-specific PRA model utilized to assess the risk associated with GSI-191.

To apply the inputs, the demand recirculation failure probability in the plant-specific PRA model is replaced with basic events (strainer failures, core flow blockage with chemical effects, and boron precipitation in the core) as shown in Table 2. Failure modes leading to core damage are explicitly modeled, excluding those that were previously addressed for the plant using deterministic evaluations. The inputs to the model include a full spectrum of pipe breaks, up to and including the design basis accident (DBA) LOCA.

Failure probabilities and associated uncertainties determined in the supporting engineering analysis provide inputs to the three new top events added to the PRA to accommodate composite GSI-191 failure processes (sump strainer failure, core flow blockage, and boron precipitation in the core). The outcome of a full spectrum of LOCA events is tested against appropriate performance thresholds for the top events (Table 2).

The plant-specific PRA model, informed with the risk-insights associated with GSI-191 failure modes, as described in Table 2, is then used to assess the difference in risk for two cases:

- Case 1: the actual plant configuration, risk-informed to model the failure mechanisms associated with the concerns raised by GSI-191, and
- Case 2: a hypothetical plant assuming no failure mechanisms associated with the concerns raised by GSI-191, otherwise identical to the actual plant.

The PRA model is required to be RG 1.200 compliant for assessing the risk of internal events associated with GSI-191.

### **III. Results and Conclusions**

The risk-informed method uses the plant-specific PRA model to assess and quantify the residual risk associated with GSI-191 concerns. This approach is used to evaluate the design of the containment sump in support of ECCS and CSS recirculation modes following postulated LOCAs.

A determination that the risk results meet the acceptance guidelines in RG 1.174 confirms acceptable sump design and provides justification for allowing fibrous insulation to remain in containment. The results provide a basis for NRC approval of the proposed change in order to reconstitute the licensing basis for long term cooling, demonstrate that the Commission's safety goals for maintaining public health and safety continue to be met, and provide closure for GSI-191.

### **IV. References**

- 1) Commission SECY Paper, "Closure Options for Generic Safety Issue - 191, Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance," July 9, 2012, SECY-12-0093 (ML121320270)
- 2) Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 2 (ML100910006).
- 3) NEI 04-07, "Pressurized Water Reactor Sump Performance Evaluation Methodology," Volume 1 "Pressurized Water Reactor Sump Performance Evaluation Methodology," Revision 0, dated December 2004 (ML050550138)
- 4) NEI 04-07, "Pressurized Water Reactor Sump Performance Evaluation Methodology," Volume 2 "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to NRC Generic Letter 2004-02, Revision 0, December 6, 2004," Revision 0, dated December 2004 (ML050550156)
- 5) Regulatory Guide 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities"

### **V. List of Tables**

Table 1: Generic Methodology for Determining Risk Associated with GSI-191 Concerns

Table 2: Modeling Basic Events, Failure Modes, and Top Events with Performance Thresholds

Table 1: Generic Methodology for Determining Risk Associated with GSI-191 Concerns

**Case 1**

In summary, use the plant-specific probabilistic risk assessment (PRA) model to assess the risk associated with GSI-191 concerns for the as-built, as-operated plant, based on realistic assessments to the extent practical. Modeling of basic events, failure modes, and new top events to accommodate composite GSI-191 failure processes with appropriate performance thresholds is described in Table 2.

- The inputs to the risk model encompass the concerns raised in GSI-191, including the major topical areas discussed in NEI 04-07 (Reference 3), as appropriate:
  - pipe break characterization
  - debris generation/zone of influence (ZOI), including latent debris
  - debris transport
  - chemical effects
  - strainer head loss, including structural margin
  - air intrusion
  - debris penetration
  - ex-vessel downstream effects
  - in-vessel downstream effects
  - boron precipitation
- For each input to the risk model, any differences between the methods to be used in the model and NRC-approved methods (refer to Reference 4 for an example) are defined.
- For each input to the risk model, an uncertainty quantification process is used to add detail (basic events, refer to Table 2) to the PRA model for the LOCA initiating sequences. Examples of appropriate sources of information include, but are not limited to:
  - applicable risk assessments
  - results obtained from generic industry and/or plant-specific testing
  - expert elicitation
  - assumptions, realistic or conservative
  - qualitative insights based on engineering judgment
- For each input to the risk model, interdependencies between the inputs to the model are considered and appropriately described in the risk model.
- The risk is determined using a plant-specific PRA that meets the necessary requirements identified in RG 1.200 (Reference 5), including the capability to model a full spectrum of LOCA events, and the capability for Level 1 and Level 2 risk assessments, including internal and external events.

**Case 2**

Evaluate the risk assuming no long term cooling failure contributors associated with GSI-191 concerns, and assuming no additional failures. Other than the basic events details associated with GSI-191 concerns, the Case 2 assessment model is identical to model used for Case 1.

**Calculate the risk associated with GSI-191 concerns**

The risk associated with GSI-191 concerns is the difference in risk between Cases 1 and 2, for comparison with the acceptance guidelines in RG 1.174.

Table 2: Modeling Basic Events, Failure Modes, and Top Events with Performance Thresholds

Using the inputs noted below, applied within the framework described in Table 1, the PRA uses risk insights to address the risk associated with failure modes resulting from GSI-191 concerns.

### Basic Events

In the plant-specific PRA model, the demand recirculation failure probability is replaced with the following:

- Pressure drop due to debris build-up on the sump strainers with chemical effects resulting in loss of net positive suction head (NPSH) margin for pumps.
- Strainer mechanical collapse. P-buckle is the strainer structural design limit for the differential pressure (DP) across the ECCS strainers at which they are analyzed to be within code design allowable stresses.
- Air ingestion through the sump strainers. F-void is the vapor fraction of the liquid just downstream of the ECCS strainers.
- Core blockage with chemical effects.
- Boron precipitation in the core.

### Failure Modes

For input into the plant-specific PRA, accident sequences from a full spectrum of LOCAs are analyzed in a realistic time-dependent manner with uncertainty propagation to determine the probabilities of various failures potentially leading to core damage.

The failure modes shall be explicitly modeled in the PRA analysis, except for failure modes that were addressed with no issues of concern as part of previous deterministic evaluations for the plant.

### Top Events and Performance Thresholds

Failure probabilities and associated uncertainties determined in the supporting engineering analysis are passed to the plant-wide PRA, which determines the incremental risk associated with GSI-191 failure modes with three new top events added to accommodate composite GSI-191 failure processes. The engineering analysis supports the three new top events by testing the outcome of every postulated LOCA scenario against seven performance thresholds, discussed in detail in Enclosure 4, and summarized below.

New Top Events	Performance Thresholds
1. Failure at sump strainers	1. Strainer DP $\geq$ NPSH margin 2. Strainer DP $\geq$ P-buckle 3. Strainer F-void $\geq$ 0.02
2. Boron precipitation in the core	4. Core fiber load $\geq$ cold leg break fiber limit for boron precipitation 5. Core fiber load $\geq$ hot leg break fiber limit for boron precipitation
3. Core flow blockage	6. Core fiber load $\geq$ cold leg break fiber limit for flow blockage 7. Core fiber load $\geq$ hot leg break fiber limit for flow blockage

## ENCLOSURE 2

Requests for Exemptions for  
STP Piloted Risk-Informed Approach to  
Closure for GSI-191

Changes to Enclosures 2, 2-1, 2-2, 2-3, and 2-4 in Supplement 1:

1. Revised delta-LERF value where cited in each enclosure
2. Changed references to Attachment to be references to Enclosure 5 to be consistent with minor format change to Supplement 1.
3. Revised requested completion date to June 2015 to be consistent with the cover letter.

## **Requests for Exemptions for STP Piloted Risk-Informed Approach to Closure for GSI-191**

### Introduction

In support of the South Texas Project (STP) risk-informed approach to resolving Generic Safety Issue (GSI)-191 (Reference 1), Enclosures 2-1 through 2-4 provide STP Nuclear Operating Company (STPNOC) requests for exemptions under 10 CFR 50.12 from certain requirements in 10 CFR 50.46 and 10 CFR Part 50 Appendix A General Design Criteria (GDC). The exemption requests support approval of a license amendment request (LAR) provided in Enclosure 3 to this letter, proposing changes to the South Texas Project (STP) Units 1 and 2 Updated Final Safety Analysis Report (UFSAR) based on NRC acceptance of the risk-informed method and results.

Specific exemption requests, pertaining to requirements that concern 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), are provided as follows:

- Enclosure 2-1, Request for Exemption from 10 CFR 50.46(b)(5)
- Enclosure 2-2, Request for Exemption from GDC 35
- Enclosure 2-3, Request for Exemption from GDC 38
- Enclosure 2-4, Request for Exemption from GDC 41

Each separate Enclosure 2-1 through 2-4 identifies the applicable rule from which exemption is requested, the regulatory requirements involved, the purpose of the request, and the technical basis and justification for the exemption request, including the presence of special circumstances pursuant to 10 CFR 50.12(a). The requested exemptions are part of a risk-informed approach to resolve GSI-191 issues. The risk-informed approach is designed to be consistent with the guidance in Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," (Reference 2).

The STP risk-informed approach addresses the five key principles in RG 1.174 for risk-informed decision-making. The resulting risk metrics, i.e. changes in Core Damage Frequency (CDF) and Large Early Release Frequency (LERF), associated with GSI-191 concerns are used to determine whether plant modifications are warranted to ensure acceptable sump performance. The requested exemptions support this approach. A generic methodology for the STP approach is provided in Enclosure 1 to this letter.

The approach is intended to be a pilot for other licensees that are pursuing a risk-informed approach to resolving GSI-191. The STP approach is the risk-informed part of an overall graded approach that is based on the amount of fibrous insulation in the plant, as discussed in SECY-12-0093, "Closure Options for Generic Safety Issue - 191, Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance," (Reference 3). STP Units 1 and 2 contain large amounts of fibrous-debris material such as insulation and coatings in the containment buildings and are expected to have higher risk of containment sump strainer blockage and in-vessel core blockage as a result of potential debris-generating postulated loss of coolant accidents (LOCAs) than plants with relatively less fiber loading.

Based on the results for STP Units 1 and 2 showing that the risk for GSI-191 is less than the threshold for Region III, "Very Small Changes," of RG 1.174, no physical changes to the facility or changes to the operation of the facility are proposed. However, the approach provides the capability to use risk-informed insights to prioritize plant modifications, such as targeting problematic fibrous insulation in containment, if required.

### Background and Overview

GSI-191 concerns the possibility that debris generated during a LOCA could clog the containment sump strainers in pressurized-water reactors (PWRs) and result in loss of net positive suction head (NPSH) for the ECCS and CSS pumps, impeding the flow of water from the sump. Generic Letter (GL) 2004-02 (Reference 4) requested licensees to address GSI-191 issues focused on demonstrating compliance with the § 50.46 ECCS acceptance criteria. GL 2004-02 requested licensees to perform new, more realistic analyses using an NRC-approved methodology and to confirm the functionality of the ECCS and CSS during design basis accidents that require containment sump recirculation. As stated in GL 2004-02:

*Although not traditionally considered as a component of the 10 CFR 50.46 ECCS evaluation model, the calculation of sump performance is necessary to determine if the sump and the ECCS are predicted to provide enough flow to ensure long-term cooling.*

*Based on the new information identified during the efforts to resolve GSI-191, the staff has determined that the previous guidance used to develop current licensing basis analyses does not adequately and completely model sump screen debris blockage and related effects. As a result, due to the deficiencies in the previous guidance, an analytical error could be introduced which results in ECCS and CSS performance that does not conform with the existing applicable regulatory requirements outlined in this generic letter. Therefore, the staff is revising the guidance for determining the susceptibility of PWR recirculation sump screens to the adverse effects of debris blockage during design basis accidents requiring recirculation operation of the ECCS or CSS. In light of this revised staff guidance, it is appropriate to request that addressees perform new, more realistic analyses and submit information to confirm the functionality of the ECCS and CSS during design basis accidents requiring recirculation operations.*

STP Units 1 and 2 have implemented compensatory and mitigative measures in response to Bulletin 2003-01 (Reference 5) and GL 2004-02 to address the potential for sump strainer clogging and other concerns associated with GSI-191. Larger containment sump strainers have been installed that greatly reduce the potential for loss of net positive suction head (NPSH). Additional compensatory measures such as operating procedures and instrumentation to

monitor core level and temperature, and actions taken by operators if core blockage is indicated, were described in the STPNOC response (also refer to Enclosure 4-1).

The Commission issued Staff Requirements Memorandum (SRM)-SECY-10-0113 directing the staff to consider alternative options for resolving GSI-191 that are innovative and creative, as well as risk-informed and safety conscious (Reference 6). Subsequently, STPNOC, through interactions with the staff, developed a risk-informed approach for the resolution of GSI-191 using the methods described in RG 1.174. By Reference 7, STPNOC submitted to the NRC the preliminary results and notified the NRC of the intent to seek exemption from certain requirements of § 50.46.

SECY-12-0093 (Reference 3) described the staff plans to use STP as a pilot for other licensees choosing to use this approach, and the STP approach referred to as risk-informed Option 2. This approach requires an exemption request in accordance with 10 CFR 50.12 from certain requirements of 10 CFR 50.46, based in part on meeting the guidance in RG 1.174. Because the residual risk of GSI-191 concerns meets RG 1.174 acceptance guidelines, the approach allows fibrous insulation and other contributors to GSI-191 concerns to remain in containment.

The STP risk-informed approach to resolving GSI-191 is consistent with the NRC staff safety evaluation of NEI 04-07 (Reference 8) that discussed the modeling of sump performance as follows:

*While not a component of the 10 CFR 50.46 ECCS evaluation model, the calculation of sump performance is necessary to determine if the sump and the residual heat removal system are configured properly to provide enough flow to ensure long-term cooling, which is an acceptance criterion of 10 CFR 50.46. Therefore, the staff considers the modeling of sump performance as the validation of assumptions made in the ECCS evaluation model. Since the modeling of sump performance is a boundary calculation for the ECCS evaluation model, and acceptable sump performance is necessary for demonstrating long-term core cooling capability (10 CFR 50.46(b)(5)), the requirements of 10 CFR 50.46 are applicable.*

A description of the STP approach with respect to the requirements of 10 CFR 50.46 is provided in Enclosure 2-1. Descriptions of the STP risk-informed method including comparisons to previously approved guidance are included in Enclosures 4-1, 4-3, and 5 to this letter.

#### Summary of the STP Risk-Informed Approach

The proposed risk-informed method applies more recent information and knowledge, gained in support of studies and testing related to GSI-191 issues, to demonstrate that the ECCS would protect the reactor during a LOCA, specifically for meeting performance criterion 50.46(b)(5). The engineering analysis and evaluations, supporting calculations and codes are designed to model the plant as accurately as possible. Where uncertainty exists, it is identified and conservatism is applied. The result is a risk-informed PRA model that is capable of predicting ECCS performance using realistic evaluations of sump performance. The results show that there is a high probability that the ECCS acceptance criteria will be met for long term cooling.

The STP risk-informed method uses the STP PRA to quantify the residual risk from those issues related to GSI-191 concerns which have not been resolved using other methods. The



supporting engineering analysis, including evaluation of defense-in-depth and safety margin, has been developed to conform to RG 1.174 guidance, acceptance guidelines, and documentation requirements. The STP approach models the physical characteristics of debris generation and transport over a full range of plausible conditions in order to provide inputs to the STP PRA.

RG 1.174 provides technical guidance for licensees who request NRC approval for changes in the licensing basis using a risk-informed approach. This guidance establishes five principles that should be considered for risk-informed changes to the licensing basis. The exemption requests are part of a risk-informed approach that addresses the principles stated in RG 1.174. Additional discussion related to implementation and monitoring the proposed change is included in Enclosure 4-1, and in the LAR in Enclosure 3 which is supported by this exemption request.

Enclosures 4-1 through 4-3 provide a summary of the STP PRA, risk assessment methodology, and engineering analysis, including modeling of physical plant properties and treatment of uncertainties, and references to other supporting information. The PRA is used to calculate the risk (CDF and LERF) associated with GSI-191 for the as-built, as-operating plant, to quantify residual risk associated with GSI-191 for the as-built, as-operated plant. The residual risk associated with GSI-191 for the as-built, as-operated plant represents those issues not previously resolved using the deterministic methods. The results demonstrate that the risk for STP Units 1 and 2 is less than the threshold in Region III, "Very Small Changes," of RG 1.174, and provides a basis for approval:

- Change in CDF is  $\sim 2.88\text{E-}08/\text{yr}$
- Change in LERF is  $\sim 1.40\text{E-}11/\text{yr}$

The results are consistent with the Commission's Safety Goals for public health and safety. As such, no further physical modifications to the plant to address GSI-191 concerns are proposed.

#### References

- 1) Generic Safety Issue (GSI)-191, "Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance"
- 2) Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 2 (ML100910006)
- 3) Commission SECY Paper, "Closure Options for Generic Safety Issue - 191, Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance," SECY-12-0093, dated July 9, 2012 (ML121320270)
- 4) Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," dated September 13, 2004 (ML042360586)
- 5) Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors," dated June 9, 2003 (ML031600259)
- 6) Staff Requirements Memorandum (SRM)-SECY-10-0113, "Closure Options for Generic Safety Issue [GSI] - 191, Assessment of Debris Accumulation on Pressurized Water Reactor [PWR] Sump Performance," dated December 23, 2010 (ML103570354)

- 7) Letter, J. W. Crenshaw, STPNOC, to NRC Document Control Desk, "Status of the South Texas Project Risk-Informed (RI) Approach to Resolve Generic Safety Issue (GSI)-191," NOC-AE-11002775, dated December 14, 2011 (ML11354A386)
- 8) GSI-191 Safety Evaluation Report, Rev. 0, "Evaluation of NEI Guidance on PWR Sump Performance," dated December 6, 2004 (ML043280007)

## ENCLOSURE 2-1

Request for Exemption from  
10 CFR 50.46(b)(5)

## **Request for Exemption from Certain Requirements of 10 CFR 50.46(b)(5)**

### **1. Exemption Request**

Pursuant to 10 CFR 50.12, STP Nuclear Operating Company (STPNOC) is submitting this request for exemption from certain requirements of 10 CFR 50.46(b)(5), “*Long-term cooling*,” as specified in § 50.46, “Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors.” 10 CFR 50.46(b)(5) states:

*After any calculated successful initial operation of the ECCS, the calculated core temperature shall be maintained at an acceptably low value and decay heat shall be removed for the extended period of time required by the long-lived radioactivity remaining in the core.*

Licensees are required to demonstrate this capability while assuming the most conservative (and worst) single failure. This regulation has been interpreted as requiring the use of a bounding calculation or other deterministic method to model sump performance, as discussed in Generic Letter 2004-02 (Reference 1) and Generic Safety Issue (GSI)-191, “Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance” (Reference 2). STPNOC requests an exemption from that requirement in order to enable the use of a risk-informed method to demonstrate acceptable sump performance and to validate assumptions in the Emergency Core Cooling System (ECCS) evaluation model.

