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0CAN080501

August 31, 2005

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

Subject: Response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors"
Arkansas Nuclear One – Units 1 and 2
Docket Nos. 50-313 and 50-368
License Nos. DPR-51 and NPF-6

Dear Sir or Madam:

By Generic Letter 2004-02, *Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors*, dated September 13, 2004 (0CNA090401), the NRC requested licensees to provide a response by September 1, 2005. The requested information for Arkansas Nuclear One (ANO) is provided in Attachment 1 to this submittal.

New commitments contained in this submittal are summarized in Attachment 2. Should you have any questions concerning this submittal, please contact Ms. Natalie Mosher at (479) 858-4635.

I declare under penalty of perjury that the foregoing is true and correct. Executed on August 31, 2005.

Sincerely,

Dale E. James
Acting Director, Nuclear Safety Assurance

DEJ/nbm

Attachments

A116

cc: Dr. Bruce S. Mallett
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Attachment 1

0CAN080501

Response Requested by September 1, 2005

ANO-1 Response

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

(a) Confirmation that the emergency core cooling system (ECCS) and containment spray system (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.

The ANO-1 ECCS (low-pressure injection (LPI)) and CSS (reactor building spray (RBS)) recirculation functions will be in compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of the subject generic letter under debris loading conditions. Response 2(b), below, describes the actions required to ensure this compliance. Additional information provided relates to the plant configurations following completion of the described actions.

The containment walkdowns (with the exception of latent debris and the foreign materials walkdowns), debris generation calculation, debris transport and head-loss calculation, downstream effects preliminary evaluation for blockage, and the procurement specification are essentially completed. The downstream effects evaluation for long-term wear is in progress and is scheduled to be completed in the fall 2005. The results will be submitted to the NRC by December 15, 2005. The ANO-1 sump strainer vendor selection is also planned to be completed in the fall 2005. This information will also be submitted to the NRC by December 15, 2005. The ANO-1 walkdowns for quantifying the latent debris (dust, lint, etc.) and unqualified labels, tape, etc. are planned for fall 2005 in order to confirm the values used in the calculation are bounding. Sargent and Lundy (S&L) has performed the generic safety issue (GSI)-191 evaluations. The evaluation of the fuel for downstream effects is being performed by Areva. This response is based on the currently available information.

(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.

Based on the results from debris generation and transport scoping analyses identified and described below, modifications to the existing debris screens will be required to meet the applicable Regulatory Requirements discussed in the generic letter. The strainer design (surface area, perforation size, and layout) and final head-loss will be determined by the strainer vendor. Based on scoping evaluations, modifications are expected to consist of new sump strainers with a surface area of greater than 10,000 (with thin bed effect (TBE)) and approximately 3,250 (without TBE) square feet with 0.125 (1/8) inch (diameter) perforations, or smaller. This area does not include sacrificial surface area for tape, labels, etc. Walkdowns to determine the sacrificial surface area are planned for fall 2005. The new strainers are expected to occupy the space currently containing the existing sump/debris barrier as well as areas adjacent to the sump. Plant modifications to install new sump strainers will be implemented during the spring 2007 refueling outage.

(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 (RG) 1.82, Revision 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.)**

The analysis of the susceptibility of the ECCS and CSS recirculation functions to the adverse effects of post-accident debris blockage was performed using methodology in the Nuclear Energy Institute (NEI) guidance document NEI 04-07 (Reference 1), as modified by the NRC's safety evaluation report (SER) for NEI 04-07 (Reference 2). Containment walkdowns to support the analysis of debris blockage were performed using the guidelines provided in NEI 02-01 (Reference 3).

ANO-1 is a two-loop (designated as loops A and B) containment. Each loop consists of one steam generator (SG), two reactor coolant pumps (RCPs) and the associated reactor coolant system (RCS) piping, and is located within its own cavity. The two loops are nearly identical with the exception that loop A includes the pressurizer and its associated piping, the reactor coolant quench tank, and the recirculation sump located right outside the cavity.

Baseline Break Selection

Several break locations were selected for evaluation following the guidance of RG 1.82, Revision 3. Breaks in feedwater and/or main steam system piping are not considered because they do not require the ECCS and/or CSS to operate in recirculation mode. In accordance with NEI 04-07, small-bore piping (2" nominal diameter and less) is not considered as the impact is bounded by the larger breaks. The selected breaks are as follows:

Break 1 is in the riser of the hot leg to SG A. As the hot leg is the largest line in containment, a break at this location produces the largest zone of influence (ZOI). Placing the break at this location, in the same SG cavity as the pressurizer, captures the most insulation debris.

Break 2 is at the pressurizer surge line at the connection to the pressurizer. This break was selected to give debris loading for other transport paths.

Break 3 is at the cross-over leg for RCP C. The cross-over has a smaller diameter than the hot leg, hence producing a smaller ZOI. However, a break in the cross-over leg from SG A to RCP C results in a more direct flow path to the screen.

Break 4 is in the riser of the hot leg to SG B. This break is the mirror image of break 1 and was selected to give debris loading for other transport paths.

Break 5 is at the cross-over leg for RCP C at a lower elevation than break 3. This break impacts the coating on the SG cavity floor.

Additionally, an alternate break (break 6) was evaluated in the same location as the bounding break (break 1) but with a break size equivalent to a double ended guillotine break of a 14-inch Schedule 160 line.

Debris Generation

Insulation: With the exception of Transco thermal-wrap and high density fiberglass (HDFG), insulation debris types were quantified using the ZOI radius specified by the SER in Table 3-2. Because no guidance is provided for Transco thermal-wrap and HDFG, a ZOI radius equivalent to that of unjacketed Nukon (17.0D) was conservatively assumed. For piping insulation debris calculation a 3D model was used to identify piping within the ZOI and the impacted insulation volume. The sections of equipment insulation within the ZOI were determined based on dimensioned insulation and plant layout drawings.

