FPL

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SEP 0 1 2005

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
11555 Rockville Pike
Rockville, Maryland 20852

L-2005-181
10 CFR 50.54(f)

Re: Florida Power and Light Company
St. Lucie Units 1 and 2
Docket Nos. 50-335 and 50-389
Turkey Point Units 3 and 4
Docket Nos. 50-250 and 50-251

FPL Energy – Seabrook, LLC
Seabrook Station
Docket No. 50-443

NRC Generic Letter 2004-02
Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors –
Second Response

On September 13, 2004, the Nuclear Regulatory Commission (NRC) issued Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors." Florida Power & Light Company (FPL), the licensee for the St. Lucie Nuclear Plant, Units 1 and 2, and Turkey Point Nuclear Plant, Units 3 and 4, and FPL Energy Seabrook, LLC (FPL Energy Seabrook), the licensee for Seabrook Station, hereby submit the second of two responses requested by Generic Letter 2004-02.

In Generic Letter 2004-02, the NRC requested that specific information be provided within 90 days of the date of the safety evaluation report providing the guidance for performing the requested evaluation. The FPL/FPL Energy Seabrook 90-day response was submitted on March 4, 2005. The NRC further requested, in Generic Letter 2004-02, that certain other information be provided no later than September 1, 2005. Accordingly, Attachment 1 provides the requested information regarding St. Lucie Nuclear Plant, Units 1 and 2, Attachment 2 provides the requested information regarding Turkey Point Nuclear Plant, Units 3 and 4, and Attachment 3 provides the requested information regarding Seabrook Station.

The attached information is provided pursuant to the requirements of Section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f).

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Please contact Rajiv S. Kundalkar at (561) 694-4848 if you have any questions regarding these responses.

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

Executed on 8/30/05

Sincerely yours,

J. A. Stall
Senior Vice President, Nuclear and
Chief Nuclear Officer

Attachments (3)

cc: Regional Administrator, Region I
Regional Administrator, Region II
USNRC Project Manager, St Lucie and Turkey Point
Senior Resident Inspector, USNRC, St. Lucie
Senior Resident Inspector, USNRC, Turkey Point
USNRC Project Manager, Seabrook Station
Senior Resident Inspector, USNRC, Seabrook Station

ATTACHMENT 1

NRC GENERIC LETTER 2004-02: POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED-WATER REACTORS

RESPONSE FOR ST. LUCIE UNITS 1 AND 2

On September 13, 2004, the Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors." In GL 2004-02, the NRC requested that specific information be provided no later than September 1, 2005. The specific NRC request and associated FPL response for St. Lucie Units 1 and 2 follow:

NRC Requested Information: *Addressees are requested to provide the following information no later than September 1, 2005:*

NRC Request 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.*

FPL Response: Corrective actions will be implemented to ensure that the emergency core cooling system (ECCS) and containment spray system (CSS) recirculation functions under debris loading conditions will be in compliance with the Applicable Regulatory Requirements section of NRC Generic Letter (GL) 2004-02 when all modifications are completed. The Applicable Regulatory Requirements section of the generic letter references three 10 CFR 50 Appendix A general design criteria (GDC) that require compliance.

St. Lucie Unit 2 is licensed to 10 CFR 50, Appendix A. St. Lucie Unit 1 received its construction permit prior to issuance of the proposed Appendix A to 10 CFR 50, therefore the current licensing bases include aspects of the 1967 proposed criteria. Although numbered and worded somewhat differently, the 1967 proposed GDC have equivalent versions of the criteria that address the same concepts as the 10 CFR 50 Appendix A GDC.

Containment walkdowns, debris generation calculations, debris transport calculations, and allocation of an allowance for chemical effects on the sump strainers have been completed. The downstream effects evaluations are in progress. The bid specification for new sump strainers has been issued, and vendor proposals have been received. The sump strainer vendor is scheduled to be selected in October, 2005.

The licensing basis will be updated to reflect the results of the analysis and modifications performed to demonstrate compliance with the regulatory requirements. This update will be performed in accordance with the requirements of 10 CFR 50.59.

The configuration of the plant that will exist once all modifications required for regulatory compliance are completed is addressed in responses 2(b) through 2(f) below.

NRC Request 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.*

FPL Response: Based on the results of the debris generation and transport analyses discussed in this response, modifications to the existing sump strainers will be made to provide added assurance that the applicable regulatory requirements are met.

Installation of new sump strainers is planned for St. Lucie Unit 1 refueling outage SL1-21 in the spring of 2007 and St. Lucie Unit 2 refueling outage SL2-17 in the fall of 2007. The final strainer design will be validated by vendor testing. It is planned to complete this testing in March, 2006.

Although the next Unit 2 refueling outage (refueling outage SL2-16) is currently planned for the Spring of 2006, implementation of in-containment modifications are planned for the following Unit 2 refueling outage, which is scheduled for the fall of 2007. This delay, which does not compromise completion of planned actions by December 31 2007, is required to ensure adequate time to complete testing and incorporate the test results into the final design.

The response to 2(f) contains a discussion of the programmatic actions that will be implemented to ensure that design bases for the new sump strainers are maintained.

Based on the downstream effects evaluations discussed in this response, additional corrective actions may be required to provide added assurance that the applicable regulatory requirements are met. It is planned to complete the downstream effects analysis, including the effect on fuel, in March, 2006.

Actions that require containment access (e.g., new sump strainer installation) will be completed prior to restart from Unit 1 refueling outage SL1-21 (spring 2007) for Unit 1, and Unit 2 refueling outage SL2-17 (fall 2007) for Unit 2. Equipment outside containment is accessible at power and therefore does not require an outage for completion. Based on this accessibility, the current evaluation status, the potential for requiring additional vendor input, and the fact that an outage is not required to meet the December 31, 2007 date, actions that do not require containment access may be scheduled for non-outage completion. Actions that do not require containment access may be scheduled for non-outage completion. All required actions, including those that may emerge after September 1, 2005, will be completed prior to December 31, 2007.

NRC Request 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.)

FPL Response:

Walkdown Surveillance Methodology: The methodology of Nuclear Energy Institute (NEI) 02-01, "Condition Assessment Guidelines: Debris Sources Inside PWR Containments," was used as guidance for walkdown surveillances. The walkdown surveillances are described in the St. Lucie response to Item 1 (b) of the requested information described in GL 2004-02, which was transmitted to the NRC in FPL Letter L-2005-034 on March 4, 2005.

Debris Generation Methodology: The methodologies that were used to determine the types, quantities, and locations of debris generated during a Loss of Coolant Accident (LOCA) event in which the plant enters the recirculation mode are those of: (a) NEI 04-07 as modified by the NRC in the "Safety Evaluation by The Office of Nuclear Reactor Regulation Related to NRC Generic Letter 2004-02, Nuclear Energy Institute Guidance Report (Proposed Document Number NEI 04-07), Pressurized Water Reactor Sump Performance Evaluation Methodology," dated December 6, 2004 (NEI 04-07), and (b) Regulatory Guide 1.82, "Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident," Rev. 3 (Reg. Guide 1.82).

The quantity of debris was conservatively determined by selecting break locations based on the specification in Reg. Guide 1.82 Rev. 3, and an evaluation process intended to maximize head loss over the sump strainer. In addition, an analytical process was used that conservatively overstates the quantity of debris from insulation by 5-15%. The debris size distribution for debris source materials is determined using the approach outlined in NEI 04-07.