Approval of this exemption will allow use of a risk-informed method to account for the probabilities and uncertainties associated with reliable containment emergency sump performance in support of the operation of the ECCS following postulated LOCAs. The method evaluates the effects on strainer blockage and core blockage resulting from debris concerns raised by GSI-191. In order to confirm acceptable sump design, the risk associated with GSI-191 is evaluated to include the failure mechanisms associated with loss of core cooling and strainer blockage.

This exemption request is in support of the accompanying License Amendment Request (LAR) (Enclosure 3) seeking NRC approval of the changes to the South Texas Project Electric Generating Station (STPEGS) Updated Final Safety Analysis Report (UFSAR), to reconstitute the long term cooling licensing basis based on acceptable design of the containment sump. The risk-informed method provides assurance, with high probability, for acceptable sump performance during ECCS operation in recirculation mode as calculated by the ECCS evaluation model.

### **2. Regulatory Requirements Involved**

STPNOC seeks exemption to the extent that 10 CFR 50.46(b)(5) requires deterministic calculations or other analyses to address the concerns raised by GSI-191 related to acceptable plant performance during the recirculation mode in containment following a LOCA. The proposed changes to the licensing basis, submitted for NRC approval with the LAR in Enclosure 3, provide closure to GSI-191 for STP Units 1 and 2 on the basis that the associated risk is shown to meet the acceptance guidelines in Regulatory Guide

(RG) 1.174 (Reference 3) and that, in conjunction with the existing licensing basis, adequate safety is demonstrated.

This exemption request is for the purpose of allowing the use of a risk-informed method to demonstrate acceptable performance of the containment emergency sump during the recirculation mode in containment following postulated loss of coolant accidents (LOCAs), and is not intended to be applicable to other criteria in § 50.46(b). The containment sump has been evaluated, using deterministic methods, to meet the current licensing basis assumptions for analyzing the effects of post-LOCA debris blockage; however, these evaluations have not been shown to fully resolve GSI-191 for the as-built, as-operated plant (Reference 4). The risk-informed approach evaluates the sump design as part of the assessment of the residual risk associated with GSI-191 concerns. Based on confirmation of acceptable ECCS design as determined by the resulting risk meeting the acceptance guidelines in RG 1.174, the licensing basis for ECCS compliance with § 50.46(b)(5) is reconstituted.

Other regulatory requirements associated with containment sumps in support of ECCS and Containment Spray System (CSS) recirculation modes following postulated LOCAs include GDC 35 for core cooling, GDC 38 for containment heat removal, and GDC 41 for containment atmosphere cleanup. These requirements are addressed as part of separate exemption requests.

## **2.1 Evaluation of Impacts on the Balance of § 50.46 and Appendix K to Part 50**

The exemption request to support closure for GSI-191 is intended to address ECCS acceptance criterion for long-term cooling as presented in § 50.46(b)(5) and is not applicable to the other acceptance criteria of § 50.46 (peak cladding temperature, maximum cladding oxidation, maximum hydrogen generation, and coolable geometry).

For the purposes of demonstrating the balance of the acceptance criteria of § 50.46(b), the design and licensing basis descriptions of accidents requiring ECCS operation, including analysis methods, assumptions, and results, which are provided in South Texas Project Electric Generating Station (STPEGS) Updated Final Safety Analysis Report (UFSAR) Chapters 6 and 15 remain unchanged. The performance evaluations for accidents requiring ECCS operation described in UFSAR Chapters 6 and 15, based on the Appendix K Large-Break Loss-of-Coolant Accident (LBLOCA) analysis, demonstrate that for breaks up to and including the double-ended severance of a reactor coolant pipe, the ECCS will limit the clad temperature to below the limit specified in § 50.46 and assure that the core will remain in place and substantially intact with its essential heat transfer geometry preserved.

The requirements of § 50.46(a)(1) remain applicable to the model of record that meets the required features of Appendix K. Approval of the requested exemption does not impact the current ECCS evaluation. This evaluation model remains the licensing basis for demonstrating that the ECCS calculated cooling performance following postulated LOCAs does not exceed the acceptance criteria.

The reference to “*acceptable evaluation model*” in § 50.46(d) is discussed in § 50.46(a)(1) and defined in § 50.46(c)(2). The purpose of the risk-informed approach is

to evaluate the ECCS sump performance to determine if the sumps are capable of supporting the ECCS function to provide enough flow to ensure the long term cooling criterion § 50.46(b)(5) is met. This aspect is discussed in GL 2004-02, and the NRC safety evaluation report on NEI 04-07 (Reference 5) which states:

*"While not a component of the 10 CFR 50.46 ECCS evaluation model, the calculation of sump performance is necessary to determine if the sump and the residual heat removal system are configured properly to provide enough flow to ensure long-term cooling, which is an acceptance criterion of 10 CFR 50.46. Therefore, the staff considers the modeling of sump performance as the validation of assumptions made in the ECCS evaluation model. Since the modeling of sump performance is a boundary calculation for the ECCS evaluation model, and acceptable sump performance is necessary for demonstrating long-term core cooling capability (10 CFR 50.46(b)(5)), the requirements of 10 CFR 50.46 are applicable."*

The STP risk-informed approach uses the plant-specific PRA model to quantify the residual risk associated with GSI-191, i.e. those issues which have not been resolved using deterministic methods, and shows that it meets the acceptance guidelines defined in RG 1.174. The exemption request is specific to the requirement for demonstrating long-term core cooling capability as required by § 50.46(b)(5) as it pertains to the validation of assumptions made in the ECCS evaluation model, and is not intended to be applicable to other requirements provided in § 50.46 or Appendix K to Part 50.

As noted above, the NRC staff considers the modeling of sump performance as an input to the ECCS evaluation model, and therefore the requirements of § 50.46 are applicable. Consistent with this, the requirements and attributes for the proposed STP risk-informed method include:

- A full spectrum of postulated, double-ended guillotine breaks is evaluated, up to and including the largest piping in containment.
- Engineering analyses and evaluations used to risk-inform the PRA model consider a wide range of effects, including those addressed in NEI 04-07 (Reference 6) and related NRC guidance for evaluation of sump performance. A realistic model, based on the as-built and as-operating facility, is used to evaluate the risk. Reliability of mitigating systems is assessed by considering a broader set of potential challenges to safety, such as common cause failures and multiple failures that extend beyond those required for deterministic methods and by the GDC.
- Applicable experimental data is used to risk-inform the PRA model.
- Simplifying assumptions are reasonable, and the bases for these assumptions are clearly stated.
- Uncertainties in the inputs to the model are identified and assessed so that uncertainty in the results of the model can be estimated, and where appropriate, conservatism added.

The proposed exemption does not affect any of the 10 CFR 50.46(a)(1) or Appendix K requirements for an acceptable ECCS evaluation model, and does not change the ECCS acceptance criteria in 50.46(b) as it applies to the calculated results. Application of the exemption request allows use of a risk-informed approach to evaluate the sump performance for the concerns associated with GSI-191 that may be present in an acceptable evaluation model. The results of the risk-informed method demonstrate that the risk associated with GSI-191 meets the acceptance guidelines of RG 1.174. The current licensing basis for addressing the adequacy of ECCS to meet the criteria of § 50.46, including the Appendix K Large-Break LOCA analysis and the associated Chapter 15 accident analysis for LOCA, remain in place.

The proposed exemption does not affect the requirements of 10 CFR 50.46(d), which states:

*The criteria set forth in paragraph (b), with cooling performance calculated in accordance with an acceptable evaluation model, are in implementation of the general requirements with respect to ECCS cooling performance design set forth in this part, including in particular Criterion 35 of appendix A.*

With respect to the reference to GDC 35, this requirement is addressed as part of a separate exemption request.

## **2.2 Evaluation of Impacts on 10 CFR 50.67 and GDC 19**

The impact of the proposed exemption on the licensing basis analysis for demonstrating radiological consequences of the design basis LOCA meet the radiological dose guidelines specified in 10 CFR 50.67 and the dose limits specified in GDC 19 was evaluated. The risk-informed method provides confirmation of reliable ECCS and CSS performance as required for the licensing basis analyses that demonstrate the requirements of 10 CFR 50.67 and GDC 19. The method demonstrates that sump performance continues to support reliable plant design and operation and does not entail any exemption from 10 CFR 50.67 or GDC 19.

For STP Units 1 and 2, which have implemented the Alternative Source Term (AST), the design-basis LOCA radiological consequence LOCA analysis is a deterministic evaluation based on the assumption of a major rupture of the reactor coolant system piping and the assumption of the deterministic failure of the ECCS to provide adequate core cooling (Reference 9). This scenario results in a significant amount of core damage as specified in RG 1.183 (Reference 10), and does not represent any specific accident sequence, but is representative of a class of severe damage incidents that were evaluated in the development of the RG 1.183 source term characteristics. Such a scenario would be expected to require multiple failures of systems and equipment and lies beyond the likely incidents evaluated for design-basis transient analyses (Reference 9). Since deterministic failure of ECCS is assumed at the onset of the accident by the analysis, the reliability of the containment emergency sumps with respect to ECCS operation does not affect the analysis for dose consequences. Therefore, for the purposes of this exemption request, the current licensing basis analyses for 10 CFR 50.67 and GDC 19 are not impacted.

## **2.3 Evaluation of Impacts on other Regulatory Requirements**

The STP risk-informed approach, as described in Enclosures 1 and 4, uses the PRA model to quantify the risk associated with GSI-191, thereby quantifying the residual risk from those issues which have not been resolved using other methods. A determination that this approach and its results meet the key principles and acceptance guidelines in RG 1.174 demonstrates acceptable sump performance in support of ECCS and CSS operation in recirculation mode following postulated LOCAs, and demonstrates that the Commission's safety goals and public health and safety are maintained.

The proposed exemption does not result in any physical changes to the facility or changes to the operation of the plant, and does not change any of the programmatic requirements. Based on demonstrating acceptable containment emergency sump and ECCS design for reconstituting the current licensing basis for compliance with § 50.46(b) as described above, compliance with other regulatory requirements that rely on acceptable design for these systems and components continue to be met in the current licensing basis.

## **3. Basis for the Exemption Request**

Under § 50.12, a licensee may request and the NRC may grant exemptions from the requirements of 10 CFR Part 50 which are authorized by law, will not present an undue risk to the public health and safety, are consistent with the common defense and security, and when special circumstances are present.

The exemption request meets a key principle of RG 1.174, which states "*The proposed change meets the current regulations unless it is explicitly related to a requested exemption.*" This exemption request is provided in support of the proposed change provided in the License Amendment Request provide in Enclosure 3.

### **3.1 Justification for the Exemption Request**

As required by 50.12(a)(2), the Commission will not consider granting an exemption unless special circumstances are present. Special circumstances are present whenever one of the listed items (i) through (vi) under 50.12(a)(2) are applicable. STPNOC has evaluated the proposed exemption against the conditions specified in 10 CFR 50.12(a) and determined that this proposed exemption meets the requirements for granting an exemption from the regulation, and that special circumstances are present. The information supporting the determination is provided below.

Pursuant to 10 CFR 50.12, "Specific exemptions," the NRC may grant exemptions from the requirements of this part provided the following three conditions are met as required by 50.12(a)(1):

*The exemption is authorized by law.*

The NRC has authority under the Atomic Energy Act of 1954, as amended, to grant exemptions from its regulations if doing so would not violate the requirements of law. This exemption is authorized by law as is provided by 10 CFR 50.12 which provides the NRC authority to grant exemptions from Part 50 requirements with provision of proper



justification. Approval of the exemption from 10 CFR 50.46(b)(5) would not conflict with any provisions of the Atomic Energy Act of 1954, as amended, any of the Commission's regulations, or any other law.

*The exemption does not present an undue risk to the public health and safety.*

The purpose of § 50.46 is to establish acceptance criteria for ECCS performance, and together with GDC 35, to provide a high confidence that the systems will perform the required functions. The proposed exemption does not involve any modifications to the plant that could introduce a new accident precursor or affect the probability of postulated accidents, and therefore the probability of postulated initiating events is not increased. The PRA and engineering analysis demonstrate that the calculated risk is small and consistent with the intent of the Commission's Safety Goal Policy Statement, which defines an acceptable level of risk that is a small fraction of other risks to which the public is exposed.

As discussed in previous § 50.46 rulemaking (Reference 7), the probability of a large break LOCA is sufficiently low that the application of a risk-informed approach to evaluate the ability of the ECCS to meet § 50.46(b)(5) with high probability and with low uncertainty, rather than using a calculational model using deterministic methods to achieve similar understanding, would have little effect on public risk. This is applicable to evaluating acceptable containment sump design in support of ECCS and CSS recirculation modes.

The proposed change is to apply a risk-informed method rather than a traditional deterministic method to quantify the risk associated with GSI-191 and to establish a high probability of success for performance of ECCS to satisfy long term cooling criterion § 50.46(b)(5). The risk-informed approach involves a complete evaluation of the spectrum of LOCA breaks, including double-ended guillotine breaks, up to and including the largest pipe in the reactor coolant system (see Enclosure 4-3, Volume 3 Section 5.3). The risk-informed approach analyzes LOCAs, regardless of break size, using the same methods, assumptions, and criteria in order to quantify the uncertainties and overall risk metrics. This ensures that large break LOCAs with relatively small contribution to CDF due to the low probability of such a break as well as smaller break LOCAs with higher probabilities of occurrence are considered in the results. Since the design basis requirement for consideration of a double-ended guillotine breaks of the largest pipe in the reactor coolant system is retained and since no physical changes to the facility or changes to the operation of the facility are being made, the existing defense-in-depth and safety margin established for the design of the facility is not reduced.

This exemption only affects § 50.46(b)(5), and does not impact the adequacy of the acceptance criteria for cladding performance that is important to maintain adequate safety margins.

*The exemption is consistent with the common defense and security.*

The exemption involves a change to the licensing basis for the plant that has no relation to the control of licensed material or any security requirements that apply to STP Units 1 and 2. Therefore the exemption is consistent with the common defense and security.

### 3.2 Special Circumstances

This section discusses the presence of special circumstances as related to 10 CFR 50.12(a). 10 CFR 50.12(a)(2) states that NRC will not consider granting an exemption to the regulations unless special circumstances are present. Special circumstances are present whenever one of the listed items (i) through (vi) under § 50.12(a)(2) are applicable.

Such special circumstances are present in this instance to warrant exemption from the implicit requirement in § 50.46(b)(5) to use a deterministic calculational method as the design basis for acceptable sump performance to validate the results of the ECCS evaluation model demonstrating long-term cooling criterion is met. Approval of this exemption request would allow the use a risk-informed method to reconstitute the design basis for acceptable performance of the containment emergency sump, as a validation of inputs in the ECCS evaluation model, and in support of the existing licensing bases for compliance with 10 CFR 50.46.

Specifically, § 50.12(a)(2)(ii) applies:

*Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule.*

The intent of 10 CFR 50.46(b)(5) is to ensure long term cooling in the recirculation mode following postulated LOCAs. This exemption request is consistent with that purpose in that use of the proposed risk-informed approach demonstrates that long term cooling is realistically available and supports a high probability of successful ECCS performance, based on the risk results meeting the acceptance guidelines of RG 1.174.

As discussed in the *Commission's Policy Statement on "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities"* (Reference 8), NRC regulations and their implementation are generally based on deterministic approaches that consider a set of challenges to safety and determine how those challenges should be mitigated. This request does not seek exemption from any explicit language in the regulatory requirements. Rather, the need is based on the implicit requirements in the regulations for using deterministic methods to demonstrate acceptable design. Regulatory requirements are largely based on a deterministic framework, and are established for design basis accidents, such as the LOCA, with specific acceptance criteria that must be satisfied. Licensed facilities must be provided with safety systems capable of preventing and mitigating the consequences of design basis accidents to protect public health and safety. The deterministic regulatory requirements were designed to ensure that these systems are highly reliable. The LOCA analysis and the General Design Criteria (GDC) were established as part of this deterministic regulatory framework.

In comparison, the risk-informed approach considers nuclear safety in a more comprehensive way by examining the likelihood of a broad spectrum of initiating events and potential challenges, considering a wide range of credible events and assessing the risk based on mitigating system reliability.

An objective of § 50.46 is to maintain low risk to the public health and safety through a reliable ECCS, as supported by the containment sump. The supporting analysis demonstrates that a risk-informed approach to sump performance is consistent with the Commission's Safety Goals for nuclear power plants and supports ECCS operation with a high degree of reliability. Consequently, the special circumstances described in § 50.12(a)(2)(ii) apply.

Specifically, § 50.12(a)(2)(iii) applies:

*Compliance would result in undue hardship or other costs that are significantly in excess of those contemplated when the regulation was adopted, or that are significantly in excess of those incurred by others similarly situated.*

In order to meet a deterministic threshold value for containment debris loading, the amount of debris generating contributors in the STP plant design would need to be significantly reduced. Estimates of radiological exposure for insulation modifications are significant and on the order of hundreds of person-Rem, depending on the scope of the modifications.

With respect to the presence of such special circumstances, dose estimates for removal of insulation from STP Units 1 and 2 are described below. These dose estimates are for additional modifications to insulation in containment that would be required to achieve full resolution of GSI-191 using the previous deterministic methods. The residual risk associated with GSI-191 concerns bounds the expected improvement to overall plant risk that could be achieved by implementing these modifications.

#### Dose Considerations: STP Units 1 and 2 Plant Dose Estimates for GSI-191 Insulation Removal

STPNOC estimated the occupational dose for STP Units 1 and 2 that would be expected to be expended if plant modifications were undertaken for GSI-191, including insulation replacement and other modifications. The scope of the estimate included the replacement of fiberglass insulation with reflective metal insulation (RMI) for reactor coolant pump (RCP) insulation and a portion of the steam generator (SG) insulation, and the banding of existing fiberglass insulation on piping in containment. SG insulation replacement considered whether locations were within the zone of influence (ZOI) or beyond, with ZOI extending to seventeen times the diameter of the piping (17D).

The total dose expected to be expended for STP Units 1 and 2 in support of insulation replacement for GSI-191 is estimated to be 158 to 176 rem.

