Nuclear Operating Company

South Texas Project Nuclear Operating Company P.O. Box 289 Wadsworth, Texas 77483

August 31, 2005
NOC-AE-05001922
10CFR50.54(f)

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

South Texas Project
Units 1 and 2
Docket Nos. STN 50-498 and STN 50-499
Supplement 1 to the Response to Generic Letter 2004-02
(TAC Nos. MC4719 and MC4720)

References: 1. NRC Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors," dated September 13, 2004 (ML042360586)

2. Letter, T. J. Jordan to Document Control Desk, "90-Day Response to Generic Letter 2004-02: Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors," dated March 8, 2005 (NOC-AE-05001862, ML050770105)

Reference 1 requested that addressees perform a mechanistic evaluation of the potential for the adverse effects of post-accident debris blockage and operation with debris-laden fluids to impede or prevent the recirculation functions of the emergency core cooling systems and containment spray systems. The NRC requested that, within 90 days of the date of the NRC safety evaluation report providing the guidance for performing the evaluation, addressees provide information regarding their planned actions and schedule to complete the evaluation. The 90-day response for STP Nuclear Operating Company (STPNOC) was provided in Reference 2.

The Generic Letter also requested that, by September 1, 2005, addressees provide confirmation that recirculation functions are or will be in compliance with applicable regulatory requirements, a description of, and schedule for, associated plant modifications, a description of the methodology used to perform the evaluation, the results of the evaluation with respect to specific attributes, a schedule for any associated changes to the plant licensing basis, and a description of any associated programmatic controls. Attachment 1 to this letter provides STPNOC's supplemental response to Generic Letter 2004-02. Attachment 2 contains the current List of Exceptions from the approved methodology with justification for the exceptions.

The only commitments in this letter are summarized in Attachment 3.

A116

STI: 31911993

If there are any questions regarding this response, please contact Scott Head at (361) 972-7136 or me at (361) 972-7902.

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

Executed on August 31, 2005

T. J. Jordan
Vice President, Engineering

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Attachments:

1. Supplement 1 to the Response to Generic Letter 2004-02
2. List of Exceptions
3. List of Commitments

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Attachment 1
Supplement 1 to the Response to Generic Letter 2004-02

2. Addressees are requested to provide the following information no later than September 1, 2005:

2.(a) Confirmation that the ECCS and CSS recirculation functions under debris loading conditions are or will be in compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of this generic letter. This submittal should address the configuration of the plant that will exist once all modifications required for regulatory compliance have been made and this licensing basis has been updated to reflect the results of the analysis described above.

STP Response

STP Nuclear Operating Company (STPNOC) has prepared an evaluation to show that the ECCS and CSS recirculation functions will be in compliance with the regulatory requirements listed for this generic letter. The evaluation demonstrated that modifications are needed. STPNOC will implement these modifications to meet the required schedule as discussed below for Item 2.(b). The design basis and licensing basis for the plant will be updated to reflect the corresponding changes due to the new regulatory requirements.

For the sump performance evaluation, STPNOC joined with other plants in the Strategic Teaming and Resource Sharing (STARS)/ Utilities Service Alliance (USA) group to engage a contractor team headed by Westinghouse Electric Co. along with Alion Science and Technology and Enercon Services Inc. Sump evaluation activities include the following:

- Containment walkdowns
- Debris generation and transport analysis
- Calculation of required and available net positive suction head (NPSH)
- Screen requirements
- Screen structural analyses
- Potential or planned design/operational/procedural modifications
- Downstream effects evaluation
- Upstream effects evaluation
- Chemical effects evaluation

STPNOC also joined with other plants in the STARS/USA group to contract with Performance Contracting Inc. (PCI) to provide an advanced design sump strainer for each respective plant. The new sump strainer will replace the present sump screens for STP. Laboratory testing will be performed by PCI (Alden Research Laboratory is proposed as the sub-contractor for this testing) to demonstrate acceptability of the new sump strainer design.