Coatings: Qualified coating debris was quantified using the ZOI radius of 10.0D, as specified by the SER in Section 3.4.2.1. The concrete and structural steel coatings within the ZOI were determined based on dimensioned plant drawings. For the purpose of determining impacted coating volumes, the coated surfaces within the ZOI for which exact coating thickness documentation does not exist are assumed to have the maximum thickness values as delineated by the specifications. In accordance with NEI 04-07 and the SER, all unqualified coatings were considered to fail regardless of their location within containment. Similarly, all qualified coatings that have been identified as being degraded were considered to fail regardless of their location within containment.

Foreign Material: Walkdowns to quantify unqualified labels, tape, etc., and latent debris (dust and lint) is planned for fall 2005. For the scoping strainer calculations latent debris quantity of 200 lbs was conservatively considered. Sacrificial strainer area equal to 75% of the surface area of the unqualified labels, tape, etc. in the containment is included in the procurement specification for the final design.

Entergy is evaluating additional refinements that could possibly be utilized in the future for margin recovery or revisions to the calculations. An example would be to add jacketing to certain insulation types. Another example would be a reduction in the ZOI for coatings which would require a technical justification that could include specific coating debris generation testing prior to implementation.

Debris Transport

The transport of the debris from the break location to the sump screen is evaluated using the methods outlined in Section 3.6 of NEI 04-07 with the enhancements recommended in the SER. The means of transport considered were blowdown, washdown, pool fill, and recirculation for all types of debris.

Transco thermal-wrap fibrous debris was characterized into four debris size categories based on the interpretation of the air-jet impact testing (AJIT) data. The NEI small fines category was subdivided into fines (8%) and small pieces (25%) and the NEI large category was subdivided into large pieces (32%) and intact debris (35%). The HDFG insulation was modeled as small fines (100%). All fines, small pieces and large pieces were considered to transport to the screen. Intact debris does not erode or transport to the screen.

The containment spray and submergence generated fibrous debris is modeled as fines and 100% transports to the screen.

The particulate and coating debris was modeled as fines and 100% transports to the screen.

The reflective metal insulation (RMI) size distribution is based on the categorization provided in the SER (Appendix II). For Transco the values used were 75% fines and 25% large debris. All fines and large RMI debris were considered to transport to the screen.

Miscellaneous debris (tape, labels, etc.) is not included in the debris load, but is considered in the procurement specification for the screen design as a sacrificial area.

The following is a summary of the overall transport fractions for the debris types:

Debris Type	Overall Transport Fraction
Transco RMI	1.00
Calcium Silicate	1.00
Transco Thermal-Wrap	0.65
HDFG	1.00
Coatings	1.00
Latent Debris	1.00
Foreign Material	1.00

Strainer Head-Loss

As noted earlier, the final strainer head-loss analysis will be performed by the strainer vendor. The debris bed head-loss and net-positive suction head (NPSH) margin analysis for the scoping evaluation is documented in Reference 6. The analysis determines that the existing sump screen cannot accommodate the debris inventory transported to the sump screen based on the head-loss through the debris bed, which would form during recirculation. In this scoping evaluation, the head-loss across the debris bed was determined separately for fiber and particulate debris and for RMI debris. The head-loss through a fiber/particulate debris bed was determined using the head-loss correlation developed in NUREG/CR-6224 while the RMI debris bed head-loss was determined using the correlation recommended in NUREG/CR-6808. The total head-loss across the sump strainer equals to the sum of the fiber/particulate debris bed head-loss, the RMI debris bed head-loss and the clean strainer head-loss. The qualified concrete coatings at ANO-1 are epoxy. The qualified steel coatings at ANO-1 are both epoxy and inorganic zinc. Unqualified coatings represent a small percentage of the total coating debris volume used at ANO-1. In the determination of debris bed head-loss, all coatings were assumed to be epoxy because epoxy conservatively results in a greater head-loss than inorganic zinc and alkyds.

In Reference 6 scoping size determination, strainer size estimates are >10,000 (with TBE) and 3,250 (without TBE) square feet. The strainer size estimates are provided based on the case where two low-pressure injection (LPI) and two reactor building spray (RBS) pumps are running. The estimates are also based on the total allowable head-loss with no NPSH margin retention. The allowable head-loss across the sump strainer, 1.76 feet, is documented in Reference 6. As noted earlier, the final strainer size and the actual head-loss across the strainer will be determined by the strainer vendor.

<u>Downstream Effects</u>

For downstream effects, see paragraphs (d)(v) and (d)(vi).

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

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

The minimum available NPSH margin for the LPI pumps in the recirculation mode at ECCS switchover to sump recirculation, not including the clean screen head-loss, is 1.76 feet. The LPI pumps are limiting for the NPSH margin (Reference 6). The clean screen head-loss is small (<0.1 feet based on experience). As noted earlier, the final values will be determined by the sump strainer vendor.

(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.

The procurement specification requires the strainers to be fully submerged (submergence of 100%, Reference 8) for both large and small break LOCAs.

(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.

The maximum postulated head-loss from debris accumulation on the submerged sump screen is specified to be 1.25 feet of water or less (Reference 8). The primary constituents of the debris bed are as follows (Reference 6):

RMI	10,017 sq. ft.
Calcium Silicate	113.9 cu. ft.
Fibers	203.5 cu. ft.
Particulate	10.7 cu. ft.
Miscellaneous Materials (tape, labels, etc.)	*
Latent Debris*	200 lbm

*200 lbm of assumed latent debris (dust and lint) is included in the debris loading. As noted earlier, a walkdown is planned to be performed during the fall 2005 outage to confirm that 200 lbm bounds the actual latent debris value. In addition, the walkdown will also quantify the area of unqualified labels, tape, etc.

Sump strainer suppliers are currently developing plans and schedules to quantify the additional head-loss associated with chemical debris (Reference 13). Entergy plans to evaluate the adequacy of the strainer design and will incorporate chemical effects once the tests results to quantify chemical debris effect on head-loss have been published. At the same time, an additional evaluation will be performed to determine the impact of the sump pH, spray duration, and the increased temperature profile on the head-loss due to chemical effects.