STP experience with this type of work suggests the lower expected dose estimates may be appropriate. However, bounding dose estimates based on the estimated installation hours including scaffold work and the average dose rates STP has historically experienced working within the bioshield are also provided below.

Insulation modifications, summary estimates:

Activities	Estimated Man-Hours	Estimated Dose per Unit (Expected)	Estimated Dose per Unit (Bounding)
Replace SG and RCP insulation with RMI	35,000	70 Rem	315 Rem
Install bands on insulated piping	9,000	9 to 18 Rem	81 Rem

Pipe insulation banding scope:

Piping Size (inches)	Insulation Thickness (inches)	Estimated Length (lineal feet)
31	3.5	120
29	4	68
27.5	3.5	76
16	4	160
12	2.5	430
8	2.5	168
6	2.5	94
4	2.5	592
2	2.5	228

SG fiberglass insulation replacement scope:

SG section	Volume per SG (cubic feet)	Total Volume – Four SGs (cubic feet)
Bottom end (<17D)	85	340
EI 37' to EI 52' (<17D)	197	788
EI 52' to EI 68' (<17D)	214	856
EI 68' to transition (<17D)	17	68
SG transition (<17D)	134	536
Transition to EI 83' (<17D)	53	212
Above EI 83' (>17D)	305	1220
Top end (>17D)	150	600
Total within ZOI (<17D)	700	2800
Total beyond ZOI (>17D)	455	1820

RCP insulation replacement scope:

- All RCP fiberglass insulation (thickness 3.5 inches) to be replaced with RMI
- Fiberglass insulation volume per RCP: 56 cubic feet
- Total fiberglass insulation volume (4 RCPs): 224 cubic feet per Unit (448 cubic feet total)

For the above estimates, the highest dose contributor is personnel work hours in close proximity to high dose sources such as steam generators and primary coolant piping. The estimates did not include any replacement of reactor pressure vessel (RPV)

insulation, which is RMI as originally designed for STP, therefore while the estimates may be indicative of a plant with high fiber loading, they do not necessarily account for activities that may be required for similar plants assuming 100-percent replacement of fibrous insulation in all areas that could be affected by a postulated LOCA. The dose estimates for STP Units 1 and 2, in addition to the actual insulation replacement, considered man-hours required to erect and remove scaffolding to support the insulation modifications and the dose associated with removal of insulation. The estimates did not consider dose associated with disposal of removed insulation or dose associated with potential hanger modifications for small bore piping insulation change to RMI.

The dose considerations discussed above demonstrate that compliance would result in substantial personnel exposure due to insulation modifications in the containment which is not commensurate with the expected safety benefit based on the results showing that the risk associated with GSI-191 concerns is less than the threshold for Region III in RG 1.174. Consequently, the special circumstances described in § 50.12(a)(2)(iii) apply.

In conclusion, special circumstances in § 50.12(a)(2)(ii) and § 50.12(a)(2)(iii) are present as required by § 50.12(a)(2) for consideration of the request for exemption.

#### **4. Technical Justification for the Exemption**

The supporting information that describes the STP risk-informed approach is provided in the enclosures to this letter. The generic methodology for the risk-informed method is described in Enclosure 1. Technical justification for the risk-informed method is provided in Enclosures 4-1 through 4-3, and in the LAR (Enclosure 3), which includes descriptions of the ECCS and containment emergency sump designs and performance criteria.

The proposed risk-informed approach meets the key principles in RG 1.174 in that it is consistent with the defense-in-depth philosophy, maintains sufficient safety margins, results in small increase in risk, and is monitored using performance measurement strategies. Detailed descriptions of the PRA and supporting engineering analyses are provided in Enclosures 4-2 and 4-3 to this letter. This proposed exemption to allow use of the risk-informed method is consistent with the key principle in RG 1.174 that requires the proposed change to meet current regulations unless explicated related to a requested exemption.

The results show that the risk associated with GSI-191 concerns is less than the threshold in Region III, "Very Small Changes," of RG 1.174, and therefore are consistent with the Commission's Safety Goals for public health and safety.

## 5. Environmental Consideration

Pursuant to the requirements of § 51.41 and § 51.21, "Criteria for and identification of licensing and regulatory actions requiring environmental assessments," the following information is provided. As demonstrated below, this exemption qualifies for a categorical exclusion in 10 CFR 51.22. However, if the NRC determines that an environmental assessment is necessary, this information will support a finding of no significant impact.

### Identification of the Proposed Action

The proposed exemption is to allow for use of a risk-informed approach to evaluate the residual risk associated with GSI-191, i.e. those concerns that have not been fully addressed using deterministic methods, for the purpose of reconstituting the design basis for acceptable performance of the containment emergency sumps during recirculation mode following postulated LOCAs. Approval of the proposed exemption would allow for approval of a change to the UFSAR, as provided in Enclosure 3 to this letter, for implementation of the risk-informed method for STP Units 1 and 2.

### Need for the Proposed Action

In the Commission's Policy Statement on "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities" (Reference 8), the Commission stated that *"the use of PRA technology in NRC regulatory activities should be increased to the extent supported by the state-of-the-art in PRA methods and data and in a manner that complements the NRC's deterministic approach"* and that is consistent with traditional defense-in-depth concepts.

The intent of the Commission's Policy Statement intent is to use the PRA to further understand the risk associated with a proposed change for the purpose of removing unnecessary conservatism associated with regulatory requirements in order to focus attention and allocation of resources to areas of true safety significance.

To implement the Commission Policy Statement, the NRC issued RG 1.174 to provide guidance on an acceptable approach to risk-informed decision-making, based on a set of five key principles. The proposed action is needed to allow STPNOC to use a risk-informed method to resolve the issues associated with GSI-191 concerns regarding the potential for insulation and other debris generated in the event of a postulated LOCA within the containment impacting acceptable recirculation operation for ECCS, and challenge the ability of ECCS to provide adequate long-term core cooling. This proposed exemption is consistent with the key principle in RG 1.174 which requires the proposed change to meet current regulations unless explicated related to a requested exemption.

### Environmental Impacts Consideration

The proposed exemption has been evaluated and determined to result in no significant radiological environmental impacts associated with the implementation of the change. This conclusion is based on the following.

The proposed exemption is to allow a risk-informed method for demonstrating the design and licensing bases for the ECCS. No physical modifications or changes to operating requirements are proposed for the site or facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. The intent of the proposed change is to quantify the risk associated with GSI-191 concerns. This quantification, provided in the form of risk metrics using the guidance in RG 1.174, demonstrates that the risk is less than the threshold for Region III, "Very Small Changes," in RG 1.174. Therefore, the proposed exemption supports a change that represents a very small change in Large Early Release Frequency (LERF) that corresponds to an insignificant impact on the environment.

Based on the results of the risk-informed method demonstrating that the increases in risk are very small, the proposed exemption has a negligible effect on accident probability, and adequate assurance of public health and safety is maintained. The proposed exemption does not involve any changes to the facility or facility operations that could create a new or significantly affect a previously analyzed accident or release path, and therefore would result in no significant changes in the types or quantities of radiological effluents that may be released offsite. The proposed change does not affect the generation of any radioactive effluents, and does not affect any of the permitted effluent release paths.

The proposed exemption has no impact on requirements related to the integrity of the reactor coolant system piping or any other aspect related to the initiation of a LOCA. No physical modifications or changes to operating requirements are proposed for the facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. Therefore, the proposed exemption does not affect the probability of an accident initiator.

The proposed exemption does not significantly impact a release of radiological effluents during and following a postulated LOCA. The design-basis LOCA radiological consequence analysis in the current licensing basis is a deterministic evaluation based on the assumption of a major rupture of the reactor coolant system piping and a significant amount of core damage as specified in RG 1.183 (Reference 9). The current licensing basis analysis shows the resulting doses to the public and to control room and technical support center personnel do not exceed the regulatory limits. The proposed change validates and does not change the input parameter value used in the radiological analysis. Therefore, the proposed exemption does not affect the amount of radiation exposure resulting from a postulated LOCA.

The proposed exemption does not involve any changes to the site property, physical changes to the facility, or changes to the operation of the facility. Therefore there are no irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented. The risk-informed method requires a

determination that the risk associated with the proposed change meets the Commission's safety goals. Therefore the proposed action would not result in a significant increase in any radiological hazard beyond those events previously analyzed in the UFSAR. There will be no change to radioactive effluents that affect radiation exposures to plant workers and members of the public. Therefore, no significant changes or different types of radiological impacts are expected as a result of the proposed action. The proposed exemption does not change the input parameter value used in the radiological analysis. Therefore, the proposed change would not significantly increase the probability or consequences of an accident, and there will be no significant offsite impact to the public from approval of the proposed exemption.

No physical modifications or changes to operating requirements are proposed for the facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. Therefore, the proposed exemption does not result in a significant increase in individual or cumulative occupational radiation exposure, and will not cause radiological exposure in excess of the dose criteria for restricted and unrestricted access specified in 10 CFR Part 20.

The proposed exemption does not involve any changes to non-radiological plant effluents or any activities that would adversely affect the environment. The proposed exemption does not affect any procedures used to operate the facility, or any physical characteristics of the facility, system, structure and components. The proposed change only pertains to the licensing basis for components located within the restricted area of the facility, to which access is limited to authorized personnel. Therefore the proposed exemption would not create any significant non-radiological impacts on the environment in the vicinity of the plant.

Since implementation of the exemption request, if approved, would result in no physical changes to the facility, there is no possibility of irreversible or irretrievable commitments of resources. Similarly, the proposed exemption does not involve the use of any resources not previously considered by the NRC in its past environmental statements for issuance of the facility operating licenses or other licensing actions for the facility. As a result, the proposed exemption does not involve any unresolved conflicts concerning alternative uses of available resources.

### Alternatives

The alternative to this exemption is compliance with the existing provisions in 10 CFR 50.46(b)(5). Compliance with 10 CFR 50.46(b)(5) would entail removal and disposal of significant amounts of insulation and installation of new insulation less likely to impact sump performance in the event of a LOCA. As discussed below, the alternative would not be environmentally preferable or cost justified.

The exemption entails a very small risk and, correspondingly, a very small environmental impact. In particular, the change in LERF is  $\sim 1.40\text{E-}11/\text{yr}$ . This change is so small that it is remote and speculative for environmental purposes.

Removal and reinstallation of insulation would entail appreciable radiation exposures to workers (estimated from 158 to 176 rem). This option results in extensive modifications.



to the facility and significant occupational dose. As such, the alternative is not environmentally preferable. Additionally, the cost of the installation replacement would be approximately \$55 million. This cost is not justified in light of the very small risk associated with the risk-informed exemption.

#### Categorical Exclusion Consideration

STPNOC has evaluated the proposed exemption against the criteria for identification of licensing and regulatory actions requiring environmental assessments in accordance with § 51.21 and determined that the proposed exemption meets the criteria and is eligible for categorical exclusion as set forth in 10 CFR 51.22, "Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review," paragraph (c)(9).

This determination is based on the fact that this exemption request is from requirements under Part 50 with respect to the installation or use of a facility component located within the restricted area, as defined in Part 20, specifically to authorize a change to the licensing basis for ECCS as it relates to acceptable containment sump performance in recirculation mode following a postulated LOCA. The proposed amendment has been evaluated to meet the following criteria under § 51.22(c)(9).

(i) *The exemption involves no significant hazards consideration.*

An evaluation of the three criteria set forth in 10 CFR 50.92(c) as applied to the exemption is provided below. The evaluation is consistent with the no significant hazards consideration determination provided in Enclosure 3 in support of the LAR.

(1) *The proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.*

Approval of the proposed exemption and accompanying license amendment request would allow the results of a risk-informed evaluation to be included in the UFSAR that concludes the ECCS and CSS systems will operate with a high probability following a LOCA when considering the impacts and effects of debris accumulation on containment emergency sump strainers in recirculation mode, as well as core flow blockage due to in-vessel effects, following loss of coolant accidents (LOCAs).

The proposed change does not implement any physical changes to the facility or any structures, systems and components (SSCs), and does not implement any changes in plant operation. The proposed change confirms that required SSCs supported by the containment sumps will perform their safety functions as required, and does not alter or prevent the ability of SSCs to perform their intended function to mitigate the consequences of an accident previously evaluated within the acceptance limits. The safety analysis acceptance criteria in the UFSAR continue to be met for the proposed change. The proposed change does not affect initiating events. The proposed change does not significantly affect the operation of the containment systems needs to ensure that there is a large margin between the temperature and pressure conditions

reached in the containment and those that would lead to failure so that there is a high degree of confidence that damage of the containment cannot occur.

The calculated risk associated with the proposed change is very small and less than the threshold for Region III as defined by RG 1.174, for both CDF and LERF. Therefore, the proposed change does not involve a significant increase in the probability or consequences of any the accident previously evaluated in the UFSAR.

- (2) *The proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.*

The proposed change neither installs nor removes any plant equipment, nor alters the design, physical configuration, or mode of operation of any plant structure, system or component. The proposed change does not introduce any new failure mechanisms or malfunctions that can initiate an accident. The proposed change does not introduce failure modes, accident initiators, or equipment malfunctions that would cause a new or different kind of accident. Therefore, the proposed change does not create the possibility for a new or different kind of accident from any accident previously evaluated.

- (3) *The proposed change does not involve a significant reduction in a margin of safety.*

The proposed change does not involve a change in any functional requirements, the configuration, or method of performing functions of plant SSCs. The effects from a full spectrum of LOCAs, including double-ended guillotine breaks for all piping sizes up to and including the largest pipe in the reactor coolant system, are analyzed. Appropriate redundancy and consideration of loss of offsite power and worst case single failure are retained, such that defense-in-depth is maintained.

The risk-informed method demonstrates the containment sumps will continue to support the ability of safety related components to perform their design functions. The proposed change does not alter the manner in which safety limits are determined or acceptance criteria associated with a safety limit. The proposed change does not implement any changes to plant operation, and does not significantly affect SSCs that respond to safely shutdown the plant and to maintain the plant in a safe shutdown condition. The proposed change does not significantly affect the existing safety margins in the barriers for the release of radioactivity. There are no changes to any of the safety analyses in the UFSAR. Therefore, the proposed change does not involve a significant reduction in a margin of safety.

- (ii) *The exemption involves no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.*

No physical modifications or changes to operating requirements are proposed for the facility, including any systems, structures and components relied upon to mitigate the

consequences of a LOCA. Approval of the exemption requires the calculated risk associated with GSI-191 to meet the acceptance guidelines in RG 1.174, thereby maintaining public health and safety. Therefore there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.

- (iii) *The proposed exemption involves no significant increase in individual or cumulative occupational radiation exposure.*

No physical modifications or changes to operating requirements are proposed for the facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. Therefore, with respect to installation or use of a facility component located within the restricted area there is no significant increase in individual or cumulative occupational radiation exposure as a result of granting the exemption request.

Based on the above, STPNOC concludes that the proposed exemption meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Additional technical justification for this conclusion is provided on the basis that the guidance and acceptance criteria provided in RG 1.174 are satisfied as described in Enclosure 4-1.

## **6. Conclusion**

Approval of an exemption to allow the use of the risk-informed approach is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security as required by § 50.12(a)(1). Furthermore, special circumstances required by § 50.12(a)(2) are present for item § 50.12(a)(2)(ii) in that application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule.

Based on the determination that the risk of the exemption meets the acceptance guidelines of RG 1.174, the results demonstrate there is reasonable assurance that the ECCS will function in the recirculation mode and that the public health and safety will be protected.

## **7. Implementation**

To support the completion of work and the resolution schedule for closure of GSI-191 as described in SECY-12-0093, STPNOC requests that this exemption request be approved for implementation by June 2015.

## **8. References**

- 1) Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," September 13, 2004 (ML042360586)
- 2) Generic Safety Issue (GSI)-191, "Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance"

- 3) Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 2 (ML100910006)
- 4) "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment Nos. 183 and 170 to Facility Operating License Nos. NPF-76 and NPF-80 STP Nuclear Operating Company, et al., South Texas Project, Units 1 and 2, Docket Nos. 50-498 and 50-499," March 25, 2008 (ML080360321)
- 5) GSI-191 Safety Evaluation Report, Rev. 0, "Evaluation of NEI Guidance on PWR Sump Performance," December 6, 2004 (ML043280007)
- 6) NEI 04-07, "Pressurized Water Reactor Sump Performance Evaluation Methodology," Volume 1 "Pressurized Water Reactor Sump Performance Evaluation Methodology," Revision 0, December 2004 (ML050550138)
- 7) Federal Register Notice, Vol. 53, No. 180 (53 FR 35996), Emergency Core Cooling Systems; Revisions to Acceptance Criteria, September 16, 1988
- 8) Commission's Policy Statement on "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities," August 16, 1995 (60 FR 42622)
- 9) South Texas Project, Units 1 and 2 - Issuance of Amendments Re: Adoption of Alternate Radiological Source Term in Assessment of Design-Basis Accident Dose Consequences (TAC Nos. MD4996 and MD4997), March 6, 2008 (ML080160013)
- 10) Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," July 2000

## ENCLOSURE 2-2

Request for Exemption from  
General Design Criterion 35

## Request for Exemption from Certain Requirements of General Design Criterion 35

### 1. Exemption Request

Pursuant to 10 CFR 50.12, STPNOC is submitting this request for exemption from certain requirements of 10 CFR Part 50 Appendix A, General Design Criterion (GDC) 35, which states:

*Criterion 35 — Emergency core cooling. A system to provide abundant emergency core cooling shall be provided. The system safety function shall be to transfer heat from the reactor core following any loss of reactor coolant at a rate such that (1) fuel and clad damage that could interfere with continued effective core cooling is prevented and (2) clad metal-water reaction is limited to negligible amounts.*

*Suitable redundancy in components and features, and suitable interconnections, leak detection, isolation, and containment capabilities shall be provided to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) the system safety function can be accomplished, assuming a single failure.*

Licensees are required to demonstrate this capability while assuming the most conservative (and worst) single failure. This regulation has been interpreted as requiring the use of a bounding calculation or other deterministic method, for the purpose of addressing containment emergency sump performance as discussed in Generic Letter 2004-02 (Reference 1) and Generic Safety Issue (GSI)-191, "Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance" (Reference 2). STPNOC requests an exemption from that requirement in order to enable the use of a risk-informed method to demonstrate acceptable sump design.

Approval of this exemption will allow use of a risk-informed method to account for the probabilities and uncertainties associated with the containment emergency sump design in support of the operation of the Emergency Core Cooling System (ECCS) following postulated LOCAs. The method evaluates the effects on strainer blockage and core blockage resulting from debris concerns raised by GSI-191. In order to confirm acceptable sump design, the risk associated with GSI-191 is evaluated to include the failure mechanisms associated with loss of core cooling and strainer blockage.