2.(b) ***A general description of and implementation schedule for all corrective actions, including any plant modifications, that you identified while responding to this generic letter. Efforts to implement the identified actions should be initiated no later than the first refueling outage starting after April 1, 2006. All actions should be completed by December 31, 2007. Provide justification for not implementing the identified actions during the first refueling outage starting after April 1, 2006. If all corrective actions will not be completed by December 31, 2007, describe how the regulatory requirements discussed in the Applicable Regulatory Requirements section will be met until the corrective actions are completed.***

STP Response

STPNOC will be in full compliance with the regulatory requirements discussed in the applicable regulatory requirements section of GNL 2004-02 by December 31, 2007. This includes the full implementation of all plant modifications and required corrective actions.

The baseline sump performance evaluation demonstrated that corrective actions are needed. Further analysis (refinements) and testing will be performed to better define the plant modifications. The description and schedule for the analysis, testing, and modifications are given below.

A three-dimensional computational fluid dynamics (CFD) analysis for debris transport is currently under preparation. The completion is scheduled to support the final design of the new sump strainer. This will better define the debris loading on the sump strainers and also determine the need to install any debris interceptors.

A revision to the sump water level calculation is currently under preparation. The completion is scheduled to support the CFD analysis described above. The revision will address the items identified in the upstream effects evaluation that was prepared by Enercon.

A latent debris walkdown inside the Unit 2 containment is scheduled for the upcoming Fall 2005 refueling outage. This will validate the conservative assumptions used for latent debris in the debris generation analysis.

The design for the new sump strainers will be validated by testing. The test goals are to demonstrate that the thin-bed effect is not a concern and that the head loss due to the STP plant-specific debris loading is acceptable.

A coatings test will be conducted by Westinghouse to demonstrate that the zone of influence (ZOI) for coatings may be defined using a radius of 5D (5 times the diameter of the break pipe). This result is planned to be used to reduce the debris loading on the sump and to demonstrate margin for the new sump strainer design. The testing is planned to be completed by the second quarter of 2006.

The following plant modifications are scheduled to be implemented in Unit 1 during the Fall 2006 refueling outage and in Unit 2 during the Spring 2007 refueling outage:

- Remove existing sump screens from each of the three emergency sumps.
- The vortex breakers will remain in place.
- Install new emergency sump strainer modules by bolting the support frame to the floor. Modules are bolted to the frame.
- Strainers are made of stainless steel with no gaskets or elastomers.

STPNOC will provide an update to this response upon completion of pending analyses and testing.

2.(c) ***A description of the methodology that was used to perform the analysis of the susceptibility of the ECCS and CSS recirculation functions to the adverse effects of post-accident debris blockage and operation with debris-laden fluids. The submittal may reference a guidance document (e.g., Regulatory Guide 1.82, Rev. 3, industry guidance) or other methodology previously submitted to the NRC. (The submittal may also reference the response to Item 1 of the Requested Information described above. The documents to be submitted or referenced should include the results of any supporting containment walkdown surveillance performed to identify potential debris sources and other pertinent containment characteristics.)***

STP Response

The methodology used to perform the analysis of the susceptibility of the ECCS and CSS recirculation functions to the adverse effects of post-accident debris blockage and operation with debris-laden fluids was in accordance with Nuclear Energy Institute report NEI 04-07 (Reference 1) and the NRC Safety Evaluation Report (SER) (Reference 2). In addition, the downstream effects evaluation also utilized the methodology and information given in WCAP-16406 (Reference 3).

To support the sump performance evaluation, STPNOC performed containment walkdowns using the guidance of NEI 02-01 (Reference 4).

The STP analysis did take exception to certain items in the industry guidance and in the SER. The list of exceptions is included in Attachment 2, which also includes justification for the exceptions.

2.(d) The submittal should include, at a minimum, the following information:

2.(d)(i) The minimum available NPSH margin for the ECCS and CSS pumps with an unblocked sump screen.