Margins exist that could be available to address head-loss increases due to chemical effects. For example, the new sump screen design provides an inherent head-loss margin of approximately 41% based on the maximum head allowed in the procurement specification versus the NPSH available. As noted earlier, Entergy plans to account for chemical effects during the screen design process.

(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.

In general, the containment floors are clear of major obstructions that could prevent flow from reaching the containment sump screens. The configuration of the containment basement elevation is conducive to directing flow to the containment sump. The entire basement elevation of the containment building serves as the ECCS sump for collection of water introduced to the containment following a LOCA. The basement floor elevation is essentially an open area except for the primary reactor shield wall, the walls and supports for the loop compartments (D-rings), and the refueling cavity. The flow paths from the upper levels of containment to the lower levels are relatively free: i.e., open stairways and/or floor grating. The D-rings contain the RCPs, SGs, and pressurizer. These vaults have large openings that allow water to spill to the containment basement elevation. Other hold-up volumes not connected to the recirculation sump have been included in the minimum water level calculation. The refueling canal drains through a combination of 2-inch pipes and valves which combine into two 4-inch pipes and spill to the containment floor. The valves are locked open during normal operation. An additional 6-inch pipe which drains to the reactor cavity is elevated 9 inches above the refueling canal floor. Therefore, a credible path to the containment pool exists and there is no hold up of inventory in the refueling canal. Furthermore, the path from the refueling canal to the containment floor does not bypass the recirculation sump screen. Drains from the reactor cavity and other drains that bypass the sump screen will be fitted with screens with the same perforation size as the main screen.

(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 high-pressure safety injection (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.

The flow paths downstream of the containment sump were analyzed to determine the potential for blockage due to debris passing through the sump screen (Reference 7). The acceptance criteria were based on WCAP-16406-P (Reference 12).

These evaluations were done for components in the recirculation flow paths including, but not limited to, throttle valves, flow orifices, spray nozzles, pumps, heat exchangers, and valves. The methodology employed in this evaluation was based upon input obtained from a review of the recirculation flow path shown on piping and instrument diagram drawings and plant procedures. The steps used in obtaining the flow clearance were as follows:

- Determine the maximum characteristic dimension of the debris (clearance through the sump screen).
- Identify the recirculation flow paths.
- Identify the components in the recirculation flow paths.
- Review the vendor documents (drawings and/or manuals) for the components to obtain flow clearance dimensions.
- Determine blockage potential through a comparison of the flow clearance through the component with the flow clearance through the sump screen.
- Identify the components that require a detailed evaluation and investigation of the effects of debris on their capability to perform their designated safety function.

The results of the preliminary evaluation for flow clearances showed that some components require additional evaluation for long-term wear. As discussed in d(vi), the long-term downstream evaluations are in progress. The resolution and corrective actions for the downstream components will be performed with the long-term evaluations.

The procurement specification requires the new strainer design to ensure that gaps at mating surfaces within the strainer assembly and between the strainer and the supporting surface are not in excess of the strainer perforation size. The design also ensures that drainage paths to the sump that bypass the sump strainer would also have a maximum debris bypass of less than the strainer perforation size.

(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.

Verification of debris blockage of downstream components is described in (d)(v). As noted earlier, verification of downstream components for long-term wear is in progress, and the final results will be reported to the NRC by December 15, 2005. The long-term downstream effects evaluation uses the methodology and acceptance criteria presented in WCAP-16406-P (Reference 12). Where excessive wear is found using this methodology, a refined approach using methods such as those described in Department of Energy, Centrifugal Slurry Pump Wear and Hydraulic Studies conducted from October 1982 to December 1987 (Reference 15) may be utilized.

(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-loss-of-coolant accident (LOCA) blockage under predicted flow conditions.

The sump is located partially inside the north SG cavity. The need for a shield to protect the strainers from the effects of missiles and expanding jets would be determined during the detailed strainer design phase. The sump design includes an 8" curb. The procurement specification requires that the strainers are designed to withstand the loads imposed by the accumulation of debris and pressure differentials under predicted flow conditions as specified in the design requirements, as well as seismically generated loads (Reference 8).

(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.

The strainers are expected to be of a passive design.

(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.

Changes to the plant licensing bases are performed during the modification process via 10CFR50.59.

(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 ECCS and the CSS after LOCA 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.

Entergy realizes that control of potential debris sources inside of containment is very important and that debris sources that are introduced to containment need to be identified and assessed. Potential debris sources can be generally categorized into the following general areas: insulation, coatings (both qualified and unqualified), miscellaneous sources (labels, tags, tape, etc.), and dirt/dust. Entergy currently implements the following controls for these potential sources of debris.

Insulation used inside of containment is identified on site drawings. In addition, insulation walkdowns were performed to support GL 2004-02. Entergy will ensure that as part of the modification process, insulation materials that are introduced to containment are identified and evaluated to determine if they could affect sump performance or lead to downstream equipment degradation.

The majority of the coatings inside of containment were procured and applied as qualified coatings. Qualified coatings are controlled under site procedures. In addition, the debris generation calculation discussed above, includes margin for potential detachment or failure of limited quantities of qualified coatings. Entergy will repair or assess damaged qualified coatings to ensure that the quantities of failed coatings in the debris generation calculation are not exceeded.

Unqualified coatings have been identified by location, surface area, and thickness. The majority of unqualified coatings inside of containment are component Original Equipment Manufacturer coatings. New or replacement equipment is evaluated for the potential of unqualified coatings. Entergy will ensure that unqualified coatings introduced to containment are identified. Entergy will implement a program to track the unqualified coatings to ensure that the quantity of unqualified coatings in the debris generation calculation is not exceeded.

Walkdowns in support of resolution of GL 2004-02 will identify and quantify miscellaneous potential sources of debris (tags, labels, tape, etc.) inside of containment. The modification process requires that materials introduced to containment be identified and evaluated for potential impact to the sump and equipment as part of the design process. Administrative procedures control the types of tags and labels that can be used inside of containment. During recent outages, efforts have been taken to reduce the quantities of these miscellaneous debris sources inside of containment. Entergy will implement a program to track the tags and labels inside containment to ensure that the amount does not exceed the sacrificial area provided in the design.