The zone of influence (ZOI) for qualified coatings is 10 times the break diameter (L/D=10). The ZOI for other materials is based on the destruction pressures established for the plant specific materials, which is an acceptable analytical refinement over the baseline evaluation approach that is presented in NEI 04-07 Section 4.2.2.1.1. Credit is not taken for shadowing effects arising from large components/equipment within a given ZOI.

Debris from qualified coatings is determined using the approach described in NEI 04-07 as modified by the NRC. Inside the ZOI, the qualified coatings are assumed to fail to pigment-sized particles. Outside the ZOI, qualified coatings are assumed to remain intact.

Debris from unqualified coatings is determined using the approach described in NEI 04-07 as modified by the NRC. All unqualified coatings in containment are assumed to fail to pigment-sized particles.

Variances from NEI 04-07 Guidance as Modified by the NRC: No departures from the NEI 04-07 methodology, as modified by the NRC, were identified. However, the following variances from NEI 04-07 input guidance, as modified by the NRC, were identified:

- The quantity of latent debris is assumed to be 150 pounds. Use of this value in lieu of applied survey results is a variance from Section 3.5 of NEI 04-07.

  The justification for using 150 lbs is based on industry information. The average debris density (averaged over the in-containment surface area) was 3.31 lbm / 10,000 ft^2. The maximum average debris density (averaged over the in-containment surface area) was 10.15 lbm / 10,000 ft^2. The value of 150 lbs corresponds to an in-containment surface area of 150,000 ft^2 and a debris density of 10 lbm / 10,000 ft^2, which is judged to be acceptable based on this data.

- The quantity of miscellaneous debris in the analysis is assumed to be bounded by the equivalent of 2% of the total piping insulation and equipment insulation. Use of this estimated quantity of miscellaneous debris is a variance from NEI 04-07.

  However, this 2% assumption was not used for the bid specification/design, where the sacrificial area (sump strainer area that is covered by miscellaneous debris) was independently estimated to be 113 ft^2. This is conservative based on the fact that St. Lucie Units 1 and 2 procedures are in place to monitor and control miscellaneous debris and other items inside containment. Thus, although this 2% assumption was used in the analysis, it does not affect the sump strainer design parameters.

- The qualified coating thickness is assumed to be 3 mils of inorganic zinc primer plus 6 mils of epoxy (or epoxy-phenolic) top coat. The unqualified coating thickness is assumed to be 3 mils of inorganic zinc (IOZ). This is consistent with the base guidance in NEI 04-07 Section 3.4.3.4. However, it is a variance from the guidance in NEI 04-07 as modified by the NRC Safety Evaluation. This assumption affects the quantity of coating debris at the sump. This assumption will be validated, or modified if necessary, to ensure that the final design and analyses account for the correct quantity of coating debris.

- The coating area in the ZOI is assumed to be equal to the surface area of the ZOI. This is consistent with the base guidance in NEI 04-07 Section 3.4.2.6. However, it is a variance from the guidance in NEI 04-07 as modified by the NRC Safety Evaluation. This assumption affects the quantity of coating debris at the sump. This assumption will be validated, or modified if necessary, to ensure that the final design and analyses account for the correct quantity of coating debris.

Debris Transport Methodology: The methodology of NEI 04-07 as modified by the NRC Safety Evaluation was used in the debris transport methodology. No exceptions to the methodology of NEI 04-07 as modified by the NRC Safety Evaluation were identified.

Debris transport is analyzed using the computational fluid dynamics (CFD) based methodology outlined in NEI 04-07.

The fraction of debris that is suspended, and the incipient tumbling velocities were determined using available transport test data from NEI 04-07, that are corrected using values cited in; (a) NUREG-0897, "Containment Emergency Sump Performance," Rev. 1, April 1983, (b) NUREG/CR-3616 "Transport and Screen Blockage Characteristics of Reflective Metallic Insulation Materials," January 1984, and (c) NUREG 6772 "GSI-191: Separate-Effects Characterization of Debris Transport in Water," August 2002.

Chemical Effects Methodology: The approach used for chemical effects is to make margin available, and use the results of sump strainer vendor head loss testing to validate, or modify if necessary, the final strainer design (e.g., increase the strainer area).

A comparison of the Westinghouse Owner's Group (WOG) integrated chemical effects test program (ICET) Test 1 and St. Lucie Unit 1 plant specific parameters, and ICET Test 2 and St. Lucie with Unit 2 plant specific parameters has been performed. The evaluation concluded that the critical parameters in the ICET Test 1 bound the plant parameters for St. Lucie Unit 1 and that the critical parameters in the ICET Test 2 bound the plant parameters for St. Lucie Unit 2. Therefore, the sump strainer vendor head loss test will incorporate the results of ICET Test 1 for St. Lucie Unit 1 and Test 2 for St. Lucie Unit 2.

Margin has been made available in several areas for chemical effects and other adverse effects that may arise in the course of testing, design, and/or fabrication. First, approximately half of the available NPSH margin has been reserved. Second, approximately 15% margin was added to the sump strainer debris load. Third, testing conducted by FPL and Framatome indicates that the qualified coating ZOI may be reduced from 10D (currently used in the analyses) to 4D, which will reduce the quantity of coating that reaches the sump strainer.

As stated above, the vendor strainer testing to validate chemical effects is planned to be completed in March, 2006.

Downstream Effects Methodology: The methodologies of NEI 04-07 as modified by the NRC Safety Evaluation (dated December 6, 2004) and WCAP-16406-P, "Evaluation of Downstream Sump Debris Effects in Support of GSI-191,"(dated June, 2005) are used to evaluate the downstream effects of debris that is passed by the sump strainer. Consistent with the guidance in NEI 04-07, the evaluation considers debris that is larger than the largest dimension of the sump strainer opening.

Analyses Performed By Contractors: The debris generation and transport analyses were performed by Framatome ANP (FANP) with input from Alden Research Laboratory. The chemical and downstream effects analyses, with the exception of fuel related analyses, are being performed by Sargent & Lundy^{LLC} (S&L). The fuel related downstream effects analyses will be performed by FANP.

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

NRC Request 2(d)(i): *The minimum available NPSH margin for the ECCS and CSS pumps with an unblocked sump strainer.*

FPL Response: Consistent with the current design basis, the existing NPSH margin is calculated for one sump not operating, and 50% screen blockage of the operating sump screen. The minimum available net positive suction head (NPSH) margin for the ECCS and CSS pumps under these conditions is 6.9 feet for St. Lucie 1 and 6.9 feet for St. Lucie 2. Based on the existing and pretest screen sizes, this value is conservative. (That is, the NPSH margin with the new sump strainer unblocked is expected to be greater than 6.9 feet.)

NRC Request 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.*

FPL Response: As discussed above, the final sump strainer design depends on chemical effects test results for the strainer. The pretest estimate of the minimum submerged area of the new sump strainer is 2100 ft^2 per sump for St. Lucie Unit 1 and 2100 ft^2 per sump for St. Lucie Unit 2 for a passive design. The strainers will be fully submerged and will have a minimum freeboard of 3 inches at switchover to sump recirculation. As stated above, the final screen size will be validated by vendor testing.