STPNOC Response

PCI is the supplier of the new sump strainers for STP. PCI will calculate a clean strainer head loss as part of the strainer design, which will be validated by testing. The available NPSH margin for the clean strainer is expected to be similar to the following margins currently reported in the UFSAR:

Pump	NPSH Required (ft)	NPSH Available for recirculation (ft)
Low Head Safety Injection	16.5	>20
High Head Safety Injection	16.1	>20
Containment Spray	16.4	>20

2.(d)(ii) The submerged area of the sump screen at this time and the percent of submergence of the sump screen (i.e., partial or full) at the time of the switchover to sump recirculation.

STPNOC Response

The current design for the new sump strainer is based on a fully submerged strainer at the time of switchover to sump recirculation and on an area of approximately 1,786 ft^2 per sump.

2.(d)(iii) The maximum head loss postulated from debris accumulation on the submerged sump screen, and a description of the primary constituents of the debris bed that result in this head loss. In addition to debris generated by jet forces from the pipe rupture, debris created by the resulting containment environment (thermal and chemical) and CSS washdown should be considered in the analyses. Examples of this type of debris are disbonded coatings in the form of chips and particulates and chemical precipitants caused by chemical reactions in the pool.

STPNOC Response

The maximum head loss on the new sump strainer will be determined during the detailed strainer design by PCI and validated by testing. The current margins for NPSH available given in the UFSAR are expected to be maintained.

The primary constituents of the debris bed for the maximum head loss were determined in the Alion debris generation analysis. The worst case head loss was for the case of a postulated hot leg break near the steam generator (Case 1). The debris loading consisted of:

Case 1 – Current Debris Loading
LBLOCA Debris Source Term

Debris Type	Debris Quantity	Debris Transport Fraction (DTF)	Quantity At Sump
Insulation			
NUKON®	985.1 ft^3	60%	591.1 ft^3
Thermal-Wrap	1,400.0 ft^3	60%	840.0 ft^3
Microtherm	1.8 ft^3	99%	1.8 ft^3/27.0 lbm
Qualified Coatings in ZOI			
Epoxy (10D)	2,938 lbm	100%	2,938 lbm (31.3 ft^3)
IOZ (10D)	2,615 lbm	100%	2,615 lbm (5.7 ft^3)
Polyamide Primer (10D)	21 lbm	100%	21 lbm (0.2 ft^3)
Unqualified Coatings			
Epoxy	1,815 lbm	100%	1,815 lbm (19.3 ft^3)
Alkyds	310 lbm	100%	310 lbm (3.2 ft^3)
IOZ	884 lbm	100%	884 lbm (1.9 ft^3)
Baked Enamel	269 lbm	100%	269 lbm (2.7 ft^3)
Latent Debris			
Latent Fiber	30 lbm	100%	30 lbm/12.5 ft^3
Dust & Dirt	170 lbm	100%	170 lbm
Tags, Signs and Stickers	100 ft^2	75%	75 ft^2

Alion also performed a baseline transport analysis and a head loss calculation using the flat screen methodology. The head loss for the new sump strainer will be calculated later using the results of the laboratory testing.

The postulated hot leg break at the reactor vessel nozzle (Case 2) generated the following debris loading that resulted in the next worst case head loss:

Case 2 – Current Debris Loading
LBLOCA Debris Source Term

Debris Type	Debris Quantity	Debris Transport Fraction (DTF)	Quantity At Sump
Insulation			
RMI	24,453 ft^2	56%	13,694 ft^2
NUKON®	424.9 ft^3	60%	254.9 ft^3
Thermal-Wrap	85.1 ft^3	60%	51.1 ft^3
Marinite	15.2 ft^3	99%	15.1 ft^3/219.0 lbm
Qualified Coatings in ZOI			
Epoxy (10D)	2,938 lbm	100%	2,938 lbm (31.3 ft^3)
IOZ (10D)	2,615 lbm	100%	2,615 lbm (5.7 ft^3)
Polyamide Primer (10D)	21 lbm	100%	21 lbm (0.2 ft^3)
Unqualified Coatings			
Epoxy	1,815 lbm	100%	1,815 lbm (19.3 ft^3)
Alkyds	310 lbm	100%	310 lbm (3.2 ft^3)
IOZ	884 lbm	100%	884 lbm (1.9 ft^3)
Baked Enamel	269 lbm	100%	269 lbm (2.7 ft^3)
Latent Debris			
Latent Fiber	30 lbm	100%	30 lbm/12.5 ft^3
Dust & Dirt	170 lbm	100%	170 lbm
Tags, Signs and Stickers	100 ft^2	75%	75 ft^2