This exemption request is in support of the accompanying License Amendment Request (LAR) (Enclosure 3) seeking NRC approval of the changes to the South Texas Project Electric Generating Station (STPEGS) Updated Final Safety Analysis Report (UFSAR), to reconstitute the licensing basis based on acceptable design of the containment sump. The risk-informed method provides assurance, with high probability, for an acceptable sump design that complies with GDC 35 and resolves GSI-191.

## **2. Regulatory Requirements Involved**

STPNOC seeks exemption to the extent that GDC 35 requires deterministic calculations or other analyses to address the concerns raised by GSI-191 related to acceptable plant performance during the recirculation mode in containment following a LOCA. The proposed changes to the licensing basis, submitted for NRC approval with the LAR in Enclosure 3, provide closure to GSI-191 for STP Units 1 and 2 on the basis that the associated risk is shown to meet the acceptance guidelines in Regulatory Guide (RG) 1.174 (Reference 3) and that, in conjunction with the existing licensing basis, adequate safety is demonstrated.

This exemption request is for the purpose of allowing the use of a risk-informed method to demonstrate acceptable design of the containment emergency sump in support of the recirculation mode in containment following postulated loss of coolant accidents (LOCAs). The containment sump has been evaluated, using deterministic methods, to meet the current licensing basis assumptions for analyzing the effects of post-LOCA debris blockage; however, these evaluations have not been shown to fully resolve GSI-191 for the as-built, as-operated plant (Reference 4). The risk-informed approach evaluates the sump design as part of the assessment of the residual risk associated with GSI-191 concerns. Based on confirmation of acceptable ECCS design as determined by the resulting risk meeting the acceptance guidelines in RG 1.174, the licensing basis for ECCS compliance with GDC 35 is reconstituted.

Other regulatory requirements associated with containment sumps in support of ECCS and Containment Spray System (CSS) recirculation modes following postulated LOCAs include 10 CFR 50.46(b)(5) for core cooling, GDC 38 for containment heat removal, and GDC 41 for containment atmosphere cleanup. These requirements are addressed as part of separate exemption requests.

### **2.1 Evaluation of Impacts on § 50.46 and Appendix K to 10 CFR Part 50**

This exemption request is intended to address ECCS design requirements for meeting GDC 35 design requirements, and is not applicable to § 50.46 or Appendix K.

A separate exemption request provided in Enclosure 2-1 addresses exemption from § 50.46(b)(5) for long term cooling and discusses impacts on § 50.46 and Appendix K.

### **2.2 Evaluation of Impacts on 10 CFR 50.67 and GDC 19**

The impact of the proposed exemption on the licensing basis analysis for demonstrating radiological consequences of the design basis LOCA meet the radiological dose guidelines specified in 10 CFR 50.67 and the dose limits specified in GDC 19 was evaluated. The risk-informed method provides confirmation of reliable ECCS and CSS performance as required for the licensing basis analyses that demonstrate the requirements of 10 CFR 50.67 and GDC 19. The method demonstrates that sump performance continues to support reliable plant design and operation and does not entail any exemption from 10 CFR 50.67 or GDC 19.

For STP Units 1 and 2, which have implemented the Alternative Source Term (AST), the design-basis LOCA radiological consequence LOCA analysis is a deterministic evaluation based on the assumption of a major rupture of the reactor coolant system piping and the assumption of the deterministic failure of the ECCS to provide adequate core cooling (Reference 9). This scenario results in a significant amount of core damage as specified in RG 1.183 (Reference 10), and does not represent any specific accident sequence, but is representative of a class of severe damage incidents that were evaluated in the development of the RG 1.183 source term characteristics. Such a scenario would be expected to require multiple failures of systems and equipment and lies beyond the likely incidents evaluated for design-basis transient analyses (Reference 9). Since deterministic failure of ECCS is assumed at the onset of the accident by the analysis, the reliability of the containment emergency sumps with respect to ECCS operation does not affect the analysis for dose consequences. Therefore, for the purposes of this exemption request, the current licensing basis analyses for 10 CFR 50.67 and GDC-19 are not impacted.

### **2.3 Evaluation of Impacts on other Regulatory Requirements**

The STP risk-informed approach, as described in Enclosures 1 and 4, uses the PRA model to quantify the risk associated with GSI-191, thereby quantifying the residual risk from those issues which have not been resolved using other methods. A determination that this approach and its results meet the key principles and acceptance guidelines in RG 1.174 demonstrates acceptable sump performance in support of ECCS and CSS operation in recirculation mode following postulated LOCAs, and demonstrates that the Commission's safety goals and public health and safety are maintained.

The proposed exemption does not result in any physical changes to the facility or changes to the operation of the plant, and does not change any of the programmatic requirements. Based on demonstrating acceptable containment emergency sump and ECCS design for reconstituting the current licensing basis for compliance with GDC 35 as described above, compliance with other regulatory requirements that rely on acceptable design for these systems and components continue to be met in the current licensing basis.

### **3. Basis for the Exemption Request**

Under § 50.12, a licensee may request and the NRC may grant exemptions from the requirements of 10 CFR Part 50 which are authorized by law, will not present an undue risk to the public health and safety, are consistent with the common defense and security, and when special circumstances are present.

The exemption request meets a key principle of RG 1.174, which states "*The proposed change meets the current regulations unless it is explicitly related to a requested exemption.*" This exemption request is provided in support of the proposed change provided in the License Amendment Request provide in Enclosure 3.



### 3.1 Justification for the Exemption Request

As required by 50.12(a)(2), the Commission will not consider granting an exemption unless special circumstances are present. Special circumstances are present whenever one of the listed items (i) through (vi) under 50.12(a)(2) are applicable. STPNOC has evaluated the proposed exemption against the conditions specified in 10 CFR 50.12(a) and determined that this proposed exemption meets the requirements for granting an exemption from the regulation, and that special circumstances are present. The information supporting the determination is provided below.

Pursuant to 10 CFR 50.12, "Specific exemptions," the NRC may grant exemptions from the requirements of this part provided the following three conditions are met as required by 50.12(a)(1):

*The exemption is authorized by law.*

The NRC has authority under the Atomic Energy Act of 1954, as amended, to grant exemptions from its regulations if doing so would not violate the requirements of law. This exemption is authorized by law as is provided by 10 CFR 50.12 which provides the NRC authority to grant exemptions from Part 50 requirements with provision of proper justification. Approval of the exemption would not conflict with any provisions of the Atomic Energy Act of 1954, as amended, the Commission's regulations, or any other law

*The exemption does not present an undue risk to the public health and safety.*

The proposed change is to apply a risk-informed method rather than a traditional deterministic method in order to quantify the residual risk associated with GSI-191 and to establish a high confidence of acceptable ECCS design. The purpose of GDC 35 is to establish acceptable design for ECCS, and together with the acceptance criteria of § 50.46, to provide a high probability that the systems will perform the required functions. The proposed exemption does not involve any modifications to the plant that could introduce a new accident precursor or affect the probability of postulated accidents, and therefore the probability of postulated initiating events is not increased. The PRA and engineering analysis demonstrate that the calculated risk is small and consistent with the intent of the Commission's Safety Goal Policy Statement, which defines an acceptable level of risk that is a small fraction of other risks to which the public is exposed.

As discussed in previous § 50.46 rulemaking (Reference 7), the probability of a large break LOCA is sufficiently low that the application of a risk-informed approach to evaluate the ability of the ECCS to meet § 50.46(b)(5) with high probability and with low uncertainty, rather than using a calculational model using deterministic methods to achieve similar understanding, would have little effect on public risk. This is applicable to evaluating acceptable containment sump design in support of ECCS and CSS recirculation modes.

The risk-informed approach involves a complete evaluation of the spectrum of LOCA breaks, including double-ended guillotine break, up to and including the largest pipe in the reactor coolant system (see Enclosure 4-3, Volume 3 Section 5.3). The risk-informed approach analyzes LOCAs, regardless of break size, using the same methods,

assumptions, and criteria in order to quantify the uncertainties and overall risk metrics. This ensures that large break LOCAs with relatively small contribution to CDF due to the low probability of such a break as well as smaller break LOCAs with higher probabilities of occurrence are considered in the results. Since the design basis requirement for consideration of a double-ended guillotine break of the largest pipe in the reactor coolant system is retained and since no physical changes to the facility or changes to the operation of the facility are being made, the existing defense-in-depth and safety margin established for the design of the facility is not reduced.

*The exemption is consistent with the common defense and security.*

The exemption involves a change to the licensing basis for the plant that has no relation to the possession of licensed material or any security requirements that apply to STP Units 1 and 2. Therefore the exemption is consistent with the common defense and security.

### **3.2 Special Circumstances**

This section discusses the presence of special circumstances as related to 10 CFR 50.12(a). 10 CFR 50.12(a)(2) states that NRC will not consider granting an exemption to the regulations unless special circumstances are present. Special circumstances are present whenever one of the listed items (i) through (vi) under 50.12(a)(2) are applicable.

Such special circumstances are present in this instance to warrant exemption from the implicit requirement in GDC 35 to use a deterministic method to evaluate for acceptable containment emergency sump design. Approval of the exemption request would allow use of a risk-informed method to reconstitute the design basis for acceptable containment sump design in support of ECCS design for compliance with GDC 35. Specifically, § 50.12(a)(2)(ii) applies:

*Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule.*

The intent of GDC 35 is to ensure ECCS design provides abundant core cooling to mitigate fuel and clad damage and clad metal-water reaction following any loss of reactor coolant. GDC 35 sets forth the general ECCS cooling performance design requirements, which are in addition to the requirements of 10 CFR 50.46. This exemption request is consistent with that purpose in that use of the proposed risk-informed approach demonstrates a high probability of successful ECCS performance, which includes realistically available long term cooling, based on the risk results meeting the acceptance guidelines of RG 1.174. The risk-informed approach assesses ECCS design for a full spectrum of breaks, and assesses equipment failures that include loss of offsite power and worst case single failure, consistent with the GDC 35 requirements.

Since the proposed exemption does not involve any physical changes to the plant, there is no affect on the GDC 35 requirements for ECCS design for redundancy in components and features, interconnections, leak detection, isolation, and containment

capabilities. The current licensing basis evaluations for ECCS compliance with GDC 35 for these aspects continue to be met.

As discussed in the *Commission's Policy Statement on "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities"* (Reference 8), NRC regulations and their implementation are generally based on deterministic approaches that consider a set of challenges to safety and determine how those challenges should be mitigated. This request does not seek exemption from any explicit language in the regulatory requirements. Rather, the need is based on the implicit requirements in the regulations for using deterministic methods to demonstrate acceptable design. Regulatory requirements are largely based on a deterministic framework, and are established for design basis accidents, such as the LOCA, with specific acceptance criteria that must be satisfied. Licensed facilities must be provided with safety systems capable of preventing and mitigating the consequences of design basis accidents to protect public health and safety. The deterministic regulatory requirements were designed to ensure that these systems are highly reliable. The LOCA analysis and the General Design Criteria (GDC) were established as part of this deterministic regulatory framework.

In comparison, the probabilistic approach considers nuclear safety in a more comprehensive way by examining the likelihood of a broad spectrum of initiating events and potential challenges, considering a wide range of credible events and assessing the risk based on mitigating system reliability.

An objective of GDC 35 is to maintain low risk to the public health and safety through a reliable ECCS, as supported by the containment sump. The supporting analysis demonstrates that a risk-informed approach to sump performance is consistent with the Commission's Safety Goals for nuclear power plants, and supports ECCS operation with a high degree of reliability. Consequently, the special circumstances described in § 50.12(a)(2)(ii) apply.

Specifically, § 50.12(a)(2)(iii) applies:

*Compliance would result in undue hardship or other costs that are significantly in excess of those contemplated when the regulation was adopted, or that are significantly in excess of those incurred by others similarly situated.*

In order to meet a deterministic threshold value for containment debris loading, the amount of debris generating contributors in the STP plant design would need to be significantly reduced. Estimates of radiological exposure for insulation modifications are significant and on the order of hundreds of person-Rem, depending on the scope of the modifications.

With respect to the presence of such special circumstances, dose estimates for removal of insulation from STP Units 1 and 2 are described below. These dose estimates are for additional modifications to insulation in containment that would be required to achieve full resolution of GSI-191 using the previous deterministic methods. The residual risk associated with GSI-191 concerns bounds the expected improvement to overall plant risk that could be achieved by implementing these modifications.

Dose Considerations: STP Units 1 and 2 Plant Dose Estimates for GSI-191 Insulation Removal

STPNOC estimated the occupational dose for STP Units 1 and 2 that would be expected to be expended if plant modifications were undertaken for GSI-191, including insulation replacement and other modifications. The scope of the estimate included the replacement of fiberglass insulation with reflective metal insulation (RMI) for reactor coolant pump (RCP) insulation and a portion of the steam generator (SG) insulation, and the banding of existing fiberglass insulation on piping in containment. SG insulation replacement considered whether locations were within the zone of influence (ZOI) or beyond, with ZOI extending to seventeen times the diameter of the piping (17D).

The total dose expected to be expended for STP Units 1 and 2 in support of insulation replacement for GSI-191 is estimated to be 158 to 176 rem.

STP experience with this type of work suggests the lower expected dose estimates may be appropriate. However, bounding dose estimates based on the estimated installation hours including scaffold work and the average dose rates STP has historically experienced working within the bioshield are also provided below.

Insulation modifications, summary estimates:

Activities	Estimated Man-Hours	Estimated Dose per Unit (Expected)	Estimated Dose per Unit (Bounding)
Replace SG and RCP insulation with RMI	35,000	70 Rem	315 Rem
Install bands on insulated piping	9,000	9 to 18 Rem	81 Rem

Pipe insulation banding scope:

Piping Size (inches)	Insulation Thickness (inches)	Estimated Length (lineal feet)
31	3.5	120
29	4	68
27.5	3.5	76
16	4	160
12	2.5	430
8	2.5	168
6	2.5	94
4	2.5	592
2	2.5	228

SG fiberglass insulation replacement scope:

SG section	Volume per SG (cubic feet)	Total Volume – Four SGs (cubic feet)
Bottom end (<17D)	85	340
EI 37' to EI 52' (<17D)	197	788
EI 52' to EI 68' (<17D)	214	856
EI 68' to transition (<17D)	17	68
SG transition (<17D)	134	536
Transition to EI 83' (<17D)	53	212
Above EI 83' (>17D)	305	1220
Top end (>17D)	150	600
Total within ZOI (<17D)	700	2800
Total beyond ZOI (>17D)	455	1820

RCP insulation replacement scope:

- All RCP fiberglass insulation (thickness 3.5 inches) to be replaced with RMI
- Fiberglass insulation volume per RCP: 56 cubic feet
- Total fiberglass insulation volume (4 RCPs): 224 cubic feet per Unit (448 cubic feet total)

For the above estimates, the highest dose contributor is personnel work hours in close proximity to high dose sources such as steam generators and primary coolant piping. The estimates did not include any replacement of reactor pressure vessel (RPV) insulation, which is RMI as originally designed for STP, therefore while the estimates may be indicative of a plant with high fiber loading, they do not necessarily account for activities that may be required for similar plants assuming 100-percent replacement of fibrous insulation in all areas that could be affected by a postulated LOCA. The dose estimates for STP Units 1 and 2, in addition to the actual insulation replacement, considered man-hours required to erect and remove scaffolding to support the insulation modifications and the dose associated with removal of insulation. The estimates did not consider dose associated with disposal of removed insulation or dose associated with potential hanger modifications for small bore piping insulation change to RMI.

The dose considerations discussed above demonstrate that compliance would result in substantial personnel exposure due to insulation modifications in the containment which is not commensurate with the expected safety benefit based on the results showing that the risk associated with GSI-191 concerns is less than the threshold for Region III in RG 1.174. Consequently, the special circumstances described in § 50.12(a)(2)(iii) apply.

In conclusion, special circumstances in § 50.12(a)(2)(ii) and § 50.12(a)(2)(iii) are present as required by § 50.12(a)(2) for consideration of the request for exemption.

#### **4. Technical Justification for the Exemption**

The supporting information that describes the STP risk-informed approach is provided in the enclosures to this letter. The generic methodology for the risk-informed method is described in Enclosure 1. Technical justification for the risk-informed method is provided in Enclosures 4-1 through 4-3, and in the LAR (Enclosure 3), which includes descriptions of the ECCS and containment emergency sump designs and performance criteria.

The proposed risk-informed approach meets the key principles in RG 1.174 in that it is consistent with the defense-in-depth philosophy, maintains sufficient safety margins, results in small increase in risk, and is monitored using performance measurement strategies. Detailed descriptions of the PRA and supporting engineering analyses are provided in Enclosures 4-2 and 4-3 to this letter. This proposed exemption to allow use of the risk-informed method is consistent with the key principle in RG 1.174 that requires the proposed change to meet current regulations unless explicated related to a requested exemption.

The results show that the risk associated with GSI-191 concerns is less than the threshold in Region III, "Very Small Changes," of RG 1.174, and therefore are consistent with the Commission's Safety Goals for public health and safety.

#### **5. Environmental Consideration**

Pursuant to the requirements of § 51.41 and § 51.21, "Criteria for and identification of licensing and regulatory actions requiring environmental assessments," the following information is provided. As demonstrated below, this exemption qualifies for a categorical exclusion in 10 CFR 51.22. However, if the NRC determines that an environmental assessment is necessary, this information will support a finding of no significant impact.

##### Identification of the Proposed Action

The proposed exemption is to allow for use of a risk-informed approach to evaluate the residual risk associated with GSI-191, i.e. those concerns that have not been fully addressed using deterministic methods, for the purpose of reconstituting the design basis for acceptable performance of the containment emergency sumps during recirculation mode following postulated LOCAs. Approval of the proposed exemption would allow for approval of a change to the UFSAR, as provided in Enclosure 3 to this letter, for implementation of the risk-informed method for STP Units 1 and 2.

##### Need for the Proposed Action

In the Commission's Policy Statement on "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities" (Reference 8), the Commission stated that *"the use of PRA technology in NRC regulatory activities should be increased to the extent supported by the state-of-the-art in PRA methods and data and in a manner that complements the NRC's deterministic approach"* and that is consistent with traditional defense-in-depth concepts.

The intent of the Commission's Policy Statement intent is to use the PRA to further understand the risk associated with a proposed change for the purpose of removing unnecessary conservatism associated with regulatory requirements in order to focus attention and allocation of resources to areas of true safety significance.