At the end of an outage, a formal containment close-out surveillance procedure is performed. The close-out is performed to ensure that materials do not affect the ECCS including the sump. Items not removed require a documented evaluation to provide the basis for concluding that the item remaining in containment is acceptable. As part of containment close-out each ECCS train containment sump and sump screens are inspected for damage or debris. Also, refueling canal drains are verified not to be obstructed and that there no potential debris sources in the refueling canal area that could obstruct the drains.

Measurements will be taken to conservatively estimate the amount of latent dirt and dust inside of containment during the next refueling outage. In order to ensure that the analysis remains bounding, Entergy intends to perform these types of measurements every third refueling outage. Assuming the results indicate that the housekeeping practices provide an adequate level of cleanliness, the plant may choose to relax this frequency after the first measurements.

References

1) NEI Document NEI 04-07, Rev. 0, Dated December 2004, *Pressurized Water Reactor Sump Performance Evaluation Methodology*

2) *Safety Evaluation by the Office of Nuclear Reactor Regulation Related to NRC Generic Letter 2004-02, NEI Guidance Report, Pressurized Water Reactor Sump Performance Evaluation Methodology*

3) NEI Document NEI 02-01, *Condition Assessment Guidelines: Debris Sources Inside PWR Containments*

4) Sargent & Lundy LLC Calculation 2005-05640, Revision 0, dated August 19, 2005, *Debris Generation due to LOCA within Containment for Resolution of GSI 191*

5) Sargent & Lundy LLC Document No. 2004-03481, dated August 5, 2004, *Walkdown Report for Evaluating Debris Sources Inside ANO Unit 1 Containment for Resolution of GSI 191*

6) Sargent & Lundy LLC Calculation No. 2005-07500, *Post-LOCA Debris Transport, Head-Loss Across Containment Sump Screen, and NPSH Evaluation for Resolution of GSI-191*

7) Sargent & Lundy LLC Document No. 2005-02840, *GSI-191 Downstream Effects – Flow Clearances*

8) Entergy Specification No. ANO-M-592, Rev. 0, dated August 29, 2005. *Technical Specification for ANO-1 Containment Sump Strainers*

9) *Chemical Effects Evaluation* (later)

10) *Downstream Effects for Wear*, Sargent & Lundy Calculation (later)

11) *Fuels Evaluation*, Areva Calculation (later)

12) Westinghouse Evaluation WCAP-16406-P, dated June 2005, *Evaluation of Downstream Sump Debris Effects in Support of GSI-191*

13) Vendor comment during NRC Public Meeting on June 30, 2005

14) *Test Plan: Characterization of Chemical and Corrosion Effects Potentially Occurring Inside a PWR Containment Following a LOCA*, Revision 12.c, dated March 30, 2005

15) Department of Energy, *Centrifugal Slurry Pump Wear and Hydraulic Studies conducted from October 1982 to December 1987*

16) Calculation ENG-ME-005, *Analysis of Available NPSH to the RHR Pumps from the Containment Sump*, Rev. 3

ANO-2 Response

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

(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.

The ANO-2 ECCS and CSS recirculation functions will be in compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of the subject generic letter under debris loading conditions. Response 2(b), below, describes the actions required to ensure this compliance. Additional information provided relates to the plant configurations following completion of the described actions.

The containment walkdowns, debris generation calculation, debris transport and head-loss calculation, downstream effects preliminary evaluation for blockage, and the procurement specification are essentially completed. The downstream effects evaluation for long-term wear is in progress and is scheduled to be completed in the fall 2005. The results will be submitted to the NRC by December 15, 2005. The ANO-2 sump strainer vendor selection is also planned to be completed in the fall 2005. This information will also be submitted to the NRC by December 15, 2005. S&L has performed the GSI-191 evaluations. The evaluation of the fuel for downstream effects is being performed by Westinghouse. This response is based on the currently available information.

(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.

Based on the results from debris generation and transport analyses identified and described below, modifications to the existing debris screens will be required to meet the applicable Regulatory Requirements discussed in the generic letter. The strainer design (surface area, perforation size, and layout) and final head-loss will be determined by the strainer vendor. Based on scoping evaluations, modifications are expected to consist of new sump strainers with a surface area of approximately 1,925 (without thin-bed effect (TBE)) and greater than 10,000 (with TBE) square feet with 0.125 (1/8) inch (diameter) perforations, or smaller. This area includes 50 square feet of sacrificial surface area for tape, labels, etc. The new strainer is expected to occupy the space around the existing sump as well as various potential areas around the containment. Plant modifications to install new sump strainers will be implemented during the fall 2006 refueling outage.

(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., RG 1.82, Revision 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.)**

The analysis of the susceptibility of the ECCS and CSS recirculation functions to the adverse effects of post-accident debris blockage was performed using methodology in the NEI guidance document NEI 04-07 (Reference 1), as modified by the NRC's SER for NEI 04-07 (Reference 2). Containment walkdowns to support the analysis of debris blockage were performed using the guidelines provided in NEI 02-01 (Reference 3).

ANO-2 is a two-loop (designated as loops A and B) containment. Each loop consists of one SG, two RCPs and the associated RCS piping, and is located within its own cavity. The two loops are nearly identical with the exception that loop A includes the pressurizer and its associated piping.

<u>Baseline Break Selection</u>

Several break locations were selected for evaluation following the guidance of RG 1.82, Revision 3. Breaks in feedwater and/or main steam system piping are not considered because they do not require the ECCS and/or CSS to operate in recirculation mode. In accordance with NEI 04-07, small-bore piping (2" nominal diameter and less) is not considered as the impact is bounded by the larger breaks. The selected breaks are as follows:

Break 1 is at the hot leg at the inlet to SG A. As the hot leg is the largest line in containment, a break at this location produces the largest ZOI with the most debris.

Break 2 is at the hot leg at the inlet to SG B. This break is the mirror image of break 1 and is selected to give debris loading for other transport paths.

Break 3 is at the interim leg for RCP C. The cold leg has a smaller diameter than the hot leg, hence producing a smaller ZOI. However, a break in the cold leg suction (interim leg) from SG A to RCP C could direct flow out of the SG A cavity along a flow path to the containment sump.