NRC Request 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.*

FPL Response: The allowance for head loss from debris accumulation on the submerged sump strainer is 4.7 feet for St. Lucie Unit 1 and 3.0 feet for St. Lucie Unit 2. The primary constituents of the debris bed are provided below. Chemical effects are discussed in the response to request 2(c).

Description of the primary constituents of the debris bed	St. Lucie Unit 1	St. Lucie Unit 2
Fiber Insulation – Nukon	65 ft^3	1410 ft^3
Fiber Insulation – Thermal Wrap	850 ft^3	None
Reflective metal Insulation – Transco RMI	207 ft^2	None
Reflective metal Insulation – Diamond Power Mirror	None	39 ft^2
Particulate – Cal-Sil	238 ft^3	10 ft^3
Particulate – Foamglas	None	31 ft^3

Description of the primary constituents of the debris bed	St. Lucie Unit 1	St. Lucie Unit 2
Qualified and Unqualified Coatings – Failed coatings	11 ft^3	10 ft^3
Latent Debris– Latent fiber	20 lbm	20 lbm
Latent Particulate Dirt and Dust	110 lbm	111 lbm
Miscellaneous Fiber	20 ft^3	30 ft^3
Miscellaneous Particulate	8 ft^3	0.2 ft^3

NRC Request 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.*

FPL Response: Containment walkdowns have been performed in accordance with the guidance of NEI 02-01. However, it is planned to obtain additional confirmation that there are no potential choke-points that could adversely affect operation of ECCS and CSS in the recirculation mode or cause the sump water level and associated NPSH to be less than the design basis values. This confirmation is scheduled to be obtained during Unit 1 refueling outage SL1-20 (fall of 2005) and Unit 2 refueling outage SL2-16 (spring 2006).

Additionally, an inspection for non-LOCA generated material that could potentially obstruct recirculating water is conducted as part of the containment cleanliness inspection program prior to restart. The controlling procedure specifically addresses the need to ensure that the containment is free of loose debris and fibrous material and items not approved for storage in containment are removed.

NRC Request 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.*

FPL Response: FPL will implement corrective actions identified as a result of downstream analyses that are necessary to ensure 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 strainer. Any identified corrective actions that require containment access will be completed prior to restart from Unit 1 refueling outage SL1-21 (spring 2007) for Unit 1 and Unit 2 refueling outage SL2-17 (fall 2007) for Unit 2. Actions that do not require containment access may be scheduled for non-outage completion. All required actions, including those that may emerge after September 1, 2005, will be completed prior to December 31, 2007.

The flow paths downstream of the containment sump are being analyzed to determine the potential for debris blockage due to debris passing through the sump strainer. The evaluations are based on an assumed sump strainer perforation size of 1/8-inch by 1/8-inch (diagonal dimension of 0.177-inch). Consistent with the guidance in NEI 04-07, the initial evaluation considers debris that is larger than the largest dimension of the sump strainer opening.

The evaluations identified eight (8) Unit 1 components and six (6) Unit 2 components that require further evaluation, not including instrumentation. The smallest identified downstream opening is 0.156 inch for St. Lucie Unit 1 (HPSI relief valve) and 0.09 inch for St. Lucie Unit 2 (fuel assembly debris screen). Instrumentation was also identified as requiring further evaluation.

As discussed under item 2 (b), a new sump strainer will be installed, and it is expected that the perforation size in the new strainer will be less than 1/8-inch by 1/8-inch, so the evaluation remains bounding for the purposes of determining the effects of debris pass-through.

Adverse gaps or breaches are prohibited by the sump strainer specification, which requires that there shall be no spaces or gaps in the final installation that would allow passage of any particles larger than the perforation size.

In addition, existing technical specifications require that the sump screens be inspected at least once per 18 months. The inspection procedure currently requires verification that there are no unacceptable holes or gaps in the screen or between the screen and adjacent structures and components. The inspection criteria will be revised to conform to the requirements of the new sump strainer prior to Unit 1 startup from refueling outage SL1-21 and Unit 2 startup from refueling outage SL2-17.

NRC Request 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.*

FPL Response: The long term downstream evaluations are in progress and it is planned to have them completed in March, 2006. It is planned that any corrective actions arising from the evaluations that require containment access will be completed prior to restart from St. Lucie Unit 1 refueling outage SL1-21 (spring of 2007) and St. Lucie Unit 2 refueling outage SL2-17 (fall of 2007) respectively. However, actions that do not require containment access may be scheduled for non-outage completion. All required actions will be completed prior to December 31, 2007.

NRC Request 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.*

FPL Response: The current recirculation sump and sump screens at St. Lucie Units 1 and 2 are outside the secondary biological shield wall. Also, the existing Unit 2 containment sump is protected by a trash rack. This location protects them from jet impingement and missiles that could arise from high energy line breaks that would require the ECCS and CSS to operate in recirculation mode. If areas of the new strainer are not protected by the secondary biological shield wall, they will be designed to ensure that the unprotected areas are capable of withstanding the force of full debris loading, in conjunction with all design basis conditions, without collapse or structural damage. The design requirements also ensure that it will be capable of withstanding the hydrodynamic loads and inertial effects of water at full debris loading without loss of structural integrity whether or not trash racks are part of the design.

NRC Request 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.*

FPL Response: The specifications for new sump strainers have been issued, vendor proposals have been received, and the vendor selection process is underway. It is currently planned to install passive strainers.

NRC Request 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.

FPL Response: At this time, FPL does not anticipate that any licensing changes will be requested as a result of the actions required to ensure compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of GL 2004-02.

NRC Request 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 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".*

FPL Response: St. Lucie Units 1 and 2 have an aggressive containment cleanliness program to provide assurance that the containment buildings are free of foreign materials and debris prior to ascension into Mode 4 following shutdown and during power operation. This program was described in detail in the St. Lucie Units 1 and 2 response (FPL letter L-2003-201, dated August 8, 2003) to NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized Water Reactors." Detailed containment cleanliness

procedures exist for unit restart readiness and for containment entry at power. The requirements to assure that the containment is free of loose debris and fibrous material, and that items not approved for storage in containment are removed, are specifically addressed.
A continuing effort to reduce and minimize the amount of unqualified coatings inside the containment buildings is a high priority objective of the St. Lucie Units 1 and 2 containment coating program. The St. Lucie Units 1 and 2 response (FPL letter L-98-277, dated November 4, 1998) to NRC Generic Letter 98-04 discussed the programmatic controls for the surface preparation, procurement, application, and maintenance activities associated with Service Level 1 protective coatings used inside containment. The St. Lucie Unit 1 and 2 response (FPL letter L-2003-201 dated August 8, 2003) to NRC Bulletin 2003-01 supplemented this discussion.

Engineering design control procedures have been revised to ensure that a change to insulation, structures, doors, gates, or any other materials/components inside containment will be evaluated for the effect on the containment sump debris generation and transport analysis and/or recirculation functions.

FPL will ensure that potential quantities of post-accident debris are maintained within the bounds of the analyses and design bases that support ECCS and CSS recirculation functions. To this end, existing programs will be reviewed and revised as required to maintain coatings, insulation, latent debris and miscellaneous debris within these design bases.