To implement the Commission Policy Statement, the NRC issued RG 1.174 to provide guidance on an acceptable approach to risk-informed decision-making, based on a set of five key principles. The proposed action is needed to allow STPNOC to use a risk-informed method to resolve the issues associated with GSI-191 concerns regarding the potential for insulation and other debris generated in the event of a postulated LOCA within the containment impacting acceptable recirculation operation for ECCS, and challenge the ability of ECCS to provide adequate long-term core cooling. This proposed exemption is consistent with the key principle which requires the proposed change to meet current regulations unless explicated related to a requested exemption.

#### Environmental Impacts Consideration

The proposed exemption has been evaluated and determined to result in no significant radiological environmental impacts associated with the implementation of the change. This conclusion is based on the following.

The proposed exemption is to allow a risk-informed method for demonstrating the design and licensing bases for the ECCS. No physical modifications or changes to operating requirements are proposed for the site or facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. The intent of the proposed change is to quantify the risk associated with GSI-191 concerns. This quantification, provided in the form of risk metrics using the guidance in RG 1.174, demonstrates that the risk is less than the threshold for Region III, "Very Small Changes," in RG 1.174. Therefore, the proposed exemption supports a change that represents a very small change in Large Early Release Frequency (LERF) that corresponds to an insignificant impact on the environment.

Based on the results of the risk-informed method demonstrating that the increases in risk are very small, the proposed exemption has a negligible effect on accident probability, and adequate assurance of public health and safety is maintained. The proposed exemption does not involve any changes to the facility or facility operations that could create a new or significantly affect a previously analyzed accident or release path, and therefore would result in no significant changes in the types or quantities of radiological effluents that may be released offsite. The proposed change does not affect the generation of any radioactive effluents, and does not affect any of the permitted effluent release paths.

The proposed exemption has no impact on requirements related to the integrity of the reactor coolant system piping or any other aspect related to the initiation of a LOCA. No physical modifications or changes to operating requirements are proposed for the facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. Therefore, the proposed exemption does not affect the probability of an accident initiator.

The proposed exemption does not significantly impact a release of radiological effluents during and following a postulated LOCA. The design-basis LOCA radiological consequence analysis in the current licensing basis is a deterministic evaluation based on the assumption of a major rupture of the reactor coolant system piping and a significant amount of core damage as specified in RG 1.183 (Reference 9). The current licensing basis analysis shows the resulting doses to the public and to control room and technical support center personnel do not exceed the regulatory limits. The proposed change validates and does not change the input parameter value used in the radiological analysis. Therefore, the proposed exemption does not affect the amount of radiation exposure resulting from a postulated LOCA.

The proposed exemption does not involve any changes to the site property, physical changes to the facility, or changes to the operation of the facility. Therefore there are no irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented. The risk-informed method requires a determination that the risk associated with the proposed change meets the Commission's safety goals. Therefore the proposed action would not result in a significant increase in any radiological hazard beyond those events previously analyzed in the UFSAR. There will be no change to radioactive effluents that affect radiation exposures to plant workers and members of the public. Therefore, no significant changes or different types of radiological impacts are expected as a result of the proposed action. The proposed exemption does not change the input parameter value used in the radiological analysis. Therefore, the proposed change would not significantly increase the probability or consequences of an accident, and there will be no significant offsite impact to the public from approval of the proposed exemption.

No physical modifications or changes to operating requirements are proposed for the facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. Therefore, the proposed exemption does not result in a significant increase in individual or cumulative occupational radiation exposure, and will not cause radiological exposure in excess of the dose criteria for restricted and unrestricted access specified in 10 CFR Part 20.

The proposed exemption does not involve any changes to non-radiological plant effluents or any activities that would adversely affect the environment. The proposed exemption does not affect any procedures used to operate the facility, or any physical characteristics of the facility, system, structure and components. The proposed change only pertains to the licensing basis for components located within the restricted area of the facility, to which access is limited to authorized personnel. Therefore the proposed exemption would not create any significant non-radiological impacts on the environment in the vicinity of the plant.

Since implementation of the exemption request, if approved, would result in no physical changes to the facility, there is no possibility of irreversible or irretrievable commitments of resources. Similarly, the proposed exemption does not involve the use of any resources not previously considered by the NRC in its past environmental statements for issuance of the facility operating licenses or other licensing actions for the facility. As a result, the proposed exemption does not involve any unresolved conflicts concerning alternative uses of available resources.



### Alternatives

The alternative to this exemption is compliance with the existing provisions in GDC 35. Compliance with GDC 35 would entail removal and disposal of significant amounts of insulation and installation of new insulation less likely to impact sump performance in the event of a LOCA. As discussed below, the alternative would not be environmentally preferable or cost justified.

The exemption entails a very small risk and, correspondingly, a very small environmental impact. In particular, the change in LERF is  $\sim 1.40\text{E-}11/\text{yr}$ . This change is so small that it is remote and speculative for environmental purposes.

Removal and reinstallation of insulation would entail appreciable radiation exposures to workers (estimated from 158 to 176 rem). This option results in extensive modifications to the facility and significant occupational dose. As such, the alternative is not environmentally preferable. Additionally, the cost of the installation replacement would be approximately \$55 million. This cost is not justified in light of the very small risk associated with the risk-informed exemption.

### Categorical Exclusion Consideration

STPNOC has evaluated the proposed exemption against the criteria for identification of licensing and regulatory actions requiring environmental assessments in accordance with § 51.21 and determined that the proposed exemption meets the criteria and is eligible for categorical exclusion as set forth in 10 CFR 51.22, "Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review," paragraph (c)(9).

This determination is based on the fact that this exemption request is from requirements under Part 50 with respect to the installation or use of a facility component located within the restricted area, as defined in Part 20, specifically to authorize a change to the licensing basis for ECCS as it relates to acceptable containment sump performance in recirculation mode following a postulated LOCA. The proposed amendment has been evaluated to meet the following criteria under § 51.22(c)(9).

(i) *The exemption involves no significant hazards consideration.*

An evaluation of the three criteria set forth in 10 CFR 50.92(c) as applied to the exemption is provided below. The evaluation is consistent with the no significant hazards consideration determination provided in Enclosure 3 in support of the LAR.

(1) *The proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.*

Approval of the proposed exemption and accompanying license amendment request would allow the results of a risk-informed evaluation to be included in the UFSAR that concludes the ECCS and CSS systems will operate with a high probability following a LOCA when considering the impacts and effects of debris accumulation on containment emergency sump strainers in recirculation

mode, as well as core flow blockage due to in-vessel effects, following loss of coolant accidents (LOCAs).

The proposed change does not implement any physical changes to the facility or any structures, systems and components (SSCs), and does not implement any changes in plant operation. The proposed change confirms that required SSCs supported by the containment sumps will perform their safety functions as required, and does not alter or prevent the ability of SSCs to perform their intended function to mitigate the consequences of an accident previously evaluated within the acceptance limits. The safety analysis acceptance criteria in the UFSAR continue to be met for the proposed change. The proposed change does not affect initiating events. The proposed change does not significantly affect the operation of the containment systems needs to ensure that there is a large margin between the temperature and pressure conditions reached in the containment and those that would lead to failure so that there is a high degree of confidence that damage of the containment cannot occur.

The calculated risk associated with the proposed change is very small and less than the threshold for Region III as defined by RG 1.174, for both CDF and LERF. Therefore, the proposed change does not involve a significant increase in the probability or consequences of any the accident previously evaluated in the UFSAR.

- (2) *The proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.*

The proposed change neither installs nor removes any plant equipment, nor alters the design, physical configuration, or mode of operation of any plant structure, system or component. The proposed change does not introduce any new failure mechanisms or malfunctions that can initiate an accident. The proposed change does not introduce failure modes, accident initiators, or equipment malfunctions that would cause a new or different kind of accident. Therefore, the proposed change does not create the possibility for a new or different kind of accident from any accident previously evaluated.

- (3) *The proposed change does not involve a significant reduction in a margin of safety.*

The proposed change does not involve a change in any functional requirements, the configuration, or method of performing functions of plant SSCs. The effects from a full spectrum of LOCAs, including double-ended guillotine breaks for all piping sizes up to and including the largest pipe in the reactor coolant system, are analyzed. Appropriate redundancy and consideration of loss of offsite power and worst case single failure are retained, such that defense-in-depth is maintained.

The risk-informed method demonstrates the containment sumps will continue to support the ability of safety related components to perform their design functions. The proposed change does not alter the manner in which safety

limits are determined or acceptance criteria associated with a safety limit. The proposed change does not implement any changes to plant operation, and does not significantly affect SSCs that respond to safely shutdown the plant and to maintain the plant in a safe shutdown condition. The proposed change does not significantly affect the existing safety margins in the barriers for the release of radioactivity. There are no changes to any of the safety analyses in the UFSAR. Therefore, the proposed change does not involve a significant reduction in a margin of safety.

- (ii) *The exemption involves no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.*

No physical modifications or changes to operating requirements are proposed for the facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. Approval of the exemption requires the calculated risk associated with GSI-191 to meet the acceptance guidelines in RG 1.174, thereby maintaining public health and safety. Therefore there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.

- (iii) *The proposed exemption involves no significant increase in individual or cumulative occupational radiation exposure.*

No physical modifications or changes to operating requirements are proposed for the facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. Therefore, with respect to installation or use of a facility component located within the restricted area there is no significant increase in individual or cumulative occupational radiation exposure as a result of granting the exemption request.

Based on the above, STPNOC concludes that the proposed exemption meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Additional technical justification for this conclusion is provided on the basis that the guidance and acceptance criteria provided in RG 1.174 are satisfied as described in Enclosure 4-1.

## **6. Conclusion**

Approval of an exemption to allow the use of the risk-informed approach is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security as required by § 50.12(a)(1). Furthermore, special circumstances required by § 50.12(a)(2) are present for item § 50.12(a)(2)(ii) in that application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule.

Based on the determination that the risk of the exemption meets the acceptance guidelines of RG 1.174, the results demonstrate there is reasonable assurance that the ECCS will function in the recirculation mode and that the public health and safety will be protected.

## **7. Implementation**

To support the completion of work and the resolution schedule for closure of GSI-191 as described in SECY-12-0093, STPNOC requests that this exemption request be approved for implementation by June 2015.

## **8. References**

- 1) Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," September 13, 2004 (ML042360586)
- 2) Generic Safety Issue (GSI)-191, "Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance"
- 3) Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 2 (ML100910006)
- 4) "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment Nos. 183 and 170 to Facility Operating License Nos. NPF-76 and NPF-80 STP Nuclear Operating Company, et al., South Texas Project, Units 1 and 2, Docket Nos. 50-498 and 50-499," March 25, 2008 (ML080360321)
- 5) GSI-191 Safety Evaluation Report, Rev. 0, "Evaluation of NEI Guidance on PWR Sump Performance," December 6, 2004 (ML043280007)
- 6) NEI 04-07, "Pressurized Water Reactor Sump Performance Evaluation Methodology," Volume 1 "Pressurized Water Reactor Sump Performance Evaluation Methodology," Revision 0, December 2004 (ML050550138)
- 7) Federal Register Notice, Vol. 53, No. 180 (53 FR 35996), Emergency Core Cooling Systems; Revisions to Acceptance Criteria, September 16, 1988
- 8) Commission's Policy Statement on "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities," August 16, 1995 (60 FR 42622)
- 9) South Texas Project, Units 1 and 2 - Issuance of Amendments Re: Adoption of Alternate Radiological Source Term in Assessment of Design-Basis Accident Dose Consequences (TAC Nos. MD4996 and MD4997), March 6, 2008 (ML080160013)
- 10) Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," July 2000

## ENCLOSURE 2-3

Request for Exemption from  
General Design Criterion 38

## Request for Exemption from Certain Requirements of General Design Criterion 38

### 1. Exemption Request

Pursuant to 10 CFR 50.12, STPNOC is submitting this request for exemption from certain requirements of 10 CFR Part 50 Appendix A, General Design Criteria (GDC) 38.

*Criterion 38— Containment heat removal. A system to remove heat from the reactor containment shall be provided. The system safety function shall be to reduce rapidly, consistent with the functioning of other associated systems, the containment pressure and temperature following any loss-of-coolant accident and maintain them at acceptably low levels.*

*Suitable redundancy in components and features, and suitable interconnections, leak detection, isolation, and containment capabilities shall be provided to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) the system safety function can be accomplished, assuming a single failure.*

Licensees are required to demonstrate this capability while assuming the most conservative (and worst) single failure. This regulation has been interpreted as requiring the use of a bounding calculation or other deterministic method, for the purpose of addressing containment emergency sump performance as discussed in Generic Letter 2004-02 (Reference 1) and Generic Safety Issue (GSI)-191, "Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance" (Reference 2). STPNOC requests an exemption from that requirement in order to enable the use of a risk-informed method to demonstrate acceptable sump design. This exemption request does not apply to other SSCs which may be required to demonstrate compliance with GDC 38.

Approval of this exemption will allow use of a risk-informed method to account for the probabilities and uncertainties associated with the containment emergency sump design in support of the operation of the Containment Spray System (CSS) following postulated LOCAs. The method evaluates the effects on containment emergency sump strainer blockage resulting from debris concerns raised by GSI-191. In order to confirm acceptable sump design, the risk associated with GSI-191 is evaluated to include the failure mechanisms associated with strainer blockage affecting CSS recirculation mode.

This exemption request is in support of the accompanying License Amendment Request (LAR) (Enclosure 3) seeking NRC approval of the changes to the South Texas Project Electric Generating Station (STPEGS) Updated Final Safety Analysis Report (UFSAR), to reconstitute the licensing basis based on acceptable design of the containment sump. The risk-informed method provides assurance, with high probability, for an acceptable sump design that complies with GDC 38 and resolves GSI-191.

## **2. Regulatory Requirements Involved**

STPNOC seeks exemption to the extent that GDC 38 requires deterministic calculations or other analyses to address the concerns raised by GSI-191 related to acceptable plant performance during the recirculation mode in containment following a LOCA. The proposed changes to the licensing basis, submitted for NRC approval with the LAR in Enclosure 3, provide closure to GSI-191 for STP Units 1 and 2 on the basis that the associated risk is shown to meet the acceptance guidelines in Regulatory Guide (RG) 1.174 (Reference 3) and that, in conjunction with the existing licensing basis, adequate safety is demonstrated.

This exemption request is for the purpose of allowing the use of a risk-informed method to demonstrate acceptable design of the containment emergency sump in support of the recirculation mode in containment following postulated loss of coolant accidents (LOCAs). The containment sump has been evaluated, using deterministic methods, to meet the current licensing basis assumptions for analyzing the effects of post-LOCA debris blockage; however, these evaluations have not been shown to fully resolve GSI-191 for the as-built, as-operated plant (Reference 4). The risk-informed approach evaluates the sump design as part of the assessment of the residual risk associated with GSI-191 concerns. Based on confirmation of acceptable containment emergency sump and CSS design as determined by the resulting risk meeting the acceptance guidelines in RG 1.174, the licensing basis for CSS compliance with GDC 38 is reconstituted.

Other regulatory requirements associated with containment sumps in support of Emergency Core Cooling System (ECCS) and CSS recirculation modes following postulated LOCAs include 10 CFR 50.46(b)(5) for core cooling, GDC 35 for core cooling, and GDC 41 for containment atmosphere cleanup. These requirements are addressed as part of separate exemption requests.

### **2.1 Evaluation of Impacts on 10 CFR 50.67 and GDC 19**

The impact of the proposed exemption on the licensing basis analysis for demonstrating radiological consequences of the design basis LOCA meet the radiological dose guidelines specified in 10 CFR 50.67 and the dose limits specified in GDC 19 was evaluated. The risk-informed method provides confirmation of reliable ECCS and CSS performance as required for the licensing basis analyses that demonstrate the requirements of 10 CFR 50.67 and GDC 19. The method demonstrates that sump performance continues to support reliable plant design and operation and does not entail any exemption from 10 CFR 50.67 or GDC 19.

For STP Units 1 and 2, which have implemented the Alternative Source Term (AST), the design-basis LOCA radiological consequence LOCA analysis is a deterministic evaluation based on the assumption of a major rupture of the reactor coolant system piping and the assumption of the deterministic failure of the ECCS to provide adequate core cooling (Reference 9). This scenario results in a significant amount of core damage as specified in RG 1.183 (Reference 10), and does not represent any specific accident sequence, but is representative of a class of severe damage incidents that were evaluated in the development of the RG 1.183 source term characteristics. Such a scenario would be expected to require multiple failures of systems and equipment and

lies beyond the likely incidents evaluated for design-basis transient analyses (Reference 9). Since deterministic failure of ECCS is assumed at the onset of the accident by the analysis, the reliability of the containment emergency sumps with respect to ECCS operation does not affect the analysis for dose consequences. The risk-informed method confirms reliable CSS operation as an input to the AST analysis. Therefore, for the purposes of this exemption request, the current licensing basis analyses for 10 CFR 50.67 and GDC 19 are not impacted.

## **2.2 Evaluation of Impacts on other Regulatory Requirements**

The STP risk-informed approach, as described in Enclosures 1 and 4, uses the PRA model to quantify the risk associated with GSI-191, thereby quantifying the residual risk from those issues which have not been resolved using other methods. A determination that this approach and its results meet the key principles and acceptance guidelines in RG 1.174 demonstrates acceptable sump performance in support of ECCS and CSS operation in recirculation mode following postulated LOCAs, and demonstrates that the Commission's safety goals and public health and safety are maintained.

The proposed exemption does not result in any physical changes to the facility or changes to the operation of the plant, and does not change any of the programmatic requirements. Based on demonstrating acceptable containment emergency sump and CSS design for reconstituting the current licensing basis for compliance with GDC 38 as described above, compliance with other regulatory requirements that rely on acceptable design for these systems and components continue to be met in the current licensing basis.

## **3. Basis for the Exemption Request**

Under § 50.12, a licensee may request and the NRC may grant exemptions from the requirements of 10 CFR Part 50 which are authorized by law, will not present an undue risk to the public health and safety, are consistent with the common defense and security, and when special circumstances are present.

### **3.1 Justification for the Exemption Request**

As required by 50.12(a)(2), the Commission will not consider granting an exemption unless special circumstances are present. Special circumstances are present whenever one of the listed items (i) through (vi) under 50.12(a)(2) are applicable. STPNOC has evaluated the proposed exemption against the conditions specified in 10 CFR 50.12(a) and determined that this proposed exemption meets the requirements for granting an exemption from the regulation, and that special circumstances are present. The information supporting the determination is provided below.