In a collaborative effort, the NRC and the nuclear industry developed an integrated chemical effects test (ICET) program. The testing characterizes chemical reaction products, including possible gelatinous materials, which may develop in a representative plant post-LOCA PWR environment. ICET Test Run 2 has been evaluated to be representative of the STP post-accident chemistry. The chemistry effects on head loss are presented in terms of "bump-up" factors, or multipliers on the head loss calculated for a debris bed and sump screen. Using preliminary data from ICET Test Run 2, "bump-up" factors applicable to STP have been evaluated.

The "bump-up" factors were evaluated using a conservative approach. However, as the data used to evaluate them is preliminary, these "bump-up" factors are also considered preliminary and are subject to change when the complete set of ICET test data becomes available.

STPNOC will require that PCI account for chemistry effects in the strainer design. PCI and other industry sump screen vendors plan to evaluate the chemistry products generated from the ICET test runs. This effort is planned to support the final design of the new sump strainer.

2.(d)(iv) The basis for concluding that the water inventory required to ensure adequate ECCS or CSS recirculation would not be held up or diverted by debris blockage at choke-points in containment recirculation sump return flowpaths.

STPNOC Response

An upstream effects evaluation has been performed by Enercon. The evaluation concluded that there were potential flow blockage areas, but that there were alternate paths available if blockage occurred. The upstream effects evaluation also identified certain areas and equipment that may act as water inventory retention points. These items will be addressed in the revision to the water level calculation that supports the CFD analysis as described in Section 2.(b). The CFD analysis will also evaluate potential choke points and verify adequate flow paths.

The water level calculation and the CFD analysis will provide the basis for concluding that the water inventory required to ensure ECCS recirculation will not be held up or diverted by debris blockage at choke points in containment recirculation sump return flowpaths. The results of these analyses will be provided in a supplemental response.

2.(d)(v) The basis for concluding that inadequate core or containment cooling would not result due to debris blockage at flow restrictions in the ECCS and CSS flowpaths downstream of the sump screen, (e.g., a HPSI throttle valve, pump bearings and seals, fuel assembly inlet debris screen, or containment spray nozzles). The discussion should consider the adequacy of the sump screen's mesh spacing and state the basis for concluding that adverse gaps or breaches are not present on the screen surface.

STPNOC Response

Westinghouse and Enercon have performed downstream effects evaluations for the components in the ECCS and CSS recirculation flowpaths. This included valves, orifices, heat exchangers, spray nozzles, fuel assemblies, pumps, and

the reactor vessel. For all components except for fuel assemblies, no debris blockage items of concern were identified. The evaluations were based on sump strainers with a hole size of 1/8". The proposed hole size for the new sump strainers is smaller than 1/8".

Resolution of the debris blockage issue concerning the fuel assemblies is currently being evaluated by Westinghouse. Results of this evaluation will be provided in a supplemental response.

2.(d)(vi)Verification that close-tolerance subcomponents in pumps, valves and other ECCS and CSS components are not susceptible to plugging or excessive wear due to extended post-accident operation with debris-laden fluids.

STPNOC Response

Westinghouse has evaluated close tolerance subcomponents for the ECCS and CSS components for plugging and excessive wear. No plugging issues were identified. No wear issues were identified that require hardware changes.

2(d)(vii) Verification that the strength of the trash racks is adequate to protect the debris screens from missiles and other large debris. The submittal should also provide verification that the trash racks and sump screens are capable of withstanding the loads imposed by expanding jets, missiles, the accumulation of debris, and pressure differentials caused by post-LOCA blockage under predicted flow conditions.