Break 4 is at the pressurizer surge line at the connection to the pressurizer. A significant quantity of fiber insulation is located on the bottom head of the pressurizer and around the inside of the pressurizer skirt. Consequently, this fiber insulation would be shielded from a break in the RCS hot legs or cold legs. Hence, a break is postulated at the pressurizer surge line connection to the pressurizer to capture this fiber.

Break 6 is at the interim leg for RCP A. The cold leg has a smaller diameter than the hot leg, hence producing a smaller ZOI. However, a break in the cold leg suction (interim leg) from SG B to RCP A could direct flow out of the SG B cavity along a flow path to the containment sump.

Additionally, an alternate break (break 5) was evaluated at the LPSI shutdown cooling discharge line connection to the RCS hot leg. This break is selected because the LPSI shutdown cooling discharge line is larger than a 14-inch Schedule 160 line, and is in approximately the same location as the bounding break (break 1). A break at this location produces a more limiting debris load than a break equivalent to a 14-inch Schedule 160 break at any location on the RCS piping.

Debris Generation

Insulation: With the exception of Transco thermal-wrap, HDFG, and cellular glass, insulation debris types are quantified using the ZOI radius specified by the SER in Table 3-2. Because no guidance is provided for Transco thermal-wrap, HDFG, and cellular glass, a ZOI radius equivalent to that of unjacketed Nukon (17.0D) was conservatively assumed. For piping insulation debris except Mirror, a 3D model was used to identify piping within the ZOI and calculate the impacted insulation volume. For equipment insulation except Mirror, the sections of insulation within the ZOI are determined based on dimensioned insulation and plant layout drawings. Based on the large ZOI radius of Mirror (28.6D), the Mirror equipment and piping insulation within the SG cavity where the break is postulated was considered to become debris.

Coatings: Qualified coating debris was quantified using the ZOI radius of 10.0D, as specified by the SER in Section 3.4.2.1. The concrete and structural steel coatings within the ZOI were determined based on dimensioned plant drawings. For the purpose of determining impacted coating volumes, the coated surfaces within the ZOI are assumed to have the maximum thickness values as delineated by the specifications. In accordance with NEI 04-07 and the SER, all unqualified coatings are considered to fail regardless of their location within containment. Similarly, all qualified coatings that have been identified as being degraded are considered to fail regardless of their location within containment.

Foreign Material: The quantity of type of foreign material inside containment was based on a walkdown performed for ANO-2. The foreign material included labels, signs, placards, etc. All foreign material was assumed to transport to the sump.

Latent Debris: A latent debris walkdown was performed in accordance with the NEI/SER guidelines in Section 3.5. Using cloths, samples were collected from the various surfaces at different floor elevations. Samples from each of the following surfaces were taken:

- Horizontal concrete surfaces (floors)
- Vertical concrete surfaces (walls)
- Containment liner (vertical)
- Cable trays (vertical)
- Cable trays (horizontal)
- Horizontal equipment surfaces (heat exchangers, air coolers, etc.)
- Vertical equipment surfaces (SG, air coolers, pressurizer, etc.)
- Horizontal heating, ventilation, and air conditioning (HVAC) duct surfaces
- Vertical HVAC duct surfaces
- Horizontal piping surfaces
- Vertical piping surfaces (Pipes running vertically)

The net weight differences between the pre-sample and post-sample weight were used to statistically extrapolate the amount of latent debris for the entire containment.

Entergy is evaluating additional refinements that could possibly be utilized in the future for margin recovery or revisions to the calculations. An example would be to add jacketing to certain insulation types. Another example would be a reduction in the ZOI for coatings which would require a technical justification that could include specific coating debris generation testing prior to implementation.

Debris Transport

The transport of the debris from the break location to the sump screen is evaluated using the methods outlined in Section 3.6 of NEI 04-07 with the enhancements recommended in the SER. The means of transport considered were blowdown, washdown, pool fill, and recirculation for all types of debris. The recirculation transport analysis was performed using CFD models developed using the computer program FLUENT. Outputs of the CFD analysis include global (entire containment) and local (near sump pit) velocity contours, TKE contours, path lines, and flow distributions for various scenarios.

Fibrous debris was characterized into four debris size categories based on the interpretation of the AJIT test data. The NEI small fines category was subdivided into fines (8%) and small pieces (25%) and the NEI large category was subdivided into large pieces (32%) and intact debris (35%). All fines were considered to transport to the screen. Based on the comparison of recirculation pool velocities determined using CFD analysis with incipient debris tumbling velocities provided in NUREG/CR-6772, the small pieces and large pieces do not transport to the screen in bulk, but are subject to erosion and subsequent transport as fines. For the purpose of screen sizing, 60% of the small and large piece fiber was determined to erode prior to shutoff of CSS (at which point the total recirculation flow is significantly reduced, thereby significantly reducing the head-loss across the screen). For long-term evaluations, 90% of the small and large piece fiber is considered to erode. Intact debris does not erode or transport to the screen.

The CSS and submergence generated fibrous debris is modeled as fines and 100% transports to the screen.

The particulate and coating debris was modeled as fines and 100% transports to the screen.

The RMI size distribution is based on the categorization provided in the SER (Appendix II). For Mirror the values used were 1.6% fines and 98.4% large debris. For Transco the values used were 75% fines and 25% large debris. Based on the comparison of recirculation pool velocities determined using CFD analysis with incipient debris tumbling velocities provided in NUREG/CR-6772, the large RMI pieces do not transport to the screen. Erosion of RMI debris was not modeled.

The debris transport phenomena due to the blowdown, washdown, pool fill-up, and recirculation transport modes were summarized using debris transport logic trees consistent with the Drywell Debris Transport Study (DDTS) documented in NUREG/CR-6369. The debris transport logic trees consider the effect of dislocation, hold-up on the floor or other structures, deposition in active or inactive pools, lift over curbs, and erosion of debris.

Miscellaneous debris (tape, labels, etc.) is not included in the debris load, but is considered in the procurement specification for the screen design as a sacrificial area.