ATTACHMENT 2

NRC GENERIC LETTER 2004-02: POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED-WATER REACTORS

RESPONSE FOR TURKEY POINT UNITS 3 and 4

On September 13, 2004, the Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors." In GL 2004-02, the NRC requested that specific information be provided no later than September 1, 2005. The specific NRC request and associated FPL response for Turkey Point Units 3 and 4 follow:

NRC Requested Information: *Addressees are requested to provide the following information no later than September 1, 2005:*

NRC Request 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.*

FPL Response: Corrective actions will be implemented to ensure that the emergency core cooling system (ECCS) and containment spray system (CSS) recirculation functions under debris loading conditions will be in compliance with the Applicable Regulatory Requirements section of NRC Generic Letter (GL) 2004-02 when all modifications are completed. The Applicable Regulatory Requirements section of the generic letter references three 10 CFR 50 Appendix A general design criteria (GDC) that require compliance.

Turkey Point Units 3 and 4 received construction permits prior to issuance of the proposed Appendix A to 10 CFR 50 and therefore the current licensing bases include aspects of the 1967 proposed criteria. Although numbered and worded somewhat differently, the 1967 proposed GDC have equivalent versions of the criteria that address the same concepts as the 10 CFR 50, Appendix A GDC.

Containment walkdowns, debris generation calculations, debris transport calculations, and allocation of an allowance for chemical effects on the sump strainers have been completed. The downstream effects evaluations are in progress. The bid specification for new sump strainers has been issued, and vendor proposals have been received. The sump strainer vendor is scheduled to be selected in October, 2005.

The licensing basis will be updated to reflect the results of the analysis and modifications performed to demonstrate compliance with the regulatory requirements. This update will be performed in accordance with the requirements of 10 CFR 50.59.

The configuration of the plant that will exist once all modifications required for regulatory compliance are completed is addressed in responses 2(b) through 2(f) below.

NRC Request 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.*

FPL Response: Based on the results of the debris generation and transport analyses discussed in this response, modifications to the existing sump screens and pressurizer relief tank insulation will be made to provide added assurance that the applicable regulatory requirements are met.

Installation of the new sump strainers is scheduled for Turkey Point Unit 3 refueling outage PT3-23 in the fall of 2007, and Turkey Point Unit 4 refueling outage PT4-23 in the fall of 2006. The final strainer design will be validated by vendor testing. It is planned to complete this testing in March, 2006.

Removal of the cal-sil insulation from the pressurizer relief tank is scheduled for Turkey Point Unit 3 refueling outage PT3-23 in the fall of 2007 and Turkey Point Unit 4 refueling outage PT4-23 in the fall of 2006.

The response to 2(f) contains a discussion of the programmatic actions that will be implemented to ensure that design bases for the new sump strainers are maintained.

Based on the downstream effects evaluations discussed in this response, additional corrective actions may be required to provide added assurance that the applicable regulatory requirements are met. It is planned to complete the downstream effects analysis, including the effect on fuel, in March, 2006.

Actions that require containment access (e.g., new sump strainer installation) will be completed prior to restart from Unit 3 refueling outage PT3-23 (fall of 2007) for Unit 3, and Unit 4 refueling outage PT4-23 (fall of 2006) for Unit 4. Equipment outside containment is accessible at power and therefore does not require an outage for completion. Based on this accessibility, the current evaluation status, the potential for requiring additional vendor input, and the fact that an outage is not required to meet the December 31, 2007 date, actions that do not require containment access may be scheduled for non-outage completion. Actions that do not require containment access may be scheduled for non-outage completion. All required actions, including those that may emerge after September 1, 2005, will be completed prior to December 31, 2007.

NRC Request 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.)*

FPL Response:

Walkdown Surveillance Methodology: The methodology of Nuclear Energy Institute (NEI) 02-01, "Condition Assessment Guidelines: Debris Sources Inside PWR Containments," was used as guidance for walkdown surveillances. The walkdown surveillances are described in the Turkey Point response to Item 1(b) of the requested information described in GL 2004-02, which was transmitted to the NRC in FPL Letter L-2005-034 on March 4, 2005.

Debris Generation Methodology: The methodologies that were used to determine the types, quantities, and locations of debris generated during a Loss of Coolant Accident (LOCA) event in which the plant enters the recirculation mode are those of: (a) NEI 04-07 as modified by the NRC in the "Safety Evaluation by The Office of Nuclear Reactor Regulation Related to NRC Generic Letter 2004-02, Nuclear Energy Institute Guidance Report (Proposed Document Number NEI 04-07), Pressurized Water Reactor Sump Performance Evaluation Methodology," dated December 6, 2004 (NEI 04-07), and (b) Regulatory Guide 1.82, "Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident ," Rev. 3 (Reg. Guide 1.82).

The quantity of debris was conservatively determined by selecting break locations based on the specification in Reg. Guide 1.82 Rev. 3, and an evaluation process intended to maximize head loss over the sump strainer. In addition, an analytical process was used that conservatively overstates the quantity of debris from insulation by 5-15%. The debris size distribution for debris source materials is determined using the approach outlined in NEI 04-07.

The zone of influence (ZOI) for qualified/acceptable coatings is 10 times the break diameter (L/D=10). The ZOI for other materials is based on the destruction pressures established for the plant specific materials, which is an acceptable analytical refinement over the baseline evaluation approach that is presented in NEI 04-07 Section 4.2.2.1.1. Credit is not taken for shadowing effects arising from large components/equipment within a given ZOI.

Debris from qualified/acceptable coatings is determined using the approach described in NEI 04-07 as modified by the NRC. Inside the ZOI, the qualified/acceptable coatings are assumed to fail to pigment-sized particles. Outside the ZOI, qualified/acceptable coatings are assumed to remain intact.

Debris from unqualified coatings is determined using the approach described in NEI 04-07 as modified by the NRC. All unqualified coatings in containment are assumed to fail to pigment-sized particles.

Variances from NEI 04-07 Guidance as Modified by the NRC: No departures from the NEI 04-07 methodology, as modified by the NRC, were identified. However, the following variances from NEI 04-07 input guidance, as modified by the NRC, were identified.

- The quantity of latent debris is assumed to be 150 pounds. Use of this value in lieu of applied survey results is a variance from Section 3.5 of NEI 04-07.

  The justification for using 150 lbs is based on industry information. The average debris density (averaged over the in-containment surface area) was 3.31 lbm / 10,000 ft^2. The maximum average debris density (averaged over the in-containment surface area) was 10.15 lbm / 10,000 ft^2. The value of 150 lbs corresponds to an in-containment surface area of 150,000 ft^2 and a debris density of 10 lbm / 10,000 ft^2, which is judged to be acceptable based on this data.

- The quantity of miscellaneous debris in the analysis is assumed to be bounded by the equivalent of 2% of the total piping insulation and equipment insulation. Use of this estimated quantity of miscellaneous debris is a variance from NEI 04-07.

  However, this 2% assumption was not used for the bid specification/design, where the sacrificial area (sump strainer area that is covered by miscellaneous debris) was independently estimated to be 50 ft^2. This is conservative based on the facts that Turkey Point Units 3 & 4 require that tags and/or items entering containment must be qualified, that all new placards are to be hung with qualified materials, and that procedures are in place to monitor and control miscellaneous debris inside containment. Thus, although this 2% assumption was used in the analysis, it does not affect the sump strainer design parameters.