Pursuant to 10 CFR 50.12, "Specific exemptions," the NRC may grant exemptions from the requirements of this part provided the following three conditions are met as required by 50.12(a)(1):

*The exemption is authorized by law.*



The NRC has authority under the Atomic Energy Act of 1954, as amended, to grant exemptions from its regulations if doing so would not violate the requirements of law. This exemption is authorized by law as is provided by 10 CFR 50.12 which provides the NRC authority to grant exemptions from Part 50 requirements with provision of proper justification. Approval of the exemption would not conflict with any provisions of the Atomic Energy Act of 1954, as amended, the Commission's regulations, or any other law

*The exemption does not present an undue risk to the public health and safety.*

The proposed change is to apply a risk-informed method rather than a traditional deterministic method in order to quantify the residual risk associated with GSI-191 and to establish a high confidence of acceptable containment sump design. The purpose of GDC 38 is to establish acceptable design for the containment heat removal system, which includes the CSS, to provide a high probability that the systems will perform the required functions. The proposed exemption does not involve any modifications to the plant that could introduce a new accident precursor or affect the probability of postulated accidents, and therefore the probability of postulated initiating events is not increased. The PRA and engineering analysis demonstrate that the calculated risk is small and consistent with the intent of the Commission's Safety Goal Policy Statement, which defines an acceptable level of risk that is a small fraction of other risks to which the public is exposed.

As discussed in previous § 50.46 rulemaking (Reference 7), the probability of a large break LOCA is sufficiently low that the application of a risk-informed approach to evaluate the ability of the ECCS to meet § 50.46(b)(5) with high probability and with low uncertainty, rather than using a calculational model using deterministic methods to achieve similar understanding, would have little effect on public risk. This is applicable to evaluating acceptable containment sump design in support of ECCS and CSS recirculation modes.

The risk-informed approach involves a complete evaluation of the spectrum of LOCA breaks, including double-ended guillotine break, up to and including the largest pipe in the reactor coolant system (see Enclosure 4-3, Volume 3 Section 5.3). The risk-informed approach analyzes LOCAs, regardless of break size, using the same methods, assumptions, and criteria in order to quantify the uncertainties and overall risk metrics. This ensures that large break LOCAs with relatively small contribution to CDF due to the low probability of such a break as well as smaller break LOCAs with higher probabilities of occurrence are considered in the results. Since the design basis requirement for consideration of a double-ended guillotine break of the largest pipe in the reactor coolant system is retained and since no physical changes to the facility or changes to the operation of the facility are being made, the existing defense-in-depth and safety margin established for the design of the facility is not reduced.

*The exemption is consistent with the common defense and security.*

The exemption involves a change to the licensing basis for the plant that has no relation to the possession of licensed material or any security requirements that apply to STP Units 1 and 2. Therefore the exemption is consistent with the common defense and security.

### 3.2 Special Circumstances

This section discusses the presence of special circumstances as related to 10 CFR 50.12(a). 10 CFR 50.12(a)(2) states that NRC will not consider granting an exemption to the regulations unless special circumstances are present. Special circumstances are present whenever one of the listed items (i) through (vi) under § 50.12(a)(2) are applicable.

Such special circumstances are present in this instance to warrant exemption from the implicit requirement in GDC 38 to use a deterministic method to evaluate for acceptable containment emergency sump design. Approval of the exemption request would allow use of a risk-informed method to reconstitute the design basis for acceptable containment sump design in support of CSS design for compliance with GDC 38. Specifically, § 50.12(a)(2)(ii) applies:

*Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule.*

The intent of GDC 38 is to ensure a containment heat removal system is provided to rapidly reduce containment pressure and temperature following any LOCA and maintain them at acceptably low levels. This exemption request is consistent with that purpose in that use of the proposed risk-informed approach demonstrates a high probability of successful CSS performance, which includes realistically available recirculation flow, based on the risk results meeting the acceptance guidelines of RG 1.174. The risk-informed approach assesses the design for a full spectrum of breaks, and assesses equipment failures that include loss of offsite power and worst case single failure, consistent with the GDC 38 requirements.

Since the proposed exemption does not involve any physical changes to the plant, there is no affect on the GDC 38 design requirements for redundancy in components and features, interconnections, leak detection, isolation, and containment capabilities. The current licensing basis evaluations for CSS compliance with GDC 38 for these aspects continue to be met.

As discussed in the *Commission's Policy Statement on "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities"* (Reference 8), NRC regulations and their implementation are generally based on deterministic approaches that consider a set of challenges to safety and determine how those challenges should be mitigated. This request does not seek exemption from any explicit language in the regulatory requirements. Rather, the need is based on the implicit requirements in the regulations for using deterministic methods to demonstrate acceptable design. Regulatory requirements are largely based on a deterministic framework, and are established for design basis accidents, such as the LOCA, with specific acceptance criteria that must be satisfied. Licensed facilities must be provided with safety systems capable of preventing and mitigating the consequences of design basis accidents to protect public health and safety. The deterministic regulatory requirements were designed to ensure that these systems are highly reliable. The LOCA analysis and the General Design Criteria (GDC) were established as part of this deterministic regulatory framework.

In comparison, the risk-informed approach considers nuclear safety in a more comprehensive way by examining the likelihood of a broad spectrum of initiating events and potential challenges, considering a wide range of credible events and assessing the risk based on mitigating system reliability.

An objective of GDC 38 is to maintain low risk to the public health and safety through a reliable CSS, as supported by the containment sump. The supporting analysis demonstrates that a risk-informed approach to sump performance is consistent with the Commission's Safety Goals for nuclear power plants, and supports CSS operation with a high degree of reliability. Consequently, the special circumstances described in § 50.12(a)(2)(ii) apply.

Specifically, § 50.12(a)(2)(iii) applies:

*Compliance would result in undue hardship or other costs that are significantly in excess of those contemplated when the regulation was adopted, or that are significantly in excess of those incurred by others similarly situated.*

In order to meet a deterministic threshold value for containment debris loading, the amount of debris generating contributors in the STP plant design would need to be significantly reduced. Estimates of radiological exposure for insulation modifications are significant and on the order of hundreds of person-Rem, depending on the scope of the modifications.

With respect to the presence of such special circumstances, dose estimates for removal of insulation from STP Units 1 and 2 are described below. These dose estimates are for additional modifications to insulation in containment that would be required to achieve full resolution of GSI-191 using the previous deterministic methods. The residual risk associated with GSI-191 concerns bounds the expected improvement to overall plant risk that could be achieved by implementing these modifications.

#### Dose Considerations: STP Units 1 and 2 Plant Dose Estimates for GSI-191 Insulation Removal

STPNOC estimated the occupational dose for STP Units 1 and 2 that would be expected to be expended if plant modifications were undertaken for GSI-191, including insulation replacement and other modifications. The scope of the estimate included the replacement of fiberglass insulation with reflective metal insulation (RMI) for reactor coolant pump (RCP) insulation and a portion of the steam generator (SG) insulation, and the banding of existing fiberglass insulation on piping in containment. SG insulation replacement considered whether locations were within the zone of influence (ZOI) or beyond, with ZOI extending to seventeen times the diameter of the piping (17D).

The total dose expected to be expended for STP Units 1 and 2 in support of insulation replacement for GSI-191 is estimated to be 158 to 176 rem.

STP experience with this type of work suggests the lower expected dose estimates may be appropriate. However, bounding dose estimates based on the estimated installation

hours including scaffold work and the average dose rates STP has historically experienced working within the bioshield are also provided below.

Insulation modifications, summary estimates:

Activities	Estimated Man-Hours	Estimated Dose per Unit (Expected)	Estimated Dose per Unit (Bounding)
Replace SG and RCP insulation with RMI	35,000	70 Rem	315 Rem
Install bands on insulated piping	9,000	9 to 18 Rem	81 Rem

Pipe insulation banding scope:

Piping Size (inches)	Insulation Thickness (inches)	Estimated Length (lineal feet)
31	3.5	120
29	4	68
27.5	3.5	76
16	4	160
12	2.5	430
8	2.5	168
6	2.5	94
4	2.5	592
2	2.5	228

SG fiberglass insulation replacement scope:

SG section	Volume per SG (cubic feet)	Total Volume – Four SGs (cubic feet)
Bottom end (<17D)	85	340
EI 37' to EI 52' (<17D)	197	788
EI 52' to EI 68' (<17D)	214	856
EI 68' to transition (<17D)	17	68
SG transition (<17D)	134	536
Transition to EI 83' (<17D)	53	212
Above EI 83' (>17D)	305	1220
Top end (>17D)	150	600
Total within ZOI (<17D)	700	2800
Total beyond ZOI (>17D)	455	1820

RCP insulation replacement scope:

- All RCP fiberglass insulation (thickness 3.5 inches) to be replaced with RMI
- Fiberglass insulation volume per RCP: 56 cubic feet

- Total fiberglass insulation volume (4 RCPs): 224 cubic feet per Unit (448 cubic feet total)

For the above estimates, the highest dose contributor is personnel work hours in close proximity to high dose sources such as steam generators and primary coolant piping. The estimates did not include any replacement of reactor pressure vessel (RPV) insulation, which is RMI as originally designed for STP, therefore while the estimates may be indicative of a plant with high fiber loading, they do not necessarily account for activities that may be required for similar plants assuming 100-percent replacement of fibrous insulation in all areas that could be affected by a postulated LOCA. The dose estimates for STP Units 1 and 2, in addition to the actual insulation replacement, considered man-hours required to erect and remove scaffolding to support the insulation modifications and the dose associated with removal of insulation. The estimates did not consider dose associated with disposal of removed insulation or dose associated with potential hanger modifications for small bore piping insulation change to RMI.

The dose considerations discussed above demonstrate that compliance would result in substantial personnel exposure due to insulation modifications in the containment which is not commensurate with the expected safety benefit based on the results showing that the risk associated with GSI-191 concerns is less than the threshold for Region III in RG 1.174. Consequently, the special circumstances described in § 50.12(a)(2)(iii) apply.

In conclusion, special circumstances in § 50.12(a)(2)(ii) and § 50.12(a)(2)(iii) are present as required by § 50.12(a)(2) for consideration of the request for exemption.

#### **4. Technical Justification for the Exemption**

The supporting information that describes the STP risk-informed approach is provided in the enclosures to this letter. The generic methodology for the risk-informed method is described in Enclosure 1. Technical justification for the risk-informed method is provided in Enclosures 4-1 through 4-3, and in the LAR (Enclosure 3), which includes descriptions of the CSS and containment emergency sump designs and performance criteria.

The proposed risk-informed approach meets the key principles in RG 1.174 in that it is consistent with the defense-in-depth philosophy, maintains sufficient safety margins, results in small increase in risk, and is monitored using performance measurement strategies. Detailed descriptions of the PRA and supporting engineering analyses are provided in Enclosures 4-2 and 4-3 to this letter. This proposed exemption to allow use of the risk-informed method is consistent with the key principle in RG 1.174 that requires the proposed change to meet current regulations unless explicated related to a requested exemption.

The results show that the risk associated with GSI-191 concerns is less than the threshold in Region III, "Very Small Changes," of RG 1.174, and therefore are consistent with the Commission's Safety Goals for public health and safety

## 5. Environmental Consideration

Pursuant to the requirements of § 51.41 and § 51.21, "Criteria for and identification of licensing and regulatory actions requiring environmental assessments," the following information is provided. As demonstrated below, this exemption qualifies for a categorical exclusion in 10 CFR 51.22. However, if the NRC determines that an environmental assessment is necessary, this information will support a finding of no significant impact.

### Identification of the Proposed Action

The proposed exemption is to allow for use of a risk-informed approach to evaluate the residual risk associated with GSI-191, i.e. those concerns that have not been fully addressed using deterministic methods, for the purpose of reconstituting the design basis for acceptable performance of the containment emergency sumps during recirculation mode following postulated LOCAs. Approval of the proposed exemption would allow for approval of a change to the UFSAR, as provided in Enclosure 3 to this letter, for implementation of the risk-informed method for STP Units 1 and 2.

### Need for the Proposed Action

In the Commission's Policy Statement on "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities" (Reference 8), the Commission stated that *"the use of PRA technology in NRC regulatory activities should be increased to the extent supported by the state-of-the-art in PRA methods and data and in a manner that complements the NRC's deterministic approach"* and that is consistent with traditional defense-in-depth concepts.

The intent of the Commission's Policy Statement intent is to use the PRA to further understand the risk associated with a proposed change for the purpose of removing unnecessary conservatism associated with regulatory requirements in order to focus attention and allocation of resources to areas of true safety significance.

To implement the Commission Policy Statement, the NRC issued RG 1.174 to provide guidance on an acceptable approach to risk-informed decision-making, based on a set of five key principles. The proposed action is needed to allow STPNOC to use a risk-informed method to resolve the issues associated with GSI-191 concerns regarding the potential for insulation and other debris generated in the event of a postulated LOCA within the containment impacting acceptable recirculation operation for the CSS, and challenge its ability to provide adequate containment heat removal. This proposed exemption is consistent with the key principle in RG 1.174 which requires the proposed change to meet current regulations unless explicated related to a requested exemption.

### Environmental Impacts Consideration

The proposed exemption has been evaluated and determined to result in no significant radiological environmental impacts associated with the implementation of the change. This conclusion is based on the following.

The proposed exemption is to allow a risk-informed method for demonstrating the design and licensing bases for the CSS. No physical modifications or changes to operating requirements are proposed for the site or facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. The intent of the proposed change is to quantify the risk associated with GSI-191 concerns. This quantification, provided in the form of risk metrics using the guidance in RG 1.174, demonstrates that the risk is less than the threshold for Region III, "Very Small Changes," in RG 1.174. Therefore, the proposed exemption supports a change that represents a very small change in Large Early Release Frequency (LERF) that corresponds to an insignificant impact on the environment.

Based on the results of the risk-informed method demonstrating that the increases in risk are very small, the proposed exemption has a negligible effect on accident probability, and adequate assurance of public health and safety is maintained. The proposed exemption does not involve any changes to the facility or facility operations that could create a new or significantly affect a previously analyzed accident or release path, and therefore would result in no significant changes in the types or quantities of radiological effluents that may be released offsite. The proposed change does not affect the generation of any radioactive effluents, and does not affect any of the permitted effluent release paths.

The proposed exemption has no impact on requirements related to the integrity of the reactor coolant system piping or any other aspect related to the initiation of a LOCA. No physical modifications or changes to operating requirements are proposed for the facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. Therefore, the proposed exemption does not affect the probability of an accident initiator.

The proposed exemption does not significantly impact a release of radiological effluents during and following a postulated LOCA. The design-basis LOCA radiological consequence analysis in the current licensing basis is a deterministic evaluation based on the assumption of a major rupture of the reactor coolant system piping and a significant amount of core damage as specified in RG 1.183 (Reference 9). The current licensing basis analysis shows the resulting doses to the public and to control room and technical support center personnel do not exceed the regulatory limits. The proposed change validates and does not change the input parameter value used in the radiological analysis. Therefore, the proposed exemption does not affect the amount of radiation exposure resulting from a postulated LOCA.

The proposed exemption does not involve any changes to the site property, physical changes to the facility, or changes to the operation of the facility. Therefore there are no irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented. The risk-informed method requires a determination that the risk associated with the proposed change meets the Commission's safety goals. Therefore the proposed action would not result in a significant increase in any radiological hazard beyond those events previously analyzed in the UFSAR. There will be no change to radioactive effluents that affect radiation exposures to plant workers and members of the public. Therefore, no significant

changes or different types of radiological impacts are expected as a result of the proposed action. The proposed exemption does not change the input parameter value used in the radiological analysis. Therefore, the proposed change would not significantly increase the probability or consequences of an accident, and there will be no significant offsite impact to the public from approval of the proposed exemption.

No physical modifications or changes to operating requirements are proposed for the facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. Therefore, the proposed exemption does not result in a significant increase in individual or cumulative occupational radiation exposure, and will not cause radiological exposure in excess of the dose criteria for restricted and unrestricted access specified in 10 CFR Part 20.

The proposed exemption does not involve any changes to non-radiological plant effluents or any activities that would adversely affect the environment. The proposed exemption does not affect any procedures used to operate the facility, or any physical characteristics of the facility, system, structure and components. The proposed change only pertains to the licensing basis for components located within the restricted area of the facility, to which access is limited to authorized personnel. Therefore the proposed exemption would not create any significant non-radiological impacts on the environment in the vicinity of the plant.

Since implementation of the exemption request, if approved, would result in no physical changes to the facility, there is no possibility of irreversible or irretrievable commitments of resources. Similarly, the proposed exemption does not involve the use of any resources not previously considered by the NRC in its past environmental statements for issuance of the facility operating licenses or other licensing actions for the facility. As a result, the proposed exemption does not involve any unresolved conflicts concerning alternative uses of available resources.

#### Alternatives

The alternative to this exemption is compliance with the existing provisions in GDC 38. Compliance with GDC 38 would entail removal and disposal of significant amounts of insulation and installation of new insulation less likely to impact sump performance in the event of a LOCA. As discussed below, the alternative would not be environmentally preferable or cost justified.

The exemption entails a very small risk and, correspondingly, a very small environmental impact. In particular, the change in LERF is  $\sim 1.40\text{E-}11/\text{yr}$ . This change is so small that it is remote and speculative for environmental purposes.

Removal and reinstallation of insulation would entail appreciable radiation exposures to workers (estimated from 158 to 176 rem). This option results in extensive modifications to the facility and significant occupational dose. As such, the alternative is not environmentally preferable. Additionally, the cost of the installation replacement would be approximately \$55 million. This cost is not justified in light of the very small risk associated with the risk-informed exemption.



### Categorical Exclusion Consideration

STPNOC has evaluated the proposed exemption against the criteria for identification of licensing and regulatory actions requiring environmental assessments in accordance with § 51.21 and determined that the proposed exemption meets the criteria and is eligible for categorical exclusion as set forth in 10 CFR 51.22, "Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review," paragraph (c)(9).

This determination is based on the fact that this exemption request is from requirements under Part 50 with respect to the installation or use of a facility component located within the restricted area, as defined in Part 20, specifically to authorize a change to the licensing basis for the CSS as it relates to acceptable containment sump performance in recirculation mode following a postulated LOCA. The proposed amendment has been evaluated to meet the following criteria under § 51.22(c)(9).

(i) *The exemption involves no significant hazards consideration.*

An evaluation of the three criteria set forth in 10 CFR 50.92(c) as applied to the exemption is provided below. The evaluation is consistent with the no significant hazards consideration determination provided in Enclosure 3 in support of the LAR.