STPNOC Response

The design of the new sump strainers is not yet finalized. However, PCI will perform a structural analysis of the strainer to show that it can withstand the design loadings including debris accumulation. Installation of trash racks is not currently planned since the advanced design strainer serves as a trash rack.

2.(d)(viii) If an active approach (e.g.,backflushing, powered screens) is selected in lieu of or in addition to a passive approach to mitigate the effects of the debris blockage, describe the approach and associated analyses.

STPNOC Response

The revised design for STP does not include the addition of any active components. The new sump strainers are passive in design.

2.(e) A general description of and planned schedule for any changes to the plant licensing bases resulting from any analysis or plant modifications made to ensure compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of this generic letter. Any licensing actions or exemption requests needed to support changes to the plant licensing basis should be included.

STPNOC Response

The UFSAR will be revised to describe the design basis changes and hardware changes that result from the sump performance evaluation. STPNOC does not anticipate that any licensing actions or exemption requests will be needed.

The only potential licensing amendment being considered is the NEI 04-07 Chapter 6 Alternate Evaluation. The use of the Chapter 6 methodology would be considered as a potential resolution of fuel blockage issues identified in the downstream effects analysis.

If additional licensing amendments are identified, this will be discussed with the Project Manager to establish a date that will meet the needs of the Staff and STPNOC.

2.(f) A description of the existing or planned programmatic controls that will ensure that potential sources of debris introduced into containment (e.g., insulations, signs, coatings, and foreign materials) will be assessed for potential adverse effects on the ECCS and CSS recirculation functions. Addressees may reference their responses to GL 98-04, "Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System after a Loss-of-Coolant Accident Because of Construction and Protective Coating Deficiencies and Foreign Material in Containment," to the extent that their responses address these specific foreign material control issues.

STPNOC Response

STPNOC has several existing programmatic controls that address potential sump debris items.

Insulation replacement inside containment is either a like-for-like replacement as a maintenance activity ("rework") or is a modification with a design change that has been approved by STPNOC Engineering. The STPNOC design change process ensures that new insulation material that differs from the initial design is evaluated.

STPNOC has a procedure that governs signs and labels containing the requirements for labeling inside containment. These requirements are used to minimize potential sump debris items.

Coatings were addressed in the STPNOC response to Generic Letter 98-04 (Reference 5).

STPNOC currently uses a procedure to maintain containment integrity with respect to potential sump debris sources. This procedure provides guidance for a visual inspection of the affected areas within containment at the completion of each containment entry when containment integrity is established to verify no loose debris is present which could be transported to the emergency sump and cause restriction of pump suction during LOCA conditions.

During outages, STPNOC maintains containment cleanliness by adherence to the housekeeping procedure. Containment cleanliness is emphasized by the reactor containment building coordinators and the work supervisors. Prior to containment closeout at the end of the outage, the building coordinators oversee the cleanup of the containment work areas to achieve the goal of no loose debris.

STPNOC does not currently plan any additional administrative or programmatic controls regarding debris sources in the reactor containment building.

References:

1. Nuclear Energy Institute report NEI 04-07, "Pressurized Water Reactor Sump Performance Methodology," dated December 6, 2004

2. Safety Evaluation by the Office of Nuclear Reactor Regulation Related to NRC Generic Letter 2004-02, Nuclear Energy Institute Guidance Report, "Pressurized Water Reactor Sump Performance Methodology," dated December 6, 2004 (ML 043280007)

3. Westinghouse document WCAP-16406-P, "Evaluation of Downstream Sump Debris Effects in Support of GSI-191," dated June 2005

4. Nuclear Energy Institute report NEI 02-01, "Condition Assessment Guidelines: Debris Sources Inside PWR Containments," dated April 2002

5. Letter, T. H. Cloninger to Document Control Desk, Response to Generic Letter 98-04, "Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System After a Loss-of-Coolant Accident Because of Construction and Protective Coating Deficiencies and Foreign Material in Containment," dated November 11, 1998 (NOC-AE-000350)

Attachment 2
List of Exceptions

This attachment identifies the exceptions taken to the Pressurized Water Reactor Sump Performance Evaluation Methodology, NEI 04-07, and to the Safety Evaluation Report (SER) by the Office of Nuclear Regulation related to NRC Generic Letter 2004-02 during the GSI 191 evaluation of South Texas Units 1 and 2 performed by Westinghouse and its contractors, Alion Science and Technology, and Enercon Services.