- The qualified/acceptable coating thickness is assumed to be 3 mils of inorganic zinc primer plus 6 mils of epoxy (or epoxy-phenolic) top coat. The unqualified coating thickness is assumed to be 3 mils of inorganic zinc (IOZ). This is consistent with the base guidance in NEI 04-07 Section 3.4.3.4. However, it is a variance from the guidance in NEI 04-07 as modified by the NRC Safety Evaluation. This assumption affects the quantity of coating debris at the sump. This assumption will be validated, or modified if necessary, to ensure that the final design and analyses account for the correct quantity of coating debris.

- The coating area in the ZOI is assumed to be equal to the surface of the ZOI. This is consistent with the base guidance in NEI 04-07 Section 3.4.2.6. However, it is a variance from the guidance in NEI 04-07 as modified by the NRC Safety Evaluation. This assumption affects the quantity of coating debris at the sump. This assumption will be validated, or modified if necessary, to ensure that the final design and analyses account for the correct quantity of coating debris.

Debris Transport Methodology: The methodology of NEI 04-07 as modified by the NRC Safety Evaluation was used in the debris transport methodology. No exceptions to the methodology of NEI 04-07 as modified by the NRC Safety Evaluation were identified.

Debris transport is analyzed using the computational fluid dynamics (CFD) based methodology outlined in NEI 04-07.

The fraction of debris that is suspended, and the incipient tumbling velocities were determined using available transport test data from NEI 04-07, that are corrected using values cited in; (a) NUREG-0897, "Containment Emergency Sump Performance," Rev. 1, April 1983, (b) NUREG/CR-3616 "Transport and Screen Blockage Characteristics of Reflective Metallic Insulation Materials," January 1984, and (c) NUREG 6772 "GSI-191: Separate-Effects Characterization of Debris Transport in Water," August 2002.

Chemical Effects Methodology: The approach used for chemical effects is to make margin available, and use the results of sump strainer vendor head loss testing to validate, or modify if necessary, the final strainer design (e.g., increase the strainer area).

A comparison of the Westinghouse Owner's Group (WOG) integrated chemical effects test program (ICET) Test 2 and the Turkey Point Unit 3 & 4 plant specific parameters with trisodium phosphate (TSP) has been performed. The evaluation concluded that the critical parameters in the ICET Test 2 bound the plant parameters with TSP. Therefore, the sump strainer vendor head loss test will incorporate the results of ICET Test 2. At the present time the buffering agent at Turkey Point Units 3 & 4 is sodium tetraborate (Borax). However, it is planned to change the buffering agent to TSP prior to Unit 3 startup from refueling outage PT3-23 (fall 2007) and Unit 4 startup from refueling outage PT4-23 (fall 2006).

Margin has been made available in several areas for chemical effects and other adverse effects that may arise in the course of testing, design, and/or fabrication. First, approximately half of the available NPSH margin has been reserved. Second, a minimum of 10% margin was added to the sump strainer debris load. Third, testing conducted by FPL and Framatome indicates that the qualified/acceptable coating ZOI may be reduced from 10D (currently used in the analyses) to 4D, which will reduce the quantity of coating that reaches the sump strainer.

As stated above, the vendor strainer testing to validate chemical effects is planned to be completed in March, 2006.

Downstream Effects Methodology: The methodologies of NEI 04-07 as modified by the NRC Safety Evaluation (dated December 6, 2004) and WCAP-16406-P, "Evaluation of Downstream Sump Debris Effects in Support of GSI-191," (dated June, 2005) are used to evaluate the downstream effects of debris that is passed by the sump strainer. Consistent with the guidance in NEI 04-07, the evaluation considers debris that is larger than the largest dimension of the sump strainer opening.

Analyses Performed By Contractors: The debris generation and transport analyses were performed by Framatome ANP (FANP) with input from Alden Research Laboratory. The chemical and downstream effects analyses, with the exception of fuel related analyses, are being performed by Sargent & Lundy^{LLC} (S&L). The fuel related downstream effects analyses will be performed by FANP.

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

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

FPL Response: Consistent with the current design basis, the existing NPSH margin is calculated for one sump not operating, and 50% screen blockage of the operating sump screen. The minimum available net positive suction head (NPSH) margin for the ECCS and CSS pumps under these conditions is 8.2 feet. Based on the existing and pretest screen sizes, this value is conservative. (That is, the NPSH margin with the new sump strainer unblocked is expected to be greater than 8.2 feet.)

NRC Request 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.*

FPL Response: As discussed above, the final sump strainer design depends on chemical effects test results for the strainer. The pretest estimates indicate the minimum submerged area is approximately 1600 ft^2 per sump for a passive design. The strainers will be fully submerged and will have a minimum freeboard of 3 inches at switchover to sump recirculation. As stated above, the final screen size will be validated by vendor testing.

NRC Request 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.*

FPL Response: The allowance for head loss from debris accumulation on the submerged sump strainer is 3.6 feet. The primary constituents of the debris bed are provided below. Chemical effects are discussed in the response to request 2(c).

Description of the primary constituents of the debris bed	Turkey Point Unit 3	Turkey Point Unit 4
Fiber Insulation – Nukon	6 ft^3	472 ft^3
Fiber Insulation – Fiber	37 ft^3	40 ft^3
Reflective metal Insulation – Transco RMI	9,223 ft^2	7,052 ft^2
Particulate – Cal-Sil with Rivets	41 ft^3	None

Description of the primary constituents of the debris bed	Turkey Point Unit 3	Turkey Point Unit 4
Particulate – Cal-Sil with Buckles	20 ft^3	None
Particulate – Cal-Sil	None	61 ft^3
Particulate – Mudd	28 ft^3	28 ft^3
Particulate – Microtherm	2 ft^3	None
Qualified/acceptable and Unqualified Coatings – Failed coatings	6 ft^3	6 ft^3
Latent Debris– Latent fiber	19 lbm	19 lbm
Latent Particulate Dirt and Dust	108 lbm	108 lbm
Miscellaneous Debris - fiber	4 ft^3	15 ft^3
Miscellaneous Debris - particulate	9 ft^3	4 ft^3

NRC Request 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.*

FPL Response: Containment walkdowns were performed in accordance with the guidance of NEI 02-01. These walkdowns noted that the refueling canal drains require further evaluation to determine if they constitute potential choke points. This will be dispositioned prior to Unit 3 startup from refueling outage PT3-23 (fall 2007) and Unit 4 startup from refueling outage PT4-23 (fall 2006).

Additionally, an inspection for non-LOCA generated material that could potentially obstruct recirculating water is conducted as part of the containment cleanliness inspection program prior to restart. The controlling procedure specifically addresses the need to assure that the containment is free of all items that could be washed to the sump.

NRC Request 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.*

FPL Response: FPL will implement corrective actions identified as a result of downstream analyses that are necessary to ensure 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 strainer. Any identified corrective actions that require containment access will be completed prior to restart from Unit 3 refueling outage PT3-23 (fall of 2007) for Unit 3 and Unit 4 refueling outage PT4-23 (fall of 2006) for Unit 4. Actions that do not require containment access may be scheduled for non-outage completion. All required actions, including those that may emerge after September 1, 2005, will be completed prior to December 31, 2007.
The flow paths downstream of the containment sump are being analyzed to determine the potential for debris blockage due to debris passing through the sump strainer. The evaluations are based on an assumed sump strainer perforation size of 1/8-inch by 1/8-inch (diagonal dimension of 0.177-inch). Consistent with the guidance in NEI 04-07, the initial evaluation considers debris that is larger than the largest dimension of the sump strainer opening.