(1) *The proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.*

Approval of the proposed exemption and accompanying license amendment request would allow the results of a risk-informed evaluation to be included in the UFSAR that concludes the ECCS and CSS will operate with a high probability following a LOCA when considering the impacts and effects of debris accumulation on containment emergency sump strainers in recirculation mode, as well as core flow blockage due to in-vessel effects, following loss of coolant accidents (LOCAs).

The proposed change does not implement any physical changes to the facility or any SSCs, and does not implement any changes in plant operation. The proposed change confirms that required SSCs supported by the containment sumps will perform their safety functions as required, and does not alter or prevent the ability of SSCs to perform their intended function to mitigate the consequences of an accident previously evaluated within the acceptance limits. The safety analysis acceptance criteria in the UFSAR continue to be met for the proposed change. The proposed change does not affect initiating events. The proposed change does not significantly affect the operation of the containment systems needs to ensure that there is a large margin between the temperature and pressure conditions reached in the containment and those that would lead to failure so that there is a high degree of confidence that damage of the containment cannot occur.

The calculated risk associated with the proposed change is very small and less than the threshold for Region III as defined by RG 1.174, for both CDF and

LERF. Therefore, the proposed change does not involve a significant increase in the probability or consequences of any the accident previously evaluated in the UFSAR.

- (2) *The proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.*

The proposed change neither installs nor removes any plant equipment, nor alters the design, physical configuration, or mode of operation of any plant structure, system or component. The proposed change does not introduce any new failure mechanisms or malfunctions that can initiate an accident. The proposed change does not introduce failure modes, accident initiators, or equipment malfunctions that would cause a new or different kind of accident. Therefore, the proposed change does not create the possibility for a new or different kind of accident from any accident previously evaluated.

- (3) *The proposed change does not involve a significant reduction in a margin of safety.*

The proposed change does not involve a change in any functional requirements, the configuration, or method of performing functions of plant SSCs. The effects from a full spectrum of LOCAs, including double-ended guillotine breaks for all piping sizes up to and including the largest pipe in the reactor coolant system, are analyzed. Appropriate redundancy and consideration of loss of offsite power and worst case single failure are retained, such that defense-in-depth is maintained.

The risk-informed method demonstrates the containment sumps will continue to support the ability of safety related components to perform their design functions. The proposed change does not alter the manner in which safety limits are determined or acceptance criteria associated with a safety limit. The proposed change does not implement any changes to plant operation, and does not significantly affect SSCs that respond to safely shutdown the plant and to maintain the plant in a safe shutdown condition. The proposed change does not significantly affect the existing safety margins in the barriers for the release of radioactivity. There are no changes to any of the safety analyses in the UFSAR. Therefore, the proposed change does not involve a significant reduction in a margin of safety.

- (ii) *The exemption involves no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.*

No physical modifications or changes to operating requirements are proposed for the facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. Approval of the exemption requires the calculated risk associated with GSI-191 to meet the acceptance guidelines in RG 1.174, thereby maintaining public health and safety. Therefore there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.

- (iii) *The proposed exemption involves no significant increase in individual or cumulative occupational radiation exposure.*

No physical modifications or changes to operating requirements are proposed for the facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. Therefore, with respect to installation or use of a facility component located within the restricted area there is no significant increase in individual or cumulative occupational radiation exposure as a result of granting the exemption request.

Based on the above, STPNOC concludes that the proposed exemption meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Additional technical justification for this conclusion is provided on the basis that the guidance and acceptance criteria provided in RG 1.174 are satisfied as described in Enclosure 4-1.

## **6. Conclusion**

Approval of an exemption to allow the use of the risk-informed approach is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security as required by § 50.12(a)(1). Furthermore, special circumstances required by § 50.12(a)(2) are present for item § 50.12(a)(2)(ii) in that application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule.

Based on the determination that the risk of the exemption meets the acceptance guidelines of RG 1.174, the results demonstrate there is reasonable assurance that the CSS will function in the recirculation mode and that the public health and safety will be protected.

## **7. Implementation**

To support the completion of work and the resolution schedule for closure of GSI-191 as described in SECY-12-0093, STPNOC requests that this exemption request be approved for implementation by June 2015.

## **8. References**

- 1) Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," September 13, 2004 (ML042360586)
- 2) Generic Safety Issue (GSI)-191, "Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance"
- 3) Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 2 (ML100910006)

- 4) "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment Nos. 183 and 170 to Facility Operating License Nos. NPF-76 and NPF-80 STP Nuclear Operating Company, et al., South Texas Project, Units 1 and 2, Docket Nos. 50-498 and 50-499," March 25, 2008 (ML080360321)
- 5) GSI-191 Safety Evaluation Report, Rev. 0, "Evaluation of NEI Guidance on PWR Sump Performance," December 6, 2004 (ML043280007)
- 6) NEI 04-07, "Pressurized Water Reactor Sump Performance Evaluation Methodology," Volume 1 "Pressurized Water Reactor Sump Performance Evaluation Methodology," Revision 0, December 2004 (ML050550138)
- 7) Federal Register Notice, Vol. 53, No. 180 (53 FR 35996), Emergency Core Cooling Systems; Revisions to Acceptance Criteria, September 16, 1988
- 8) Commission's Policy Statement on "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities," August 16, 1995 (60 FR 42622)
- 9) South Texas Project, Units 1 and 2 - Issuance of Amendments Re: Adoption of Alternate Radiological Source Term in Assessment of Design-Basis Accident Dose Consequences (TAC Nos. MD4996 and MD4997), March 6, 2008 (ML080160013)
- 10) Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," July 2000

## ENCLOSURE 2-4

Request for Exemption from  
General Design Criterion 41

## **Request for Exemption from Certain Requirements of General Design Criterion 41**

### **1. Exemption Request**

Pursuant to 10 CFR 50.12, STPNOC is submitting this request for exemption from certain requirements of 10 CFR Part 50 Appendix A, General Design Criteria (GDC) 41.

*Criterion 41— Containment atmosphere cleanup. Systems to control fission products, hydrogen, oxygen, and other substances which may be released into the reactor containment shall be provided as necessary to reduce, consistent with the functioning of other associated systems, the concentration and quality of fission products released to the environment following postulated accidents, and to control the concentration of hydrogen or oxygen and other substances in the containment atmosphere following postulated accidents to assure that containment integrity is maintained.*

*Each system shall have suitable redundancy in components and features, and suitable interconnections, leak detection, isolation, and containment capabilities to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) its safety function can be accomplished, assuming a single failure.*

Licensees are required to demonstrate this capability while assuming the most conservative (and worst) single failure. This regulation has been interpreted as requiring the use of a bounding calculation or other deterministic method, for the purpose of addressing containment emergency sump performance as discussed in Generic Letter 2004-02 (Reference 1) and Generic Safety Issue (GSI)-191, "Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance" (Reference 2). STPNOC requests an exemption from that requirement in order to enable the use of a risk-informed method to demonstrate acceptable sump design in support of the operation of the Containment Spray System (CSS) in recirculation mode following postulated LOCAs, as required to show compliance with GDC 41. This exemption request does not apply to other structures, systems and components (SSCs) which may be required to demonstrate compliance with GDC 41.

Approval of this exemption will allow use of a risk-informed method to account for the probabilities and uncertainties associated with the containment emergency sump design in support of the operation of the CSS following postulated LOCAs. The method evaluates the effects on containment emergency sump strainer blockage resulting from debris concerns raised by GSI-191. In order to confirm acceptable sump design, the risk associated with GSI-191 is evaluated to include the failure mechanisms associated with strainer blockage affecting CSS recirculation mode.

This exemption request is in support of the accompanying License Amendment Request (LAR) (Enclosure 3) seeking NRC approval of the changes to the South Texas Project Electric Generating Station (STPEGS) Updated Final Safety Analysis Report (UFSAR), to reconstitute the licensing basis based on acceptable design of the containment sump. The risk-informed method provides assurance, with high probability, for an acceptable

sump design that complies with GDC 41 and resolves GSI-191.

## **2. Regulatory Requirements Involved**

STPNOC seeks exemption to the extent that GDC 41 requires deterministic calculations or other analyses to address the concerns raised by GSI-191 related to acceptable plant performance during the recirculation mode in containment following a LOCA. The proposed changes to the licensing basis, submitted for NRC approval with the LAR in Enclosure 3, provide closure to GSI-191 for STP Units 1 and 2 on the basis that the associated risk is shown to meet the acceptance guidelines in Regulatory Guide (RG) 1.174 (Reference 3) and that, in conjunction with the existing licensing basis, adequate safety is demonstrated.

This exemption request is for the purpose of allowing the use of a risk-informed method to demonstrate acceptable design of the containment emergency sump in support of the recirculation mode in containment following postulated loss of coolant accidents (LOCAs). The containment sump has been evaluated, using deterministic methods, to meet the current licensing basis assumptions for analyzing the effects of post-LOCA debris blockage; however, these evaluations have not been shown to fully resolve GSI-191 for the as-built, as-operated plant (Reference 4). The risk-informed method evaluates the sump design as part of the assessment of the residual risk associated with GSI-191 concerns. Based on confirmation of acceptable containment emergency sump and CSS design as determined by the resulting risk meeting the acceptance guidelines in RG 1.174, the licensing basis for CSS compliance with GDC 41 is reconstituted.

Other regulatory requirements associated with containment sumps in support of Emergency Core Cooling System (ECCS) and CSS recirculation modes following postulated LOCAs include 10 CFR 50.46(b)(5) for core cooling, GDC 35 for core cooling, and GDC 38 for containment heat removal. These requirements are addressed as part of separate exemption requests.

### **2.1 Evaluation of Impacts on 10 CFR 50.67 and GDC 19**

The impact of the proposed exemption on the licensing basis analysis for demonstrating radiological consequences of the design basis LOCA meet the radiological dose guidelines specified in 10 CFR 50.67 and the dose limits specified in GDC 19 was evaluated. The risk-informed method provides confirmation of reliable ECCS and CSS performance as required for the licensing basis analyses that demonstrate the requirements of 10 CFR 50.67 and GDC 19. The method demonstrates that sump performance continues to support reliable plant design and operation and does not entail any exemption from 10 CFR 50.67 or GDC 19.

For STP Units 1 and 2, which have implemented the Alternative Source Term (AST), the design-basis LOCA radiological consequence LOCA analysis is a deterministic evaluation based on the assumption of a major rupture of the reactor coolant system piping and the assumption of the deterministic failure of the ECCS to provide adequate core cooling (Reference 9). This scenario results in a significant amount of core damage as specified in RG 1.183 (Reference 10), and does not represent any specific accident sequence, but is representative of a class of severe damage incidents that were evaluated in the development of the RG 1.183 source term characteristics. Such a

scenario would be expected to require multiple failures of systems and equipment and lies beyond the likely incidents evaluated for design-basis transient analyses (Reference 9). Since deterministic failure of ECCS is assumed at the onset of the accident by the analysis, the reliability of the containment emergency sumps with respect to ECCS operation does not affect the analysis for dose consequences. The risk-informed method confirms reliable CSS operation as an input to the AST analysis. Therefore, for the purposes of this exemption request, the current licensing basis analyses for 10 CFR 50.67 and GDC 19 are not impacted.

## **2.2 Evaluation of Impacts on other Regulatory Requirements**

The STP risk-informed approach, as described in Enclosures 1 and 4, uses the PRA model to quantify the risk associated with GSI-191, thereby quantifying the residual risk from those issues which have not been resolved using other methods. A determination that this approach and its results meet the key principles and acceptance guidelines in RG 1.174 demonstrates acceptable sump performance in support of ECCS and CSS operation in recirculation mode following postulated LOCAs, and demonstrates that the Commission's safety goals and public health and safety are maintained.

The proposed exemption does not result in any physical changes to the facility or changes to the operation of the plant, and does not change any of the programmatic requirements. Based on demonstrating acceptable containment emergency sump and CSS design for reconstituting the current licensing basis for compliance with GDC 41 as described above, compliance with other regulatory requirements that rely on acceptable design for these systems and components continue to be met in the current licensing basis.

## **3. Basis for the Exemption Request**

Under § 50.12, a licensee may request and the NRC may grant exemptions from the requirements of 10 CFR Part 50 which are authorized by law, will not present an undue risk to the public health and safety, are consistent with the common defense and security, and when special circumstances are present.

### **3.1 Justification for the Exemption Request**

As required by 50.12(a)(2), the Commission will not consider granting an exemption unless special circumstances are present. Special circumstances are present whenever one of the listed items (i) through (vi) under 50.12(a)(2) are applicable. STPNOC has evaluated the proposed exemption against the conditions specified in 10 CFR 50.12(a) and determined that this proposed exemption meets the requirements for granting an exemption from the regulation, and that special circumstances are present. The information supporting the determination is provided below.

Pursuant to 10 CFR 50.12, "Specific exemptions," the NRC may grant exemptions from the requirements of this part provided the following three conditions are met as required by 50.12(a)(1):

*The exemption is authorized by law.*



The NRC has authority under the Atomic Energy Act of 1954, as amended, to grant exemptions from its regulations if doing so would not violate the requirements of law. This exemption is authorized by law as is provided by 10 CFR 50.12 which provides the NRC authority to grant exemptions from Part 50 requirements with provision of proper justification. Approval of the exemption would not conflict with any provisions of the Atomic Energy Act of 1954, as amended, the Commission's regulations, or any other law

*The exemption does not present an undue risk to the public health and safety.*

The proposed change is to apply a risk-informed method rather than a traditional deterministic method in order to quantify the residual risk associated with GSI-191 and to establish a high confidence of acceptable containment sump design. The purpose of GDC 41 is to establish acceptable design for the containment atmospheric cleanup system, which includes the CSS, to provide a high probability that the systems will perform the required functions. The proposed exemption does not involve any modifications to the plant that could introduce a new accident precursor or affect the probability of postulated accidents, and therefore the probability of postulated initiating events is not increased. The PRA and engineering analysis demonstrate that the calculated risk is small and consistent with the intent of the Commission's Safety Goal Policy Statement, which defines an acceptable level of risk that is a small fraction of other risks to which the public is exposed.

As discussed in previous § 50.46 rulemaking (Reference 7), the probability of a large break LOCA is sufficiently low that the application of a risk-informed approach to evaluate the ability of the ECCS to meet § 50.46(b)(5) with high probability and with low uncertainty, rather than using a calculational model using deterministic methods to achieve similar understanding, would have little effect on public risk. This is applicable to evaluating acceptable containment sump design in support of ECCS and CSS recirculation modes.

The risk-informed approach involves a complete evaluation of the spectrum of LOCA breaks, including double-ended guillotine break, up to and including the largest pipe in the reactor coolant system (see Enclosure 4-3, Volume 3 Section 5.3). The risk-informed approach analyzes LOCAs, regardless of break size, using the same methods, assumptions, and criteria in order to quantify the uncertainties and overall risk metrics. This ensures that large break LOCAs with relatively small contribution to CDF due to the low probability of such a break as well as smaller break LOCAs with higher probabilities of occurrence are considered in the results. Since the design basis requirement for consideration of a double-ended guillotine break of the largest pipe in the reactor coolant system is retained and since no physical changes to the facility or changes to the operation of the facility are being made, the existing defense-in-depth and safety margin established for the design of the facility is not reduced.

*The exemption is consistent with the common defense and security.*

The exemption involves a change to the licensing basis for the plant that has no relation to the possession of licensed material or any security requirements that apply to STP Units 1 and 2. Therefore the exemption is consistent with the common defense and security.

### 3.2 Special Circumstances

This section discusses the presence of special circumstances as related to 10 CFR 50.12(a). 10 CFR 50.12(a)(2) states that NRC will not consider granting an exemption to the regulations unless special circumstances are present. Special circumstances are present whenever one of the listed items (i) through (vi) under § 50.12(a)(2) are applicable.

Such special circumstances are present in this instance to warrant exemption from the implicit requirement in GDC 41 to use a deterministic method to evaluate for acceptable containment emergency sump design. Approval of the exemption request would allow use of a risk-informed method to reconstitute the design basis for acceptable containment sump design in support of CSS design for compliance with GDC 41.

Specifically, § 50.12(a)(2)(ii) applies:

*Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule.*

The intent of GDC 41 is to ensure systems in the plant design to control fission products, hydrogen, oxygen, and other substances which may be released into the reactor containment shall be provided as necessary to reduce, consistent with the functioning of other associated systems, the concentration and quality of fission products released to the environment following postulated accidents, and to control the concentration of hydrogen or oxygen and other substances in the containment atmosphere following postulated accidents to assure that containment integrity is maintained. This exemption request is consistent with that purpose in that use of the proposed risk-informed approach demonstrates a high probability of successful containment emergency sump and CSS performance, which includes realistically available recirculation flow, based on the risk results meeting the acceptance guidelines of RG 1.174. The risk-informed approach assesses the design for a full spectrum of breaks, and assesses equipment failures that include loss of offsite power and worst case single failure, consistent with the GDC 41 requirements.

Since the proposed exemption does not involve any physical changes to the plant, there is no affect on the GDC 41 design requirements for redundancy in components and features, interconnections, leak detection, isolation, and containment capabilities. The current licensing basis evaluations for CSS compliance with GDC 41 for these aspects continue to be met.

As discussed in the *Commission's Policy Statement on "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities"* (Reference 8), NRC regulations and their implementation are generally based on deterministic approaches that consider a set of challenges to safety and determine how those challenges should be mitigated. This request does not seek exemption from any explicit language in the regulatory requirements. Rather, the need is based on the implicit requirements in the regulations for using deterministic methods to demonstrate acceptable design. Regulatory requirements are largely based on a deterministic framework, and are established for design basis accidents, such as the LOCA, with specific acceptance criteria that must be

satisfied. Licensed facilities must be provided with safety systems capable of preventing and mitigating the consequences of design basis accidents to protect public health and safety. The deterministic regulatory requirements were designed to ensure that these systems are highly reliable. The LOCA analysis and the General Design Criteria (GDC) were established as part of this deterministic regulatory framework.

In comparison, the risk-informed approach considers nuclear safety in a more comprehensive way by examining the likelihood of a broad spectrum of initiating events and potential challenges, considering a wide range of credible events and assessing the risk based on mitigating system reliability.

An objective of GDC 41 is to maintain low risk to the public health and safety through a reliable CSS, as supported by the containment sump. The supporting analysis demonstrates that a risk-informed approach to sump performance is consistent with the Commission's Safety Goals for nuclear power plants, and supports CSS operation with a high degree of reliability. Consequently, the special circumstances described in § 50.12(a)(2)(ii) apply.