1. Unqualified Coating Particulate Size

The Guidance Report (NEI 04-07) and SER require licensees to assume that all unqualified coatings fail as 10 μ particulate. Although this requirement is conservative when evaluating head loss across a sump screen for which a "thin bed" effect is possible, it is not conservative when evaluating wear on components and valves. The wear evaluation of Emergency Core Cooling System valves and components assumes an unqualified coating particulate size distribution that varies from 110% of the sump screen opening to 10 μ. This assumption is reasonable and conservative when evaluating the impact of unqualified coatings particulate on component and valve wear. There is significant publicly-held documentation that shows that coatings, outside the conditions defined in the Zone of Influence (ZOI) will tend to fail at sizes above their constituent pigment size.

2. Containment Walkdown and Latent Debris Sampling

The Guidance Report (GR) and SER recommend that a containment walkdown and sampling of latent debris be conducted to assess the quantity of latent debris and the constituents of the latent debris. Although a containment walkdown and latent debris sampling has not yet been performed, the evaluation conservatively assumed 200 lb. of latent debris which is consistent with the GR. The latent debris properties are as recommended in the SER. During the Fall 2005 outage for Unit 2, STPNOC plans to perform a containment walkdown and sampling of latent debris as recommended by the GR and SER.

3. 5-ft Break Intervals

The SER advocates break selection at 5-ft intervals along a pipe in question but clarifies that "the concept of equal increments is only a reminder to be systematic and thorough." It further qualifies that recommendation by noting that a more discrete approach driven by the comparison of debris source term and transport potential can be effective at placing postulated breaks. The key difference between many breaks (especially large breaks) will not be the exact location along the pipe, but rather the envelope of containment material targets that is affected.

For the NUKON™ and Thermal-Wrap insulation a 17D ZOI radius is used, which is equivalent to a sphere with an approximate 41 ft radius, dependant upon the size of the particular pipe break. Similarly the Marinite and Microtherm® insulation have a 28.6D ZOI radius. The spherical ZOIs of those sizes are bounded by structural barriers surrounding the RCS, i.e., the reactor cavity and secondary shield wall, the floor and operating floor slabs, etc. The specific location along a particular pipe has little if any impact on debris generated. Further, a reasonable determination of the most limiting location can be made by inspection of plant equipment drawings. For example, the configurations of the four RCS loops at STP are very similar. Loops A and D are grouped together in one compartment and Loops B and C are grouped together in another compartment. Loops C and D are closer to the sumps and intuitively have a more direct transport path to the sump screens; breaks in Loops A and B therefore, are bounded by breaks evaluated for C and D. Specific break locations can be selected by plotting the ZOI along the RCS piping to maximize major targets that fall within the perimeter of the ZOI sphere.

Attachment 3
List of Commitments

The following table identifies those actions committed to by the STP Nuclear Operating Company in this document. Any statements in this submittal with the exception of those in the table below are provided for information purposes and are not considered commitments. Please direct questions regarding these commitments to Scott Head at (361) 972-7136.

Commitment	Due Date	Condition Report
1. STPNOC will provide a Supplemental Response to Generic Letter 2004-02 upon completion of pending analyses and testing.	01/31/2006	04-12498-9
2. STPNOC will be in full compliance with the regulatory requirements discussed in the applicable regulatory requirements section of GNL 2004-02 by December 31, 2007. This includes the full implementation of all required corrective actions.	12/31/2007	04-12498-10