The evaluations identified 17 components (9 unique models) that require further evaluation, excluding instrumentation. One (1) component has been identified as having a gap smaller than 0.177-inch. Instrumentation was also identified as requiring further evaluation.

As discussed under item 2 (b), a new sump strainer will be installed, and it is expected that the perforation size in the new strainer will be less than 1/8-inch by 1/8-inch, so the evaluation remains bounding for the purposes of determining the effects of debris pass-through.

Adverse gaps or breaches are prohibited by the sump strainer specification, which requires that there shall be no spaces or gaps in the final installation that would allow passage of any particles larger than the perforation size.

In addition, existing technical specifications require that the sump screens be inspected at least once per 18 months. The inspection procedure currently requires verification that there are no unacceptable holes or gaps in the screen or between the screen and adjacent structures and components. The inspection criteria will be revised to conform to the requirements of the new sump strainer prior to Unit 3 startup from refueling outage PT3-23 (fall of 2007) and Unit 4 startup from refueling outage PT4-23 (fall of 2006).

NRC Request 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.*

FPL Response: The long term downstream evaluations are in progress and it is planned to have them completed in March, 2006. It is planned that any corrective actions arising from the evaluations be implemented prior to restart from Unit 3 refueling outage PT3-23 (fall of 2007) and Unit 4 refueling outage PT4-23 (fall of 2006) respectively. However, actions that do not require containment access may be scheduled for non-outage completion. All required actions will be completed prior to December 31, 2007.

NRC Request 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.

FPL Response: The current recirculation sump and sump screens at Turkey Point Units 3 and 4 are outside the secondary biological shield wall. This location protects them from jet impingement and missiles that could arise from high energy line breaks that would require the ECCS and CSS to operate in recirculation mode. If areas of the new strainer are not protected by the secondary biological shield wall, they will be designed to ensure that the unprotected areas are capable of withstanding the force of full debris loading, in conjunction with all design basis conditions, without collapse or structural damage. The design requirements also ensure that it will be capable of withstanding the hydrodynamic loads and inertial effects of water at full debris loading without loss of structural integrity.

NRC Request 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.*

FPL Response: The specifications for new sump strainers have been issued, vendor proposals have been received, and the vendor selection process is underway. It is currently planned to install passive strainers.

NRC Request 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.*

FPL Response: At this time, FPL does not anticipate that any licensing changes will be requested as a result of the actions required to ensure compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of GL 2004-02.

NRC Request 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.*

FPL Response: Turkey Point Units 3 and 4 have an aggressive containment cleanliness program that ensures the containment buildings are free of foreign materials and debris prior to ascension into Mode 4 following shutdown and during power operation. This program was described in detail in the Turkey Point Unit 3 and 4 response (FPL letter L-2003-201, dated

August 8, 2003) to NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized Water Reactors." Detailed containment cleanliness procedures exist for unit restart readiness and for containment entry at power. The requirements to assure that the containment is free of loose debris and fibrous material, and that items not approved for storage in containment are removed, are specifically addressed.

A continuing effort to reduce and minimize the amount of unqualified coatings inside the containment buildings is a high priority objective of the Turkey Point Units 3 and 4 containment coating program. The Turkey Point Units 3 and 4 response (FPL letter L-98-272, dated November 9, 1998) to NRC Generic Letter 98-04 discussed the programmatic controls for the surface preparation, procurement, application, and maintenance activities associated with Service Level 1 protective coatings used inside containment. The Turkey Point Unit 3 and 4 response (FPL letter L-2003-201 dated August 8, 2003) to NRC Bulletin 2003-01 supplemented this discussion.

Engineering design control procedures have been revised to ensure that a change to insulation, structures, doors, gates, or any other materials/components inside containment will be evaluated for the effect on the containment sump debris generation and transport analysis and/or recirculation functions.

FPL will ensure that potential quantities of post-accident debris are maintained within the bounds of the analyses and design bases that support ECCS and CSS recirculation functions. The programmatic actions that will be implemented to ensure that design bases for the new sump strainers are maintained will be implemented prior to Unit 3 startup from refueling outage PT3-23 (fall 2007) and Unit 4 startup from refueling outage PT4-23 (fall 2006).

ATTACHMENT 3

NRC GENERIC LETTER 2004-02: POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED-WATER REACTORS

RESPONSE FOR SEABROOK STATION

On September 13, 2004, the Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors." In GL 2004-02, the NRC requested that specific information be provided no later than September 1, 2005. The specific NRC request and associated FPL Energy Seabrook response for Seabrook Station follow:

NRC Requested Information: *Addressees are requested to provide the following information no later than September 1, 2005:*

NRC Request 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.*

FPL Energy Seabrook Response: Corrective actions will be implemented to ensure that the emergency core cooling system (ECCS) and containment building spray (CBS) system recirculation functions under debris loading conditions will be in compliance with the Applicable Regulatory Requirements section of NRC Generic Letter (GL) 2004-02 when all modifications are completed.

Containment walkdowns, debris generation calculations, debris transport calculations, and allocation of an allowance for chemical effects on the sump strainers have been completed. The downstream effects evaluations are in progress. The bid specification for new sump strainers has been issued, and vendor proposals have been received. The sump strainer vendor is scheduled to be selected in October, 2005.

The licensing basis will be updated to reflect the results of the analysis and modifications performed to demonstrate compliance with the regulatory requirements. This update will be performed in accordance with the requirements of 10 CFR 50.59.

The configuration of the plant that will exist once all modifications required for regulatory compliance are completed is addressed in responses 2(b) through 2(f) below.

NRC Request 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.

FPL Energy Seabrook Response: Based on the results of the debris generation and transport analyses discussed in this response, modifications to the existing sump strainers will be required to meet the applicable regulatory requirements discussed in the generic letter.

Installation of the new sump strainers is scheduled for Seabrook Station refueling outage OR11 in the fall of 2006. The final strainer design will be validated by vendor testing. It is planned to complete this testing in March, 2006.

The response to 2 (f) contains a discussion of the programmatic actions that will be implemented to ensure that design bases for the new sump strainers are maintained.

Based on the downstream effects evaluations discussed in this response, additional corrective actions may be required to provide added assurance that the applicable regulatory requirements are met. It is planned to complete the downstream effects analysis, including the effect on fuel, in March, 2006.

Actions that require containment access (e.g., new sump strainer installation) will be completed prior to restart from refueling outage OR11 (fall of 2006). Equipment outside containment is accessible at power and therefore does not require an outage for completion. Based on this accessibility, the current evaluation status, the potential for requiring additional vendor input, and the fact that an outage is not required to meet the December 31, 2007 date, actions that do not require containment access may be scheduled for non-outage completion. Actions that do not require containment access may be scheduled for non-outage completion. All required actions, including those that may emerge after September 1, 2005, will be completed prior to December 31, 2007.