The following is a summary of the overall transport fractions for the debris types:

Debris Type	Overall Transport Fraction
Mirror	0.016
Transco RMI	0.75
Calcium Silicate	1.00
Transco Thermal-Wrap	0.42/0.59(1)
Preformed HDFG	0.42/0.59(1)
Preformed HDFG (CS/Submergence Generated)	1.00
Cellular Glass	1.00
Coatings	1.00
Latent Debris	1.00
Foreign Material	1.00

Notes: (1) Fiber overall transport fraction of 0.42 corresponds to transport considered for screen sizing (60% erosion of small and large pieces). Fiber overall transport fraction of 0.59 corresponds to transport considered for long-term evaluations (90% erosion of small and large pieces).

Strainer Head-Loss

As noted earlier, the final strainer head-loss analysis will be performed by the strainer vendor. The debris bed head-loss and NPSH margin analysis for the scoping evaluation is documented in Reference 6. The analysis determines that the existing sump screen cannot accommodate the debris inventory transported to the sump screen based on the head-loss through the debris bed, which would form during recirculation. In this scoping evaluation, the head-loss across the debris bed is determined separately for fiber and particulate debris and for RMI debris. The head-loss through a fiber/particulate debris bed was determined using the head-loss correlation developed in NUREG/CR-6224 while the RMI debris bed head-loss is determined using the correlation recommended in NUREG/CR-6808. The total head-loss across the sump strainer is equal to the sum of the fiber/particulate debris bed head-loss, the RMI debris bed head-loss and the clean strainer head-loss. The qualified concrete coatings at ANO-2 are epoxy. The qualified steel coatings at ANO-2 are both epoxy and inorganic zinc. Unqualified coatings represent a small percentage of the total coating debris volume used at ANO-2. In the determination of debris bed head-loss, all coatings were assumed to be epoxy because epoxy conservatively results in a greater head-loss than inorganic zinc and alkyds.

In Reference 6 scoping size determination, strainer size estimates are greater than 10,000 (with TBE) and approximately 1,925 (without TBE) square feet. The strainer size estimates are provided based on the case where one ECCS and two containment spray pumps are running because the NPSH margin for the ECCS pumps is more limiting for one pump operation than for two pump operation. The estimates are also based on the total allowable head-loss with no NPSH margin retention. The allowable head-loss across the sump strainer, 1.36 feet, is documented in Reference 6. As noted earlier, the final strainer size and the actual head-loss across the strainer will be determined by the strainer vendor.

<u>Downstream Effects</u>

For downstream effects, see paragraphs (d)(v) and (d)(vi).

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

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

The minimum available NPSH margin for the ECCS HPSI pumps in the recirculation mode at ECCS switchover to sump recirculation, not including the clean strainer head-loss, is 1.36 feet (one pump operation) and 2.18 feet (two pump operation) (Reference 6). The HPSI pumps are limiting for the NPSH margin. The clean strainer head-loss is small (<0.1 feet based on experience). As noted earlier, the final values will be determined by the sump strainer vendor.

(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.

The procurement specification requires the strainers to be fully submerged (submergence of 100%, Reference 8) for both large and small break LOCAs.

(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.

The maximum postulated head-loss from debris accumulation on the submerged sump strainer is specified in the following table (Reference 8).

	1 HPSI and 2 CS Pumps Operating	2 HPSI and 2 CS Pumps Operating
Maximum (gpm)	6,165	7,000
Total Head-Loss (ft.)	1.0	1.75

The primary constituents of the debris bed are as follows (Reference 6):

RMI (fines)	5397 sq. ft.
Calcium Silicate	38.2 cu. ft.
Fibers	35 cu. ft.
Particulate	22.6 cu. ft.
Miscellaneous Materials (tape, labels, etc.)	12.3 sq. ft.
Latent Debris*	47 lbm

* 47 lbm of latent debris (dust and lint) was calculated from the results of walkdowns. 150 lbm of latent debris is used in the strainer design procurement specification.

Sump strainer suppliers are currently developing plans and schedules to quantify the additional head-loss associated with chemical debris (Reference 13). Entergy plans to evaluate the adequacy of the strainer design and will incorporate chemical effects once the tests results to quantify chemical debris effect on head-loss have been published. At the same time, an additional evaluation will be performed to determine the impact of the sump pH, spray flow to area ratio and duration, and the increased temperature profile on the head-loss due to chemical effects.

Margins exist that could be available to address head-loss increases due to chemical effects. For example, the new sump screen design provides an inherent head-loss margin of approximately 36% based on the maximum head allowed in the procurement specification versus the NPSH available. As noted earlier, Entergy plans to account for chemical effects during the screen design process.

(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.

In general, the containment floors are clear of major obstructions that could prevent flow from reaching the containment sump screens. The configuration of the containment basement elevation is conducive to directing flow to the containment sump. The entire basement elevation of the containment building serves as the ECCS sump for collection of water introduced to the containment following a LOCA. The basement floor elevation is essentially an open area except for the primary reactor shield wall, the walls and supports for the loop compartments (D-rings), and the refueling cavity. The flow paths from the upper levels of containment to the lower levels are relatively free, i.e., open stairways and/or floor grating. The D-rings contain the RCPs, SGs, and Pressurizer. These vaults have large openings that allow water to spill to the containment basement elevation. Other hold-up volumes not connected to the recirculation sump have been included in the minimum water level calculation. The refueling canal drains through a combination of 2-inch, 6-inch, and 8-inch pipes and a 6-inch valve to the South D-ring and from there to the sump. The valve is locked open during normal operation. Therefore, a credible path to the containment pool exists and there is no hold up of inventory in the refueling canal. Furthermore, the path from the refueling canal to the containment floor does not bypass the ECCS suction screen.

(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.

The flow paths downstream of the containment sump were analyzed to determine the potential for blockage due to debris passing through the sump strainer (Reference 7). The acceptance criteria were based on WCAP-16406-P (Reference 12).