Specifically, § 50.12(a)(2)(iii) applies:

*Compliance would result in undue hardship or other costs that are significantly in excess of those contemplated when the regulation was adopted, or that are significantly in excess of those incurred by others similarly situated.*

In order to meet a deterministic threshold value for containment debris loading, the amount of debris generating contributors in the STP plant design would need to be significantly reduced. Estimates of radiological exposure for insulation modifications are significant and on the order of hundreds of person-Rem, depending on the scope of the modifications.

With respect to the presence of such special circumstances, dose estimates for removal of insulation from STP Units 1 and 2 are described below. These dose estimates are for additional modifications to insulation in containment that would be required to achieve full resolution of GSI-191 using the previous deterministic methods. The residual risk associated with GSI-191 concerns bounds the expected improvement to overall plant risk that could be achieved by implementing these modifications.

#### Dose Considerations: STP Units 1 and 2 Plant Dose Estimates for GSI-191 Insulation Removal

STPNOC estimated the occupational dose for STP Units 1 and 2 that would be expected to be expended if plant modifications were undertaken for GSI-191, including insulation replacement and other modifications. The scope of the estimate included the replacement of fiberglass insulation with reflective metal insulation (RMI) for reactor coolant pump (RCP) insulation and a portion of the steam generator (SG) insulation, and the banding of existing fiberglass insulation on piping in containment. SG insulation replacement considered whether locations were within the zone of influence (ZOI) or beyond, with ZOI extending to seventeen times the diameter of the piping (17D).

The total dose expected to be expended for STP Units 1 and 2 in support of insulation replacement for GSI-191 is estimated to be 158 to 176 rem.

STP experience with this type of work suggests the lower expected dose estimates may be appropriate. However, bounding dose estimates based on the estimated installation hours including scaffold work and the average dose rates STP has historically experienced working within the bioshield are also provided below.

Insulation modifications, summary estimates:

Activities	Estimated Man-Hours	Estimated Dose per Unit (Expected)	Estimated Dose per Unit (Bounding)
Replace SG and RCP insulation with RMI	35,000	70 Rem	315 Rem
Install bands on insulated piping	9,000	9 to 18 Rem	81 Rem

Pipe insulation banding scope:

Piping Size (inches)	Insulation Thickness (inches)	Estimated Length (lineal feet)
31	3.5	120
29	4	68
27.5	3.5	76
16	4	160
12	2.5	430
8	2.5	168
6	2.5	94
4	2.5	592
2	2.5	228

SG fiberglass insulation replacement scope:

SG section	Volume per SG (cubic feet)	Total Volume – Four SGs (cubic feet)
Bottom end (<17D)	85	340
EI 37' to EI 52' (<17D)	197	788
EI 52' to EI 68' (<17D)	214	856
EI 68' to transition (<17D)	17	68
SG transition (<17D)	134	536
Transition to EI 83' (<17D)	53	212
Above EI 83' (>17D)	305	1220
Top end (>17D)	150	600
Total within ZOI (<17D)	700	2800
Total beyond ZOI (>17D)	455	1820

RCP insulation replacement scope:

- All RCP fiberglass insulation (thickness 3.5 inches) to be replaced with RMI
- Fiberglass insulation volume per RCP: 56 cubic feet
- Total fiberglass insulation volume (4 RCPs): 224 cubic feet per Unit (448 cubic feet total)

For the above estimates, the highest dose contributor is personnel work hours in close proximity to high dose sources such as steam generators and primary coolant piping. The estimates did not include any replacement of reactor pressure vessel (RPV) insulation, which is RMI as originally designed for STP, therefore while the estimates may be indicative of a plant with high fiber loading, they do not necessarily account for activities that may be required for similar plants assuming 100-percent replacement of fibrous insulation in all areas that could be affected by a postulated LOCA. The dose estimates for STP Units 1 and 2, in addition to the actual insulation replacement, considered man-hours required to erect and remove scaffolding to support the insulation modifications and the dose associated with removal of insulation. The estimates did not consider dose associated with disposal of removed insulation or dose associated with potential hanger modifications for small bore piping insulation change to RMI.

The dose considerations discussed above demonstrate that compliance would result in substantial personnel exposure due to insulation modifications in the containment which is not commensurate with the expected safety benefit based on the results showing that the risk associated with GSI-191 concerns is less than the threshold for Region III in RG 1.174. Consequently, the special circumstances described in § 50.12(a)(2)(iii) apply.

In conclusion, special circumstances in § 50.12(a)(2)(ii) and § 50.12(a)(2)(iii) are present as required by § 50.12(a)(2) for consideration of the request for exemption.

#### **4. Technical Justification for the Exemption**

The supporting information that describes the STP risk-informed approach is provided in the enclosures to this letter. The generic methodology for the risk-informed method is described in Enclosure 1. Technical justification for the risk-informed method is provided in Enclosures 4-1 through 4-3, and in the LAR (Enclosure 3), which includes descriptions of the CSS and containment emergency sump designs and performance criteria.

The proposed risk-informed approach meets the key principles in RG 1.174 in that it is consistent with the defense-in-depth philosophy, maintains sufficient safety margins, results in small increase in risk, and is monitored using performance measurement strategies. Detailed descriptions of the PRA and supporting engineering analyses are provided in Enclosures 4-2 and 4-3 to this letter. This proposed exemption to allow use of the risk-informed method is consistent with the key principle in RG 1.174 that requires the proposed change to meet current regulations unless explicated related to a requested exemption.

The results show that the risk associated with GSI-191 concerns is less than the threshold in Region III, "Very Small Changes," of RG 1.174, and therefore are consistent with the Commission's Safety Goals for public health and safety.

## 5. Environmental Consideration

Pursuant to the requirements of § 51.41 and § 51.21, "Criteria for and identification of licensing and regulatory actions requiring environmental assessments," the following information is provided. As demonstrated below, this exemption qualifies for a categorical exclusion in 10 CFR 51.22. However, if the NRC determines that an environmental assessment is necessary, this information will support a finding of no significant impact.

### Identification of the Proposed Action

The proposed exemption is to allow for use of a risk-informed approach to evaluate the residual risk associated with GSI-191, i.e. those concerns that have not been fully addressed using deterministic methods, for the purpose of reconstituting the design basis for acceptable performance of the containment emergency sumps during recirculation mode following postulated LOCAs. Approval of the proposed exemption would allow for approval of a change to the UFSAR, as provided in Enclosure 3 to this letter, for implementation of the risk-informed method for STP Units 1 and 2.

### Need for the Proposed Action

In the Commission's Policy Statement on "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities" (Reference 8), the Commission stated that *"the use of PRA technology in NRC regulatory activities should be increased to the extent supported by the state-of-the-art in PRA methods and data and in a manner that complements the NRC's deterministic approach"* and that is consistent with traditional defense-in-depth concepts.

The intent of the Commission's Policy Statement intent is to use the PRA to further understand the risk associated with a proposed change for the purpose of removing unnecessary conservatism associated with regulatory requirements in order to focus attention and allocation of resources to areas of true safety significance.

To implement the Commission Policy Statement, the NRC issued RG 1.174 to provide guidance on an acceptable approach to risk-informed decision-making, based on a set of five key principles. The proposed action is needed to allow STPNOC to use a risk-informed method to resolve the issues associated with GSI-191 concerns regarding the potential for insulation and other debris generated in the event of a postulated LOCA within the containment impacting acceptable recirculation operation for the CSS, and challenge its ability to provide adequate containment atmosphere cleanup. This proposed exemption is consistent with the key principle in RG 1.174 which requires the proposed change to meet current regulations unless explicated related to a requested exemption.

### Environmental Impacts Consideration

The proposed exemption has been evaluated and determined to result in no significant radiological environmental impacts associated with the implementation of the change. This conclusion is based on the following.

The proposed exemption is to allow a risk-informed method for demonstrating the design and licensing bases for the CSS. No physical modifications or changes to operating requirements are proposed for the site or facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. The intent of the proposed change is to quantify the risk associated with GSI-191 concerns. This quantification, provided in the form of risk metrics using the guidance in RG 1.174, demonstrates that the risk is less than the threshold for Region III, "Very Small Changes," in RG 1.174. Therefore, the proposed exemption supports a change that represents a very small change in Large Early Release Frequency (LERF) that corresponds to an insignificant impact on the environment.

Based on the results of the risk-informed method demonstrating that the increases in risk are very small, the proposed exemption has a negligible effect on accident probability, and adequate assurance of public health and safety is maintained. The proposed exemption does not involve any changes to the facility or facility operations that could create a new or significantly affect a previously analyzed accident or release path, and therefore would result in no significant changes in the types or quantities of radiological effluents that may be released offsite. The proposed change does not affect the generation of any radioactive effluents, and does not affect any of the permitted effluent release paths.

The proposed exemption has no impact on requirements related to the integrity of the reactor coolant system piping or any other aspect related to the initiation of a LOCA. No physical modifications or changes to operating requirements are proposed for the facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. Therefore, the proposed exemption does not affect the probability of an accident initiator.

The proposed exemption does not significantly impact a release of radiological effluents during and following a postulated LOCA. The design-basis LOCA radiological consequence analysis in the current licensing basis is a deterministic evaluation based on the assumption of a major rupture of the reactor coolant system piping and a significant amount of core damage as specified in RG 1.183 (Reference 9). The current licensing basis analysis shows the resulting doses to the public and to control room and technical support center personnel do not exceed the regulatory limits. The proposed change validates and does not change the input parameter value used in the radiological analysis. Therefore, the proposed exemption does not affect the amount of radiation exposure resulting from a postulated LOCA.

The proposed exemption does not involve any changes to the site property, physical changes to the facility, or changes to the operation of the facility. Therefore there are no irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented. The risk-informed method requires a determination that the risk associated with the proposed change meets the Commission's safety goals. Therefore the proposed action would not result in a significant increase in any radiological hazard beyond those events previously analyzed in the UFSAR. There will be no change to radioactive effluents that affect radiation exposures to plant workers and members of the public. Therefore, no significant changes or different types of radiological impacts are expected as a result of the

proposed action. The proposed exemption does not change the input parameter value used in the radiological analysis. Therefore, the proposed change would not significantly increase the probability or consequences of an accident, and there will be no significant offsite impact to the public from approval of the proposed exemption.

No physical modifications or changes to operating requirements are proposed for the facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. Therefore, the proposed exemption does not result in a significant increase in individual or cumulative occupational radiation exposure, and will not cause radiological exposure in excess of the dose criteria for restricted and unrestricted access specified in 10 CFR Part 20.

The proposed exemption does not involve any changes to non-radiological plant effluents or any activities that would adversely affect the environment. The proposed exemption does not affect any procedures used to operate the facility, or any physical characteristics of the facility, system, structure and components. The proposed change only pertains to the licensing basis for components located within the restricted area of the facility, to which access is limited to authorized personnel. Therefore the proposed exemption would not create any significant non-radiological impacts on the environment in the vicinity of the plant.

Since implementation of the exemption request, if approved, would result in no physical changes to the facility, there is no possibility of irreversible or irretrievable commitments of resources. Similarly, the proposed exemption does not involve the use of any resources not previously considered by the NRC in its past environmental statements for issuance of the facility operating licenses or other licensing actions for the facility. As a result, the proposed exemption does not involve any unresolved conflicts concerning alternative uses of available resources.

### Alternatives

The alternative to this exemption is compliance with the existing provisions in GDC 41. Compliance with GDC 41 would entail removal and disposal of significant amounts of insulation and installation of new insulation less likely to impact sump performance in the event of a LOCA. As discussed below, the alternative would not be environmentally preferable or cost justified.

The exemption entails a very small risk and, correspondingly, a very small environmental impact. In particular, the change in LERF is  $\sim 1.40\text{E-}11/\text{yr}$ . This change is so small that it is remote and speculative for environmental purposes.

Removal and reinstallation of insulation would entail appreciable radiation exposures to workers (estimated from 158 to 176 rem). This option results in extensive modifications to the facility and significant occupational dose. As such, the alternative is not environmentally preferable. Additionally, the cost of the installation replacement would be approximately \$55 million. This cost is not justified in light of the very small risk associated with the risk-informed exemption.



### Categorical Exclusion Consideration

STPNOC has evaluated the proposed exemption against the criteria for identification of licensing and regulatory actions requiring environmental assessments in accordance with § 51.21 and determined that the proposed exemption meets the criteria and is eligible for categorical exclusion as set forth in 10 CFR 51.22, "Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review," paragraph (c)(9).

This determination is based on the fact that this exemption request is from requirements under Part 50 with respect to the installation or use of a facility component located within the restricted area, as defined in Part 20, specifically to authorize a change to the licensing basis for the CSS as it relates to acceptable containment sump performance in recirculation mode following a postulated LOCA. The proposed amendment has been evaluated to meet the following criteria under § 51.22(c)(9).

(i) *The exemption involves no significant hazards consideration.*

An evaluation of the three criteria set forth in 10 CFR 50.92(c) as applied to the exemption is provided below. The evaluation is consistent with the no significant hazards consideration determination provided in Enclosure 3 in support of the LAR.

(1) *The proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.*

Approval of the proposed exemption and accompanying license amendment request would allow the results of a risk-informed evaluation to be included in the UFSAR that concludes the ECCS and CSS will operate with a high probability following a LOCA when considering the impacts and effects of debris accumulation on containment emergency sump strainers in recirculation mode, as well as core flow blockage due to in-vessel effects, following loss of coolant accidents (LOCAs).

The proposed change does not implement any physical changes to the facility or any SSCs, and does not implement any changes in plant operation. The proposed change confirms that required SSCs supported by the containment sumps will perform their safety functions as required, and does not alter or prevent the ability of SSCs to perform their intended function to mitigate the consequences of an accident previously evaluated within the acceptance limits. The safety analysis acceptance criteria in the UFSAR continue to be met for the proposed change. The proposed change does not affect initiating events. The proposed change does not significantly affect the operation of the containment systems needs to ensure that there is a large margin between the temperature and pressure conditions reached in the containment and those that would lead to failure so that there is a high degree of confidence that damage of the containment cannot occur.

The calculated risk associated with the proposed change is very small and less than the threshold for Region III as defined by RG 1.174, for both CDF and LERF. Therefore, the proposed change does not involve a significant increase

in the probability or consequences of any the accident previously evaluated in the UFSAR.

- (2) *The proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.*

The proposed change neither installs nor removes any plant equipment, nor alters the design, physical configuration, or mode of operation of any plant structure, system or component. The proposed change does not introduce any new failure mechanisms or malfunctions that can initiate an accident. The proposed change does not introduce failure modes, accident initiators, or equipment malfunctions that would cause a new or different kind of accident. Therefore, the proposed change does not create the possibility for a new or different kind of accident from any accident previously evaluated.

- (3) *The proposed change does not involve a significant reduction in a margin of safety.*

The proposed change does not involve a change in any functional requirements, the configuration, or method of performing functions of plant SSCs. The effects from a full spectrum of LOCAs, including double-ended guillotine breaks for all piping sizes up to and including the largest pipe in the reactor coolant system, are analyzed. Appropriate redundancy and consideration of loss of offsite power and worst case single failure are retained, such that defense-in-depth is maintained.

The risk-informed method demonstrates the containment sumps will continue to support the ability of safety related components to perform their design functions. The proposed change does not alter the manner in which safety limits are determined or acceptance criteria associated with a safety limit. The proposed change does not implement any changes to plant operation, and does not significantly affect SSCs that respond to safely shutdown the plant and to maintain the plant in a safe shutdown condition. The proposed change does not significantly affect the existing safety margins in the barriers for the release of radioactivity. There are no changes to any of the safety analyses in the UFSAR. Therefore, the proposed change does not involve a significant reduction in a margin of safety.

- (ii) *The exemption involves no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.*

No physical modifications or changes to operating requirements are proposed for the facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. Approval of the exemption requires the calculated risk associated with GSI-191 to meet the acceptance guidelines in RG 1.174, thereby maintaining public health and safety. Therefore there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.

- (iii) *The proposed exemption involves no significant increase in individual or cumulative occupational radiation exposure.*

No physical modifications or changes to operating requirements are proposed for the facility, including any systems, structures and components relied upon to mitigate the consequences of a LOCA. Therefore, with respect to installation or use of a facility component located within the restricted area there is no significant increase in individual or cumulative occupational radiation exposure as a result of granting the exemption request.

Based on the above, STPNOC concludes that the proposed exemption meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Additional technical justification for this conclusion is provided on the basis that the guidance and acceptance criteria provided in RG 1.174 are satisfied as described in Enclosure 4-1.

## **6. Conclusion**

Approval of an exemption to allow the use of the risk-informed approach is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security as required by § 50.12(a)(1). Furthermore, special circumstances required by § 50.12(a)(2) are present for item § 50.12(a)(2)(ii) in that application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule.

Based on the determination that the risk of the exemption meets the acceptance guidelines of RG 1.174, the results demonstrate there is reasonable assurance that the CSS will function in the recirculation mode and that the public health and safety will be protected.

## **7. Implementation**

To support the completion of work and the resolution schedule for closure of GSI-191 as described in SECY-12-0093, STPNOC requests that this exemption request be approved for implementation by June 2015.

## **8. References**

- 1) Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," September 13, 2004 (ML042360586)
- 2) Generic Safety Issue (GSI)-191, "Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance"
- 3) Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 2 (ML100910006)

- 4) "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment Nos. 183 and 170 to Facility Operating License Nos. NPF-76 and NPF-80 STP Nuclear Operating Company, et al., South Texas Project, Units 1 and 2, Docket Nos. 50-498 and 50-499," March 25, 2008 (ML080360321)
- 5) GSI-191 Safety Evaluation Report, Rev. 0, "Evaluation of NEI Guidance on PWR Sump Performance," December 6, 2004 (ML043280007)
- 6) NEI 04-07, "Pressurized Water Reactor Sump Performance Evaluation Methodology," Volume 1 "Pressurized Water Reactor Sump Performance Evaluation Methodology," Revision 0, December 2004 (ML050550138)
- 7) Federal Register Notice, Vol. 53, No. 180 (53 FR 35996), Emergency Core Cooling Systems; Revisions to Acceptance Criteria, September 16, 1988
- 8) Commission's Policy Statement on "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities," August 16, 1995 (60 FR 42622)
- 9) South Texas Project, Units 1 and 2 - Issuance of Amendments Re: Adoption of Alternate Radiological Source Term in Assessment of Design-Basis Accident Dose Consequences (TAC Nos. MD4996 and MD4997), March 6, 2008 (ML080160013)
- 10) Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," July 2000