NRC Request 2(c): *A description of the methodology that was used to perform the analysis of the susceptibility of the ECCS and CBS 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.)*

FPL Energy Seabrook Response:

Walkdown Surveillance Methodology: The methodology of Nuclear Energy Institute (NEI) 02-01, "Condition Assessment Guidelines: Debris Sources Inside PWR Containments," was

used as guidance for walkdown surveillances. The walkdown surveillances are described in the Seabrook response to Item 1 (b) of the requested information described in GL 2004-02, which was transmitted to the NRC in FPL Letter L-2005-034 on March 4, 2005.

Debris Generation Methodology: The methodologies that were used to determine the types, quantities, and locations of debris generated during a Loss of Coolant Accident (LOCA) event in which the plant enters the recirculation mode are those of: (a) NEI 04-07 as modified by the NRC in the "Safety Evaluation by The Office of Nuclear Reactor Regulation Related to NRC Generic Letter 2004-02, Nuclear Energy Institute Guidance Report (Proposed Document Number NEI 04-07), *Pressurized Water Reactor Sump Performance Evaluation Methodology*, " dated December 6, 2004 (NEI 04-07), and (b) Regulatory Guide 1.82, "Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident ," Rev. 3 (Reg. Guide 1.82).

The quantity of debris was conservatively determined by selecting break locations based on the specification in Reg. Guide 1.82 Rev. 3, and an evaluation process intended to maximize head loss over the sump strainer. In addition, an analytical process was used that conservatively overstates the quantity of debris from insulation by 5-15%. The debris size distribution for debris source materials is determined using the approach outlined in NEI 04-07.

The zone of influence (ZOI) for qualified coatings is 10 times the break diameter (L/D=10). The ZOI for other materials is based on the destruction pressures established for the plant specific materials, which is an acceptable analytical refinement over the baseline evaluation approach that is presented in NEI 04-07 Section 4.2.2.1.1. Credit is not taken for shadowing effects arising from large components/equipment within a given ZOI.

Debris from qualified coatings is determined using the approach described in NEI 04-07 as modified by the NRC. Inside the ZOI, the qualified coatings are assumed to fail to pigment-sized particles. Outside the ZOI, qualified coatings are assumed to remain intact.

Debris from unqualified coatings is determined using the approach described in NEI 04-07 as modified by the NRC. All unqualified coatings in containment are assumed to fail to pigment-sized particles.

Variances from NEI 04-07 Guidance as Modified by the NRC: No departures from the NEI 04-07 methodology, as modified by the NRC, were identified. However, the following variances from NEI 04-07 input guidance, as modified by the NRC, were identified:

- The quantity of latent debris is assumed to be 150 pounds. Use of this value in lieu of applied survey results is a variance from Section 3.5 of NEI 04-07.

  The justification for using 150 lbs is based on industry information. The average debris density (averaged over the in-containment surface area) was 3.31 lbm / 10,000 ft^2. The maximum average debris density (averaged over the in-containment surface area) of any of these plants was 10.15 lbm / 10,000 ft^2. The value of 150 lbs corresponds to an in-containment surface area of 150,000 ft^2 and a debris density of 10 lbm / 10,000 ft^2, which is judged to be acceptable based on this data.

- The quantity of miscellaneous debris in the analysis is assumed to be bounded by the equivalent of 2% of the total piping insulation and equipment insulation. Use of this estimated quantity of miscellaneous debris is a variance from NEI 04-07.

  However, this 2% assumption was not used for the bid specification/design, where the sacrificial area (sump strainer area that is covered by miscellaneous debris) was independently estimated to be 150 ft^2. The 150 ft^2 is an allowance for tags, placards and labels that are not environmentally qualified. Thus, although this 2% assumption was used in the analysis, it does not affect the sump strainer design parameters.

- The qualified coating thickness in the analyses is assumed to be 3 mils of inorganic zinc primer plus 6 mils of epoxy (or epoxy-phenolic) top coat. The unqualified coating thickness in the analyses is assumed to be 3 mils of inorganic zinc (IOZ). However, different coating systems exist at Seabrook Station. The assumption, in itself, is consistent with the base guidance in NEI 04-07 Section 3.4.3.4, but is a variance from the guidance in NEI 04-07 as modified by the NRC Safety Evaluation. This assumption affects the quantity of coating debris at the sump. This assumption will be validated, or modified if necessary, to ensure that the final design and analyses account for the correct quantity of coating debris.

- The coating area in the ZOI is assumed to be equal to the surface area of the ZOI. This is consistent with the base guidance in NEI 04-07 Section 3.4.2.6. However, it is a variance from the guidance in NEI 04-07 as modified by the NRC Safety Evaluation. This assumption affects the quantity of coating debris at the sump. This assumption will be validated, or modified if necessary, to ensure that the final design and analyses account for the correct quantity of coating debris.

Debris Transport Methodology: The methodology of NEI 04-07 as modified by the NRC Safety Evaluation was used in the debris transport methodology. No exceptions to the methodology of NEI 04-07 as modified by the NRC Safety Evaluation were identified.

Debris transport is analyzed using the computational fluid dynamics (CFD) based methodology outlined in NEI 04-07.

The fraction of debris that is suspended, and the incipient tumbling velocities were determined using available transport test data from NEI 04-07, that are corrected using values cited in; (a) NUREG-0897, "Containment Emergency Sump Performance," Rev. 1, April 1983, (b) NUREG/CR-3616 "Transport and Screen Blockage Characteristics of Reflective Metallic Insulation Materials," January 1984, and (c) NUREG 6772 "GSI-191: Separate-Effects Characterization of Debris Transport in Water," August 2002.

Chemical Effects Methodology: The approach used for chemical effects is to make margin available, and use the results of sump strainer vendor head loss testing to validate, or modify if necessary, the final strainer design (e.g., increase the strainer area).

A comparison of the Westinghouse Owner's Group (WOG) integrated chemical effects test program (ICET) Test 1 and the Seabrook Station plant specific parameters has been

performed. The evaluation concluded that the critical parameters in the ICET Test 1 bound the plant parameters. Therefore, the sump strainer vendor head loss test will incorporate the results of ICET Test 1.

Margin has been made available in several areas for chemical effects and other adverse effects that may arise in the course of testing, design, and/or fabrication. First, approximately half of the available NPSH margin has been reserved. Second, approximately 15% margin was added to the sump strainer debris load. Third, testing conducted by FPL and Framatome indicates that the qualified coating ZOI may be reduced from 10D (currently used in the analyses) to 4D, which will reduce the quantity of coating that reaches the sump strainer.

As stated above, the vendor strainer testing to validate chemical effects is planned to be completed in March, 2006.

Downstream Effects Methodology: The methodologies of NEI 04-07 as modified by the NRC Safety Evaluation (dated December 6, 2004) and WCAP-16406-P, "Evaluation of Downstream Sump Debris Effects in Support of GSI-191," (dated June, 2005) are used to evaluate the downstream effects of debris that is passed by the sump strainer. Consistent with the guidance in NEI 04-07, the evaluation considers debris that is larger than the largest dimension of the sump strainer opening.

Analyses Performed By Contractors: The debris generation and transport analyses were performed by Framatome ANP (FANP) with input from Alden Research Laboratory. The chemical and downstream effects analyses, with the exception of fuel related analyses, are being performed by Sargent & Lundy^{LLC} (S&L). The fuel related downstream effects analyses will be performed by FANP.