These evaluations were done for components in the recirculation flow paths including, but not limited to, throttle valves, flow orifices, spray nozzles, pumps, heat exchangers, and valves. The methodology employed in this evaluation was based upon input obtained from a review of the recirculation flow path shown on piping and instrument diagram drawings and plant procedures. The steps used in obtaining the flow clearance were as follows:

- Determine the maximum characteristic dimension of the debris (clearance through the sump screen).
- Identify the recirculation flow paths.
- Identify the components in the recirculation flow paths.
- Review the vendor documents (drawings and/or manuals) for the components to obtain flow clearance dimensions.
- Determine blockage potential through a comparison of the flow clearance through the component with the flow clearance through the sump screen.
- Identify the components that require a detailed evaluation and investigation of the effects of debris on their capability to perform their designated safety function.

The results of the preliminary evaluation for flow clearances showed that some components require additional evaluation for long-term wear. As discussed in d(vi), the long-term downstream evaluations are in progress. The resolution and corrective actions for the downstream components will be performed with the long-term evaluations.

The procurement specification requires the new strainer design to ensure that gaps at mating surfaces within the strainer assembly and between the strainer and the supporting surface do not have gaps in excess of the strainer perforation size. The design also ensures that drainage paths to the sump that bypass the sump strainer would also have a maximum debris size bypass of less than the strainer perforation size.

(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.

Verification of debris blockage of downstream components is described in (d)(v). As noted earlier, verification of downstream components for long-term wear is in progress, and the final results will be reported to the NRC by December 15, 2005. Preliminary results are summarized as follows.

The long-term downstream effects evaluation is in progress using the methodology and acceptance criteria presented in WCAP-16406-P (Reference 12). Where excessive wear is found using this methodology, a refined approach using methods such as those described in Department of Energy, Centrifugal Slurry Pump Wear and Hydraulic Studies conducted from October 1982 to December 1987 (Reference 15) may be utilized.

For the long-term wear evaluations, the quantity and type of debris is derived from the debris transport and head-loss calculations (Reference 6) and the sump screen procurement specification (Reference 8). The "ANO-2 Containment Flood Maximum and Minimum Levels" is used for the amount of fluid in which the debris is mixed. Preliminary calculations have been performed for orifices and spray nozzles. These calculations are based on conservative values C_{∞} of 0.0007 and decay coefficient of 0.02 for Equation 5.8-5 of WCAP-16406-P. The preliminary results are as follows:

- The containment spray nozzles in the CSS show acceptable wear for the required mission time of 30 days.
- Orifices in the CSS show acceptable wear for the required mission time of 30 days.
- Orifices in the HPSI system show acceptable wear for the required mission time of 30 days.

- Evaluations for pumps, piston (lift) check valves, relief valves in the HPSI and CSS, debris settling in instrument lines, instrumentation root valves, and throttle valves used for flow balancing in the HPSI are in progress.

(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.

The sump is located outside the missile barriers and any zones of influence of high energy line breaks. Therefore, the strainers are not subject to loads from missiles or expanding jets. The need for trash racks would be determined during the detailed strainer design phase. The procurement specification requires that the strainers are designed to withstand the loads imposed by the accumulation of debris and pressure differentials under predicted flow conditions as specified in the design requirements, as well as seismically generated loads (Reference 8).

(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.

The strainers are expected to be of a passive design.

(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.

Changes to the plant licensing bases are performed during the modification process via 10CFR50.59.

(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 ECCS and the CSS after LOCA 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.

Entergy realizes that control of potential debris sources inside of containment is very important and that debris sources that are introduced to containment need to be identified and assessed. Potential debris sources can be generally categorized into the following general areas: insulation, coatings (both qualified and unqualified), miscellaneous sources (labels, tags, tape, etc.), and dirt/dust. Entergy currently implements the following controls for these potential sources of debris.

Insulation used inside of containment is identified on site drawings. In addition, insulation walkdowns were performed to support GL 2004-02. Entergy will ensure that as part of the modification process, insulation materials that are introduced to containment are identified and evaluated to determine if they could affect sump performance or lead to downstream equipment degradation.

The majority of the coatings inside of containment were procured and applied as qualified coatings. Qualified coatings are controlled under site procedures. In addition, the debris generation calculation discussed above, includes margin for potential detachment or failure of limited quantities of qualified coatings. Entergy will repair or assess damaged qualified coatings to ensure that the quantities of failed coatings in the debris generation calculation are not exceeded.

Unqualified coatings have been identified by location, surface area, and thickness. The majority of unqualified coatings inside of containment are component Original Equipment Manufacturer coatings. New or replacement equipment is evaluated for the potential of unqualified coatings. Entergy will ensure that unqualified coatings introduced to containment are identified. Entergy will implement a program to track the unqualified coatings to ensure that the quantity of unqualified coatings in the debris generation calculation is not exceeded.

Walkdowns in support of resolution of GL 2004-02 identified and quantified miscellaneous potential sources of debris (tags, labels, tape, etc.) inside of containment. The modification process requires that materials introduced to containment be identified and evaluated for potential impact to the sump and equipment as part of the design process. Administrative procedures control the types of tags and labels that can be used inside of containment. During recent outages, efforts have been taken to reduce the quantities of these miscellaneous debris sources inside of containment. Entergy will implement a program to track the tags and labels inside containment to ensure that the amount does not exceed the sacrificial area provided in the design.

At the end of an outage, a formal containment close-out surveillance procedure is performed. The close-out is performed to ensure that materials do not affect the ECCS including the sump. Items not removed require a documented evaluation to provide the basis for concluding that the item remaining in containment is acceptable. As part of containment close-out each ECCS train containment sump and sump screens are inspected for damage or debris. Also, refueling canal drains are verified not to be obstructed and that there no potential debris sources in the refueling canal area that could obstruct the drains.