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

NRC Request 2(d)(i): *The minimum available NPSH margin for the ECCS and CBS pumps with an unblocked sump screen.*

FPL Energy Seabrook Response: Consistent with the current design basis, the existing NPSH margin is calculated for one sump not operating, and 50% screen blockage of the operating sump screen. The minimum available net positive suction head (NPSH) margin for the ECCS and CBS pumps under these conditions is 0.54 feet. Based on the existing and pretest screen sizes, this value is conservative. (That is, the NPSH margin with the new sump strainer unblocked is expected to be greater than 0.54 feet.)

NRC Request 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.*

FPL Energy Seabrook Response: As discussed above, the final sump strainer design depends on chemical effects test results for the strainer. The pretest estimates indicate the

minimum submerged area is approximately 2700 ft^2 per sump for a passive design. The strainers will be fully submerged and will have a minimum freeboard of 3 inches at switchover to sump recirculation. As stated above, the final screen size will be validated by vendor testing.

NRC Request 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.*

FPL Energy Seabrook Response: The allowance for head loss from debris accumulation on the submerged sump strainer is 0.27 feet. The primary constituents of the debris bed are provided below. Chemical effects are discussed in the response to request 2(c).

Description of the primary constituents of the debris bed	Seabrook Station
Fiber Insulation – Nukon	2,944 ft^3
Reflective Metal Insulation	None
Particulate	None
Qualified and Unqualified Coatings – Failed coatings	14 ft^3
Latent Debris– Latent fiber	19 lbm
Latent Particulate Dirt and Dust	108 lbm
Miscellaneous Debris-fiber	55 ft^3

NRC Request 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.*

FPL Energy Seabrook Response: A walkdown and analysis of the Seabrook containment was performed to assess potential chokepoints in the path from the RCS loops to the ECCS sump, including gates and screens. The walkdown confirmed that there are no potential chokepoints that would adversely affect operation of ECCS and CBS in the recirculation mode or cause the sump water level and associated NPSH to be less than the design basis values.

Additionally, an inspection for non-LOCA generated material that could potentially obstruct recirculating water is conducted as part of the containment cleanliness inspection program prior

to restart. The controlling procedure specifically addresses the need to assure that the containment is free of loose debris or fibrous material that could be transported to the sump.

NRC Request 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.*

FPL Energy Seabrook Response: FPL Energy Seabrook will implement corrective actions identified as a result of downstream analyses that are necessary to ensure that inadequate core or containment cooling would not result due to debris blockage at flow restrictions in the ECCS and containment building spray (CBS) flowpaths downstream of the sump strainer. Any identified corrective actions will be implemented prior to startup from refueling outage OR11 in the fall of 2006. Actions that do not require containment access may be scheduled for non-outage completion. All required actions, including those that may emerge after September 1, 2005, will be completed prior to December 31, 2007.

The flow paths downstream of the containment sump are being analyzed to determine the potential for debris blockage due to debris passing through the sump strainer. The evaluations are based on an assumed sump strainer perforation size of 1/16-inch by 1/16-inch (diagonal dimension of 0.088-inch).

The evaluations identified 22 components that require further evaluation, excluding instrumentation. One (1) component has been identified as having a gap smaller than 0.088-inch. Instrumentation was also identified as requiring further evaluation. As stated above, it is planned to have all downstream evaluations completed in March, 2006.

As discussed under item 2 (b), a new sump strainer will be installed. The perforation size of 1/16-inch by 1/16-inch assumed in the downstream effects evaluation is consistent with the specification for the new sump strainer, which calls for retention of particles larger than 1/16-inch. Consistent with the guidance in NEI 04-07, the evaluation considers debris that is larger than the largest dimension of the sump strainer opening.

Adverse gaps or breaches are prohibited by the sump strainer specification, which requires that there shall be no spaces or gaps in the final installation that would allow passage of any particles larger than the perforation size.

In addition, existing technical specifications require that the sump screens be inspected at least once per 18 months. The inspection procedure currently requires verification that there are no unacceptable holes or gaps in the screen or between the screen and adjacent structures and components. The inspection criteria will be revised to conform to the requirements of the new sump strainer prior to startup from refueling outage OR11 in the fall of 2006.

NRC Request 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.*

FPL Energy Seabrook Response: The long term downstream evaluations are in progress and it is planned to have them completed in March, 2006. It is planned that any corrective actions arising from the evaluations be implemented during refueling outage OR11 in the fall of 2006. However, actions that do not require containment access may be scheduled for non-outage completion. All required actions will be completed prior to December 31, 2007.

NRC Request 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.*

FPL Energy Seabrook Response: The current recirculation sump and sump screens at Seabrook Station utilize trash racks and are protected from jet impingement and missiles by a missile shield above the recirculation sump.

The sump strainer design requirements ensure that it will be capable of withstanding the force of full debris loading, in conjunction with all design basis conditions, without collapse or structural damage. The design requirements also ensure that it will be capable of withstanding the hydrodynamic loads and inertial effects of water at full debris loading without loss of structural integrity.

The specification for the new sump strainer requires that the new strainer design take jet impingement and missiles into account if it extends beyond the existing missile shield.

NRC Request 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.*

FPL Energy Seabrook Response: The specifications for new sump strainers have been issued, vendor proposals have been received, and the vendor selection process is underway. It is currently planned to install passive strainers.

NRC Request 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.*

FPL Energy Seabrook Response: At this time, FPL Energy Seabrook does not anticipate that any licensing changes will be requested as a result of the actions required to ensure compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of GL 2004-02.

NRC Request 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 CBS recirculation functions. Addressees may reference their responses to GL 98-04, "Potential for Degradation of the Emergency Core Cooling System and the Containment Building 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.*

FPL Energy Seabrook Response: FPL Energy Seabrook currently has an aggressive containment cleanliness program to provide assurance that the containment building is free of foreign materials and debris prior to ascension into Mode 4 following shutdown and during power operation. This program was described in detail in the Seabrook Station response (FPL letter L-2003-201, dated August 8, 2003) to NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized Water Reactors." Detailed containment cleanliness procedures exist for unit restart readiness and for containment entries at power. The requirement to assure that the containment is free of loose debris and fibrous material that could be transported to the sump is specifically addressed.

A continuing effort to reduce and minimize the amount of unqualified coatings inside the containment buildings is a high priority objective of the Seabrook Station containment coating program. As documented in the response to NRC Generic Letter 98-04 (North Atlantic letter NYN-98125 dated November 6, 1998), Seabrook has controls for the surface preparation, procurement, application, surveillance, and maintenance activities for Service Level 1 protective coatings used inside the containment in a manner that is consistent with the licensing basis and regulatory requirements applicable to Seabrook Station. This program addresses both new coatings and ongoing maintenance activities. The Seabrook Station response (FPL/FPL Energy letter L-2003-201 dated August 8, 2003) to NRC Bulletin 2003-01 supplemented this discussion.

Engineering design control procedures will be revised to ensure that a change to insulation, structures, doors, gates, or any other materials/components inside containment will be evaluated for the effect on the containment sump debris generation and transport analysis and/or recirculation functions.

FPL Energy Seabrook will ensure that potential quantities of post-accident debris are maintained within the bounds of the analyses and design bases that support ECCS and CBS recirculation functions. The programmatic actions that will be implemented to ensure that design bases for the new sump strainers are maintained will be implemented prior to restart from refueling outage OR11 (fall 2006).