As discussed above, as part of the containment walkdowns used to identify potential debris sources, measurements were taken to conservatively estimate the amount of latent dirt and dust inside of containment. These measurements were taken at a point during the respective refueling outage where the level of dirt and dust would be much higher than during normal power operation. Subsequent to the measurements being taken but prior to unit startup, extensive cleaning was performed. These cleaning activities are consistent with normal housekeeping practices and associated administrative requirements. To provide an additional level of conservatism, the actual dirt and dust quantities assumed in the analysis are much greater than the values determined from the measurements. In order to ensure that the analysis remains bounding, Entergy intends to perform these types of measurements every third refueling outage. Assuming the results indicate that the housekeeping practices provide an adequate level of cleanliness, the plant may choose to relax this frequency after the first measurements.

References

1) NEI Document NEI 04-07, Rev. 0, Dated December 2004, *Pressurized Water Reactor Sump Performance Evaluation Methodology*

2) *Safety Evaluation by The Office of Nuclear Reactor Regulation Related to NRC Generic Letter 2004-02, NEI Guidance Report, Pressurized Water Reactor Sump Performance Evaluation Methodology*

3) NEI Document NEI 02-01, *Condition Assessment Guidelines: Debris Sources Inside PWR Containments*

4) Sargent & Lundy LLC Calculation 2005-00381, Revision 0, dated August 8, 2005, *Debris Generation Due to LOCA within Containment for Resolution of GSI 191*

5) Sargent & Lundy LLC Document No. 2003-09781, Rev. 0, dated December 9, 2003, *Walkdown Report for Evaluating Debris Sources Inside ANO-2 Containment for Resolution of GSI 191*

6) Sargent & Lundy LLC Calculation No. 2005-01687, *Post-LOCA Debris Transport, Head-Loss Across Containment Sump Screen, and NPSH Evaluation for Resolution of GSI-191*

7) Sargent & Lundy LLC Document No. 2005-02540, *GSI-191 Downstream Effects – Flow Clearances*

8) Entergy Specification No. ANO-M-2703, Rev. 0, dated August 29, 2005, *Technical Specification for ANO-2 Containment Sump Strainers*

9) *Chemical Effects Evaluation* (later)

10) *Downstream Effects for Wear* (later)

11) *Fuels Evaluation* (later)

12) Westinghouse Evaluation WCAP-16406-P, dated June 2005, *Evaluation of Downstream Sump Debris Effects in Support of GSI-191*

13) Vendor comment during NRC Public Meeting on June 30, 2005

14) *Test Plan: Characterization of Chemical and Corrosion Effects Potentially Occurring Inside a PWR Containment Following a LOCA*, Revision 13, dated July 20, 2005

15) Department of Energy, *Centrifugal Slurry Pump Wear and Hydraulic Studies conducted from October 1982 to December 1987*

16) Calculation No. 90-E-0100-04, Rev. 03, *ANO-2 Containment Flood Maximum and Minimum Levels*

Attachment 2

0CAN080501

List of Regulatory Commitments

List of Regulatory Commitments

The following table identifies those actions committed to by Entergy in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

COMMITMENT	TYPE (Check One)		SCHEDULED COMPLETION DATE (If Required)
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
The results of the downstream effects evaluation for long-term wear will be submitted to the NRC for both ANO units.	X		December 15, 2005
The selected sump strainer vendor will also be submitted to the NRC for both ANO units.	X		December 15, 2005
The ANO-1 walkdowns for quantifying the latent debris (dust, lint, etc.) and unqualified labels, tape, etc. are planned for fall 2005 in order to confirm the values used in the calculation are bounding	X		Fall 2005
Based on the results from debris generation and transport scoping analyses identified and described below, modifications to the existing debris screens will be required to meet the applicable Regulatory Requirements discussed in the generic letter. The strainer design (surface area, perforation size, and layout) and final head-loss will be determined by the strainer vendor.	X		Fall 2006 (ANO-2) Spring 2007 (ANO-1)
ANO-1 walkdowns to determine the sacrificial surface area are planned for fall 2005.	X		Fall 2005
Plant modifications to install new sump strainers will be implemented during an upcoming refueling outage.	X		Fall 2006 (ANO-2) Spring 2007 (ANO-1)
The ANO-1 walkdown will also quantify the area of unqualified labels, tape, etc.	X		Fall 2005

Entergy plans to evaluate the adequacy of the strainer design and will incorporate chemical effects once the tests results to quantify chemical debris effect on head-loss have been published. At the same time, an additional evaluation will be performed to determine the impact of the sump pH, spray duration, and the increased temperature profile on the head-loss due to chemical effects.	X		Fall 2006 (ANO-2) Spring 2007 (ANO-1)
ANO-1 drains from the reactor cavity and other drains that bypass the sump screen will be fitted with screens with the same perforation size as the main screen	X		Spring 2007
The resolution and corrective actions for the downstream components will be performed with the long-term evaluations for both ANO units.	X		December 15, 2005
Entergy will ensure that as part of the modification process, insulation materials that are introduced to containment are identified and evaluated to determine if they could affect sump performance or lead to downstream equipment degradation.		X	Fall 2006 (ANO-2) Spring 2007 (ANO-1)
Entergy will repair or assess damaged qualified coatings to ensure that the quantities of failed coatings in the debris generation calculation are not exceeded.		X	Fall 2006 (ANO-2) Spring 2007 (ANO-1)
Entergy will ensure that unqualified coatings introduced to containment are identified.		X	Fall 2006 (ANO-2) Spring 2007 (ANO-1)
Entergy will implement a program to track the unqualified coatings to ensure that the quantity of unqualified coatings in the debris generation calculation is not exceeded.		X	Fall 2006 (ANO-2) Spring 2007 (ANO-1)

ANO-1 walkdowns in support of resolution of GL 2004-02 will identify and quantify miscellaneous potential sources of debris (tags, labels, tape, etc.) inside of containment.	X		Fall 2005
Entergy will implement a program to track the tags and labels inside containment to ensure that the amount does not exceed the sacrificial area provided in the design.		X	Fall 2006 (ANO-2) Spring 2007 (ANO-1)
Measurements for ANO-1 will be taken to conservatively estimate the amount of latent dirt and dust inside of containment during the next refueling outage.	X		Fall 2005
In order to ensure that the analysis remains bounding, Entergy intends to perform these types of measurements (latent debris) every third refueling outage.		X	Recurring every third refueling outage